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*Приятного чтения!*

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### Greetings from the Ural Federal University

**Elvira E. Symaniuk**

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Yekaterinburg, Russia

## ОТ РЕДКОЛЛЕГИИ

### Приветствие Уральского федерального университета

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### Dear authors and readers!

This issue is devoted to research findings presented at the International Forums of *Cognitive Neuroscience* at Ural Federal University in 2019 and 2020.

In recent years, growing interest in cognitive neurosciences has created a need for high-quality research, dialogue and interaction of all structures related to the sphere. Ural Federal University became a center for discussing the latest achievements in neurocognitive research, defining trends of its development, fostering international and regional partnership, establishing links for large-scale longitudinal research, building scientific competencies in the field of neuroscience.

The topics of the Forums address a wide range of issues. This is the neurocognitive development of a person at different stages of ontogenesis (from birth to aging); mechanisms of the formation of cognitive functions in typically and atypically developing children; neuropsychology and psychogenetics; the functioning of cognitive processes; machine learning problems; practical application of neurotechnologies, hardware diagnostic tools; psycholinguistics and neuroheuristics; issues of differentiation of neurosciences.

The Forums presented research: in the field of genomics of aggressive and depressive human behavior; specific features of early development and formation of motor skills; issues of digitalization and modern childhood; research findings on working memory and ways of information processing; the use of neurointerfaces, methods of teaching artificial intelligence; age-related disorders, depression and resources for successful aging; differentiation of neurosciences, including their analysis from the perspective of art.

A separate section is devoted to the work of young researchers who are beginning their journey in the area of neurocognitive sciences.

The possibility of wide application of fundamental knowledge about the functions of the brain, neural processes, mechanisms of the psyche, behavior and interaction in practical activity is discussed. Thus, brain-computer interfaces are increasingly used to solve problems in the fields of medicine, education, psychology and behavioral economics. Insight into EEG correlates, neuroadaptive technologies and interpretation of brain signals makes it possible to introduce such scientific applications as *Neurobarometer* (N. V. Galkina, Neurotrend), which is designed to detect the neurophysiological reactions of respondents to assess perception content (incentives) of one kind or another; *My Baby Check* (A. I. Kotyusov, E. V. Suleimanova, Ural NeuroNet Center), a software for comprehensive assessment of the trajectory of development of children in the first year of life based on artificial intelligence; *Smart Clothes for Athletes* (A. E. Khramov, V. B. Kazantsev, Innopolis University), that will help to improve traditional training methods and build personal training schemes.

An interesting, very insightful round-table discussion with scientists and practitioners *Neurotechnologies in Education, Science and Business* was held within the Forum-2020. It united the representatives of such companies as Neurotrend, NeuroNet, SKB-Kontur, Pyaterochka, the Institute of Regional Education, Tochka Bank, NPO Automatics, AMG Media Agency, ANO University 20.35, Examus Project, and Navigator of Continuing Education InLearno. The discussion addressed the issues regarding the application of cognitive research and neurotechnology to solve real-life business problems.

Within the framework of the Forum-2020, new research projects were initiated. For example, the intention of Ural Federal University to participate in the project of the Russian Academy of Sciences *Brain: Health, Intelligence, Innovation* was supported. Ural Federal University alongside project collaborators is ready to initiate research in the program fundamentals aimed at creating an advanced scientific groundwork to study the neural mechanisms of the brain development and functioning, its plasticity, learning and memory, intelligence, consciousness and personality.

It was agreed to create a consortium *Human Well-being in the Face of Demographic Challenges and Digitalization of Society* that will encompass all Forum topics. The purpose of the consortium is to conduct fundamental and applied research in the field of cognitive, social and human sciences taking into account the specific character of the society transformation and regional issues. The consortium members are: UrFU, Psychological Institute of the Russian Academy of Education, Institute of History and Archeology of the Ural Branch of the Russian Academy of Sciences, etc.



The International Forums of *Cognitive Neuroscience* strengthens the research potential of the regions, facilitates the development of interdisciplinary and cross-cultural research and enhances the position of Ural Federal University as a research center to study neurophysiological, psychophysiological and neuropsychological predictors of the normative functioning of the cognitive processes of an adult, to determine the mechanisms and technologies for accelerating the assimilation of information, to study the brain and neurocognitive development of normatively developing children and children with special needs.

The Forum is annually attended by up to 300 participants, including more than 50 foreign scientists (from Japan, Sweden, Hungary, Germany, USA, and other countries).

The Forum is facilitated by the support of the Russian Foundation for Basic Research in 2019 and 2020.

Ural Federal University welcomes you to cooperation, active participation in the next Forums and publication in the *Lurian Journal*!

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**RESEARCH PAPERS**

**НАУЧНЫЕ ИССЛЕДОВАНИЯ**



## Cognitive Neuroscience of Neuroinfectious Diseases

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## Когнитивная нейробиология нейроинфекционных заболеваний

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**Abstract.** Infectious diseases, particularly those involving viral pathogens, involve infiltration of CNS structures. Increasing suspicion of hypoxic-related neuronal infiltration has been documented in COVID-19. Increasingly effective treatments for hypoxia and prophylactic vaccinations with improved efficacy will result in greater survival rates of COVID-19 patients. The burden of COVID-19 disease impacts the employed adult population with the likelihood that lingering cognitive sequelae requires investigation and redress as the world assumes normality in the various work arenas. Whilst the effects of COVID-19 on cognitive functions and hence employability are strongly suspected, no systematic theoretical framework of the underlying neuropathological processes and pathways and approaches to assessment

have been offered. This abstract proposes Luria's Model of Neuropsychological Functioning (Luria, 1980) as a broad framework to investigate and document the neurocognitive effects of neuroinfectious diseases such as COVID-19. The authors acknowledge that, with increasing knowledge of the diverse symptom patterns associated with disease process underlying COVID-19, the framework of neurocognitive assessment will need to undergo refinement to provide a succinct synopsis of the cognitive capacity of survivors of this disease to inform best medical practices and the decisions facing other sectors such as employers.

**Keywords:** *neuroinfectious disease; virus; COVID; Luria; neuropsychology; neuropathology*

**Аннотация.** Инфекционные заболевания, особенно с участием вирусных патогенов, вызывают инфильтрацию структур ЦНС. Возникновение нейронной инфильтрации, связанной с гипоксией, документально подтверждено при COVID-19. Более эффективные методы лечения гипоксии и профилактические прививки приведут к увеличению выживаемости пациентов с COVID-19. Одним из последствий заболевания COVID-19 являются длительные когнитивные осложнения, требующие исследования и компенсации, чтобы у людей трудоспособного возраста восстановились трудовые навыки. Несмотря на то что высока вероятность влияния COVID-19 на когнитивные функции и, следовательно, на трудоспособность, никакой систематической теоретической основы для определения нейропатологических процессов, а также подходов к оценке тяжести осложнений не было предложено. В этой публикации рассматривается модель нейropsychологического функционирования, разработанная А. Р. Лурия (1980), в качестве широкой основы для исследования и документирования нейрокогнитивных эффектов нейроинфекционных заболеваний, таких как COVID-19. Авторы признают, что с увеличением знаний о разнообразных симптомных паттернах, связанных с болезненным процессом, лежащим в основе COVID-19, структура нейрокогнитивной оценки должна будет подвергнуться уточнению. Это позволит предоставить краткий обзор когнитивных способностей излечившихся от данного заболевания и использовать новую информацию для разработки лучших медицинских практик и решений проблем, возникающих в других сферах, в том числе в трудовой деятельности.

**Ключевые слова:** *нейроинфекционное заболевание; вирус; COVID; Лурия; нейропсихология; невропатология*

Infectious diseases are part of world history (Morens & Fauci, 2020), and despite progress in medical management (Marchand-Sénécal et al., 2020), transmissions appear to have sporadic surges and patterns of increase (Nath, 2015). These patterns are part of human history as viral pathogens continue to rise, mutate and infect human populations.

There are growing challenges in the identification and diagnoses of neuroinfectious diseases (Matthews et al., 2020). With respect to SARS-CoV-2, virus mutations have resulted in variants, posing challenges to the vaccination process.

Those populations who have significant medical morbidity or are considered vulnerable to infectious diseases have either succumbed to or, if they survive, are likely to be left with residual complaints that require redress. With the current COVID-19 pandemic,

neuronal injury has been implicated in those cases where hypoxia due to severe respiratory infection precipitated dependence on ventilation to support oxygenation of the brain (Chandra, Chakraborty, Pal, & Karmakar, 2020). Presence of intact CoV particles together with SARS-CoV-2 RNA in the olfactory mucosa, as well as in neuroanatomical areas receiving olfactory tract projections, may suggest the occurrence of SARS-CoV-2 neuroinvasion via axonal transport. However, given that the apparatus in which viral reproduction takes place is thought to be found in the neuronal somata, morphological detection of single viral particles in axons is very difficult, if possible at all, due to the low number of viral particles that are expected (Meinhardt et al., 2020). Further adding to this difficulty in visualizing SARS-CoV-2 within the CNS on a cellular level is the fact that the olfactory bulb is a relatively small CNS region with a limited number of neurons, which is evidenced by the small amount of viral RNA that was obtained in COVID-19 cases harboring SARS-CoV-2 PCR-positive olfactory bulbs.

Animal models have offered some insight into the patterns of COVID-related diseases. For example, enduring and sex-specific changes have been reported in rodent samples, with male rodents showing greater vulnerability to cognitive decline (Tchessalova & Tronson, 2020).

Direct SARS-CoV-2 viral invasion of the brain has been indicated such as in selected autopsy reports (Maiese et al., 2020). Continuous improvement in the treatment and attempts to mitigate infectious spread are hampered by second- and third-waves of COVID resurgence with more deaths but also survivors with residual complaints that require continuous assessment and management. The experience of a life-threatening disease with uncertain outcomes and requiring isolation from family and loved ones adds to the psychological burden of these patients, clouding the neurocognitive sequelae patterns that are emergent (Kontoangelos, Economou, & Papageorgiou, 2020). COVID-19 might be more visible in adults, but the health impact on infants and children is still uncertain and at this stage considered to be relatively low. Case studies of placental transfer of the SARS-CoV-2 virus have emerged, with the outcomes in ante- and post-natal stages in the developing infant inconsistently reported or documented (Hosier et al., 2020). The patterns of enduring cognitive decline will probably be domain-specific with memory and attention most vulnerable to the disease. Thus, a neurocognitive model that identifies neuronal pathways and centres, such as those proposed by Luria (1980), may provide a useful framework for studying, identifying and explaining short and long-term cognitive effects of COVID-19 and their effects on Activities-of Daily-Living.

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## **Psychological Well-being by Late Adulthood People**

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## **Психологическое благополучие людей в период поздней зрелости**

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**Abstract.** There is a need to find resources for successful aging. So one of the significant personal and psychological characteristics reflecting the process of successful aging is psychological well-being. The purpose of study is to determine the personal factors of the psychological well-being of late adulthood people. The study involved 100 people at the age from 56 to 75 years: 31 men, 69 women. The following methods were used: the scale of psychological well-being by C. Ryff, the Big Five Personality Test by R. McCrae, the Coping Strategy Indicator by D. Amirkchan, The Personal Views Survey III-R by S. Muddi, the method of diagnosing the type of behavioral activity by L. I. Wasserman and N. V. Gumenyuk, the Life Orientation Test by C. Carver and M. Scheier, questionnaire on the socio-professional qualities definition of the subjects. The study identified the factors for achieving psychological

well-being by elderly people such as *Agency, Attitude to the world, Strategy for adaptation to old age, Meaning of life, Value*.

**Keywords:** *psychological well-being; late adulthood; agency; successful aging; adaptation strategies*

**Аннотация.** Существует потребность в поиске ресурсов, обеспечивающих успешное старение. Так, одной из значимых личностно-психологических характеристик, отражающих процесс успешного старения, является психологическое благополучие. Цель исследования заключалась в определении факторов достижения психологического благополучия людьми позднего возраста. В исследовании приняли участие 100 человек в возрасте от 56 до 75 лет: 31 мужчина, 69 женщин. Использовались следующие методики: шкала психологического благополучия К. Рифф, пятифакторный личностный опросник Р. Мак-Крае и П. Коста, опросник копинг-стратегий Д. Амирхана, тест жизнестойкости С. Мадди, методика диагностики типа поведенческой активности Л. И. Вассермана и Н. В. Гуменюка, тест диспозиционного оптимизма Ч. Карвера и М. Шейера, анкета по определению социально-профессиональных качеств испытуемых. В исследовании выявлены факторы достижения психологического благополучия людьми пожилого возраста, такие как *субъектность, отношение к миру, стратегия адаптации к старости, смысл жизни, ценность*.

**Ключевые слова:** *психологическое благополучие; поздняя взрослость; субъектность; успешное старение; стратегии адаптации*

## Introduction

At the moment, the population of Russia is about 146 million people, among them 36 million are late adulthood people, which amounts a quarter of the total population of the country. In general, the image of a late adulthood person in our country, which is broadcasted by the mass media and exists in the everyday consciousness, is not very attractive. A late adulthood person is represented as unprotected, weak and unadapted to life.

Late adulthood is the final stage of human ontogenesis, which was initially seen as a period characterized by a deterioration in the psychophysiological sphere, however, in the second half of the 20th century, approaches and theories appear in Russian and foreign psychological science that consider this period from the perspective of development potential and unique positive newly-formed structures. As a result, late adulthood is started to be considered not only from the point of view of the negative changes associated with age, but also from the point of view of the resources of successful aging. The issues of the meaning of life in late adulthood, positive functioning and development in conditions of psycho-physiological change, a happy old age, professional self-preservation become significant (Zeer, Symaniuk, & Borisov, 2017).

The most interesting are the problems of a *happy old age* and *successful aging* as they integrate all other issues of development, functioning that determine the living of one's own late adulthood.

Successful aging is used as a synonym for happy aging and involves the constant efforts and the development of skills to cope with the conditions of aging, both external and internal (Boyd & Bee, 2015). Successful aging implies the preservation of one's own identity, the integrity of the person, despite the ongoing changes. First of all, the key aspect of successful aging is everyday, continuous effort. E. Erickson, describing ego-integration, as the main task of late maturity, singled out the achievements of ego-integration of a late adulthood person.

In his book *Vital Involvement in Old Age* E. Erikson made a conclusion on the basis of the analysis of the stories of people over seventy, that in order to maintain the integrity of one's individual self the human motivational system must continue to develop (Erikson, E., Erikson, J., & Kivnick, 1994). N. Kh. Alexandrova, considering subjective well-being, relates it to successful aging: "successful aging" is especially close to experiencing one's own social significance, experiencing one's own attitude to the life lived and to oneself" (Aleksandrova, 2000, p. 13).

Proceeding from the position on the conformity of well-being and successful aging, let us turn to positive psychology as a scientific field, which subject is well-being.

Let us consider the various approaches to psychological well-being. The first studies of psychological well-being are associated with the works of N. Bradburn (1969), where this characteristic was viewed as reflecting states of happiness or unhappiness, a feeling of satisfaction or dissatisfaction with life.

One of the most generally accepted approaches to psychological well-being as a phenomenon are hedonistic and eudemonic approaches, derived from the concepts of happiness in ancient philosophy. R. Ryan and E. Deci (2001) differentiated all theories of well-being into hedonistic and eudemonic. The hedonistic approach includes theories in which psychological well-being is characterized by a continuum of *satisfaction-dissatisfaction*, based on a balance of positive and negative effects. The eudemonic approach is derived from the ideas of humanistic psychology, it considers psychological well-being as personal growth, the development of one's own individuality.

The most popular is the concept of Carol Ryff, who considers psychological well-being as a complex characteristic of the positive functioning of a person. C. Ryff (1995) considers psychological well-being as a basic subjective construct that reflects the perception and evaluation of its functioning from the position of a person's maximum potential, in this case well-being implies the realization of a wide range of psychological possibilities and is a multidimensional process, but not a state.

This approach allowed us to summarize and highlight the components of psychological well-being: positive relations with others, autonomy, self-acceptance, environmental mastery, purpose in life, personal growth (Ryff & Keyes, 1995).

A popular approach to psychological well-being is the one proposed by T.D. Shevelenkova and P.P. Fesenko (2005). It is based on the theory of C. Ryff. These authors interpret psychological well-being as a holistic experience, characterized by a subjective feeling of happiness, satisfaction with one's own life and oneself and that it is associated with basic human values and needs.

In this work, we consider psychological well-being as a characteristic that determines the aging process of a person and whether it will be successful, it also determines one's success and a high level of life satisfaction.

The question of our study is which characteristics are capable of ensuring psychological well-being at late adulthood. Thus, the aim of our study is to determine personality factors that contribute to the achievement of psychological well-being at late adulthood.

The **objectives** of the study are:

- (1) Justification of the personal characteristics of late adulthood people's psychological well-being for the selection of methodological research tools.
  - (2) Identification of personality factors of late adulthood people's psychological well-being, using the maximum likelihood method.
  - (3) The study of the obtained factors of late adulthood people's psychological well-being.
- Let us consider personality characteristics that can affect psychological well-being.

In the process of studying the connection of psychological well-being with personal qualities, various models are used. However, in recent years, the five-factor personality model has been most popular. The five-factor personality model, or, as it is called, the *Big Five*, originates from the ideas of G. Allport, R. Cattell, and H. Eysenck. The model consists of the following factors: extraversion, agreeableness, conscientiousness, neuroticism, openness to experience (Goldberg, 2013). Studies show that late adulthood is characterized by a greater agreeableness and conscientiousness, but it has lower rates of openness to experience and extraversion compared with young people. In addition to this, there are results that indicate that the sense of purpose of life at this age is associated with rates of neuroticism, extraversion, and conscientiousness. Openness to experience, as one of the factors of the big five, is considered as the quality of the personality, which allows a person to age more successfully. Research results show that late adulthood people, who have higher rates of openness to experience, have better everyday functioning skills. At the level of characteristics, it was found that openness to ideas and meanings is correlated with successful aging (Merino-Tejedor, Hontangas-Beltrán, Boada-Grau, & Lucas-Mangas, 2015).

Another quality of personality that can determine psychological well-being is optimism. Optimism is the quality of a healthy, mature personality, focused on overcoming problems, and not on exaggerating, ignoring or avoiding their solving, which is considered to be a characteristic of a neurotic personality. Optimism is understood as a personality trait that allows people to perceive and control their life, which is associated with its well-being. In late adulthood, optimism contributes to a positive assessment of their future (Sychev, 2008). Without optimism, as the conviction that something good is waiting for a late adulthood person in the future, it is impossible to create a temporary perspective, which is necessary for psychological well-being at this age.

Another characteristic that may determine psychological well-being is hardiness. Hardiness is a set of personality attitudes that help in changing the perception of stressful circumstances. People with a high level of hardiness, perceive stressful circumstances not as a source of possible disturbances and difficulties, but as opportunities for personal development. The attitudes that make up hardiness are commitment, control, challenge (Maddi, 2004).

Hardiness and optimism influence the strategy of coping with life's difficulties. Coping strategies are defined as cognitive and behavioral ways of overcoming specific external and internal requirements that are assessed by a person as significant or exceeding his capabilities. Many scientists, both domestic and foreign, emphasize that coping strategies for problem solving and social support are an important factor in psychological well-being at any age (Gordeeva, Osin, Rasskazova, Sychev, & Shevyakhova, 2010).

American researchers considered activity in the period of late adulthood as one of the factors of psychological well-being. So, J. Hayden, R. Cottrell, L. Green, F. Ames, and D. Ramsey (2008) describe their experiences of retirement age when returning to professional activities. Describing their experience, researchers offer two ways to further develop their professional careers: to work as a consultant on certain issues or work on a voluntary basis in an organizational or a presidential position. They also note, that in this case combining professional activity with leisure is appreciated.

According to P. Moem, it is important to acquire new meanings of life in order to turn living in late adulthood into successful aging (Carr & Komp, 2011).

Based on the analysis presented above, we identified the following potential characteristics that can form the factors of psychological well-being — these are various personal psychological characteristics, such as: openness to experience, optimism, hardiness, and coping strategies for solving problems and social support, meaning of life, balanced behavioral activity and social and professional status.

We have identified the following research **hypotheses**:

- (1) Activity, presence of life meaning, positive interaction with other people are factors of the psychological well-being of late adulthood people.
- (2) The resulting factors are related to each other and form a model of psychological well-being in late adulthood.

## Methods

### Sample

The study involved 100 people aged 59 to 75 years: 31 men, 69 women. A sample of the study was composed of members of leisure clubs for late adulthood people in Yekaterinburg. According to the statistical bulletin of the Russian Federation, at the beginning of 2018 in Russia the proportion of men among the population older than working age is 29.7 %, in the Sverdlovsk region it is 38 %. The age group of people aged from 60 to 75 years in the Sverdlovsk region is 660 528 of which 252 624 are men. It is also worth mentioning that the study was conducted on the basis of institutions that are mostly visited by women, this was reflected in the gender advantage of the sample. All the participants gave their informed consent before starting the study. The study was carried out in accordance with the Helsinki Declaration, protocol No. 21 (October 11, 2019) was approved by the Scientific Council of Ural Humanitarian Institute in Ural Federal University. The representativeness of the sample is ensured by the use of randomization (Druzhinin, 2000).

## Methods

Questionnaire to determine the socio-professional qualities of the subjects. The questionnaire is aimed at identifying such qualities as the subjects' professional employment, professional experience, and reasons for continuing their professional activity.

The research method is psychodiagnostics, which was carried out using the following methods:

- Scale of Psychological Well-Being by C. Ryff (adaptation of T. D. Shevelenkova and P. P. Fesenko). This technique was used to assess psychological well-being.
- Coping Strategy Indicator by D. Amirkhan (adaptation of N. A. Sirota and V. M. Yaltonsky). Used to assess coping with difficulty.
- Big Five Personality Test by R. McCrae, P. Kosta (adaptation of A. B. Khromov). Used to assess the personal qualities of the subjects.
- The Personal Views Survey III-R by S. Muddi (adaptation of E. N. Osina and E. I. Rasskazova). Used to assess the resilience of the individual and the attitudes of its constituents.
- Methods for Diagnosing the Type of Behavioral Activity by L. I. Wasserman and N. V. Humenyuk. Used to determine the activity characteristics of late adulthood people.
- Life Orientation Test by C. Carver and M. Scheier (adaptation by T. O. Gordeeva, O. A. Sycheva, E. N. Osina). Used to determine the positive, negative expectations of the subjects.

## Procedure

After providing the informed consent, a participant received a questionnaire containing the research methods, which he/she filled in at home. Since the questionnaire contained several time-consuming techniques, the participant was asked to fill it in in a staged manner with breaks of one or two days.

The first section of the questionnaire contained the following methods: Questionnaire for determining the social and professional qualities of the subjects, Scale of Psychological Well-Being by K. Riff, Coping Strategy Indicator by D. Amirkhan.

The second section contained the following methods: Big Five Personality Test by R. McCrae, P. Kosta, The Personal Views Survey III-R by S. Muddy.

The third section contained: Methods for Diagnosing the Type of Behavioral Activity by L. I. Wasserman, N. V. Gumenyuk, Life Orientation Test by C. Carver and M. Scheier.

The questionnaires were completed within seven days and returned to the leisure club, where they were then transferred to the research team. The study used only fully completed questionnaires. After completing the study, the participants were thanked and presented the results individually.

Empirical data processing was performed using the maximum likelihood estimation and varimax rotation method.

## Results

Using the maximum likelihood estimation, we obtained a five-factor model for the achievement of psychological well-being by late adulthood people. Factor loadings of variables are presented in brackets.

The first factor possesses 20 % of the total variance, at one extreme we have the variables: *Commitment* (−0.62); *Positive expectations* (−0.43); *Absolute vocation* (−0.43); *Person as an open system* (−0.38); *Self-control of behavior* (−0.36), at the other extreme there are variables: *Emotional stability — emotional instability* (0.81); *Depression — emotional comfort* (0.76); *Emotional lability — emotional stability* (0.70); *Curiosity — reality* (0.53); *Tension — relaxation* (0.50); *Anxiety — carefreeness* (0.48); *Extroversion — introversion* (0.42); *Sociability — isolation* (0.36).

The first factor is called *Agency*. This is due to the fact that at one extreme there is a variable *Involvement*, which has a high load (−0.62), which means the desire to overcome difficulties through activity, emotional involvement in the outside world, which implies activity. The other extreme has a maximum load on the variable *Emotional instability* (0.82), which means inability to control one's emotions, increased impulsiveness, lack of a sense of responsibility, evasion from reality, capriciousness.

The second factor possesses 12 % of the total variance, at one extreme there is a variable *It's necessary to work somewhere* (−0.58), at the other extreme the variables *Respect others — self-respect* (0.86); *Responsibility — irresponsibility* (0.82); *Artistry — no artistry* (0.78); *Understanding — misunderstanding* (0.74); *Cooperation — rivalry* (0.71); *Affection — indifference* (0.68); *Perseverance — lack of perseverance* (0.60); *Expressiveness — practicality* (0.54); *Search for social support* (0.52); *A person as an open system* (0.52); *Positive relationships with others* (0.51); *Activity — passivity* (0.49); *Dominance — subordination* (0, 41); *Sensitivity — insensitivity*; *Anxiety — carefreeness* (0.41) are presented.

The second factor is called *Attitude*. At one extreme of the factor, most of the variables that characterize attitudes towards other people and the world in general, the ability to sympathize with both people and fictional characters are presented. Besides, the variables *Responsibility* (0.82) and *Activity* (0.49) are presented there. At the other extreme there is a variable *We need to work somewhere* (−0.58), this may mean that the source of relationships for a person is the formal space of professional activity.

The third factor possesses 6 % of the total dispersion, at one extreme we have the variables *Plasticity — rigidity* (0.82); *Curiosity — conservatism* (0.64), *Search for impressions — avoidance of impressions* (0.53), *Personal growth* (0.47), *Expressiveness — plasticity* (0.47), *Type of behavioral activity A1* (0.41), *Sociability — isolation* (0.41), *Extroversion — introversion* (0.40), *Display — avoidance of sense of guilt* (0.37), at the other extreme there is a variable *Negative expectation* (0.49).

The third factor is called the *Adaptation strategy for old age*. At one extreme the presented variables are *Plasticity* (0.82), *Curiosity* (0.64), *Search for impressions* (0.53), which means cognitive and behavioral flexibility, the desire to gain new knowledge and experi-



ences. At the other extreme there is a variable *Negative expectation* ( $-0.49$ ), which means that a person does not expect anything good from his future.

It also allows an elderly person to feel the consistency of his/her development, to experience a feeling of fulfilment and to change in accordance with new ideas and knowledge.

The fourth factor possesses 5 % of the total variance, at one extreme there are the following variables: *Purpose in life* (0.81), *Environmental mastery* (0.78), *Challenge* (0.70), *Problem solving* (0.65), *Search for impressions — avoidance of impressions* (0.58), *Type of behavioral activity of AB* (0.56), *Autonomy* (0.53), *Domination — subordination* (0.50), *Positive expectations* (0.49), *Commitment* (0.45), *Display — avoiding feeling of guilt* (0.42), *Accuracy — carelessness* (0.39), *Worked 10 years in retirement* (0.34), at the opposite extreme we have *Effect balance* ( $-0.78$ ), *Negative expectations* ( $-0.61$ ), *Type of behavioral activity B1* ( $-0.59$ ), *Self-criticism — self-sufficiency* ( $-0.44$ ).

The fourth factor is called *The meaning of life*. This is connected with the fact, that at one extreme the *Purpose in life* variable (0.81) has the greatest load. That means that there are life goals and a sense of orientation, as well as an understanding that past and present life possesses meaning. An elderly person clings to convictions which are the basis of his/her life goals, and has plans for the future life. At the other extreme, the *Effect balance* ( $-0.78$ ) and *Negative expectations* ( $-0.61$ ) variables have the greatest load, which can mean negative self-esteem, dissatisfaction with real life circumstances, a sense of one's own helplessness and powerlessness, and the lack of positive expectations from the future.

The fifth factor possesses 4 % of the total variance, at one extreme it has the variables *Gullibility — suspiciousness* (0.71), *Positive relations with others* (0.48), *It is necessary to work somewhere* (0.43), *Tension — relaxation* (0.38), *Sensitivity — insensitivity* (0.36), *Sociability — isolation* (0.35), at the other extreme it has *Interest as the reason to continue professional activity* (0.41).

The fifth factor is called *Value*. The leading variables at one extreme are *Credibility* (0.71) and *Positive relations with others* (0.48), which may mean a person's trust in close people, the ability to make concessions, the ability to take care of another person, to form close relationship and not be afraid of attachment. At the other extreme there is interest as a cognitive need.

## Discussion and Conclusion

The purpose of this study is to determine the personal factors that contribute to the achievement of psychological well-being by late adulthood people. As a result of the empirical research, we identified the following factors: a manifestation of one's own agency, a positive attitude towards other people and the outside world, striving for personal development, the presence of life meaning, the value of interaction.

The factor *Agency* is characterized by the fact that late adulthood as a whole can be represented as a critical life period (Liders, 2000), in which in the conditions of social and psychological transformation, an application of activity and a manifestation of one's



own agency to adapt to a new situation are required. That is the formation of an adequate vision of this new world and one's place in it and what good can be expected from it; developing a form of behavior that will adequately meet the new situation. At the same time, the non-manifestation of one's own agency causes disadaptation and, as a result, isolation from the outside world and oneself, which causes negative emotional reactions, such as anxiety and depression, emotional instability, a sense of one's own helplessness and inability to live in a new situation.

The identification of subjectivity as a manifestation of activity as a factor in psychological well-being is consistent with the study by F. Guillen and J. Angulo (2016), the results of which showed that physical activity in late adulthood promotes optimism and hope and, in general, the achievement of psychological well-being. A study by A. Delle Fave and colleagues (Delle Fave, Bassi, Boccaletti, Roncaglione, Bernardelli, & Mari, 2018) examined the effects of two programmes of adapted physical activity on psychological well-being in late adulthood. The results showed that in addition to improving the physiological state, the participants observed the use of more adaptive strategies for regulating emotions after trainings. The results of another study show that not only physical, but also leisure activity has a positive effect on psychological well-being in late adulthood (Han & Shibusawa, 2015).

The second factor can be represented as an *attitude* to the world in general. A new situation in late adulthood requires a new attitude to it (Ermolaeva, 2000). Understanding that the formation of a new attitude depends only on the person himself/herself and requires activity, perseverance, an ability to resist the prevailing external factors, willingness to learn new things allows the person to create a trustworthy attitude to the world where the respect of another person is significant, and the elderly person can empathize with other people, interact with them flexibly, understand various social phenomena. In addition, a trustworthy attitude to others allows a late adulthood person not to be afraid of seeking help in case of difficulties. At the same time, narrow-mindedness, obsession with already adopted formal relations prevent an elderly person from creating new systems of relations.

The positive attitude towards other people as the ability to establish and maintain them is consistent with the study by V. Bedan (2015), which was conducted on groups of "lonely" and "not lonely" people. The results of the study showed that the ability of the lonely group to establish and maintain trusting relationships is too low. This group is also characterized by conformism, lack of formulated life goals, a feeling of inability to change or improve their life, personal stagnation, negative self-awareness, dissatisfaction with some characteristics of one's own human nature, abstract nature of future prospects, which indicates a low level of psychological well-being. The representatives of the not lonely group demonstrate positive self-esteem, determination, empathy, openness and flexibility in communication, independence, creative thinking, an ability to achieve the desired, the desire for self-development, a sense of purpose of life, self-confidence and confidence in one's own strength, openness to some new experience.

Third factor has the name *Adaptation strategy for old age*. There are two strategies for adaptation to ageing. The first is "closed loop", which is characterized by a reduc-

tion in the interests of the individual, his/her focusing on survival, since the existing conditions become hostile to the person, he/she no longer expects anything good from the future (negative expectations). The second strategy involves adaptation to ageing through the development of personality by means of the realization of one's capabilities, the manifestation of one's individuality. This adaptation strategy allows a person to respond flexibly to the environment, to be curious about everything new, to seek and experience new impressions. The behavior of a late adulthood person, in this case, is characterized by activity, assertiveness, purposefulness, focusing on the outside world and consistency. It also allows a late adulthood person to feel the consistency of his/her development, to experience a feeling of fulfilment and to change in accordance with new ideas and knowledge (Ermolaeva, 2004).

The desire for development as a factor of psychological well-being in late adulthood is also considered in the studies of J. Choy and V. Lou (2016), where they show that a problem-oriented coping strategy reduces symptoms of depression and increases life satisfaction for late adulthood people. The adoption of a new social role as grandparents is a form of personal growth and has a positive impact on psychological well-being (Taubman-Ben-Ari, Ben Shlomo, & Findler, 2018).

Fourth factor. We have called this factor *The Meaning of life* because the presence of the meaning of life is one of the most important conditions for "successful aging", as it gives a late adulthood person a sense of orientation, allows to integrate all stages of a person's life and to have positive expectations for the future. This is externalized in behavior in the ability to manage one's own activities, find and create opportunities to realize one's own needs, be involved in the real world and perceive all difficulties that occur as a source of development. It means harmoniously combine various types of activity and leisure, while at the same time striving to achieve one's own life goals, without submitting to other persons' opinions and external circumstances. The absence of the meaning of life leads to negative self-esteem and a feeling of one's own helplessness and uselessness. Only something negative is expected from the future because of the one's tendency toward excessive self-criticism and too rational conviction that life does not make sense.

The meaning of life as a factor of psychological well-being is highlighted in a study by M. Mohseni and colleagues, where they show that the presence of a meaning in life has a positive effect on mental, physical and social well-being (Mohseni, Iranpour, Naghibzadeh-Tahami, Kazazi, & Borhaninejad, 2019). A study by C. P. Freitas and colleagues (2018) show that the meaning of life mediates the influence of the pursuit of development and well-being of all ages.

One of the key elements of leading activity of late adulthood people is emotionally charged communication with other people. Meeting this need allows them to feel the emotional richness of life, which protects them from a feeling of loneliness, which can later lead to depression. Moreover, interest as a cognitive need for psychological well-being no longer has its former significance, a shift of rationality to the emotional sphere is observed here.

Let us turn to the theory of postformal thinking by J. Labouvie-Vief, the stage of cognitive development that occurs in late adulthood. This stage of cognitive development

occurs in late adulthood, after the stage of formal operations. The stage of formal thinking is characterized by logical operation with abstract categories. Besides logic, postformal thinking includes a subjective and emotional component, so that many phenomena acquire greater relativity. Interest, as a cognitive need, does not have so much significance for the well-being of a late adulthood person as it had at earlier age stages (Stuart-Hamilton, 2010).

A study by C. Noriega and colleagues (2017) shows that value-based behavior has a positive effect on psychological well-being.

The resulting factor structure can be represented as stages of psychological well-being. The first stage is associated with the manifestation of one's agent activity in a crisis situation, when psycho-physiological and social changes occur. The manifestation of activity and involvement in what is happening around will allow to change this crisis, to develop a new adequate form of behavior and image of the situation, to discover not only the shortcomings, but also the merits of one's position. That is, the basis of the psychological well-being of late adulthood people is agency.

For a new situation, a new system of relations is required, which will be formed with an understanding of one's own responsibility for what is happening around and one's own future, generates activity that is aimed at developing a new attitude towards people and the outside world, besides, a late adulthood person must show sufficient perseverance and even dominance to resist social negative influence. As a result, a late adulthood person achieves respect and forms the ability to empathize, understand other people and the outside world, rather than focusing only on oneself, which allows him/her to turn to other people for help in a situation when his/her own strength and capabilities are insufficient.

A new attitude to the world determines the strategy of adaptation to old age through personal development, because there is an image of the world and environment that is not dangerous, and the person will have positive expectations from his/her future and, as a result, strive to realize his/her potential in accordance with new conditions.

The strategy of adaptation through development allows a late adulthood person to find a new meaning of life and, as a result, to acquire a temporary perspective, that very quality, without which it is impossible to achieve psychological well-being in late adulthood.

Attainment a new meaning of life allows you to form the value of interaction and communication. Because it is communication and interaction in late adulthood that allow you to feel the emotional fullness, the feeling of a full life. It can even be assumed that the meaning of life is not aimed at achieving a specific goal, but at the realization of some kind of joint activity.

However, the flip side of this process remains: what happens to a late adulthood person who at some stage failed to adequately express his/her agency, form a new system of relations, adapt to his/her age through development, find a new meaning of life and realize the value of interaction.

Passivity at the first stage causes a feeling of worthlessness and helplessness, a state of depression. The failure to understand that it is a person himself/herself who forms his/

her own attitude towards the world and that this requires taking certain actions, forces a person to focus on formal systems of relations that existed in the past and do not correspond to the present-day reality. A late adulthood person who perceives the outside world as incomprehensible and hostile, adapts to it by narrowing his/her needs and interests and gradually begins to focus only on the preservation of his/her individual properties. As a result, a person is not able to find any meaning for his life, he/she is guided only by the past and rationalizes that he/she is weak and helpless. Even if a person subsequently shows any interest in the world around, it does not give any emotional satisfaction, since all of this seems to be relative to a person.

The resulting model in the context of the theory of aging is consistent with the theory of activity (Havighurst, 2009). This theory understands the aging process as the constant maintenance of one's activity to achieve one's goals and to resist attempts to exclude oneself from society. Also, the resulting model is consistent with the theory of the third age, where the post-retirement period is characterized as the time of personal self-realization, which is promoted by decrease of social responsibility and the presence of goals (Laslett, 1987). However, it does not address aspects of the development of new social roles and the impact of life on the aging process.

A further perspective of our research is the study of the psychological well-being of late adulthood people in the context of professional activity. In the context of pension reform, the study of psychological resources that ensure the preservation of psychological health, support efficiency and contribute to personal development, acquire particular importance and relevance. Another perspective is the validation of the stages of achieving psychological well-being in late adulthood.

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## **Emotion Regulation Training During the Preparation for the Basic State Examination (OGE): Case Analysis**

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## **Обучение регуляции эмоций во время подготовки к основному государственному экзамену (ОГЭ): анализ случая**

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**Abstract.** The article describes a clinical psychological case research of emotional self-regulation training during the process of preparation to the Russian General State Exam. There are presented theoretical and methodological foundations of the cognitive behavioral therapy protocol for children's and adolescents' phobic anxiety disorders treatment (by the example of panic attacks experience).

**The aim of the study.** Investigation of the anxiety dynamics during the process of cognitive behavioral therapy of anxiety issues amongst adolescents.

**The context and relevance of the study.** The problem of an anxiety increase amongst adolescents and the need for emotionally stable behavior development at the time of solving important life tasks such as General State Exam are still up to date. The treatment is based on cognitive behavioral psychotherapy and the principle of neuroplasticity. The knowledge of cognitive and behavioral theories of panic disorder, panic neurobiological foundations, components of the cognitive behavioral therapy general protocol for children's and adolescents' phobic anxiety disorders treatment (working with parents and informing them; cognitive block: working with assumptions about clients' own personality and the world around, self-esteem and self-confidence, and perfectionism; self-help techniques: muscle relaxation and breathing exercises, emotional expression and regulation; behavioral block: desensibili-

zation and gradual exposure in-vivo & in-vitro, coping strategies and skills) allows to plan therapy process with a client.

**The design of the study.** We use the case-study design and present the case analysis. As the stress factor there are considered training variants of the Russian General State Exam. As the dependent variable are measured attitudes toward these tests including markers of the anxiety and intensity of experienced panic attacks.

**Methods.** Conceptualization, mood scale. We organize the psychotherapy treatment for gaining emotional regulation experience during panic attacks, present the content of therapy sessions, home tasks, and fragments of dialogues between the psychotherapist and adolescent.

**Results.** The effect of the psychotherapy process of emotional stabilization is discovered. Also there is presented the effectiveness of the psychotherapy plan that includes cooperation with parents and teachers, self-monitoring, use of the STOP technique and technique of cognitive regulation, breathing relaxation; metaphors of a good and bad companion in correlation with positive and negative (catastrophic) thoughts.

**Keywords:** *neuroplasticity; panic attacks; cognitive-behavioural therapy; emotional self-regulation*

**Аннотация.** Описан клинико-психологический случай обучения эмоциональной саморегуляции в ходе подготовки к ОГЭ. Представлено теоретико-методологическое основание протокола когнитивно-поведенческой психотерапии по работе с тревожно-фобическими расстройствами у детей и подростков (на примере переживания панической атаки).

**Цель исследования.** Изучение динамики состояния тревоги в ходе реализации когнитивно-поведенческой психотерапии тревоги при работе с подростками.

**Контекст и актуальность исследования.** На сегодняшний день актуальным остается вопрос о росте тревоги среди подростков и необходимости формирования эмоционально устойчивого поведения во время решения жизненно важных задач, например, сдачи ОГЭ. В оказании такой помощи опорой выступают когнитивно-поведенческая психотерапия и принцип нейропластичности. Знание когнитивных и поведенческих теорий паники, нейробиологических основ паники, составляющих общего протокола когнитивно-поведенческой психотерапии тревожно-фобических расстройств детей и подростков (информирование и работа с родителями; когнитивный блок: работа с убеждениями в отношении себя, окружающего мира, с самооценкой и уверенностью в себе, работа с перфекционизмом; техники самопомощи: мышечная релаксация и дыхательные упражнения; выражение и регуляция эмоций; поведенческий блок: десенсибилизация и градуированная экспозиция in-vivo и in-vitro, копинг-стратегии, навыки) позволяет планировать психотерапевтическую работу с клиентом.

**Дизайн исследования.** Использовался дизайн кейс-стади, представлен анализ конкретного случая. В качестве стрессового фактора рассматривались тренировочные тестовые задания ОГЭ. В качестве зависимой переменной было взято отношение к ним, включавшее показатели тревоги, интенсивности переживаемых панических атак.



**Методы.** Концептуализация, шкала настроения. Проведена психотерапевтическая работа по формированию опыта эмоциональной саморегуляции в ходе переживания панических атак, представлены ход и содержание психотерапевтических сессий, домашнее задание, а также фрагменты диалога психотерапевта с подростком.

**Результаты.** Выявлен эффект психотерапевтической работы по формированию навыка стабилизации эмоционального состояния. Представлена результативность плана психотерапии, включающего: работу с родителями, работу с учителями, само-мониторинг, применение техник «стоп» и когнитивного самоконтроля, дыхательной релаксации; метафоры хорошего и плохого попутчика в отношении позитивных и негативных (катастрофических) мыслей.

**Ключевые слова:** *нейропластичность; панические атаки; когнитивно-поведенческая психотерапия; эмоциональная саморегуляция*

## Introduction

Over the last few years an increase of anxiety level among adolescents becomes rather noticeable. Volatile information sphere, intense educational and examinational activities are strong psychotraumatic factors for teen students who are getting through physical changes of their bodies, maturation, development of the nervous system and general emotional lability. When we feel emotions, amygdala generates “feelings” that change the meaning of information that comes to our brains. A person makes decisions not only on the basis of structural and logical conclusions but also on the previous experience that carries encoded in our memories emotional charge. As a functionally unified complex of nervous structures limbic system is responsible for our emotional behaviour, motivation, processes of learning and memorizing, instincts and circadian rhythm regulation. Therefore, there is a need for training of emotionally stable behaviour at the time of solving life’s important tasks like passing the exam.

## Theoretical Foundations

According to different authors, the prevalence of anxiety-phobic disorders among children and adolescents is 9–32 % (Chutko, 2010). Fear in extreme situations is a normal physical reaction that is aimed to mobilize body resources. Due to the fear a person can immediately pull oneself together and decide how to act in a dangerous situation. Within ICD-10 classification the following blocks are frequently used to define anxiety disorders of children and adolescents (Nullera & Cirкина, 1994):

F93 Emotional disorders with onset specific to childhood.

F93.0 Separation anxiety disorder of childhood.

F93.1 Phobic anxiety disorder of childhood.

F93.2 Social anxiety disorder of childhood.

F40.1 Social phobias.

F41.0 Panic disorder.

F42 Obsessive-compulsive disorder.

With the fact of the new ICD-11 classification where the chapter of *Mental Disorders* was changed and harmonized with American DSM-5 classification (according to the authors of working group) coming to force soon below there are listed the most frequent nosological units of anxiety-phobic disorders among adolescents and children (from the DSM-5 classification (Nullera & Cirkina, 1994)):

- Separation anxiety disorder.
- Selective mutism.
- Social phobia.
- Specific phobia.
- Panic disorder.
- Generalized anxiety disorder.

Psychotherapists of children and adolescents in their practice often work with specific phobias, social anxiety disorder of childhood, social phobias, separation anxiety disorder, panic disorder and agoraphobia.

Panic disorder — recurring unexpected attacks of severe anxiety, which are not restricted to any particular situation (Beck & Clark, 2019). Panic attacks are the consequence of high anxiety level that is increased because of autonomic nervous tension accumulation and autonomic system attenuation. Fatigue of autonomic system leads to more sensitive perception of symptoms and more intensive reactions to light, sound and touch.

The ICD-10 diagnostic criteria (F41.0) (Nullera & Cirkina, 1994):

- Recurrent and unpredictable attacks of severe anxiety (panic), which are not restricted to any particular situation.
- Vegetative symptoms, depersonalization and derealization that are coming along with the anxiety.
- Secondary fear of dying or going mad.
- Secondary avoidance of the situation where the first panic attack has occurred.
- Secondary fears of loneliness, crowded places, recurrent panic attacks.

Panic appears spontaneously however sometimes it is provoked by agitation, physical tension, sexual activity, and psychoactive drugs consumption. Main symptoms are extreme fear along with tachycardia, shortness of breath, sweating. An adolescent tries to leave the place where the panic attack has occurred and searches for help. The panic attack lasts up to an hour. Between panic attacks, there is an anxious expectation of repeated attack. Panic disorder occurs not only among adults but also among children. Often there is a connection between panic disorder and negative emotions experienced in the childhood. Tentatively we can identify four types of psychological childhood traumas that impact on development of the following personalities (Bakunova et al., 2018):

- (1) Usually, dramatic situations in childhood occur in the families where one or both parents suffer from alcoholism. It can cause violent family conflicts with dangerous consequences. It is assumed that these situations lead to fear fixation and

in adulthood under certain circumstances this fear with accompanying vegetative symptoms or the first panic attack can occur suddenly.

- (2) Emotional deprivation is possible in families where the sphere of parents' interests is concentrated on work or other non-family things. The child grows in emotional isolation. This situation frequently happens in incomplete families or when the child is grown by one of the immediate relatives. In other cases, the child sometimes can be forgotten when one of the parents suffers from severe mental or body disease and all the family cares about his or her health. Children and adolescents who were grown in such families feel a constant need in someone's approval and emotional contacts. Thus, their ability to resist stress substantially decreases.
- (3) Overanxious and overprotective behaviour. Anxiety as behavioural trait of one or both parents negatively impact on parenting. Parents excessively care about child's health, study and actions. Parents' anxiety finds expression in the constant anticipation of dangers or disasters and leads to limitation of child's independence. Those parents can walk their child to school and home again, accompany him to doctor's visits, different classes and courses till senior school. Thereby they stimulate infantilism of their child or in other words child's inability and unsuccessfulness in social sphere.
- (4) Chronic family conflicts with different causes create constant emotional instability in the family. Under these circumstances the child who includes into conflict emotionally can't successfully influence on it and finds the uselessness of his actions. This situation can develop child's feeling of helplessness. On the basis of this child's experience future difficult situations client will consider as unsolvable, he starts to feel helplessness that decreases his stress resistance.

Diagnostics observes severe anxiety attacks along with vegetative symptoms. Antidepressants, anxiolytics and cognitive-behavioural psychotherapy are used for treatment.

Cognitive-behavioural psychotherapy is a form of psychotherapy that includes techniques of cognitive and behavioural therapies. It is focused on certain problems and results. In the case of anxiety-phobic disorders therapy's goal is to reduce anxiety and neutralize fears. In turn it leads to the improvement of social functioning, self-regulation, mental flexibility to the acquisition of new more adaptive skills.

Theoretical-methodological foundations of working with the phenomena:

- Fundamental paradigms.
- The Biopsychosocial Model (G. Engel) (Lifintsev & Antsuta, 2013).
- Cognitive-behavioural paradigm (cognitive learning is realized by "cells assemblies" — neural connections and the development of neurons (neurogenesis) (Hebb, 1955).
- Cognitive and behavioural panic theories.
- Panic results from the misinterpretation of bodily sensations or emotional reactions as signs of inevitable catastrophe (D. Clark, P. Salkovskis).

- Psychophysiological vicious circle (A. Ehlers, J. Margraf).
- Neurobiological bases of panic (Chutko, 2010).
- “Automatic” amygdala activation (fight-or-flight response (Cannon, 2011)).

The development of the corticolimbic system happens through neuroplasticity — neurons’ ability of adaptation to the impact of life experience and other external and internal factors.

D. Clark’s vicious circle includes: Hormonal changes, stress, abstinence, unconscious aggressiveness → Unexpected sensations (fast heart rate, etc.) → Concentration of attention (scanning) → Catastrophic interpretations (“I’m dying,” “I’m going mad,” etc.) → Increased anxiety, activation of stress response, adrenaline emission that lead to even faster heart beating. The circle goes again.

Some authors of cognitive-behavioural psychotherapy suggested picking methods and techniques for adults individually depending on their distress level (Padesky & Beck, 1988). This principle is inappropriate for children and adolescents. For instance, while working with so called physical fears therapy is focused on cooperation with parents and their study of constructive forms of reactions to fears of falling asleep). In cases of slight anxiety at school the focus is made on social skills training (time management, etc.) and again on cooperation with parents. If anxiety and fears are more severe the variety of methods and techniques will be expanded.

Standard CBT protocol for anxiety-phobic disorders in children and adolescents includes the list of the following methods (Freidberg & McClure, 2015; Remshmidt, 2000):

- Parents’ awareness and interaction.
- Self-help techniques: muscle relaxation and breathing exercises.
- Emotional expression and regulation.
- Complex of behavioural methods: desensitization, in vivo and in vitro graduated exposure therapy, coping strategies, skills.
- Complex of cognitive methods: challenging beliefs about oneself and the world around, work with self-esteem, assertiveness and perfectionism.

Parents’ awareness and interaction. Parents’ awareness consists of explanations of children and adolescents fear and anxiety sources, manifestation of fear, causes of sleep problems, things that can provoke increased anxiety and fears, constructive reactions to kids’ fears, what to do and what not to do, the way of family environment stabilization (Brish, 2012).

An example of general recommendations for parents “What to do, and what not to do, when children experience fears”:

Parents should not (Kendall, Settapani, & Cummings, 2012):

- Laugh and make jokes about child’s fears.
- Blame and punish children for their behaviour associated with fears, ignore or do not pay attention.
- Convince children that “it is not possible or real.”
- Often talk about diseases and death.
- Isolate children from the world and overprotect them.

- Allow to watch everything.

Parents should:

- Take attention to the problem and think of what among the family environment, parents' behaviour or school atmosphere decreases the feeling of safety.
- Try to demonstrate calm and confident behaviour.
- Share examples about their own way of solving these fears in childhood.
- Encourage the child to talk freely about fears.
- Spend more time for pleasant things (entertainments, games, recreations) and sensibly manage time for study and extra activities (sport, classes, tutors).

Self-help techniques. Self-help techniques include muscle and breathing relaxation that are intended to decrease an extreme emotional tension during the “reliving” of stressful situations and maintain less anxious and more stable emotional state. Especially should be marked an importance of correct explanation to the child and parents the meaning of these techniques (Neff, 2003).

Training of emotional expression and regulation consists of emotional verbalization and description of somatic symptoms (sensations), acceptance of fears and ability to manage them, the use of pictures and photos for emotional training, the use of art therapy techniques and games, fear management. Muscle and breathing relaxation and distraction techniques are used for emotional regulation. The level of anxiety or fear can be defined through child's self-monitoring.

## Materials and methods

The article presents a clinical psychology case analysis of panic attacks. The girl (hereafter we are going to use the name Olya) of 14 years old has experienced panic attacks while working with sample variants of the OGE (Basic State Examination is a compulsory examination at the end of the 9th grade of the secondary school in Russia). According to her parents, she started to experience these panic attacks during her work with these tests at school and at home. Panic is provoked by agitation and physical tension. Main symptoms are extreme fear along with tachycardia, shortness of breath, sweating. The adolescent tries to leave the place where the attack has occurred and searches for help. The panic attack lasts up to an hour. Between panic attacks, there is an anxious expectation of repeated attack.

Teachers and parents are really concerned about Olya's behaviour. During the *first session*, we observed that Olya is extremely scared of being unintelligent and not going to the university because of comparing to her brother who successfully passed the exams and now is studying at the university. Olya's main fear is to panic right at the time of her exam, leave the classroom and therefore fail the exam.

During the first session, Olya was open to contact but acted anxiously. She said that she started to wake up really early and could not fall asleep after that because she felt

the fear of failure and it caused panic. She noted that she could not control herself, that she got swamped by strong emotions that she barely could verbalize.

Conceptualization: Olya's anxiety increases when she faces difficult tasks and she is not sure about their decisions. Then catastrophic thoughts about "her failure," "her inability to get through this" and "its negative effect on her future" appears and generates the fear of future that sometimes get stronger and grow into panic (Furman, 2013).

With this background the quality of her work objectively gets worse and alongside with increase of anxiety she feels shame, unpleasantness with herself and thinks about "her unintelligence and weakness." These feelings are strengthened by her constant comparison to her successful older brother and as it turned out by the pressure from teachers at school who motivated their students through intimidations of future failures if they get a low score on the test.

While working with emotions we discuss that it is important to learn how to measure and control the degree and intensity of anxiety and fears. For anxiety degree and intensity measurement Olya was suggested to fill the anxiety scale (three times per day mark the intensity of her anxiety from 0 to 10 where 0 is really low and 10 is really high) and describe the hardest situations in the diary of thoughts with the following columns: Situation; What did I feel? What thoughts did come to my mind? What did I do in response? What were the consequences? Effectivity of my actions (something that worked out well, not really or did not work at all) (Burdin & Ignatova, 2019).

Breathing relaxation, metaphor of good and bad companion and then cognitive self-control (self-persuasion) were chosen as the first methods of anxiety and panic control.

Abstracts from the dialog (where P — psychotherapist, O — Olya):

P: Let's talk about what is happening when you are working on the OGE test?

O: Okay.

P: You said that panic appears when you face tasks that are hard to solve. What are you thinking about at that moment?

O: I start to think that I'm a loser, that I can't solve all of these tasks, that I won't achieve anything. Thoughts in my head start to circle around, my body starts to shiver and it's getting hard to sit still. I want to run, to hit my head and call myself a loser.

P: How do you call this emotional state at this moment? Is it an uneasiness, anxiety or panic?

O: An anxiety... a strong one...

P: If we take panic as 100 % how many percent do you give to this anxiety?

O: Approximately 80 %.

P: Do you start doing something in order to cope with this state?

O: I try to read the task again and again but it doesn't help. I start to think that I'm a fool. Then try to stop thinking, close my eyes and clear my mind but it's not working. The first thought that comes to my mind is "I'm a fool." Then that "I can't make it," "I won't get to the university," "Everybody will laugh at me"...

P: How much do you believe in these words at this moment?

O: Pretty much. It seems so real.

P: Yes, that's hard. Please, tell me are there any real facts that approve your thoughts?

O: Yes, kind of. I can't solve the task and that's bad because I learned this at school. If I can't solve it then I won't get to the university and even if I get there, I won't be able to study.

P: Please, wait. You're starting to talk really fast and emotional. Describe your emotional state now.

O: It feels like I'm in the classroom solving the test. Do you understand me? Like I'm there. I feel like everything inside me is shaking. I can't control it.

P: Please, rate your state on the anxiety scale where zero is calmness and seven is panic.

O: Six.

P: Could you describe your physical sensations during this emotional state?

O: Everything inside me is shivering, my hands are shaking and sweating, heart's beating fast. Thoughts are confused. I can't concentrate.

P: Well, you describe everything in a very detailed and vivid way, good job. Look, soon you are going to pass the OGE, right? [Olya nods.] In order to pass this exam, it's important for you to learn how to work with your emotions and control anxiety. Would you like to learn it?

O: Yes.

P: Now you feel a strong discomfort and tension, right? You described your emotional state as a strong anxiety. As I understand if along with this state there are thoughts about failure and unsuccessful future your anxiety will grow into panic, right? [Olya nods.] Let's try to overcome this anxiety. There are a lot of methods to do this. First of all, you need to learn special breathing. Do you agree?

O: Yes.

Thus, Olya agreed to start working with her emotions and eventually overcome her fear. The main way of therapy was the development of emotional stability skills. At the end of the session Olya made a deal with the psychotherapist about working on breathing techniques twice a day on a regular basis in a calm state and additionally before solving the test and in other moments of anxiety. Task for her parents was to encourage and praise her, talk about school and lessons. Also there was a suggestion to her parents to stop comparing Olya to her older brother and share with her their childhood memories when they similarly felt worried at school and their way of coping with these feelings.

Further therapy plan was approximately as follows:

- (1) Work with parents: explanation of fear sources, development of adequate forms of reactions on daughter's behaviour, the use of positive reinforcement for her achievements in coping anxiety and fear.
- (2) Preferably work with teachers: explanation of fear sources, development of adequate forms of reactions on children's anxiety and panic, recommendation to organize a lesson about coping with stress, change of motivational model at school, exclusion of intimidation and the use of positive reinforcement and praise.
- (3) Self-monitoring — with the help of anxiety scale and diary of anxious thoughts.



- (4) “STOP” techniques, cognitive self- regulation.
- (5) Breathing relaxation.
- (6) Metaphor of good and bad companions towards positive and negative (catastrophic) thoughts.

### ***Second session***

Evaluation of Olya’s emotional state dynamics shows that a strong anxiety and sometimes panic are still persisted.

Homework analysis: regularity and correctness of breathing relaxation. Olya followed the recommendations to do breathing relaxations, but she did it not for a long enough period of time. Sometimes she forgot about them and sometimes started to worry that she is spending her precious time on breathing instead of working on test.

Abstracts from the dialog:

P: Last time you said that when you can’t solve the task you start to panic and some “bad thoughts” about the future appear in your mind. How strong are they now? Use the same 7-point anxiety scale.

O: I would rate them as five. It’s hard to control these emotions.

P: Ok. Let’s talk. Your emotions can help you or they can disturb you. Figuratively speaking, they can be both bad and good companions. You’ve already been trying to decrease your anxiety or in other words gradually change your emotions into your good companions with the help of breathing relaxation. Let’s try other methods. Do you agree?

O: Yes.

P: Our emotions depend on our thoughts and vice versa. You said to me that when worry a lot you start to think about negative future consequences. [Olya nods.] Can we suggest that these thoughts help you to control your emotions as well?

Olya was suggested to fill in the following blank: My anxiety tells me: ...I can answer to it..., e. g.:

“Anxiety is like a wind, it blows on and then always blows away.”

“These thoughts only disturb me, it’s better not to think about it.”

“Everybody worries during exams and tests. That’s normal.”

“I’ve already experienced these emotional states. I’ve coped with them before and I will cope with them now. I’m in control of my emotions.”

Write down 5–6 more sentences that could be answers to your fears and anxiety.

It was explained to Olya that when she feels anxiety or panic there is a need to talk to these emotions and thoughts. It is important to tell them the information from the blank and notice which of these sentences better stabilize her emotions and use them in the future.

Homework. To continue practicing breathing relaxation and “STOP” technique, using the metaphor of good and bad companions, filling in the blank of responses to fears



and anxiety, choosing the most effective answers for self-persuasion and making notes in an anxiety diary.

The following child's cognitive schemas were defined:

Automatic thoughts: "I'm unintelligent," "I won't get to the university," "I can faint," "I can lose control."

Compensation strategies: avoidant behaviour, hypercontrol.

Conditional rules: "If I control my emotional state, I will be safe," "If I avoid dangerous situations, I will be safe."

Core beliefs: "I'm helpless and I can't control myself." "World is a dangerous place."

When Olya cannot solve the task — the following thought appears: "I'm a loser, I won't achieve anything." The thought contributes to anxiety increase and panic (with the body shivering, desire to hit her head and inability to sit still). Olya rereads tasks but that does not help her to calm down. The child starts to think: "I'm a fool and everybody will laugh at me." This thought leads to the anxiety increase and continuing scanning for unpleasant physical sensations and attempts to avoid this situation...

Homework includes the following techniques (Freidberg & McClure, 2015):

- (1) Breathing relaxation: 1. Lie down and close your eyes. Focus on your bodily sensations. Make a few breaths. 2. Lay one hand on your chest and the other on your belly (a bit lower than your waist). While taking breaths imagine that you lead the air flow deeply inside your body. The hand that lies on your chest should stay absolutely motionless meanwhile the other hand that lies on your belly have to go up and down with each breath. 3. Continue to slowly breathe in and breathe out. Let your breathing find the right rhythm. 4. After a few breaths start to count the number of breaths. After ten breaths start to count again from the beginning. 5. Do not wait something special: just breathe and count. Take attention to your emotional state before and after the exercise and after a week of practicing.
- (2) "STOP" technique: Step 1. Say STOP to yourself when emotion appears. Step 2. Take a break for 5–7 minutes. Breath (make at least 10 breaths). Step 3. Work with thoughts. Give names to the emotions: "Now I feel worried about ...," "I feel that ...," "I can go away now or I can break the contact," "I can scream or concentrate and solve the task." "I have every right to do it. I can choose any way of reaction. I want to choose the most effective way of reacting." Breathe deeply from your belly again for 1–2 minutes.
- (3) Metaphor of good and bad companions: Step 1. Accept the presence of emotion. Step 2. Realize what you feel now. Step 3. Understand what kind of companions are with you now. Choose the good one. Step 4. Accept the fact of suffering. Step 5. Self-help and self-compassion as a skill of caring for ourselves while facing the fact of our inferiority, mistakes, failures and painful life situations.
- (4) Dialogue with fears and anxiety: "Anxiety is like a wind, it blows on and then always blows away, y" "These thoughts only disturb me, it's better not to think about it," "Everybody worries during exams and tests. That's normal," "I've already

experienced these emotional states. I've coped with them before and I will cope with them now. I'm in control of my emotions."

(5) Keeping an anxiety diary.

Training of emotional self-regulation was based on repetition that consequently strengthened neuroplasticity potential of nervous system in general (Samohvalov, 2002).

At the end of the therapy, it was important to organize the session for self-regulation skills development monitoring.

Comments: in this case for emotional regulation and decrease of anxiety we used behavioural techniques that influence client's physical state (breathing relaxation) along with cognitive techniques (cognitive self-control/self-persuasion). At the same time was organized psychological education for parents. Further it is necessary to consolidate acquired skills and continue the therapy for working with self-esteem (changing girl's beliefs about herself), development of the realistic (non-catastrophic) vision of the future and conversion of habitual schema of catastrophic thinking.

The theoretical-methodological fundamentals of the article are neurocognitive and cognitive-behavioural approaches. Our work is based on the principle of neuroplasticity that demonstrates neurons' ability of adaptation to the impact of life experience and other external and internal factors (Zhivolupov, Samartsev, & Syroezhkin, 2013). External factor of psychocorrection is an actualization of family system support, internal factor is the development of emotional self-regulation skill. In the process of (during) conceptualization we detected client's fear of being unintelligent and fear of panic attack occurrence right at the time of passing the exam. Priority of our therapy was the development of emotional stabilization skill.

## Results

At the end of the therapy we receive the following results: dynamics of estimations on the anxiety score is 9–8–6–5–3.

The girl still worries while working on tests and other control activities, but she can handle her emotional state. Through the training of emotional regulation we create new synaptic connections.

Olya has passed the sample variant of the OGE with a relatively high score.

Treatment with the aim of neurons' adaptation to different impact with the help of cognitive-behavioural techniques was done. Dynamics of girl's emotional state estimations shows that before training panic was persistent however after the neurons' adaptation and development of emotional self-regulation skills panic attacks decreased.

## Conclusion

In order to solve the problem of emotional instability in adolescence we use neurocognitive and cognitive-behavioural approaches that demonstrate their effectiveness for working with panic attacks. For psychocorrection we use the protocol of cognitive-behavioural therapy for children and adolescents anxiety-phobic disorders:

- (1) Parents' awareness and interaction: explanation of fear sources, development of adequate forms of reactions on daughter's behaviour.
- (2) Interaction with teachers: explanation of fear sources, development of adequate forms of reactions on children's anxiety and panic.
- (3) Fear thermometer.
- (4) Training of self-help techniques (e.g. "STOP" technique, breathing relaxation, metaphor of good and bad companions).
- (5) Training of emotional expression and regulation.

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## **Diagnostic Tools for Children with Severe Multiple Developmental Disorders: Eye-tracking and Electroencephalogram Approaches**

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## **Диагностические инструменты для обследования детей с тяжелыми множественными нарушениями развития: айтрекер и электроэнцефалограмма**

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**Abstract.** Two pilot studies of children with profound damages of central nervous system were conducted by using eye-tracking. Design of electroencephalographic event related potentials (ERP) study is proposed. We aimed to test different approaches for diagnostic of this clinical group using eye-tracking and electroencephalography.

First study was an attempt to adopt classical diagnostic tool with verbal instruction to presentation on tablet with integrated eye-tracker. The result of this study reveals that it is impossible to use standard tools for very impaired children. Furthermore, we proposed several factors that could be crucial for eye-tracking tasks performance.

In the second study we tried to avoid tasks that require verbal instruction and voluntary control. Visual search task and Posner cuing task were presented through tablet with integrated eye-tracker. No reliable records of gaze were obtained in this study.

Planning study is developed for using of ERP for diagnostic. We proposed that ERP passive oddball paradigm may allow us to examine psychological state and cognitive process

of children. In the end we discussed the conditions and requirements for both approach application in diagnostic children with severe multiple developmental disorders.

**Keywords:** *developmental disorders; psychological diagnostic; cerebral palsy; eye-tracking; electroencephalography (EEG); event related potentials (ERP); oddball task*

**Аннотация.** В статье представлены результаты двух пилотных исследований детей с тяжелым поражением центральной нервной системы, проведенных с использованием айтрекинга. Спроектирован дизайн исследования с применением электроэнцефалографических потенциалов, связанных с событием (ПСС). Целью работы стало тестирование различных подходов к обследованию данной группы лиц с использованием айтрекинга и электроэнцефалографии.

В первом исследовании сделана попытка использовать классический диагностический инструментарий, предъявленный на планшете со встроенным айтрекером и вербальными инструкциями. Результат этого исследования показал, что использование стандартных инструментов для данной категории детей крайне неэффективно. Кроме того, был выявлен ряд факторов, которые могут иметь решающее значение при выполнении заданий, предполагающих отслеживание взгляда.

Во втором исследовании была сделана попытка избежать заданий, требующих вербальных инструкций и произвольного контроля. Задача визуального поиска и задача с периферической подсказкой Познера были предъявлены через планшет со встроенным айтрекером. В этом исследовании также не было получено надежных записей взгляда.

Спроектированное исследование предполагает использование ПСС. Мы выдвинули гипотезу, что применение oddball-парадигмы позволит изучить психологическое состояние и когнитивные процессы данной группы детей. В заключении статьи обсуждаются условия и требования, необходимые для проведения обследования детей с тяжелыми множественными нарушениями развития.

**Ключевые слова:** *нарушения развития; психологическая диагностика; детский церебральный паралич; электроэнцефалография (ЭЭГ); потенциалы, связанные с событиями (ПСС); oddball-парадигма*

## Introduction

The term *severe multiple developmental disorders* (SMDD) has traditionally been used in Soviet and Russian national special pedagogy to “designate a combination of three, or more pronounced developmental disorders” (Filatova & Karakulova, 2017, p. 7). A. M. Tsarev notes that mental retardation (Tsarev & Golovchits, 2014), which mainly manifests itself in a moderate, severe, or intensive degree, is the main one in the clinical picture of SMDD.

Since the adoption of the Law on Education in the Russian Federation (with amendments and supplements introduced by the law dated 2012), this category of children has

been recognized as *educable*. However, there are still difficulties in determining what and how to teach such people, which to some extent, is due to insufficient understanding of their abilities and capabilities (Federal Law No. 273-ФЗ, 2012).

Severe intellectual and psychophysical underdevelopment among SMDD people can be combined with local or systemic visual, hearing, musculoskeletal disorders, disorders of the emotional-volitional sphere, autistic disorders. Experts working with such children also detect current mental and somatic diseases (Order of the Ministry of Education... 2014). Children's speech is represented by inarticulate sounds or a set of several onomatopoeic or sound-imitating words. In cases when other people address such children, they perceive, first of all, intonation.

The clinical and psychological structure of the defect in children with SMDD is caused by the phenomena of "irreversible underdevelopment of the brain as a whole with predominantly immaturity of its cortex, primarily of the frontal and parietal lobes" (Lebedinskaya & Lebedinsky, 2011, p. 40).

This group of children is extremely heterogeneous. Their distinctive feature is the varying severity of intellectual impairment and psychophysical development among children of the same age. The level of formation of a particular mental function, practical skills can vary significantly.

Due to the specific features, children with SMDD are usually perceived as deeply mentally retarded, and professional literature seldom differentiates this category of children, taking into account the nature and degree of their intellectual impairment.

*Specific features of SMDD children with moderate mental retardation* (Shipicyna, 2002), as a rule, begin to appear in the first months of a child's life and subsequently lead to inexpressiveness, "diffuseness" of the main periods of developmental and age crises. It is difficult to define the shifts in the leading type of such children's activities and qualitative changes in their psyche and personality.

Such children demonstrate a slow and uneven pace of development. First of all, this applies to the late formation of motor functions. The children begin to roll over, sit down, get up, and occupy an upright position later than their equals in age. Fine motor skills remain undeveloped. It is difficult for such children to formulate a standard program of action. This problem affects their emotional shiftability and dynamics.

Depending on the predominance of the processes of inhibition or arousal, the behavior of the children can be different. Some children are very lethargic, passive, inhibited, while others, on the contrary, are very mobile, restless, animated. They continuously strive to do something, take various objects, try to manipulate them, but quickly drop what they have begun to do and start doing something else. Left to themselves, many children are practically not capable of any purposeful and creative activity.

Their storage of knowledge and ideas about the external world is small and often limited to the knowledge about the objects of everyday life. Their attention is extremely unstable; the process of memorization is mechanical; hand-eye coordination is grossly impaired; it is difficult for them to understand the situation, to single out the main as-



pect in it; to establish causal relationships; to transfer an already familiar, known action to new conditions.

Proceeding from the level of speech formation, S. D. Zabramnaya and T. N. Isaeva (2012) distinguish three groups of children. They are as follows: the group of children who have no speech, i. e., “speechless” or “non-speaking” children; the group of children with statements at the level of individual words and the group with the continuum of a phrase. All children have a limited perception of conversational speech and its situational understanding. Sometimes the first words appear in 3–4 years, a simple phrase only in 5–6 years. However, having appeared, the phrase remains slurred, speech-defected, rare, with multiple grammar mistakes. In their passive dictionary, there are words with clearly fixed meanings of objects from their immediate surroundings. There are the replacements of object names with the words denoting actions. Speech does not serve as a means of communication for such children. This state of speech, to a greater or lesser extent, persists throughout their life, which indicates the persistence of speech disorders.

The formation of the game for these children largely depends on the participation of the surrounding adults. Own play is usually limited to unfocused manipulations with toys. Only after repeated repetitions of an adult, joint reproduction of simple plots — such a child can repeat them individually.

When choosing toys, children give preference to well-known toys which are frequently a part of their everyday life. Most often, they repeat the same actions with toys in a learned manner. Some children have a chain of subject-game actions of 2–3 operations, but, as a rule, a complete plot does not arise. Self-introduction of game actions does not occur; the use of substitute toys is absent.

The degree to which hygiene skills and self-care are developed may vary. The greatest difficulty for children with moderate mental retardation is lacing, tying shoelaces, and button fastening, as well as skills associated with tools (brushing, combing).

The children may have a reduced need for contacts. The skills to interact with peers are hardly formed. In the process of interacting with adults, they are capable of accepting explanatory and educational assistance. Transfer of learned methods of action is possible only with the help of an adult. Own activities are possible, depending on the previously learned methods of action and organized assistance. During activity performance, the children can compare their actions with a sample. They have an emotional reaction to success and failure, an understanding of praise and criticism.

*SMDD children with severe mental retardation* (Shipicyna, 2002) do not initiate contact on their own even at the beginning of school-going age. They are characterized by passive submission. They experience difficulties in understanding oral address; they need a clear instruction with a gesture or a facial expression. Such children have little interest in new items. It is possible to draw their attention to something only for a very short time.

Children are not capable of transferring the shown mode of action to a similar task. They do not distinguish the functional purpose of many objects. The main way to learn



new things is only through joint action with an adult. Independent actions are only possible at the level of individual operations.

There is no self-control skill, children may be indifferent to criticism.

These children are only familiar with objects of their immediate environment (rooms, streets where they walk). They can show only basic parts of the body. The own speech of such children most often ranges from its complete absence to sound complexes and sound imitating.

Self-service skills are almost entirely absent, and they need care. Only a small part of the children tries to dress and undress on their own, but they do it ineptly, they confuse the sequence of operations. The skills of eating are better formed than other skills, i.e., they hold a spoon in their fist, although their eating is sloppy.

The co-existing disabilities of the *intense mental retardation* disorders in children with SMDD include the conditions which are as follows: cerebral palsy, epilepsy, hydrocephalus, microcephaly, malformations of internal organs. Therefore, one of the most pressing questions arising in relation to these children is the question of clarifying their intellectual state and learning opportunities.

Given these features, the examination of children with SMDD requires the use of special diagnostic techniques, since the classic diagnostic tools existing in practice make it possible to record the result of a specific child's performance or non-fulfillment of the proposed tasks, based on the level of formation of connections between the perception of the instruction, action, and speech. However, SMDD children do not use words to fulfill the function of building the relationship between sensorimotor processes and thinking.

Thus, the use of traditional methods often indicates the impossibility to objectively assess the level of development of higher mental functions, the level of learning and training, and other indicators.

Due to the difficulties of examining children who cannot express their reactions to tasks in the usual way — speech (sounds) or actions — it is necessary to organize the diagnosis using methods that are available to them using safe analyzers, primarily visual.

At present, there is a large body of world literature describing the use of eye-tracker technology in working with people with severe motor impairments, i.e., tetraparesis (Anand, Geethamsi, Pasha, & Kodali, 2013; Clarke, Loganathan, & Swettenham, 2012; Hernández, Encinas, Gómez, Rodríguez-Elías, & Gerardo, 2016; Lee et al., 2019; Myrden, Schudlo, Weyand, Zeyl, & Chau, 2014; and others), neurodegenerative conditions (Buenoa, Sato, & Hornberger, 2019), amyotrophic lateral sclerosis (Linse et al., 2017). These are pilot studies that are conducted on small samples of patients with disabilities — from 1 (Anand et al., 2013) to 11 (Linse et al., 2017). These studies aim to search for opportunities for forming alternative communication methods, or at least communicate the patients' needs to guardians (Hernández et al., 2016; Lee et al., 2019; Linse et al., 2017; Myrden et al., 2014). Only a small part of the research targets evaluating cognitive functions (Buenoa et al., 2019).

Currently, a large number of methods have been created that allow the examination of SMDD children (Baryaeva, 2003; Baryaeva, Gavrilushkina, Zarin, & Sokolova, 2012; Baryaeva et al., 2010; Boryakova, 2000; Levchenko & Zabramnaya, 2003; Morozov, 2015; Morozova, 2007; Nefedova, 2010; Shipicyna, 2002; Shipicyna, 2012; Strebeleva, 1998; Strebeleva, Mishina, Razenkova, Orlova, & Shmatko, 2004; Strebeleva, Venger, & Ekzhanova, 2002; Strebeleva & Zakrepina, 2018; Vereshchaga, Moiseeva, & Pajkova, 2017; Zabramnaya, 1988, 1998, 2005; Zabramnaya & Borovik, 2003; Zarin, 2015; and others), however, their use requires systematization, and may not be used for all children in this group. So, for example, the work by L. M. Shipitsyna (2002) describes the features of the diagnosis of sensory-perceptual functions and social development of children and adolescents with moderate, severe, and deep mental retardation, as well as social skills of young people with these features. In addition, it describes the specifics of parents' assessment of the formation of social skills and emotional and behavioral reactions in adult children with moderate and severe mental retardation. The work by S. D. Zabramnaya and T. N. Isaeva (2012) describes in detail the procedure for examining children in their first two weeks of schooling. In the recommendations by I. V. Vereshchaga et al. (2017), it is proposed to use a diagnostic kit, including the assessment of auditory, visual, tactile perception, and also, the conditions for the diagnosis, including the organization of positioning during the examination. S. S. Morozova (2007) points out how to diagnose children with severe complicated forms of autism through observation. In the appendix to this work, there are an extensive stimulus material and samples of diagnostic charts. The federal resource center for SMDD children in the city of Pskov (Russia) does an enormous work to create special tools for such children.

Nevertheless, the analyzed work practically does not provide any instrument operating examination methods. However, in recent years, it is proposed to use these methods for examining SMDD children: event related potentials (ERP) survey, electroencephalography (EEG), electrooculography (EOG), myography, eye-tracker (Antropova, Tretyakova, & Shulakov, 2018).

## Research

Our **general aim** was to develop the diagnostic tool adopted with using of electroencephalography and eye-tracking for group of SMDD children. The diagnostic tool should allow to examine cognitive abilities of such children and help to develop their educational trajectory.

### Experiment 1

The aim of the first study was to attempt to make an eye-tracing adaptation of classical diagnostic tools used in Psychological Medical Pedagogical Commission (PMPC) assessment (Anand et al., 2013) for observation SMDD children.

The participants were 10 foster-children of Yekaterinburg orphanage for disabled children, 5 of them are living in palliative department, other 5 are living in the department

of social rehabilitation. Participant's age was from 6 years 2 month to 13 years 3 months. Clinical diagnosis of participants are shown in the *Table 1*.

*Table 1*

**Neurological status of participants**

Participant	Age	Neurological status
Child 1 Boy	8 years 10 months	Residential period of severe traumatic brain injury. Post-traumatic hydrocephalus. Intracranial bypass surgery. Spastic tetraparesis, more on the left. Pseudobulbar syndrome. Structural focal epilepsy, remission.
Child 2 Boy	9 years	Structural focal epilepsy, remission. Secondary microcephaly. Pseudobulbar syndrome. Cerebral palsy, spastic syndrome.
Child 3 Girl	8 years 10 months	Organic damage to the Central nervous system. Internal hydrocephalus. Cerebral palsy, spastic syndrome. Pseudobulbar disorders. Structural focal epilepsy, remission.
Child 4 Girl	8 years 10 months	Occlusive tetraventricular hydrocephalus, decompensation. Cerebral atrophy of the 3rd degree. Condition after repeated intracranial bypass surgery. Cerebral palsy, spastic syndrome. Violation of motor activity level 5. Pseudobulbar disorders. Structural focal epilepsy, remission.
Child 5 Girl	13 years 3 months	Cerebral palsy, spastic syndrome. Violation of motor activity level 3–4. Pseudobulbar disorders. Structural focal epilepsy, remission.
Child 6 Boy	9 years 4 months	Residual cerebral-organic insufficiency.
Child 7 Boy	6 years 2 months	Down syndrome. Autonomic dysfunction syndrome.
Child 8 Girl	8 years 5 months	Organic damage to the Central nervous system. Secondary microcephaly. Fetal alcohol syndrome. Myotonic syndrome.
Child 9 Girl	12 years 8 months	Organic damage to the Central nervous system. Microcephaly. Fetal alcohol syndrome. Structural focal epilepsy, remission. Syndrome of pyramidal, extrapyramidal insufficiency operated congenital heart disease.
Child 10 Girl	8 years 3 months	Residual cerebral-organic insufficiency.

Records were performed by Tobii PCEye eye-tracker integrated with Lenovo Miix 510 tablet.

Stimuli were standard tasks (Baryaeva, 2003) used for assessment of preschool and early school children and adopted for presentation on the tablet: assessment of standard visual figures differed by color/shape/size; recognition of images, congruent to the observer's instruction: parts of the face, body and times of day, familiar things (spoon, ball), and familiar actions (ablutions, sleeping). All the stimuli were adopted for perception features of SMDD children under the following demands:

- Hand-drawn realistic pictures.
- Low detailed images, with simple shapes. Not simplified depiction of objects (e.g. a window was not depicted by one line; a star was not depicted by a simple shape etc.).
- An absence of optical and cognitive illusion, ambiguous or indistinct images.
- Illustrations with a tendency to planar painting.
- Avoiding cartoon-like and pseudo-childish depiction.
- Using of Luscher's color circle, avoiding of ambiguous shades and complex colors.
- Simple objects composition with definite, without overlapping, objects positions.

Stimuli were presented by software MS PowerPoint. The two-dot calibration was performed. Records were conducted in the playing room. Two children were laying on the couch, other one was staying in verticalizer, other three were sitting in wheelchairs, and others were sitting by themselves on a chair.

Gaze data were analyzed frame by frame for defining gaze direction. Only qualitative analyses of records were performed, as due low calibration quality and big amounts of artifacts quantitative analysis couldn't be performed.

Areas of Interesting (AOIs) were made for each object on the picture. Following measures were used for evaluation of task performance: fixation duration on AOIs before instruction; fixation duration on AOIs after instruction; differences in fixation durations on AOIs before and after instruction. The response to the instruction was evaluated as general difference in gaze movement before and after instruction presentation.

Records were carried out for 8 participants, and were not conducted for two participants: one of them refused to establish an eye contact and gone from the room, and another one's gaze could not be record due sever permanent nystagmus with great amplitude. General task performance description is provided in the *Table 2*.

It is important to notice that only 4 children were able to recognize standard visual figures. Five children were able to recognize parts of the face, body, and familiar actions. Only one participant was able to recognize time of a day.

The attempt of adaptation classical PMPC diagnostic tools in general was unsuccessful. The main reason of this was applying of standard tasks included verbal instruction. During the experiment the most of participants demonstrated poor response to the instruction or absence of such response that was revealed by the absence of difference in gaze behavior before and after instruction presentation. Such results could be interpreted by the several factors: general speech underdevelopment, low receptive language development, low executive functions development, visual or speech perception impairment, agnosia.

Furthermore, a small number of correct responses could be result of that educational materials and programs used for SMDD children did not include materials that related to task, used in the experiment.

Table 2

## General task performance description

Participant	Calibration quality	Instruction response	Task performance
1	One point complete. Poor	Impossible to assess	—
2	No calibration	Impossible to assess	—
3	<i>Record did not conducted due nystagmus</i>		
4	Two points complete. Poor	Expressed poor	Differences in fixation duration before and after instruction for a few tasks.
5	Two points complete. Average	Expressed poor	Differences in fixation duration before and after instruction for a few tasks. Gaze shift after instruction presentation.
6	Two points complete. Average	Expressed enough	Differences in fixation duration before and after instruction for a few tasks. Gaze shift after instruction presentation. Motor responses.
7	<i>Record did not conducted due refuse of participant</i>		
8	Two points complete. Poor	Expressed poor	Differences in fixation duration before and after instruction for a few tasks.
9	Two points complete. Poor	Expressed poor	Differences in fixation duration before and after instruction for a few tasks. Motor responses.
10	Two points complete. High quality	Clearly expressed	Gaze shift after instruction presentation. Motor and verbal responses.

Additionally, we proposed following problems and possible way of solution that could help improve the quality of eye-tracking diagnostic:

- (1) **Problem.** Assessed children mostly have different motor impairments in the range from local limbs paresis to severe spastic diplegia. Due the motor impairments the pose of child during assessment could not allow to locate enough good eye-tracker related to child.

**Solution.** Application of special verticalizer or couch with eye-tracker's support arm for achievement optimal interlocation of participant and eye-tracker

- (2) **Problem.** The speciality of SMDD children is low level of sustained attention, high fatigability. Our experiment was conducted in the playing room with average luminosity and in presence of several experimenter and PMPC specialists. Such ambience could decrease the quality of recording.

**Solution.** It is crucial for SMDD children eye-tracker's experiment to minimize distracting effects: luminosity must be low (but not absence); exclude any noises; experiment must be carry out by one experimenter, it is acceptable presence of one caregiver; record's should be conducted when children are in tranquil but vigorous state.

- (3) **Problem.** Some children from rehabilitation care demonstrated good level of cognitive development and were trying to take motor responses to the instruction questions, and therefor interrupt the record. On the other hand, other children with severe complex impairments demonstrated low calibration and record quality and they could not be assessed.

**Solution.** We need to specify characteristics of SMDD children who may be assessed by eye-tracking. Using tablet eye-tracking for less impaired children may have advantage only for special tasks (e.g. antisaccade task). Children with severe neurological and developmental diseases could have strong damage of essential for eye-tracking cognitive, motor, and communicative skills.

Results of the first experiment allow us to conclude that diagnostic procedure of SMDD children should exclude a verbal instruction. For this end we supposed to use tasks and procedures adopted for the infant studies.

## Experiment 2

Aim of the second experiment was to test SMDD children with specially developed stimuli and procedure based on that used for infant researches and do not need any instruction.

The participants were 6 foster-children of Yekaterinburg orphanage for disabled children living in palliative department. Participant's age was from 4 to 11 years. Clinical diagnosis of participants are shown in the *Table 3*.

There were two kind of tasks used in this experiment.

*The first task* was classical visual search task adopted for infant research. Stimuli and procedure were similar to those used in study C. H. M. Cheung, R. Bedford, M. H. Johnson, T. Charman, and T. Gliga (2016).

There were total 16 images with circle array of 8 symbols. 7 symbols were distractors letters "X" and one symbol was a target. In 8 images target was "+" and in other 8 target was a capital letter "O". Duration of image presentation was 1.0 s. Target position was changed in each image in random sequence and never repeated. Before each image presentation the fixation cross in the center of screen was shown for a 1.0 s. The image presentation sequence was random.

*The second task* was modification for eye-tracking of M. I. Posner (1980) cueing task used for attention assessment.

We used following presentation sequence: fixation cross in the center of screen for a 1.0 s; left or right cue; fixation cross in the center of screen for a 1.0 s; left or right target. If the target and cue position was on one side the condition count as congruent, otherwise the condition was incongruent. There were total 10 trials with random side and condition presentation.

Table 3

## Neurological status of participants

Test subject	Age	Neurological status	Related violations
Child 1 Girl	14 years	Cerebral palsy, spastic syndrome. Violation of motor activity level 5. Pseudobulbar disorders. Structural focal epilepsy, remission.	Convergent strabismus, dysphagia, dysphonia, lack of articulation, tongue deviation.
Child 2 Boy	10 years	Cerebral palsy, spastic syndrome. Violation of motor activity level 5. Pseudobulbar disorders. Structural focal epilepsy, remission.	Exotropia, dysphagia, lack of articulation, tongue deviation.
Child 3 Girl	5 years	Multi-level occlusion hydrocephalus, compensation stage. State after multiple operational interventions. Total encephalomalation. Cerebral palsy, spastic syndrome. Violation of motor activity level 5. Pseudobulbar disorders. Structural focal epilepsy, remission. Generalized kinesigenic hyperkinesis.	Exotropia, dysphagia, dysphonia, lack of articulation, tongue deviation.
Child 4 Boy	11 years	Cerebral palsy, spastic syndrome. Violation of motor activity level 4. Pseudobulbar disorders. Structural focal epilepsy, remission.	Dysphagia, lack of articulation.
Child 5 Girl	4 years	Multi-level multicystic hydrocephalus, compensation stage. State after multiple bypass operations. "Disconnected" fourth ventricle syndrome. Total encephalomalation. Cerebral atrophy. <u>Epileptic encephalopathy (axial tonic spasms, clonic attacks)</u> , remission. Cerebral palsy, spastic syndrome. Violation of motor activity level 5. Pseudobulbar syndrome. Palliative status.	Exotropia, horizontal nistagmus, dysphagia, dysphonia, lack of articulation, tongue deviation.
Child 6 Boy	9 years	Cerebral palsy, spastic syndrome. Violation of motor activity level 5. Structural focal epilepsy, remission. Palliative status.	Convergent strabismus, dysphagia, lack of articulation, tongue deviation.



Gaze data were analyzed frame by frame for defining gaze direction. In visual search task the fixation duration on target and relative fixation duration on target / distractor were measured. In Posner cueing task fixation duration on target and time from target appearance to gaze shift.

Records of gaze were taken only from 2 participants. Furthermore, calibration quality of these records was very low therefore analysis could not be performed.

However applied tasks did not demand any instruction or voluntary control of attention or movement, we were not being able to get any reliable results from our participants. Records we have got could not be used for defining of gaze direction, moreover four participants were not recorded because of their states. It should be noted that participants were very inactive: an absence of any vocalizations, poor oculomotor activity etc. Such behavior may related to severe neurological state or to applying of sedatives for participants.

Based on two attempts of SMDD assessment we may propose that applying of eye-tracking technology for such participants diagnostic or rehabilitation is almost impossible. Thus, we stated the next experiment aim is to test the reliability of using for SMDD children assessment of ERP in oddball paradigm.

### Experiment 3

Aim of the third study is to test applying the ERP in oddball paradigm for assessment of cognitive functions in SMDD children.

We are planning to measured ERP in 15 foster-children of Yekaterinburg orphanage living in palliative department with severe multiple development disorders in the age range from 4 to 13 years.

We are going to use passive oddball paradigm. There are a lot of study demonstrated the possibility of using this paradigm for consciousness level evaluating (Erlbeck et al., 2016) or, at least, sensitivity of passive oddball for severe consciousness and cognitive impairments (Real et al., 2016). Whereas some locked-in state patients may not exhibit brain response to such stimulation (Lugo et al., 2016), there is no doubt that existing of the response will reveal the presence of basic cognitive processes.

We will use passive oddball paradigm with two tones: standard (440 + 880 + 1760 Hz) will presented 400 times; deviant (247 + 494 + 988 Hz) will presented 80 times. All the stimuli durations will 50 ms, with graduating volume increasing during 5 ms in the beginning and decreasing in the end. Stimulus onset asynchrony (SOA) will varied from 950 ms to 1050 ms. Stimuli will be presented binaurally by speakers placed on the 50 cm distance of both sides from participant. Sound intensity level will be 70 dB.

Records will be conducted in acoustically insulated room with low illuminance about 50–100 lux. ERP will be recorded by 19-channal system NVX36 (Medical Computer System, Russia). Electrodes will be placed according to 10–20 system. Additionally bipolar vertical and horizontal oculography components will be measured. Scalp electrode impedance will be less than 50 kOhm during all experiment. The mastoid reference will be used. The digitalization rate will 1000 Hz, and the low pass filter will 500 Hz.



For data processing we will use software package EEGLab and ERPLab for Matlab (MathWork, Inc.). Records will be filtered and clear from oculographic artefact. Epochs will be marked in the interval –200 ms to 700 ms relative to the stimulus presenting. Baseline correction will be performed in the interval –200 to 0 ms. The Pz, Cz, and Fz channels will be chosen for ERP measurement.

We suppose that some of SMDD children will demonstrate different amplitude of ERP components N2, P3a and P3b for standard and deviant stimuli in passive oddball task. Moreover, we guess that existent of such differences will be connected with better neurological and psychological state in children. The results are supposed to be used for developing if ERP based diagnostic tool for SMDD children.

## Discussion

Eye-tracking technology is widely used in diagnostics and rehabilitation of adult patients with severe central nervous system impairments (Anand et al., 2013; Buena et al., 2019; Lee et al., 2019; Linse et al., 2017; Myrden et al., 2014). However, for adaptation the eye-tracking for SMDD children it is needed to develop special stimuli and procedures. The applying of eye-tracking for SMDD children with profound intellectual disability and living in palliative departments of special orphanages may demands additional participant selection. Thus, from eleven palliative participant there were only two reliable eye records.

Therefore, we may conclude that eye-tracking applying is preferable for children without severe impairments of visual pathway, primary visual areas; absence of II, II, IV, and VI cranial nervous nucleus and pathways damages. Apparently most of SMDD children from palliative department have got some of the structural-functional impairments that made eye-tracking diagnostic almost impossible.

A small amount of correct answer were given by participants who pass the eye-tracking in the first experiment could be explained by absence of corresponding tasks and materials in the educational program that was provided for participants. These results should be also considered by the specialists of PMPC.

The given results determine the necessary of develop new methodic materials for SMDD children that must be chosen individually depends on disease features and prognosis, factors influenced on the record quality. Furthermore, it must be developed the diagnostic tool that allow to control the influence of such factors and evaluate psychological development of children.

The reliability of applying the measurement of electroencephalographic ERP in passive oddball paradigm for children assessment based on great body of studies. Differences in brain activity could be observed even in newborn (Partanen, Pakarinen, Kujala, & Huotilainen, 2013) or in first year of life infants (Choudhury & Benasich, 2011; Friedrich, Weber, & Friederici, 2004). Moreover, ERP measurements could predict further psychological development (Choudhury & Benasich, 2011), allow discriminating alertness and sleeping states (Friedrich et al., 2004). Passive oddball paradigm successfully used

for assessment of patients in minimally conscious state and in vegetative state (Erlbec et al., 2016; Risetti et al., 2013) and for locked-in state patients (Lugo et al., 2016). From this perspective we suppose that applying of passive oddball paradigm for assessment of SMDD children with profound brain damages will allow us evaluate their psychical and cognitive state with more accuracy.

## Conclusion

We suppose that using of eye-tracking for SMDD children is possible under definite criteria:

- (1) Development of exclusion and inclusion criteria (based on actual neurological state, anamnesis, speech and motor abilities, and developmental impairments).
- (2) Development of special research procedure.
- (3) Development of diagnostic tools for tablet integrated eye-tracker.

Moreover, for diagnostic of SMDD children with profound nervous system damages it looks useful the applying of measurement of ERP in, among other things, passive oddball paradigm.

We propose that using of these technologies may improve the range and sensitivity of standard diagnostic tools and give us additional information about psychical processes of SMDD children.

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## Verbalization of Emotions in the Cognitive Theory of Metaphor: An Ontological and Epistemological Aspects

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## Вербализация эмоций в когнитивной теории метафоры: онтогносеологический аспект

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**Abstract.** The article analyzes the ontological and epistemological bases (onto-epistemological foundations) of emotion verbalization in the framework of the cognitive theory of metaphor. The ontological aspect of the emotion verbalization problem is the identification of emotional markers for different communication environments. The epistemological aspect describes structural models that organize recognized, modulated, and produced emotions for systematization and categorization. The processes of verbalization (conceptualization and lexicalization) of words with emotional coloring and their philosophical meaning, as well as descriptive and normative connotations of metaphors, are shown.

Metaphor is understood as a fundamental cognitive process. Metaphor is not limited only of the language sphere, but is a way of knowing the environment and a way of thinking, including through cognitive scenarios that allow to be aware of emotions and those of interlocutors, or through idealized cognitive models that allow to separate a metaphorical expression from a conceptual metaphor. Within the framework of the onto-epistemological approach, the article discusses the problems of the dynamics of the language code, reveals the mechanisms of recognizing other people's emotions and managing their own emotions in the process of communication.

There is a fundamental interdisciplinarity of research in the field of emotions, which allows to reveal the mechanisms of recognition and modeling of emotions in intelligent systems.

**Keywords:** *metaphor; emotions; onto-epistemological foundations; cognitive processes*

**Аннотация.** В статье проанализированы онтогносеологические основания вербализации эмоций в рамках когнитивной теории метафоры. Онтологическим аспектом проблемы вербализации эмоций является выделение эмоциональных маркеров для разных коммуникативных сред. Гносеологический аспект описывает структурные модели, организующие распознаваемые, модулируемые и продуцируемые эмоции для систематизации и категоризации. Показаны процессы вербализации (концептуализации и лексикализации) слов с эмоциональной окраской и их философский смысл, а также дескриптивная и нормативная коннотации метафоры.

Метафора понимается как фундаментальный когнитивный процесс. Метафора не ограничена только языковой сферой, но является способом познания окружающей среды и способом мышления, в том числе через когнитивные сценарии, которые дают возможность осознавать свои эмоции и эмоции собеседников, или через идеализированные когнитивные модели, позволяющие отделить метафорическое выражение от концептуальной метафоры. В рамках онтогносеологического подхода в статье обсуждаются проблемы динамики языкового кода, раскрываются механизмы распознавания чужих эмоций и управления собственными эмоциями в процессе коммуникации.

Отмечается междисциплинарность исследований в области эмоций, позволяющая раскрыть механизмы распознавания и моделирования эмоций в интеллектуальных системах.

**Ключевые слова:** метафора; эмоции; онтогносеологические основания; когнитивные процессы

## Introduction

Metaphor can be represented as a way of categorizing and conceptualizing the surrounding reality, if we consider it not only as a speech-mediated cognitive process, but also as a tool for verbalizing emotions that affect the perception of the world.

Language means of expressing emotions in most cases are metaphorical, and metaphor is a verbalized method of thinking about the world. Man thinks in metaphors, categorizing the known and the unknown.

The study of the verbalization of emotions is engaged in psychology, philosophy, and the linguistics of emotions (emotiology). At the same time, emotiology as the science of artistic and expressive means of language is closely related to philosophy as the science of the ultimate bases of knowledge. In addition, emotion recognition is a task of computer and technical sciences. Thus, the study of emotion verbalization becomes an interdisciplinary task. The problem of verbalization of emotions in metaphors has both ontological and epistemological aspects.



## Methods and Equipment

The onto-epistemological approach helps to structure different approaches within a single interdisciplinary task. Social and cultural factors constitute the existential foundations of human existence, and ontological analysis allows them to specify and highlight significant factors of reality. In turn, the epistemological component denotes differences in the ways of cognition and description of the world, defines meanings at the level of discursive constructions. Ontological and epistemological grounds are closely linked, while creating the necessary integrity of the description.

The ontological aspect of the problem of emotions verbalization can be called the allocation of emotional markers, which can be allocated separately for each communicative environment. Note that a person exists in many communication environments and uses them simultaneously. So, if we talk about written communication environment (the main method — analysis of emotional tone in the text), the markers are emotive words, affective words, etc. If we talk about voice communication environment, the markers will be the sounds that identified with certain emotions. If we talk about vision (the main methods are related to the recognition of emotions on the face and body), then, for example, markers can be points by the movement of which emotions are recognized. There are also emotional markers based on such physiological indicators of the body as cardiogram, heart rate, etc. It is important to contact the ontological factor with the epistemological one in using the biofeedback method, since researchers determine (and can change) what will be the marker of the emotion. We should also emphasize the emotional markers identified through eye movements (eye tracking).

All these markers mark the separate emotion. And there are more differences between different people than similarities. But emotion recognition systems are becoming more effective with every year. The main problem is that there are many theories about emotions, but there is no complex theory about emotions as a phenomenon that exists in different communication environments.

The epistemological aspect of emotion verbalization answers the question of how to describe recognized, modulated, and produced emotions. To answer this question, researchers develop structural models that organize a huge number of possible emotions into a common list that can be systematized and categorized.

The problem of describing the organization of the emotional sphere is solved by different researchers in line with two main approaches. First, the dimensional approach in which there is a selection of dimensions that characterize and define emotions. Among the representatives of this approach can be called such as O. S. Arkhipkina, Ch. Osgood, J. Russell, G. Schlosberg.

An example of a study based on a dimensional approach is the map of emotional vocalizations compiled by A. S. Cowen, H. A. Elfenbein, P. Laukka, and D. Keltner (2018).

Criticisms of this approach have been made by R. E. Lucas, E. Diener, R. J. Larsen (2003) regarding how many dimensions should be allocated and how emotional categories will differ from non-emotional ones.



Second, it is the selection of basic emotions, combinations of which generate a variety of emotional phenomena or the approach of basic emotions. Representatives of this approach: P. Ekman, C. Izard, O. Mourer, S. Tomkins. The methodology associated with the basic emotion approach uses control points and micro expressions to construct mathematical models of facial expression. The FACS system (Facial Action Coding System) uses action units (AE) — the main movements performed by individual muscles. AE are numbered. And action descriptors (AD) are also used — movements made by groups of muscles (for example, pushing the lower jaw forward). The intensity is indicated by adding Latin letters from A to E. For example, AE 1A is the most difficult to distinguish movement of AE 1, and AE 1E is the maximum possible intensity for a certain person.

This approach is criticized for the concept of *basic emotion*, since it is difficult to determine which emotions are basic, especially since their number is constantly growing (Ortony & Turner, 1990). The number of basic emotions estimated by researchers ranges from 6 to 26 or more. In addition, you must always consider the presence of the context while recognizing emotions.

The choice of approach is important, since it entails various experimental procedures that are used in the construction of the experiment, the recognition and format of the responses of the subjects, and the way the results are interpreted.

Within the framework of studying the verbalization of emotions in the cognitive theory of metaphor in the written communication environment there is interesting sentiment analysis as the class of content analysis methods in computational linguistics. Goal of this analysis is based on finding markers of opinions in the text (direct opinions and their comparisons). An immediate opinion is a tuple of five elements ( $e, f, o/p, h, t$ ) that includes entity as a tonality object, as well as the feature properties; orientation or polarity as the author's tonal score; holder as the subject of the tonality and the time, when the opinion was left.

Emotional markers in the text are called emotional verbs and predicate phrases, adjectives and adverbs, as well as the presence of generalizations and moralizations in statements and some extralinguistic means (multiple exclamation marks, the use of uppercase keys and font selection).

In modern systems of automatic determination of emotional evaluation of a text, both multidimensional emotional spaces and one-dimensional ones (positive or negative) can be used. In the well-known semantic thesaurus WordNet-Affect, synsets of verbs, nouns, adjectives, and adverbs representing the description of emotions are manually marked and marked with such emotional categories as joy, fear, anger, sadness, disgust, and surprise. Another thesaurus, SenticNet 2, links concepts at the semantic level and links cognitive information to emotional information (semantics and sentics). SenticNet 2 is built using sentic computing, which is an interdisciplinary approach to analyzing the tonality of text. Sentiment analysis methods are used, for example, in the Twitter sentiment visualization project (Tweet Visualizer Online) (Healey, 2019).

Practical research using sentic calculations conducts on the material of metaphors. Since the nomination of emotions can take place either directly (anger, fear), or through expressions (interjections), or through the description of facial expressions or poses.

For such studies, seems to be effective an approach using cognitive scenarios that allow to be aware of emotions. The works of linguists N. D. Artyunova, T. V. Bulygina, S. G. Vorkachev, and A. Wierzbicka are devoted to the development of cognitive scenarios. Thus, A. Wierzbicka explores the nomination of anger, pity on the material of Russian, English, German and Polish languages (Wierzbicka & Besemeres, 2009). But Wierzbicka talks about semantic primitives, when language penetrates the internal structure of the names of human emotions, lexicalizing them and creating a Natural Semantic Metalanguage (NSM).

The analysis of tonality verbalization in the cognitive theory of metaphor leads to the need to use interdisciplinary research methods that take into account both ontological and epistemological factors.

In philosophy, F. Nietzsche, H. Ortega y Gasset, P. Riker, L. Wittgenstein, E. Cassirer, E. R. Mac Cormack and many others wrote about metaphorical thinking. E. V. Budayev and A. P. Chudinov (2008) reviewed studies of a conceptual metaphor with significant cognitive potential.

According to the cognitive theory of metaphor in the presentation of G. Lakoff and M. Johnson (1980) the metaphorization is based on procedures for processing knowledge structures (frames and scenarios) of two conceptual domains — the source domain and the target domain. Source sphere elements structure the target sphere elements during metaphorical mapping. Metaphor is not limited only to the language sphere, but it is a way of knowing the environment and a way of thinking. Any conceptual structure is metaphorical initially. G. Lakoff and M. Johnson combines linguistics and philosophy, offering an empirical approach to knowledge as opposed to subjectivism and objectivism.

Later, G. Lakoff (1987) outlines the basis of the approach, which has now been modified, called embedded cognition, and says that conciseness grows out of the body foundation. The theory of idealized cognitive models on the basis of language data, helps G. Lakoff separated the metaphorical expression from the conceptual metaphor. Metaphorical expressions are based on sensorimotor experience, and conceptual metaphors are often not recognized as metaphors. Thus, the orientation metaphor with the spatial orientation *happy is up* shows that *happiness* corresponds to *top*. Kinesthetic view-schemes (for example, part-whole/part-whole or source-path-goal/source-path-goal) are dynamic examples of perception processes that give our experience coherence. Language means of expressing emotions are mostly metaphorical. G. Lakoff and M. Johnson argue that “metaphors are essentially phenomena that provide understanding” (Ibid., p. 208).

G. Lakoff and M. Johnson (1999) write that the human conceptual system is formed through sensorimotor systems and give preference to an empirically responsible philosophy, one that relies on the best empirical data. If Lakoff and Johnson talk about the unambiguity of metaphorical projection for two-domain spaces (metaphorical mapping, two-domain mapping), while other researchers talk about conceptual integration

as a generic concept for metaphor (Turner & Fauconnier, 1995). Conceptual integration forms the many-space model.

## Results

Metaphor can be presented as the way to categorize and conceptualize the surrounding reality. Many people's actions are guided by emotions (Izard, 1991). Often emotions do not appear in their pure form and separately but are realized as a cluster of emotions. For example, the group *anger* includes irritation, indignation, rage, resentment, and others. Different degrees of intensity of emotions are reflected in the language.

From an ontological point of view, we should consider the existence of two semiotic systems of emotions — body language and verbal language. Many emotions are expressed by the body, but they are practically not expressed in words. But there is no universal theory of emotions.

If the speaker and listener share a common linguistic knowledge of the external world, several strategies for understanding metaphorical utterances can be implemented. That is, "statements of the form '*S is P*', where the speaker metaphorically means that *S is R* (for  $R \neq P$ ), the following strategies are separately necessary, and together sufficient" (Searle, 1990, p. 335).

First, there must be a strategy that allows you to recognize that the listener is speaking metaphorically, not literally. Second, "there must be General principles that associate the term *P* (whether its value, truth conditions, or denotation, if there is one) with a set of possible values of *R*" (Ibid.). This is the most important problem of metaphor — the formulation of such principles that connect a term with a set of possible meanings. Third, there must be strategies to limit the range of possible values of *R*, while finding the only value of *R* that was embedded in the metaphor. "The basic principle of this step is that the real values of *R* can only be those possible values of *R* that set the possible properties of *S*" (Ibid.).

Stable metaphorical projections are called *conceptual metaphors*. For European culture, these are, for example, such metaphorical projections: time is money, life is history, love is a journey, etc. So, N. D. Arutiunova (1999) writes about the mosaic of images of an emotion, which leads to the fixation of a set of attributes that serve words related to emotions. If we talk about emotional states in general, then "it should probably be considered the dominant idea of them as a liquid body that fills a person, his soul, heart, taking the form of a vessel" (Ibid., p. 320).

Z. Kövecses (2004) illustrates an end-to-end cross-linguistic analysis of how many concepts of emotion reflect widespread metaphorical patterns of thought. These emotional metaphors arise from repeated embodied experiences, which is one of the reasons why human emotions in many cultures correspond to certain basic biological and physiological processes in the human body and the interaction of the body with the outside world.

G. Lakoff talks about the concept of *body mind* and that we are embedded beings (Lakoff & Johnson, 1999). What is important here is the embodiment of meaning, which is related to spatial orientation. For example, a person is in the state of anxiety. The preposition *in* indicates a location somewhere. In turn, *anxiety* is an abstract concept. But a person is *in trouble* like things in a container or a book in a closet.

*Cognitive models* can be formed based on conceptual metaphors. The theory of idealized cognitive models on the basis of language data allows you to separate a metaphorical expression from a conceptual metaphor. Conceptual metaphors are often not recognized as metaphors, and metaphorical expressions are based on sensorimotor experience. According to G. Lakoff and M. Johnson (1999), we can talk about kinesthetic view-schemes as dynamic patterns of perception that give our experience coherence. It is noted that such image-schemes appear in the minds of children before the corresponding concepts.

Each time specific ideas are activated in our neural circuits, they become stronger. Over time, neural network complexes create the worldview frame through which we see the world. But the main problem is that these frames are unconscious. You do not know about this because you do not have access to your neural circuits. When a person hears facts that do not fit into their worldview, they cannot process them: either ignore them, reject them, or attack them.

M. Johnson gives a huge number of examples of the embodiment of kinesthetic figurative schemes. For example, the figurative scheme *container* includes the concept of a border that separates the internal and external, differentiates “in ‘and’ out” and conceptualizes human activity. S. Lindner (1981) describes in detail what is hidden behind almost six hundred verbs in combinations with the particle out, and not only in direct uses such as stretch out *to stretch* and in spread out *to expand, unfold, scatter*, but also in metaphorical meanings such as figure out *to understand, solve*, work out *to solve (the problem)*, etc. According to Lindner, there are many metaphors based on the cognitive scheme *container*. We treat things related to the orientations of the body in the language of *receptacles*, and later extend this language to the realm of abstract concepts. For example, *coming out of a daze* is metaphorical and does not mean literally coming out of a container.

The metaphor performs an epistemological function, forming the area of secondary predicates. Internal properties of a person can be characterized by physical signs: a bright personality, a deep mind, a heavy hand, etc. Based on analogies, metaphors of emotions form *metaphorical fields*. The analogy of liquid, fluid substances (passions boil, drink grief, wave of tenderness), the analogy of fire (the flame of love, feelings overwhelm), the analogy with disease or poison (fever of love, get over love, envy poisons the soul), etc. Metaphors of negative emotions are often based on an analogy with what causes pain through mechanical action (feelings torment, bite, wound, cut to the heart). Positive emotions are expressed more monotonously and diffusely than negative ones. But negative emotions are always more specific, distinct, and diverse (Nöth, 1992, p. 83). All vocabulary in a language can be emotive. V.I. Shakhovsky (2009) notes: “Semantic categorization

of emotions in the lexical system of language is thus represented by emotivity in three statuses: meaning, connotation and potential [...]” (p. 39).

I. A. Dmitrieva (2000) identifies two solutions to the problem of semantic innovation: the theory of nomination and the theory of predication. In V. N. Telia’s nominative interpretive concept, the model of the metaphorical process consists of entities and their interaction, understood as a relation established by the subject of metaphorization between the features and associative complexes of these entities.

The predicative theory of metaphor through the *epiphore* — *diaphore* distinction allows us to solve “the problem of the birth of a new meaning on the basis of giving a logical status to similarity as a method of predication (assignment by a logical subject of previously incompatible predicates)” (Dmitrieva, 2000, p. 11).

As it has been effectively summarised by G. Brun and D. Kuenzle (2008), five epistemic functions have been claimed for emotions: motivational force, salience and relevance, access to facts and beliefs, non-propositional contributions to knowledge and understanding, and epistemic efficiency.

M. Minsky (1988) believes that cognitive metaphors draw analogies, representing one object through another, which “allows you to apply the knowledge and experience acquired in one area to solve a problem in another area” (p. 291). Neuroscientists have discovered the integrated functionality of emotions and reasoning in our mental life. Emotions are now understood as a constitutive element of human rationality, justifying the creation of the concept (Candiottio, 2019).

It should be considered that the verbal identification of emotions can be subjective (Diller, 1992). And then we are talking about where exactly the border between a generally valid metaphor and its subjective understanding passes.

In cognitive psychology, E. Roche investigated the problems of categorization and identified basic-level categories or prototypes. Categories have their center and periphery according to their typicality and degree of approximation to the prototype.

E. Roche’s early research focused on color categories. In the Dani language of New Guinea, there are two basic color categories: *mili* (a dark color with a cold tint, including green and blue) and *mola* (a light color with a warm tint, including white, red and yellow) (Petkelite, 2011). Roche’s research indicated that native speakers of the Dani language chose central colors as examples of two-color categories. For example, the *mola* category was called white, red, or yellow, with different subjects making different decisions.

Other scientists have conducted a similar study on three-year-old children. They were shown a series of colored chips, then hidden and asked to identify the color. Children chose central colors more often than non-central (Heider, 1971).

The central colors correspond to what in later research by E. Roche was called Cognitive Reference Points or prototypes — those members of a category or subcategory that have a special cognitive status: “to be the best example of a category” (Petkelite, 2011, p. 52). For example, a robin is more in line with the idea of a *bird* category than chickens, penguins, or ostriches, and table chairs are more in line with the *chair* category than rocking chairs, shell chairs, and barber chairs or electric chairs.

Prototypes themselves do not form a specific model for processing, representation, or learning. This is so often a source of error that it requires explanation: when we talk about prototypes in general, we are simply referring to a convenient grammatical construct (fiction); here only judgments about the degree of prototyping are real.

## Discussion

Within the framework of the onto-epistemological approach, it is possible to discuss the problems of the dynamics of the language code, the development and implementation of its hidden capabilities, as well as issues of emotional specificity of speech in different communication conditions.

How can emotions be vehicles of knowledge? What is the relationship between emotions and beliefs?

An interesting statement by H. Ortega y Gasset (1990), who characterizes the nominative possibilities of metaphor in relation to the world of emotions, notes:

It is not surprising that the vocabulary has a small number of words that from the very beginning designated the phenomena of the psyche. Almost all modern psychological terminology is a pure metaphor: words with a specific meaning were adapted to denote phenomena of a psychological order. (p. 76)

In 1985, E. R. Mac Cormac in his work *The Cognitive Theory of Metaphor* defines metaphor as a cognitive process that occurs through the comparison of disparate semantic concepts. As an example of a basic metaphor, he calls the computer metaphor: the brain is analogous to a computational mechanism, while the mind is identified with a set of programs that stimulate the brain.

Many studies use a cognitive-discursive approach to metaphor analysis, since it is impossible to clearly distinguish the cognitive and discursive dimensions of metaphor. Therefore, “metaphor is simultaneously described as both a mental and a linguosocial phenomenon” (Budayev & Chudinov, 2013, p. 11). “The exchange of emotions is an important social activity that is part of everyday conversation and interaction and helps us maintain both our mental and physical health” (Alba-Juez & Larina, 2018, p. 10). The cyclic structure of sense-think-act is in the Dynamic System Theory, a mathematical theory that was conceived to explain physical phenomena such as the movement of celestial bodies but is now also used to explain cognitive phenomena.

Human emotions are at the heart of verbal communication. It is possible to say that a person becomes Homo Sentiens (Shakhovsky, 2008). In this way, the world of philosophy and linguistics has adapted to what is now called the *emotional turn* (Alba-Juez & Larina, 2018).

There is no agreement among researchers on the existence of universal emotional concepts. Emotions are a complex linguistic object (Barrett; Ekman, Izard) and are endowed



with a number of specific features (clusterism, dynamism, continuity, differentiability, implicitness of flow, subjectivity of perception and interpretation, etc.). M. Schwarz-Friezel (2015) describes an emotion as a mental state or process with three main parameters, namely: “(a) value (positive or negative), (b) duration, and (c) intensity” (p. 162).

A. Wierzbicka (1999) speaks about the existence of universal concepts of human culture, where emotional concepts can be represented as elementary semantic primitives. As we said early, the theory of semantic universals assumes the existence of an NSM — Natural Semantic Metalanguage. However, different cultures have different emotional scenarios. The English words *sad* and *sadness* have no exact equivalents in Russian, which has three words for expressing different types of sadness, varying in duration and intensity: *grust*, *pechal* and *toska* (Wierzbicka, 2001). As a result, Russian, unlike English, has a higher number of emotional verbs. It is impossible to distinguish only a few basic human emotions, since they are all the result of interpretation, and are also associated with the lexical *grid of coordinates* of the native language.

Five main areas of cultural complexity related to emotions were identified: (a) the language of emotions, (b) conceptual knowledge of emotions, (c) values related to emotions, (d) rules of feeling, i. e. norms of subjective experience, and (e) rules of display, i. e. norms of emotional expression (Wierzbicka & Besemeres, 2009). These areas are subsystems for system of emotions in different cultures.

Interdisciplinary research helps to reveal the mechanisms of recognizing other people's emotions and managing their own emotions in the process of communication, as well as coordinating and stimulating positive and neutralizing negative emotions in communication acts. How do our thoughts about emotions shape our self-awareness and self-understanding? What role does narrativity play in practical reasoning, and how do emotions contribute to it?

An attempt to formalize gestalts, knowledge structures that are responsible for a person's awareness of a problem situation and decision-making, led to the creation of the frame apparatus — a formal way (in fact, a method) of representing knowledge in image recognition systems (Baranov, 2014). However, it turned out that this method of representation is so convenient and productive (technological) that it makes it possible to build a variety of hypotheses and models of human intellectual behavior.

In addition, interdisciplinary research reveals the mechanisms of emotion recognition and modeling in intelligent systems and identifies the problem of computer recognition and modeling of metaphors.

Thus, D. Rumelhart (1993) proceed from the fact that the metaphorical interpretation of a language expression does not differ significantly from the many different interpretations of sentences of this kind: “The police officer raised his hand and stopped the car” (p. 73). To understand this phrase fully requires a lot of knowledge about the police, police officers, traffic rules, drivers, etc. An intelligent system that models the understanding of the text does not need a special block of interpretation of metaphors. They should be understood as any other idiomatic expressions. This removes the problem

of understanding new metaphors. However, it is not clear what the rules for generating new metaphors should look like in this case.

H. Ortner (2015) studies emotivity in the age of information and communication technologies. He argues that the construction and sharing of emotions is one of the main functions of computer-mediated communication. The metaphor has not only a descriptive, but also a normative connotation: “the metaphors themselves actively convey expectations about the future” (Wyatt, 2004, p. 258). And the normative connotation of the metaphor sets the image of the future.

The neurologist A. Damasio (1994) summarizes a wide variety of case studies; he concludes that emotions are part and parcel of rational thinking and that the absence of emotion can interfere with rationality and intelligent, can render decision making impossible.

Just as there seem to be cognitive modules for language or problem solving, there may be emotion modules that mediate action in a specific context. The task for cognitive science, then, is to incorporate these emotion modules into models of mind and to specify how the new models interact with the cognitive models already postulated. (Friedenberg and Silverman, 2006, p. 441)

A. Damasio and K. Man (2019) think about homeostasis (the principle of regulation of vital activity) as a way of forming feelings in machines. Under certain conditions, machines capable of implementing a process resembling homeostasis might also acquire a source of motivation and a new means to evaluate behavior, akin to that of feelings in living organizations.

The fundamental innovation of these machines is the introduction of risk-to-self. Traditional concepts of intelligence offer outward-directed perception and abstract problem solving. Damasio and Man view high-level cognition as an outgrowth of resources that originated to solve the ancient biological problem of homeostasis. And the latter is understood as self-interest and the ability to take risks. This approach is very similar to autonomous embedded systems but having a body to help solve problems is not enough to generate meaning. In addition, calculating a certain emotional parameter and labeling it *emotion* does not make this parameter meaningful. Damasio and Man write that a robot concerned with its own survival can creatively solve the problems it faces. Understanding autonomy (as having a sufficient amount of semantic information) is important in relation to the architecture of emotional intellectual systems.

## Conclusion

It is important to understand both the ontological and epistemological status of a metaphor: a metaphor can be both a mental phenomenon and a way of knowing the world. Metaphor is a fundamental cognitive process that organizes our judgments and emotions.



The interweaving of metaphors forms a cognitive map — a network of concepts that connects abstract ideas and human sensorimotor experience.

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## **Chronotype and Life Satisfaction: The Role of Sex and Age**

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## **Хронотип и удовлетворенность жизнью: возрастные и половые различия**

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**Abstract.** Chronotype represents the preference for evening or morning hours for mental and physical performance and viewed as a stable human behavioral trait and personality feature. Chronotype relates to many biological, social, and psychological aspects. Depression, anxiety, and health problems are associated with eveningness in the clinical and non-clinical populations. At the same time, morningness demonstrates a positive relationship with well-being. Many studies show that age and sex is a significant predictor of time-of-day preference. This

study is attempted to investigate the association between life-satisfaction and morningness-eveningness and explore age and sex differences. Two hundred thirty-eight persons participated in this study; age distribution was: 17–28 years. The reduced Morningness–Eveningness Questionnaire was used to measure chronotype preferences, and Social frustration and life satisfaction scale were used to assess the subjective level of life satisfaction. Age differences were found for chronotype demonstrating the tendency to eveningness for young adults (23–28 age) than for students (18–22 age), but no sex differences in morningness-eveningness were found. Eveningness negatively correlates with all life-satisfaction dimensions, but this association differs depending on sex and age. In general, the morningness-eveningness preferences seem to be dependent on age more than sex, but the life satisfaction influenced by both factors. We may report the existence of association between eveningness and life satisfaction, which is much more reliable for men and younger persons.

**Keywords:** *chronotype; morningness; eveningness; life-satisfaction; age; sex*

**Аннотация.** Хронотип рассматривается как стабильная поведенческая и личностная черта, которая характеризуется предпочтением вечерних или утренних часов для умственной и физической работы. Хронотипические предпочтения рассматриваются в связи с различными биологическими, социальными и психологическими характеристиками. Исследования на клинических и неклинических выборках показали, что тревожность, депрессивность и проблемы со здоровьем больше связаны с вечерним хронотипом. В то же время утренний хронотип обнаруживает положительную связь с благополучием. Было установлено, что возраст и пол являются важными предикторами предпочтения времени суток для активности. Данное исследование направлено на изучение связи между удовлетворенностью жизнью и утренним или вечерним хронотипом в зависимости от возрастных и половых различий. В исследовании приняли участие 238 человек в возрасте от 17 до 28 лет. Для измерения хронотипических предпочтений использовался краткий опросник для определения утреннего — вечернего хронотипа, а для оценки субъективного уровня удовлетворенности жизнью применялась шкала социальной фрустрации и удовлетворенности жизнью. Большая склонность к вечернему хронотипу была обнаружена у респондентов в возрасте 23–28 лет, чем у студентов в возрасте (18–22 лет), что может быть связано с внешним распорядком жизни студентов (академический год, расписание и др.). Не было обнаружено половых различий в отношении предпочтений утреннего или вечернего хронотипа. Вечерний хронотип отрицательно коррелирует со всеми аспектами удовлетворенности жизнью, но эта связь различается в зависимости от пола и возраста. В целом хронотипические предпочтения больше связаны с возрастными факторами, чем с полом, но на удовлетворенность жизнью влияют оба фактора. Можно утверждать, что для мужчин и молодых людей в большей степени характерны связи между вечерним хронотипом и удовлетворенностью жизнью.

**Ключевые слова:** *хронотип; утренний хронотип; вечерний хронотип; удовлетворенность жизнью; возраст; пол*

## Introduction

### Chronotype

Through the last decades, the research about Chronotype or morningness-eveningness preferences has been significantly risen. Chronotype describes the timing of sleeping and the preference for evening or morning hours for mental and physical performance. Morning or evening preference has proven to be a stable human behavioral trait with a measurable and predictable impact in different physiological systems (Adan et al., 2012). It is viewed as an interesting aspect of personality, and the psychometric measurements have been well-established and validated (Randler, Baumann, & Horzum, 2014; Tonetti, Adan, Di Milia, Randler, & Natale, 2015).

Morning oriented persons or “Larks” prefer to get up early and go to bed early; they reach their maximum in cognitive performance and well-being during the morning. Whereas opposed to them evening oriented persons, “Owls” get up late, prefer later bedtimes and rise times, and perform better in the afternoon or evening hours. There is the third type of chronotype — neither-type placed in intermediate position and represents the majority of the population (Adan et al., 2012; Díaz-Morales, 2007). Self-reported measures usually assess morningness-eveningness (e.g., Di Milia, Adan, Natale, & Randler, 2013; Tonetti et al., 2015). One of the most popular scales is the scale for self-assessment of morningness-eveningness (Horne & Östberg, 1977).

Many biological markers, such as the sleep-wake cycle, body temperature, and the hormones melatonin and cortisol, are associated with circadian rhythmicity. As an example, greater morningness is associated with an increased cortisol level upon awakening and a higher overall cortisol output; however, it was not associated with the cortisol awakening response (Petrowski, Schmalbach, & Stalder, 2020). It should be mentioned that the connections between chronotype and biological markers are more complex conjointly with age (Adan et al., 2012; Meliska et al., 2011; Randler & Schaal, 2010). The influence of longitude and latitude of residence is also a relevant factor in chronotype as well as the levels of light exposure during the day- or nighttime (Randler, 2008b).

Chronotype relates to many psychological aspects, e.g., personality traits, as well as psychopathology. Negative associations have been found between morningness and neuroticism and psychoticism with the Eysenck personality model (Adan et al., 2012). The morningness-eveningness features are related to personality characteristics, especially to novelty seeking, and persistence in Cloninger’s biological model. Studies with the Zuckerman sensation seeking scale in adults have revealed the association between eveningness and sensation seeking, and the tendency to participate in disinhibited activities (Antúnez, Navarro, & Adan, 2014). Concerning the Big-five model, there are some studies showing that morning-oriented people are more conscientious and less extravert (Tavernier, Hill, & Adrien, 2019).

### **Chronotype and Life Satisfaction**

People's health and well-being may be determined by the interaction of endogenous and external factors, and chronotype may be considered in this line as an important feature. An extensive amount of research on sleep in relation to negative psychological functioning showed that poor sleep quality and short sleep duration turns to lower general life satisfaction (Tavernier et al., 2019). On the other hand, the facts suggests that positive affect (a part of well-being) is an important factor of affecting individuals' overall sleep. Positive affect regulation-dysregulation relates to good sleep patterns or sleep disturbances (Gariépy, Doré, Whitehead, & Elgar, 2019). Nurturing basic psychological needs help to improve sleep quality characteristics among students (Tavernier et al., 2019).

Different health problems were more common among adolescents with a later chronotype, irrespective of their sleep duration and lifestyle factors as well as depressive tendencies, bulimic behaviors, and higher morbidity (Urban, 2010). It is well-known that evening types consume more stimulants, are more often habitual smokers, and their mealtimes are more irregular (Kim S. J. et al., 2010). Turning to prior studies, one may find that depression was associated with eveningness in the clinical and non-clinical population, which has also been reported (Ong, Kim, Young, & Steptoe, 2017; Putilov, 2018; Yeo et al., 2019). Besides, the relation between eveningness and anxiety has found higher anxiety scores in evening types compared to morning types, but it is more significant for women (Díaz-Morales & Sánchez-López, 2008). The studies mentioned above, one would expect a positive relationship between satisfaction with life and morningness. The relationship between morningness-eveningness and life satisfaction seems to be independent of geographical location and cultural differences (Jankowski, 2012).

### **Chronotype and Age, and Sex Differences**

The association between morningness-eveningness and age has been well established (Adan et al., 2012). During adolescence, the morningness preference shifts to an evening preference, but from the beginning of adulthood, morningness preference gradually returns. It explains the result of physical changes and changes in the social demands in adolescence (Adan et al., 2012; Randler, 2008b). Many studies show that age is a significant predictor of time-of-day preference (Cavallera & Giudici, 2008); however, conscientiousness is a significant mediator between them (Walker, Kribs, Christopher, Shewach, & Wieth, 2014).

The role of age as a moderator of the connection between chronotype and depression was uncovered in a few studies. So, the relationship of depressive symptoms with eveningness revealed for younger and older people than for the middle age group (Ong et al., 2017). The same underlying mechanism as the circadian instability may be the reason for eveningness-associated depression of younger or older age. However, the social demands are stricter for middle-age people forcing them to regulate sleep-wake time accurately.

Concerning sex differences, many studies report that larger proportion of evening chronotype is found among males, while morning chronotype is more commonly observed among females (Adan & Natale, 2002; Randler, 2011). The difference in favor



of morning chronotype in adult women is in accordance with the fact that the circamensual rhythmicity is associated with the menstrual cycle in women (Adan & Natale, 2002). Otherwise, there are some studies which showed that boys and men sleep shorter than girls and women, and further, sleep timing is shorter in women, and thus, men have earlier chronotypes. It is quite evidently to suggest that chronotype is influenced by individual factors, such as age and sex (Adan et al., 2012).

Taking into account available studies about chronotype and lifestyle, personality traits, sleep patterns, and school schedule, we aimed to investigate the association between life-satisfaction and morningness-eveningness in subjects with a broader age range and to explore the sex differences.

We primarily hypothesized that life satisfaction would correlate with morningness-eveningness and that the association between life satisfaction and morningness-eveningness would be more prominent in specific age groups, especially in younger age groups in whom that association has already been reported. Our study hypotheses were based not on any specific theoretical model, but on the results of previous studies on depression and morningness-eveningness.

## Methods and Equipment

### Participants

Two hundred thirty-eight persons participated in this study (30 % of men). Age distribution was: 17–28 years; the mean age was 19.68 years. Subjects were not paid for participating in the study, and they all gave their informed consent prior to their inclusion in the study. All participants were tested in groups. Subjects completed questionnaires on circadian typology (rMEQ), Social frustration level questionnaire, and completed a self-report questionnaire with information on sociodemographic variables.

### Methods

**Morningness–eveningness.** The circadian typology was assessed using the reduced Morningness–Eveningness Questionnaire (rMEQ) (Horne & Östberg, 1977). We used a shortened 5-item version of the scale to assess the individual differences. The highest score corresponds with Eveningness Chronotype as the lowest score with Morningness chronotype. The rMEQ internal reliability for the present sample was adequate ( $\alpha = .78$ ). The higher scores in the questionnaire show the tendency to Eveningness and lower to Morningness.

**Life satisfaction.** Different life satisfaction domains were evaluated by the questionnaire Social Frustration and Life Satisfaction Scale which contains 20 items, 4 for each of the five dimensions considered (Vasserman, Iovlev, & Berebin, 2004). These dimensions are the satisfaction with relations with family and relatives, social relationships, social status,

socioeconomic level, and satisfaction with health and work capacity. Students rated each item on a 5-point Likert scale (1 — never; 5 — always).

The internal reliability (Cronbach's) of dimensions were adequate for the present sample, from .76 to .81.

**Procedure and data analysis.** The total sample was divided into two groups: undergraduate students ( $N = 201$ ; from 18 till 22 ages;  $M = 19.86$ ,  $SD = 1.23$ ) and young adults ( $N = 50$ ; from 23 till 28 ages;  $M = 26$ ,  $SD = 1.95$ ). Because of the inequivalence of respondents in groups, the tests for normality and equivalence of variance were made. *U*-Mann–Whitney test was used to compare age and sex groups. Correlation analysis was made for preliminary results about the association between Chronotype and Life-Satisfaction scales. Correlation analysis and *U*-Mann–Whitney test was used for data analysis.

## Results

### Age and Sex Differences

Age differences revealed for Chronotype measure showing the tendency to Eveningness for young adults more than for students (*Table 1*). Life-satisfaction measures significantly differ between age groups. Young adults have lower satisfaction except for satisfaction with socio-economic level.

*Table 1*

Means, standard deviations and *U*-test statistics for the chronotype and life-satisfaction variables in two age groups

Variables	Undergraduated students		Young adults		<i>U</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Chronotype	2.43	.51	2.8	.55	3005.5***
Satisfaction with relations with family and relatives	2.49	1.06	1.98	.99	3513.5***
Satisfaction with social relations	2.5	1.09	2.04	1.01	3595.5***
Satisfaction with social status	2.68	1.00	2.28	1.05	3686***
Satisfaction with socio-economic level	2.7	.92	2.49	.99	4304
Satisfaction with health and work capacity	2.73	1.04	2.17	1.05	3379.5***
Cumulative satisfaction score	2.62	.86	2.19	.88	3343.5***

*Note.* \*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .001$ .

There is no significant difference between men and women in time of day preferences (Table 2). Otherwise, for the life-satisfaction features, the significant differences were proved except satisfaction of relations with family and relatives.

Table 2

Means, standard deviations and *U*-test statistics for the chronotype and life-satisfaction variables for men and women

Variables	Men		Women		<i>U</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Chronotype	2.59	.61	2.47	.5	5776.5
Satisfaction with relations with family and relatives	2.19	.92	2.48	1.11	5728.5
Satisfaction with social relations	2.15	1.01	2.51	1.11	5310.5**
Satisfaction with social status	2.28	1.03	2.73	.99	4814.5***
Satisfaction with socio-economic level	2.47	.9	2.74	.95	5444.5*
Satisfaction with health and work capacity	2.41	1.13	2.7	1.02	5406.5*
Cumulative satisfaction score	2.3	.87	2.63	.86	4972**

Note. \*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .001$ .

Next, we perform the ANOVA to find interaction between age and sex factors.

Significant effect of age ( $F = (1.25) 19.43, p < .001$ ) and interaction of sex and age factors ( $F = (1.25) 3.85, p < .05$ ) on Chronotype was found.

### Association between Chronotype and Life-Satisfaction

On the level of zero-order correlations were found significant associations of Chronotype with all life-satisfaction dimensions in the whole sample (Table 3). All correlations reflect the negative relationship between Chronotype and satisfaction in any life domains.

Table 3

Spearman correlations for the chronotype and life-satisfaction variables ( $r_s$ )

Variables	All sample	Undergraduated students	Young adults	Men	Women
	chronotype				
Satisfaction with relations with family and relatives	-.220**	-.162*	-.202	-.323**	-.173*
Satisfaction with social relations	-.169**	-.124	-.132	-.328**	-.091

End of Table 3

Variables	All sample	Undergraduated students	Young adults	Men	Women
	chronotype				
Satisfaction with social status	-.177**	-.130	-.176	-.326**	-.088
Satisfaction with socio-economic level	-.189**	-.141*	-.288*	-.316**	-.105
Satisfaction with health and work capacity	-.336**	-.265**	-.366**	-.432**	-.281**
Cumulative satisfaction score	-.271**	-.200**	-.256	-.430**	-.186*

Note. \*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .001$ .

Though for the two age groups, correlations are the same except the association between Chronotype and Satisfaction of relations with family and relatives in undergraduate students' sample.

For the men sample Chronotype significantly is associated with all life-satisfaction aspects. However, for the women sample Chronotype correlates with the satisfaction with relations with family and relatives, satisfaction with health and work capacity, and cumulative satisfaction score.

## Discussion

Our study hypotheses were based not on any specific theoretical model, but on the results of previous studies on morningness-eveningness and life-satisfaction.

Younger adults showed the tendency to evening type in comparison with undergraduate students. This fact contradicts to the previous findings that growing up leads to morningness (Adan et al., 2012; Randler, 2008b). Our findings can be explained from the point of view that for undergraduate students' everyday life is more external regulated — academic year, and timetables, and this coincides with the previous works (Ong et al., 2017; Zimmermann, 2011). In contrast, young adults may have more flexible schedules, and without extremal control or regulation, they became more evening type. We may propose that this age group is more stressed because of the transition to self-sufficient life, and this stress provoke the change in time preferences.

Chronotype has no differences regardless of sex in our study, which contradicts to other works, but the question about sex differences in chronotype remains debatable (Adan & Natale, 2002). Among the student age, women are more evening-oriented, but in the next age period, men are more evening-persons. These facts are partially related to studies of sleeping time (Borisenkov, Kosova, & Kasyanova, 2012; Tonetti, Fabbri, & Natale, 2008).

Life satisfaction seems to be determined by different factors, like sex and age. Men are less satisfied with any aspects of life from social relations to economic conditions, but concerning family life, they are satisfied like women. It corresponds with previous studies that postulate that under 45 years of age women tend to be happier than men (Inglehart, 2002).

Next, the question emerges, are the characteristics of eveningness reduce to satisfaction with life? Randler's results (2008a) indicate that individuals skewed towards morningness report higher overall satisfaction with life. At the same time, evening types experience affective disturbances because their endogenous sleep-wake cycle does not fit into current social and working schedules (Wittmann, Dinich, Merrow, & Roenneberg, 2006). As a result, they were less satisfied with lives, and we may confirm that also affective disorders and depression correlated with eveningness, and our data support these statements. This study revealed that, regardless of age and sex, chronotype was linearly related to greater life satisfaction. Setting out in detail, eveningness for women is less related to different aspects of life-satisfaction while men are related with all life-satisfaction features. Besides, for young adults, eveningness is not relate with the satisfaction with family relations. In general, for social relations as well as for the health and economic capacity, morning persons are more satisfied. So, these facts are marked in the previous studies that health problems are mostly related to evening chronotype (Kim S.J. et al., 2010; Urban, 2010).

## Conclusion

In summary, the morningness-eveningness and seems to be dependent on age more than sex, but the life satisfaction is influenced by the both factors. We may report an association between eveningness and life satisfaction, which was much more reliable for men and younger persons.

Limitations of the present study may include a relatively small sample size for dividing group by age. Future studies will be needed to verify the psychological mechanism by which age and sex moderate the relationship between life-satisfaction and eveningness.

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## **The Role of Reflexivity in the Development of Personality in the Elderly**

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## **Роль рефлексивности в личностном развитии в старости**

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**Abstract.** This study is devoted to clarifying the relationship between types of reflection and the status of ego-identity, corresponding to dynamic changes in ego in normative crises of late age. Understanding the specifics of reflexivity will clarify the strategies of individual and group psychological support for older people. Successful aging depends on the awareness and acceptance of the challenges of age development. The identity achievement status as a result of the regulatory crisis is an indicator of the maturity of the individual at this age stage and indicates the ego-integration of the individual. The reflection parameters are compared in groups of respondents with different identity statuses. Identity statuses characterize a certain phase of a normative crisis as a transition from one stage to the next. A discriminant analysis of the main indicators of personality maturity and different types of reflection was carried out. The indicator of deadlock reflection is most characteristic of older people with a foreclosure identity. The reflection indicator of future activities is most pronounced among respondents

characterized by a moratorium of identity and among respondents with a foreclosure status of identity. These statuses correspond to the first phase of the crisis and the critical phase, respectively. The indicators of general reflexive activity, retrospective reflection, reflection of current activity, perspective reflection, auto-reflection, deadlock reflection statistically reliably distinguish groups of respondents with a moratorium of identity and respondents with achieved status of identity. Reflective activity is most characteristic of respondents with a moratorium on identity, which indicates the presence of an acute phase of the crisis.

**Keywords:** *older adults; reflection; identity; ego-integration; normative crisis; personality identity status*

**Аннотация.** Исследование посвящено выявлению взаимосвязи между рефлексивностью и статусами эго-идентичности личности в период нормативного кризиса на поздних этапах онтогенеза. Понимание специфики рефлексии в старости позволит уточнить стратегии индивидуальной и групповой психологической поддержки пожилых людей. Индивидуальная вариативность личностного развития в старости во многом зависит от осознания и принятия новых возрастных задач. Статус автономной идентичности, достигнутый в результате успешного проживания нормативного кризиса, является индикатором зрелости индивида на этой возрастной стадии. Параметры рефлексивности сравниваются в группах респондентов с разным статусом идентичности. Статусы идентичности характеризуют определенную фазу нормативного кризиса, знаменуя переход от одной стадии к другой. Проведен дискриминантный анализ основных показателей зрелости личности и различных типов рефлексии. Показатель тупиковой рефлексии наиболее характерен для пожилых людей с предрешенным статусом идентичности. Показатель рефлексии будущей деятельности наиболее ярко выражен среди респондентов, для которых характерен мораторий идентичности, и среди респондентов с предрешенным статусом идентичности. Эти статусы соответствуют первой фазе кризиса и критической фазе соответственно. Показатели общей рефлексивной активности, ретроспективной рефлексии, рефлексии текущей активности, перспективной рефлексии, ауторефлексии, тупиковой рефлексии статистически достоверно различаются в группах респондентов с мораторием на идентичность и респондентов с достигнутым статусом идентичности. Рефлексивная активность наиболее характерна для респондентов с мораторием на идентичность, что свидетельствует о наличии острой фазы кризиса.

**Ключевые слова:** *пожилые люди; рефлексивность; личностное развитие в старости; эго-интеграция; нормативный кризис; статус идентичности личности*

## Introduction

The age of a person is determined by the age-related stratification of society and is specifically historically determined. Age is expressed in a sense of one's own age identity and determines a person's belonging to a particular age cohort. A transition from one develop-

mental stage to another goes smoothly if it is accompanied by specific rituals such as initiation. They organize the developmental cycle and relationship between different age groups and reflect their principles and values. In case the specific rituals are absent, the change from one developmental stage to another becomes difficult and time-consuming. That is due to the need of an individual to become familiar with the social expectations and the new tasks on his own. As a result, an important question rises concerning the ways an individual accustoms to age-related norms and identifies with them. The personal level of identity includes identity with one's own goals, meaning of life and life values. The social level of identity is a commitment to the goals and values of the social group with which a person associates himself.

Identity changes over the course of a person's life, and the main changes occur in normative crises. A normative crisis is a transition to the next age stage associated with changes in the structure of the personality in accordance with age goals as the social expectations. A normative crisis includes three phases that are associated with a consistent change in identity status: from a foreclosure through a moratorium to an identity achievement. Developing the theory of E. Erikson (1968) and J. Marcia (1966), we found that they have a certain continuity.

The result of successfully overcoming the normative crisis is identity achievement. Identity achievement means that a person understands the own age identity and comprehensively realizes the new guidelines for the own development with accordance of age tasks as a social expectations and his (her) life goals. Such restructuring of the personality structure lead to achievement of personal maturity (Soldatova & Shlyapnikova, 2013).

Successful ageing is combined with age-related stereotypes (Weiss & Kornadt, 2018). There are two potential approaches to the relationship. On the one hand, lifelong age-related ageing stereotypes influence on development at the advanced age. Negative effects related to stereotype danger in seniors are the best reported (Armenta, Scheibe, Stroebe, Postmes, & Van Yperen, 2018) because negative age-related stereotypes have the strongest impact on senile behavior (Meisner, 2012). The more evident age-related identification is, the stronger negative influence of age-related stereotypes is observed (Kang & Chasteen, 2009). Impact of personal ageing concept on health (Wurm, Diehl, Kornadt, Westerhof, & Wahl, 2017), self-rating (Rothermund & Brandtstädter, 2003), cognitive and physical results (Menkin, Robles, Gruenewald, Tanner, & Seeman, 2017) is empirically confirmed.

On the other hand, seniors do not response on stereotypes that seemed to be unrealistic in virtue of their own experience (Fung et al., 2015). Therefore, projection is a response to already existing changes (Kornadt, Voss, & Rothermund, 2017). Facing negative age-related stereotypes, seniors are prone to distance and to dissociate themselves from them (Weiss & Kornadt, 2018). A relationship between self-rating and evaluation of other seniors is more evident for positive personal properties (Lin, Ankudowich, & Ebner, 2017).

The development of personality in late adulthood is characterized by the integration of ego-identity — self-identity in the past, present and future (Erikson, 1968). The boundaries of crises of late adulthood are difficult to differentiate due to the large influence of social factors and the high level of variability of individual development at this age.

However, it is possible to determine which phase of the crisis a person lives in relation to the status of identity.

The mechanism for the formation of age-related identity is universal for adult development and includes some normative crisis associated with a regular changes of ego-identity statuses. During the crisis, identity changes from a foreclosure through a moratorium to an identity achievement (Soldatova, 2006). Restructuring of ego-identity in the process of crisis is accompanied by an active search, reflection of changes in the process of adopting a new lifestyle. Reflection is an important component of the mechanism of development of the personality of an adult.

The leading role of reflection to achieve personality maturity is preserved in late adulthood. Progressive development in late adulthood is associated with the comprehension, integration and transmission of the semantic and value content of their life experience to future generations, that is, with a reflection of the past life path.

The ability to reflection can be understood as the ability to reconstruct and analyze a broadly understood plan for building one's own or another's thoughts; as the ability to single out its composition and structure in this regard, and then to objectify them, to work out accordingly to the goals set. A. V. Karpov points to the existence of an optimum of reflexivity, which is characterized by the fact that with an increase in reflexivity, both the integration and differentiation of the system of metaprocesses increase. But at high and very high values of reflection, its differentiating function clearly dominates (Karpov, 2003).

Reflexivity is a multimodal process. It is possible to differentiate the significance of certain types of reflection for the development of a person's personality at a later age. There are both positive (for example, systemic reflection) and negative (for example, quasi-reflection) varieties of reflexive processes (Leontiev & Osin, 2014), therefore the positive role of reflection in personality development is combined with reflexivity as a property characteristic of an idle, passive person.

In addition, reflection can be a kind of response to stress when a person goes through the possible causes of his condition, actions, and reactions, which ultimately enhances a depressed state and personality maladaptation (Hilt, Cha, & Nolen-Hoeksema, 2008). The multimodality of reflection also explains the high variability of research results (Sizikova, 2019).

There are several reasons for the classification of reflection. First, they distinguish intrapsychic reflection (the ability to self-perceive the content of one's own psyche and its analysis) and interpsychic reflection (the ability to understand the psyche of other people). Secondly, according to the temporary principle, the following three types of reflection can be distinguished: situational reflection provides direct self-control of human behavior in the current situation, retrospective reflection is manifested in a tendency to analyze past activities and accomplished events, perspective reflection is correlated with: the function of analyzing future activities and predicting likely outcomes.

According to the direction of reflective activity, they distinguish activity reflection (an individual's ability to evaluate various parameters of one's own activity), commu-

nication reflection (the basis for productive interpersonal communication), deadlock reflection is fruitless self-digging that does not lead to thoughts about one's own life (Zav'yalova, 2016).

Thus, reflection is crucial in the process of forming an individual's identity, being, in fact, a tool for self-development of a person's personality and achievement of personality maturity. Reflection allows you to rethink your life path, the value-semantic conditionality of your life during a crisis. The integration of self-image through the activation of reflection skills allows you to successfully live through regulatory crises, reaching personal maturity at the current age stage. This study is devoted to specifying the relationships between the statuses of ego-identity and the severity of various types of reflection in late adulthood.

## Methods and Equipment

### Subjects

Subjects were enrolled by snowballing. Age ( $\geq 55$  years old) ( $M = 64.89$ ;  $SD = 6.85$ ) was an inclusion criterion. In total, 306 subjects (including 188 females) filled up a question list and submitted sociodemographic data (such as sex, age, marital status, place of residence and educational background). 36 % and 64 % of subjects are married and unmarried, respectively. 72 % and 28 % of respondents live in city and country, respectively. 18 %, 58 % and 24 % had elementary/incomplete secondary education, general/special secondary education and higher professional education, respectively. In general, percentage ratio of sociodemographic parameters complies with the study population.

### Materials

To provide data on current status of a senile personal identity, modified E. L. Soldatova's Ego-Identity Structure Test was performed to evaluate personal identity status (Soldatova, 2006).

A. V. Karpov and V. V. Ponomaryova's Individual Reflexivity Test represents a self-rating of several reflection types (including retrospective reflection parameters). The method was applied to measure current change reflection and spent life reflection (Karpov, 2003).

C. R. Rogers and R. F. Dymond social and psychological adaptation diagnosis adapted by A. K. Osnitskiy (2004) evaluates personal characteristics related to both social and psychological adaptation and relevant personal characteristics conventionally considered as ones supporting successful ageing. The method enables determination of integral indicators such as adaptation, acceptance-of-others, internality, self-acceptance, emotional comfort, need for dominance and escapism.

## Results

The status of personality identity indicates the psychological characteristics of awareness and the degree of acceptance of changes that have occurred in connection with age. We

believe that the process of creating a renewed age identity in old age is associated with reflection. In this regard, we assume that in people with different identity status in old age, there are differences in the severity of different types of reflection. To clarify the specifics of actualization of various types of reflection in people with different statuses of identity, a pairwise comparison of the corresponding extreme groups of respondents was carried out according to the parameters of various types of reflection.

Comparison of indicators of actualization of reflection skills in groups of respondents with Identity achievement status and moratorium revealed the following significant differences (*Table 1*).

*Table 1*

**Comparison of indicators of actualization of reflection skills  
in groups of respondents with identity achievement status and moratorium**

Indicators	Identity achievement		Moratorium		Significance of Differences
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Overall level of reflection	63	5.527	70.6	6.693	.001
Retrospective reflection of activity	63	5.527	70.6	6.693	.002
Reflection of the present activity	63.27	5.86	64.67	6.91	.001
Reflection of future activities	63	5.527	70.6	6.693	.017
Reflection of communication	38.4	4.288	38.1	5.579	.76
Retrospective reflection	41.3	4.708	47.23	5.575	.000
Actual reflection	42.5	5.316	43.63	4.672	.365
Perspective reflection	63.27	5.86	64.67	6.91	.089
Interpsychic reflection	63.27	5.86	64.67	6.91	.436
Autoreflexia	63	5.527	70.6	6.693	.000
Deadlock reflection	32.27	4.548	38.37	4.93	.000

Respondents with an autonomous identity status — identity achievement have a statistically significantly lower general indicator of the severity of reflective activity compared with respondents with a moratorium status ( $p = .001$ ), this is also characteristic of the following indicators: retrospective reflection of activity, reflection of present activity, reflection of future activity, retrospective reflection, auto-reflection, dead-end reflection. Probably, the autonomous status of identity (an indicator of personality maturity) contributes to self-acceptance and significantly reduces the reflective activity of a person.



A comparison of indicators in groups of respondents with moratorium and foreclosure identity status revealed the following significant differences (*Table 2*).

*Table 2*

**Comparison of indicators of actualization of reflection skills in groups of respondents with moratorium and foreclosure identity status**

Indicators	Moratorium		Foreclosure status		Significance of Differences
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Overall level of reflection	70.6	6.693	64.67	11.309	.169
The overall level of reflection in sten	38.1	5.579	39.47	7.899	.218
Retrospective reflection of activity	70.6	6.693	64.67	11.309	.098
Reflection of the present activity	64.67	6.91	62.93	10.583	.109
Reflection of future activities	70.6	6.693	64.67	11.309	.013
Reflection of communication	38.1	5.579	39.47	7.899	.422
Retrospective reflection	47.23	5.575	43.3	9.363	.064
Actual reflection	43.63	4.672	42.63	8.177	.689
Perspective reflection	64.67	6.91	62.93	10.583	.054
Interpsychic reflection	64.67	6.91	62.93	10.583	.756
Autoreflexia	70.6	6.693	64.67	11.309	.031
Deadlock reflection	38.37	4.93	35.63	7.397	.197

In the group of respondents with moratorium identity status, the reflection of future activities and auto-reflection is statistically significantly higher than in the group of respondents with a foreclosure status ( $p = .013$ ). This shows that people with a predetermined ego-identity status are less likely to think about their future and really live in the illusion of accepting their new age status. A comparison of indicators in groups of respondents with autonomous and predetermined status of identity revealed the following significant differences (*Table 3*).

In the group of respondents with an identity achievement status, the indicator of deadlock reflection is statistically significantly lower compared to the group of respondents with a foreclosure identity status ( $p = .033$ ), which confirms the rejection of oneself due to age-related changes and indicates that people with an identity achievement of ego-identity to a lesser extent prone to reflection restricting the development of personality.

Table 3

Comparison of indicators of actualization of reflection skills in groups of respondents with achievement and foreclosure identity status

Indicators	Achievement status		Foreclosure status		Significance of Differences
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Overall level of reflection	63	5.527	64.67	11.309	.525
The overall level of reflection in sten	38.4	4.288	39.47	7.899	.664
Retrospective reflection of activity	63	5.527	64.67	11.309	.256
Reflection of the present activity	63.27	5.86	62.93	10.583	.3
Reflection of future activities	63	5.527	64.67	11.309	.599
Reflection of communication	38.4	4.288	39.47	7.899	.37
Retrospective reflection	41.3	4.708	43.3	9.363	.5
Actual reflection	42.5	5.316	42.63	8.177	.672
Perspective reflection	63.27	5.86	62.93	10.583	.486
Interpsychic reflection	63.27	5.86	62.93	10.583	.745
Autoreflexia	63	5.527	64.67	11.309	.382
Deadlock reflection	32.27	4.548	35.63	7.397	.033

To identify the significance of the status of ego-identity in the structure of personality maturity as ego integration, a discriminant analysis of the main indicators of personality maturity as ego integration and various types of reflection was carried out. The results indicate that the indicators of reflection to a greater extent determine the differentiation of the diffuse status of ego-identity, according to the tendency to reflective activity, we can judge the presence of an acute phase of living of the regulatory crisis of the transition to the age of wisdom. Moreover, of particular importance is: perspective reflection, retrospective reflection, including activities, auto-reflection, reflection of future activities.

To identify the significance of various indicators of ego integration as personal maturity and reflection for differentiating the status of ego identity, a discriminant analysis of the main indicators of personality maturity, including the structure of identity, and various types of reflection was carried out. A graphical representation of all objects and centroids of ego-identity status classes on the axes of canonical functions is shown in the *Figure*.

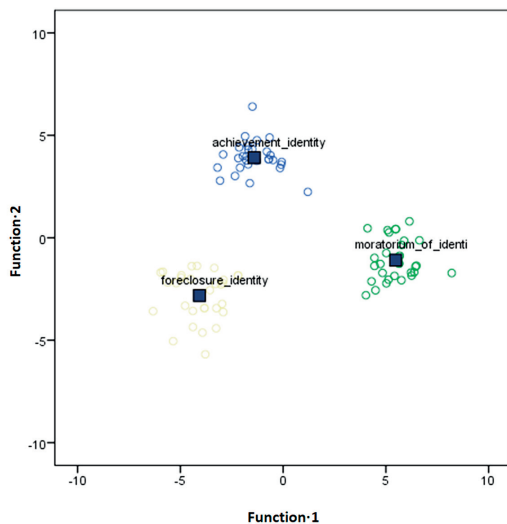


Figure. Graphic expression of canonical discriminant functions.

Note. ■ = centroid group

The differences between moratorium of ego-identity and the other two identity statuses are highlighted in *Figure* (function 1). An analysis of the factors presented in these functions will clarify the relationship between the identity statuses, indicators of personal maturity and the level of reflection. The results of the structural matrix of differential functions of ego-identity statuses are presented in the *Table 4*.

Table 4

Structural matrix of differential functions of ego-identity statuses (fragment)

	Maximum correlations with function 1			Maximum correlations with function 2	
	function			function	
	1	2		1	2
Retrospective reflection	.267	-.052	Ejection of others	.102	-.349
Deadlock reflection	.264	.012	Maladaptation	.103	-.322
Reflection of future activities	.264	.165	Integral indicator of acceptance of others	-.130	.317
Retrospective reflection of activity	.245	-.018	Integral Adaptation Index	-.08	.306
Autoreflexia	.213	.000	Escapism	.209	-.301
Overall level of reflection	.201	.034	Emotional discomfort	.052	-.28
Interpsychic reflection	.196	.098	Statement	.174	-.266

The content of function 1 includes features such as the retrospective reflection, overall level of reflection, the reflection of future activity, the retrospective reflection of activity, auto-reflection, the general level of reflection. Conventionally, function 1 can be called “The trend toward reflective activity.” This is consistent with the idea of phase 2 of the normative crisis as a time to rethink your life, introspection, and redefine yourself.

Function 2 mainly includes indicators of personality maturity. Such indicators as the non-acceptance of others, maladaptiveness, the integral indicator of acceptance of others, the integral indicator of adaptation, escapism, emotional discomfort, the statement, the rejection of oneself, the integral indicator of emotional comfort, the integral indicator of self-acceptance, have the maximum value for differentiating the achievement and foreclosure status of ego-identity.

## Discussion

Elderly people with the achievement status of identity significantly differ from people during the moratorium of identity in terms of the general indicator of reflective activity, the retrospective reflection of activity, the reflection of present activity, the reflection of future activity, retrospective reflection, auto-reflection, deadlock reflection.

These differences indicate that elderly people who have reached maturity, differ significantly in terms of reflection from people who have not yet accepted their updated age status. People with the moratorium of identity status are statistically significantly different from people with a foreclosure status in one indicator — reflection of future activities (in the group with moratorium of identity  $M = 70.6$ ;  $SD = 6.693$ ; in the group with foreclosure status  $M = 64.67$ ;  $SD = 11.309$ ). This is consistent with the idea that people with a foreclosure status of identity do not critically perceive their own future.

A foreclosure identity status characterizes the first phase of the crisis and indicates an uncritical acceptance of changes and one's own future, which is confirmed by significantly lower reflection indicators of future activities and self-reflection in comparison with the results in the with moratorium of identity. At the same time, there are no significant differences in other indicators of reflection, which indicates relatively weak differences in reflective activity in people with a foreclosure ego-identity status and with moratorium of identity.

People with achievement identity status are significantly different from people with a foreclosure status in one indicator: deadlock reflection (in the group with achievement identity  $M = 32.27$ ;  $SD = 4.548$ ; in the group with foreclosure identity status  $M = 35.63$ ;  $SD = 7.397$ ), which again indicates an uncritical assessment of changes in life in people with a foreclosure identity status.

A discriminant analysis of the main indicators of personality maturity, including the structure of identity, and various types of reflection, confirmed that the tendency to reflection is more manifested in people with moratorium of identity. Reflection indicators to a greater extent determine the differentiation moratorium of identity, according

to the tendency to reflexive activity, we can judge the presence of an acute phase of living of the normative crisis of the transition to the old age. Moreover, perspective reflection, retrospective reflection, retrospective reflection of activities, auto-reflection, reflection of future activities is particular importance. While differentiating the foreclosure identity status and achievement identity status seems to be a much more difficult task. The key points in this are the formation of signs of a prosperous — mature personality, the most important of which are: self-awareness and self-acceptance, authorship of one's life, successful relationships with other people, socio-psychological adaptation, emotional comfort.

## Conclusion

To determine the characteristics of the status of identity means to identify the phase of the crisis and predict the dynamics of overcoming the crisis. Understanding the features of reflexivity will allow you to adjust the strategies of individual and group psychological support for older people, indicating the current possibilities of reflexive activity. In the first phase of the regulatory crisis, reflective activity is reduced, with the exception of deadlock reflection, a person does not accept the future, is prone to an uncritical and ossified analysis of his life. At the peak of the normative crisis, the diffuse status of ego-identity is characterized by the actualization of reflexive activity, the most important of which are auto-reflection and retrospective reflection. Subjectively, this period can be perceived as maladaptive, however, under the control of a person of deadlock reflection, it can lead to a safe living of a normative crisis. When an autonomous identity is achieved, reflective activity decreases slightly compared to the acute crisis phase, the person is more adapted, assumes his updated age status.

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## **The Development of Young Children: The Review of Assessment Methods**

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## **Развитие детей раннего возраста: обзор методов оценки**

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**Abstract.** The problem of the state of health of early children, especially infants of the perinatal risk group, remains relevant. Modern trials show that the first two to three years of a child's life are an important age period and the infant's nervous system has significant compensatory capabilities during this period. Delayed psychomotor development may be the first sign of distress, and may be a leading syndrome in various somatic or neurological diseases in etiology and pathogenesis. Accordingly, it is important to be able to objectively monitor the main parameters of development throughout the entire period of early childhood. Today the Prechtl's Method is a unified and reliable methodology. In recent years, the most prognostically significant features of general movements have definitely been identified and their clinical role has been considered in detail, especially with regard to the prediction of cerebral palsy. Hammersmith Neonatal Neurological Examination is a highly reliable method of neurological examination of premature and full-term newborns. Habilitation programs should be implemented within the framework of the concept of early intervention. It is necessary

to have a unified methodology for monitoring, correcting or minimizing consequences of disease based on the knowledge of ontogenetic features of the child organism, objective data on structural and functional disorders thereof and the degree of restriction of activity and participation for successful habilitation of at risk kids.

**Keywords:** *perinatal pathology; psychomotor development; methods of assessment; general movements; habilitation*

**Аннотация.** Проблема состояния здоровья детей раннего возраста, особенно младенцев группы перинатального риска, остается актуальной. Современные исследования показывают, что первые два-три года жизни ребенка являются важным возрастным периодом, и в этот период нервная система ребенка обладает значительными компенсаторными возможностями. Задержка психомоторного развития может быть первым признаком дистресса, а может быть ведущим синдромом при различных соматических или неврологических заболеваниях в этиологии и патогенезе. Соответственно, важно уметь объективно отслеживать основные параметры развития на протяжении всего периода раннего детства. Сегодня метод Прехтля — это единая и надежная методология. В последние годы выявлены наиболее прогностически значимые особенности общих движений новорожденных и подробно рассмотрена их клиническая роль, особенно в отношении прогнозирования церебрального паралича. Неонатальное неврологическое обследование по шкале Хаммерсмит является высоконадежным методом неврологического обследования недоношенных и доношенных новорожденных. Программы абилитации должны осуществляться в рамках концепции раннего вмешательства. Для успешной абилитации детей группы риска необходима единая методика мониторинга, коррекции или минимизации последствий заболевания, основанная на знании онтогенетических особенностей детского организма, объективных данных о его структурных и функциональных нарушениях, степени ограничения активности и участия.

**Ключевые слова:** *перинатальная патология; психомоторное развитие; методы оценки; общие движения; абилитация*

## Introduction

Despite favorable trends in the development of obstetric and pediatric services in the health-care system of the Sverdlovsk region and the Russian Federation in general, perinatal pathology has a significant impact on the level of disability of the child population.

Low-weight gestation and premature infants are the main risk group for early childhood disability. They are more likely to detect violations of motor, sensory, cognitive and communicative functions, leading to further restriction of life's activity and social maladaptation. Knowledge of risk factors, complications, and adverse outcomes and their early prediction determine the possibility to take preventive measures to harmonize the development of the child and limit the negative impact of the environment (Palchik,

Fedorova, & Ponyatishin, 2011). In this regard, the issues of optimizing the quality of medical care for patients in the early stages of ontogenesis remain relevant (Voroshilina & Rovda, 2015).

There is a rapid development of the brain in early childhood. The formation of visual and auditory analyzers is completed. All the structures necessary for the normal development of intellectual, cognitive and communicative abilities of the child mature (Kustova, Taranushenko, & Demyanova, 2018).

Modern trials show that the first two to three years of a child's life are an important age period and the infant's nervous system has significant compensatory capabilities during this period. The basis for the restoration of impaired functions is neuroplasticity — the ability of the nervous tissue to structural-functional restructuring that occurs after its damage (Kryzhanovsky, 2001). Currently, it has been revealed that the “plasticity” of the brain of children with developmental disorders and children at risk of developing them can be activated by early therapeutic intervention.

Rehabilitation is a set of measures (medical, pedagogical, psychological, social, legal, etc.) aimed at restoring impaired functions and social adaptation of a person (Kadykov, Chernikova, & Shakhparonova, 2008).

It should be noted that the generally accepted methods of dispensary observation and the “schematic” approach to the management of children with developmental disorders or risk of such disorders do not fully provide the necessary rehabilitation measures in this group of patients. The reasons are the lack of a general methodology for assessing the child's psychomotor development. In addition, timeliness and inconsistency of diagnostics and knowledge of age-related norms of formations of sensorimotor and cognitive functions are necessary. Delayed psychomotor development may be the first sign of distress, and may be a leading syndrome in various somatic or neurological diseases in etiology and pathogenesis. That is why a significant proportion of young children with certain developmental problems have a common diagnosis of delay or lag in psychomotor development. Accordingly, it is important to be able to objectively monitor the main parameters of development throughout the entire period of early childhood (Kustova et al., 2018).

Specialists efforts should be directed to early risk prediction using reliable assessment scales use of data-based evidence-based medicine intervention technologies (Novak et al., 2017).

## Methods of Assessment

### **Prechtl's Method on the Qualitative Assessment of General Movements (GMA)**

Heinz Prechtel (1990) formulated the basic requirements for an ideal method of neurological evaluation of newborns. It should be non-invasive, time-consuming and highly sensitive to changes in the age-related functional repertoire (Cioni, Belmonti, & Einspieler,

2014). Observation of children's spontaneous movements in the early months of life allowed H. Prechtl and his colleagues to classify several normal and abnormal motor patterns. Among other things, so-called "general movements" (GMs) — movements covering all parts of the infant's body proved particularly suitable for evaluation (Prechtl, 1990, 2001). This became the basis of Prechtl's Method on the qualitative assessment of generalized movements in preterm, term and young Infants (Einspieler, Prechtl, & Bos, 2005).

Although the evaluation of general movements is based on a holistic and qualitative judgment, the method has proven itself to be very practical. Its validity and reliability have been demonstrated in a number of studies focusing on prediction of cerebral palsy development, evaluation of minor neurological disorders, analysis of cognitive development, diagnosis of Rett syndrome, as well as autism spectrum disorders (Cioni et al., 2014).

"Normal" general movements involve the entire body in a complex sequence of movements of the arms, legs, neck and torso. GMs appear as early as 9–12 weeks of gestation and continue after birth without significant change in their form until 46 to 49 weeks of postconceptual age. There is a significant change in the form of movements between the age of 46 to 49 weeks. At about 3 months of age so-called fidgety movements appear (Prechtl, 1990). After 5–6 months of life, the GMs disappear, transforming into more coordinated motor patterns. Despite the complexity of their determination, GMs can be classified into a limited number of recognizable patterns, such as in relation to postconceptual age, or characterized as "normal" or "abnormal."

Their representation and age compliance correlates with the optimality state-coordinating formation and cognitive functions (Hadders-Algra, 2004). Global visual perception of movements quality has proven to be a powerful and reliable tool for recognition of "normal" and "abnormal" GMs. At the same time, specialists should be properly trained, and the analysis technique is carefully observed.

Today the Prechtl's Method is a unified and reliable methodology. In recent years, the most prognostically significant features of GMs have definitely been identified and their clinical role has been considered in detail, especially with regard to the prediction of cerebral palsy. Various scientific groups evaluated the value of FMs for early prediction of cerebral palsy. Burger and Low analyzed 15 studies on the prognostic value of FMs and found the sensitivity of this method > 91 % and specificity > 81 %. An interesting fact is that normal FMs are also absent in infants with some genetic diseases. Thus, fidgety movements are significant in the forecast of cerebral palsy, as well as other motor features combined with the absence of FMs (Cioni et al., 2014).

### **Assessment of the Neurological Status of Full-Term and Premature Infants**

Currently, Hammersmith Neonatal Neurological Examination (HNNE) is a highly reliable method of neurological examination of premature and full-term newborns. The evaluation parameters are organized into six sections: posture and tone, reflexes, movements, abnormal signs and behavior (Cioni et al., 2014). Typical normal and abnormal signs detailed in the manual have proved to be easily applicable in clinical practice. The "optimality" index was also calculated for full-term and premature newborns for research purposes

(Mercuri et al., 2003; Romeo et al., 2012). Thus, in the study of Spittle A. J. the co-authors a reliable association of low HINE scores in premature infants (gestational age at birth 32–36 weeks) with cognitive development problems at the age of two years was established (Spittle et al., 2016).

Based on the above-mentioned survey, Dubowitz with colleagues developed a Protocol for use after the neonatal period in infants between 2 and 24 months of life (Hammersmith Infant Neurological Examination, HINE) (Cioni et al., 2014). The Protocol consists of 26 points in 5 domains, which are devoted to the evaluation of neurological signs (including cranial nerves, position control, motor skills, muscle tone, reflexes), regardless of age, the formation of motor skills and characteristics of three behavioral models. Summing points in each domain allows you to determine the “total” score (Dubowitz, Mercuri, & Dubowitz, 1998).

HINE is easy to perform and accessible to most doctors, has good reliability of application even for low-experienced employees. One of the advantages of the method, compared to other similar tools, is that HINE not only identifies children at risk of developing cerebral palsy, but also often provides additional information about the type and severity of motor disorders (Romeo, Ricci, Brogna, & Mercuri, 2016).

Research data indicate the high diagnostic significance of Hammersmith Infant Neurological Examination in relation to cerebral palsy. The HINE score < 57 at the age of three months is a prognostically valuable factor in the formation of cerebral palsy. According to the international clinical guidelines on cerebral palsy, it is recommended to use the HINE method, especially in situations where the most accurate predictive tools cannot be applied (the Prechtl method for qualitative assessment of general movements and MRI of the brain).

HINE allows clinicians to monitor the development of high-risk infants in longitudo over two years of life, reproducing specific threshold scores at different age periods. The obtained results can help plan for appropriate intervention.

### **The Bayley Scales of Infant and Toddler Development (BSID-III)**

BSID-III is a standardized series of evaluation scales originally developed by psychologist Nancy Bayley (1969). The evaluation protocol consists of a series of developmental game tasks that may take about 60 minutes to complete. It is used to analyze the development of children between the ages of 1 to 42 months of life.

BSID-III consists of the following scales. The cognitive scale that includes elements such as attention to familiar and unfamiliar objects, object search, and game interaction. The language development scale that evaluates the receptive and expressive forms of speech function. The motor sphere rating scale allows you to analyze large- and small-motor skills.

The Bayley Scales of Infant and Toddler Development helps professionals identify the need for further monitoring and inclusion in early intervention programs. The Bailey-III Scale is actively used as an objectification tool in clinical research (Weiss, Oakland, & Aylward, 2010).

**Assessment of Sensory Functions in Young Children. The Test of Sensory Functions in Infants (TSFI)**

Some time ago, experts faced the problem of identifying children who are at risk for violations of cognitive or emotional development (lack of objective criteria and information on the formation of sensory functions). The Sensory Function Test for children was created as a research and diagnostic tool that can be used to identify children with disorders of regulatory function, with developmental delay, who are at risk learning and having sensory disorders. The test provides a General assessment of sensory processes and reactions in infants. TSFI includes 24 modules used to evaluate sensory and reaction processes in children aged 4 to 18 months of life.

The Protocol consists of five subtests: response to tactile deep stimuli, adaptive motor functions, visual-tactile integration, oculomotor control, and response to vestibular stimulation. TSFI is intended for clinical application by pediatricians, psychologists, physiotherapists and ergotherapists with instructions for interpretation of the obtained results in the field of sensory functions.

TSFI can be used in parallel with other tests to provide a holistic and accurate assessment of development, for example, in conjunction with the Bayley Scales of Infant and Toddler Development or other standardized assessment scales. The development of such tools plays an important role in providing preventive measures and implementing preventive approaches among (Barton, Reichow, Schnitz, Smith, & Sherlock, 2015).

Each scale, under certain conditions, may have its own limitations. The methods described above were chosen precisely in view of their high applied significance. In the context of our practice, the main problem limiting the use of the part of the described methods (GMA, BSID-III) is the lack of certified specialists. Specialists who are proficient in these technologies implement their knowledge within the framework of research projects, outside practical health care.

A comprehensive approach using development assessment techniques has been successfully implemented in various international medical centers. We are currently using the HINE and TSFI scales. In terms of the development of our clinic, several specialists are planned to be trained in techniques such as Prechtl's method on the qualitative assessment of general movements and The Bayley Scales of Infant and Toddler Development to carry out consistent surveillance of at-risk patients and organize timely habilitation.

## **Rehabilitation**

It is necessary to state that today the absence of a single scientifically sound rehabilitation strategy causes difficulties in setting tasks of rehabilitation, determining the starting point and its duration, and evaluating the effectiveness of the measures taken. Overdiagnosis and overactive therapy result in excessive stimulation, and wait-and-see tactics lead to a late start of the rehabilitation process, when the optimal time for the development or formation of functions has already been missed (Kazanskaya, 2008).

The term “rehabilitation” for children at risk for violations of ontogenetic development is quite controversial. In infants, the issue of formation, rather than restoration of lost functions, is relevant, so it would be more accurate to use the term *habilitation* for this group of patients. Habilitation is understood as a process aimed at developing the child’s functions that are initially absent, preventing the appearance of restrictions on activity and participation, or reducing their degree of expression.

Infancy is a unique time interval during which, with adequate treatment and timely habilitation, the outcome is the most promising. From birth to three years of age, a child has great potential in terms of physical, cognitive, emotional, and social development. Maturation and complication of the motor and mental functions, the formation of the child’s personality occurs under the influence of hereditary factors and in the process of mastering social experience (Kustova, 2018).

Habilitation programs should be implemented within the framework of the concept of early intervention. It is a system of measures and a set of services aimed at the development of young children with developmental disorders or the risk of such violations, as well as measures aimed on supporting the family and improving the competence of parents on the harmonious development of their children.

The distinctive features of the program of early intervention from the traditional model are: the earliest detection of developmental deviations, inclusion in the program of children not only with developmental disorders, but also with the risk of their occurrence. Early intervention is based on an interdisciplinary and family-oriented approach, takes into account the individual assessment in building an assistance program based on functional classification of disorders, analysis of human activity and participation in the life of society against the usual statement and categorization of the identified pathology.

The practice of early intervention is based on the integration of modern research data, scientifically based habilitation approaches, requests and needs of the family directly involved in the adaptation and upbringing of a child at risk.

The systematization of data indicates that programs to form the correct motor skills and general harmonious development can be the most promising way to adapt children at risk to modern living conditions.

As an example, we can refer to the Portugal’s experience, where the early intervention system was introduced 15 years ago. The impact of this model of assistance was significant not only for the infant’s neurodevelopment, but also for specialists (improving their competencies) involved in the program. The analysis of our foreign colleagues has shown that the early intervention program can serve as a positive example of the implementation of state projects. Its implementation is recommended as part of comprehensive measures to assist the population throughout the country (Franco, Melo, Santos, Apolónio, & Amaral, 2017).

A group of Dutch researchers revealed that early intervention had a positive effect on long-term outcomes in children with a birth weight of less than 1500 grams, especially in deeply premature infants with bronchopulmonary dysplasia (Van Hus et al., 2016).



According to a review from Australia, early intervention contributes to the motor and cognitive development of children born prematurely in the first two years of life (Doyle et al., 2014).

## Conclusion

The scales presented above are a highly reliable tool for assessing the development of young children. Consequently, the deficit identified with the help of these methods serves as a foundation for making a decision based on the need for habilitation measures. For example, BSID-III is the “gold standard” of evaluation and provides analysis of all major areas of child’s development. This, in turn, helps to select a range of specialists in various fields who will take part in the therapy. It should be emphasized that these scales are not intended to predict the child’s limitations or success in the future, but their use allows monitoring the child’s development at the stages of the habilitation process.

It is necessary to have a unified methodology for monitoring, correcting or minimizing consequences of disease based on knowledge of ontogenetic features of the child organism, objective data on structural and functional disorders and the degree of activity restriction and participation in successful habilitation of risk group kids.

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## Overview of the Most Important Advances in Magnetoencephalography Technology

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## Обзор наиболее важных достижений в технологии магнитоэнцефалографии

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**Abstract.** The overview of the latest advances in magnetoencephalography (MEG) technology, including the development of optically pumped magnetometers (OPM), is presented. The main advantage of OPM over conventional superconducting quantum interference devices (SQUID) is the absence of cryogenic cooling, which reduces the cost of equipment by 2–3 times. Moreover, the OPM can be positioned a few millimeters from the scalp, which roughly doubles the signal-to-noise ratio. In addition, they are not as susceptible to muscle artifacts as electroencephalography (EEG) signals. Moreover, placing the OPM in a nulling magnetic field reduces the effects of head movement artifacts in the surrounding field. All these advantages open up great potential for the development of a new generation of OPM-based brain-computer interfaces (BCIs) that are cheaper, more flexible and more responsive than SQUID-based BCIs, which can perform both motor and non-motor tasks. Despite the tremendous progress made over the past few years, OPM–MEG is still an evolving technology that requires further improvement. Due to the large size of the sensors, the number of channels is relatively small (less than 50), so they cannot cover the entire head. Although many BCI applications require only a few sensors, their correct placement in selected areas

of the scalp is very important. The miniaturization and versatility of lightweight helmets could be an important step towards the further development of OPM for BCI and other applications.

**Keywords:** *magnetoencephalography (MEG); superconducting quantum interference device (SQUID); optically pumped magnetometer (OPM)*

**Аннотация.** Представлен обзор новейших достижений в технологии магнитоэнцефалографии (MEG), включая разработку магнитометров с оптической накачкой (OPM). Основным преимуществом OPM перед обычными сверхпроводящими квантовыми интерференционными устройствами (SQUID) является отсутствие криогенного охлаждения, что снижает стоимость оборудования в 2–3 раза. OPM можно расположить на расстоянии нескольких миллиметров от кожи головы, что примерно вдвое увеличивает соотношение сигнал/шум. Кроме того, они не так восприимчивы к мышечным артефактам, как сигналы электроэнцефалографии (ЭЭГ). Размещение OPM в обнуляющем магнитном поле снижает влияние артефактов движения головы в окружающем поле. Все эти преимущества открывают большой потенциал для разработки нового поколения интерфейсов мозг — компьютер (BCI) на основе OPM, они дешевле, гибче и чувствительнее, чем BCI на основе SQUID, которые могут выполнять как моторные, так и немоторные задачи. Несмотря на огромный прогресс, достигнутый за последние несколько лет, OPM–MEG все еще является развивающейся технологией, требующей дальнейшего совершенствования. Из-за большого размера датчиков количество каналов относительно невелико (менее 50), поэтому они не могут покрыть всю голову. Для многих приложений BCI требуется всего несколько датчиков, но при этом очень важно правильно разместить их в выбранных областях черепа. Миниатюризация и универсальность легких шлемов может стать важным шагом на пути дальнейшего развития OPM для BCI и других приложений.

**Ключевые слова:** *магнитоэнцефалография (MEG); сверхпроводящее квантовое интерференционное устройство (SQUID); магнитометр с оптической накачкой (OPM)*

Magnetoencephalography (MEG) is a widely used neuroimaging technique, that measures weak magnetic fields generated by neurocortical ionic currents. This is a safe noninvasive method of brain imaging that provides important information about neuronal activity in the living human brain with high temporal (about 1 ms) and spatial (about 1–2 mm) resolution. While the EEG modality benefits from the simplicity of the measurement equipment, it suffers from a relatively low (around 2 cm) spatial resolution. At the same time, MEG requires more sophisticated instrumentation and measurement methods due to extremely low magnetic fields generated by the brain tissue. Currently, there are two MEG techniques, one is based on superconductivity under low (helium) temperatures, so-called superconducting quantum interference device (SQUID), and another one, known as optically pumped magnetometers (OPM), explores quantum mechanical properties of alkali atoms under optical pumping and operates under room temperatures.

The main advantage of OPMs is that they do not require cryogenic cooling, that decreases the OPM price by 2–3 times as compared to the conventional SQUID-based

MEG systems. Moreover, the OPMs can be placed within millimeters from the scalp, that approximately doubles the signal-to-noise ratio (SNR). In addition, they are not so susceptible to muscle artefacts as EEG (Boto et al., 2018). The location of OPMs in a field-nulling apparatus (Holmes et al., 2018) decreases the influence of artefacts caused by head movement in the ambient field. Recently, 3D-printed helmets were demonstrated (Boto et al., 2018; Lin et al., 2019; Tierney et al., 2018). All these features give potential possibilities to develop a new generation of OPM-based BCIs, cheaper, more flexible and sensitive than SQUID-based BCIs, which can serve for both motor and non-motor tasks.

Despite the enormous progress, OPM-MEG is so far a developing technology that needs improvement. Due to their large size, the number of channels is relatively small (less than 50) (Borna et al., 2020; Boto et al., 2018; Iivanainen, Zetter, Grön, Hakkarainen, & Parkkonen, 2019) and therefore they cannot cover the entire head. In addition, OPMs can only be mounted in specific areas over the brain cortex. Although for many BCI applications only several sensors are required, their correct location over selected brain areas is very important. The miniaturization and universality of lightweight helmets would be an essential step towards further development of OPM wearable for BCI applications.

Significant progress in the MEG research has been achieved in cognitive neuroscience. For example, Chholak, Maksimenko, Hramov, and Pisarchik (2020) studied how voluntary and involuntary attention affect brain dynamics. The authors performed the MEG experiment with the Necker cube, in which the pixels' intensities on two faces were modulated with different frequencies. The tags at these frequencies and their harmonics were observed in the average power spectra of the MEG data recorded from the visual cortex. The subjects were asked to voluntarily interpret the cube as either left- or right-orientated. The wavelet analysis allowed identifying the currently perceived cube orientation since the spectral energy was higher at the modulation frequency of the cube face to which the subject focused attention. The results of this experiment confirmed our hypothesis that higher attention requires a larger neuronal network to process information and make decision, this in turn increases neural noise since a larger number of synapses and neurons are involved (Pisarchik et al., 2019). Finally, it was shown that stronger brain noise causes more frequent switching between perceptual states or more frequent response selection and hence shorter dominance times.

Further development of studies using MEG is likely to be directed towards combination with fMRI. Not only the cerebral cortex can be used as a source of the magnetic field, but signals from deeper brain tissues will also be available for research. It is expected that new computational models will be developed to reconstruct MEG signals to help better understand the processes associated with specific brain functions.

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## **Late-Life Depression and Cognitive Deficits: A Neuropsychological Portrait**

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## **Депрессия в позднем возрасте и когнитивный дефицит: нейropsychологический портрет**

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**Abstract.** The article presents an analysis of the symptoms of neurocognitive deficit in late-life depression, revealed in the neuropsychological diagnostic study of 197 patients with depression (average age  $68 \pm 13$  years), who were on inpatient treatment in the clinic of the Scientific center of mental health (Moscow). The results of the study allowed to give a description of the features of memory, attention, different types of perception, voluntary movements and actions, language functions, thinking in late depressions. The author of the article formulated assumptions about possible variants of localization and lateralization of brain dysfunctions in late depression, the degree of severity of neurocognitive deficit, the possible role of age, educational factors and social status in reducing cognitive functioning. The findings state that various manifestations of neurocognitive deficit in late-life depression are observed quite often. Therefore, therapy of late depression should be aimed not only at optimizing the affective status of patients, but also to compensate for the deficit of cognitive functioning.

**Keywords:** *aging; depression; neuropsychological approach; mental functions; neurocognitive deficits*

**Аннотация.** В статье представлен анализ симптомов нейрокогнитивного дефицита при депрессии в позднем возрасте, выявленных при нейропсихологическом диагностическом исследовании 197 пациентов с депрессией (средний возраст  $68 \pm 13$  лет), находившихся на стационарном лечении в клинике Научного центра психического здоровья (Москва). Результаты исследования позволили дать характеристику особенностей памяти, внимания, различных типов восприятия, произвольных движений и действий, языковых функций, мышления при поздних депрессиях. Автором статьи сформулированы предположения о возможных вариантах локализации и латерализации мозговых дисфункций при депрессии в позднем возрасте, степени выраженности нейрокогнитивного дефицита, возможной роли возраста, образовательных факторов и социального статуса в снижении когнитивного функционирования. Полученные данные свидетельствуют о том, что различные проявления нейрокогнитивного дефицита при депрессии позднего возраста наблюдаются довольно часто. Поэтому терапия депрессии в позднем возрасте должна быть направлена не только на оптимизацию аффективного статуса больных, но и на компенсацию дефицита когнитивного функционирования.

**Ключевые слова:** старение; депрессия; нейропсихологический подход; психические функции; нейрокогнитивный дефицит

## Introduction

In recent decades, many countries around the world have seen a significant increase in the number of elderly and senile people (Frolkis, 1991; Gavrilova, 2011; Korsakova, 1996; Krasnova & Lidars, 2002; Stuart-Hamilton, 2010). Accordingly, the frequency of certain mental diseases, especially affective disorders, increases. Their prevalence in old age significantly exceeds the indicators of young and middle age. Depressions cause a decrease in the quality of life, exacerbate the course of somatic diseases, and increase the risk of social isolation. Cognitive impairment in late-onset depression plays a role in chronicling the disease with a worsening prognosis. Affective disorders of the depressive spectrum are now one of the central objects of research in psychiatry, neurology, and clinical psychology (Balashova & Mikeladze, 2015b; Birren & Schaie, 1985; Kontsevoy, 1999; Kontsevoy, Medvedev, & Yakovleva, 1997; Ryakhovsky, 2011; Simutkin, 2000). The special attention of scientists to late-life depressions is due not only to their high prevalence, but also to the fact that some aspects of this mental disorder are still insufficiently studied.

One of these aspects is the neurocognitive deficit that accompanies affective disorders of late age. In publications of recent decades, there are frequent references to possible memory and attention deficit in late depressions (Kontsevoy, 1999; Ryakhovsky, 2011). The degree of severity of this deficit can vary from very serious violations (with so-called “pseudo-dementia”) to minor ones, noticeable only to specialists. The third mental function, which is often mentioned in domestic and foreign publications on late-life depressions — is the perception of time (Balashova & Mikeladze, 2013; Balashova & Mikeladze, 2015a; Balashova & Mikeladze, 2015b; Balashova & Portnova, 2006; Ivry &

Spencer, 2004). But what about other mental processes? What other cognitive functions are more or less vulnerable to affective disorders of the depressive spectrum in the elderly and old people? Is it possible to assess the extent of this vulnerability? What can we say about the localization of brain dysfunctions in such disorders?

We will try to give answers to these questions in the present article.

## **Methods and Participants**

### **Methods**

All participants underwent a comprehensive neuropsychological examination (Balashova & Kovyazina, 2012; Luria, 2000). This survey included diagnostic methods aimed at studying perception, memory, voluntary movements and actions, speech functions, attention, thinking, energy and regulatory components of mental activity. Qualitative analysis of the results, their interpretation in the context of the methodology of the Luria's syndrome approach, as well as quantitative processing, were carried out.

### **Participants**

In the study, 197 patients of Mental Health Research center (Moscow, Russia) with depression (average age 68+13 years) were voluntarily admitted. Neuropsychological examination of patients was performed on the recommendation of the attending medical doctor. Patients had the following diagnoses: recurrent depressive disorder (F33) — 93 patients; bipolar affective disorder (F31) — 46 patients; depressive episode (F32) — 24 patients. In addition, a separate group of patients with other types of depression was identified — 34 patients. The studied sample was dominated by apato-adyamic and anxiety depressions of moderate severity. Among the patients, 59 % were women and 41 % — men, 63 % had higher education, 37 % — secondary or specialized secondary education; 76 % of patients were retired, 24 % continued to work. According to the self-report, 90 % of patients were right-handed, 4 % left-handed, and 6 % were Ambidextrous.

## **Results**

The data of neuropsychological examination allowed us to state a number of features of cognitive functions that are characteristic of many depressive patients.

### **Memory**

In the mnestic sphere, patients with late depression often have increased inhibition of traces of unorganized auditory-speech material and individual violations of their selective purposeful actualization in the form of contamination. These symptoms are clearly noticeable when memorizing and delayed playback of five words and two groups of three words (Balashova & Kovyazina, 2012). When performing the first of these methods, it may also

be difficult to remember the order of auditory-speech stimuli. The process of memorizing the material proceeds more slowly in depressed patients than in healthy individuals of late age; they require more presentations of the word series; they have lower productivity of delayed reproduction (Balashova, 2016; Zarudnaya & Balashova, 2018). A number of these negative manifestations can be compensated for when introducing semantic organization of the material (for example, when memorizing and delaying the reproduction of two sentences). In some patients, there is also a decrease in involuntary memory: they cannot remember a small text they have just read. In addition, in a significant part of patients, indicators of updating knowledge stored in long-term verbal memory deteriorate. When it is necessary to name a number of words that have a common perceptual feature (five sharp objects), patients often paused; they need verbal stimulation from the psychologist or a hint in the form of additional clarification of the semantic field (Zarudnaya & Balashova, 2018). Patients with depression may have difficulty in remembering and delayed recall of visual-spatial stimuli and symptoms of reduced involuntary memorization.

### **Attention**

In most patients with depression, neuropsychological examination reveals fluctuations in attention. These fluctuations are closely related to the uneven level of achievement in the performance of various tasks; in many cases, they appear in a single syndrome with a slowdown in the pace of mental activity, difficulties in including in the performance of tasks, total or partial exhaustion.

Fluctuations in attention could be manifested in special tests (for example, when searching for numbers in Schulte tables), as well as in other types of mental activity. Recall that in modern Russian neuropsychology, the prevailing idea of attention as a special quality (selectivity) of any mental process (Chomskaya, 1987). Sometimes the fluctuations in attention observed in patients with depression were modal-specific. As an example, we can mention the left-hand “inattention” in the visual sphere, which is manifested, in particular, when it is necessary to count the characters in the story picture “Carefully,” when performing visual object gnosis tests, etc. (Balashova & Kovyazina, 2017). Note also that in late-life depressions, such gross attention disorders as “field behavior” or pathological distraction are never encountered (Luria, 2000).

### **Perception of Time**

The perception of time, according to many modern psychologists, is a complex functional system (Mikeladze, 2016). This system includes orientation in the past and current time, the ability to evaluate and measure intervals of various durations, understanding the sequence or simultaneity of events, as well as verbal and figurative representations of time, structuring and experiencing the temporal perspective of the individual as a continuum of the past, present and future. In the case of late-age depressions, the functional system described can be identified as safe and vulnerable links. The first includes orientation in time, understanding the sequence or simultaneity of events, using logical and grammatical structures that describe various time relations and categories, possession

of the rules for using the means of determining time created in the course of cultural and historical development (clocks, calendars, etc.). Now let's talk about the vulnerable links. In late-age depressions, subjective time is accelerated (patients usually have a very short subjective minute; they tend to overestimate the short time intervals between two clicks of the stopwatch; they often have a significant error in the direct (without relying on the clock) assessment of the current time and duration of the neuropsychological examination) (Balashova & Mikeladze, 2015a; Balashova & Portnova, 2006; Carrasco, Bernal, & Redolat, 2001; Hazeltine, Helmuth, & Ivry, 1997). In later depressions, the time perspective also changes in comparison with normal aging. According to the findings, received when using Zimbardo Time Perspective Inventory (Zimbardo & Boyd, 1999), depressive patients begin to dominate negative assessments of the past, fatalistic perception of the present, and reduced orientation to the future (Balashova & Mikeladze, 2013).

### **Tactile, Auditory, Visual Perception**

If we talk about tactile, auditory, visual perception, in general, they are quite intact in affective disorders of late age. Their changes in depression are never qualified as agnosia. In the sample we examined, we observed almost no cases of deficits in tactile gnosis, speech perception, visual object and letter gnosis. In the examined group of patients with depression, we observed almost no cases of deficits in tactile gnosis, speech perception, visual object and letter gnosis. However, in a fairly noticeable part of patients, there may have been some errors in the assessment of the rhythmic structures presented to the ear and in the optical-spatial tasks. In the latter case, it was the error so-called "on step" ( $\pm 5$  minutes,  $\pm 1$  hour) in determining the time by the "silent" clock and in self-alignment arrows drawn on the clock, the deficit of spatial representations with self-drawing and copying of volume objects (table on four legs, cube, etc.), slight constriction of the volume of visual perception.

### **Voluntary Movements (Praxis)**

The sphere of voluntary movements (praxis) in late-life depressions, it also presents an ambiguous picture. Errors in tests of kinesthetic and regulatory praxis are quite rare; only sometimes in these types of movements there are so-called "errors of attention," which have the character of individual manifestations and in most cases are available for independent correction or correction on the instructions of a psychologist.

The areas of spatial and dynamic praxis are somewhat more problematic. In sensitized versions of H. Head tests (i.e., in reproducing cross and two-handed poses), patients with depression often make mirror errors or simplify the sample pose. Interestingly, after minimal intervention by a psychologist, these errors disappear, and the performance is again stabilized. This fact testifies not only to a certain decrease in the level of the spatial factor and independent control functioning over the course of activity, but also to the possibility of compensating for the cognitive deficit when external mediation is enabled. In dynamic praxis, quite often (especially at the initial stages of performing tests), there is a tendency to deautomatization of movements, to stereotypes, to a decrease in speech self-regulation. These symptoms are also partially compensated. Manifestations of deautomatization, lack

of dynamic organization of movements (A. R. Luria called it kinetic melody) can also be observed in writing and when copying a pattern of two changing links (Balashova & Kovyazina, 2012; Luria, 2000).

### **Language Functions**

In the language sphere, there are no pronounced manifestations of any aphasia in late-age depressions. However, the majority of patients have some difficulties in remembering the names of details of objects (these questions are usually included in the procedure for studying visual object gnosis). Sometimes it is also difficult to differentiate images of subject complexes described by speech constructions with prepositions *for* and *before*, *right* and *left*. However, constructions with prepositions *under*, *on*, and *in* are usually interpreted correctly. Sometimes patients with depression had insufficient speech activity when composing stories based on scene pictures, when explaining the figurative meaning of proverbs and metaphors.

### **Thinking**

As for thinking, many patients with depression have single errors in the process of serial subtraction from 100 to 7 (while preserving the ideas about the bit structure of the number and performing counting operations separately). The same can be said about a test in which the omitted sign of an arithmetic action must be reconstructed based on the result (Balashova & Kovyazina, 2017). It is also difficult to solve arithmetic problems without relying on the help of a psychologist (especially at the stages of orientation in the conditions, building the program and changing it when moving to a new task).

In other verbal-logical tasks, many patients have uneven levels of achievement, when some subtests are performed quickly and correctly, and in others there are difficulties or a decrease in the level of generalization. Such unevenness is observed when explaining the figurative meaning of Proverbs, metaphors and idioms, when selecting antonyms for nouns, adjectives, adverbs, verbs, when excluding an extra item from the four proposed options, when highlighting essential features of objects and phenomena, when comparing concepts. It is interesting that about a quarter of the examined patients, when excluding an extra item, as well as when comparing concepts, noted cases of using latent, unusual properties of objects, difficulties in differentiating their essential and secondary features. Such manifestations of features of cognitive activity characteristic of individuals of the schizoid circle indicate a possible endogenous radical in the clinical picture of some late depressions.

Explanation of the meaning of various plot images is generally available to depressive patients; only in a small number of cases there are superficial interpretations of their content, insufficient attention to the individualized (in the words of Ya. A. Meerson) signs of the depicted people and objects, or manifestations of a lack of simultaneous perception.

### **Localization and Lateralization of Brain Dysfunction in Late-Life Depressions**

The neuropsychological portrait of late depressive disorders would be incomplete without data on the localization of brain dysfunctions in such diseases.

Our research shows that late-life depressions are most characterized by symptoms of dysfunction of the subcortical structures of the brain, the frontal and temporal zones. For example, it turned out that certain symptoms of dysfunction of subcortical structures of the brain were found in all patients without exception. Analysis of the results also revealed that the manifestations of subcortical dysfunction in late-age depression were variable. Some of them reflected general changes in the energy support of mental activity and could be observed when performing almost any task of neuropsychological examination; others were of a more “partial” nature and were detected only in certain types of motor or graphic activity. The obtained data also indicate that in late depressions, a number of vulnerable links are found in the state of a number of parameters of mental activity provided by subcortical structures. Thus, difficulties in including in performance of tasks were observed in 78 % of patients, fluctuations in voluntary attention and level of achievement — in 82 %, slow pace of task completion — in 46 %, tremor — in 42 %. Depletion (deterioration in the quality of activity at the end of the neuropsychological examination or when performing a single task) and micrography were less common in the examined group of depressed patients.

Dysfunction of the frontal parts of the brain was most often expressed in a small deficit of control, in impulsivity, in a lack of criticality to mistakes made, in violations of dynamic praxis. At the same time, some mistakes made could be successfully corrected after the instructions of a psychologist. Impulsivity was manifested in the fact that the patient began to act without previous thinking about the sequence of operations, without analyzing its conditions. According to modern scientists, this symptom is characteristic of dysfunction of the right frontal area. In the tasks of dynamic praxis (related primarily to the functioning of the posterofrontal region of the left hemisphere of the brain), in patients with depression may be observed a tendency to deautomatization of movements, to stereotypes, to a decrease in speech self-regulation. At the same time, in the syndrome of frontal dysfunction in late-age depressions, manifestations of pathological inertness (perseverations), echolalia, echopraxia, and severe voluntary attention disorders were very rare.

According to the concepts of modern neuropsychology, dysfunction of the temporal parts of the brain is usually expressed in violations of the assessment and reproduction of rhythmic structures, nominative speech function, in manifestations of narrowing the volume of auditory-speech perception. There may also be manifestations of increased inhibition of traces of auditory-verbal memory and a deficit in their selective actualization, errors in the reproduction of word order, violations of phonemic hearing, sound-letter analysis, and some other symptoms. Analysis of the results of our study showed that the most common symptoms of temporal brain dysfunction in the group of depressive patients were increased inhibition of traces of auditory-verbal memory, narrowing of its volume and violations of word order during memorization or delayed reproduction. These symptoms were observed mainly when memorizing unorganized auditory-verbal material (five words, two groups of three words). Somewhat less frequent were manifestations



of a deficit in the nominative function of speech (i. e., difficulties in naming objects and / or their details) and errors in evaluating and reproducing rhythmic structures.

The question of lateralization of brain dysfunction in late-life depressions is quite complex. The following facts can be noted. Brain dysfunction in depression is not local, but diffuse. Quite often, the neuropsychological syndrome is limited to manifestations of a deficit of neurodynamic support for mental activity, the specific manifestations of which (exhaustion, fluctuations in attention, slow speed of task completion, etc.) simply cannot be associated with changes in the work of the left or right hemisphere only. In later depressions, neuropsychologists often observe bilateral brain dysfunction. However, in many cases, they also report more distinct symptoms from the right hemisphere of the brain. Such symptoms include, for example, manifestations of left-hand inattention in the visual sphere, difficulties in evaluating simple rhythmic structures, specific errors in visual-spatial gnostic and graphic tasks, failures of the left hand in reciprocal coordination, fragmentation of visual perception and specific changes in the perception of time.

## Discussion

The obtained data allow us to make a number of observations about the nature of neurocognitive deficit in late-life depressions.

First, we should say about the brain substrate of the described symptoms. In all probability, most often we can talk about the dysfunction of subcortical structures of the brain. Processing of data obtained during the neuropsychological examination shows that in the examined group there were 100 patients with dysfunction of subcortical brain formations. In 13 patients with depression, dysfunction of subcortical formations was combined with changes in the posterior (mainly temporal and/or parietal) parts of the brain; in 47 patients — with changes in the work of the anterior parts of the brain. In 35 patients, the brain dysfunction was more extensive: along with the dysfunction of subcortical formations, symptoms were observed from both the posterior and anterior parts of the brain. In 2 people, the examination did not reveal any pathology of mental functions. If we talk about the predominant connection of the identified brain dysfunctions with changes in the work of the brain hemispheres, it can be stated that the most likely is the right-hemisphere accent of the complex of symptoms. This is evidenced by the nature of performing a number of optical-spatial tests, changes in the perception of time, the absence of any significant language disorders, etc.

Secondly, the degree of severity of the detected neurocognitive deficit in most cases is not significant. These data coincide with the clinical indicators of the MMSE test (Mini Mental State Examination), which detect the absence of cognitive impairment or the presence of mild to moderate disorders in patients with late depression.

Third, the severity of many aspects of neurocognitive deficit is associated with a number of factors. These are age, educational level, and social status. Patients with higher education who continue their work are more successful in performing of the majority

of neuropsychological tests. Results are also reduced in patients over 75 years of age compared to younger patients. However, the study does not reveal significant gender differences, as well as the influence of the factor of manual dominance. The degree of severity and nature of neurocognitive deficit may be associated with the duration of the disease, with the characteristics of its course and clinical manifestations.

Finally, it should be noted that the presence of neuropsychological dysfunctions may be associated with the prognosis of the disease. In particular, the presence of symptoms of frontal dysfunction is a risk factor for further development of depression.

## Conclusion

In conclusion, it should be said that various manifestations of neurocognitive deficit (in terms of components and degree of manifestation) are observed quite often in late-age depressions. Therefore, therapy for late depression should be aimed not only at optimizing the affective status of patients, but also at compensating the certain aspects of cognitive functioning.

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## Cognitive A Priori and Amodal Perception in the Focus of Experimental Philosophy

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## Когнитивные а priori и амодальное восприятие в фокусе экспериментальной философии

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**Abstract.** The article discusses the prospects of neurophenomenology as a substantive theory with respect to the results of neurocognitive research. Some relevant ideas and theoretical findings of the phenomenology of Edmund Husserl, which are of great importance for the interpretation of experimental data from neuroscience, are consistently presented and analyzed. In particular, the emphasis is made on the procedure of analogizing apperception (appresentation), based on an even deeper pairing mechanism. In so doing, I consider and trace the evolution of these ideas in Husserl's works of different years and periods. As an example, that clearly demonstrates the universal *a priori* rock-bottom role of appresentation in cognition and perception, the procedure of amodal completion is chosen. Amodal completion is the process of perception by which an object is apprehended as a whole while some parts of it are occluded by other objects. These research seems to open up wide opportunities for neurophenomenology as the theoretical basis of the sciences of consciousness, mind and brain.

**Keywords:** *analogizing apperception; appresentation; neurophenomenology; amodal completion; cognitive neuroscience*

**Аннотация.** В статье рассматриваются перспективы нейрофеноменологии как обосновывающей теории по отношению к результатам нейрокогнитивных исследований.

Последовательно представлены и проанализированы некоторые актуальные идеи и теоретические выводы феноменологии Эдмунда Гуссерля, которые имеют большое значение для интерпретации экспериментальных данных нейронаук. В частности, акцент делается на процедуре аналогизирующей апперцепции (аппрезентации), основанной на еще более глубоком механизме удвоения. Прослеживается эволюция этих идей в работах Гуссерля разных лет и периодов. В качестве примера, который наглядно демонстрирует универсальную априорную роль аппрезентации в познании и восприятии, выбрана процедура амодального завершения. Амодальное завершение — это процесс восприятия, посредством которого объект воспринимается как единое целое, в то время как некоторые его части скрыты другими объектами. Представляется, что исследования в этом направлении открывают широкие возможности для рассмотрения нейрофеноменологии как теоретической основы наук о сознании, разуме и мозге.

**Ключевые слова:** *аналогизирующая апперцепция; аппрезентация; нейрофеноменология; амодальное завершение; когнитивные нейронауки*

## Introduction

The cognitive turn we are witnessing in science these days resulted from rapidly developing empirical brain-and-mind research and likewise active development of consciousness studies. Consciousness, by virtue of its specificity, turned out to be the object of both natural science and humanitarian speculative knowledge. Having established the interdependence of the brain and its neurostructures with the phenomena of consciousness available in acts of reflection, it would seem that we should clearly realize the productivity of the interpenetration of philosophy and the empirical Sciences studying cognitive experience. Deep conceptual relationship of philosophy with cognitive and neuroscience has manifested itself in Gestalt and phenomenological psychology (K. Koffka, F. Perls), neurophenomenology and enactivism (E. Roche, E. Thompson, F. Varela), embodied simulation theory (V. Gallese), etc. Increasingly, scientists involved in empirical research in various academic fields, turn to metaphysics, and address the issues of foundations for cognition and knowledge, consciousness and morality, thought and language. A. Damasio, H. Maturana, S. Pinker, F. Varela, F. de Waal, A. Wierzbicka and hundreds of other researchers in their books raise questions that with equal facility can fall into the realm of modern biology, psychology, psycholinguistics and other sciences, as well as be directly subsumed under the general heading of “philosophy.”

Numerous attempts of scientists to get out of the narrow professional boundaries into an interdisciplinary philosophical space clearly demonstrate that within the scientific community the request for serious theoretical and philosophical thought emerges full blown. At the same time, the crisis that L. Vygotsky spoke about, referring to the methodological opposition of natural science and humanities, remains a live issue today. The rigid distinction of real-ideal as a theoretical and cognitive premise accepted by a number of philosophers and scientists who study consciousness makes many of them still quite skeptical

about the convergence of philosophy and experimental sciences. In the natural science community, they often do not realize the need to turn to philosophy, without which it is unlikely that the theoretical design of the huge array of experimental data, which, according to literature, is rapidly increasing in size, is possible. Meanwhile the phrase “experimental philosophy” also causes skepticism among some philosophers, in particular philosophers of mind who practice it in the analytical tradition.

The main goal of this paper is to demonstrate how research in the field of cognitive neuroscience can be philosophically understood and interpreted. It seems that this understanding can and should play at least a double role. On the one hand, it will allow to organize and systematize numerous, often disparate results of empirical research. On the other hand, the neurophilosophical interpretation of a variety of cognitive procedures has a serious heuristic potential and can lead to the generation of new original hypotheses, the empirical verification of which in turn will require a new design of experiments.

In this article, by the example of neurophenomenological interpretation of amodal completion, I will demonstrate the grounding role of the embedded and embodied cognitive mechanism of an analogizing apperception in understanding, at first glance, completely different cognitive procedures: from typing and categorization to reasoning and learning models. A detailed study of apperception (appresentation) was carried out by the philosopher, founder of phenomenology Edmund Husserl.

In section Husserlian Phenomenology and Cognitive Science, a kind of philosophical introduction to the problem will be presented. That way I will try to characterize the most important aspects of Husserl’s phenomenology, which, in my opinion, makes it the most preferable candidate for both the philosophical study of consciousness (as a philosophy of consciousness) and the methodological interpretation of experimental research of neural correlates of consciousness. Section Analogizing Appresension as a Basis for Amodal Completion is devoted, firstly, to the direct consideration of analogizing apperception, and secondly, to establishing the connection of this mechanism with amodal perception. The final part summarizes the results of the study undertaken and outlines the prospects for future work.

### **Husserlian Phenomenology and Cognitive Science**

The methodological opposition of humanities and natural science knowledge mentioned in the Introduction continues to in philosophy takes the form of peculiar phobias of psychologism and physicalism. The term *psychologism* is still perceived by many philosophers of analytic traditions and logicians only in a negative connotation, as an attempt to reduce the ideal content of consciousness to empirical temporal objects, their relationships and structures. That way, they consider anti-psychologism as the only alternative to psychologism, where the latter for some of them obtains the features of an *innate idea*.

It is well-known that anti-psychologism appeared at the turn of XXth century as a reaction to the psychologization of logic and apodictic knowledge in general. The founder

of phenomenology, E. Husserl, whose work has yet to be appreciated at its true value by the cognitive science of the XXIst century, in *Logical Investigations* (1970) subjected psychology in logic to a comprehensive and severe criticism, considering that the subject-matter of logic is objective ideal semantic connections, and not the process of their empirical formation. Criticism of psychologism in logic was absolutely fair and timely on the cusp of the XIXth and XXth centuries, because it allowed to outline the subject field of logic as a scientific discipline in its own right, independent of psychology, as well as to determine the vector of its further development. Husserl in his criticism of psychologism, which calls into question the objectivity and a priori of logical laws, sought to defend the objective status of scientific theoretical knowledge. Any theory that claims to be scientific was considered by him from the side of unity of sense, grounded in logic. From this perspective, every science as a system of knowledge was considered as applied logic. With this in mind, it becomes clear that the relativization of logical laws automatically led to relativization of apodictic theoretical knowledge, especially mathematical knowledge, which was completely unacceptable for Husserl.

Speaking about anti-psychologism nowadays, it is important to understand what restrictions Husserl himself imposed on it, and which we should keep in mind when talking about psychologization, or naturalization. Husserl's anti-psychologism concerned the field of pure logic, because logic is not about who makes science and how, rather it investigates what makes science a science. In other words, anti-psychologism had to do with scientific knowledge, which was considered from the side of its sense content, without taking into account issues related to its genesis. Husserl believed that the areas of pure logic and methodology should not be confused. Psychologism cannot be accepted in pure logic, while in methodology, it is possible and even necessary to allow both the psychologicality and the logicity. Husserl focuses on the construction of phenomenology as purely descriptive method of research of consciousness. The vector of his research program is directed not so much towards logic as towards cognitive science and artificial intelligence. Dreyfus brothers were right when they identified Husserl as the father of the information-processing model of the mind and artificial intelligence (Dreyfus H. L., Dreyfus S. E., & Athanasiou, 2000).

In his criticism of psychologism, Husserl supported his senior colleague, the logician and mathematician G. Frege, who laid the foundation of modern symbolic logic. Husserl's phenomenology may well be called an attempt to clarify the definitions of meaning given, but not disclosed, by his senior colleague Frege. I mean defining meaning as a way of specifying an object. The founder of phenomenology makes a grand attempt to comprehensively study consciousness as a way of constituting the objective world, which will eventually lead him to understand the a priori grounds that allow us to consider the world as originally cognitively determined or predestined. In this case, for Husserl, predestination did not mean that the world first appears through knowledge, but that the cognitive acts performed in relation to individual objects of experience are directed to completely indeterminate substrates.



For us the world is always a world in which cognition in the most diverse ways has already done its work. Thus, it is not open to doubt that there is no experience, in the simple and primary sense of an experience of things, which, grasping a thing for the first time and bringing cognition to bear on it, does not already “know” more about the thing than is in this cognition alone [...]. This preknowledge is indeterminate as to content, or not completely determined, but it is never completely empty; and were it not already manifest, the experience would not at all be experience of this one, this particular, thing. (Husserl, 1973a, pp. 31–32)

Throughout his work, Husserl developed the idea that the cognition of an object is an embedding into the existing semantic context, instantiating, exemplification of existing meanings and meaning structures. This understanding certainly implies an answer to the question of the nature of primary, initially given a priori cognitive concepts, structures, and mechanisms. Husserl conducts a genetic study of cognition, revealing its multi-layered structure, that suggests a passive, anonymous, independent of the reflective Ego, level. What we call verbal thinking turns out to be just the tip of an iceberg, a huge part of which is hidden.

The student of Husserl M. Merleau-Ponty, addressing the concept of the body as a counterpart of the Husserlian active Ego, draws attention to the passivity and anonymity of the body. According to Merleau-Ponty (2002), Ego is not the initiator of the processes occurring around it, but only expresses them in language. The body can record the processes taking place, but it never fully owns them. What does this mean? We cannot make ourselves understand anything, we can't control thoughts that arise spontaneously, let alone emotions. We cannot force ourselves to love, or, on the contrary, to feel disgust at something that is experienced as pleasure. Being a part of nature, rooted in a single spatio-temporal physical world, we cannot help but react to changes in the environment, to objects-stimuli in a certain way, including changes that support homeostasis. All this is not in our competence. Our cognition, whether directed inwards or outwards, is biased by transcendental entities and mechanisms that only indicate their presence by pointing to the very a priori that we do not own, but that own us. The discovery and research of these a priori, carried out in reflection, is extremely important, since it allows us to identify the basic cognitive concepts and mechanisms that fund our experience and provide its theoretical understanding. Moreover, this allows us to adequately assess our ambitions in the field of artificial intelligence, limiting them to weak (or narrow) artificial intelligence, which focuses on modeling of specific cognitive procedures.

Phenomenology, carrying on the transcendental tradition, explores the boundaries of cognition indicated by those a priori that are discovered and explored through phenomenological reflection. Phenomenological reduction allows us to identify transcendental a priori grounds of cognition of meaning structures and mechanisms that provide the possibility of cognition, revealing through the abilities of Ego to discover more and more new features of objects. This way of research and identification of various a priori will lead Husserl at his later period to the idea of a unified objective totality, directly related to nature, that is, to manifold of sensually perceived objects, and through it —

to all things in existence: human beings, animals, cultural values, and so on. Everything that exists in the world, thus, appears to be related to nature. For Husserl, it is allowable to talk about the naturalization of the spirit! This naturalization is based on the fact that everything that exists in the world takes its place in the space-time sphere. Everything is located somewhere, has a spatial localization, this place can be defined as *here* or *there*. Any cognitive act, being a real temporal event of consciousness, can be considered from the side of its space-time structure. Accordingly, any ideal object that is constituted in these acts has its real temporal correlate. The phenomenological method of Husserl is the bridge that brings together philosophical reflection and empirical research of cognition. Since all spatio-temporal objects can be measured using instruments, we have access to both the sensuously perceived objects themselves and their non-sensuously perceived correlates, because non-sensuously perceived objects, also belong to this world (*aus der Welt*), which is a single spatio-temporal horizon. Husserl makes an extremely important phenomenological observation that the existence of the real can have only one meaning of *existence in*, that is, being in the universe, in the open space-time horizon, in which there is constantly a real awareness of the object through a set of individual apperceptions, initially transcended by meaning. Meaning, then, turns out to be a way of knowing and organizing the world at the same time. It means that the boundaries of meaning coincide with the boundaries of the world.

In the early period of his work, in *Logical Investigations* (Husserl, 1970), justifying the correlation of sense and ontological structures, Husserl studied not only consciousness as a mental universe filled with various kinds of ideal meaningful objects, but also consciousness as a way of building the object world. If for Frege's logic the cognitive aspect of thinking remained on the periphery of his research project, then in the construction of phenomenology, the answer to the question *how* is extremely important. Husserl's conception of language and logical semantics is cognitively based. Consciousness is considered by Husserl as a set of cognitive meanings-bestowal acts of a special kind, in which semantic minings — the meanings of language expressions — are formed. In addition to semantic sense — linguistic meaning, Husserl considers its cognitive correlate (*Sinn*), which characterizes the corresponding cognitive act. This approach implicitly contains an idea that is extremely important for understanding the development of the phenomenological method. The idea is that any ideal object as a meaningful *static* objectivity must be considered from the point of view of its genesis, taking into account the *real*, temporal cognitive process. This view gives us an understanding that any ideal object, abstraction of the highest level is not an initially given entity stored somewhere "out-of-the-box" in a ready state, rather it is "constituted" in real temporal cognitive act.

Husserl, as it were, weaves ideal meanings into the fabric of the real cognitive process, drawing attention to the fact that the ideal object is also an experienced object. The ideal differs from the real only in the mode of experience. Husserl interprets the meaning as the moment of identity of co-directed cognitive acts. The very intention to identify turns out to be a fundamental a priori characteristic of cognition. The process of identification is associated with cognition as a typification of objects, which avoids the infinite

variety of objects by transforming the transcendent world of stimuli into an *Umwelt*, or *world for the agent*. Any animal, including a human being, lives in a typed world, perceives any object as a type, reacting to it in a typical way that is fixed in the experience. A cat reacts to a mouse as to a type, in particular as to type-of-food. We also inhabit a world of objects that are meaningful as types: a dog, a cat, a child, a house, etc. From this point of view, any *Umwelt*, including a human one, should be considered as a typified, initially pragmatically determined, *world for a certain kind (type) of living beings*. Taking into account the animal nature of man and the objective totality of the natural world to which we all belong, it becomes possible to talk about common, not only human, foundations of adaptive cognition a priori: cognitive prototypes (proto concepts), cognitive principles and mechanisms that are inherent not only in man, but also in other animals.

When researching cognition, Husserl uses the expression *constitution of an object*, which means for him a specific activity of consciousness, thanks to which objects are perceived not as independent of consciousness (like a reflection in the mirror), but are formed from the components of consciousness. This line of Husserl's thought is closely related to another important feature of phenomenological method of inquiry — intentionality (directedness to). Consideration of consciousness from the side of intentionality will allow Husserl to substantiate phenomenologically the *transcendence* of the object world. For us, this means that although any object, being the result of cognitive processing and interaction of the agent and the environment, acquires the status of a phenomenon or *object of my Umwelt*, a priori determined, it is at the same time, due to its spatial localization, naturally perceived as an external object, initially opposed to the transcendental Ego. Due to intentionality, subject-object distinction is initially sewn into cognition, where the former is considered as an intentional, directed to, bipolar relationship. The transcendental Ego turns out to be an integral part of the a priori structural characteristic of consciousness, the disappearance of which is equivalent to the disappearance of the very possibility of cognition and the world. The transcendental Ego, as a condition of cognition, must be distinguished from the empirical Ego, which *exists in the world*. Empirical Ego can completely or partially disappear, for example, as a result of memory loss: a person does not remember himself, she does not know who she is; or as a result of autopsychic depersonalization, when alienation of thoughts, feelings, motives, etc. occurs. The man says: it is not me, it is not my thoughts. Can be that man in the mirror sees himself, but feels that it's not him, but someone else looking at him from there and so on. It is obvious that in all these cases, arguing and analyzing the situation Ego, as the subjective pole of self-reflection acts, is preserved, it is the deformation of empirical Ego that occurs, and the boundaries of this empirical self-coincide with the individual inner experience.

The distinction between Ego that constitutes the world and the empirical Ego that exists in the world turns out to be intentionally conditioned in phenomenology. Intentionality justifies the pre-destination and unavoidability not only of the Ego that constitutes the world, but also of the transcendence, the primordial reality of the objects of the world. Considering the temporal embodied process of cognition as the realization of cognitive a priori, as an initially set intention in the outside, we thus recognize that Ego

and the environment are indispensable full participants in the constitution of the world-for-agent. If cognition is concerned in the context of adaptation taking into account the concept of intentionality, it should be borne in mind not only the adaptation of the organism to the environment, but also the potential environment, enabling the transformation of the environment in the world-for-agent. Any living system, from a single-celled organism to a human, captures and processes only those data that it is ready to accept and process on a priori cognitive basis. These a priori are found in empirical research as certain presuppositions, dispositions, and in the centuries-old practice of philosophical reflection as irreducible, necessary conditions of our experience.

Phenomenology was originally conceived by Husserl as an unconditional descriptive theory, as an attempt to go *back to the things themselves* experienced so and so. This path certainly demonstrates the ideological affinity of phenomenology and natural science. Merleau-Ponty, describing the phenomenology of Husserl, writes about the proximity of eidetic phenomenology and empirical psychology, noting the possibility of a dialog of two types of sciences that are difficult to distinguish.

In speaking of eidetic phenomenology and empirical psychology, Merleau-Ponty concludes that inductive and essential knowledge are homogeneous! These are just different steps in the explanation. Husserl in *Experience and Judgment* (1973a) has drawn attention to the fact that “the term ‘induction’ is useful because it suggests *vordeutet* (itself an ‘induction’), induction in the ordinary sense of a mode of inference and also because it implies that the latter, for its elucidation to be completely intelligible, must refer back to the original, basic anticipation” (p. 32).

The proximity of phenomenology and empirical knowledge is shown by the attitude of the founder of the phenomenological method to biology, which he expressed in the unpublished in his lifetime *Addendum XXIII of The Crisis of European Sciences and Transcendental Phenomenology* (2013):

Biology’s proximity to the sources of evidence (*Quellen der Evidenz*) grants it such a proximity to the depths of the things themselves (*Tiefen der Sachen*), that its access to transcendental philosophy should be the easiest and with it the access to the true a priori to which the world of living beings refers. [...] Hence, it seems to me that biology, which is apparently inferior to mathematics and physics and that for so long has been considered almost pityingly by physicalism, as a preliminary phase, incomplete and purely descriptive with regard to the subsequent physicalistic “explanation,” has always been able to remain closer to philosophy and to true knowledge. (p. 7)

From Husserl’s point of view, biology, being a truly universal science, must encompass the entire concrete world, implicitly including physics, and by turning to the study of correlations of this world, become a “completely universal philosophy” (Husserl, 2013a, p. 8). The turn to biology meant that Husserl’s attention focuses on human being as a representative of the animal world, and his/her biological nature is considered as the starting point of the study. In *Phenomenology on Intersubjectivity* (Husserl, 1973c) he postulates

the existence in the human environment (Umwelt) and in the human being itself of special layer — “a layer of animality (das Tierische), that is to say, that which is shared with the animal” (p. 180). As a result, Husserl comes to the idea of a generative a priori underlying animal nature, grounding not just the human Umwelt, but also Umwelts of other animals.

### **Analogizing Appresension as a Basis for Amodal Completion**

Husserl addresses analogizing appresension in Cartesian Meditations when he is confronted with the problem of the Alter Ego and inresubjectivity. However, well in advance, right after *Logical Investigations* (1970) in unpublished during Husserl's life *Thing and Space. Lectures of 1907* (1973b/1997), and written a decade later, in *Analyses Concerning Passive and Active Synthesis* (1966/2001) which also was not published in his lifetime Husserl so to say was doing the groundwork for further considerations of the interconnection of intersubjectivity and subjectivity. This research goes through several stages, among which the first and extremely important is how our consciousness constitutes the thing — *the object of straightforward experience*. In his view, this process is a transition from passivity to activity which results in forming of an object as it is “given” to consciousness. The very first, passive syntheses of an object presupposes the new answer to “Kantian question of how we take several different appearances to be appearances of one and the same object. [...] First, having a unified perceptual consciousness across multiple appearances requires that the appearances have certain sensible qualities in common” (Husserl, 1966/2001, p. 10). In turn this requirement is guaranteed due to specific associations that ensure unity and diversity and include pairing, similarity, uniformity, heterogeneity, fusion and contrast, etc. In particular the associations, based on pairing and similarity are the prototype of the analogizing appresension.

Alter Ego and his/her subjective experience is not given to us initially and directly, so the intentional experience of the Other, according to Husserl, is characterized by mediation, arising on the basis of the *primordial world* and giving the opportunity to present to consciousness something that nevertheless is not itself present and can never achieve self-presence. We have here, accordingly, a kind of making “co-present,” a kind of “appresentation,” in Husserl words (Doyon, 2019, p. 109). In the context of the Cartesian Meditations Husserl needs it to show that Alter Ego is constituted as a projection of Ego. This projection is based on a more fundamental, low-level procedure of *likeness* between a new stimulus (other body in our case) and a model object experienced earlier. This analogy supports a *transfer of sense* from the model object to the external thing, whereby the latter is typed so and so. Thus, in Husserl's words: “Even the physical things of this world that are unknown to us are, to speak generally, known in respect of their type” (Ibid., p. 111). The ground for the appresentation lies an even deeper procedure of pairing. Ego and Alter Ego are always and necessarily given in an original pairing. Pairing manifesting itself as a pair and then as a group or a plurality, is a *universal phenomenon of the transcendental sphere*, at the same is a primal form of association. The characteristic feature of pairing is that, in the most primitive case, two objects are given intuitively in unity of a consciousness and

thus in pure passivity as data appearing with mutual distinctness, they have found a phenomenological unity of similarity and thus are always constituted exactly as a pair (Husserl, 2013b). In pairing, there is a mutual awakening and overlapping of senses associated with the members of the pair. In the extreme case, this overlap is expressed as a complete likeness. As a result, there is a mutual transfer of senses in paired data, that is the very apperception. Two well-known Husserlian examples illustrate the idea and mechanism of appresentation and pairing. “An appresentation occurs even in external experience, since the strictly seen front of a physical thing always and necessarily appresents a rear aspect and prescribes for it a more or less determinate content” (Doyon, 2019, p. 109). And then: “The child who already sees physical things understands, let us say, for the first time the final sense of scissors; and from now on he sees scissors at the first glance as scissors but naturally not in an explicit reproducing, comparing, and inferring” (Ibid., p. 111).

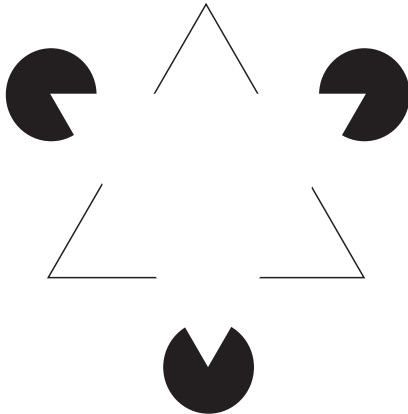
It is important to note that Husserl distinguishes between different types of appresentation. In more detail this theme is presented in (Husserl, 2013b). That way, Husserl is talking about *a concrete appresentation*, which he calls an *indication*. An example of this is the hunter’s perception of a trail left by a wild animal, which tells the hunter that the animal is somewhere nearby and thus indicates its co-presence. As a result of this considerations, Husserl arrives at differentiation of “(1) apperceptions referring to a simultaneous content (or co-presentations), (2) anticipatory or prospective apperceptions, pointing to future incidents, and (3) retrospective apperceptions referring to ‘ad-memorized’ content” (Ibid., p. 174), where ad-memorization splits into *plain* (as illustrated by trail-example) and analogizing one (manifested as *an old toy from my childhood, coffee stains on my book from this morning*, etc.). All this strongly suggests that appresentation is a fundamental universal cognitive procedure that underlies acts of different quality and different levels is primarily associated with typing, or universal understanding. In consistence with Husserl’s later writing this cognitive interpretation of appresentation corresponds evolution of his understanding of perceptual experience as the process of realizing empty intentions without appealing to imagination. To recognize the stimulus presented, we only need to recognize the corresponding type (the model object stored in memory). This makes clear the instantaneous nature of pre-understanding based on the transfer of meaning. It is impossible to understand something for three hours or ten minutes, the understanding is an immediate act of point nature.

All the above considerations clearly indicate the specific substantiating character of appresentation. This cognitive procedure is indeed a fundamental cognitive mechanism which is at the core of cognitive activity. Its task, apparently, is to typify the world, allowing human beings and other animals to avoid the infinite variety of the world, to structure it in accordance with the structural organization of the agent itself. Of course, this understanding of appresentation expands our definition of cognition, including the intuitive, non-verbal, non-reflexive level, and can be considered as a justification for cognition in the context of biological adaptation and evolution. It is habitual to animals, and we are learning more and more about their proto-thinking and proto-consciousness from experimental data. They have a real primitive ontology, they live in the world of objects-types



just like us. A cat reacts to a mouse as a type. Animals inhabit the world of whole objects, rather than those parts of them that are given in perception. Manifestations of appresentation can be found in a variety of areas: in categorization and instance-based learning, in the formation of concepts and rhetoric reasoning. As an illustration, consider the closest cognitive procedure of amodal perception.

The term *amodal completion* was coined by Albert Michotte. Interestingly, he offered an explanation of the procedure indicated by this term in a phenomenological way. It is the ability to perceive an entire (completed) object when some parts of it are occluded. Nowadays, it is common to illustrate the difference between a modal and an amodal completion using the example of a Kanizsa triangle (see *Figure*). The perception is amodal, as in the case of a triangle in the background, when we complete constructing an object hidden by an occluder. This process is considered to occur automatically and unconsciously. Modal completion is under way when an object is unconsciously experienced in front of inducers, as the perception of the white imaginary triangle.



*Figure.* Kanizsa triangle

Amodal completion is a particular case of our ordinary perception of the world. Almost constantly, we perceive an object as a whole based on incomplete information. In most cases, objects appear partially occluded to us, and we complete the hidden parts without even noticing it. The same is true for the perception of three-dimensional objects, since we never have simultaneous access to such objects from all sides. Despite the apparent evidence, the phenomenon of amodal completion is still widely discussed in literature. In particular, the debate on how it is represented neurally is still far from over. The throughout survey of relevant neuroimaging findings can be found in (Ferencz-Flatz, 2012). In this regard, it is appropriate to mention the so-called *identity hypothesis* (Thielen, Bosch, van Leeuwen, van Gerven, & van Lier, 2019), which claims that modal and amodal completion are caused by similar mechanisms.

Even this superficial description of amodal perception suggests a similarity between this cognitive procedure and Husserl's appresentation considered above. First of all, it should be noted that Husserl himself practically indicated the proximity of these proce-



dures when describing the process of cognition. Thus, in the second volume of the *Logical Investigations* he writes:

If I see an incomplete pattern, e. g. in this carpet partially covered over by furniture, the piece I see seems clothed with intentions pointing to further completions — we feel as if the lines and coloured shapes go on “in the sense” of what we see — but we expect nothing. (Husserl, 1970, p. 211)

Husserl (1973b/1977) returns to this topic and explores it more deeply, treating an example with the perception of the table, which we always see from a certain side. It is obvious that the table has an opposite side and an invisible lower part. Nevertheless, we perceive the table as a whole, as a unity of the visible and the hidden. “Viewing the front side of the table we can, whenever we like, orchestrate an intuitive presentational course, a reproductive course of aspects through which the non-visible side of the thing would be presented to us” [Ibid., p. 41]. Thus, when I look at a table, I do not see just the side of it, I actually see the table as visible from this side. All these arguments are carried out in the context of the analysis of passive synthesis and associations of similarity and pairing, that is, in fact, as a clarification of analogizing apperception.

It is interesting to note that according to current research (see Nanay (2018) which provides an extensive review of the literature), the neural mechanisms responsible for modal and amodal completion are very close. In both cases, these are areas of the primary visual cortex of the brain. As the author summarizes, “in other words, from a neuroscience point of view, modal and amodal completion are very similar, if not equivalent” (Ibid., p. 4). This conclusion in support of the identity hypothesis is also confirmed by the neurophenomenological interpretation of perception in the spirit of Husserl. Both modal and amodal completion are based on an embedded and embodied cognitive mechanism, coined by Husserl as analogizing apperception, and related to the sphere of passive synthesis. In both cases, external differences are secondary to the underlying nature of this cognitive procedure. Moreover, additional arguments in favor of the universal nature of the appresentation can be found in animal cognition studies. C. T. Miller, E. Dibble, and M. D. Hauser (2001) provides evidence that nonhuman primate amodally complete biologically meaningful acoustic stimuli. Hence, we can suppose the existence of a common ancestor that is 40 million years away from us, long before the divergence of these two primate clades, from whom human and nonhuman apes inherited a common universal neural mechanism that provides, among other faculties, amodal completion.

## Conclusion

The article substantiates the perspective of interaction between cognitive science and phenomenology, the proximity of phenomenological and natural science approaches to the study of consciousness. This perspective is especially relevant in the light of increa-

singly realized need for a theoretical understanding of experimental data, which involves addressing the problem of the first principles of knowledge and the external world, traditionally considered within the competence of philosophy. By the example of amodal and modal completions, I considered the basic universal cognitive mechanism that supports these procedures, coined by Husserl analogizing apperception (appresentation). It has been shown that appresentation based on pairing is the basis of passive synthesis of perception of the outworld and, therefore, is an embedded and embodied form of the initial cognitive activity inherent in various living beings. In turn, analogizing apperception appears to be based on cognitive a priori mechanisms associated with the intentional structure of cognition, which underlie the typification of the world.

This mechanism manifests itself at different levels and in different cognitive procedures, which clearly demonstrates the prospects for further research some of them already outlined in a number of papers. Thus, the article Zaitseva (2019) analyzes a special rhetorical reasoning based on an example, known as *paradeigma* since the time of Isocrates and Aristotle, and demonstrates that its cognitive basis is still the same appresentation. In another article (Zaitsev & Zaitseva, 2019), the same mechanism is used to model instance-based concept learning. In particular, a specific rule for concept introduction based on the identification of the presented stimulus and the model object is based on appresentation. All these and other works of researchers in the phenomenological field show that the neurophenomenological project is very fruitful and has a number of important advantages over the armchair philosophy in the study of experience, mind and consciousness as well as cognitive faculties of a rational agent.

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## Qualitative and Quantitative Neuropsychological Assessment: A False Dichotomy

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## Качественная и количественная нейропсихологическая оценка: ложная дихотомия

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**Abstract.** Neuropsychological examination tries to define the state of the mental capacities of patients with brain injury. Traditionally, a dichotomy is established between qualitative and quantitative (psychometric) evaluations. Luria's qualitative evaluation is frequently opposed to "western" psychometric approaches. After reviewing a series of topics (symptoms due to brain lesions, assessment objectives, functional brain model, complex functional systems, and the metric characteristics of neuropsychological variables), it is concluded that a good neuropsychological assessment requires both quantitative and qualitative approaches.

**Keywords:** *neuropsychological assessment; qualitative neuropsychology; quantitative neuropsychology*

**Аннотация.** Нейропсихологическое обследование позволяет определить состояние психических функций при локальных нарушениях головного мозга. Традиционно проводится дихотомия между качественной и количественной (психометрической) оценкой. Качественная оценка А. Лурия часто рассматривается как противоположность «западной» психометрии. После изучения ряда тем (симптомы заболеваний головного мозга, цели оценки, функциональная модель мозга, сложные функциональные системы

и метрические характеристики нейропсихологических переменных) был сделан вывод о том, что для хорошей нейропсихологической оценки требуются как качественные, так и количественные методы.

**Ключевые слова:** *нейропсихологическая оценка; качественная нейропсихология; количественная нейропсихология*

## Introduction

Neuropsychological examination tries to define the state of the mental capacities of patients with brain injury. Traditionally, a dichotomy is established between qualitative and quantitative (psychometric) neuropsychological evaluations. Luria's qualitative evaluation is frequently opposed to western psychometric approaches (Akhutina & Melikyan, 2012). The objective of this paper is to show that a good neuropsychological assessment requires both quantitative and qualitative approaches.

## Materials and Methods

The following topics were reviewed: (1) Types of symptoms due to brain lesions. (2) Neuropsychological evaluation objectives. (3) Functional brain model. (4) The concept of complex functional system and the componential structure of mental capacities. (5) The variables of a test and their metric characteristics.

## Development

### Types of Symptoms due to Brain Lesions

Brain injuries are expressed in four main clinical fields: neurological disorders, cognitive disorders, neuropsychiatric disorders, and medical disorders (e. g. endocrinological). Symptoms depend on the etiology, as well as on the topography, the extent of the lesions and the time of evolution.

### Neuropsychological Assessment Objectives

Neuropsychological evaluation attempts to identify the extent and nature of potential or demonstrated injury to the brain. In fact, neuropsychological assessment tries to define patterns of neuropsychological performance in terms of damage to one or more of the components of a model of normal cognitive functioning.

### Functional Brain Model

The interpretation of test data can be carried out in a systematic, and objective way, if it is based on a comprehensive model of brain-behavior relationships. Recently, a brain

functional model beyond Luria's three functional units was proposed. This model includes elements that are missing from Luria's model. Five functional brain blocks were recognized: preferential, limbic, cortical, basal ganglia, and cerebellar (Peña-Casanova & Sigg-Alonso, 2020). The inclusion of new functional components allows differentiating clinical aspects such as the following: cognitive dysmetria (cerebellar block), learned routines *versus* executive functions (basal ganglia). In addition, the model reconsiders the anatomy of semantics as described by Luria.

### **The Concept of Complex Functional System and the Componential Structure of Mental Capacities**

There is agreement that mental functions, as complex structures, are organized in functional systems of concertedly working zones, each of which performs its role. Luria accepted Goldstein's idea about determining "the basic disturbance (Grundstörung) that results directly from the lesion" (Luria, 1970, p. 99). The concept of *basic disturbance* or *neuropsychological factor* refers: (a) to the neurological impairment of a local brain area (a local processor), and (b) to the associated psychological phenomena. In fact, the concept of neuropsychological factor couples aspects of cognitive functioning with brain anatomy (Mikadze, 2011). Thus, qualitative symptom analysis is considered crucial in order to establish a correspondence between symptoms and lesion localization. Beyond these considerations, it is possible to integrate and combine qualitative and quantitative assessment approaches (Glozman, 1999).

### **The Variables of a Test and their Metrics and Qualitative Characteristics**

There are two types of test variables metrics: dichotomous and distributed. *Dichotomous variables* are all those in which a maximum or complete performance is expected in all normal subjects, that is, a constant score. Many tests meet these characteristics (e.g. repetition of words). These tests are considered dichotomous (normal *versus* abnormal = qualitative variable), pathognomonic (errors are indicative of brain disorders). They have been described as "lurian," as they are the type of test used mainly by Luria's qualitative neuropsychology. *Distributed variables* show a normal or Gaussian distribution (e.g. scores of the Boston Naming Test). These scores are expressed as means, deviations, percentiles or scaled scores. In many cases, moreover, raw scores are adjusted for sociodemographic factors such as age or education.

Without a quantitative approach, it is impossible to make certain types of analysis. Without scores, it is impossible to determine the degree of deficit and its evolution over time. In the case of clinical trials, the quantitative approach is required. Some tests necessarily require a psychometric approach, especially when the scores, in normal subjects, depend on social and cultural factors such as age and schooling. In these cases, it is also imperative to carry out a qualitative analysis of the response process and the result (a lurian task, and characteristic of the Boston Process and Achievement Approach). In language assessment, for example, in addition to scores, symptoms must be described and classified. The same is true in any area of neuropsychological evaluation. On the other hand, the ipsative analysis of quantitative scores may lead to qualitative diagnostic clinical profiles.

## Conclusions

Neuropsychological examination tries to define qualitative and quantitative dissociations between affected and preserved capacities. In many cases, trying to find a single basic (qualitative) disorder that explains a syndrome is illusory due the wide distribution of brain lesions. Neuropsychological assessment requires an updated comprehensive brain functional model. The proposed model is more realistic than the three blocks model. This model allows a better analysis of the neuropsychological symptoms and their anatomical relationships. This work shows that such a qualitative-quantitative contrast is, in fact, a false dichotomy. A correct neuropsychological evaluation must be both qualitative and quantitative. Quantitative dissociations represent in fact qualitative patterns.

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**IN MEMORY OF A. R. LURIA**

**ПАМЯТИ А. Р. ЛУРИЯ**



## Mother's Face of Developmental Psychology

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## Материнское лицо детской психологии

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**Abstract.** The paper is devoted to the memory of Liudmila Obukhova (1938–2016) — the chef of the department of developmental psychology in Moscow State University of Psychology and Education. L. F. Obukhova was both an outstanding researcher and extraordinary personality, taking maternal care of her disciples and colleagues. She contributed a lot for the development of cultural-historical psychology.

**Keywords:** *L. F. Obukhova; developmental psychology; a child in the culture; J. Korczak; L. S. Vygotsky; J. Piaget*

**Аннотация.** Статья посвящена памяти профессора Людмилы Филипповны Обуховой (1938–2016), заведующей кафедрой возрастной психологии Московского государственного психолого-педагогического университета. Л. Ф. Обухова была не только выдающимся ученым, но и необыкновенной личностью, по-матерински заботившейся о своих учениках и сотрудниках. Подчеркнута роль Л. Ф. Обуховой в развитии культурно-исторической психологии.

**Ключевые слова:** *Л. Ф. Обухова; детская психология; ребенок в культуре; Януш Корчак; Л. С. Выготский; Ж. Пиаже*

If our developmental psychology were presented in faces, its maternal face would undoubtedly belong to L. F. Obukhova. There are many founding fathers in psychology. And Liudmila Obukhova was both the founder and a real mother of our developmental psychology. Exactly 5 years ago, on July 20, 2016, on a summer day as fine as today, she

passed away unexpectedly, having returned from an expedition trip to Kamchatka. Two months earlier, in May, it was a trip to China. Her trips always lectures and speeches. In Kamchatka, at the university, she spoke about my teacher V. V. Davydov. She also showed the film she had made about him. She came home to Moscow to celebrate her 78th anniversary on July 22nd, and the next day she was supposed to be back on a plane to Japan to attend the World Congress of Psychology. And suddenly her life way was interrupted. People usually say that about the young, but Liudmila Obukhova stayed young forever, leaving this world, which she had flown far and wide, “on the fly.”

The world for her was always, above all, the world of childhood, in which most adults were only guests. Most — but not Liudmila Obukhova. She did so much to prepare professionally not only psychologists but also adults in general for living in this world, so that they would not be just guests.

Developmental psychology, having lost Liudmila Obukhova that day, was literally orphaned. I am speaking not only about the whole universal community of her students, but also about all those who were brought up on what she had done, through her books, lectures, articles. With her help, they were able to become those adults who understand the nature of childhood and the meaning of what is going on in the children’s world. It is impossible to be truly mature without such understanding; the concept of *maturity* without the concept of *childhood* is meaningless. Liudmila Obukhova was a mother to them, too. A young mother of adults. Obukhova’s motherly nature was apparent in everything — her tremulousness, attention, great tenderness, and generous tolerance, ability to listen and wait, to come to the rescue when you were too embarrassed to ask for help... She had a gift to love as only she could. Everyone who was lucky enough to call himself or herself Obukhova’s children — as students, undergraduates, graduate students, colleagues — will attest to it. There were legendary four deaf-blind Ilyenkov’s children, pupils of A. I. Meshcheryakov (sadly, only two are with us today), whom Ilyenkov got places at the psychology department of MSU and also housing in Moscow. When these children were passed on to L. F. Obukhova, they found not only a curator but also a mother. The kids of Ilyenkov and Obukhova...

However, I want to say the main thing. The cultural-historical psychologist L. F. Obukhova did not categorically accept *the child and culture* concept. For her it could be only *the child in culture, inside culture*, in maternal bosom of human inside humans. After all, culture can also be defined as a form of care about one human by another one, albeit in absentia. Only a notch on the tree was needed for a man to get out of the woods. Otherwise, he would have wandered, poking around, guided by the impulse, and maybe he would have stayed in the forest. Does the sky help a man? Yes, it does! He did not hang the stars in the sky, but he guessed to read in their arrangement a geographical map, with the help of which the early navigators and foot travelers did not disappear in the world, and got where they needed. “If stars are lit, it means someone wants them to be...” It also works with the ruler used by a student not to put thousands of things to each other (although this is also a measurement) to estimate their size... A motherly care of culture is all around us! People take care of each other within the cultural world they have cre-

ated, and by doing that they work on themselves and do not blindly submit to external circumstances. This is the meaning of Vygotsky's cultural-historical theory.

After all, in order to comprehend and accept this care, the child has a lot to learn. Especially in order to respond with care to care. Liudmila Obukhova, the embodiment of maternal care, devoted her life to working on this problem.

Symbolically, her birthday coincided with that of Janusz Korczak. They both possessed the secret of the emergence of human sociality. The secret is not that everyone behaves in the same way. Even colonial animals do not live their lives like that (and if they did, it would be as Bernard de Mandeville describes in his *Fable of the Bees*), not to mention the so-called social animals. Sociality is when people become and remain human in any, even non-human, circumstances. It is an immunity from the inhuman behavior, from the wildness into which it is very easy to fall, without leaving the community of people. Sociality is an immunity that is gained anew every time. Sociality is not simply a set of individuals living together, incapable of doing much without the other. This also includes herds, flocks and even colonies. It's a sense of community when you're alone. Also a heart beats somewhere far away and is inaudible. It's the thought that has penetrated the nature of what you do not even suspect the existence of, for example, of a particular sociality that cannot yet declare itself in a commonly understood language. That is about child sociality (of course, by origin and nature always child-adult).

Children's sociality mixes in itself many things: the social and the individual, deeply personal; meaning and significance, normativity and sometimes that seems like an anomie. Adults strive to put everything in order — transparent and convenient, first, for themselves. They are not aware of the fact that they act in a clichéd pupil way, i. e. not in an adult way at all. By doing that, they are repressing the child's eternal craving for himself or herself, no matter how unusual it may appear. The outstanding psychologist D. B. Elkonin wrote about this craving in his scientific diaries. L. F. Obukhova also studied it with her students and followers. In essence, it is also what all of Janusz Korczak's books are about.

This means that it is not necessary to draw any additional ethical consequences from the cultural-historical approach. Liudmila Obukhova wrote:

If today Piaget's theory is presented to us as a rational, quite objective scientific system corresponding to the natural-scientific approach to the study of the human psyche, then L. S. Vygotsky's theory forms the basis for a new view of human nature and development — a highly moral and fully humanistic view that may be correlated, oddly enough, with the religious ideas of Creation and Love. It is with this new approach the solution of the problem of learning and development is connected. (Obukhova, 2016, p. 231)

I have written about this before, but let me repeat myself. We are happy in the profession we live in if we are born into a field of amazing love of our teachers for our own and for each other. Liudmila Obukhova's dialogues with her teachers (that are documented in a series of articles — you can search Psyjournals for L. F. Obukhova's page) are amazing and prove that she expressed this love like no one else. And she generously gave it

to others. Others, without realizing it themselves, could no longer do anything below the degree of this feeling. Liudmila Obukhova simply fell in love, loved and gave her love to everyone around her. Without this one cannot understand the specificity of her scientific and pedagogical gift.

It was also a form of her mother-daughter care, but already about science.

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