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Strategies of Coping with Crisis in the Professional Development of Teachers

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ОТ РЕДКОЛЛЕГИИ

Стратегии преодоления кризиса профессионального развития педагогов

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Abstract. This article discusses professional crises and strategies of coping with them. The study was conducted in Yekaterinburg (Russia) and involved 291 secondary school teachers. The teachers wrote psychobiographical essays, which were processed through content analysis methods. As a result, two types of coping strategies were identified: reactive and proactive. Reactive strategies imply taking the initiative rather than merely adjusting to the situation while in proactive strategies defence and adaptation mechanisms prevail. We found that in their professional development teachers switch from reactive to proactive strategies. Reactive

strategies predominate in professional and educational orientation and profession choice crises while proactive ones, in crises of career choice, professional growth, professional expectations and non-normative crises.

Keywords: *professional development; crisis; coping strategies; psychobiographical method; content analysis*

Аннотация. В статье анализируются профессиональные кризисы и стратегии их преодоления. Исследование проводилось в Екатеринбурге (Россия) с участием 291 учителя средней школы. Учителя писали психобиографические эссе, которые обрабатывались методом контент-анализа. В результате были определены два типа копинг-стратегий: реактивный и проактивный. Реактивные стратегии предполагают проявление инициативы, а не просто приспособление к ситуации; в проактивных стратегиях преобладают механизмы защиты и адаптации. В ходе исследования выявлено, что в процессе повышения квалификации учителя переключаются с реактивных стратегий на проактивные. Реактивные стратегии преобладают в кризисах профессиональной и образовательной ориентации и выбора профессии, а проактивные — в кризисах выбора карьеры, профессионального роста, профессиональных ожиданий.

Ключевые слова: *профессиональное развитие; кризис; копинг-стратегии; психобиографический метод; контент-анализ*

Introduction

Recently, the concept of *crisis* has started to be used widely by the public. This concept usually carries negative associations: it creates tension and dissatisfaction and provokes a generally "critical" attitude people.

International psychological studies have paid a great deal of attention to age-related crises, in particular the mid-life crisis (Brim & Kagan, 1980; Halloran, 1985; Keyes & Ryff, 1998; Lang, Staudinger, & Carstensen, 1998; Neupert, Almeida, & Charles, 2007). Crises of professional development are often left outside the research area, since the main emphasis is placed on the process of professional development, its characteristics, and stages. For example, Mark Barnes discusses teachers' needs in their professional development (Bandhu, 2007); Tom Guskey, the professional development of educators (Guskey, 2000; Guskey & Sparks, 1996) and Helen Timperley, teachers' professional learning and development (Hattie & Timperley, 2007). In Russian psychology, however, researchers mostly focus on the crises which professionals face in the course of their development (Antsyferova, 1996; Khukhlaeva, 2006; Kuleshova & Strizhickaya, 2008; Kuz'mina, 1990; Markova, 1996; Zeer, 1999).

We define crises of professional development as situations when professional identity, including one's motives and values, undergoes radical reconsideration while the individual's professional excellence diminishes. There are two types of crisis in professional development: normative and non-normative. Many authors believe that crisis is a norma-

tive phenomenon. Eric Erikson considered normativity as "turning points, moments of decision between progress and regression, integration and retardation" (1996, p. 23). In his research, L. H. Ginsberg approached all crises as normative ones (Datan & Ginsberg, 2013). L. S. Vygotsky (1984) also described crisis as a normative phenomenon determined by internal and external factors.

Normative crises in professional development coincide with a person's transition from one stage of their professional development to the next. According to E. F. Zeer (1999), normative crises of professional development include crises of professional and educational orientation (optation stage); profession choice (stage of professional training); professional expectations (stage of professional adaptation); professional growth (stage of initial professionalisation); professional career (stage of secondary professionalisation); social and professional self-actualisation (stage of professional excellence); and separation from employment (stage of separation from employment).

These crises are often caused by external factors which disrupt the established routines of daily life. Non-normative crises of professional development can occur at any stage of this process and are usually provoked by accidental or extraordinary events. In cases of multiple non-normative crises, the process of professional development can be more time-consuming because coping with each of these crises requires considerable physical, mental, and temporal resources.

Methodology

The major objective of this study is to describe the strategies teachers use to cope with crises of professional development.

The survey was completed by 291 teachers aged 23–57 from secondary schools in Yekaterinburg. The respondents had a specialised vocational or higher pedagogical education and had opportunities for further training.

To conduct this survey, we applied the stratified sampling method: we randomly chose eight schools from different administrative districts of Yekaterinburg and surveyed all special subject teachers in each school. Since the vast majority of respondents were women, it would be reasonable to extrapolate the conclusions drawn from this survey to this specific category of teachers.

We applied the psychobiographical method to study crises in professional development (Alfred Adler, Gordon Allport, B. G. Ananiev, Charlotte Bühler, Zigmund Freud, N. A. Loginova, V. G. Norakidze, S. L. Rubinshtein, N. A. Rybnikov, etc.). This method is a psychological reflection on person's biographical data: its re-assessment provides a possibility to re-examine a person's professional past and professional development, to define further career trajectories and coping strategies. Thus, it allows a person to "pay attention to life from the angle of self-actualization in one's life acts" (Loginova, 1986, p. 106). To use this method a formalized biograhical questionnaire (put forward by V. G. Norakidze (1989) was developed into a psychobiographical essay (Zeer, 1999). The

biography plan includes the following aspects: family background, social and economic life conditions, childhood history, professional development (including gender-based aspects), plans for future. The psychobiographies are later studied by means of content analysis — a method for identifying and assessing specific characteristics of texts. The psychobiographical method shows the dynamics of professional development at every stage and reveals critical periods in this process. As part of the research procedure, the teachers were asked to use this questionnaire to write an essay describing their psychobiographies. The length of the essay had no limit, although the teachers were given two hours to write it.

We processed the data by applying content analysis to find and evaluate specific characteristics of the texts. The texts were approached as personal, informal, primary documents explicitly intended for the purposes of this research. We should emphasise that the format of a free-form essay minimises the impact of the researcher when compared to questionnaires and interviews.

The psychobiographical texts were divided into meaningful units referring to the crises (*category A*) or the ways of coping with them (*category B*); these included evaluative judgements and specific descriptions. Definition of the categories of analysis stemmed from the research purpose and the content of the analyzed texts. On its basis a detailed description of the categories was worked out. Together with that, a coding instruction was elaborated. The following categories were distinguished: A — crises of professional development, B — coping strategies. When working out the coding instruction, subcategories of the first and second order were singled out within these categories. The frequency of occurrence of subcategories was entered into matrices with subsequent expression as a percentage of the total number of selected categories of analysis. Based on the data obtained, a level of expression of the semantic units (which were selected for the study) was determined. The statements were defined into categories and an indicator table for *category A, the type of crisis* was offered (*Table 1*).

Our analysis of the psychobiographies has shown that most often respondents became aware of crises in professional growth (27.6 %), professional and educational orientation (21.5 %), and professional expectations (19 %). The crisis which was identified least frequently was that of profession choice (6.5 %). Non-normative crises tend to be less pronounced (14.7 %), despite the psychogenic tension they create.

The next stage of our research was the study of coping strategies used by teachers. Coping mechanism is a complex multi-faceted phenomenon that is analysed by psychologists from different perspectives: problem — or emotion-focused coping (Folkman & Lazarus, 1980), 13-dimensional scale of coping (Carver, Scheier, & Weintraub, 1989), etc. The approach offered in the present paper uses the cited theoretical models as guidelines and is developed in relation to coping process in a professional sphere, i. e. strategies of coping with professional crises through analysing the respondents' psychobiographies. We built an indicator table for *category B, ways of coping with the crisis* (*Table 2*).

We created a coding scheme for the category *Strategies of Coping with Crises in the Professional Development of Teachers* (*Table 3*). Within this category, we identified

subcategories of the first and second order. We designed matrices with the frequency of occurrence of the subcategories and calculated their share in the total number of the analysed categories.

Table 1

Indicator table (category A — crises of professional development)

Subcategory of the first order	Indicators
A1 — crises of professional and educational orientation	"Disillusionment" "It was a serious blow" "It came as a total shock" "For me it was a real tragedy, I had suicidal thoughts" "My castles in the air were ruined"
A2 — crises of profession choice	"When I was in my third year, I started to have second thoughts and suffered from anxiety" "A fatal mistake" "I felt that there was a stark contrast" "I started feeling an aversion to biology"
A3 — crises of professional expectations	"I felt hopeless and scared" "I felt that I was going through some kind of crisis" "I felt useless" "I didn't like the job, I experienced physical and mental discomfort" "Another moment of crisis" "Boredom, monotony"
A4 — crises of professional growth	"I felt restless" "A total crisis" "Frequent crises" "I felt that it was not for me" "I had feelings of growing frustration and dissatisfaction" "I was annoyed at how dreary and monotonous it all was"
A5 — crises of professional career	"Creativity crisis" "Nothing to devote my energy to, deadlock" "A feeling of exhaustion" "Went through a crisis" "Lost my professional edge"
A6 — non-normative crisis	"It all collapsed in one moment" "I didn't want to hear or see anybody" "I had this feeling of disaster" "I thought I would never get over this crisis"

Table 2

Indicators of strategies for coping with professional development crises (category B — coping strategies)

Subcategory of the first order B1	
subcategory of the second order (B10–B18)	indicators
B10	"University studies" "Studies and advanced training" "I enrolled in a course of advanced training" "I joined a group of teachers to work in another country" "Continuing self-education"
B11	"I passed the attestation assessment for obtaining a qualification category" "I passed the assessment" "I was awarded the category"
B12	"I was transferred to another school" "I changed job"
B13	"Had to switch to teaching another subject" "Was promoted to another position that was more satisfying" "Changed occupation"
B14	"I learned to see good things in my work" "I feel that my job is significant" "What's most important is that children ask me for help or advice; this is where my professional happiness lies" "I started to be more realistic about my abilities" "A new attitude to myself, my students, and work" "Passion for work, love for children"
B15	"I got help from my colleagues" "We had a good team and we helped each other a lot" "I was lucky to have good advisors" "I was lucky to have nice colleagues, we helped each other" "I was fortunate to have good supervisors, they always helped and supported me"
B16	"Retrained within the same specialisation" "Started to work as a teacher"
B17	"I didn't like my new position so I returned to the old one" "I returned to my old position" "I accepted a higher position but after working there for some time and improving my expertise I went back to my old place of work"
B18	"So I quit" "I changed my career" "I decided not to go back to teaching"

Table 2 (continued)

Subcategory of the first order B2	
subcategory of the second order (B20–B25)	indicators
B20	"I became interested in community work"
B21	"Professional apathy" "I felt numb and indifferent about everything" "The world seemed bleak and monotonous, nothing brought me joy" "I couldn't change anything about my work, everything went on as usual, only I couldn't care less"
B22	"I dropped out of college and my parents insisted that I became a driver" "I followed my mother's advice and went to the university" "The school director offered my a job"
B23	"I chose this college because they provided accommodation" "I entered the college by chance because I was too ashamed to return home" "I continue doing this work because I have no other options"
B24	"Lady Luck smiled on me" "I entered by chance and then I grew to love it" "I majored in pre-school education and later realised that I actually liked it" "I entered a pedagogical college and it turned out that it was something I actually wanted to do"
B25	"I adapted and became like everyone else" "I continued my studies in the field I wasn't interested in" "I felt submerged in the same dreary routine" "I gradually became accustomed" "I got used to this since there were no other options" "I didn't have anything else I could do at that moment"

Table 3

Coding scheme for the category strategies of coping with crises in the professional development of teachers

	Category B — coping strategies
Subcategories first order (B1, B2)	Subcategories second order (B10–B18, B20–B25)
B1 — proactive	B10 — advanced training; B11 — passing attestation assessment; B12 — changing employment; B13 — finding another job within the same field; B14 — revision of life goals, resources, and creation of new scenarios of professional life; B15 — asking supervisors and colleagues for assistance; B16 — retraining within the same profession; B17 — returning to the old job and position; B18 — change of profession
B2 — reactive	B20 — self-realisation in extra-professional spheres of life; B21 — professional apathy and stagnation; B22 — the conflict was resolved because parents, friends, and colleagues insisted on it; B23 — finding a compromise which relieved tension but did not solve the problem; B24 — adaptation to the situation; B25 — the solution was found accidentally and had a positive outcome

Results

As it can be seen from the *Tables 1–3*, professional crisis is not a homogeneous phenomenon, it comprises several types of crises that present the notion of crisis in dynamics. Thus, professional crisis, like any other activity, "represents by itself a complete act, a certain dynamic structure" (Luria, 1960, p. 205). These types of crises were analysed within the framework of coping strategies. We have identified two types of strategies for coping with crises of professional development: reactive and proactive.

Proactive strategies imply that a person actively pursues their goals and takes full responsibility for their decisions and actions. The choice of this strategy demonstrates a person's psychological maturity. This strategy means that a person tries to handle the crisis in an effective manner.

Reactive strategies, on the contrary, are characterised by a low level of personality integration and by weak and unstable cognitive, emotional, and volitional attitudes (Aseev, 1981). This strategy is dominated by mechanisms of psychological defence and adaptation.

Let us analyse the coping strategies found in the way the respondents dealt with each crisis in their professional development. In the psychobiographies, the *crisis of professional and educational orientations* is most often associated with reactive strategies (93.6 %). The only category that reveals proactive strategies includes text units which demonstrate that the respondents *revised their life goals and resources and built new scenarios of professional life* (6.4 %).

The research showed that 14.5 % of the text units reflected a choice *for compromise solutions which did not eliminate the contradiction but helped the respondents to stop worrying*. It can be concluded that the majority of solutions falling within the reactive strategy type are targeted at relieving tension, not at dealing with the problem itself. Thus, reactive strategies lessen emotional tension but do not resolve the contradictions which provoked the crisis.

Let us now turn to the strategies used by teachers to overcome *crises of profession choice.* For this type of crisis, reactive strategies (66.7 %) still prevail over proactive ones (33.3 %), but they are used less frequently.

Our analysis has shown that the most popular way of coping with such crisis is to *gradually adjust to the situation* (44.7 %). Going through the crisis during professional training, many respondents prefer to get drawn into the daily routines of studying rather than trying to change educational institution or specialisation. In other words, they choose to adapt to the situation; however, some of the respondents preferred to look for other ways. At the same time, 16.7 % of the statements describe an active approach — these people changed their fields of specialisation.

According to the research findings, 11.1 % of the units described *the revision of life goals and available opportunities and the creation of new life scenarios*. Professional self-determination often makes people adjust their career plans and reconsider their ideas about different spheres of specialisation.

Reactive strategies are used to reduce stress by shifting the focus of the person's attention to an extra-professional sphere. Another example of such strategies is a situation where a person allows their parents or friends to talk them into' taking a specific decision or just waits for the situation to change.

As for *crises in professional expectations*, most of the units corresponded to proactive strategies (79.6 %), while units reflecting reactive strategies accounted for 20.4 %.

The respondents tended to choose *advanced training* (24.1 %) more frequently. Since professional education in Russia focuses on providing students with sufficient theoretical knowledge rather than practical expertise, many specialists at the professional adaptation stage find themselves lacking in professional competence. On the other hand, many of our respondents attend courses of advanced training because they enjoy being students again.

According to the research data, 18.5 % of the units indicate that at the stage of professional adaptation many respondents choose to *seek assistance from their colleagues and supervisors* in order to cope with the crisis.

The study showed that 14.8 % of the units point out the option of *retraining within the same field of specialisation.* This way of overcoming a crisis is characteristic of teachers

with a vocational education since, after finishing a pedagogical college, young specialists start their careers at school by teaching vocational skills courses such as cooking, sewing, metal work, carpentry, and so on.

Another way of dealing with a crisis in professional expectations is *gradual acceptance of professional duties* (13.1 %) Even if a teacher is dissatisfied with their professional activity, they tend to put up with their functions rather than try to change anything or make any big decisions ("I gradually got used to it," "I became accustomed," "there was no other way," and so on).

Changing employment is another statistically significant way of coping with this kind of crisis (11.1 %). Teachers often choose to look for another job because they are dissatisfied with their relationships at work or because their expectations come into conflict with reality.

To address *crises in professional growth,* the vast majority of the teachers resort to proactive strategies (98.8 %). 66.7 % of the text units indicate advanced training as a way of coping with this sort of crisis. Teachers realise their need for professional growth through various advanced training courses and thus raise their educational status.

Another way to cope with such a crisis *is to revise and adjust one's life goals and resources and create alternative scenarios* (5 %). Teachers reconsider their values, ambitions, and resources, define new perspectives, and set new goals.

If career aspirations remain unfulfilled, teachers may consider *changing their current occupation or seeking support from their colleagues.* In certain cases, the respondents view these solutions as temporary and do not rule out the possibility of returning to the previous place of work and their old position. If a person is unable to adapt to a new place or is dissatisfied with their new field of work, they tend *to return to their old duties and routines.*

The only reactive strategy that was mentioned for this type of crisis is gradual acceptance. In this case, teachers generally experience feelings of hopelessness and frustration, lose their motivation for showing initiative, and adopt a passive attitude towards the situation.

Some teachers decide to *change their employment* (5 %) if they feel unfulfilled, do not have promotional opportunities, are dissatisfied with their relationships with co-workers, or are disappointed with their low professional status. They believe that they can overcome all these difficulties if they change the job.

The distribution of reactive and proactive strategies remains the same for crises in professional career. The psychobiographies we analysed did not reveal any reactive strategies, which means that all respondents chose proactive strategies. Due to the psychological characteristics of this crisis, not all teachers are aware of it but their strategies are indicative of psychological maturity.

It was found out that 39.4 % of the units demonstrate that the respondents chose to *undergo attestation assessment* to deal with this variant of crisis. Many teachers associate attestation and the subsequent upgrading of their category with a higher social and professional status. The system of attestation thus satisfies teachers' need for professional development.

Another statistically significant way of coping with this is *advanced training* (27.3 %). Some teachers choose to *master a new profession or specialisation within the same field* (15.2 %): if they are not satisfied with their current occupation, they can seek to learn another one.

The process of coping with the crisis often involves *the revision of life goals and opportunities and the creation of alternative scenarios of professional life* (12.1 %). Teachers point out that their "attitude to themselves and others has changed," that they can now "see good things in their work," and that "the crucial thing is that children ask me for help and advice, which is a really rewarding experience!"

Let us now characterise the strategies of coping with *non-normative crises* in professional development. Most of the units in the psychobiographies reveal proactive strategies (83.7 %), while reactive strategies account only for 16.3 %. When dealing with a non-normative crisis, teachers often *try to change the job* (30.2 %) because these crises are accidental.

Some of the respondents reported that they *asked their colleagues and supervisors for assistance* (14 %). It is interesting that help provided by co-workers is often perceived as a sign of good luck: "I was fortunate to have such colleagues, we all helped each other," "I was lucky to have good supervisors: they always helped and supported me."

The two other ways of dealing with non-normative crises were *to retrain within the same profession* (11.6 %) or to *change profession* (11 %).

Discussion

There is extensive international (Guskey, 2000; Postholm, 2012; Timperley, 2008) and Russian (Kuzmina, 1990; Markova, 1996; Zeer, 1999) research on teachers' professional development.

The main emphasis has been placed on professional stress (Austin, Shah, & Muncer, 2005; Jepson & Forrest, 2006), or the emotional burnout of teachers (Babita & Gurmit, 2014; Boyko, 1996; Formanyuk, 1994; Khukhlaeva, 2006; Rosenow, 2013; Tatar & Horenczyk, 2003) and its prevention (Chesnokova & Morozova, 2014).

Crises are essential for professional development. Our research has shown that in the course of their professional development teachers apply reactive and proactive strategies of coping with crises.

At earlier stages, especially in the crises of professional and educational orientation and profession choice, reactive strategies prevail (from 93.6 to 66.7 %). Proactive strategies are more characteristic of later stages: crises of professional career, professional growth, non-normative crises, and crises of professional expectations (from 80 to 100 %). The choice of strategies determines the further trajectory of the teacher's professional development.

Conclusions

Our findings show that there are two clearly defined strategies for coping with crises in the professional development of teachers: reactive and proactive. We consider this classificatory approach useful to handle professional crises as it encompasses a wide array of psychological aspects in a coping process: psychological maturity and aptitude *vs* psychological defence and adaptation. In order to reveal strategies to cope with a professional crisis, it was considered from different perspectives: crisis of (1) professional and educational orientations, (2) profession choice, (3) professional expectations, (4) professional growth, (5) non-normative crises in professional development.

The research showed that coping strategies varied according to a type of crisis. Proactive strategies were prevalent for coping with crises of professional expectations, professional growth and non-normative professional crises. Teachers tend to use reactive strategies to deal with crises of professional and educational orientations and profession choice. As it can be seen from the research findings at the initial stage of career development the respondents were less psychologically mature and more dependent on aid and advice from the outside whereas further professional development provided them with greater confidence, psychological aptitude and tools to cope with professional crises effectively and self-dependently.

We hope that our approach to professional crises and coping strategies, their interrelation and dynamics may be useful to study coping processes in other professional communities.

At the same time, our results show that the problem of crises as part of professional development requires further research and specification.

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Neuromyths in the Light of the Theory of Systemic-Dynamic Brain Organization of Mental Functions

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Нейромифы в свете теории системно-динамической мозговой организации психических функций

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Abstract. Knowledge about brain functioning is important for many professionals, especially in the fields of medicine and education, but for a wide audience as well. Neuromyths are false (completely or partially) simple and seemingly logical statements about the anatomy or functioning of the human brain. This paper presents typical sources of such errors such as misinterpretation, oversimplification, or overgeneralization. Special attention is given to analysis of some examples of the long-established source of misconceptions — regarding functional asymmetry of brain hemispheres, to the myth of the triune brain, and the so called "Mozart effect" from the point of view of the Lurian systemic-dynamic approach to brain functions.

Keywords: *brain development; neuromyths systemic-dynamic approach; Mozart effect; triune brain; interhemispheric asymmetry*

Аннотация. Знания о функционировании мозга важны не только для профессионалов, работающих в области медицины и образования, но также и для широкой аудитории. Нейромифы — это полностью или частично ложные, упрощенные но, казалось бы, логичные утверждения об анатомии или функционировании человеческого мозга. В этой статье представлены типичные источники таких ошибочных представлений: неправильное толкование, чрезмерное упрощение или чрезмерное обобщение. Особое

внимание уделяется анализу некоторых примеров давно известных заблуждений — мифов о функциональной асимметрии полушарий мозга, мифе о триедином мозге и так называемом «эффекте Моцарта» с точки зрения системно-динамического подхода к функционированию мозга А. Р. Лурия.

Ключевые слова: *развитие мозга; нейромифы; системно-динамический подход; триединый мозг; «эффект Моцарта»; межполушарная асимметрия*

Introduction

Neuromyths are false (completely or partially) statements about the anatomy or functioning of the human brain and their influence on human behavior, mostly aimed to explain individual differences in behavior. Usually such statements are appealing to common sense simple and seemingly logical, but their logic is similar to the claim that the earth is flat. Though there is no evidence for their truth, and even very often disproof, these false ideas used as a basis for pedagogical or rehabilitation recommendations, which divert precious time and money from those who are in need of real evidence-based help.

Cambridge researcher Usha Goswami is concerned with neuroscience application to education:

> Cognitive neuroscience is making rapid strides in areas highly relevant to education. However, there is a gulf between current science and direct classroom applications. Most scientists would argue that filling the gulf is premature. Nevertheless, at present, teachers are at the receiving end of numerous 'brain-based learning' packages. Some of these contain alarming amounts of misinformation, yet such packages are being used in many schools. (Goswami, 2006, p. 406)

This is perhaps a global problem, because the theme of neuromyths in teachers' education, knowledge and practice has recently become subject matter for research and publications in many countries: USA, Canada, Greece, Spain, Britain, Ireland, the Netherlands, Turkey, China, Russia, Austria (Grospietsch & Mayer, 2020; Howard-Jones, 2014; Papadatou-Pastou, Haliou, & Vlachos, 2017; Van Dijk & Lane, 2020).

Some widespread misconception in much of psychology about the brain, for example about evolution of the brain widely shared in introductory psychology textbooks, although long discredited among neurobiologists stands in contrast to the clear and unanimous agreement on these issues among those studying nervous-system evolution (Cesario, Johnson, & Eisthen, 2020).

Most widespread and long-lasting, especially among educators, are different myths related to "hemisphericity" inspired by Robert Ornstein who encouraged the use of different ways of teaching to stimulate the "creative" right brain versus our intellectual left brain. Arguing that modern society undervalues the right hemisphere's touchy-feely mode of approaching the world, dichotomizers touted fanciful simple schemes for boosting this hemisphere's activity. The followers of Ornstein in books and seminars promised to free us

of the barriers to personal growth imposed by an inflexible school system that favors "left hemisphere thinking" (Lilienfeld, Lynn, Ruscio, & Beyerstein, 2009). Some educational texts encourage teachers to determine whether a child is left-brained or right-brained before they attempt to teach them (criticized by Howard-Jones, 2014).

As opposed to neuromyths, neurofacts are results and conclusions based on researches of structure and functions of the human brain in relation to human behavior. Often neuromyths are based on wrong interpretation of neurofacts or oversimplification of facts, using some hypothesis which is still unproved or reported in an inaccurate investigation, or incomplete information. Professional scientists are immunized against neuromyths by knowledge of neurofacts and the theory underlying them, their own critical thinking protecting them from false declarations. The Lurian theory of systemic-dynamic approach to brain organization of higher mental processes seems to be the proper base for developing such a protection and we will try to critically analyze three popular neuromyths from the point of view of this theory. We choose to focus on the following myths: some aspects of the hemisphericity myths; the triune brain myth and the "Mozart effect" myth.

Human Interhemispheric Cooperation: From Myths to Facts

The subject of brain functional asymmetry historically is the source of many myths. It started from the mid-nineteenth century with the idea of hemispheric equipotentiality. The root of the idea can be found in the book of Arthur Wigan *The Duality of Mind* (1844). For twenty years he gathered and described cases of patients with seemingly normal behavior, though they had damage to one of the hemispheres to the extent of practical inactivity. He concluded that the patients' activity was possible because the two hemispheres are equal and each one is completely capable of regulating all mental life, like two eyes: each eye is self-sufficient, but when working together they can see better.

As an additional indication of the existence of two minds controlled by two hemispheres he took from cases of *split personality* and the fact that it is normal for people to conduct *an inner dialog,* as if discourse between ego and alter-ego, while each one is based in its own hemisphere.

Analysis of Wigan's logic is useful for understanding how wrong thinking can lead to myths and intermittently to laterality booms in education.

Wigan started from the simple and potentially verifiable declaration that with damage to one of the hemispheres mental life can remain complete by means of the other hemisphere. Describing examples, he did not mention which hemisphere was damaged at what age and how the activity was assessed and concluded that there is duplication. Referring to functioning of two eyes he ignored the fact of both right and left semi visual-field representations in each hemisphere to make each eye self-sufficient. He saw education as a source of developing harmony, although he suggested that "the willpower" of one hemisphere is "tyrannizing" over the other. Usually the left one is stronger and that is why the right hand is more effective as an instrument of will (Wigan, 1844).

It occurred that the idea of equality and parallel independent functioning of hemispheres was so attractive for common opinion especially among educators that this myth revived more than once even much later.

Discoveries of P. Broca (1861), and C. Wernicke (1875) of speech disorders following damage to the left hemisphere of the human brain marked the beginning of development of a scientific approach to brain functioning. Aphasiology may be considered as a first step to modern neuropsychology, in which attention was focused on the role of the left hemisphere in language and speech functions. Moreover, I. Boulloud (1865) associated aphasia due to damage of the left hemisphere with the fact that most people are right-handed. In some cases, damage to the right hemisphere in lefthanded patients caused aphasia, so called crossed aphasia (Bramwell, 1899).

Thus, the *conception of dominance of the left hemisphere* was formulated with a *conjunction hypothesis*, suggesting connection of handedness with hemispheric dominance with special attention to the manual dominance. This conception supposed that the *left hemisphere is dominant for all main processes including speech, thinking and generally for intellectual life*.

The conception of dominance became the basis of a new misconception and myths, and practical recommendations for parents and educators. An educational trend to promote left hemispheric dominance started and was one of the most long lasting.

Orton (1937) noted that some children having profound difficulties in reading and writing (but who otherwise were intellectually normal) showed frequent and prolonged confusion in directional orientation of letters and words. Many of these children were also "motor intergrades" that is their handedness was unclear: incomplete or mixed. Orton's remedial programs were highly individualized. He rejected any simplified and universally applicable formula, but his followers developed more rigid and simplified programs.

Because hemispheric dominance is related to handedness, attention must be paid to encouragement of right-handedness to avoid problems in development of speech and mental retardation. A negative attitude to left-handedness as a kind of "defect" had deep roots in religion and culture even earlier. In 1811 Mary Palmer Tyler published instructions on teaching infants "the right use of their hands." Recognizing, however, that left-handedness was hereditary "that it ran in families" she pronounced it no less natural than right-handedness and saw this as a reason why counteraction, although well intended, could be effective only in part. She also reassured parents that a child without this "natural defect" will never acquire it after birth, so that "all anxiety upon the subject is superfluous." But even where it appeared in a child not "born" with it, they would have had no reason to pay special attention to the child's hand use (Harris, 2010, pp. 7–9).

Though M. Tyler was so kind and reassuring for anxious parents, but after the establishment conception of dominance the usual practical recommendation for parents and caregivers was to promote right handedness. Some older lefthanders around us still can tell how their left hand was bound to their body to give the right hand an opportunity to develop writing skills. The attitude toward left-handedness gradually changed during the twentieth century. While at the beginning of the twentieth century there were only

three per cent of lefthanders, up till the millennium a rather stable across countries and continents distribution was gradually formed: ten to twelve per cent lefthanders among men and nine to ten per cent among women (McManus, 2009). So, there is no longer any pressure on lefthanders, but there are different attempts to influence hemispheric functions for better cognition and academic achievements.

Back at the beginning of the twentieth century, as a reaction to the concept of dominance, almost immediately a conflict between two myths began: hemispheric equipotentiality versus the conception of left hemispheric dominance. The wide public interest in the functioning of the brain with a critical attitude toward handedness and propagation of ambidexterity can be found in many publications. In 1900 Doctor James Sawyer wrote: "I desire to join in recommending the general culture and adoption of ambidexterity… In our own manifold profession ambidexterity is a great equipment. In laryngoscopy, in ophthalmoscopy… in examination *per vias naturales* it is useful" (Sawyer, 1900, p. 1303). *The Ambidextral Culture Society and the Duality of Mind* (Harris, 1985) was established with a propaganda — the equal training of right and left hands in the arts and crafts of the day, as stated in the book of the founder of this society John Jackson (1905) *Ambidexterity, or Two-Handedness and Two-Brainedness.* He considered that one handedness is an artifact of civilization and inspired a reform movement in education (Harris, 1985). This idea was immediately criticized by a more informed professional doctor N. Harman:

> …ordinarily trained men are possessed of a real ambidexterity, or, as it would be better stated, co-ordination of bimanual action. It follows from this that the aim of the Ambidextral Culture Society is futile; mother nature has already done the work which this new society proposes, and done it so quietly and secretly and so delicately… (Harman, 1905, p. 16)

Harman also alerted against "cultivation of educational fads," but at the end of the 20th century his statement was still actual because educational fads were still appealing to hemispheric functions. In the 1970s a movement erupted: attempt to push our society out of our left brain thinking, and into a more intuitive, artistic right brain mode. Lauren Harris' comprehensive review is highly recommended (Harris, 1985).

The interest in human hemispheres is still very active. Two new different, though related myths can be found today on many different sites of the Internet.

One is related to the aging brain, the other is related to the developing brain, while looking for differences in functional asymmetry at different stages of life. There is a statement on the Internet: "Starting from age sixty people use two hemispheres for solving problems, *while young people use only one*" (for example here: Ovsianik, 2019). The site *Neuroscience News* has an intriguing caption: Children Use Both Brain Hemispheres to Understand Language, Unlike Adults (2020). Both declarations clearly proclaim that young adults use only one hemisphere, presumably the left one as they still embrace the conception of left hemispheric dominance and see advantage in lower asymmetry in children and aging people.

First of all, according to the systemic-dynamic approach to functional organization of the human brain, the problem of cerebral dominance in verbal processes appears not as an advantage or dominance of one over the other, but rather as description of a specific contribution of each to the complete verbal activity.

After publication of results of researches patients with bisected brain (Gazzaniga, 1970; Sperry, 1962) much attention was paid to functions of the right hemisphere in all aspects of mental functions and specifically to its role in language.

There are different sources of information about participation of the right hemisphere in verbal functions.

Today it is a well-established fact that the right hemisphere has an important role in language. In case of right hemisphere lesions in brain regions equivalent to Broca's area expressive language tends to be hasty, monotonous, lacking in prosody; there is a slight tendency to simplification of articulatory movements resulting in errors in syllables with complex phonetic combination (e.g. transport-tasport). Patients with right hemisphere lesions tend to use functional descriptions (circumlocutions), neologisms instead of correct names without hesitation or discomfort. When phonetic cues or names of the object are given to the patient, he points out the word or accepts the name, but without showing that he was having difficulty trying to find this name. There is also disautomatization in signature (Simernitskaya, 1974) and other problems of writing and reading (Ardila, 1984). The right hemisphere has an important function in modulation the affective component of the language through prosody and emotional gesturing (Ross, 1984).

Research dealing with verbal activity immediately after right- and left-sided electroshock seizures provided valuable material regarding the specific input of the right hemisphere. The right-sided electroshock seizure resulted in gross disorder of verbal behavior: while lexically and grammatically speech was normal, but the patients became overly loquacious, tending to give detailed description of improper details, pointless notes and commentary. They become unreasonably communicative intruding, giving advice. At the same time, they still have problems with voice and prosody (Balonov & Deglin, 1976).

In the foreword to the monograph of E. G. Simernitskaya (1978) A. R. Luria wrote in November 1975:

> Recent data reveal a need to depart from the simplified concept that one type (verbal) of process provided by just one, left (in right-handers) hemisphere, at the same time other (nonverbal) — only by right hemisphere.
>
> Psychological analysis reveals that practically all mental processes have complex functional organization because they can take place at different levels (voluntary and involuntary, conscious and unconscious, immediate and mediated). This provides a sufficient basis to suggest that there is an intimate interhemispheric cooperation, while the role of each one can change dependent on the task of a specific mental activity and its structure. (p. 6)

Such an approach is characteristic for Luria's disciples (Goldberg, 2009; Goldberg et al., 2013; Golod, 1984; Kotik, 1975, 1992; Kotik-Friedgut & Ardila, 2020; Simernitskaya, 1978, 1985).

According to the systemic-dynamic approach to functional organization of the human brain, the problem of cerebral dominance in verbal processes appears not as advantage or dominance one over the other, but rather as description of a specific contribution of each to the complete verbal activity. With such an approach we need to be especially cautious interpreting neuro-images not to retreat to localizationistic interpretations of signs or absence of signs of increased activation as basis for a far reached conclusion.

So, the claim that only one hemisphere is active in young adults is just a very rude simplification of the concept of hemispheric dominance. As to the facts of neuropsychology of aging there are many relevant publications, but none that referring to *"young people use only one"* (Ovsianik, 2019).

Brain Hemispheres in Aging

Older adults are generally slower in many aspects of activities. To maintain successful levels of performance during demanding cognitive tasks, they recruit compensatory mechanisms and strategies. Cognitive neuroimaging studies often report that older adults display more activation of neural networks than do younger adults. Such a situation is often referred to as *overactivation*.

Greater or more widespread activity frequently *involves bilateral recruitment* of both cerebral hemispheres, especially the frontal cortex.

This was the beginning of a new line of research of the aging brain. Further research revealed that the reduced asymmetry in fMRI is a result of compensatory activation of the right prefrontal region and it is more pronounced in subjects with better performance in memory tasks (Cabeza, Anderson, Locantore, & McIntosh, 2002).

The findings of fMRI examinations f show a broad pattern of *changes that support cognitive performance* in older adults' interhemispheric and intra-hemispheric reorganization. In tasks of different levels of demands on working memory older adults with higher working memory capacity demonstrated higher levels of network integration in the most difficult task conditions. Thus, age-related network reorganization suggests that changes in network connectivity may act as an adaptive form of compensation, with older adults recruiting a more distributed cortical network as task demands increase (Sala-Llonch et al., 2012).

There are several more models describing aging brain reorganization. The PASA (Posterior-Anterior Shift in Aging) model pays attention to posterior-anterior shift of activation due to involvement of frontal areas. This change is revealed in older subjects with tasks of different types and different levels of complexity (Crowell et al., 2020; Davis, Dennis, Daselaar, Fleck, & Cabeza, 2008). With verbal semantic tasks this frontal involvement is clearer in the left hemisphere (Left Anterior-Posterior Aging effect — LAPA) thus revealing both inter-hemispheric and intra-hemispheric changes, in other words hemispheric reorganization of the aging brain (Hoyau et al., 2017). Special attention

is given to age-related decreases in interhemispheric resting-state functional connectivity of symmetrical zones (Zhao et al., 2020).

Functional Asymmetry in the Developing Brain

Let us analyze the attention-grabbing statement that children unlike adults use both hemispheres on a site *Neuroscience News*, claimed to be based on a paper of neuroscientists from Georgetown University Medical Center ("Children use both," 2020; Olulade et al., 2020).

The study was focused on one task, language, and finds that to understand language (more specifically, processing spoken sentences), children use both hemispheres. The research revealed that while a large proportion of the youngest (mean age four and a half years) children show significant activation in their right hemisphere homologs of the left hemisphere language areas, this proportion decreases with age as does the right hemisphere activation itself. The fMRI pictures demonstrate no focused activation in the right hemisphere. It is also noted with reference to several sources that in healthy adults and stroke patients right hemisphere activation increases with sentence complexity, task difficulty and effortful performance. But in the present research there was no significant correlation between right hemisphere activation and task performance, suggesting that the right hemisphere activations "reflect genuine functional involvement of the right hemisphere in language processing and not an artifact of our specific task" (Olulade et al., 2020, p. 23480). It is claimed that the results of this study help to explain why despite early damage to the left hemisphere children can develop speech. While it is mentioned that the young brain is highly plastic, the authors hypothesize:

> The normal involvement of the right hemisphere homologs of language processes during very early childhood may permit the maintenance and enhancement of right hemisphere language development when the left hemisphere is injured. In this hypothesis, the declining involvement of the RH in sentence processing over development — and the increasing dedication of the RH homolog areas to processing other aspects such as prosody — may explain why language recovery after LH stroke is not as good in adults as it is in children. (Ibid, p. 23481)

So the focus of attention in explanation of functional changes over age is shifted from plasticity, which is mentioned only once, to a kind of plastic or dynamic laterality of language functions: from participation of the RH to LH dominance.

The site *Neuroscience News* takes it as a great discovery:

> Infants and young children have brains with a superpower, of sorts, say. Whereas adults process most discrete neural tasks in specific areas in one or the other of their brain's two hemispheres, youngsters use both the right and left hemispheres to do the same task. The finding suggests a possible reason why children appear to recover from neural injury much easier than adults. ("Children use both," 2020)

The problem of a possible process of compensation for brain damage in language development is the focus also of a group of researchers at the Swiss academy of Development. Karen Lidzba and her colleagues consider that pre- or perinatally acquired (congenital) left-hemispheric brain lesions can be compensated for by reorganizing language into homotopic brain regions in the right hemisphere. But it is important that they consider and emphasize in their approach that language comprehension may be hemispherically dissociated from language production (Lidzba, de Haan, Wilke, Krägeloh-Mann, & Staudt, 2017; Lidzba, Schwilling, Grodd, Krägeloh-Mann, & Wilke, 2011).

From the point of view of the systemic-dynamic approach it has to be s emphasized that the lifelong acquisition of cognitive skills shapes the maturation of the brain. In the study of Elisa Newport's group (Olulade et al., 2020) only a task of sentence comprehension was used. It is reasonable to propose that 13-year-old and adult subjects in the research were literate. We would like to mention acquisition of literacy as a factor which influences maturational dynamic changes of brain organization of higher mental functions.

There is enough evidence of influence of literacy on brain organization of language (Ardila et al., 2010). Castro-Caldas and Reis compared the repetition of auditorily presented words and pseudo-words in literate and illiterate women. The repetition of pseudo-words was significantly worse in the illiterate group than in the literate group. This difference was reflected in positron emission tomography images with a more bilateral involvement in illiterates (Castro-Caldas, Petersson, Reis, Stone-Elander, & Ingvar, 1998; Castro-Caldas & Reis, 2000). The acquisition of literacy transforms the human brain. By reviewing studies of illiterate subjects, Stanislas Dehaene and his colleagues propose specific hypotheses on how the functions of core brain systems are partially reoriented or recycled when learning to read. Literacy also modifies phonological coding and strengthens the functional and anatomical link between phonemic and graphemic representations. Literacy acquisition therefore provides a remarkable example of how the brain reorganizes to accommodate a novel cultural skill (Dehaene, Cohen, Morais, & Kolinsky, 2015).

Myth of the Triune Brain

In the 1960s, American neuroscientist Paul MacLean formulated the Triune Brain theory, which is based on the division of the human brain into three distinct regions. He started from research of brain regulation of visceral functions and coined the term *limbic system* (MacLean, 1955). But his later book *The Triune Brain in Evolution: Role in Paleocerebral Functions* (MacLean, 1990) became a source of one of the most popular neuromyths. It is so influential that most introductory psychology books published in the last decade presenting knowledge about brain evolution use incorrect information of MacLean (Cesario et al., 2020).

Along with neurofacts MacLean's book incorporated many insufficiently based interpretations. According to the theory of the triune brain the process of the brain's evolution resembles the geological development of the earth: new strata cover the old ones like

the layers of the earth. According to MacLean, as a consequence of the appearance of new types of animals, new brain parts were added to the already existing ones. Most primitive and ancient parts, such as the spinal cord, brain stem, pons Varolii and middle brain, which are present in all animals, are responsible for survival. MacLean calls this arrangement the *Neural Chassis*. Upon this arrangement three executive layers or three "drivers" are built up, which regulate the chassis (each in its own way). The most ancient among the three is R-complex (reptilian complex). Reptilian brain comprised mostly of basal ganglia the newer are the limbic system (paleomammalian complex) and neocortex (neomammalian complex). Those three drivers are relatively *independent*, though widely cooperating. Each "executor" *is responsible for its' own type of behavior.* This responsibility is the result of brain evolution. Thus R-complex is the oldest and responsible for ritualized, stereotypic forms of behavior. After that the early mammals evolved the limbic system responsible for emotional and instinctive behavior and, finally, the neocortex of modern mammals is responsible for thinking. From the point of view of MacLean, human beings retain all these types of behavior and their functioning has changed very minimally since these three executors first appeared in the process of evolution.

The three main assumptions of MacLean's model are: the layering of evolutionary new executors upon old ones, the independence of executors from one another and their responsibility for specific behaviors, aroused a wave of discussions and criticism among specialists (Cory, 1999; Reiner, 1990). At the same time his ideas became very popular among non-professionals in neurophysiology. The popularity of the theory of the triune brain rocketed after publication of the book by Carl Sagan in 1977 *The Dragons of Eden*, which was reprinted many times (Sagan, 1977/2012). This is a nonacademic text (the author defined it as *Speculations on the Evolution of Human Intelligence*) and it is nearly impossible to differentiate facts about evolution of the brain from free speculations because of lack of references to sources and a lot of authoritative names of scientists. The reader even does not know that the author is not a professional involved in research in the theme he is presenting. He is professional in astrophysics and a kind of science interpreter but inspired by ideas of MacLean he writes about psychiatric disorders and a misbalance between three parts of the brain. Particularly he speculates about ritual components in psychiatric disorders as probable pathological activity in some center in the reptilian complex or inability of some part in the neocortex to inhibit or exclude this reptilian complex. He further discusses ritualized behavior of children and supposes that it results from incomplete development of the neocortex. Thus, he finds easy explanations for pathology: imbalance between reptilian and mammalian parts of the brain, while neuroscientists continue researches to find evidence-based solutions for real problems.

The false ideas of MacLean and his supporters influenced a tendency among modern psychologists to explain intrapersonal problems and conflicts based on the triune brain concept. Thus, egoistic or impulsive behavior may be explained as a dominance of reptilian or limbic behavior over the rest which gives seemingly "neuroscientific" interpretation of Freud's ideas about conscious, subconscious and unconscious parts of mind.

At her own webpage psychologist Susannah LaCombe (2020) writes: "If you're frustrated by your lack of progress in therapy, consider that the reptilian lizard part of your brain is holding you back. This primitive area of the brain controls much more of our behavior than we realize." Immediately she has a "prescription": "This is one of the key insights from body psychotherapy. When you calm the reptilian brain, you have more control over your emotions including your intentional behavior."

Other transmitters of MacLean's ideas may be found on YouTube. These include NY Times bestselling author and marketing expert Seth Godin lecturing about "How to overcome your 'lizard brain' to get ahead in your relationships and your career" (2019) and even neuroscientists such as Robert Sapolsky (2019) speaking about *3 Brain Systems That Control Your Behavior: Reptilian, Limbic, Neo Cortex*, etc.

Some popular trends in therapy such as Brain Gym® without confirmed value propose simple physical exercises for improvement of brain connectivity (Dennison P. E. & Dennison G. E., 1986; Spaulding, Mostert, & Beam, 2010). Such methods often are based on MacLean's ideas (Hannaford, 1995). The Brain Gym was deeply criticized by researchers who stand for evidence-based approaches in education and are fighting against neuromyths (Goswami, 2006).

Let us analyze the logic of MacLean from the point of view of the theory of systemic dynamic brain organization of mental functions.

The first of the basic assumptions of MacLean's model, the layering of evolutionary new executors upon old ones is perhaps the most criticized and refuted. His critics declare that his view was outdated even at the moment of the first publication of his book in 1989 and it was proven that not only mammals, but also reptiles and birds already have a limbic system and neocortex (Reiner, 1990). And MacLean's opponents' most important claim is that the evolutional line of mammals differs from that of reptiles and birds. That way the idea of layering of new brain structures of evolutionary newer species over the old ones is basically wrong (Cesario et al., 2020).

Moreover, much before the theory of MacLean appeared, there were enough data for a completely different approach to the evolution and functioning of the human brain. The roots of the systemic dynamic approach to organization of mental functions can be found in the book of Bernstein[1] (2003). As an example of changes of the system of visual perception in different species of animals, he formulated the following conclusions: appearance of new segments in the system leads to restructuring including new connections between structures, changes in old connections (often weakening or joining), delegation of the execution to the new more elaborated structures, while diminishing involvement of the old executive structures or even their cardinal change. At the same time the brain continues to function as a complete system — not as a complex of separate and partially independent systems which challenge each other in solving a specific problem. As an

[1] The book *The Modern Searches in the Physiology of the Neural Process* was written in 1935, but because of Soviet political restrictions it was forbidden; it was published only in 2003. For historical details see Sirotkina (2014).

example of such a process, N. Bernstein demonstrated that the tegmentum, which is the main brain part in fish, stops to be a part of for the processing visual signals in mammals. The visual tract in mammals goes to the primary visual cortex via the lateral geniculum, while only a narrow range of functions are preserved in the tegmentum, such as the regulation and control of pupillary reflex (Bernstein, 2003).

Evidently, similar changes normally occur in ontogenesis, when the brain systems for specific problem solving functions are replaced by more elaborately developed systems. The line in development goes from extreme disunity to redundant connectivity with low functional differentiation of specific brain areas to development of clear functional system of local zones that are more segregated and specialized (Annaz, Karmiloff-Smith, & Thomas, 2008; Farber, 2014). Another example: the control of the eye movement shifts from the subcortical structures to a complex system based on cooperation of occipital and frontal regions during development of the first 6 months. While prefrontal areas among other parts of the cortex are part of the visual perception, their reaction to sensory features of these stimuli is nonspecific until the age of 3–4 years and only at the age 6–7 do we find a frontal-specific reaction related to a more "adult" processing of visual information. These facts are clear evidence of the change of function of different brain structures at different stages of ontogenesis. Visual perception in adults is cardinally different from children: it does not demand a detailed analysis of the picture. Adult perception can start from using a very quick appraisal system (including the prefrontal cortex), putting forward hypotheses, which are "examined" and verified by slower systems of the visual cortex equipped for a more detailed analysis of visual images (Bar, 2003).

All facts described above demonstrate that not only the first idea of MacLean about layering new structures over the old ones was an error, but also show that the two other ideas about independence of the executive structures and preserving their evolutionary defined functions were similarly flawed. We clearly can see that the brain works as a concord and different structures can change their role in cognitive activities not only in a phylogenetic process, but also during ontogenesis.

The last two assumptions about independent executive centers are close to strict localizationism which was criticized by A. R. Luria. Sometimes the idea of the triune brain is mentioned alongside Luria's concept of three functional brain units, but the resemblance is very superficial. Some authors may see "The resemblances between MacLean's well known theory and Luria's lesser known theory are nothing short of remarkable. Luria's focus on the role of the sensory impulses (primitive neural structures) resembles MacLean's reptilian complex" (Kostyanaya & Rossouw, 2013, p. 54). The similarity is indeed superficial because according to Luria functional units are universal for all complex forms of mental functions (Luria, 1978). Such declarations, in spite of the fact that all Luria's neuropsychological works were immediately translated into English (and basic books in many other languages), motivate us to emphasize the difference between these two approaches and to publicize in the 21st century even more actively the relevance of basic ideas of Luria's systemic-dynamic approach for understanding the brain functions (Kotik-Friedgut & Ardila, 2020).

Luria's idea that each mental function is based on the integrative functioning of different brain regions united in brain functional systems has long become the fundamental idea of modern neuropsychology and cognitive neuroscience (Glozman, 2020).

Luria formulated the first "*law of hierarchical structure of the cortical zones*. …The relationships between the primary, secondary and tertiary cortical zones composing this system do not, of course remain the same, but *change in the course of ontogenetic development*" (Luria, 1973, p. 74).

According to Vygotsky (as cited in Luria, 1973), in development the interaction between the cortical zones goes "from below upward," meaning that defects of the lower zones in infancy must lead to incomplete development of the higher zones. By contrast, among adults the interaction goes "from above downward," and the tertiary zones then have a compensatory influence if the secondary zones are damaged (pp. 74–75).

According to the theory of systemic-dynamic organization of brain functions the changes of brain functions can be expected not only on such long-term phenomena as phylogenesis but even more so on ontogenesis. Brain organization of mental processes can be changed here and now, when the conditions of activity change. This is the basic idea in formulating neuropsychological rehabilitation via activation and involvement of intact brain areas for achievement of desirable cognitive results.

Thus, depending on the aim, seemingly the same operation can involve different brain mechanisms. For example, raising a hand may be realized and controlled differently if it happened as a result of fright, instruction to raise the hand, trying to reach a point (e. g. light switch), or to greet somebody. Such plasticity completely excludes any fixed rigid connection between a complex mental process and activity of some brain system which would make it impossible to adapt to changing conditions.

The Myth that Cognition may be Promoted through Listening to Music

One of the widely propagated neuromyths is the myth about the positive influence of Mozart's music on cognitive abilities, the so-called *Mozart effect*. The historical root of this myth is found in the results of the work of a group of researchers that revealed an increase of efficiency of spatial problem solving after ten minutes of listening to music (concerto No. 448 for two fortepianos), but the effect was absent after listening to music of composer-minimalist Philip Glass (Rauscher, Shaw, & Ky, 1993). They reported on their subjects' 8–9 units increasing of IQ, though the effect lasted only for a short time — 10–15 minutes. Later Frances Rauscher's group demonstrated that after eight months of music training (weekly electronic piano lessons and everyday singing lessons) 3–4-year-old children scored 34 % higher on the Object Assembly subtest from the Wechsler Preschool and Primary Scale of Intelligence — Revised (Wechsler, 1989) than children given computer or singing lessons or no training. The same day, Richard Knox (1993), a health, medicine, and science writer for The Boston Globe, reported the story in an article entitled *Mozart*

Makes You Smarter, Calif. Researchers Suggest. Knox called it the Mozart effect, the first to use this term, and other media picked up the story.

The effect was present already after four months music training (Rauscher et al., 1997). In this study there was no focus on Mozart (children learned to play simple melodies of Mozart and Beethoven), but the next results of the same group were even more impressive: spatial problem solving improved even in rats (Rauscher, Robinson, & Jens, 1998). In 1997, Don Campbell, a classically-trained pianist and teacher, published *The Mozart Effect*, the first in a series of books promising that listening to Mozart would, to quote its subtitle, not only "strengthen the [infant's] mind," it would "heal the body" and "unlock the creative spirit" (Campbell, 1997). Reports of the impressive impact of Mozart's music spread rapidly. Based on this myth, especially in the United States an immense market for Mozart-effect CDs or music toys targeted toward babies emerged to foster the intelligence of very young children (Düvel, Wolf, & Kopiez, 2017).

The results of Rauscher's group researches do not imply that listening to Mozart's music enriches human intelligence. A lot of questions still had to be addressed after these researches. For example, which specific characteristics of Mozart's music could influence spatial problem solving? Are there other types of stimuli with similar impact? Does music influence specifically spatial abilities or is the influence nonspecific (for example general activation)? For how long does the influence persist? If the effect can be seen only for several minutes or even hours, can it be concluded that Mozart's music can influence a child's development?

Attempting to replicate these results other researchers produced contradictory results: some came to similar conclusions, while others did not (Jenkins, 2001). Thus, one experiment repeated exactly the conditions of Rauscher's research, but their results did not confirm improvement in solving spatial problems after listening to Mozart's music (Steele, Bass, & Crook, 1999).

In 1999 the journal Nature published a discussion *Prelude or Requiem for the 'Mozart Effect'* (Chabris, 1999). The meta-analysis of 20 papers presented at the discussion failed to find any correlation between listening to Mozart's music and indexes of intelligence. Rauscher replied:

> Our results on the effects of listening to Mozart's *Sonata for Two Pianos in D Major, K. 448* on spatial-temporal task performance, have generated much interest but several misconceptions, many of which are reflected in attempts to replicate the research. The comments by Chabris and Steele et al. echo the most common of these: that listening to Mozart enhances intelligence. We made no such claim. The effect is limited to spatial-temporal tasks involving mental imagery and temporal ordering. (p. 827)

Later based on meta-analysis of nearly 40 studies, over 3000 subjects, the authors concluded that "on the whole, there is little evidence left for a specific, performance-enhancing Mozart effect" (Pietschnig, Voracek, & Formann, 2010, p. 314).

If we admit as true that a short-term Mozart effect exists, what would account for it?

Perhaps, at least partial explanation of a Mozart effect can be related to general activation triggered by audial stimulation. When describing principles of the first functional unit, which generally regulates activation, A. R. Luria illustrated the activating effect of stimulation of reticular formation on the cortex, evoking an arousal response as a result of a ringing bell sound awakening the cat. He emphasized the existence of two types of results in such stimulation: a *general activating effect on the cortex* and deep brain structures responsible for awakening via functioning of ascending reticular formation a kind of *non-specific activation,* which is distinguished radically from specific activation of the auditory cortex by its afferent connections via the thalamus, impelling the cat to turn and look at the ringing bell (Luria, 1973, pp. 48–58).

An experiment of researchers from Michigan University investigated the effect of music listening for performance on a 25-question portion of the analytical section of the Graduate Record Exam by 72 undergraduate students. Five levels of an auditory condition were based on approximately 6 minutes listening to a Mozart Piano Sonata; or a rhythm excerpt; or a melody excerpt; or traffic sounds; and silence. Participants were randomly assigned to one type of stimulus. After the listening period, participants answered the questions. Analysis indicated participants achieved significantly higher mean scores after all auditory conditions than did those in the silent condition. No statistically significant pairwise mean difference appeared between scores for the various auditory conditions. Findings were interpreted in terms of an arousal framework, suggesting the higher mean scores in all auditory conditions may reflect immediate exposure to auditory stimuli (Roth & Smith, 2008).

It means that the Mozart effect is not specifically related to Mozart's music or any music but is the effect of arousal as reaction to auditory stimulation.

Is it generally reasonable to expect that any musical training may influence development of cognitive abilities not related to music, such as a visual-spatial thinking as suggested by the Rauscher group (Rauscher et al., 1997)? There were attempts to explain such transfer pointing to the activation of allegedly identical brain areas while listening to music (Jenkins, 2001). Clearly such attempts are futile because they ignore the systemic-dynamic nature of any cognitive activity. According to Luria's systemic-dynamic approach to the brain's organization any mental function, especially higher mental activity (music listening is certainly human mental activity), cannot be localized in one or even several cortex areas. It is a complex widespread activity involving all three brain functional units, which is dynamic and influenced by changing conditions — internal as well as external. It is also incorrect to speak about a brain system of music listening or perception in general because music can be absolutely different according to rhythm (march or lullaby) according to emotional message (joyful or sad, major or minor) according to pitch, according to the sound of instruments, etc. In each case a specific dynamic functional system will develop. Accordingly, music can be a powerful tool in medical rehabilitation (Pauwels, Volterrani, Mariani, & Kostkiewics, 2014).

Recent meta-analysis of 54 researches selected according to rigorous criteria (experiment, control group, tests of cognitive (not musical) abilities of subjects, absence of any

musical training and enough data to calculate effect) revealed the absence of any influence of musical training on cognitive abilities or academic skills. The higher the quality of experiment designs the lower the correlation of musical training and cognitive improvement of subjects. In addition to disproving the Mozart effect, these authors suggest that there is little or no probability of transfer of results of training in one skill on improvement of other far different abilities (Sala & Gobet, 2020).

Such an attempt was undertaken in a meta-analytic review to test if working memory training can improve performance on measures of intelligence or other measures of "far transfer." It has been claimed that working memory training programs produce diverse beneficial effects. A meta-analysis of working memory training studies (with a pretest-posttest design and a control group) that examined transfer to other measures (non-verbal ability, verbal ability, word decoding, reading comprehension, or arithmetic; Eighty seven publications with 145 experimental comparisons). Immediately following training there were reliable improvements in measures of intermediate transfer (verbal and visuo-spatial working memory). For measures of far transfer (nonverbal ability, verbal ability, word decoding, reading comprehension, arithmetic) there was no convincing evidence of any reliable improvements when working memory training was compared with a treated control condition. Furthermore, mediation analyses indicated that across studies, the degree of improvement of working memory measures was not related to the magnitude of far-transfer effects found. Finally, analysis of publication bias shows that there is no evidential value from the studies of working memory training using treated controls. The authors concluded that working memory training programs appear to produce short-term, specific training effects that do not generalize to measures of "real-world" cognitive skills. These results cast serious doubt on the practical and theoretical importance of current computerized working memory programs as methods of training working memory skills (Melby-Lervåg, Redick, & Hulme, 2016). Similar results have been shown in other fields as well: improvement of trained components of cognitive function, but no far transfer effect in experiments about gamified visual training (Duyck & Op de Beeck, 2019) and about near-and far-transfer effects among children's executive function skills (Kassai, Futo, Demetrovics, & Takacs, 2019).

Thus, the idea of improving some abilities through the training of other abilities proves to be futile according to the results of modern research, based mainly on magical thinking and myths. It is doubtful that audio stimulation can improve communicative skills or that a sequence of simple movements can solve problems of reading, writing or calculating.

In the neuropsychological approach to correction and rehabilitation developed by A. R. Luria the whole activity is in the focus of attention and not a specific component.

> The aim of rehabilitation is functional reconstruction of the activity. After determining which links of the activity are disturbed, we try to determine which links remained untouched. In treating the disturbance, we try to use the remaining links, which we supplement with external aids to reconstruct the activity on the basis of a new functional system… During

> the process we try to find ways to give the patient as much feedback as possible concerning both the defect and its effect on the patient's actions. (Luria, 1979, p. 144)

Thus, the patient takes an active part in the process of achieving independent activity, without external help. Raising the activity to a conscious level the patient has an opportunity to develop new skills for problem solving to replace the lost ability.

When we undertake to assist a child struggling with learning problems, we also aim to develop additional skills (reading, writing, calculating) which later will become the basis for more complex cognitive activities. The main principle of neuropsychological correction is to help create a functional system for these skills, using strong components and finding an adequate replacement for the weak ones. In other words, we work with the complex activity instead of training nonrelated or weakly related skills.

The optimal organization of communication within the therapy group provides the conditions for the mobilization of creative activity in the patient's mental sphere, and personality and aids the growth of one's "mental growth" and self-perception. "The internal (the subject) acts through the external and in doing so, changes itself" (Glozman, 2004, pp. 148–149).

Returning to the musical myths, we can agree with Lauren Harris, that criticizing the myth of the Mozart effect we do not mean that music does not have importance for people of all ages.

> If it has not yet managed to enhance our ability to reproduce (I do not know of any reports that it improves fecundity), there are abundant signs that it can promote our learning and well-being in many other ways. For the vast majority, music surely does have strong hedonic powers — it does bring great pleasure… Music fattens neither the body nor the brain… It is not a panacea, an answer for every need or every individual, but what it can do seems reason enough to make it an integral part of our education and life experience. (Harris, 2019, pp. 131–132)

But references to neuroscience and the brain now crop up regularly in academic and pedagogical literatures in early childhood music education. Educators concerned about this recent "brainification" (a term coined by Vandenbroeck in 2014) of early childhood music education point out problems and pitfalls that can arise from this current enthusiasm for neuroscience narratives (Young, 2020).

Conclusion

In this paper we analyzed as an example only some of the most popular neuromyths that continue to influence people who do not have enough knowledge about brain anatomy and functions. It is especially important to increase caution in dealing with neuromyths because they are detrimental and persistent in education worldwide. *Brain-friendly*

learning is a new trend in school and university instructional practice. It can be seen that some myths are a result of careless analysis or presentation of experimental data by the researchers who then continue to produce new myths. We can love music, but our belief that music is enriching does not mean that listening to music promotes development of intelligence, especially if it is overused as a replacement for communication with a devoted parent or babysitter.

We can only emphasize the need of inclusion of neuropsychology as a compulsory course in teacher education. We consider a wider popularization of the Lurian systemic-dynamic approach as a kind of intellectual immunization against the spreading of neuromyths.

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Brain Plasticity and the Idea of the Functional System

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Нейропластичность и идея функциональной системы

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Abstract. The paper shows that the idea of brain plasticity underpins Luria's theory of the functional system and his approach to diagnosis and rehabilitation of brain-damaged patients. Although the functional system is frequently quoted in neuropsychological literature its important facets are as a rule overlooked or misunderstood. First of all, the functional system is not only composed of various often quite distant brain structures but it undergoes changes in accord with the arriving circumstances including chances and difficulties encountered by a given person. Accordingly, these alternations may be positive or may be enforced by brain diseases, which results in performing a particular function in different ways.

The notion of neuroplasticity was also incorporated in the works of Luria on development and culture. It should be noted that he stressed the role of social factors in the evolvement of cognitive processes with special emphasis put on social means of which he considered language to play the most important role. Luria argued that the use of these tools results in alternations in the structure and flow of mental functions both in children and in adults. It was exemplified in his experiments with twins and with inhabitants of remote villages in Central Asia. All his ideas have found confirmation in contemporary studies. First, all

mental processes depend upon the interconnections between neural clusters of changing patterns depending upon the nature of the task performed and the life experience of an individual. Second, the brain works depend to a considerable degree upon the organism as a whole a well as a social environment, which many authors link with the emergence and functioning of the mind. Third, the approach to diagnosis and remediation techniques that takes into account the feelings and life story of the patient is nowadays accepted not only in dealing with brain-damaged patients but also in the case of other disorders. Also, those traditionally labeled as somatic. In addition, we observe the revival of case studies in the scientific literature.

Keywords: *dynamic functional systems; brain plasticity; mind; development; environment; culture*

Аннотация. В статье показано, что идея пластичности мозга лежит в основе теории А. Р. Лурия о функциональной системе и его подхода к диагностике и реабилитации пациентов с повреждениями головного мозга. Хотя термин «функциональная система» часто используется в нейропсихологической литературе, но важные аспекты его трактовки, как правило, упускаются из виду или неправильно понимаются. Функциональная система состоит из различных, часто достаточно удаленных друг от друга структур мозга, но она может и претерпевать изменения в связи с возникающими обстоятельствами, включая трудности, с которыми сталкивается тот или иной человек. Эти изменения могут носить не только положительный характер, но и быть вызваны заболеваниями мозга, что приводит к выполнению той или иной функции различными способами.

Понятие нейропластичности также встречается в трудах Лурия, посвященных развитию когнитивных процессов. Следует отметить, что он подчеркивал роль социальных факторов в развитии когнитивных процессов, особо выделяя социальные средства, он считал, что наиболее важную роль играет язык. Лурия утверждал, что использование этих средств приводит к чередованию структуры и потока психических функций как у детей, так и у взрослых. Примером тому служат его эксперименты с близнецами и с жителями отдаленных сел Центральной Азии. Все его идеи нашли подтверждение в современных исследованиях. Во-первых, его утверждение о том, что все психические процессы зависят от взаимосвязей между нейронными кластерами изменяющихся паттернов, с учетом характера выполняемой задачи и жизненного опыта индивида. Во-вторых, его идея о том, что работа мозга в значительной степени зависит от организма в целом, а также от социальной среды, которую многие авторы связывают с появлением и функционированием разума. В-третьих, его подход к методам диагностики и коррекции, учитывающий чувства и жизненный опыт пациента, сегодня применяют не только при работе с пациентами, получившими повреждения головного мозга, но и у больных с другими расстройствами, включая те, которые традиционно обозначаются как соматические. Сегодня в научной литературе вновь возрождается интерес к анализу отдельных случаев подобных заболеваний.

Ключевые слова: *динамические функциональные системы; пластичность мозга; психика; развитие; окружающая среда; культура*

Dynamic Nature of Luria's Functional System

It often presumed that neuroplasticity is a newly discovered revolutionary phenomenon, while in fact it was reported already in the 1780s by the Italian anatomist Michele Vincenzo Malacarne. He trained one of the two birds from the same clutch of eggs and one dog from the same litter for several years. Afterward, he compared the brains of the trained and untrained animals and found that the cerebellum of the trained ones was significantly larger (Costandi, 2016). At the beginning of the 20th century an eminent psychologist and behaviorist, Karl Lashley (1923) was giving different motor tasks to a rhesus monkey and derived different motor maps in the motor area of its brain. The idea of the immutability of the central nervous system prevailed, however, to the end of the twentieth century when it was dispelled by the experiments of Merzenich and colleagues (Allard, Clark, Jenkins, & Merzenich, 1991; Merzenich et al., 1983, 1984).

It might be, therefore, worthy to remind that the idea of brain plasticity lays at the basis of both Luria's theory and his approach to clinical work. And it was formulated already in the first half of the 20th century. It is best expressed in his concept of a functional system. However, the review of neuropsychological literature shows that despite being generally known its important facets are often missing. First, its dynamic malleable character is quite frequently overlooked. Second, but equally important, are close links with social and cultural factors, and third, perhaps most significant is the tenet of Luria's approach to diagnosis and rehabilitation of brain-damaged patients. He expressed it clearly in his autobiographic book *The Making of Mind: A Personal Account of Soviet Psychology*:

> Truly scientific observation is not merely a pure description of separate facts. Its main goal is to view an event from as many perspectives as possible. The eye of science does not probe 'a thing' an event isolated from other events or things. Its real object is to see and understand the way a thing or event relates to other things or events […] it seeks out the most important traits or primary basic factors that have immediate consequences and then seeks the secondary or 'systemic' consequences of these basic underlying factors. *Only after these basic factors and their consequences have been identified can the entire picture become clear.* The object of observation is thus to ascertain a network of important relations. (Luria, 1979, p. 177–178)

This quotation reveals the essentials of syndrome analysis, which aims to delineate the basic defect linked to the damage of a specific brain area. Careful observation of the ways the patient is performing particular tasks and difficulties that might appear makes it possible to unveil a cluster of interrelating symptoms that constitute a syndrome characteristic of a dysfunction of the brain area in question.

It is also worth noting that a similar type of structured observation was also used by another great psychologist, Jean Piaget who christened it a clinical review. Fundamentals of that approach were summarized by Édouard Claparéde who wrote:

> This clinical method, therefore, which is also an art, the art of questioning, does not confine itself to superficial observations, but aims at capturing what is hidden behind the immediate appearance of things. It analyses down to its ultimate constituents the least little remark made by the young subjects. It does not give up the struggle when the child gives incomprehensible or contradictory answers, but only follows closer in chase of the ever-receding thought, drives it from cover, pursues and tracks it down till it can seize it, dissect it, and lay bare the secret of its composition. (Claparéde, 1926, p. xiv)

We have decided to give this rather lengthy quotation since it pertains to Luria's manner of examination. For him, syndrome analysis meant not only the evaluation of errors made by the patient, while performing particular tasks, but also the observations of the patient's strategies to overcome difficulties that appeared. It is a well known clinical fact that these difficulties often stem from compensatory mechanisms, which in effect distort a clinical picture of the illness. Hence, Luria's approach was focused on the patient, and the type and amount of help the patient needed to complete the task.

Claparède referred also to another significant aspect of a clinical method centered on the process. Namely, a requirement to elaborate the material gathered since such an approach leads to the abundance of available data. In the case of Piaget, it was his biological background that enabled him precise organizing and classifying different types of conversation. Luria was able to do it due to his medical qualifications. In fact, he applied rules and structure of medical history and incorporated psychological tasks making it possible to get a clear picture of neuropsychological symptoms.

Anyone, who had a chance to observe Aleksandr Romanovich performing a neuropsychological assessment, was deeply impressed by his art and craftsmanship. Especially, by his ability to come into close contact with the patient and to put questions that enabled revealing the true nature of symptoms observed. He also used to say that classical neurological examination is veterinary in its nature since neurologists seem to forget that we can learn a lot about a patient's difficulties while talking with him or her (personal communication).

Another significant tenet of the Lurian method arouse from his close contacts with two great Russian physiologists: Nikolai Bernstein and Pyotr K. Anokhin. Bernstein posited that all activities are complex and goal-oriented and require the interaction of multiple components controlled by the central organ. Due to the complexity of behaviors the control must be secured by a pattern of interacting factors of a functional system. At the same time, Bernstein (1961, 1967) emphasized the dynamic character of such systems in response to interactions of the organism with its surroundings. The idea of dynamic functional systems providing for adaptive behavior and supporting homeostasis in response to both internal and external changes that might occur was also proposed by Anokhin (1935, 1940, 1964). Also, Anokhin argued that functional systems are self-organizing nonlinear systems composed of many synchronized widely spread components. For our present considerations of particular importance is Anokhin's discrimination between simple and complex functions. An example of a simple function

is a production of bile by the liver while complex functions are in fact composite multiple processes of which mental functions are most typical exemplars.

Anokhin argued that all complex functions are composed of multiple elements and, thence, they cannot be localized in a specific brain area, therefore, their "localization" has to be distributed in its various parts. This assumption gave rise to the creation of the Lurian complex dynamic system composited of three basic blocks or subsystems. His theory of three functional systems is generally known so we shall not discuss it in detail. Of significance, however, is the above mentioned dynamic malleable character. It means that the structure of the Lurian functional system undergoes continuous alternations in accordance with changes taking place in the environment as well as in the organism itself during its maturation and development. This property of the system discussed is closely linked to the ideas formulated by Lev Vygotsky (Luria & Vygotsky, 1992; Vygotsky & Luria, 1930). Notably, Aleksandr Romanovich used to emphasize his intellectual debt to Vygotsky who was not only his collaborator but also a close friend. They both believed that observation of the manner of unfolding or disruptions of psychological processes provides an insight into their true nature revealing their real complex character.

The premise of the participation of each area of the brain in numerous functions is also frequently quoted as a basic feature of Luria's theory. Recent studies, however, assert that the dynamic systemic location of particular functions in the brain is organized into working assemblies of neurons that integrate individual neuronal nets. Such a "wiring diagram" has been called a connectome to emphasize the significance of connections between neural cells within particular neural nets and within the brain as a whole. Seung (2012) posits that four factors play a significant role in these processes: reweighting, reconnection, rewiring, and regeneration (defined as four R's): reweighting means strengthening or weakening connections among neurons; reconnection connotes creating and eliminating synapses; rewiring is attained by growing and retracting branches, and regeneration occurs as a result of creating new neurons and extinction of the existing ones.

It might, therefore, seem that Luria's model is a bit out-fashioned due to the level of knowledge about the brain work of that time. We can, however, find a statement referring to the "clusters of brain neurons" that get integrated into different functional systems in his book *Human Brain and Mental Processes* (1963a), at least in the original Russian edition. Moreover, Luria often stressed that the three functional units distinguished by him are created of smaller functional units and that the combination of all these units makes possible efficient functioning of the whole brain. He also argued that higher mental functions are the output of interacting and intervariable brain systems. It again is in accordance with the findings that different patterns of neural networks enable smooth flow of different processes (see Costandi, 2016; Doidge, 2007; Kaczmarek & Markiewicz, 2018; LeDoux, 2002).

The idea of systems consisting of interchangeable connections of different brain structures acting in accord with the particular action is closely connected with Luria's approach to neuropsychological assessment and the idea of a symptom. He stressed that particular symptoms may differ to a considerable degree when one or another link is bro-

ken since it results in the disruption of the whole functional system or its subsystems to be exact. It is another significant aspect of Luria's theory. The other is the idea that the work of the functional system is secured by the participation of all levels of the brain (Luria, 1963a, 1963b, 1973a, 1980).

We have focused on the above-described aspect of neuroplasticity since it is closely linked to Luria's theory and his clinical work. That is also the reason for presenting works of classic authors since their ideas lay at the basis of Luria's functional system. Other manifestations of neuroplasticity such as neurogenesis and glial plasticity are discussed in another paper (see Kaczmarek, 2020).

The Social Brain

The above-described studies show that tightly interconnected networks, which are responsible for performing particular functions, undergo continuous alternations. They encompass not only changes in neural connections but also the functioning of neural clusters (nets). These processes are affected to a considerable degree by our environment and all events that we experience during our life. It was neatly summarized by Marcus (2004) who stated that our brain is not wired but prewired. Indeed, it is not only prewired but also soft-wired since it undergoes continuous changes during our life-span (see Merzenich, 2013) The "wiring" depends to a considerable degree upon social and cultural factors, hence, the term the social brain has been coined (see Dunbar, 1998, 2016; Gazzaniga, 1985, 2012; Glozman & Krukov, 2013; Goleman, 2006; Graziano, 1967).

The impact of the environment upon the brain works is emphasized by many authors (e. g. Bao & Pöppel, 2012; Costandi, 2016; Dehaene, 2014; Johnson, 2017; Varela, Thompson, & Rosch, 2016). It is yet another feature of Luria's writing that found its confirmation along with the advancement of diagnostic techniques in neuroscience. As mentioned earlier, Luria and Vygotsky believed the human brain to develop and undergo changes as a result of social and cultural influences. These changes occur in two ways: (1) those related to alternations in the content and structure of cognitive processes Luria considered as mental plasticity, (2) the changes in brain structure mostly identified with neuroplasticity (see Mikadze, 2014). The role of environmental factors in these processes illustrate the following extract:

> In order to explain the highly complex forms of human consciousness, one must go beyond the human organism. One must seek the origins of conscious activity and 'categorical' behavior not in the recesses of the human brain or in the depths of the spirit, but in the external conditions of life. Above all, this means that one must seek these origins in the external processes of social life, in the social and historical forms of human existence (Luria, 1981, p. 25).

The impact of culture upon thinking was confirmed in field experiments performed by Vygotsky and Luria (Luria, 1971, 1979). The study found that illiterate inhabitants

of remote villages in Uzbekistan refused to solve syllogisms and other abstract problems and their reasoning was mainly based on their everyday experience. They were ready to discuss only the syllogisms drawn from their practical experience and describing familiar situations. When asked to classify the object presented to them, they took into account the relations between those objects occurring in real-life situations and not logical categories. Luria points out that those of them who undertook school education were able to accomplish such tasks. Similar results gave studies performed on Polish manual workers who also relayed on their personal experience when solving logical tasks (Tłokiński, 1995). For example, they explained the meaning of the proverb: *Make haste slowly* in the following way. "Well, that depends. It is good for work safety, but bad for work efficiency for productivity" (Tłokiński, 1995, p. 141; see also Kaczmarek, 1999).

Luria's findings were also confirmed by a group of psychologists in experiments performed in far-off places of the Kamchatka peninsula. In addition, one of the experimenters, Janna Glozman, noted a very important fact: "This tendency for situation-based generalization was more pronounced in nomadic herdsmen than in village inhabitants with the same level of education. So, the practical life conditions are more important for reasoning functioning than the level of education" (Glozman, 2018, p. 12).

The second expedition and its findings are quite well known but Luria (1931) also led a large group of psychologists during the first expedition to Uzbekistan. During that expedition, he concentrated on visual perception and "visual thinking" of nomads. He found that their processing of visual and spatial tasks differed from the abilities of educated persons. It showed that the influence of culture concerned also non-linguistics functions. As mentioned earlier the impact of social and cultural factors is nowadays emphasized by many authors, which allows the conclusion that one more of Luria's ideas has found confirmation with the development of neuroscientific studies.

Brain and Environmental Factors

This brings us to Luria's interest in socio-cultural and developmental psychology. He discussed the importance of social means, with special emphasis put on language, in both developing and shaping cognitive functions in many of his works (1928, 1971, 1976, 1981). First of all, Luria and Vygotsky (1992) believed the human brain to develop and to undergo changes as a result of social and cultural influences. Luria stressed that the social activity of a child has a considerable impact on the manner his/her cognitive processes are organized (Luria, 1961, 1976, 1981). He stressed the importance of a child's adaptation to the requirements of his surroundings pointing to its impact upon the maturation of the brain and asserted that this adaptation depends upon social environment and conditions to a greater degree than natural inborn processes linked to maturation. As mentioned earlier, he emphasized the role of tools the child has a chance to use and believed that language is the most significant "tool" enabling cognitive development, which is linked not only with functional but also structural neuroplasticity (Luria, 1961). A marked influence

of the children's environment on their cognitive development was presented in the book *Speech and the Development of Mental Processes in the Child* (Luria, & Yudovich, 1959). Two boy twins at the age of five, retarded in their cognitive development, were separated. The main reason for the separation was that they were using specific jargon to communicate and used mainly gestures to communicate with adults. The boys were enrolled to separate kindergarten groups. It resulted in the spectacular development of their speech abilities during the period of ten-month. Moreover, one of the boys was given special language training. As a consequence, his mental abilities were more developed than those of the untrained brother. For example, he was able to classify objects presented to him in accordance with the logical classes, while his brother organized the objects based on their irrelevant features. Accordingly, he put the red streetcar together with a carrot since they both were red. Moreover, the trained boy became an organizer of the activities that required planning, while before the training he was a subordinate to his physically stronger and less retarded brother. Similar results reported Douglas and Button (1978) who provided specific language training for two twin girls. Tskhovrebova (2018) reported that Luria and colleagues were conducting broader studies on monozygotic and dizygotic twins. They found that younger monozygotic twins (aged 5 to 7) were more similar between themselves in cognitive capacities than dizygotic twins, however, these differences were much smaller in older (aged 11 to13) twins (see also Bowden, 1971). It indicates the significance of the environment. In her paper Tskhovrebova (2018) also argues that Luria proposed "various modifications of twin method for psychogenetics" (p. 893).

Awareness of the impact of environmental factors upon genes has led to the creation of the new branch of science — epigenetics. Studies show that severe stress has a significant impact on the development and ability to cope with stressful situations of the off-springs of the individuals exposed to such traumas (see Carey, 2012; Francis, 2011). Also, it was observed that stress and depression lead to the hippocampus shrinkage due to the adverse reaction of its cells (Dokter & von Bohlen und Halbach, 2012; Duman, 2004; Duman, Malberg, & Nakagawa 2001; LeDoux, 2002; Sapolsky, 2004). Nowadays the new medications for depression treatment were created. These drugs stimulate genes to create new proteins that induce alternations in the level of neurotransmitters (Duric & Duman, 2013; Gerhard, Wohleb, & Duman, 2016; Medrihan et al., 2017).

At the same time, studies show that structural changes may relate to the development of new brain cells. Accordingly, the proliferation of new hippocampal neurons and an increase of the hippocampus volume in London taxi drivers were observed. Woollett and Maguire (2011) linked it with the necessity to memorize a complex map of the city addresses and routes. On the other hand, Maguire, Woollett, and Spiers (2006) reported no such changes in bus drivers probably because they drive a constrained set of routes. It allows the conclusion that neuroplasticity is linked both with alternations within neuronal circuits, neurogenesis, and epigenetic changes caused by environmental factors, which again is in line with Luria's approach to the brain works.

It might be also worth recalling studies that revealed the possibility of reconstructing neuronal circuits with the use of mental exercise. Pascual-Leone and colleagues (1995)

trained two groups of people in the skills of playing the piano. The first group was playing a five-finger piano exercise for two hours for five days while the participants of the other group were asked to imagine they played it during the same period. As a result, both the improvement of playing skills and changes in the cortical representation of the hand used in the exercise were observed in both groups.

Also, neuroimaging studies using positron emission tomography (PET) and functional magnetic resonance (fMRI) brought examples of structural alternations in brain networks induced by mental meditations (Brefczynski-Lewis, Lutz, Schaefer, Levinson, & Davidson, 2007; Davidson & Lutz, 2008; Lazar et. al., 2005; Lutz, Brefczynski-Lewis, Johnstone, & Davidson, 2008; Lutz, Greischar, Perlman, & Davidson, 2009; Slagter, Davidson, & Lutz, 2011; Telles, Singh, & Balkrishna, 2015). A meta-analysis on 21 brain imaging studies examining 300 meditation practitioners showed that:

> …eight brain regions consistently altered in meditators, including areas key to meta-awareness (frontopolar cortex/BA 10), exteroceptive and interoceptive body awareness (sensory cortices and insula), memory consolidation and reconsolidation (hippocampus), self and emotion regulation (anterior and midcingulate; orbitofrontal cortex), and intra- and interhemispheric communication (superior longitudinal fasciculus; corpus callosum). (Fox et al., 2014, p. 48)

Furthermore, Schwartz and Begley (2003) reported changes in the brains of patients with obsessive-compulsive disorder (OCD) after applying effective cognitive-behavior therapy. The changes were observed mainly in the orbital frontal cortex, the cingulate gyrus, and the caudate and manifested in a decrease of hyperactivity of these brain structures. These are structures closely linked to feelings, and needs, which are the main drives of all human beings. Not to look far, recent findings reveal that the human brain is directed toward historically beneficial goals, which is strictly connected with the sensation of pleasure. It may be best observed in various kinds of activities leading to addiction, which, at least at its first stage, are strongly connected with the activation of the brain reward circle (Volkow & Fowler, 2000). It was also observed that our brain shows greater plasticity to memorize the desired (rewarded) states (Kropotov, 2009).

Clinical Benefits of Brain Plasticity

The studies of Schwarz and Begley showed the significance of brain plasticity for the rehabilitation of individuals suffering from mental disorders, and thus are linked to a clinical tenet of Luria's work. As mentioned earlier, the very idea of the functional system assumed the possibility of its alternations in the case of brain damage. These alternations might occur spontaneously or require hard work of both the patient and his/her therapists depending upon nature and extend of the lesion. Thus, the idea of plasticity lies at the heart of Luria's approach to therapy of brain-damaged patients. Neuroplasticity also benefited patients who took part in a therapy program at the Cracow Rehabilitation Center un-

der the guidance of prof. Maria Pąchalska (Pąchalska, Kaczmarek, & Kropotov, 2014; Pąchalska, MacQueen, & Knapik, 1998). Spectacular improvement could be observed in Maria L., who suffered from severe motor aphasia and right-sided paresis as well as amusia after the brain stroke. It was very painful for her since she was a piano teacher before brain injury. At first, she was reluctant to take part in art therapy but after several sessions, she discovered that her painting skills were surprisingly good. An example of her painting abilities is presented in *Figure*. It is a copy of a picture produced by a prominent Polish artist, Stanisław Wyspiański, drawn after one year of rehabilitation. It had encouraged her to redouble her efforts to improve her piano skills. After several years of training, she was able to resume her work as a music teacher, which shows that brain plasticity is possible also in people over 60 years of age.

Figure. Helenka with a vase by Stanisław Wyspiański (right); a copy made by a patient of M. L. aged 60, after one year of rehabilitation (left).
Source: Clinical material of Maria Pąchalska (with permission)

Maria L. later produced many other works of art, both watercolors and oil paintings, but she kept them as a memento. We have decided to present this patient not only because of her newly acquired painting skills but also because she regained the ability to sing and to compose melodies as well as the improvisation capability. It should be emphasized that art therapy is only one of the components of the carefully planned remediation program, and many more patients have improved their motor and cognitive abilities in the course of this therapeutic procedure. Most spectacular is the case of patient W.W. who has become a renowned artist whose paintings are exhibited all over the world (see Kaczmarek, 2020; Pąchalska et al., 2013, 2014).

Conclusions

The above-described facets of Luria's works show that his ideas have found confirmation in the studies that benefited from the refinement of neuroimaging techniques. At the same time, we have tried to draw attention to these tenets of Aleksandr Romanovich that used to be overlooked or misunderstood. First of all, it concerns the notion of the functional

system and its complex, dynamic, and malleable character. Moreover, Luria (1973b) believed it to be a "*self-regulating system*" thereby ensuring the appropriate flow of mental activities. Siegel (2016) argues that:

> …self-organization is not dependent upon a programmer or a program. In other words, it is not caused by a specific something; it simply emerges. Self-organization is an emergent property of complex systems that simply arises as a function of complexity. As a self-organizing process, it is recursively shaping that from which it arises. (p. 49)

The idea of emergence is nowadays frequently raised in writings discussing the connection between the brain, mind, and consciousness (see Chalmers, 2010; Damasio, 2018; Dehaene, 2014; Graziano, 1967; Johnson, 2017; Koch, 2012).

The above remarks show that Luria's understanding of the functional system was very broad and multifaceted. Another manifestation of the complexity of his approach is neuroplasticity, which he did not limit to the reconstruction of the functional system as a result of brain disorders. He stressed its complex and adaptive nature closely linked with the individual life experiences and events that took place in the environment. As described earlier, this idea is now generally excepted and finds its reflection in the frequently used terms social brain or social mind (e. g. Boyer, 2018; Gazzaniga, 2012; Graziano, 1967; Kaczmarek, 2012; Steven & Fernbach, 2017; Tomasello, 2014). Awareness of the significance of social factors in the way the brain works is also reflected in launching an international journal *Social Neuroscience*.

It is really impressive that these ideas were expressed by Luria already in his first book (Luria, 1922/2003). Glozman (2020) quotes the following credo formulated by Luria in this work:

> — To deal with the concrete personality, the living human being, as a biological, social and psychological unity.
> — To study individual regularities, uniquely determined sequences, that is to combine a description of individual, unique processes with the study of lawful, regular processes.
> — To study an individual human mind as a whole and the particular mental phenomena as functions, elements of this whole, developing in this concrete human personality, with the possibility of change through the transformation of social conditions.
> — To study individual values of the examined psychological phenomena for the life of the actual personality. (p. 43)

Two additional aspects are highlighted here. Namely, the significance of taking into account the personality of an individual in neuroscientific studies. It is closely linked to contemporary studies on neuropsychological foundations of the self and identity (Feinberg & Keenan, 2005; Pąchalska, Kaczmarek, & Bednarek, 2020; Pąchalska, Kaczmarek, & Kropotov, 2020; Zaytseva et al., 2014). Another significant tenet is the notion of the wholeness of the mind. This idea has been developed by David Bohm (2002),

physicist and philosopher, who drew from the quantum theory to explain the principles of the work of the brain and mind. He stressed their close interrelationships, holistic nature, and the flux of action. Similar ideas were voiced by a number of prominent philosophers, and their ideas were summarized in the book under a telling title *Emergence: Contemporary Readings in Philosophy and Science* edited by Bedau and Humphreys (2008).

In sum, the above-presented data show that the scope of Luria's interests goes beyond clinical matters limited to diagnosis and remediation of brain disorders but encompasses basic problems of human existence. Naturally, captured from a psychological point of view. Moreover, his ideas are developed by researchers representing various branches of science also when they do not refer to his writings.

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Letters to Vygotsky: Thinking about the Cultural-Historical Psychology in the Contemporary Clinic

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Письма к Выготскому: размышления о культурно-исторической психологии в современной клинике

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Abstract. This article aims to make a tribute to Lev Semenovich Vygotsky and his contributions to Cultural-Historical Psychology in the contemporary psychological clinic. In order

to build these reflections, we chose the letter format, considering that Vygotsky, a lover of literature, shared his theory with his students, collaborators and co-workers through letters as well. We understand that psychological clinic has always been one of Vygotsky's interests, which has been expressed, for example, in the construction of the pedology and the defectology. Although Lev Vygotsky was not a psychotherapist in the models we know today, we identified that his concepts such as mediation, learning, and zone of proximal development among others can contribute significantly to the work in the psychotherapy field. With affection, we realize that Cultural-Historical Psychology is a current theory and presents itself as a great power in the field of psychotherapy. We suggest that clinical investigations should be done in this promising field.

Keywords: *cultural-historical clinic; clinical psychology; cultural-historical psychotherapy; cultural-historical theory; Vygotsky*

Аннотация. Цель данной статьи — показать заслуги Льва Семеновича Выготского в области культурно-исторической психологии и значимость его идей для современной клинической психологии. Данный посыл реализован авторами статьи в формате письма, поскольку Л. С. Выготский, будучи любителем литературы, также делился своими идеями с учениками, соратниками и коллегами с помощью писем. Психологическая клиника всегда входила в круг интересов Л. С. Выготского, примером может служить сформированные им основы педологии и дефектологии. Несмотря на то что Лев Выготский не был психотерапевтом с точки зрения современных моделей психотерапевтической практики, необходимо признать, что его концепции медиации, обучения, зоны ближайшего развития, а также многие другие могут быть значимыми при исследованиях в области психотерапии. В статье отмечается, что культурно-историческая психология — это актуальная теория, имеющая большой потенциал для психотерапии. Авторы статьи предлагают организовать проведение клинических исследований в рамках данного перспективного направления.

Ключевые слова: *культурно-историческая клиника; клиническая психология; культурно-историческая психотерапия; культурно-историческая теория; Выготский*

Dear Vygotsky,

Allow us to address you these words in such a close and affectionate way. The historical gap between our existences has placed us at very different moments of life. However, your genius, your revolutionary ideas, your passion for Psychology and your deep look at the human being in all dimensions are sources of inspiration and support for psychological practice even today, in the 21st century. The idea of talking to you in a letter is a tribute and, at the same time, a mediating resource for us to translate how your Cultural-Historical Psychology has supported our clinical practice.

This letter also allows us to get closer to a literary and poetic language, crossed by the art that you admired so much and that proved to have a relevant psychological function. It allows us to access subjectivity with great force and provokes peculiar emotions. Therefore, it also motivates our capacity for thinking, creating, imagining (Alessandroni,

2017), among other functions which are so essential for a full development of the person. In our clinic, art has been an important ally.

We understand by creativity activity the idea that it is a kind of activity which creates something new, it can be a representation of an object, or a construction of a feeling of the human being (Vygotsky, 2014). In this sense, there is no way to think about psychology and above all, clinical practice without this creative power that belongs to the human, and allows us to integrate the past, present and future.

The words here contained were written with extreme respect, care and accuracy. They are a reconstruction of your entire work, in the field of psychological clinic. It is beautiful to be able to enjoy in these words all the compilation inspired by your word and our experience with psychotherapy, encompassing concepts and understandings that our thoughts have passed through our subjective filters and through the sieve of a clinic that has always asked for passage. Vygotsky, my dear, you would be very proud of this passionate elaboration made by your faithful followers. From objectivity to subjectivity and from subjectivity to objectivity, the construction and reconstruction of concepts, the own and unique reading of each one of us, update and authenticate Historical-Cultural Psychology under the aegis of a Brazilian group that portrays it with faithful appreciation.

So, my dear Vygotsky, a clinic based on your theory is concerned with apprehending the phenomena in its social genesis, that is, how it is constructed, shared and revealed. After all, as Marx and Engels (2007) mention it, it is not consciousness that determines life, but the opposite. Consequently, the formation of the human psyche occurs in the material, historical and dialectical relationship with the objective conditions of life. This results in a clinic that goes beyond the illness and understands the psyche in a systemic structure as you explained when referring, for example, to mental illness what changes are not the functions and its structure, what changes is the hierarchy between them while the whole systemic process is affected (Vygotsky, 2015).

Your early death deprived us of many writings that would certainly be brilliant, but, at the same time, left relevant questions to be expanded in the field of Psychology. Among these issues, we have the psychotherapy practice. The clinic as care, as understanding of the whole human development and as intervening. We can see through your contributions that human process is qualitative and full of changing and transformation.

It seems strange to talk about Cultural-Historical Clinic. The most appropriate word is perhaps "approach." This statement is based on some reflections:

1. Psychology, as a body of knowledge taught in universities, had, for a long time, remained based only on classic approaches in the clinical field.
2. Your writings arrived late in Brazil and still have translation problems.
3. The initial appropriations of your theory took more place in the field of education.
4. Some views that affirmed about the non-social character of individual psychotherapy. In this sense, they say that a theory anchored in Marxism could not support the psychotherapeutic clinic.

5. The idea that you did not bring systematic work about the clinic.
6. The pedagogical clinic, that is, the children's clinic you did, was less studied in our context.

Dear master, we will highlight below our own reflections based on practical experiences as well as in the content of this vast work, which sweeps through all the concepts of your theory. Clinical practice in its theoretical line has been studied and developed by neoVygotskyan professionals, constituting a way of working structured on top of solid conceptual pillars, brought by you. If we consider that man develops through the relationships when he establishes with another human being (Vygotsky, 1994), we have as a basic premise that at least two humans are necessary for this relational assumption, the main component in a psychotherapy process and in any relationship that presupposes the other. Thus, the interaction between therapist and client constitutes the philosopher's stone within the Cultural-Historical Clinic. Then, we will, through the heritage of your work, dive together in this universe so unique and peculiar of the therapeutic relationship.

Your work is a theory of human development. As such, it is the basis for understanding and performing in psychological clinic. You and Luria have even developed studies and practices in psychiatry and neuropsychology. Subsequently, other authors, such as Leontiev, Zeigarnik, Rubinstein, Elkonin and many others, brought relevant themes to systematize clinical practice.

In the beginning, there were many doubts and concerns about whether Cultural-Historical Psychotherapy was possible. At the same time, there was a certainty that in science we need to dare, advance and expand knowledge and practices. When you say: that the knowledge is able to be reframed; for us, it means bringing new signs in light of the demands of a specific historical moment. I would love to tell you, my dear Vygotsky, the more we read your writings, the more we found a resonance with our idea of psychological clinic.

Firstly, the very idea that you brought in the work *Psychology of Art* (Vygotsky, 1999) that the social is not just a collective, it can be a single person with his deepest pains too. Therefore, the Cultural-Historical Clinic is possible in the most diverse formats: individual or in group psychotherapy, in the community, in Psychosocial Care centers and in other spaces. It brings, in its nature, a social dimension, as well as the human being that goes beyond its biological constitution and inscribes himself in the world through the conversion of culture into psychological processes. That is, organic and social nature can no longer be separated. Objectivity and subjectivity cannot be thought in a dualistic way. In the clinic, the subject and his complaint are situated in a personal/social history; the symptom is an expression of this subject seeking to deal with the difficulty, the limit, the pain. At the same time that it brings something of destruction, it has something about the possibility of construction. For this reason, the Cultural-Historical Clinic does not label, does not identify the subject as being "pathology."

Since the caregiver-baby relationship, there is already a need to create relational bonds to prevent delays, benefiting and optimizing the child's potential. Significant bonds are essential to promote the neurological and psychological development of human beings.

According to Fonseca (2013), we believe that bond is the first step towards intelligence (be it cognitive or emotional, if they unfold). Thus, it is essential that basic preventive guidance is provided, which can be widely disseminated in the public sector, on the importance of establishing relationships from the beginning: early in life. Through the bonds and the mediating language that transits within this relationship, the objective becomes subjective in a dialectical process, which begins with the other and, gradually, when it is signified, it says goodbye to the other, becoming ones own and independent (Vygotsky, 2015).

Considering the dimension of language that you have emphasized so much, the person can go on tracing a new path of himself and breaking with a reified subjectivity that alienates the subject from himself and the world. A clinic that allows the subject to appropriate himself of, even of what is expressed as illness. It is not the psychologist who is going to give you labels or be the owner of an absolute knowledge about the other.

From your studies, we saw that this process happens in this relationship with culture, by converting the external into the internal; which allows us to subjectify. About this, it is opportune to bring your word when you say:

> An interpersonal process is transformed into an intrapersonal process. All the child's developmental functions appear twice: first at the social level and then at the individual level; first among people (interpsychological) and, later, inside the child (intrapsychological) […] all higher functions originate from real relationships between human individuals. (Vygotsky, 1994, p. 57)

Your theory makes us look at ourselves also as subject mediators in the clinical process. This reminds me of your story brought by biographers when they say that everyone who lived with you in the work and gym settings emphasized your attitude of respect for others, your attentive listening and your ability to aggregate many around your ideas, without behaving in an authoritarian way. Also without losing your firm leadership. So, we are playing roles in the clinic. The clinic itself is a cultural invention, and the psychopathologies are expressions of times and ways of life in society (Zeigarnik, 1972). They don't come out of nowhere or are just the result of genetic arrangements. They are woven into multiple human relationships.

Following this point of view about contemporary clinic and human relationships, we want to understand how dialogical relationships promote human development. Leal (2003) mentions that it is in the "I-Other" relationship that the exchanges of sometimes "I", sometimes "You" occur. These exchanges that respect the alternate rhythm of the people involved, reconstruct and reframe reality building the human maxim: subjectivity. The indicated pause is important for a next initiative. Thus, we also launch these thoughts certain that the delivery of the transmission will fulfill its destiny, and reissue many other initiatives.

Many critics will say that the book *Psychology of Art* was one of Vygotsky's first publications. We believe it is an empty argument. There you were and nothing you wrote

was denied in your later works. So, we started to look at the clinic as a symbolic space for the production and transformation of meanings and senses. Space for languages and, therefore, for dialogue. The external mediating therapist facilitates internal mediations and new areas of development of the person in psychotherapy.

In this work, you speak of something fundamental for the psychological clinic; whatever the idea of transformation is. A word that contains powerful meaning and inspires us to think about the miracle of the human in search of producing himself as an active subject in the world. At that point, we remember your beautiful words when you wrote:

> The true nature of art always implies something that transforms, that surpasses the common feeling, and that same fear, that same pain, that same restlessness, when raised by art, imply something more than what is in them contained. And this something overcomes these feelings, eliminates these feelings, turns water into wine, and thus the most important mission of art is accomplished. (Vygotsky, 1999, p. 307)

Returning to your practice, precious teacher, when you emphasized that instruments, actions and social relations are presented to the child, in the first instance, on a social level and only afterwards the maturation is guided on an internal and subjective level, through the process of internalization, justifying the essential need for interpersonal contact to constitute human subjectivity, thus bringing the visionary and current way of understanding (Vygotsky, 1994).

For us, the most important is that cognition and affection as a unity present in all human development and activity. The concepts of emotion, subjectivity and perezhivanie must be studied as a generative system inseparable from the individual (Fleer, Rey, & Veresov, 2018). As you said yourself, there is no word without emotion (Vygotsky, 2004). You also stated that "emotions cannot be understood unless in the context of the whole dynamics of human life. Only then do emotional processes reach their sense and meaning" (Vygotsky, 2015, p. 414).

In the clinic, we see that every emotion can also be expressed, translated and brought to consciousness. In fact, consciousness as a central function defines the human being. For this very reason, it carries with it the contradiction that there are aspects that are not symbolized and remain unconscious. After all, you showed us that development is based on crises that do not necessarily bring the idea of something bad or harmful. These are moments when we need to live to advance new tasks in development. However, without favorable contexts and adequate mediations, they can also become moments of illness and stagnation (Wertsch, 1991).

In the relationship with the other, we seek to understand their internal world and the appropriation of reality that built their subjective world and, from this, we work what is within their reach. The questions to be developed must meet what each individual is able to accomplish, work and reframe and the Cultural-Historical professional must always be attentive to the degree of understanding and embodied experience in the person of his client. Master, your theory respects each one's internal and historical time. There

is nothing more eternal than the present, it reissues us, as expressed in your recently translated notebooks (Zavershneva & Van Der Veer, 2018).

As emphasized by you, the focus of the Cultural-Historical therapist must always be focused on the potential of your client and, in this way, we understand that it is essential to go to him, wherever he is, to support and guide him, being the mediator resting between the external and the internal environment. Its premise is that we walk together, therapist and client, side by side towards the internalization of meanings that make sense and that we can intercede helping in the process of appropriating reality through exchanges, leading to developmental and transforming goals, which well conducted will lead him to psychic independence.

In these discoveries, in clinical care at the University, we were advancing and faced demands loaded with psychological suffering in contexts of extreme social vulnerability. We saw that perejivanies took place in pain, in self-denial, in helplessness, in exclusion, in violence. So, my dear, it is the demand of a school service at a public university. As you have always emphasized, psychology investigates human development in its movement. So you and your collaborators make it clear that when studying the development of the infantile psyche, for example, we should start by analyzing how the child's activity is built in the concrete conditions of life. "Only with this mode of study can the role of external conditions of life, as well as the potentials that it has, be elucidated" (Vygotsky, Luria, & Leontiev, 1988, p. 63).

Children, adolescents, adults with the most diverse and urgent complaints urging for help. Thus, we were discovering how the approach was coherent and proposed a social, human and effective clinic to promote significant transformations in the lives of the users of the service where we work in. Mainly, when considering that the disease does not designate the subject, our focus is on the person. It is his autonomy and the production of himself as a subject in the world, aware of his potentialities, his possibilities and also of his difficulties, challenges and the issues that are of the order of the scenarios and the ways of life.

However, along this path, we missed more theoretical systematization, in order to actually build a praxis. Imbued with this desire, we began to study, investigate and reflect on our clinical activity. We discovered, on the way, that your theory allows us to create concrete instruments of mediation, mainly in psychotherapy. Thus, we have been developing our own ways of acting and facilitating therapeutic processes.

In this letter, we want to make it clear to you that we were always attentive to the epistemology that supported Cultural-Historical Psychology, when it was created, without losing sight of the look at the contradictions that emerged in this process. We also want to tell you that reinventing ourselves in psychological clinic can be understood from the tripod: need, motive and activity. We started from the need for a clinic according to a Psychology that understood man in movement, as already expressed by Silvia Lane (1999). A clinic committed to a Psychology that would break dualisms and fragmentations in the understanding of the human being. A Psychology that looked at the clinic as a body of knowledge at the service of the human as a being of creation, transformation, interaction, contradictions and differences.

Having this need, our motive or central engine in the Clinic was increasingly to build knowledge that would allow a practice that situates the subject as an integral health producer and aware of his roles in the drama within existence itself. Not as subjugated character, but as a protagonist who is capable of self-awareness and realizing reality with its complexities. For this reason, our professional activity in the clinic has been full of happy affections, questions, theoretical productions, debates and many ZPDs (Zone of Proximal Development).

This concept of a zone of near development is presented by Vygotsky (1994, p. 97) when he mentions that it refers to those "functions that have not yet matured, but that are in the process of maturation, functions that will mature, but are currently in an embryonic state." Still within this theme Valsiner (1984) points out that the ZPD consists of collective processes that lead to the development of new skills. Therefore, it is a symbolic field of actions that are only possible in social interaction, which is fundamental in a clinical process either in individual or group psychotherapy.

It is worth emphasizing that we are aware that your work has not escaped controversies, grievances and criticisms. Even from your time here, even taking you as a reference, there are different ways of situating your work. For us, this only further reinforces the richness of your legacy. So, we always take care to see if the historical and dialectical materialist essence of your work is maintained by the commentator. After all, we don't believe in neutral science. I imagine that if you lived in our time, you wouldn't believe in it either.

Concluding this letter, we can even remember the many letters you wrote to your friend Luria, many of them in the hospital bed with tuberculosis in an advanced stage. Even so, you expressed your commitment to not let die the Psychology you were creating and that crossed your life (Akhutina, 2003). This leads us to think that this Psychology was forged in the dialectic of fragility, expressed by the disease and in the strength expressed by the will, commitment, by the rich thinking. For us, it symbolizes the clinic. Place of listening and welcoming pain, joy, strength and weakness. Place of the human in its entirety and, as you highlighted, a being whose genesis is based on four planes: in the species, in its own development, in the social sphere and in the singularities of each person.

Dear Vygotsky, it was still necessary to systematize this journey, in order to share practices, reflections, memories and contribute to the strengthening of a clinic, based on the Cultural-Historical Approach.

We can assure that there are plenty of benefits in these words, because they reflect the potential of your theory applied in the clinic area. Our thoughts are the result of collective feelings, and we address them to you, with expressive beauty. We hope these contributions can be read as a portrait with appreciable biographical and historical value of those who knew how to address themselves to the master.

Finally, in order to be fulfilled, letters need to cross, so, we offer to deposit them (each one) at the master's feet, in his Museum in Moscow. *Letters to Vygotsky* will be there, fulfilling its intention to be delivered to the first and precious recipient.

Best regards, the authors.

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Comprehensive Study of Speech and Personal Changes in the Process of Logopsychotherapy

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Комплексное исследование речевых и личностных изменений в процессе логопсихотерапии

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Abstract. The article presents the results of a comprehensive psychological and neuropsychological study of speech and personality changes in the process of socio-rehabilitation

of different age groups of family logopsychotherapy. 29 subjects, aged 8–32 years, took part in the study. 18 of them were males and 11 were females. After the end of family logopsychotherapy, significant differences were revealed in their praxis, memory, and verbal functions. Significant differences were also found in the rigidity of the emotional state and self-esteem. Some differences between different groups of participants are explained by composition and format of work in different years.

Keywords: *stuttering; speech; personality; assessment; family group speech therapy*

Аннотация. В статье представлены результаты комплексного психологического и нейропсихологического исследования речевых и личностных изменений в процессе социореабилитации у участников разновозрастных групп семейной логопсихотерапии. Всего в исследовании приняло участие 29 человек в возрасте 9–32 лет, из них 18 мужского пола и 11 женского. Были выявлены значимые отличия в показателях функций праксиса, памяти и речи после прохождения участниками группы семейной логопсихотерапии. Значимые различия были обнаружены также по параметрам ригидности и самооценки эмоционального состояния. Были выявлены некоторые отличия между участниками разных групп, что связано со спецификой состава и формата работы в разные годы.

Ключевые слова*: заикание; речь; личность; диагностика; семейная групповая логопсихотерапия*

Introduction

As L. S. Vygotsky noted, "…any defect is not limited to an isolated loss of function, but entails a radical restructuring of the entire personality" (Vygotsky, 1983, p. 43). It is especially true for communication defects, as well of organic (aphasia) or functional (logoneurosis) or social (lack of development of communication skills) nature (Glozman, 2004).

The stuttering (logoneurosis) has a complex psychological structure (combination of speech fluency disturbances and of the patient's personality disorders) and can serve as a means for analyzing a whole range of speech practices (Karpova & Glozman, 2019). Modern ideas also emphasize the complex and systemic nature of this disorder, which includes biological, psychological and social factors. Respectively, the assessment should include an assessment of all these factors.

The specific feature of speech pathology in the form of stuttering is that in many subjects speech disturbance is not the major problem. Instead of this, its neurotic component leads to a complex "set" of communication problems (fear of speaking in public, shyness, increased anxiety about the attitude of others, suspiciousness). The mediating role of parents in the formation of the self-esteem of a child with stuttering also affects the restoration of impaired verbal communication (Karpova & Nikolaeva, 2020).

Therefore, remedial work with stuttering should be comprehensive and combine speech therapy, psychological and psychotherapeutic approaches. One of the scien-

tifically grounded systems in this area is group logopsychotherapy (Nekrasova, 1968, 1992, 2006) and the system of family group logopsychotherapy developed on its basis by Yu. B. Nekrasova and N. L. Karpova (Karpova, 1997/2003, 2011; Karpova, Volkova, Kruglikova, & Yanchenko, 2007), where parents and relatives are included in the rehabilitation work with stutterers at all stages.

We present the methodological aspects of assessing the effectiveness of restoring impaired verbal communication in people who stutter through evaluation participants of different age groups of family logopsychotherapy. Assessment took place before and after the course of social rehabilitation (Karpova & Danina, 2018; Karpova, Danina, & Elistratova, 2018). Results of many years of work with people who stutter are summarized in the collective monograph *Family group logopsychotherapy: A study of stuttering* (Karpova, 2011). Various psychological and pedagogical aspects of the problem of stuttering and its correction were discussed in it. In recent years, our approach to the sociorehabilitation of people of different ages who stutter is focused on the neuropsychological and psychophysiological research at all stages of logopsychotherapy.

The purpose of this article is to present the results of the study of speech and personal changes in the participants of family group logopsychotherapy in recent years.

Subjects

The subjects were the participants in family group logopsychotherapy of 2018–2020 with a total number of 29 people aged 8–32, of which 18 were males and 11 were females. Experts assessed the severity of speech and personality disorder on a 3-point scale, where 3 is the *maximum* severity of speech and/or personality disorder, 2 is *moderate* degree of disorder, 1 is a *mild* degree of disorder. At the time of the initial examination, before treatment started, 16 subjects (55.2 %) had severe speech disorder (score 2.5–3), 4 people (13.8 %) mild degree of speech disorder (score 1) were identified, the remaining 9 people had a moderate degree of speech disorder (score 1.5–2). According to the degree of personal problems associated with speech communication, 19 out of 29 people (65.5 %) had severe personality disorder (score 3), 10 had a moderate degree of personality disorder (score 1.5–2) and none had mild disorder (score 1).

Also, each group differed in its composition and characteristics.

Group 1 (2018): eleven 12–32 years old subjects, of which 8 were males and 3 were females (the average age of 21.1 years); with the traditional distribution of male and female participants (3 : 1). For the first time in our experience, 9 out of 11 people had a severe degree of speech and personality disorders (as mentioned above, it was assessed by experts).

Group 2 (2019): nine 13–27 years old subjects (4 males and 5 females, average age — 19.2 years); the peculiarity of the group is that for the first time in our practice there were 5 girls out of 9 subjects.

Group 3 (2020): nine 8–17 years old subjects (6 males and 3 females, average age — 13.9 years). This group consisted entirely of schoolchildren 9–16 years old. Because

of pandemic for the first time the treatment course at the active stage of family group logopsychotherapy was carried out in online format using Zoom platform.

Research Design

To conduct a comprehensive psychological and neuropsychological study, we did three assessments: before and after the main course of active family group logopsychotherapy and at the end of the control-supporting stage. The course program was adapted for this complex study. 26 of 29 participants completed the full course of social rehabilitation and all assessments.

The system of *family group logopsychotherapy* consists of 4 main stages:

Stage I — propaedeutic diagnostic stage lasts for 3–6 months and is based on dynamic psychotherapeutic assessment developed by Yu. B. Nekrasova for stutterers. It was extended and supplemented by N. L. Karpova for their family members.

Stage II is a session of emotional stress psychotherapy by K. M. Dubrovsky, modified by Yu. B. Nekrasova. In 1 to 1.5 hours, it removes the symptoms complex of stuttering through "personality reconstruction" in a frustrating situation.

Stage III — active family group logopsychotherapy — follows the Stage II and lasts for 3–4 weeks. The main goal of daily 8–9-hour classes is the formation of sanogenic (health-improving) mental states through their consistent evocation, prolongation and consolidation as persistent personality changes. The creative methods of bibliotherapy, symbol therapy, kinesiotherapy meet this purpose.

Stage IV — control-supporting stage — takes place in six months, lasts for 2 weeks and repeats the main elements of the previous stage at a higher level of complexity. It uses also new elements and methods (film and video therapy, etc.) (Karpova, 2011).

All subjects underwent *neuropsychological assessment* of cognitive (speech, memory, perception, reasoning), motor and neurodynamic functions before the start of active group work. We used the methods developed by A. R. Luria, with a quantitative (scoring) evaluation of the severity of defects (Glozman, 2012).

Psychological assessment — a study of the severity of speech and personal problems associated with speech communication. We evaluated the State and personal anxiety, rigidity and self-assessment of emotional states as well as the self-perception of communicative situations by participants before and after a course of family group logopsychotherapy. The following methods were used: State-Trait Anxiety Inventory (Spielberger, 1989), Rigidity Test (Levitov, 1977), Ricks-Wessman Test (Wessman & Ricks, 2004), Self-Characteristics Questionnaire by Yu. B. Nekrasova (1980), as well as the analysis of medical documents and independent experts method.

Comprehensive Study Results

Neuropsychological Assessment

The results of neuropsychological assessment are presented on an extended sample of 34 subjects: the data of 29 main participants are supplemented by data from 5 graduates of the groups of previous years who actively participated in the work helping newcomers. All subjects were divided by age into 2 subgroups: 8–19 years old (19 people) and 21–32 years old (15 people). The *Tables 1–3* present the results of the examination before and after the full course of speech therapy.

Table 1

Results of neuropsychological assessment. Average penalty scores for different mental functions

Age	Neuro-dynamics		Praxis		Speech		Gnosis		Memory		Reasoning		Total score	
	before	after	before	after	before	after	before	after	before	after	before	after	before	after
9–19	**.55**	**.45**	**.48**	**.21**	**.37**	**.15**	**.79**	**.34**	**.39**	**.09**	**.34**	**.20**	**2.92**	**1.44**
Dynamics in the subgroup	.11 (1.24)		.27 (2.30)		0.22 (2.43)		.45 (2.31)		.30 (4.30)		0,14 (1.68)		1.48 (2.02)	
21–32	**.30**	**.13**	**.19**	**.06**	**.38**	**.15**	**.13**	**.00**	**.37**	**.09**	**.13**	**.03**	**1.50**	**.47**
Dynamics in the subgroup	.17 (2.25)		.13 (3.30)		.22 (2.43)		0.13 (–)		.28 (4.10)		.10 (3.99)		1.03 (3.20)	

Table 2

Assessment of the significance in the dynamics of neuropsychological indicators according to the Wilcoxon sign rank test (subgroup 9–19 years old)

Statistical criteria	Summary of Wilcoxon signed rank test for related samples						
	neuro-dynamics	praxis	speech	gnosis	memory	reasoning	total score
Negative discrepancies	7	19	17	8	17	13	19
Positive discrepancies	4	0	0	0	0	1	0
Matching observations	8	0	2	11	2	5	0
Total score	19	19	19	19	19	19	19
W	27	0	0	0	0	3,5	0
Z	–.544	–3.839	–3.624	–2.555	–3.629	–3.119	–3.823
p	.586	.000**	.000**	.011*	.000**	.002**	.000**

Note. * $p < .05$; ** $p < .01$.

Table 3

Assessment of the significance of the dynamics of neuropsychological indicators according to the Wilcoxon sign rank test (subgroup 21–32 years)

Statistical criteria	Summary of Wilcoxon signed rank test for related samples						
	neuro-dynamics	praxis	speech	gnosis	memory	reasoning	total score
Negative discrepancies	4	13	12	2	14	8	15
Positive discrepancies	0	0	0	0	0	0	0
Matching observations	11	2	3	13	1	7	0
Total score	15	15	15	15	15	15	15
W	39	0	0	0	0	6	0
Z	–1.890	–3.194	–3.062	–1.342	–3.326	–2.565	–3.408
p	.059	.001**	.002**	.180	.001**	.010*	.001**

Note. * $p < .05$; ** $p < .01$.

Let's take a closer look at each of the indicators.

Neurodynamics. Neurodynamics variability depends on the age of the participants and negative trends are presented in the younger subgroup (up to 21 years old). In 56 % of the group participants, the neurodynamic indices did not change; in 32 %, it was positive, in 12 % — negative. However, when dividing into age subgroups, it was found that negative dynamics was observed only in the younger age subgroup (under 21 years old): 7 out of 19 had positive dynamics (37 %), 4 had negative (21 %), 8 had no changes (42 %). For comparison: in the older age subgroup (from 21 years old), there was positive dynamics in 4 participants (27 %), in 11 out of 15 (73 %) changes in neurodynamics were not found, neither were negative changes. In general, for both subgroups, the dynamics are positive. The penalty scores in the subgroup under 21: before therapy 0.55, after — 0.45; in the subgroup over 21 years old: before therapy 0.30, after — 0.13.

Thus, it can be concluded that fluctuations in neurodynamic status are mainly observed at the age of up to 21 years, and negative dynamics are observed exclusively in this younger subgroup. In subjects over 21 years of age, this function is stable and can be considered as an indicator of its maturity. There were no statistically significant differences in neurodynamic status before and after therapy.

Praxis. In 32 out of 34 subjects, noticeable positive changes in praxis were revealed, i. e. this function showed a significant ($p < .01$) positive dynamics after therapy. At the same time, there are significant differences in the subgroups in terms of the average penalty scores: the younger subgroup is characterized by significantly more pronounced disturbances in the sphere of praxis (in the subgroup under 21 years old: before therapy, 0.48, after — 0.21; in the subgroup older than 21 years before therapy, 0.19, and after — 0.06).

Speech. In 29 out of 34 subjects, we revealed positive changes in speech: improvement of prosodic, grammatical correctness and development of expressive speech, increased vocabulary, improvement of writing, i. e. this function showed a pronounced positive trend in the course of therapy. There are no age differences.

Gnosis. The picture is similar to that observed in neurodynamics. A pronounced predominance of disturbances of acoustic gnosis in the subgroup of subjects under 21 years was revealed. In 3 subjects with severe disturbances of acoustic gnosis, no positive dynamics is observed (average scores in the subgroup under 21: before therapy 0.79, after — 0.34; in the subgroup older than 21 years: before therapy 0.13, after — 0.00, i. e. complete normalization of the function).

Memory. Memory function during therapy showed high plasticity: in 31 out of 34 subjects positive dynamics (91 %) was revealed. No changes were found in the remaining 3. There were no age-related differences, and positive dynamics was strongly expressed in both subgroups ($p < .01$).

Reasoning. The predominance of disturbances of the intellectual sphere in the younger subgroup is noticeable. The dynamics in both subgroups is positive, but in the younger subgroup it is more pronounced (in the subgroup under 21 years old: before therapy 0.34, after — 0.20, $p < .01$; in the subgroup over 21 years old: before therapy 0.13, after — 0.03, $p < .05$).

Thus, we revealed the differences between the younger and older subgroups. The younger group consists in a greater number and greater severity of disorders in different mental functions. The largest number of disturbances are in the functions of praxis, memory and speech. Memory and speech disorders do not depend on age, and praxis disorders are noticeably more pronounced in the younger subgroup. At the same time, the therapy had the greatest effect on these three functions ($p < .01$): praxis, memory and speech — positive dynamics is observed in all subjects with impaired functions.

To a lesser extent, the subjects have intellectual defects, and although positive dynamics is clearly traced in both subgroups, it is more pronounced in the younger subgroup ($p < .01$) than in the older subgroup ($p < .05$). At the same time, disturbances of the reasoning are more pronounced in the younger subgroup, while in the older subgroup they are less common, less pronounced and respond well to the therapy.

Age-related differences can be seen in different mental functions with general positive dynamics after logopsychotherapy. The greatest dependence on age was shown by the functions of acoustic gnosis and neurodynamics. In the older group, these disturbances are rare, isolated and less pronounced. In the younger group, these disturbances are revealed in more than half of the cases. Acoustic gnosis in general shows positive dynamics in the course of therapy, although not very pronounced: for the younger subgroup, $p < .05$, and for the older subgroup, the differences before and after therapy are statistically insignificant. Neurodynamics is highly variable in the younger group, showing different directions: negative dynamics in 4 subjects, positive — in 7 subjects of the younger group. In the older group, this function is more stable. This explains the absence of statistically significant differences in neurodynamic scores in both subgroups before and after therapy.

Psychological Assessment

The positive results, revealed by the participants' neuroassessment were confirmed by the psychological assessment. We tested the differences in psychological values before and after the course of family group logopsychotherapy for participants in Moscow — 2018, 2019, and 2020 groups. The groups were compared using the Wilcoxon test, the data are presented in the *Table 4*.

Significant differences were shown between the values before and after treatment in the Rigidity Test in participants of all three groups ($p < .001$), as well as in the Ricks-Wessman Test ($p < .0004$). With regard to Spielberger Test, a significant difference was found only in trait anxiety in one of three groups, however, based on the analysis of more detailed data for each group, it can be concluded that there are corresponding tendencies for significance.

Table 4

Comparison of values in psychological questionnaires in the 2018, 2019, and 2020 groups

Questionnaire/scale	Average Values Group 2018	Average Values Group 2019	Average Values Group 2020
Rigidity *before* the course	.54	.58	.54
Rigidity *after* the course	.44*	.41*	.43*
Emotional state (Ricks-Wessman Test) *before* the course	24	23.89	24.18
Emotional state (Ricks-Wessman Test) *after* the course	27.67*	32.28*	28.09*
State anxiety (Spielberger Test) *before* the course	38.78	40.14	48.8
State anxiety (Spielberger Test) *after* the course	35.37	35.14	45.7
Trait anxiety (Spielberger Test) *before* the course	49.44	49.57	51
Trait anxiety (Spielberger Test) *after* the course	38.87*	42.71	46.67

Note. * $p < .05$.

The comparison of the mean values for the tests in three groups suggests that there are no significant differences between groups, that is the sample is homogeneous. Thus, despite the differences in ages and gender proportions, the different format (on or off line) of the treatment course during family group logopsychotherapy, in general, the studied characteristics of the subjects coincide.

According to the results of participants examination at the end of the active course of family group logopsychotherapy, 2 out of 16 (7 %) remained with a high degree of speech disorders (score 2.5–3). The moderate degree of speech defects (score 1.5–2) was noted in 10 participants (34.5 %); 9 subjects (31 %) had mild speech disorders (score 0.5–1),

8 people (27.5 %) achieved a fluent speech. According to the degree of personal disorders associated with verbal communication, with some improvement, 3 out of 19 people (10.3 %) had a high degree of personality disorders (2.5 points), 12 had a moderate degree (points 1.5–2), 14 people had mild degree (score 0.5–1). It should be underlined, that before the start of the course, all participants had severe or moderate personality problems. Thus, improvements in all indicators, both in speech and in personal disorders, occurred in all group members, and 27.5 % of the participants achieved fluency in speech as a result. This corresponds to the results of logopsychotherapy done by Yu. B. Nekrasova (1968).

Comparison of the dynamics of values by tests in all three groups deserves special attention (*Table 5*).

Table 5

Comparison of the dynamics of values of psychological questionnaires in the 2018, 2019, and 2020 groups

Questionnaire/scale	Average values Group 2018	Average values Group 2019	Average values Group 2020
Rigidity	–.1	–.17	–.11
Emotional state (Ricks-Wessman Test)	3.67	8.39	3.91
State anxiety (Spielberger Test)	–3.41	–5	–3.1
Trait anxiety (Spielberger Test)	–10.57	–6.86	–4.33

The comparison of the dynamics of values of questionnaires allows us to state some differences. For example, the 2018 group showed the strongest dynamics in personal anxiety by the end of the course compared to the 2019 and 2020 groups. Other most noticeable differences can be observed in the dynamics of values in the Ricks-Wessman Test (self-assessment of emotional states) in 2019 compared to other years. Rigidity indicators have similar dynamics in all three groups. Despite the fact that on the basis of such a comparison it is impossible to draw a conclusion about the reasons for these particular data, we can assume that the severity of speech and personality disorders, as well as the format of the group's work, are of great importance.

In addition to the quantitative study of the dynamics of scores in the group's members, qualitative methods were used — the Self-Characteristics Questionnaire. They allow one to see meaningful changes in the own representation of the speech problem. We have developed a categorical grid for content analysis of subjects' self-characteristics (*Table 6*). This categorical grid reflects both the content aspects of the texts (used words that are close in meaning) and the formal ones — the total number of categories, positively and negatively colored categories, categories denoting attitudes towards oneself and categories denoting attitudes towards speech.

Table 6

Analysis of self-characteristics of group members of 2018, 2019, 2020 years

	Most frequently used categories	Positive categories about oneself	Positive categories about speech	Negative categories about oneself	Negative categories about speech	Total
			2018			
Before the course	"Sincere," "good at home"	114	75	39	16	250 words / 119 categories (0.79)
After the course	"Calm," "treatment helped"	27	27	0	11	68 words / 45 categories (0.66)
			2019			
Before the course	"Kind," "insecure"	25	11	38	6	341 words /126 categories (0.31)
After the course	"Confident," "easier to speak"	10	7	0	0	112 words /39 categories (0.34)
			2020			
Before the course	"Kindness," "laziness"	32	15	9	3	225 words /123 categories (0.54)
After the course	"Confidence," "there is an effect"	13	18	3	0	85 words /38 categories (0.44)

It can be seen that the indicators in the three groups differ, maintaining the general trend towards a decrease in the number of words and categories *after* rehabilitation, especially negative ones. In the 2018 group, negative categories about speech remain after working in the group. In 2020, negative categories about oneself remain. This result can be associated with significantly more severe speech disorders in 2018-year participants and the online work of the group's in 2020. The overall results for all three groups are presented in *Table 7*.

A general decrease in both positive and negative categories in relation to the person himself and his speech after completing the course is evident. It can be assumed that the adequacy of self-perception of participants will increase by the end of work in the system of family group logopsychotherapy.

Table 7
Overall results of self-assessment in categories by groups 2018, 2019, 2020

	Positive categories about myself	Positive categories about speech	Negative categories about myself	Negative categories about speech
Before the course	171	101	86	25
After the course	50	52	3	11

Discussion

Numerous studies of stuttering suggest the neuropsychological basis of speech impairment. So, within the functional system of speech, the violation of the mechanism of readiness for speech contributes to the formation of stuttering (Glozman, 2004). Adult stutterers show increased activity in parts of the right hemisphere and abnormal coordination between areas of the brain that plan and execute speech function (Glozman, 2019).

This is consistent with the results of the presented study. We have shown that the subjects of the younger subgroup under 21 years of age differ initially having more pronounced defects (the total score is three times higher than that of the older subgroup) in praxis, gnosis, reasoning, neurodynamics (including large fluctuations in neurodynamic state), and show less pronounced positive dynamics during therapy for all functions. Subjects over 21 years of age have initially a less pronounced defect, more stable functions (when compared before and after therapy), lack of negative dynamics and have a significantly more pronounced positive dynamics in all functions during therapy, except for speech and memory, where the dynamics is equally high in both subgroups. This picture can be explained by the maturity of the central nervous system and of coordination between brain regions in subjects over 21 years old, and the higher positive dynamics of the older group is a consequence of the developed HMF (Higher Mental Functions), which makes it possible to implement compensatory mechanisms and of a greater social experience in surmounting problems.

We reviled a significant correlation between the degree of stuttering/personality problems with the total score of neuropsychological examination and with the score for speech defects (Glozman, Karpova, & Cheburashkin-Antipov, 2018a). The degree of personality problems (according to expert assessment) significantly correlates with the score for praxis, memory, gnosis, and reasoning in neuropsychological examination. This connection is reasonable and confirmed by practical experience of working with severe cases of stuttering, but the nature of this connection has not yet been established. We assume that personality and speech disorders have common factors and reinforce each other in ontogenesis (Glozman, Karpova, & Cheburashkin-Antipov, 2018b).

The relationship between the severity of communication defects and the quality of life and indicators of mental health in various age and nosological groups has been experimentally proved. The mobilization of personal resources in the groups of family speech psychotherapy contributes to the overall positive dynamics of mental health indicators. This is achieved through a system of creative functional learning in various situations of verbal communication, where new methods of self-regulation and effective communication are purposefully developed, formed and automated (Karpova & Danina, 2019). Our research also confirms the efficiency of the integrated approach to restore the impaired verbal communication in the family group logopsychotherapy (Karpova, 2011; etc.).

Conclusion

A comprehensive study of speech and personality changes in the process of speech psychotherapy shows evident positive dynamics of indicators reflecting neuropsychological, verbal and personal changes in group members. In general, we can state the homogeneity of the psychodiagnostic data before the start of treatment, regardless of the sex and age differences of the participants. At the same time, neuropsychological indicators differ in the groups of younger (under 21 years old) and older participants, which is a natural consequence, given the heterochrony of maturation of the studied functions in the process of ontogenesis.

Neuropsychological assessment showed that functions such as praxis, memory and speech are the most impaired in stuttering, and they show the most pronounced dynamics after undergoing a course of family group logopsychotherapy.

Personality assessment showed significant differences between the participants values before and after treatment in the Rigidity Test in all three groups ($p < .001$), as well as in the Ricks-Wessman Test ($p < .0004$), but not according to the Spielberger Test (with the exception of the 2018 group, which had the most severe personality disorders at the time of treatment).

Thus, in the course of a complex, multifaceted, but at the same time methodologically structured work, not only speech amelioration is achieved (a decrease in the intensity and frequency of stuttering), but also significant personality changes are observed (attitude to speech communication, the level of logo phobia, adequate awareness of speech defect, perception and behavior in critical situations, the level of egocentrism, using coping strategies, communication skills and other parameters of speech communication that are significant for stutterers).

It can be argued that the system of creative functional training in various social conditions of communication with the active participation of parents and relatives of stutterers has a beneficial effect on the possibilities of verbal communication in subjects.

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Limitations

The limitations of the study are related to the small sample size and the inability to control the gender-age influences. Besides, a significant limitation is the lack of a control sample for a full controlled randomized study of the effectiveness of family group logopsychotherapy.

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Personal Attitudes of Young Men Prosecuted for Commission of Sexual Offences

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Установочно-смысловые детерминанты у юношей, привлеченных к уголовной ответственности за совершение сексуальных преступлений

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Abstract. The problem of attitudes of a person who commits sexual crimes is of particular interest to personality psychology, since it does not contain open destructions and signs of personality disorders. The purpose of the study is to identify the features of the installation and semantic determinants in young men brought to criminal responsibility for committing sexual crimes. Personality attitudes are stable psychological processes that cause not only stable, but also reactive behavioral reactions. The attitudes associated with values and meanings and laid down in adolescence are guiding in relation to oneself and others. The research presents data demonstrating the semantic determinants of young men convicted of sexual crimes undergoing the procedure of clinical and psychological examination. A qualitative analysis showed that young men accused of committing sexual assaults are already initially inclined to interpret the gestures of their communication partner as more aggressive than their own. The leading attitude that the partner is more active and initiative in communication and

that they are responsible for the emergence of problems and conflicts, creates the basis for a hostile perception against the background of the value of "friendly relationship." The results of the study allow to conclude that one's own destructiveness acts as an attempt to resist the pressure of a partner, no matter who they are (male or female). The low level of their own communication activity, suspicion are the basis of the attitude to transfer responsibility for interaction to the communication partner.

***Keywords**: personal attitudes; value orientations; personal semantic orientations; aggressiveness; suspicion; conflict; sexual offences*

Аннотация. Проблема установок человека, совершающего сексуальные преступления, представляет особый интерес для психологии личности, поскольку личностные установки не содержат открытых деструкций и признаков расстройств личности. Цель исследования — выявление особенностей установки и смысловых детерминант у юношей, привлеченных к уголовной ответственности за совершение преступлений сексуального характера. Личностные установки — это устойчивые психологические процессы, которые вызывают не только устойчивые, но и реактивные поведенческие реакции. Установки, связанные с ценностями и смыслами и заложенные у человека в подростковом возрасте, являются руководящими по отношению к себе и другим. В исследовании представлены данные, демонстрирующие семантические детерминанты молодых мужчин, осужденных за сексуальные преступления и проходящих процедуру клинико-психологического обследования. Качественный анализ показал, что молодые люди, обвиняемые в совершении сексуальных посягательств, уже изначально склонны интерпретировать жесты своего партнера по общению как более агрессивные, чем их собственные. Изначальная установка на то, что партнер более активен и инициативен в общении и что он несет ответственность за возникновение проблем и конфликтов, создает основу для враждебного восприятия на фоне ценности «дружеских отношений». Результаты исследования позволяют сделать вывод, что собственная деструктивность выступает как попытка противостоять давлению партнера, кем бы он ни был (мужчиной или женщиной). Низкий уровень собственной коммуникативной активности, подозрительность обусловливают передачу ответственности за взаимодействие партнеру по общению.

***Ключевые слова**: установки личности; ценностные ориентации; смысловые ориентации личности; агрессивность; подозрительность; конфликтность; сексуальные преступления*

Introduction

At the current stage of humanities knowledge, development the researchers' attention is focused on interdisciplinary phenomena, characterizing a human as a sovereign individual. These phenomena are reflected in such concepts as readiness to decide, autonomy and self-determination, resiliency, rational efficiency and other phenomena, disclosing mechanisms of human self-realization. These categories have a common denominator.

It is a human capability, based on internal control and value-semantic orientations of behavior in the broad context of life implementation and individual internality. The central issues for personality psychology are the issues of human decisions and actions. It is determined by different factors of human nature including human being (Asmolov, 2002; Remschmidt, 1994).

The diversity of psychological approaches to solution of these issues is connected with the diversity of perceptions about a human and an individual (Stepanova, 2010). According to Vygotsky, the core concept is that "acquisition of own behavior by various means" is an essential psychological characteristic of the individual and "the decision is the most specific for acquisition of own behavior" (Vorontsov, 2014, p. 11).

The problem of mental reflection selectiveness is showed in Vygotsky's work. It is considered that a human always makes a choice and all mental health is based on it. In the context of positive side of mental health, it is based on an intentional attitude toward subject (Vygotsky, 1983). Any of psychological concepts, even ignoring the principle of activity, implicitly contain the idea about a human, who has to make a decision (Rerke & Glazkova, 2019; Praizendorf & Morozova, 2019; Tarchenko, 2019).

The attitude of an individual committing criminal acts is the problem, which is particularly relevant for modern personality psychology. Not only the number of crimes is increasing, but also the severity of committing offences. It is always considered that a person, who don't have any psychological disturbances, make own decisions (Ford Kellan & Beach Frank, 2001; Bratus, 1988; Bruno, 2019).

The offences connected with actions of sexual nature are related to special category of personality problems originating from family relations. In case, when offences are committed by young men from non-needy families, it is necessary to see the reasons particularly (Dozortseva, 2000; Klochko & Galazhinskiy, 2009, Kudryakov, 1996; Kuznetsova, Abramova, Efremov, & Enikolopov, 2019). Unified determinant, reliance on opinion of legal psychology about personality characteristics of criminals, who are convicted of committed sexual offence, is unlikely to help practical psychology choose an effective way of preventing and correcting of personality disorders.

Methodology and Methods

The research about personal attitudes of young men, who are prosecuted for commission of sexual offences, is based on general methodological foundation of the theory about culture-historical personality development and psychical functions (Vygotsky, 1983), the general principles of psychological activity theory (Leontiev, 1997; Rubinstein, 2007): the principle of the unity of consciousness and activity, the principle of object-orientedness, the principle of the unity of affect and intellect, the principle of internalization and externalization. According to Vygotsky's works and other researchers as E. V. Galazhinskiy and B. E. Klochko (2009), A. A. Kirikov (2017), O. V. Lukyanov (2007), our work is included the concept of the individual as culture-historical and

meaning system process, process of selective and directive human interaction with social environment and self-interaction.

As practical aspects the research is based on the idea of active and meaningful nature of consciousness (Vygotsky, 1983; Zhdan, 2008), the theory of attitudes, understanding of attitudes and adjusting meaning regulation role in the sustainability management (Asmolov, 2002), the idea of subjectivity as an essential personal characteristic, the conception of world vision as comprehensive meaning system of human including subjectivity in the capacity of core integrative principle (E. U. Artemeva, V. P. Serkin, S. D. Smirnov), understanding of a personal choice as an act of uncertainty resolution (Kornilova & Smirnov, 2019; Leontiev, 1997). The research is carried out by taking into account scientists' ideas of depth psychology (G. Allport, V. Frankl, R. May, A. Maslow, C. Rogers) about individual decision and responsibility in human's life, the concept of humans as optional creatures, that are able to analyze themselves (Korzhova, 2006; Rerke & Glazkova, 2019; Yunusova, 2008). The research works of psychoanalytic tradition about the law of psychosexual stage, mechanisms of normal or neurotic personal conditions within the framework of human capability to make own decision, were taken into consideration.

In total, 135 young men, aged 17–20, took part in this research. Male minors accused of committing sexual assaults: mainly rape (Article 131 of the Criminal Code of the Russian Federation), violent acts of a sexual nature (Article 132 of the Criminal Code of the Russian Federation), and in 7 cases by a combination of articles. The study was carried out as part of forensic psychological evaluations and clinical and psychological examinations at the Nizhnevartovsk Neuropsychiatric Dispensary (as part of the Program of Psychological Support for Young People from 2018).

Research methods were chosen due to the aim, especially identifying of personal attitudes: questionnaire, the Rokeach Value Survey (M. Rokeach), the Test of Life-Purpose Orientation (D. A. Leontiev), the Ratio Level of Value and Availability in Various Life Spheres (E. B. Fantalova), the projective technique Hand Test (Kurbatova & Mulyar, 2001); *U*-Mann–Whitney test, *W*-Wilcoxon test.

The Results of Research

Two groups participated in the study: 1 group, young men convicted of committing sexual crimes, 2 group "norm." The results of questionnaire survey showed that young men committed sexual offences consider that they were accused unfair and committed these offences with partner agreement (50 %). 100 % of young men confirm that a man takes the lead in sexual relations. So that a woman can be emotionally distant from a man, although she wants to have a relationship with a man. Forcing and insistence are taken as a game in sexual relationships.

The results obtained on the Rokeach Value Survey demonstrate the lack of values shape (97 %). According to psychological interpretation, the unformed value system is an argument of personal immaturity. It means that young men committed sexual of-

fences have contradictory in value orientations. It entails inconsistence and unpredictability of human behavior. Immaturity of value orientations defines infancy, domination of extrinsic stimulus in personal behavior and therefore conformism and anonymity. The lack of formed value orientations describes a person as immature.

The results of the ratio level of value and availability in different life spheres 1 group, young men convicted of sexual offences (E. B. Fantalova) are shown in *Table 1*.

Table 1

The results of learning "value" and "availability," group 1, average values

Variables	Value	Availability	Difference between Value — Availability
Active life	3.3	6.3	–3
Health	8.9	4.1	4.8
Interesting job	5.3	5.3	0
Beauty of nature and art	3.4	7.5	–4.1
Love	6.6	5.8	.6
Material wealth	7.4	2.7	4.7
Having loyal friends	6.2	5.7	.5
Self-confidence	5.4	7.1	–1.7
Cognition	2.7	5.9	–3.2
Freedom as independence of actions	5.6	6	–.4
Happy family life	10.1	6.9	3.2
Creative work	1.2	2.7	–1.5
$R = \sum \lvert \text{Value} - \text{Availability} \rvert$			27.7

Analyzing the results, it is shown that the most valuable spheres are love and having good friends — 40 %, material wealth — 50 %, health — 26.7 %. This is due to the fact that love and having good friends are the main life spheres for young men from group 2 (norm). Besides, they also consider that the main condition is material wealth.

The least important life spheres are art, cognition, active life and beauty of nature. But the most available spheres for them are beauty of nature, active and happy family life, self-confidence.

The next stage was the research method, identifying young men's attitudes and actions.

The researchers of this method have a theory that the total number of responses is connected with having so called *tendency to action*, which reflects action potential and personal degree of activity. Young men prosecuted for commission of sexual offences have a low level of activity (on average 14.73 — high frame of low values). Moreover, they describe their friends as more active than themselves (22.43 and 19.15). The total number

of responses, which are shown in other three interpretations, is lower ($p \leq .05$), although in quantitative terms action potential is found in female gestures interpretations.

It is worth mentioning there is intensity of attitude to communication, which points to person's communicative activity. In interpretations of male partner's, female partner's and enemy's gestures the reactions are in the ratio 3 : 1. But in own and friendly gestures interpretations it is in the ratio 1.5 : 1, that is below normal for adolescence aimed at communication.

As a result, it demonstrates that young men show a tendency to attribute high activity and initiative to strangers (men or women) and enemies.

The group of young men prosecuted for commission of violent offences is characterized by an average level of psychic activity. It was identified from higher total number of responses (the amount of responses is on average 22.20). However, significant difference in the number of different subjects' responses wasn't identified. There is also a high level of communicative activity: it is in ratio 3 : 1, that points to high interest in communication.

The average values of attitudes common rate have negative sign, that show attitudes to conflict behavior.

The next stage is the qualitative research in interpretations of nonverbal behavior. The research results of the men's group prosecuted for commission of sexual offences, are shown in *Table 2*.

Table 2

Group values of interpretation of gestures of young men convicted of sexual crimes, average values

Interpretation of gestures	Agg	Dir	Com	Aff	Dep	F	Act	Pas	Des	Ex	Crip	Ten
Own	17.14	20.52	7.66	8.65	3.43	3.65	9.40	12.57	9.57	2.06	4.03	1.31
Partner	29.28	21.38	18.07	3.17	2.95	1.81	15.98	1.12	1.46	4.58	.19	
Woman	28.77	22.25	15.35	3.24	5.10	2.61	10.82	3.38	2.23	5.67	.57	
Enemy	29.43	21.21	18.00	2.88	2.87	1.52	16.59	1.15	1.46	4.90	.00	
Friend	10.32	18.10	9.01	16.60	7.14	3.90	7.54	14.05	8.20	1.37	3.78	
Average	**22.75**	**20.78**	**13.08**	**7.73**	**4.46**	**2.70**	**12.06**	**6.42**	**4.58**	**3.72**	**1.71**	

Note. Agg, Dir = readiness for an open aggressive behavior, unwillingness to adapt to the social environment; Com = readiness for communication; Aff = the ability for an active social life, the desire to cooperate with other people; Dep = the need for help and support from other people; F = ability to resist open aggressive behavior; Act, Pas = social sensitivity, sensitivity in interpersonal relationships, human anxiety; Des = emotional ambivalence, a tendency to contemplate, comprehend, experience; Ex = correlates with hysterical personality traits, with an indefatigable and persistent desire to be in the center of events; Crip = feeling of physical inadequacy, fear of one's own weakness or physical disabilities; Ten = personality anxiety or "neuroticism."

This table demonstrates that young men have high level of similarity between own interpretation and friendly non-verbal behavior interpretation ($p \leq .05$).

On the other hand, the interpretations of enemy's gestures have the same similarity because it's connected with an abstractive partner and a woman ($p \leq .05$). The results are presented in graphs in *Figure*. So that both strangers and women are perceived as enemies, but friends are identified with themselves.

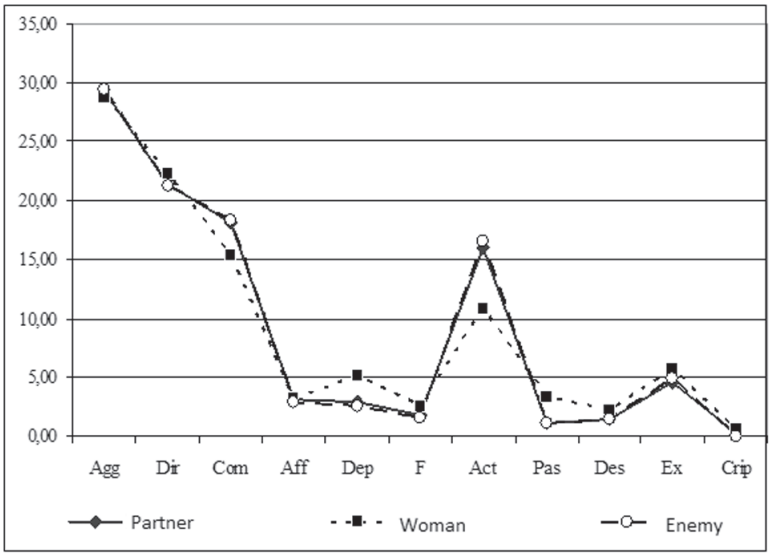

Figure. Indicators of Hand Test in different interpretations, such as partner, woman and enemy gestures. The vertical axis is an indicator of aggressiveness. Decoding of scales see *Table 2*

The qualitative research of certain indicators shows that young men accused for committing sexual offences have a tendency to interpret partner's gestures more aggressive than their own. The indicator of partner's aggressiveness is higher than the comparable indicator in own gestures interpretation ($p \leq .05$). Aggressiveness, attributed to an enemy, is much higher. The lowest indicator of this category is in friend's gestures interpretation. The significant difference and other indicators gain 99 % level in other interpretations.

It is believed that the results are explained with the effect of defense mechanisms. The young men of this group attribute activity and initiative of communication to others (strangers, women, enemies). So that they are responsible for problems and conflicts. Their actions lead to the high level of destructiveness. Their own destructiveness is an attempt to resist aggressive actions of other people.

Meanwhile, these men have higher level of gestures directive estimation than the indicator of aggressiveness, according to their own and friend's gestures interpretations. The number of directive responses is about the same in all interpretations, but the difference is within a range of statistical uncertainty. In men's opinion, interaction, including

in the category of directiveness (psychological pressure, commands and instructions) plays an important role in any communication.

In fact, these men have a low percentage of responses in the category of communication (*group averages* are 13.08). Moreover, there is the lowest communication estimation in own gestures interpretation and the highest in stranger's and enemy's gestures interpretation ($Com_{stranger}$ = 4.96; Com_{enemy} = 18.35; $p \leq .01$). The same indicator of friend's gestures interpretation is also lower than interpretation of abstractive partner's, woman's and enemy's nonverbal behavior ($p \leq .05$). They have a tendency to interpret own and friendly gestures as showing emotions to other people (Aff_{own}= 10.15; Aff_{other} =14.82). They have a high level of fears (F_{own} = 3.97; F_{other} = 3.79). But these indicators (Aff_{own} = 6.57; F_{enemy} = 1.78) are lower in partner's gestures interpretation than in own gestures interpretation ($p \leq .05$).

Interpretations of own and friendly gestures have a high percentage of responses in the category of *inactivity* (Pas_{own} = 11.53; Pas_{other} = 14.05) and *characterization* (Des_{own} = 10.77; Des_{other} = 8.47). But interpretations of partner's and enemy's nonverbal behavior have more responses estimated by the category *impersonal activity* ($Act_{partner}$ = 18.20; Act_{enemy} = 15.76). Besides, interpretations of partner's and enemy's gestures have higher responses rate in the category of *ostentation* ($Ex_{partner}$ = 4.81; Ex_{enemy} = 4.35). There is a small percentage of responses in own gestures interpretations, but interpretations of friend's gestures have a low level (the indicators are 0.71 *и* 2.14). So, a partner is a person, who is aggressive, more active and readier to demonstrate own domination. These young men consider that their own nonverbal behavior is passive, emotional and filled with fears.

What is interesting in this data is that the interpretations of one's own and friendly gestures reveal a large percentage of responses in which the "hand" is perceived as damaged (sick, crippled, deformed). As noted by T. N. Kurbatova and O. I. Mulyar (2001), this fact indicates a concern about the appearance and the impression that the subject makes on others. While the corresponding indicators in the interpretation of partner and enemy gestures are low.

Thus, the analysis allows us to conclude that a group of young men accused of committing sexual assaults shows a generally negative attitude to communication, a low level of communicative activity and insufficient communicative competence. The complex of these manifestations is the basis of the attitude to transfer responsibility for interaction to the communication partner.

Conclusion

The study of the set-semantic determinants of young men convicted of sexual assaults and undergoing a clinical and psychological examination showed that the majority have negative attitudes towards the other, with signs of protective ones. Thus, the revealed high level of suspicion in relation to a communication partner, a high level of rivalry and readiness to resist, is associated with the attitude towards greater activity of the partner

and readiness to resist the conflict. Even before entering into interaction with other people, the attitude of young men that the other is inclined to manifest open aggression affects the character and style of communication. When engaging in communication, young men tend to interpret the non-verbal behavior of a stranger as hostile. At the same time, the image of the enemy is formalized: it is perceived by them as a real threat — an active aggressor, ready to demonstrate his superiority and incapable of manifesting positively oriented reactions.

Despite the existing lack of trust in another young man, accused of committing sexual assaults show a high interest in sincere emotional contacts, as evidenced by the values identified in them (the value of *having friends* is 40 %). Summarizing the data obtained, it is now possible to state that only those who fulfill certain conditions can count on a positive emotional attitude, according to the group of studied young men. These conditions can be traced in the interpretation of the gestures of the other: the absence of aggressiveness, the active expression of a positive emotional attitude and the ability to empathize. The attitudes and interpretation of a woman's non-verbal behavior reveals similarities with the interpretation of the enemy's gestures. That is, in the minds of these young men, a woman is aggressive, dominant, active and, ultimately, hostile. It can be assumed that young men accused of sexual assaults have difficulties in communicating with women and problems in finding constructive solutions to the complications that arise in such situations.

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The World after the Pandemic: Challenges and Prospects for Neuroscience (Based on the Materials of the II Summer International School named after A. R. Luria)

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Мир после пандемии: вызовы и перспективы для нейронауки (по материалам II Летней международной школы имени А. Р. Лурия)

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Abstract. In August 2020, Moscow State University named after M. V. Lomonosov and Ural Federal University named after the first President of Russia B. N. Yeltsin held the II Summer International School named after A. R. Luria. Thirteen well-known experts in the world scientific community, as well as 246 listeners from 47 countries took part in it as speakers. Each speaker presented his report, and also took part in one of two panel discussions on current topics. Research findings by young scientists were presented in the format of an e-poster session. This article is a final report on the thematic areas of the School's work, which included

not only the results of the presented studies, but also the judgments of experts in the field of neuroscience about the new coronavirus reality. The event was supported by the Russian Science Foundation for Basic Research.

Keywords: *neurosciences; Luria approach; youth science; cross-cultural studies; neuropsychology; integrative approach; integrated research*

Аннотация. В августе 2020 г. Московский государственный университет имени М. В. Ломоносова и Уральский федеральный университет имени первого Президента России Б. Н. Ельцина провели II Летнюю международную школу имени А. Р. Лурия. В качестве докладчиков в ней приняли участие тринадцать известных экспертов мирового научного сообщества, а также 246 слушателей из 47 стран. Каждый докладчик представил свой доклад, а также принял участие в одной из двух панельных дискуссий по актуальным темам. Результаты исследований молодых ученых были представлены в формате электронной стендовой сессии. Данная статья представляет собой итоговый отчет по тематическим направлениям работы школы, в который вошли не только результаты представленных исследований, но и суждения специалистов в области нейробиологии о новой коронавирусной реальности. Мероприятие прошло при поддержке Российского научного фонда фундаментальных исследований.

Ключевые слова: *нейронауки; нейропсихологический подход Лурия; молодежная наука; кросс-культурные исследования; нейропсихология; интегративный подход; интегрированные исследования*

The II Summer International Neuropsychological School named after A. R. Luria was held in August 2020 on the basis of Ural Federal University named after the first President of Russia B. N. Yeltsin. The school was held in English. The online format was chosen as the only possible one due to the difficult epidemiological situation in the world. It should be noted that an increase in the number of participants and their geography was a positive result of the online event. In total, the event was attended by over 240 listeners — students, post-graduate students, young scientists from 47 countries of the world. The work went on for three days for 6 hours. The experts' lectures were interspersed with communication with the audience, which was moderated in the school's chat room. The final events of the first two days were panel discussions, where eminent speakers and students of the School discussed the current trends in the development of neurosciences, including the impact of the coronavirus pandemic. In general, the interactive part of the event, despite the remote format, turned out to be bright and meaningful. So, over three days of work, the chat received more than 500 questions and replies from listeners. The best ones were awarded special prizes and certificates from the organizers.

Given a key task of the School to create a communicative cross-cultural platform for interaction between the renowned and novice scientists, an e-poster session for young people became a separate landmark event. It presented research cases from eight research groups, most of which are undergraduate and graduate students of various universities and research centres of the world.

The feedback received by young scientists will help bring their research to a new qualitative level.

Most of the experts' reports were related to studies that were carried out within the framework of the paradigm developed by the founder of Russian neuropsychology A. R. Luria. Scientific reports were organized into several topics: *Brain Resources in a Changing World, The Value of a Cultural-Historical Approach in a Changing World, Neuro-Linguistics: Ways to Search for New Meanings, Neuropsychological Approach in Helping Children with Developmental Delays*. From the global problematics of cultural dominants of cognition, the conceptual and categorical apparatus of the approach of A. R. Luria and the neuropsychological analysis of the consequences of the pandemic, the focus of the participants' attention shifted to the format of discussing urgent practical problems. Among them were the problems of the modern child population (risks in the formation of children rejection revealed in their speech development, neuropsychological support for typical and atypical children of different ages, etc.), neuropsychological support for people of mature and older age who experience difficulties in the conditions of radical environmental changes, total digitalization, information overloads, etc.

The School focused on a fundamental scientific problem related to understanding the connection between the brain and human behaviour. Achievements in solving this scientific problem make it possible to develop scientifically based and effective mechanisms for human adaptation to a new reality, to reveal and develop the resources of the brain to overcome the challenges that arise in modern civilization associated with changing environmental conditions, for example, such as the coronavirus pandemic. This topic has been presented across the entire age range: from the birth to the "silver" age.

The integrative potential of neurosciences has contributed to the variety of topics discussed. Thanks to this, the educational content of the event was distinguished by interdisciplinarity, it also comprised new data on various levels of brain activity — from the cellular to the social. The paradigm and approach developed within the framework of the teachings of A. R. Luria, allowed the participants of the event to analyse the risks and opportunities of human development in contemporary world from comprehensive and holistic perspective, taking into account modern knowledge about the work of the brain.

The II Summer International Neuropsychological School became an online educational platform, where experts in different areas of the global neuropsychological scientific movement worked productively together with young Russian and foreign scientists. On the one hand, the School showed the possibility of further development and expansion of Luria's approach in solving the fundamental problem of the relationship between the brain and the psyche. In particular, it was shown how modern advances in neuroscience can be used to understand how the brain provides the psyche and human behaviour within the framework of the theory of systemic dynamic localization of functions in the brain, as well as the theory of functional brain blocks (report by J. Peña-Casanova from Spain). On the other hand, there was an extension of the paradigm to an early age,

including the infant period of brain development (report by G. Lazarus from the USA). It was shown that the use of the paradigm of Luria contributes to high efficiency in neuropsychological diagnostics, neuro-correction and neurorehabilitation (reports by K. Anauate, J. Glozman, S. Kiselev, Yu. Solovieva). The School showed the importance of the integrative trend in neurosciences, as well as a focus on the implementation of research and the search for technologies for unlocking and optimizing brain resources in a rapidly changing world. Such a constructive combination of the fundamental nature and practical orientation of neurosciences, in particular, finds its expression in new technological solutions for various spheres of human social life.

A more in-depth review of the studies presented is as follows. One of the first posters to go on was from the University of San Paulo. Carolina Magre presented her study on the neuroscience and inclusive education — a teacher training program. She emphasized the relevance of inclusion in public policy for education. The study aimed to incorporate inclusive education to teacher training policy. 50 teachers were recruited from elementary schools and private kindergartens. The teachers received a total of 16 hours of training based on neuroscience of learning and neurodevelopmental disorder. The study concluded that a better understanding of neurodevelopment disorders helps create better more focused educational plans.

Olga I. Dorogina, Elena V. Khlystova and Julia V. Burmistrova from Ural Federal University presented their study on the neurocognitive functions as an indication of subjective adaptation to involuntary processes. The establishment of a marker which could indicate the functional level of the elderly people is quite significant. The involuntary functions are vital for a good functional level and it was assumed that the neurocognitive functions are associated with the former. Ninety-four elderly participants, without higher education, were recruited, aged between 60 and 74 years. Five different tests were used: Multilevel personality questionnaires, Montreal Cognitive Assessment Scale, Comorbidity rating system, 10-words Test by Luria, Schulte Tables. The sample was divided in high (55 %), average (22 %) and low (24 %) level of involuntary functions. Montreal Cognitive Assessment Scale showed that 70 % of the participants had normal cognitive functions. Data analysis showed that high level of involuntary functions was positively correlated with cognitive functions ($r = .429$, $p > .05$) and negatively with solving prediction problems ($r = .169$, $p > .05$) and the level of comorbidity ($r = .271$, $p = .05$). In conclusion, the level of involuntary functions is associated with the level of cognitive functions such as memory and decision-making. Also, high cognitive functions are negatively associated with comorbidity.

The research of Marina Halpern Chalomon *Identifying Twice Exceptionality* is based on the case study of a gifted child with ADHD. The study defined twice exceptionality as a person that shows immense potential in high achievement in one or two academic spheres connected to one or more disabilities (LD, ADHD, ASD). The study's methodology is as follows: the primary focus of the study is based on an 8-year-old boy facing attentional issues. Multiple assessment tools and scales are used. The Lurian psychomotor and cognitive remediation protocol founded on the Methodology of Compensatory

Development was carried out for 6 months twice a week. A stimulation program was used with a positive behaviour reinforcement in mind. In addition. The program also included self-control exercises. Social skills were trained through cognitive exercises. Marina identified, based on the Lurian theory, that the child faced attention problems related to the 3rd block. The study concludes that with twice exceptionality, intervention strategies should take into account deficits and while taking advantage of the ability and looking to help with emotional development. In the case of the 8-year-old his attentional problems were concealing his gifts.

Master Students from the Psychology Department of Ural Federal University (Hajar Ayed and Hareen Kaur) presented a cross cultural study on the effects of diet and mindful eating on emotional intelligence. The authors looked at two paradigms: the relationship between a diet and emotional intelligence and mindful eating and emotional intelligence among 3 different cultural groups. The study recruited 90 participants (30 Moroccans, 30 Iraqis, and 30 Indians). Questionnaires were used to measure emotional intelligence and mindful eating. The study concluded that mindful eating is positively correlated to emotional intelligence.

Tomsk State University Researchers Alina V. Pustovaya and Evgenia N. Pustovaya presented their findings on the topic of neuropsychological indicators of the level of formation of higher mental functions in children with Autism Spectrum Disorders. The authors emphasized the importance of examining the higher mental functions of children with ASD in the neuropsychological assessment process. The study recruited a total of 49 children aged between 7 to 15 years with ASD diagnosis. The survey covered cognitive, social, neurodynamic and regulatory development. The results indicated that the least formed aspects were in the sphere of social development whereas the most formed ones were in the sphere of motor development.

Another study from Ural Federal University was presented by Ludmila V. Tokarskaya, Anastasia V. Kolchurina, and Valeria V. Lapteva who studied the emotional state of pregnant women. The authors argued that an increase in emotional issues of the pregnant women, such as anxiety, is associated to various social factors. Thus, a detailed analysis of pregnant women's emotional state is paramount to build an effective supportive and preventive program. Forty-three women were recruited from the Yekaterinburg Clinical Perinatal Center during 2017 and they were separated into three groups: first time pregnant, pregnant with miscarriage history, and second or third time pregnant. Data collection was performed using four tools: Test of Relations of a Pregnant Woman by Dobryakov, Self-Assessment of Emotional States by Wessman and Ricks, Self-Estimate by Dembo and Rubinstein, Test of Meaningful Life Orientation by Krambo and Makholikh. Data analysis, via Fisher transformation and Mann-Whitney U-test, found that the second group showed statistically significant higher negative emotions such as anxiety, low self-esteem, low life satisfaction while the first and third groups showed more positive emotions such as happiness, self-confidence and meaning in life.

The Department of Psychology from the University of Social Sciences and Humanities (Warsaw, Poland) presented a poster on the *Effect of News on Optimism Pessimism*

Depression Mood and Self-Esteem by Activating DMN. The author, Emrullah Ecer, investigated the possible association between reading positive/negative news and optimism/pessimism, depressed mood and self-esteem. Reading activates the Default Mode Network which consists of distant parts in the brain linking medial temporal lobe with posterior cingulate cortex/precuneus and anterior cingulate cortex. The participants read positive and negative news and the investigators measured their optimism/pessimism, depressed mood, and self-esteem. They found a connection between reading positive news with optimism, low depressed mood while reading negative news was connected with pessimism, increased depressed mood. No connection was found between the type of news and self-esteem.

Another research was presented by the Laboratory of Neurotechnology and Department of Information Technology from Ural Federal University. It was a study on the reproducibility of foreign words in their memorizing by artificial bilinguals under various visual accompaniment in virtual reality. The authors made the case that nowadays virtual reality finds more use in education which provides an abundant audio-visual environment. These features can improve the reproduction of memorized foreign words. The present study attempted to investigate the role of virtual environment in foreign word memorization and hypothesized that visual aid would be associated with the correct word reproduction. Sixteen people were recruited, 5 of them were from a high educational level while 11 of them were from a low educational level. They were subjected to 45 virtual reality scenes with 3 different types of background (empty, neutral and associative). Word reproduction was measured once after the session and then one day later. Virtual reality system based on a personal computer was used. No difference was found between the amount or reproduced words right after the session and one day later. However, Wilcoxon's test showed a statistically significant difference between reproduced words with blank and associative backgrounds ($p = .042$) and with associative and neutral background ($p = .022$) right after the session. Also, Mann–Whitney *U*-test showed a statistically significant difference between the reproduced words with neutral background right after the session by the high and low educational level group. Thus, the proposed hypothesis was confirmed regarding the role of visual aid in word memorization.

From the of Ibero-American University Puebla, Mexico, María Alejandra Morales González presented a paper on the professional motives in primary school teacher. The author postulated that people's actions are driven by an internal force coming from the motivational sphere which is an important factor in personality development. According to the activity theory by Leontiev the object of psychological analysis is the action, and its elements can be either materialistic/external or psychic/internal. Contemporary researchers have been studying new domains of activity such as professional work. Professional motivation is a hierarchical system of motives driving the educator's teaching activity. The teaching/learning activity is considered to be an active process and needs a connected activity between the teacher and the student. The present qualitative study is to analyze the hierarchy of motives of primary school teacher. The investigators recruited 6 sixth grade students and a teacher. Data collection was performed via semi-structured inter-

views, written narratives and class video recording. The types of motives were divided into cognitive or internal, positive external, neutral external and negative external. Data analysis showed two cases of student's internal positive motivation, similarly with the teacher as he showed a strong calling towards teaching activity, continuous training.

From the University of Economics and Innovation, Poland, Anna Mazur presented her paper on the structure of the relationship between physical activity and psychosocial functioning of women and men during the COVID-19 epidemic in Poland. The author highlighted the importance of conducting empirical research aimed at identifying risk and protective factors in the affected population as the COVID-19 pandemic is becoming a serious problem all over the world. The goal of the present study is to determine the relationship between physical activity, mental health, cognitive and social functioning. Four-hundred-fifty-two Polish men and women were recruited, aged between 18 and 65 years. Four different tools were used for data collection: Physical Activity Questionnaire, General Heath Questionnaire-28, Attention and Perceptiveness Scale, Social Functioning Scale. Data analysis showed that individualized physical activity may be an important factor for the psychosocial support of people affected by the novel coronavirus.

The organizers received a lot of positive feedback about the event. Most of the participants and students of the II Summer School expressed their readiness to take part in this project next year and suggested using a mixed (modern full-time and remote work format) to expand the geography and increase the availability of modern scientific knowledge. The annual conference held in Ekaterinburg has become an event that in many ways embedded itself within the scientific community here in the Urals and Internationally! The forum provides an opportunity for both novice and expert researchers to communicate and develop network. It creates a platform to exchange ideas and boost scientific discourse in different areas and fields. We hope to see this tradition continue as we look forward to the 2021 forum by Ural Federal University.

Special Circumstances

The full text of the materials is presented:

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IN MEMORY OF A. R. LURIA

ПАМЯТИ А. Р. ЛУРИЯ

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To the 100th Anniversary of E. N. Sokolov

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Abstract. September 23, 2020 is the 100th anniversary of the birth of E. N. Sokolov, one of the founders of Russian psychophysiology. A significant role in E. N. Sokolov's research career belongs to A. R. Luria, who collaborated extensively with E. N. Sokolov in the 50s and endorsed the establishment of the Department of Psychophysiology and the development of international collaborations.

Keywords*: history of neuroscience; vector psychophysiology; psychophysiology of focal brain lesions*

Аннотация*.* 23 сентября 2020 г. исполнилось 100 лет со дня рождения одного из основателей российской психофизиологии Е. Н. Соколова. В становлении Е. Н. Соколова как ученого немалую роль сыграл А. Р. Лурия, который активно работал с ним в 50-е гг., поддержал создание кафедры психофизиологии и способствовал развитию международного сотрудничества.

Ключевые слова*: история нейронауки; векторная психофизиология; психофизиология локальных поражений мозга*

Eugene Nikolayevich Sokolov was born on September 23rd 1920 in Gorky (Nizhny Novgorod). In 1939, he graduated from Public High School No. 2 in Gorky and enrolled in Gorky Institute of Industry, specializing in naval engineering. On his first year of studies, he enlisted in the Red Army and got posted as an interpreter in the investigative unit of the intelligence service of the 3rd Army Division. From 1941 to 1945, Sokolov fought

in the Second World War on the Western, Kalinin, 2nd Baltic-state and First Belarusian fronts, where he served as an interpreter in the intelligence divisions (Chernorizov & Danilova, 2019).

Studentship and doctoral studies. In 1945–1946, Sokolov got an external degree in contemporary German language from Maurice Thorez Moscow State Pedagogical Institute of Foreign Languages.

In those years, Sokolov began to develop his interests in the physiology of higher nervous activity and enrolled in the doctoral program of Psychology section of the Institute of Philosophy, USSR Academy of Sciences. He started working on his doctoral thesis in the psychological laboratories of Prof. Sergey Vasilyevich Kravkov.

Work at the Lomonosov Moscow State University. In 1950, Sokolov defended the doctoral thesis in Philosophy entitled *Problems of Psychology of Perception in the Context of Pavlovian Conditioning*. Upon the completion of the doctoral degree, he was invited to work at the Department of General Psychology of the Faculty of Philosophy. He continued his work on visual perception (Sokolov, 2003).

Collaboration with A. R. Luria. E. N. Sokolov and A. R. Luria started to work together in 1953 when the laboratory of Sensory Receptors at the Department of General Psychology was established (Luria, 2003). At the same time, A. R. Luria invited E. N. Sokolov with his colleagues and students to join his laboratory at the Institute of Defectology, USSR Academy of Pedagogical Sciences. The laboratory employed objective methods of registering vegetative and electroencephalographic reactions in diagnostics of vision and hearing impairments. E. N. Sokolov and his colleagues from the Institute studied the mechanisms of perception and orienting activity, along with the interaction of the two signal systems in normal and pathological conditions (Sokolov, 2003).

In 1950–1961, A. R. Luria was the Deputy-Director for Science at the Institute of Defectology and the Head of the division for clinical and pathophysiological studies of children with abnormal development. Among the techniques that A. R. Luria employed for studying patients with focal brain lesions and developmental retardations, were the methods developed by E. N. Sokolov and colleagues, including students, doctoral students and employees of the two researchers (E. D. Homskaya, M. Yu. Klimovskiy, A. I. Mescheryakov, E. N. Pravdina-Vinarskaya, O. S. Vinogradova, and others) (Luria, 2003). The orienting response is related to the changes in the brain's functional state, which can be reflected in the changes of bioelectrical activity of the cerebral cortex, as well as of the characteristics of the autonomic nervous system; it differs in normal and pathological conditions (Sokolov, 2003).

Research directions included: impairments of vegetative components of the orienting response in focal brain lesions, impairments of the semantic-fields perception, impairments of the general activation level, impairments of motor control (Homskaya, 2004).

The studies conducted at the Institute of Defectology were later published in three collections of works and a number of papers; they were presented as examples in textbooks and collections of works in neuropsychology. The collaboration between the two

researchers gave rise to a novel field of studies between psychophysiology and neuropsychology — psychophysiology of focal brain lesions (Luria, 2003).

Research. Comprehensive studies of the orienting response concluded in 1958 with the publication of E. N. Sokolov's main monograph, entitled *Perception and Conditioned Reflex* (Chernorizov & Danilova, 2019). In 1963, it was published in English by Oxford University Press in the UK and was further distributed in the USA, Japan, Argentina and Mexico.

In 1960, Sokolov defended the thesis (*Perception and Conditioned Reflex*) for the title of Doctor of Sciences in Biological sciences. In 1962, he was awarded the title of Professor of Psychology (Chernorizov, 2010).

In the beginning of the 60s, in the Sensory Receptors laboratory, E. N. Sokolov supervised the emerging psychophysiological studies on the role of memory in perception. The studies addressed not only the psychological functions of memory but also the mechanisms of memory at the cellular level. Sokolov was the first researcher in global neurophysiology to use the methods of extra- and intracellular recordings of the single-neuron reactions. This allowed discovering the specific neural mechanism of anticipatory reflection, i. e., the development of neural stimulus model. The studies resulted in the description of the habituation effect in a single neuron. The works in this filed placed E. N. Sokolov among the leading international psychophysiologists. Studying various sensory receptors and mechanisms of higher nervous activity allowed describing the general principles in the organization of sensory and executive systems. This, in turn, led to creating a theory of sensory-receptor functioning in form of a generalized model called *conceptual reflexive arc*, which can be employed in the development of artificial sensory receptors, for example, in robotics. This model later became the foundation for the vector paradigm of information processing in neural networks (Sokolov, 2003, 2010). The vector paradigm unifies detector and ensemble theories of sensory information encoding within a single self-consistent system. Accordingly, the vector encoding principle applies also to the neural mechanisms of executive and modulating processes, which allows explaining the surprising coherence in the interaction between the sensory domain and the behavior. Within the bases of vector psychophysiology, E. N. Sokolov supervised fundamental studies in comparative biology of color vision in animals and humans (Chernorizov & Danilova, 2019).

In 1970, Sokolov started extensive psychophysiological studies of visual perception of color, shape and depth.

E. N. Sokolov envisioned the research strategy as a *human — neuron — model* cycle. A psychological phenomenon should be initially studied at a macroscopic level; then, its neural mechanisms are analyzed in animal studies, and finally, one creates a model that includes the specifics of the psychological process of interest and its adequate neural characteristics.

In 1971, the Sensory Receptors laboratory was transformed into the Department of Psychophysiology at the Faculty of Psychology. From 1971 to 2001, E. N. Sokolov was

the head of the Department, where he continued to lead and supervise research and academic work and developed international collaborations.

In 1995, E. N. Sokolov initiated the establishment of the Center for Magnetic-Resonance studies in the MSU that provided new perspectives for developing Russian neuroscience and conducting experimental studies.

Teaching activity. E. N. Sokolov was an outstanding teacher. His annually repeated courses at the Moscow State University included Physiology of higher nervous activity, Physiology of sensory receptors, and Psychophysiology. He actively developed specialized courses in Neural intelligence, Orienting response, Information processes in neural networks, and practical courses in Psychophysiology of memory and learning, Neural cybernetics, and Dynamic organization systems. Sokolov wrote guidelines and handbooks for students in such disciplines as *Physiology of Higher Nervous Activity* (part 1–1974, part 2–1981), *Psychophysiology* (1979), *Theoretical Psychophysiology* (1986), *Psychophysiology. Neuron. Computerized Course* (1988). He supervised many course projects and theses, over 70 doctoral theses and 12 theses for the title of Doctor of Sciences (Chernorizov & Danilova, 2019).

As a visiting professor, Sokolov taught at the universities of Cambridge, Oxford, Sofia, Budapest, Helsinki, Stanford University, MIT and Caltech.

International collaborations. E. N. Sokolov was a recognized scientist both in Russia and abroad. He was a member of the USSR Academy of Pedagogical Sciences (since 1984), a member of the Russian Academy of Education (since 1993), a visiting professor at MIT (since 1974), a member of the National Academy of Sciences of the USA (since 1975), an honorary member of the International Organization of Psychophysiology (since 1980), a member of the Finnish Academy of Science and Letters (since 1984), a member of the International Academy of Informatization (since 1993), professor emeritus of the Moscow State University (since 1998), a member of the Central Council of the International Organization for Brain Studies affiliated with UNESCO (Chernorizov, 2010).

In 1984, he was awarded the Pavlov Gold Medal Award for the studies of higher nervous activity. In 1988, American Society for Psychophysiological Research presented E. N. Sokolov with a special diploma "For outstanding contributions to psychophysiology," which is awarded to researchers whose works of fundamental nature have a significant effect on the development of science. In 1989, he received a distinction award from the Society for Psychophysiological Research (USA). In 1993, E. N. Sokolov was awarded the Lomonosov medal for high quality of teaching courses and lectures. In 1997, he received "the medal of the century" from the International Organization of Psychophysiology, and in 1998, the same Organization presented him with the Prize of the Century-1998 (the highest award of the Organization) (Chernorizov & Danilova, 2019).

E. N. Sokolov died on May 14th 2008 at the age of 88.

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