Russian Psychological Society

ISSN 1812-1853 (Print)
ISSN 2411-5789 (Online)

RUSSIAN PSYCHOLOGICAL JOURNAL

Vol. 23 № 1

2026

Russian Psychological Journal, 2026, Vol. 23, № 1
ISSN 1812-1853 (Print)
ISSN 2411-5789 (Online)

Russian Psychological Journal

Founder – Russian Psychological Society

Editorial office:
of. 114, b. 140, Pushkinskaya Str., Rostov-on-Don, Russian Federation, 344006
E-mail: editor@rpj.ru.com

Publisher address (CREDO):
house 13A, building 2 Yaroslavskaya Str., Moscow, Russian Federation, 129366
Tel./fax (495) 283–55-30
E-mail: izd.kredo@gmail.com

Founder address (Russian Psychological Society):
b. 11/9, Mokhovaya Str., Moscow, Russian Federation, 125009
E-mail: ruspsysoc@gmail.com

ISSN 1812-1853 (Print)
ISSN 2411-5789 (Online)

Website: rpj.ru.com

Russian Psychological Journal, 2026, Vol. 23, № 1
ISSN 1812-1853 (Print)
ISSN 2411-5789 (Online)

Russian Psychological Journal

Russian Psychological Journal is a peer-reviewed open access journal that publishes original research papers on all aspects of psychology.

It was founded by the Russian Psychological Society in 2004.

Russian Psychological Journal is published quarterly in both printed and online versions. English versions of metadata are available for all the full-text articles submitted in Russian. Since 2019, the journal publishes the full-text articles both in Russian and English.

All manuscripts submitted to the journal undergo a double-blind peer review process involving at least two experts.

The journal adheres to international standards of publishing ethics in accordance with the recommendations of the Committee on Publication Ethics (COPE).

Mission

The mission of Russian Psychological Journal is to advance knowledge and practice in all areas of psychology through publishing scholarly, research-based, peer-reviewed articles that meet quality standards and help test, expand, or build psychological theory and contribute to psychological practice.

Aims & Scope

The journal aims to promote international scientific collaboration and exchange of new knowledge and recent developments in areas related to psychology. It seeks to familiarize specialists and all interested readers with the latest achievements of Russian scholars in resolving issues in present-day psychology.

The ultimate objective is to create a novel forum for: (a) providing novice and experienced scholars with high quality scientific information; (b) rapid communication of new findings, ideas, or perspectives; (c) facilitating international collaboration between researchers and practitioners in the field of psychology and education; and (d) increasing citations, visibility, credibility, and authority of Russian scholarly researches through indexing in international databases.

Russian Psychological Journal accepts theoretical, methodological and empirical contributions relating to scientific research results and achievements in implementation of these results and other innovations in the field of psychology.

The scope of the journal covers all areas of experimental, applied, fundamental, and interdisciplinary psychological sciences and includes (but is not limited to): general psychology; personality psychology; history of psychology; psychophysiology; medical psychology; correctional psychology; legal psychology; social psychology; educational psychology; developmental psychology; acmeology; labor psychology.

Target Audience

The journal is intended not only for researches, scholars, students, and practitioners, but also for general readers with an interest in the state-of-the-art and most recent developments in psychology.

Russian Psychological Journal welcomes submissions from established researchers, young scholars, educators, and practitioners making significant contributions to thematic fields of the journal.

The journal is included in the current list of peer-reviewed scientific publications approved by the Higher Attestation Commission (VAK RF). It is also included in the Scopus, Ulrichsweb, ResearchBib, Directory of Open Access Journals (DOAJ) and other academic databases.

The journal is a member of the following associations: ANRI, EASE, and CrossRef.

Russian Psychological Journal, 2026, Vol. 23, № 1
ISSN 1812-1853 (Print)
ISSN 2411-5789 (Online)

CONTENTS

Russian Psychological Journal, 2026, Vol. 23, № 1
ISSN 1812-1853 (Print)
ISSN 2411-5789 (Online)

Research Article
UDC 159.9
https://doi.org/10.21702/rpj.2026.1.1

Mental Regulation of Psychological States in the Weekly Cycle of Production Workers: A Dynamic Aspect

Alexander O. Prokhorov*, Natalya Yu. Kayumova, Albert V. Chernov, Mark G. Yusupov

Kazan Federal University, Kazan, Russian Federation

*Corresponding author: alprokhor1011@gmail.com

Abstract

Introduction. Work performance of production workers is associated with self-regulation of psychological states. This study explores the dynamics of functional structures of mental regulation of psychological states of production workers during the work week and examines the relationships between psychological states and mental structures, as well as self-regulatory measures. **Methods**. The study sample comprised 62 production workers (17 males and 45 females, $M = 34$, $\sigma = 6.7$). At the beginning of the study, the characteristics of respondents' mental structures (self-attitude, meaningfulness in life, and reflection) were identified. Afterwards, during the week, their psychological states and self-regulatory measures were assessed. **Results**. Production workers most often experience states of optimal mental performance at the beginning (74%) and end of the work week (71%). The incidence of high-intensity negative psychological states (tension, anxiety) increases from Monday to Thursday and then decreases. The highest incidence of low-intensity negative states (fatigue, drowsiness) occurs on Monday (23%) and Friday (16%). The maximum number of self-regulatory measures is observed in the middle of the work week. Specific patterns of the involvement of mental regulation indicators and regulatory measures in changes in psychological states during the weekly cycle were identified. **Discussion**. The study found that the increase in high- and low-intensity unbalanced states that reduce work productivity in the middle and end of the work week is compensated by increased regulatory activity among employees. The greatest involvement

of indicators of mental structure and regulatory measures in self-regulation of psychological states is characteristic of the beginning and end of the work week. The main indicators of mental regulation of states during the work week are indicators of meaningfulness of life (life purpose and outcome), self-attitude (self-management) and employee overall reflection.

Keywords

psychological state, mental regulation, dynamics, reflection, self-regulation, professional activities

Funding

This study was supported by a grant from the Russian Science Foundation, project no. 23-18-00232

For citation

Prokhorov, A.O., Kayumova, N.Yu., Chernov, A.V., & Yusupov, M.G. (2026). Mental regulation of psychological states in the weekly cycle of production workers: A dynamic aspect. *Russian Psychological Journal, 23*(1), 6–22, https://doi.org/10.21702/rpj.2026.1.1

Introduction

According to the structural-functional model of mental regulation of a subject's psychological states that we develop (Prokhorov, 2020), the mental mechanisms and structures of consciousness, which are integral parts of a person's mental (subjective) experience, are the leading factors in the "conscious" regulatory process. The structure of mental experience integrates the components of consciousness (meaning-related and reflective structures, experiences, mental representations, the self-system) and their interaction aimed at achieving the goal of regulating the subject's psychological state.

The important role of consciousness components and their interactions in the regulation of psychological states has been pointed out in several studies. Thus, M. I. Kartasheva (2022) demonstrated the structure of relationships between the characteristics of consciousness during the regulation of psychological states, where indicators of the ego system play a central role. In turn, G. Yu. Martyanova (2015) notes that the subjective image of states performs a regulatory function during adaptation to difficult life situations, differentially influencing the subject's regulatory activity. In addition, the degree and direction of the influence of students' basic meaning-related attitudes on the regulatory processes of the conscious regulatory system of educational activities has been established (Galuzo, 2016), and the role of various meaning-related constructs in the self-regulation of psychological states in the educational activities of students has been identified (Mukhrygina, 2008).

It is also worth mentioning the research of A. V. Karpov (2012), conducted within the framework of a meta-systemic approach that shows that reflection is a fundamental procedural tool of consciousness. M. A. Kholodnaya (2022) emphasizes that a high level of self-reflection can be associated with both productive forms of self-regulation, manifested in increased performance, and maladaptive forms, accompanied by a decrease in performance. The author also found similar patterns at low reflection levels. The author identifies the individual's metacognitive abilities as the key mechanism responsible for the splitting effect of reflection indicators.

Research devoted to the study of performance and the effectiveness of self-regulation of an individual's states plays an important role in psychological literature. For example, within the structural-integrative approach, A. S. Kuznetsova, M. A. Titova, and T. A. Zlokazova (2019) obtained results demonstrating the great importance of self-regulation of functional state for specialists in different professions, especially in the case of increased working stress. Research conducted within the integrative approach by V. M. Byzova, A. E. Lovyagina, and E. I. Perikova (2019) demonstrated that the effectiveness of self-regulation of learning activities is largely determined by the components of students' reflection and metacognitive processes.

E. A. Sergienko (2018), exploring the psychological level of behavioral regulation, points out that the regulatory function in relation to a subject's psychological states and activities belongs to behavioral control, which enables a person to realize his/her individual resources in accordance with his/her goals and objectives. In turn, N. V. Grishina (2023), in describing the determination of human behavior, along with the influences of their past experience and current situation, emphasizes constructs of the future, among which a person's goals and life plans play an important role. V. I. Morosanova (2021) emphasizes that the development of conscious self-regulatory resources promotes successful learning, serves as the basis for adaptation and the formation of a new self-organization of life, and also prevents the development of acute stress reactions and negative emotional states in a person.

Among mental structures, reflection and its role in regulating states and emotions have a special place in global research. They distinguish between reflection, which is aimed at regulating a person's states and emotions, and rumination, which manifests itself in self-reflection and has a pronounced negative impact on a person's experiences (Lyke, 2009). Thus, N. A. Dunn & A. F. Luchner (2022) note that, unlike rumination, reflection has a positive effect on the states of individuals with high levels of self-criticism. A paper by K. J. Bucknell, M. Kangas & M. F. Crane (2022) convincingly demonstrates that the level of rumination negatively impacts subjective well-being, while adaptive reflection and resilience, conversely, are crucial factors in personal well-being. Another study (Jones, Papadakis, Hogan & Strauman, 2009) noted that moderate and high levels of rumination are associated with depressive symptoms and goal-achievement failure, in contrast to the regulatory form of reflection. The latter is often considered a crucial condition for subjective well-being (Wang & Jun, 2025) and a significant factor in the regulation of emotional states (Orvell et al., 2020).

The role of self-esteem in regulating psychological states is often examined in terms of its influence on a subject's mood. It has been shown (Gütges et al., 2025) that instability in

self-perception influences frequent mood swings in respondents, while reflected self-esteem, being a more stable structure, leads to stabilization of states in a person's daily life. Another study (Brown & Mankowski, 1993) found that people with low self-esteem tend to further underestimate their own qualities when they are in a negative mood, while this does not occur when they are in a positive mood. Collins & Winer (2023) also highlight that when assessing themselves in a state of depression, individuals are less likely to choose positive words and more likely to turn to negative comparisons, unlike non-depressed states, where positive words and comparisons prevail.

Global research has also paid attention to the importance of meaning-related structures in the regulation of psychological states. For example, He et al. (2023) showed that low levels of meaningfulness in life are directly related to levels of psychological stress, reflecting its increased levels among respondents. Another study (Akdağ, Ünsal & Gürbüz, 2024) found that reduced psychological stress in adolescents is associated with both meaningfulness in life and their level of psychological resilience.

Our previous studies demonstrated that the effectiveness of students' mental regulation of their psychological states is determined by the intensity of the learning situation (Prokhorov, Chernov, 2023). Meanwhile, another study (Prokhorov et al., 2023) found that by the final stage of their studies, students develop a stable system of mental regulation of their psychological states, and the number of mental self-regulatory techniques they employ increases. Similar results were obtained in studies by D.N. Grinenko and I.S. Morozova (2017), which demonstrated the influence of a complex of cognitive-stylistic factors on the development of personal self-regulation in educational activities.

This study **aims** to identify the specific characteristics of mental self-regulation of psychological states of production workers during the work week.

Methods

The participants in the study were production workers (plastic pipe production and clothing production), N = 62; 17 males and 45 females; M = 34 years.

The empirical study was carried out in several stages. In *the first stage*, the characteristics of mental structures and regulatory measures were measured. The subjects were asked to complete the following assessment tools:

1. Assessment of Reflective Processes: Recognition, Awareness, and Identification by A.O. Prokhorov and A.V. Chernov (Prokhorov, Chernov, 2019).

2. Purpose-in-Life Test (PIL) modified by D.A. Leontiev (Noëtic Orientations Test, NOT) (Leontiev, 2000).

3. Self-Attitude Questionnaire (SAQ) by S.R. Pantileev (Pantileev, 1993).

4. Typology of Self-Regulatory Measures for Psychological states (Prokhorov, Nazarov, 2019).

5. Mental Structures (Prokhorov et al., 2025).

In *the second stage*, participants were asked to evaluate their current psychological state within five days using the Relief of Personal Psychological state assessment tool (Prokhorov, 1998). Additional questions were asked to indicate the self-regulatory measures that were used if the current state did not meet the requirements of the activity.

The analysis of the dynamics of psychological states in a weekly cycle was carried out based on the classification of psychological states by their level of mental activity: states of optimal mental activity (balanced), unbalanced states of increased or decreased intensity (Prokhorov, 1998). The group of optimal psychological states included *calm, joy, concentration,* and *interest*. The group of unbalanced states of high mental activity included *tension, anxiety, excitement,* and *thrill*. The group of unbalanced states of low mental activity included *fatigue, drowsiness, apathy, indifference, sadness,* and *sorrow*. From here on, when we refer to psychological states of different levels of mental activity, we refer specifically to these psychological states.

In this study, we focused on the following **objectives**: (a) identifying the influence of mental structures on the self-regulation of psychological states during the weekly working cycle and (b) establishing the dynamics of the application of various self-regulatory measures in their relationships with psychological states during work activity.

To analyze the dynamics of mental regulation of psychological states and the level of organization of respondents' mental structures, the *Index of Organization of Structures* (IOS) was calculated. For each component of the mental structure of self-regulation of states, relationships at a significance level of $p \leq 0.01$ were assigned 1 point, then the total score was calculated for each day of the week (Karpov, 2004).

Statistical processing of the obtained data was performed using frequency analysis and Spearman's correlation analysis. When analyzing the mental structures of self-regulation, *only highly significant correlations ($p \leq 0.01$) were considered*. These correlations are further denoted by "**". All calculations were performed using SPSS 23.0 software.

Results

A phenomenological analysis of the qualitative characteristics of psychological states revealed that, during the work week, production workers most frequently experience states of optimal mental activity (see Figure 1). The highest rates of optimal psychological states were observed on Monday, Tuesday, and Friday.

The incidence of experiencing unbalanced psychological states of high mental activity (tension, anxiety, excitement, etc.) is lowest on Monday, highest on Wednesday and Thursday, and the same on Friday as Tuesday. The percentage of unbalanced psychological states of low mental activity (fatigue, drowsiness, apathy, etc.) is highest on Monday, lowest on Wednesday, and gradually increases towards Friday.

Figure 1

Relative incidence of psychological states during the work week, %.

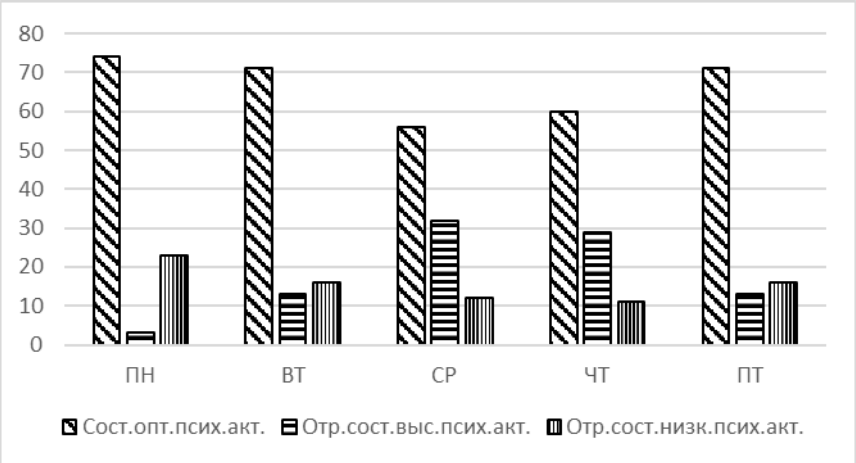


Table 1

Absolute incidence of self-regulatory measures in a five-day cycle

Self-regulatory measures	Mon	Tue	Wed	Thu	Fri
Passive rest	9	15	14	9	14
Activation of positive imagery	26	20	21	11	17
Self-suggestion	7	14	10	6	4
Active relaxation	5	9	5	7	8
Thinking	13	9	7	4	5
Shutdown / switching	15	28	30	18	15
Communication	12	11	9	9	8
Passive relaxation	0	1	8	0	1
Working out	27	15	23	13	14
Eating	3	19	13	12	6
Total	117	141	140	89	92

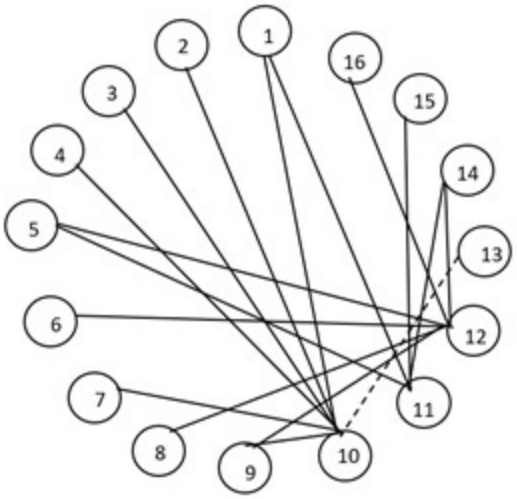
A frequency analysis of employees' self-regulatory measures (see Table 1) shows that the most common measures for Monday are *working out* and *activation of positive imagery*; for Tuesday, Wednesday, and Thursday – shutdown / switching attention; and for Friday – *activation of positive imagery*. The lowest rates throughout the week, with the exception of Wednesday, are characteristic of *passive relaxation*, while on Wednesday, it's *active relaxation*. This distribution of self-regulatory measures may be due to the limited ability to regulate states

during the workday. In most cases, employees are confined to their workstations and only have short breaks. Therefore, self-regulatory measures that don't require special equipment or locations (sports equipment and/or special rooms for active relaxation, nap couches, etc.) are used. Respondents tend to use accessible, simple, and reliable measures for self-regulation.

Next, we consider the dynamics of relationships between psychological states and mental indicators of self-regulation by working week days (correlations were considered at a statistical significance level of $p \leq 0.01$).

Figure 2

Functional structure of self-regulation of psychological states on the first day of the week (Monday)



Note: *Legend: 1 – life purpose, 2 – life outcome, 3 – self-confidence, 4 – self- management, 5 – self-acceptance, 6 – closeness, 7 – identification process (reflection), 8 – overall level of reflection, 9 – overall indicator of the involvement of mental structures in self-regulation, 10 – states of optimal mental activity, 11 – unbalanced states of low mental activity, 12 – unbalanced states of high mental activity. Self-regulatory measures: 13 – passive relaxation, 14 – passive rest, 15 – thinking, 16 – activation of positive imagery*

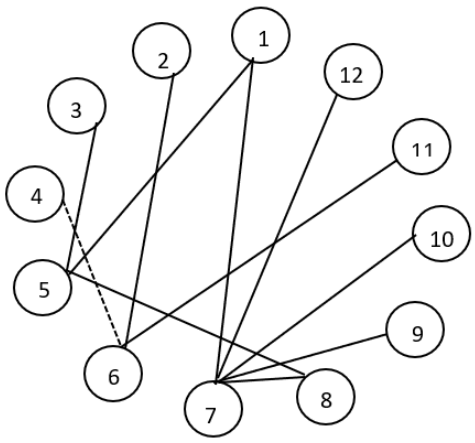
Figure 2 shows the functional structure of self-regulation of psychological states characteristic of Monday. On Monday, the greatest number of respondents (74%) experience psychological states of optimal mental activity. This group of states is characterized by relationships with the *life purpose* (0.423**), *life outcome* (0.385**) and *self-attitude* indicators ("*self-confidence*" (0.442**) and "*self-management*" (0.451**). From the perspective of reflection, relationships with the *identification* scale (0.404**) and the *overall reflection level* (0.418**) were established. There is also a positive correlation with the indicator of the Mental Structures diagnostic instrument (0.479**). In addition, there is a negative correlation with

the *passive relaxation* self-regulatory measure (-0.434**). For unbalanced states of low mental activity there were correlations with the *life purpose* (0.648**), *self-acceptance* (0.797**) and self-regulatory measures: *passive rest* (0.608**), *thinking* (0.691**). For unbalanced states of high mental activity, relationships were established with the *overall reflection level* (0.422**), indicators of *mental structures* (0.713**) and self-attitude: *isolation* (0.601**) and *self-acceptance* (0.548**). Among the self-regulatory measures, *passive rest* (0.442**) and *activation of positive imagery* (0.467**) are used.

By Tuesday, the proportion of respondents experiencing psychological states of optimal activity (calm, interest, etc.) began to decline (67%). This group of states correlates with *self-suggestion* (0.385**). For unbalanced states of high mental activity (tension, anxiety, etc.), a negative correlation with the *life process* was found (-0.876**). For states of low mental activity (fatigue, drowsiness, etc.), correlations were found with self-attitude characteristics: *self-management* (0.800**) and the self-regulatory measure of *activating positive imagery* (0.768**).

Figure 3

Functional structure of self-regulation of psychological states of production workers on Wednesday



Note. Legend: 1 – life purpose, 2 – life outcome, 3 – self-confidence, 4 – self-blame, 5 – states of optimal mental activity, 6 – unbalanced states of low mental activity, 7 – unbalanced states of high mental activity. Self-regulatory measures: 8 – self-suggestion, 9 – activation of positive images, 10 – communication, 11 – active relaxation, 12 – passive rest

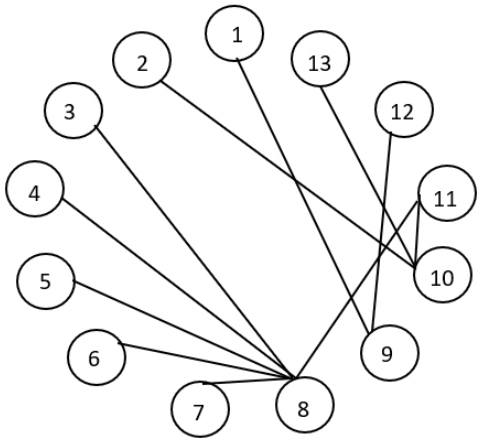
On Wednesday, the number of respondents experiencing psychological states of optimal activity continued to decline (53%). This group of states correlates with the life purpose (0.540**) and self-confidence (0.537**) scales, as well as with the self-suggestion self-

regulatory measure (0.507**). For unbalanced states of high mental activity, a correlation was found with the life purpose indicator (0.643**) and the self-regulatory measures including passive rest (0.628**), self-suggestion (0.568**), activation of positive images (0.607**), and communication (0.591**). For unbalanced states of low mental activity, correlations were found with the life outcome (0.944**) and self-blame (-0.954**) indicators, and with the active relaxation self-regulatory measure (0.855**).

On Thursday, 59% of employees experience states of optimal mental activity. For this group of states, correlations were found with self-management (0.484**), mental structures (0.479**), and the overall reflection level (0.448**). For unbalanced states of high mental activity, a correlation was found with the life purpose scale (0.639**). For unbalanced states of low mental activity, a negative correlation was found with external locus of control (-0.941**), as well as positive correlations with the passive relaxation (0.896**) and shutdown/switching (0.971**) self-regulatory measures.

Figure 4

Functional structure of self-regulation of psychological states of production workers on Friday



Note. Legend: 1 - life purpose, 2 – internal locus of control, 3 - life outcome, 4 - self-management, 5 - self-worth, 6 - self-attachment, 7 - recognition process (reflection), 8 - states of optimal mental activity, 9 - unbalanced states of low mental activity, 10 - unbalanced states of high mental activity. Self-regulatory measures: 11 - thinking, 12 - self-suggestion, 13 - passive relaxation.

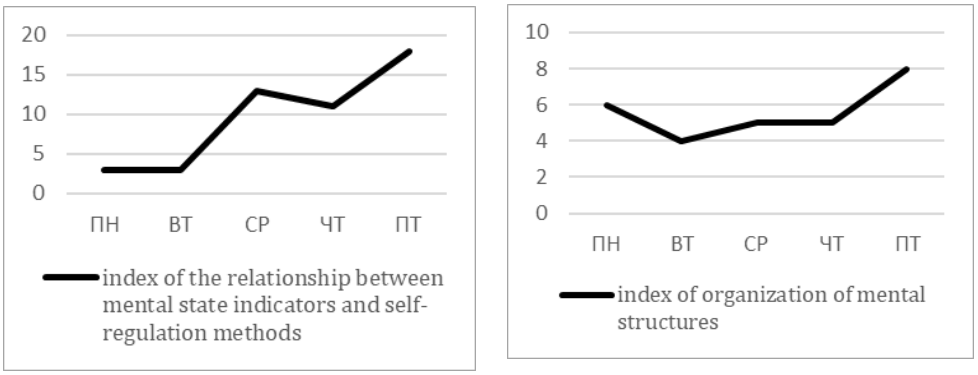
On Friday, the proportion of respondents experiencing states of optimal mental activity increases to 69%. This group of states is characterized by correlations with the indicators of *life outcome* (0.413**), *self-management* (0.434**), *self-worth* (0.400**), *self-attachment* (0.456**),

and *recognition of reflective processes* (0.408**). For unbalanced states of high mental activity, a correlation was established with *thinking* (0.835**). For unbalanced states of low mental activity, a correlation was established with *self-suggestion* (0.833**).

For a general understanding of the relationship between mental structures of self-regulation and psychological states, let us consider the dynamics of the indices of structures organization.

Figure 5

Dynamics of the indices of organization of the structures of mental regulation of psychological states in a five-day cycle



Note: The vertical axis represents the index of the organization of mental structures of self-regulation; the horizontal axis represents days of the week.

Figure 5 shows that the greatest number of relationships between psychological state indicators and self-regulatory measures occurs in the second half of the week, probably indicating the growing role of self-regulation in maintaining optimal states required to perform work functions. An increase in the number of unbalanced states in the middle of the work week leads to an increase in the number of self-regulatory measures. Thus, Monday is characterized by relationships of states with four self-regulatory measures (passive relaxation, thinking, activation of positive imagery, and passive rest), Tuesday – with two measures (self-suggestion and activation of positive imagery), Wednesday – with five measures (self-suggestion, passive rest, activation of positive imagery, communication, and active relaxation), then this indicator begins to decline, Thursday – with two self-regulatory measures (passive relaxation and shutdown/switching attention), Friday – with three self-regulatory measures (thinking, self-suggestion, and passive relaxation).

Table 2

Number of correlations between mental structures and psychological states across days of the week

Indicators		Mon	Tue	Wed	Thu	Fri	Total	
Meaning-related sphere	**1**	2	0	2	1	1	6	
	2	1	0	1	0	1	3	
	3	0	0	0	1	0	1	12
	4	0	0	0	0	1	1	
	5	0	1	0	0	0	1	
Reflection	**6**	1	0	0	0	0	1	
	7	0	0	0	0	1	1	6
	8	0	0	0	1	0	1	
	9	2	0	0	1	0	3	
Self-attitude	**10**	1	0	1	0	0	2	
	11	1	1	0	1	1	4	
	12	0	0	1	0	0	1	
	13	0	0	0	0	1	1	12
	14	2	0	0	0	0	2	
	15	0	0	0	0	1	1	
	16	1	0	0	0	0	1	
Total		**11**	**2**	**5**	**5**	**7**	**30**	**30**

Note: *Legend: 1 – life purpose, 2 – life outcome, 3 – external locus of control, 4 – internal locus of control, 5 – life process, 6 – identification (reflection), 7 – recognition (reflection), 8 – awareness (reflection), 9 – overall reflection level, 10 – self-confidence, 11 – self-management, 12 – self-blame, 13 – self-attachment, 14 – self-acceptance, 15 – self-worth, 16 – isolation*

Let's examine the distribution of relationships between mental structures and psychological states across days of the week, as presented in Table 2.

The data presented suggest that the greatest involvement of mental structures is typical for Monday and Friday, i.e., the beginning and end of the work week. The greatest number of correlations was found for the following indicators: life purpose, life outcome, self-management, and overall reflection level. Among these, indicators of meaningfulness in life are somewhat more prominent in the mental regulation of psychological states during the work week.

During the weekly cycle, changes in the level of organization of mental structures are also observed, with the highest indicators occurring on Monday and Friday, reaching their maximum on Friday. The data obtained relate to the dynamics of unbalanced states during the week. Thus, Monday is characterized by the greatest number of unbalanced states of low mental activity (fatigue, drowsiness, apathy, indifference, etc.), while Friday is characterized by the greatest number of unbalanced states of high mental activity (tension, anxiety, agitation, etc.).

Discussion

Based on the results obtained, the following generalization can be formulated: The increased incidence of high- and low-intensity unbalanced states in the middle and end of the work week is compensated by increased regulatory activity, which is achieved in two ways – through the increased involvement of mental structures in the self-regulation of states (at the beginning and end of the week) and through the increased correlation of regulatory actions with unbalanced states (from the beginning to the end of the weekly cycle). Self-regulation is aimed both at maintaining psychological states of optimal activity and at overcoming the negative effects of low-intensity (at the beginning of the week) and high-intensity (at the end of the week) negative states. Thus, we have obtained an important result – the involvement of certain mental characteristics in the regulatory process contributes to an increased incidence of optimal states and, at the same time, a decrease in the incidence of negative unbalanced states.

The characteristics of self-attitude and meaningfulness in life are most prominent in the structure of mental regulators of psychological states, which is consistent with our previous results obtained in a student sample (Prokhorov, Chernov, Yusupov, Basina, 2023).

The main result of the study is the following: Mental regulatory mechanisms are most fully developed at the beginning and end of the work week. Apparently, this reflects the general pattern of mental regulation of states identified in our previous studies. Thus, the greatest activity of students' mental regulation of states is observed at the beginning and end of seminars (Prokhorov, Chernov, Yusupov, Basina, 2024), and for working students (students attending evening classes), it is at the beginning of the circadian cycle (morning hours) and during rest periods (evening hours) (Prokhorov, Valiullina, Yusupov, 2025).

In our study, we found that an increasing level of integration of mental indicators is an indicator of the functioning of conscious state regulatory mechanisms: The higher

this organization, the more differentiated the selection of regulatory tools and the more pronounced the positive effect of self-regulation. This characteristic of mental regulation has also been demonstrated in studies on the self-regulation of functional states (Kuznetsova, Titova, Zlokazova, 2019).

The results presented can be useful for the psychological services of production teams. They can be used in particular to formulate a number of recommendations for maintaining the optimal psychological states of employees during work activities.

Limitations

The study did not take into account the actual motivation of employees for work activities, nor did it take into account the age- and gender-related characteristics of self-regulation among production workers.

Conclusion

1. The dynamics of the level of organization of mental structures for self-regulation of psychological states change parabolically during the work week, with the highest values observed on Mondays and Fridays, probably due to the change in a work–rest regimen. The strongest interaction between mental structures of self-regulation and psychological states is characteristic of Monday and Friday.
2. The greatest involvement in the interaction with psychological states during the work week is demonstrated by indicators of meaningfulness in life (life purpose and outcome), self-attitude (self-management), and the overall reflection level.
3. The highest incidence rates during the work week are typical for optimal mental activity states, with their highest indicators at the beginning and end of the week. These states are more closely related to indicators of meaningfulness of life and self-esteem. Unbalanced states are mainly associated with indicators of meaning in life and reflection.
4. From the beginning to the end of the week, the degree of involvement of regulatory measures in the regulation of psychological states increases; the latter are aimed both at maintaining optimal activity states and at regulating unbalanced states.
5. The most common self-regulatory measures used by employees during the weekly cycle of work are reflection, activating positive imagery, shutdown/switching attention, and working out. The highest number of self-regulatory measures is observed in mid-week (Wednesday).

References

Akdağ, B., Ünsal, C., & Gürbüz, A. (2024). Psychological resilience as a mediator in the relationship between meaning in life and psychological distress in adolescents. *European Journal of Therapeutics, 30*, 777–785. https://doi.org/10.58600/eurjther2516

Brown, J. D., & Mankowski, T. A. (1993). Self-esteem, mood, and self-evaluation: Changes in mood and the way you see you. *Journal of Personality and Social Psychology, 64*, 421–430. https://doi.org/10.1037/0022-3514.64.3.421

Bucknell, K. J., Kangas, M., & Crane, M. F. (2022). Adaptive self-reflection and resilience: The moderating effects of rumination on insight as a mediator. *Personality and Individual Differences, 185*, 111234. https://doi.org/10.1016/j.paid.2021.111234

Byzova, V. M., Lovyagina, A. E., & Perikova, E. I. (2019). A metacognitive approach to diagnosing difficulties in students' mental self-regulation. *Russian Psychological Journal, 16*(2), 25–42. https://doi.org/10.21702/rpj.2019.2.2 (in Russ.)

Collins, A. C., & Winer, E. S. (2023). Self-referential processing and depression: A systematic review and meta-analysis. *Clinical Psychological Science, 12*(4), 721–750. https://doi.org/10.1177/21677026231190390

Dunn, N. A., & Luchner, A. F. (2022). The emotional impact of self-criticism on self-reflection and rumination. *Psychology and Psychotherapy: Theory, Research and Practice, 95*(4), 1126–1139. https://doi.org/10.1111/papt.12422

Galuzo, P. R. (2016). Meaning-related attitudes as determinants and consequences of conscious regulation of students' academic activity. *Vesnik of Yanka Kupala State University of Grodno. Series 3. Philology. Pedagogy. Psychology, 6*(1), 123–134. (in Russ.).

Grinenko, D. N., & Morozova, I. S. (2017). Formation of self-regulation and cognitive-stylistic organization of personality in the context of psychological and educational support. *Siberian Journal of Psychology*, 64, 149–157. https://doi.org/10.17223/17267080/64/10 (in Russ.)

Grishina, N. V. (2023). Goal-based regulation of human behavior. *Vestnik of Saint Petersburg University. Psychology. 13*(3), 310–323. https://doi.org/10.21638/spbu16.2023.302 (in Russ.)

Gütges, I. D., Xi, H., Gauggel, S., & Forster, S. D. (2025). Mirroring minds: Assessing the relative stability of self-appraisal and reflected appraisal in daily life. *Frontiers in Psychology, 16*, 1576353. https://doi.org/10.3389/fpsyg.2025.1576353

He, X. X., Wang, X., Steger, M. F., Ji, L. J., & Liu, M. (2023). Meaning in life and psychological distress: A meta-analysis. *Journal of Research in Personality, 104*, 104381. https://doi.org/10.1016/j.jrp.2023.104381

Jones, N., Papadakis, A., Hogan, C., & Strauman, T. (2009). Over and over again: Rumination, reflection, and promotion goal failure and their interactive effects on depressive symptoms. *Behaviour Research and Therapy, 47*, 254–259. https://doi.org/10.1016/j.brat.2008.12.007

Karpov, A. V. (2004). *Metasystem organization of level structures of the psyche.* Moscow: Institute of Psychology, Russian Academy of Sciences. (in Russ.).

Karpov, A. V. (2012). Reflection in the structure of consciousness. *Bulletin of P. G. Demidov Yaroslavl State University. Humanities Series, 1*(19), 6–12. (in Russ.).

Kartasheva, M. I. (2022). The role of the self-system in the structure of mental regulation of psychological states during learning. *Yaroslavl Pedagogical Bulletin, 1*(124), 162–174. https://doi.org/10.20323/1813-145X-2022-1-124-162-174 (in Russ.)

Kholodnaya, M. A. (2022). Light and dark sides of reflection and areflection: Splitting effect. *Psychological Journal, 43*(4), 15–26. https://doi.org/10.31857/S020595920021475-8 (in Russ.)

Kuznetsova, A. S., Titova, M. A., & Zlokazova, T. A. (2019). Psychological self-regulation of functional state and professional success. *Moscow University Psychology Bulletin, 1*, 51–68. https://doi.org/10.11621/vsp.2019.01.51 (in Russ.)

Leontiev, D. A. (2000). *Noëtic Orientations Test (NOT)* (2nd ed.). Moscow: Smysl. (in Russ.).

Lyke, J. A. (2009). Insight, but not self-reflection, is related to subjective well-being. *Personality and Individual Differences, 46*, 66–70. https://doi.org/10.1016/j.paid.2008.09.010

Martyanova, G. Yu. (2015). Regulatory characteristics of the subjective image of a state in a difficult life situation. *Psychology and Psychotechnics, 10*(85), 1064–1071. https://doi.org/10.7256/2070-8955.2015.10.16543 (in Russ.)

Morosanova, V. I. (2021). Conscious self-regulation as a meta-resource for achieving goals and resolving life problems. *Moscow University Psychology Bulletin, 1,* 4–37. https://doi.org/10.11621/vsp.2021.01.01 (in Russ.)

Mukhrygina, O. I. (2008). Meaning-related constructs of self-regulation of states in university students. *Bulletin of the Samara Humanitarian Academy. Series: Psychology, 2*(4), 39–45. (in Russ.).

Orvell, A., Vickers, B., Drake, B., Verduyn, P., Ayduk, O., Moser, J., Jonides, J., & Kross, E. (2020). Does distanced self-talk facilitate emotion regulation across a range of emotionally intense experiences? *Clinical Psychological Science, 9*, 1–11. https://doi.org/10.1177/2167702620951539

Pantileev, S. R. (1993). *Self-Attitude Questionnaire*. Moscow: Smysl. (in Russ.).

Prokhorov, A. O. (1998). *Unbalanced psychological states.* Moscow: Institute of Psychology, Russian Academy of Sciences. (in Russ.).

Prokhorov, A. O. (2020). Structural and functional model of mental regulation of a subject's menal states. *Psychological Journal, 41*(1), 5–18. https://doi.org/10.31857/S020595920007852-3 (in Russ.)

Prokhorov, A. O., Valiullina, M. E., Chernov, A. V., & Yusupov, M. G. (2025). Mental Structures Questionnaire. In A. V. Chernov (Ed.), *Psychology of mental states: Proceedings of the XIX All-Russian Scientific and Practical Conference for Students, Master's Students, Postgraduate Students, Young Scientists, and University Lecturers* (pp. 452–458). Kazan University Press. (in Russ.)

Prokhorov, A. O., Valiullina, M. E., & Yusupov, M. G. (2025). Dynamics of mental structures regulating of mental states in the first half of the circadian rhythm. *Experimental Psychology, 18*(3), 67–84. https://doi.org/10.17759/exppsy.2025180305 (in Russ.)

Prokhorov, A. O., & Nazarov, A. N. (2019). Methodology for studying the typology of methods of self-regulation of mental states. In A. V. Chernov & M. G. Yusupov (Eds.), *Psychology of* mental *states: A collection of articles of undergraduates, master's students, postgraduate students, and young scientists* (pp. 274–279). Kazan University Press. (in Russ.)

Prokhorov, A. O., & Chernov, A. V. (2019). *Reflective regulation of psychological states.* Moscow: Institute of Psychology, Russian Academy of Sciences. (in Russ.)

Prokhorov, A. O., Chernov, A. V., Yusupov, M. G., & Basina, I. S. (2023). Development of the system of mental regulation of students' mental states in everyday and stressful learning situations. *Yaroslavl Pedagogical Bulletin, 5*(134), 129–141. https://doi.org/10.20323/1813-145X_2023_5_134_129 (in Russ.)

Prokhorov, A. O., Chernov, A. V., Yusupov, M. G., & Basina, I. S. (2024). Dynamics of mental regulation of psychological states in various conditions of educational activity of students. *Experimental Psychology, 17*(3), 130–143. https://doi.org/10.17759/exppsy.2024170309 (in Russ.)

Sergienko, E. A. (2018). *Behavioral control as a basis for self-regulation. South-Russian Journal of Social Sciences, 19*(4), 130–146. https://doi.org/10.31429/26190567-19-4-130-146 (in Russ.)

Wang, H., & Jun, G. (2025). The relationship between self-reflection and mental health: A meta-analysis review. *Current Psychology, 44*, 3899–3913. https://doi.org/10.1007/s12144-025-07415-9

Received: June 16, 2025
Revision received: October 12, 2025
Accepted: January 12, 2026

Author Contribution

Alexander Oktyabrinovich Prokhorov contributed to the research concept and experimental design, prepared the Conclusion section (25%).

Natalya Yurjevna Kayumova conducted the empirical study, contributed to data processing and interpretation (25%).

Albert Valentinovich Chernov contributed to research design, prepared the Introduction section (25%).

Mark Gennadjevich Yusupov contributed to research design, summarized research findings, prepared the Conclusion section (25%).

Author Details

Alexander Oktyabrinovich Prokhorov – Dr. Sci. (Psychology), Professor, Kazan Federal University, Kazan, Russian Federation; Researcher ID: M-9449-2013, Scopus ID: 23393491600, Author ID: 1658-6960, ORCID ID: http://orcid.org/0000-0002-8636-2576; e-mail: alprokhor1011@gmail.com

Natalya Yurjevna Kayumova – Assistant of the Department, Kazan Federal University, Kazan, Russian Federation; Author ID:1239682 ORCID ID: https://orcid.org/0009-0003-7351-1530; e-mail: paix@inbox.ru

Albert Valentinovich Chernov – Cand. Sci. (Psychology), Associate Professor, Kazan Federal University, Kazan, Russian Federation; Researcher ID: M-9116-2013, Scopus ID: 56439003700, Author ID: 702354, ORCID ID: https://orcid.org/0000-0002-6490-8400; e-mail: albertprofit@mail.ru

Mark Gennadjevich Yusupov – Dr. Sci. (Psychology), Associate Professor, Kazan Federal University, Kazan, Russian Federation; Researcher ID: M-9816-2013, Scopus ID: 55555907200 Author ID: 505698, ORCID ID: https://orcid.org/0000-0001-9618-223X; e-mail: yusmark@yandex.ru

Conflict of Interest Information

The authors have no conflicts of interest to declare.

Research article
UDC 159.9.07
https://doi.org/10.21702/rpj.2026.1.2

Sensitivity to Rejection Due to Appearance in Female Gymnasts and Non-Athletes

Ekaterina V. Shindrikova*, Alexandra E. Lovyagina

Saint Petersburg State University, Saint Petersburg, Russian Federation

*Corresponding author: e.shindrikova@spbu.ru

Abstract

Introduction. According to modern research, in recent years, due to the spread of inflated standards of thinness and attractiveness, young women have increased dissatisfaction with their appearance, contributing to a decrease in self-esteem and increased sensitivity to rejection due to appearance. The aim of the study was to compare the subjective assessment of weight, sensitivity to rejection due to appearance, satisfaction with body image, and self-esteem of female students engaged in rhythmic gymnastics and non-sports students. **Methods.** *Sample*: 80 female students aged 18-23 years (40 professional gymnasts and 40 non-athletes). *Methods:* socio-biographical questionnaire, BISS body image state scale, "Appearance-Based Rejection Sensitivity, ARS", Rosenberg Self-Esteem Scale RSES. *Methods of mathematical statistics:* descriptive statistics, Student's criterion for independent samples, correlation analysis (Pearson's criterion), and univariate analysis of variance (ANOVA). **Results.** Significant differences in body mass index were found in the comparison groups. Subjective perception of their weight often does not correspond to objective categorization according to WHO criteria in gymnasts compared to their non-athlete peers. Gymnasts are more likely to receive negative assessments of their appearance than female students without professional sports experience. Significant correlations were found between sensitivity to rejection due to appearance and body image satisfaction and self-esteem in both groups. Low body image satisfaction is associated with increased sensitivity to rejection due to appearance in girls aged 18–23 years. **Discussion.** Potential causes of differences in subjective weight assessments among female rhythmic gymnasts and female students not involved in professional sports. For the first time, a comparative analysis of the sensitivity to rejection due to appearance was

performed between female students engaged in professional rhythmic gymnastics and those who are not involved in sports. Furthermore, the relationships between these indicators and the experience of negative appearance-related evaluations from others, body image satisfaction, and self-esteem were analyzed.

Keywords

sensitivity to rejection due to appearance, body image satisfaction, self-esteem, female students, rhythmic gymnastics

For citation

Shindrikova, E. V., Lovyagina, A. E. (2026). Sensitivity to rejection due to appearance in female gymnasts and non-athletes. *Russian Psychological Journal, 23*(1), 23–40. https://doi.org/10.21702/rpj.2026.1.2

Introduction

Despite the fact that a person's ideas about their appearance have been studied by psychologists for a century, interest in this issue has been growing in recent years due to the increasing importance of physical attractiveness for professional self-realization, interpersonal communication, mental health, subjective well-being, value orientation, self-esteem, etc. (Volkova & Veresov, 2019; Kapitanova, 2022; Labunskaya, 2020; Labunskaya & Drozdova, 2017; Labunskaya et al., 2019; Faustova et al., 2024; Javaid & Ajmal, 2019; Tylka & Wood-Barcalow, 2015). Currently in psychology to determine the perceptions of the person about their appearance are used concepts of body image (Sokolova, & Dorojevec, 1985; Belogay, & Morozova, 2019; Schilder, 1999; Hogue & Mills, 2019), a structural component of self-concept "I" or physical "I" corporal (Con, 1984; Shishkovskaya, 2009; Berns, 1986; Cash & Smolak, 2011), the relationship to the external appearance (Labunskaya, 2023). These concepts are largely similar, since they characterize the system of human representations about their body that is part of the structure of self – consciousness-its mental representation, as well as assessments of their appearance and related emotions, experiences, and relationships. Focusing on the various aspects of these constructs, the authors unanimously emphasize that the leading role in the formation and dynamics of self-assessment of one's appearance (especially in adolescents and young people) is played by assessments from significant people and generally accepted standards of external attractiveness distributed in social media at this stage of society's development (Labunskaya, 2020; Labunskaya, Drozdova,2012). 2017; Labunskaya et al., 2019; Pirogova & Vasilenko, 2022; Pogontseva, 2014; Polskaya & Yakubovskaya, 2022; Serikov, 2018; Hogue & Mills, 2019). It is important that perceptions of how attractive appearance is from the point of view of others have a greater impact on self-assessment of appearance than its objective indicators (Pogontseva, 2014; Park, 2007). Due to the pressure of socio-

economic stereotypes dissatisfaction with their appearance experienced by many people in different countries, men and women, representatives of different age groups, those who have any physical defects or mental disabilities, and those who have not, therefore, modern society is characterized by "normative discontent" with their appearance (Belogay, Morozova, 2019; Ramsey, Harcourt, 2009; Kolmogorov, Tarkhanov, 2014;Fuller-Tyszkiewicz et al., 2019; Herbozo et al., 2004).

Broadcast standards of appearance, in particular, a very thin, toned body, body proportions used in the modeling field and used in clothing advertising, doll production, cinematography and computer games form certain body standards in children, adolescents and young people, often idealized and unattainable in real life (Labunskaya et al., 2019; Polskaya & Yakubovskaya, 2022; Tiggemann & Slater, 2013).The discrepancy between one's own body image and common standards often causes negative emotions, persistent dissatisfaction with one's appearance, decreased self-esteem, and anxiety in communication, and thus contributes to increased sensitivity to rejection by other people (Polskaya et al., 2020;Javaid & Ajmal, 2019).

Sensitivity to rejection due to appearance (ARS) is defined as readiness to perceive rejection due to appearance in real or imagined interpersonal contacts, accompanied by an anxious expectation of social rejection and other negative emotional reactions (Razvalyaeva & Polskaya, 2020; Park, 2007). As one of the types of sensitivity to rejection, ARS is based on cognitive and affective signals coming from others (cues, looks, etc.), which form a complex of self-assessments and beliefs about one's external attractiveness, as well as an anxious anticipation of a negative assessment of one's appearance by other people and a strong emotional reaction to the alleged social rejection (Park et al., 2009).Receptivity to rejection can increase to such a level that even neutral or ambiguous assessments of others will be interpreted as rejecting (Polskaya, Yakubovskaya, Razvalyaeva, 2023;Downey & Feldman, 1996). An increase in ARS is manifested in an increase in vulnerability to rejection in situations of evaluating or comparing the parameters of one's appearance with broadcast significant people or social media. With a high ARS, dissatisfaction with one's appearance and anxiety increase, self-esteem instability and its dependence on appearance increase, as a result of which the risk of eating disorders and unjustified appeals to plastic surgery methods increases (Razvalyaeva, Polskaya, 2020; Polskaya, Yakubovskaya, Razvalyaeva, 2023).

It seems that the problems of dissatisfaction with appearance and ARS are especially acute among representatives of those activities in which very high and strict requirements are imposed on appearance: modeling business and technical and aesthetic sports: rhythmic gymnastics (RG), figure skating, aesthetic gymnastics, etc. Young women who are engaged in RG from preschool age are taught that you need to look beautiful, and for this you need to be very thin, control your weight, and follow a diet. In a number of sports schools for RG, height-weight tables are used that reflect the standard of body parameters established in this sport, corresponding to asthenic and muscular-asthenic body types (Samusev, 2021). Compared to their peers, artistic gymnasts have lower body mass index (BMI) and body fat percentage (Vybornaya et al., 2021), but there are more of them who are not satisfied with their body (Vetvitskaya, 2021).

Despite the fact that the body parameters and weight of female athletes are not regulated by the rules approved by the International Gymnastics Federation and the programs of the federal standard of the Russian Federation for sports training in the sport of "rhythmic gymnastics", coaches of this sport pay special attention to the appearance of female athletes, and above all, body weight and proportions. The strict requirements imposed by the coaches on the light weight and very thin physique of artistic gymnasts are explained by the need for high-quality performance of complex movements that make up the technique of gymnastic exercises and the desire to impress the judges during the performance not only by the complexity of the performed programs, but also by the appearance of the athletes. In an effort to ensure that their wards meet unofficial but generally accepted standards of appearance in this sport, coaches regularly evaluate the figure of athletes, often make comments, constantly remind them of the need to maintain weight, and practice control measurements (weighing, measuring). From the first years of training, coaches form beliefs about the need to be as thin as possible for a successful sports career in rhythmic gymnastics, not only among athletes, but also among their parents. Dreaming of high sports achievements of their children, parents closely monitor the weight and strictly control the nutrition of gymnasts, their appearance is often discussed in the family and even small weight gains are condemned. Judges, spectators, sports journalists and specialists who post comments and tips on the weight and figure of certain athletes on social media make their contribution to evaluating the appearance of female gymnasts.

The authors ' experience of working as psychologists with artistic gymnasts shows that many athletes have a hard time accepting negative assessments of their appearance from their coach, parents, and comments about their figure in social networks. Negative evaluation statements about the appearance or comparing the figure not in favor of one of the gymnasts are not only unpleasant, but also cause deep and long-term experiences in some athletes, leading to a decrease in self-esteem, increased anxiety, feelings of social isolation and rejection.

Rhythmic gymnastics refers to complex coordination sports, which are characterized by the above-described features of social pressure in connection with the appearance of athletes. Therefore, in comparison with athletes of other sports disciplines, representatives of this group of sports are distinguished by the highest dissatisfaction with their appearance, excessive concern about weight, a constant desire to "lose weight" and a more pronounced tendency to eating disorders (Davletova & Tafeeva, 2023). The culmination of the sports career of most gymnasts-artists occurs at the age of 18-23 years and, usually, young women not only train intensively and often participate in competitions, but also combine sports with study. Like non-sports students aged 18-23, gymnasts need to solve the main tasks of this age period – to find their place in society, both professionally through mastering the profession and roles, and personally through the need for intimacy and understanding, through the formation of their own authenticity and correlation with others (Nartova-Bochaver et al., 2023). The implementation of these tasks is closely related to self-reflection and self-esteem (Solovyova, 2022), which, in turn, are interrelated with personal health and satisfaction with one's appearance.

The aim of the study: to study the features of subjective assessment of their weight, ARS, body image satisfaction (BIS) and self-esteem among female students engaged in rhythmic gymnastics and non-sports students.

The objectives of the study included a comparison of objective indicators of weight (BMI) and its subjective assessments, as well as a comparative analysis of the experience of negative assessments of their appearance, ARS, BIS and self-esteem in female students engaged in RG and female students not engaged in professional sports.

Based on the above analysis of modern standards of attractiveness and social pressure due to appearance in relation to female students engaged in RG and not involved in sports, the following **hypotheses were put forward:**

- the subjective perception of their weight by female students engaged in rhythmic gymnastics often does not correspond to the objective categorization (WHO standards) than in female students who are not engaged in sports;
- female students who practice rhythmic gymnastics are more likely to be exposed to other people because of their appearance than female students who don't do sports.
- in female students who are engaged in rhythmic gymnastics, ARS is more pronounced than in female students who are not engaged in sports.

Methods

Methods of empirical research

1. A socio-biographical questionnaire that includes questions about age, height, and weight to determine BMI, current diet adherence, and use (1-yes, currently dieting, 2-slightly, slightly dieting, 3-not currently dieting), and others' perception (assessment) of your weight and a subjective assessment of your own weight (you are underweight; Your weight is normal; You are slightly overweight; You are very overweight), individual questions about the experience of negative assessments from representatives of your own sex, the opposite sex, relatives, teachers/coaches (never; rarely; sometimes; often; always). Thus, the socio-biographical questionnaire included questions that reveal various aspects of body image, the degree of satisfaction with body parameters and weight, the desire to adjust body parameters using diets, the experience of negative assessments of body type and weight, and the manifestation of concern about appearance as a component of body image.
2. To identify overall body image satisfaction BIS, BISS (Body Image States Scale) developed by Thomas Cash (Cash et al., 2002) was used, adapted by L. T. Baranskaya & S. S. Tataurova (2011). The methodology consists of 6 questions that identify evaluative experiences about body image, including appearance, attractiveness, and weight relative to the average person, and allows you to quantify overall satisfaction with body image. The range of values is from 1.0 to 8.0 points, higher values according to this method indicate greater satisfaction with the body image at present.

3. The method of "Appearance-based Rejection Sensitivity", developed by L. E. Park (Park, 2007), adapted by A. Yu. Razvalyaeva & N. A. Polskaya (2020). The methodology consists of describing 15 brief situations, for example, weight gain, a flaw in appearance, other people's statements about appearance, and others, to which two questions and / or statements are asked: the first of them (point A) reflects the affective color, the intensity of anxiety in this situation for the respondent, point B reveals a negative belief, concern about yourself and your appearance; the answers to both questions should be rated on a 6-point scale from "Won't bother you at all"/"Very unlikely" to "Will be very disturbing"/"Most likely." The higher the overall final score, the higher the anxious expectation of rejection due to appearance in the respondent.

4. M. Rosenberg's Self-Esteem Scale, RSES (Rosenberg, 1965), adapted by A. A. Zolotareva (2020). The methodology consists of 10 statements that reveal individual components of self-esteem and its manifestations: self-esteem, self-respect, self-worth assessment, sense of dignity, and other components. Higher values correspond to higher self-esteem of the respondent.

Mathematical and statistical analysis of the obtained data was carried out using the licensed program IBM SPSS Statistics 27.0. using descriptive statistics, Student's criterion for independent samples, Pearson correlation coefficient, univariate analysis of variance (ANOVA).

Description of the study sample

Respondents were recruited through an electronic invitation to participate in the study among students of 3 universities (St. Petersburg State University, Lesgaft, National University, First Pavlov State Medical University of St. Petersburg), by self-filling out a psychodiagnostic battery in the Google Forms format. The study protocol, informed consent, and psychodiagnostic battery were reviewed and approved by the St. Petersburg State University Ethics Committee (Protocol No. 115-02-5 of 21.06.2023).

The final sample of the study consisted of 80 young women aged 18-23 years, who are students and receive their first higher education. 40 of them are professional athletes who are engaged in rhythmic gymnastics for 13-15 years (13.47±0.27 years) and have sports qualifications: candidate for master of sports (26 people), master of sports (13 people), master of sports of international class (1 person). 6 respondents have chronic diseases: 2 episodes of pyelonephritis, 1 episode of pyelonephritis, 1 episode of pyelonephritis, an episode of gastritis, 1 episode of chronic tonsillitis, which were not excluded from the study sample due to the fact that these diagnoses/diseases do not directly affect the studied indicators in respondents. Two respondents with a diagnosis of "depressive disorder" were excluded from the group of female students who were not professionally involved in sports, as their condition could complicate the objectivity of the psychodiagnostic examination.

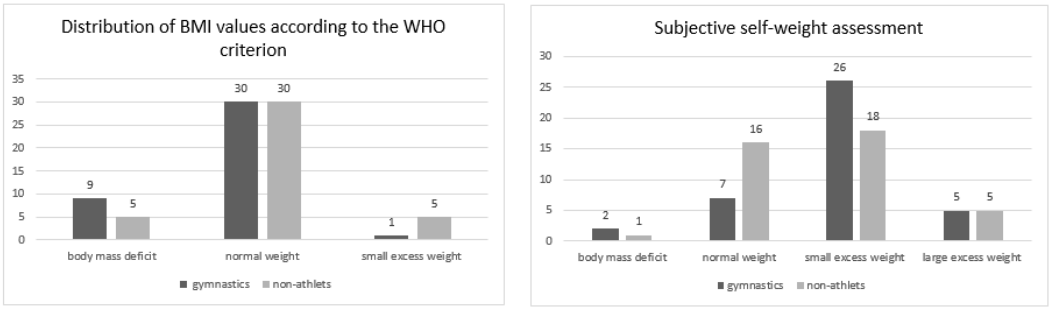
The average age of the entire sample was 20.09±0.16 years: female athletes were 19.91±0.23 years old, and non-sports students were 20.26±0.23 years old.

Results

Among female students engaged in RG, BMI (M±m 19.65±0.34, n=40) is close to the lower limit of the WHO standard range, which is consistent with the results of other studies in this age group (Miteva, 2020; Purenović-Ivanović et al., 2019). Female students who are not professionally engaged in sports have a BMI (M±m 21.28±0.5, n=40) in the middle of the standard range and corresponds to the data of studies of young women of the same age (Pitirut, 2023). BMI of female gymnasts is statistically significantly lower than that of non-athletic female students (Student's t-test: t=-2.692, p=0.009, df=78).Similar differences in BMI were found in the study of K. V. Vybornaya et al. (2021).

The distribution of BMI according to WHO criteria in the group of female students engaged in rhythmic gymnastics (female gymnasts) and in the group of female students not engaged in professional sports (non-female athletes) is shown in Figure 1 (left). Body mass deficit was detected in 22.5% of the sample in the group of gymnasts and 12.5% in the second group, the standard BMI value in both groups is 75%, excess body weight in the group of gymnasts was detected in 2.5% and 12.5% in the group of non-athletes.

Figure 1
Distribution of BMI values in comparison groups (left) and distribution of subjective self-weight assessment by group (right)

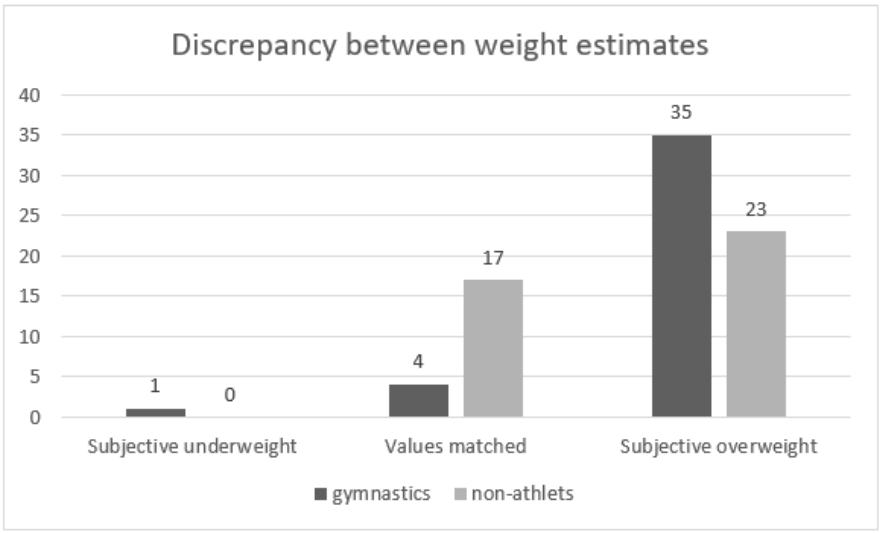


Respondents were asked to assign their weight to one of 4 categories: body mass deficit, normal weight, small excess weight (overweight), large excess weight (obesity), the distribution by groups is shown in Figure 1 (right). In the group of female students engaged in rhythmic gymnastics, 17.5% of all respondents in this group rated their weight as corresponding to the standard value, and 65% described it as slightly overweight (excess body weight), 12.5% noted that they have a large excess weight (obesity). According to the WHO criterion, excess body weight in the group of gymnasts was detected only in 1 respondent, according to a subjective assessment, the value above the standard value was noted in 31 respondents, that is, in 77.5% of the group of gymnasts and in 23 respondents in the group of non-athletes, which is 57.5% of the sample. Thus, young women aged 18-23 years tend to assess their weight as higher, compared to the WHO BMI categorization. The distribution of episodes of overlap or

discrepancy between the objective weight assessment (BMI) and the subjective assessment by group is shown in Fig. 2. In 87.5% of the sample of female students engaged in RG, there is a subjective overestimation of their own weight, while in the second group this indicator is 57.5%. At the same time, almost half of the respondents (42.5%) had similar grades in the group of female students who were not involved in sports, while only 10% of the sample had female athletes.

Figure 2

The number of cases of overlap and discrepancy in the smaller and larger sides when correlating the BMI (WHO) weight category and subjective assessment



Female students who practice rhythmic gymnastics are more likely than non-athlete students to receive negative ratings and comments about their appearance and weight from their own gender (other female athletes), teachers, and coaches. Compared to non-athletic female students, female gymnasts pay more attention to their appearance and are more likely to follow diets (Table 1).

In the group of gymnasts, increased adherence to diets is associated with an increase in ARS (correlation analysis, Pearson's criterion, r=-0.341, p=0.031) (a decrease in points on the diet adherence scale means an increase in this indicator, and an increase in points on the ARS scale means an increase in the anxious expectation of rejection due to appearance.) In the group of female students who are not professionally engaged in sports, an increase in the BIS is associated with a decrease in the desire to adhere to diets (correlation analysis, Pearson's criterion, r=0.600, p=0.000). In the same group, increased adherence to diets is associated with an increase in age (correlation analysis, Pearson's test,r=-0.369, p=0.019). (A decrease in points on the diet adherence scale means an increase in this indicator, and an increase in

points on the BIS and age scales means an increase in them). Thus, young women who are not engaged in sports resort to diets in case of low satisfaction with body image, while for athletes, actions aimed at weight loss and figure correction are primarily due to the desire to reduce negative comments from significant individuals (which contribute to an increase in ARS).

Table 1

Experience of negative assessments of their appearance from the outside and attention to their appearance among female gymnast students and non-sports students (univariate analysis of variance)

Indicators	Female students engaged in rhythmic gymnastics (n=40)	Female students who are not professionally engaged in sports (n=40)	F	p
Negative appearance ratings from members of one's own sex	More often	Less	4.35	0.04
Negative appearance ratings from teachers and trainers	More often	Less	67.293	0.000
Attention to one's appearance and weight	More	Less	4.345	0.04
Adherence to diets	More	Less	12.841	0.001

The indicators of sensitivity to rejection due to appearance (ARS), body image satisfaction (BIS), and self-esteem of female gymnasts and non-sports students do not differ statistically significantly (Table 2). In both groups of respondents, the indicators of ARS and BIS correspond to the average level, while self-esteem is above the average level.

Table 2

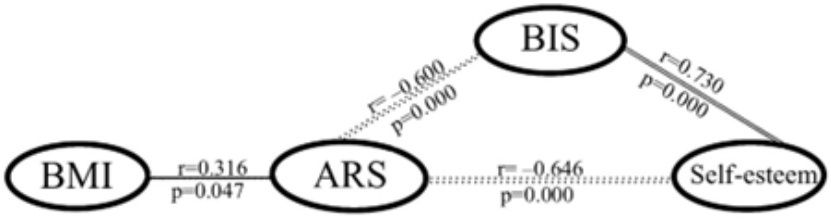
ARS, BIS and self- esteem in female gymnasts and non-female students

Indicators	Female students engaged in rhythmic gymnastics (n=40)	Female students who are not professionally engaged in sports (n=40)	Student's criterion
	M±m	M±m	t
Sensitivity to rejection due to appearance	11.4±1.12	11.97±1.13	Not significant
Body image satisfaction	5.39±0.27	5.89±0.25	Not significant
Self-esteem	19.8±0.95	19.92±0.85	Not significant

In female rhythmic gymnastics students, an increase in ARS is associated with an increase in BMI and with a decrease in body image satisfaction and self-esteem (Figure 3). Apparently, gymnasts with higher weight indicators are more likely than other athletes with lower weight to hear comments and negative comments about their appearance, as a result of which they experience a higher mental state. tension and expect negative assessments of their appearance from the outside. Because of the real and potential threats of a negative assessment of the appearance of female gymnast students, ARS increases, as well as BIS and self-esteem decrease.

Figure 3

Relationships of the sensitivity index to rejection due to appearance (ARS) with body image satisfaction (BIS), self-esteem (RSES) and BMI in the group of female students engaged in rhythmic gymnastics



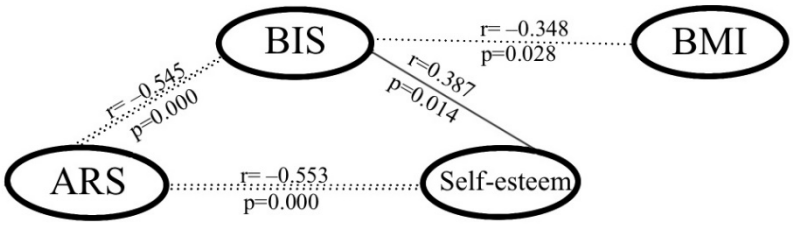
It was found that the ARS decreases due to an increase in the age of gymnasts (correlation analysis, Pearson's criterion: r=-0.345, p=0.029). This can be explained both by a decrease in the need to meet the standard figure of a gymnast due to the planned completion of a

sports career by older athletes, and by an improvement in resistance to negative assessments. Obviously, older athletes, having more experience of experiencing pressure "on appearance" from the outside, adapt more successfully to this pressure, using various methods of reducing the significance of comments: rationalization, ignoring, displacement, etc.

In female students who do not play sports, as well as in gymnasts, an increase in ARS is associated with a decrease in body image satisfaction and a deterioration in self-esteem (Figure 4). In contrast to rhythmic gymnasts, non-athlete students exhibit no association between ARS and BMI.

Figure 4

Relationships of the sensitivity index to rejection due to appearance (ARS) with body image satisfaction (BISS), self-esteem (RSES) and BMI in the group of female students who are not engaged in professional sports



Both female and non-female students involved in RG have an increase in body image satisfaction associated with improved self-esteem, which confirms the role of body image assessment in overall self-esteem and self-esteem in young women aged 18-23 years and is consistent with data on the relationship between appearance satisfaction and personal self-esteem (Mukhina, 2018; Imankulova, Kudaibergenova, 2021; Lozenko, 2021; Shoraka & Amirkafi, 2019).

Discussion

Objective values of BMI according to WHO criteria in most female students who are engaged in RG and not involved in sports correspond to the norm. However, the subjective estimates of their weight in gymnasts are overestimated and coincide with the objective values of BMI much less often than in female students who are not engaged in sports. The higher subjectivity of gymnasts can be explained by stricter and diverse criteria for evaluating their appearance. When assessing their weight, female students who are not professionally engaged in sports are guided by age norms and existing ideas about the attractiveness of young women in society. In addition to the above-mentioned parameters, female gymnast students also take into account the influence of weight on the performance of gymnastic exercises, being reasonably or exaggeratedly afraid that being overweight can lead to injuries during the performance of

elements, to a negative impression of themselves from judges and coaches, and to a decrease in points for the competition program.

Only 36 respondents out of 80 (including 11 gymnasts and 25 non-athletes) noted that they do not follow a diet at present, which reflects the importance of weight, appearance and confirms the available data on the widespread dissatisfaction with body image and the use of various methods of body correction in young women (Labunskaya et al., 2019; Faustova, Yakovleva, 2017; Faustova et al., 2024). Showing the standard for this age group dissatisfaction with their appearance, accompanied by a desire to improve it, gymnasts, unlike young women who do not play sports, more closely monitor their weight and appearance, as they are more often subjected to pressure due to appearance from both peers and mentors (Table 1).

Despite the fact that compared to female students who are not professionally engaged in sports, gymnasts more strictly assess their weight and more often receive comments about their appearance from other people, in particular from representatives of their own gender (other athletes) and coaches, they, like "non-athletes", demonstrate an average level of ARS. This can be explained both by the fact that in the course of many years of practicing rhythmic gymnastics, athletes adapt to criticism of their appearance from other people, and by the fact that by adolescence in rhythmic gymnastics there is a "natural dropout": athletes with a weaker nervous system and low emotional stability stop practicing at earlier stages, and remain they have a stronger nervous system and are resistant to emotionogenic factors (including harsh comments from the outside). It is also important to note that rhythmic gymnastics is a sport with an early professionalization, and by the age of 16, athletes begin to perform in the Masters of Sports (MS) program. Due to high workloads, some athletes finish their sports career after receiving the MS at the age of 16-18 years, while the other part ends their sports career when entering the university.

Both female students who are engaged in RG and non-sports demonstrate an average level of ARS and BIS, and they rate themselves at a level slightly higher than average. Similar data were obtained when studying the severity of these indicators in the same age group (Razvalyaeva, Polskaya, 2020, Vetvitskaya, 2021). The respondents of both groups (gymnasts and non-athletes) ARS did not have statistically significant differences in their ARS, BIS, and self-assessment (Table 1), despite the fact that in comparison with female students who do not play sports, female gymnasts are more likely to receive negative assessments of their appearance from the outside (Table 2). It is important to note that, having a more negative experience of evaluating their appearance from the outside, gymnasts pay more attention to their appearance and more often adhere to diets than those who do not play sports. female students who are not engaged in sports (Table 2). The results obtained give grounds to state that female students who are engaged in RG, in the process of playing sports, form the skills of working with critical comments of their appearance. Obviously, gymnasts tend not to "delve deeply" into their feelings, but to push them out or try to take appropriate measures (diet, etc.) to improve their appearance. The absence of "obsession" with emotions and the awareness that something is being done to improve your appearance allow you to maintain an optimal level of ARS, BIS and self-esteem.

Both female students who are engaged in RG and non-sports ARS students have closely interrelated indicators of ARS, BIS and self-esteem (Fig. 3 and Fig. 4), which is consistent with other studies (Imankulova & Kudaibergenova, 2021; Lozenko, 2021; Shoraka & Amirkafi, 2019).

Probably, the close interrelationships found in our and similar studies between ARS, BIS, and self-assessment are explained by individual features of assessment (Baturin & Vyboishchik, 2011) and individual differences in control and assessment as a regulatory process (Morosanova, 2012). Actualization of ARS, BIS, and self- esteem involves evaluating one's appearance and comparing it with the normatively defined or desired one. It can be assumed that the identified consistent manifestation of ARS, BIS, and self-esteem is associated with a moderate or categorical pessimistic evaluation style (Baturin & Vyboyschik, 2011), a tendency to overestimate the severity of subjective evaluation criteria, and a minimization of the degree of inconsistencies that cause correction of actions (Morosanova, 2012).

Since an increase in ARS is closely related to a decrease in BIS and self-esteem, and an increase in BIS is related to an increase in self-esteem (Fig. 3, Fig. 4), it is reasonable to assume that psychological influences aimed at increasing self-esteem and forming self-respect can increase the acceptance of one's own body and BIS, thereby forming a protective, protective factor for reducing ARS. However, this assumption requires further empirical verification.

Attention is drawn to the fact that in gymnasts, an increase in BMI is associated with an increase in ARS, and in female students – with a decrease in BIS (Fig. 3, Fig. 4). Gymnasts with higher weight indicators are more likely to expect negative comments about their appearance from the outside, and female students are less satisfied with their appearance. Thus, objective weight gain in gymnasts is associated with increased readiness for social rejection, and in female students-with an increase in their dissatisfaction with the body. It is likely that the awareness that weight gain will lead to more comments contributes to more rigorous subjective weight estimates among gymnasts than among female students – according to the data of this study, subjective weight estimates coincide with BMI in gymnasts less often than in female students.

Conclusion

Compared to female students who are not professionally engaged in sports, female gymnasts are less objective in their assessment of their weight, often exaggerating its value relative to the objective BMI. Female students who are engaged in RG are more likely than female students who are not professionally engaged in sports to receive negative assessments about their appearance from others (coaches, parents, other athletes). More than half of female students (both gymnasts and "non-athletes") follow diets to maintain the right weight, but those who are engaged in RG do this more often than those who are not engaged in sports. An increase in BMI in female gymnasts is associated with an increase in ARS, and in non-athletic female students-with a decrease in BIS. The revealed features indirectly indicate the significance of external assessments of appearance for gymnasts, and orientation to their own assessments of appearance in "non-athletes".

The level of ARS, BIS, and self-esteem does not differ between female students involved in RG and non-athletic women; in both groups, ARS and BIS are expressed at an average level, and self-esteem is slightly higher than average. An increase in ARS is correlated with a decrease in BIS and self-esteem in female students who are engaged in RG and not involved in sports. There is reason to assume that the interrelated manifestation of ARS, BIS, and self-esteem identified in this study and in other studies ARS is based on individual assessment features. However, this assumption requires verification in a special study.

Thus, the hypotheses were confirmed that female students who are professionally engaged in RG assess their weight less objectively (exaggerating) than non-sports students and are more likely than the latter to be subjected to negative pressure from others because of their appearance.

The hypothesis that female students involved in HG have more pronounced ARS than non-athletic female students was not confirmed. The results obtained can be explained by the fact that gymnasts for many years (12–15 years) sports careers get used to regular assessments of others appearance. Gymnasts adapt to pressure from outside because of their appearance, developing certain skills in working with comments on their appearance: some statements are “ignore”, others are pushed out by switching to something else, some take note and “go on a diet”, etc. Learning skills to counteract the pressure of others regarding appearance would allow us to concretize the understanding of adaptation to negative statements due to appearance and develop recommendations for optimizing the level of ARS through the formation of appropriate skills.

Limitations

This study has the following limitations:

1. The sample size is not too large: 40 female students who are engaged in rhythmic gymnastics and 40 female students who are not involved in sports.
2. Sample size: university students from Saint Petersburg only, including permanent residents of Saint Petersburg and nonresidents.
3. This study did not take into account the factors of gymnasts ' attitude to sports and the success of their sports career, which can influence the formation of the studied indicators: subjective perception of their weight, self-esteem, satisfaction with body image, sensitivity to rejection due to appearance.

References

Baranskaya, L. T., & Tataurova, S. S. (2011). Methods of body image research. Yekaterinburg: Ural Federal University Press. (In Russ.)

Belogaj, K. N., & Morozova, I. S. (2019). Characteristics of Body Image at Different Stages of Psychosomatic Development. *Siberian journal of psychology, 74*, 167–182. (In Russ.) https://doi.org/10.17223/17267080/74/11

Baturin, N. A., & Vyboyschik, I. V. (2011). Psychology of assessment and evaluation: theoretical and applied aspects. Chelyabinsk: Publishing Center of the South Ural State University. (In Russ.)

Vetvitskaya, T. V. (2021). Attitude of female athletes engaged in rhythmic gymnastics. Ananyevsky Readings-2021, 727–728. (In Russ.)

Volkova T.G., & Veresov N. N. (2019). Physical image of I students in the context of psychological health. *Health, Physical Culture and Sports, 15*(4), 70–78. (In Russ.)

Vybornaya K.V., Semenov M.M., Zakharova M.F., Radzhabkadiev R.M., Nikitjuk D.B. (2021). Features of Physical Development in Girls and Teenagers in Rhythmic Gymnastics. *Human. Sport. Medicine 21*(3), 14–22. (In Russ.) https://doi.org/10.14529/hsm210302

Davletova, N. H., & Tafeeva, E. A. (2023). Perception of the body image and its influence on the development of maladaptive eating behaviors in sports university students. *Science and Innovations in Medicine, 8*(1), 22–28. (In Russ.) https://doi.org/10.35693/2500-1388-2023-8-1-22-28

Zolotareva, A. A. (2020). Validity and Reliability of the Russian Version of the Rosenberg Self-Esteem Scale. *Herald of Omsk University. Series "Psychology", 2*, 52–57. (In Russ.) https://doi.org/10.24147/2410-6364.2020.2.52-57

Imankulova, I. A., & Kudaibergenova, S. K. (2021). Women`s body image satisfaction: connection with age and self-esteem. *The Journal of Psychology and Sociology, 77*(2), 28–37. (In Russ.) https://doi.org/10.26577/JPsS.2021.v77.i2.04

Kapitanova, E. V. (2022). Appearance in the structure of value orientations of young people who are concerned about it or satisfied with it. *Personality in a changing world: health, adaptation, development, 10*(4), 383–393. (In Russ.)

Kohn, I. S. (1984). *In search of self: personality and its self-consciousness*. Moscow: Politizdat. (In Russ.)

Labunskaya, V. A. (2020). The external appearance of a person as a cultural and natural construct that generates psychological problems of the individual. In *the face of man in the contexts of nature, technology and culture* (p. 11-25). Cogito-Center, Moscow Institute of Psychoanalysis. (In Russ.)

Labunskaya, V. A. (2023). Socio-demographic Factors in the Structure of Relationships Between Self-assessments of Appearance and Assessments of Subjective Well-being. *Russian Psychological Journal, 20*(3), 255–273. (In Russ.) https://doi.org/10.21702/rpj.2023.3.14

Labunskaya, V. A., & Drozdova, I. I. (2017). A theoretical and empirical analysis of the influence of socio-psychological factors on young people's assessment and self-assessment of appearance. *Russian Psychological Journal, 14*(2), 202–226. (In Russ.) https://doi.org/10.21702/rpj.2017.2.12

Labunskaya, V. A., Serikov, G. V., Shkurko, T. A. [et al.]. (2019). Social Psychology of Appearance: theoretical approaches and empirical research (collective monograph). Rostov-on-Don: Mini Type LLC. (In Russ.)

Lozenko, K. S. (2021). The Problem of Satisfaction with the Image of the Physical Self. *Modern scientific researches and innovations, 2*, 29–29. (In Russ.)

Morosanova, V. I. (2012). *Self-regulation and human individuality* (2nd ed.). Moscow: Nauka Publishing House. (In Russ.)

Mukhina, Yu. I. (2018). Research of the relationship between self-esteem of a person and satisfaction with appearance. *Humanization of education, 4*, 90–96. (In Russ.)

Nartova-Bochaver, S. K., Yerofeyevaa, V. G., Bayramyana, R. M., & Chulyukina, K. S. (2023). Everyday Representations of Authenticity: From Childhood to Youth. *Psychology. Journal of the Higher School of Economics, 20*(3), 523–547. (In Russ.) https://doi.org/10.17323/1813-8918-2023-3-523-547

Pirogova, O. D., & Vasilenko, V. E. (2022). Satisfaction with body image and interpersonal relationships in older adolescents. *World of Science. Pedagogy and psychology, 10*(2). (In Russ.) https://mir-nauki.com/PDF/25PSMN222.pdf

Pogontseva, D. V. (2014). The desire to lose weight: a socio-psychological analysis. *Science Time, 5*, 159–165. (In Russ.)

Polskaya, N. A., Tseitlina, M. D., & Yakubovskaya, D. K. (2020). Rejection sensitivity and mental health. *Questions of psychology, 66*(5), 119–129. (In Russ.)

Polskaya, N. A., & Yakubovskaya, D. K. (2022). Idealization of the Body in the Social Media. *Psychological journal, 43*(2), 128–141. (In Russ.)

Polskaya, N.A., Yakubovskaya, D.K., & Razvaliaeva, A.Y. (2023). Vulnerability to Interpersonal Rejection Based on Appearance in Body Positive and Pro-Anorexic Online Communities. *Social Psychology and Society, 14*(1), 150–171. (In Russ.) https://doi.org/10.17759/sps.2023140109

Razvaliaeva, A.Y., & Polskaya, N.A. (2020). Validating Appearance-Based Rejection Sensitivity and Fear of Negative Appearance Evaluation Scales in the Russian Sample. *Counseling Psychology and Psychotherapy, 28*(4), 118–143. (In Russ.) https://doi.org/10.17759/cpp.2020280407

Ramsey, N., & Harcourt, D. (2009). Psychology of appearance (translated from English). St. Petersburg: Publishing House "Piter". (In Russ.)

Samusev, R. P., Ageeva, V. A., Zubareva, E. V., Rudaskova, E. S., & Adelshina, G. A. (2021). Constitutional features of female athletes with different types of motor activity. *Volgograd Scientific and Medical Journal, 20*(4), 21–24. (In Russ.)

Serikov, G. V. (2018). Attractive Appearance as an Instrumental Value and its Importance Among Young People. *Psychologist, 6*, 21–31. (In Russ.) Https://doi.org/10.25136/2409-8701.2018.6.27934

Sokolova, E. T., & Dorozhevets, A. N. (1985). Research of "body image" in foreign psychology. *Bulletin of the Moscow University. Episode 14. Psychology, 4*, 39–49. (In Russ.)

Solovyova, A. E. (2022, November). Self-assessment in adolescence: a theoretical aspect. *Postulate, 11*. (In Russ.)

Faustova, A. G., Labunskaya, V. A., Yakovleva, N. V. [et al.]. (2024). *Psychological studies of appearance and body image* (collective monograph). Ryazan: Ryazan State Medical University. Academician I. P. Pavlov. (In Russ.)

Faustova, A. G., & Yakovleva, N. V. (2017). Problems of defining and measuring normative dissatisfaction with the body in clinical psychology. *Personality in a Changing World: Health, adaptation, development, 5*(3), 359–380. (In Russ.) https://doi.org/10.23888/humJ20173359-380

Kholmogorova, A. B., & Tarkhanova, P. M. (2014). Appearance standards and culture: the role of physical perfectionism and its implications for adolescent and youth health. *Questions of psychology, 2*, 52–65. (In Russ.)

Shishkovskaya, A.V. (2009). Theoretical ideas about the image of the physical self in psychology. *North Caucasian Psychological Bulletin, 3*, 71–78. (In Russ.)

Berns, R. (1986). *Развитие Я-концепции и воспитание* (пер. с англ.). Москва: Педагогика.

Cash, T. F., Fleming, E. C., Alindogan, J., Steadman, L., & Whitehead, A. (2002). Beyond body image as a trait: The development and validation of the Body Image States Scale. *Eating Disorders, 10*(2), 103–113. https://doi.org/10.1080/10640260290081678

Cash, T. F., & Smolak, L. (Eds.). (2011). *Body image: A handbook of science, practice, and prevention*. New York, NY: Guilford Press.

Downey, G., & Feldman, S. I. (1996). Implications of rejection sensitivity for intimate relationships. *Journal of Personality and Social Psychology, 70*(6), 1327–1343. https://doi.org/10.1037/0022-3514.70.6.1327

Fuller-Tyszkiewicz, M., Chhouk, J., McCann, L. A., Urbina, G., Vuo, H., Krug, I., … Heron, K. (2019). Appearance comparison and other appearance-related influences on body dissatisfaction in everyday life. *Body Image, 28*, 101–109. https://doi.org/10.1016/j.bodyim.2018.12.001

Herbozo, S., Tantleff-Dunn, S., Gokee-Larose, J., & Thompson, J. K. (2004). Beauty and thinness messages in children's media: A content analysis. *Eating Disorders, 12*(1), 21–34. https://doi.org/10.1080/10640260490267742

Hogue, J. V., & Mills, J. S. (2019). The effects of active social media engagement with peers on body image in young women. *Body Image, 28*, 1–5. https://doi.org/10.1016/j.bodyim.2018.11.002

Javaid, Q., & Ajmal, A. (2019). The impact of body image on self-esteem in adolescents. *Clinical and Counselling Psychology Review, 1*(1), 44–54. https://doi.org/10.32350/ccpr.11.04

Miteva, S., Yanev, I., Kolimechkov, S., Petrov, L., Mladenov, L., Georgieva, V., & Somlev, P. (2020). Nutrition and body composition of elite rhythmic gymnasts from Bulgaria. *International Journal of Sports Science & Coaching, 15*(1), 108–116. https://doi.org/10.1177/1747954119892803

Park, L. E. (2007). Appearance-based rejection sensitivity: Implications for mental and physical health, affect, and motivation. *Personality and Social Psychology Bulletin, 33*(4), 490–504. https://doi.org/10.1177/0146167206296301

Park, L. E., Calogero, R. M., Harwin, M. J., & DiRaddo, A. M. (2009). Predicting interest in cosmetic surgery: Interactive effects of appearance-based rejection sensitivity and negative appearance comments. *Body Image, 6*(3), 186–193. https://doi.org/10.1016/j.bodyim.2009.02.003

Pitirut, I. B., Swami, V., Poamă-Neagră, T., & Enea, V. (2023). Appearance-based rejection sensitivity mediates the relationship between Instagram addiction and dysmorphic concerns in young adult women. *Scandinavian Journal of Psychology*. https://doi.org/10.1111/sjop.12973

Purenović-Ivanović, T., Popović, R., Bubanj, S., & Stanković, R. (2019). Body composition in high-level female rhythmic gymnasts of different age categories. *Science & Sports, 34*(3), 141–148. https://doi.org/10.1016/j.scispo.2018.10.010

Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.

Schilder, P. (1999). *The image and appearance of the human body* (1st ed.). London, England: Routledge. https://doi.org/10.4324/9781315010410

Shoraka, H., Amirkafi, A., & Garrusi, B. (2019). Review of body image and some of contributing factors in Iranian population. *International Journal of Preventive Medicine, 10*, Article 24. https://doi.org/10.4103/ijpvm.IJPVM_293_18

Tiggemann, M., & Slater, A. (2013). NetGirls: The Internet, Facebook, and body image concern in adolescent girls. *International Journal of Eating Disorders, 46*(6), 630–633. https://doi.org/10.1002/eat.22141

Tylka, T. L., & Wood-Barcalow, N. L. (2015). What is and what is not positive body image? Conceptual foundations and construct definition. *Body Image, 14*, 118–129. https://doi.org/10.1016/j.bodyim.2015.04.001

Received: July 24, 2024
Revised: March 19, 2025
Accepted: January 12, 2026

Author Contributions

Ekaterina V. Shindrikova – development of a research project, literature analysis and article preparation, research and mathematical data processing.

Alexandra E. Lovyagina – development of a research project, literature analysis and article preparation.

Author Details

Ekaterina V. Shindrikova – Assistant, General Psychology Department, Saint Petersburg State University, Saint Petersburg, Russia; Author ID (RSCI): 1126447; RSCI SPIN code: 7801-6420; ORCID ID: https://orcid.org/0000-0001-6828-3906; e-mail: E.shindrikova@spbu.ru

Alexandra E. Lovyagina – Cand.Sci. (Psychology), Associate Professor of the General Psychology Department, Saint Petersburg State University, Saint Petersburg, Russia; Researcher ID: ACS-2536-2022; Scopus ID: 57200438021; Author ID (RSCI): 369477; RSCI SPIN code: 8300-2047; ORCID ID: https://orcid.org/0000-0001-6120-1808; e-mail: Lovagina2@mail.ru

Conflict of Interest Information

The authors have no conflicts of interest to declare.

Scientific article
UDK 159.923
https://doi.org/10.21702/rpj.2026.1.3

The Bright and Dark Personality Traits of Modern Students: The Influence of Value Orientations and Basic Beliefs

Vladimir G. Maralov[1*], Marina A. Kudaka[1], Vyacheslav A. Sitarov[2], Larisa V. Romanyuk[2], Irina I. Koryagina[3]

[1]Cherepovets State University, Cherepovets, Russian Federation

[2]Moscow City Pedagogical University, Moscow, Russian Federation

[3]Ivanovo State Medical University, Ivanovo, Russian Federation

[*]Corresponding author: vgmaralov@yandex.ru

Abstract

Introduction. The relevance of the problem is determined by the significance of identifying psychological factors that determine the functioning of integrated personality characteristics, which may include constructs of the Dark (Machiavellianism, narcissism, psychopathy) and Light (belief in humanity, humanism, Kantianism) triads of personality. The novelty of the study lies in identifying the relationship between value orientations, basic beliefs, and traits of the Dark and Light triads of personality among students. **Methods.** The following questionnaires were used: the PVQ Portrait Questionnaire. Schwartz's adaptation by N.M. Lebedeva, R. Janoff-Bulman's Basic Beliefs Questionnaire adapted by M.A. Padun, A.V. Kotelnikova, D.N. Jones and D.L. Paulhus's Short Dark Triad Questionnaire adapted by M.S. Egorova, M.A. Sitnikova, and O.V. Parshikova, and S.B. Kaufman's Light Triad Questionnaire. Adapted by D.S. Kornienko, V.K. Vyazovkina, and A.N. Nevryuev. The study involved 406 students (30.54% male) aged 17 to 25 (M = 19.03; SD=1.27) from various universities in the Russian Federation. **Results.** It has been established that the manifestations of Machiavellianism are influenced by the disregard of dangers, low level of universalism, the belief in the injustice of the world, the manifestations of narcissism are influenced by the power and value of the self, and the manifestations of psychopathy are influenced by the value of stimulation in combination with the disregard of dangers and low level of universalism. Faith in humanity is associated with the belief in the justice of the world, while humanism is associated with security, benevolence, universalism,

and the belief in the justice of the world. The manifestations of Kantianism are influenced by benevolence and universalism. **Discussion.** The study concludes that the traits of the Dark and Light triads of personality are not only interconnected with value orientations and basic beliefs, but also serve as predictors of each other. The findings can be used in the process of communicating with students to help them develop their individual self-development trajectories.

Keywords

dark triad, light triad, value orientations, basic beliefs, students

For citation

Maralov, V. G., Kudaka, M. A., Sitarov, V. A., Romanyuk, L. V., Koryagina, I. I. (2026). Bright and dark personality traits of modern students: influence of value orientations and basic beliefs. *Russian Psychological Journal, 23*(1), 41–60, https://doi.org/10.21702/rpj.2026.1.3

Introduction

University training and the development of educational and professional activities require students to have not only special competencies, but also certain personal qualities. Among these qualities, there are certain personality characteristics that integrate typical traits. These include psychological constructs known as the Dark and Light Triads of Personality.

These constructs have only recently been used in modern psychology. The Dark Triad was described by D. L. Paulhus and K. M. Williams in 2002 (Paulhus &Williams, 2002), and the Light Triad was described even later in 2019 by a group of authors consisting of S. B. Kaufman, D. B. Yaden, E. Hyde, and E. Tsukayama (Kaufman et al., 2019). The dark triad consists of the following: Machiavellianism, which is expressed in the use of manipulation in interactions with people; non-clinical narcissism (hereinafter referred to as narcissism), which is the individual's perception of themselves as exceptional and deserving of admiration; and non-clinical psychopathy (hereinafter referred to as psychopathy), which is characterized by arrogance, impulsive reactions, and hostile and aggressive behavior.

The Light Triad is the diametric opposite of the Dark Triad, and it is represented by: a belief in humanity, which is based on the belief that people are inherently good and kind; humanism, which is based on the belief that people deserve recognition and respect; and Kantianism (named after the German philosopher Immanuel Kant), which is based on the view that people are valuable and not just a means to an end. To be fair, it should be noted that there are also alternative approaches to highlighting the features of the Bright Triad of personality (Johnson, 2018; Musek & Grum, 2021; Gouveia et al., 2021, etc.). In this work, we will adhere to the position of S.B. Kaufman, which is the dominant one in modern science.

It should be noted that there is an extensive bibliography of research on the relationship between triads, especially the Dark Triad, and various personality traits, including those of students. For example, the relationships of the Dark triad with the sexual characteristics of the students (Deris, 2019), the manifestations of aggression (Kajonius, Persson & Jonason, 2015), depressive symptoms (Li et al., 2024), the role of Light and Dark triad committing academic misconduct by students (Chabrol et al., 2009), have shown the influence of the Dark triad traits to choose from in the process of interaction positions of coercion and manipulation, and the Light of the triad, the choice of the position of non-violence (stags, Kudakov, Smirnova, 2024).

As a special problem, we would like to point out the importance of identifying the relationships between the traits of the Dark and Light triads of personality and the values and basic beliefs of the individual. This is because a person's life and actions are influenced by their values and beliefs, which directly or indirectly affect their behavior. As behavioral patterns become established, they become traits of the personality, including the traits of the Dark or Light triads, which in turn influence the value system. Knowledge of such relationships will provide a basis for developing special programs aimed at developing pro-social values and personal qualities, which are necessary for specialists in various fields of life.

In modern psychology, there is a significant number of approaches to defining and highlighting human values. In this paper, we rely on the classical approach of S. Schwartz (1994), who identified ten values that reflect significant motivational aspects of a person. They were grouped into four types: values of openness to change (independence, stimulation); values of self-determination (universalism, benevolence), values of self-affirmation (achievement, power, hedonism); values of preservation (conformity, tradition, security). Subsequently, this concept was revised by the author, and eventually, the number of values was increased (Schwartz, 2012).

Along with the concept of values, modern psychology widely uses the concept of basic beliefs, which logically complement the concept of personality value orientations. Thanks to the research of R. Janoff-Bulman (Janoff-Bulman, 1989) : 1) benevolence/unbenevolence of the surrounding world; 2) justice/unjustice of the surrounding world; 3) the idea of oneself as a worthy or unworthy person (the value of "I") were included. Later, when adapting the R. Yanoff-Bulman questionnaire to the Russian-speaking sample by M.A. Padun and A.V. Kotelnikova (2012), two more beliefs were added: the ability to control the situation – the individual's belief that they can control the events that happen to them; and luck – the individual's belief that he/she is a lucky person.

Literature review

Let us turn to the analysis of some works that reveal the relationship of the Dark and Light triads of personality with value orientations in the context of the concept of S. Schwartz. In particular, P.J. Kajonius et al. (Kajonius et al., 2015) have concluded that there is a positive relationship between Machiavellianism and narcissism with the values of achievement and power, and psychopathy with the values of hedonism and power. In a study by P.K. Jonason

et al. (Jonason et al., 2018), the relationship between the Dark Triad traits and hedonism and achievement was identified. Similar results were obtained by V. Lim and G. Feldman (Lim & Feldman, 2020), who found that the traits of the Dark Triad show a positive correlation with self-assertion (power, achievement, and hedonism) and openness to change (self-reliance and stimulation), and a negative correlation with self-determination (universalism and benevolence) and preservation (conformity, tradition, and security).

As for the relationship between the Light Triad and values, there is much less research in this area. First of all, we would like to mention a work by S.B. Kaufman et al. (Kaufman et al., 2019), in which the authors found a strong positive association between the Light Triad and values of self-determination, and a strong negative association with values of self-assertion.

Let's turn to the second part of our problem, which is identifying the relationships between the traits of the Dark and Light triads and the underlying beliefs.

Since the early works of R. Yanoff-Bulman (Janoff-Bulman, 1989), basic beliefs have been studied in connection with psychological trauma and post-traumatic stress, which is largely caused by their destruction, while the world begins to be perceived as unfair and hostile. L.T. Mathews and S.J. Marwit (Matthews & Marwit, 2004). They carried out a differentiated analysis of the impact of various types of losses on the basic beliefs of parents. P.K. Ferrajão and A. Elklit (Ferrajão & Elklit, 2020) showed that interventions aimed at restoring ideas about the benevolence of the world and increasing the value of the Self should be the focus of attention in post-traumatic stress therapy.

Gradually, the scope of research on the role of basic beliefs in human life expanded significantly. It has been proven that basic beliefs are associated with well-being (Markina, 2023; Poulin & Cohen Silver, 2008), with dispositional personality traits, locus of control, and life satisfaction (Chertkova and Zyryanova, 2019), and with trust in people (Zhang, 2021). I.A. Filenko et al., 2023) found that basic beliefs act as predictors of the psychological health of students. N.A. Tsvetkova and K.E. Lagvilava (Tsvetkova and Lagvilova, 2022) identified differences in basic beliefs among working and non-working students.

Unfortunately, we have not found any special works that discuss the relationship between students' basic beliefs and the Dark and Light triads of personality, with the exception of one study (Pustovik, Khramtsova, 2022). However, there are related studies that address this issue. For example, in a study conducted by I. Correia and C. Dalbert (Correia & Dalbert, 2008) on a sample of Portuguese adolescents, it was found that the stronger the adolescents' belief in a just world, the less likely they were to engage in peer bullying, which is a negative trait associated with the Dark Triad. Alternatively, in another study by Y. Guo et al. (Guo et al., 2022) the relationship between belief in a just world and prosocial behavior, which is one of the components of the Light Triad personality has been proven.

Thus, based on the analysis of the literature, it can be concluded that in modern psychology, the relationship between value orientations and the traits of the Dark Triad has been studied to a greater extent, while the relationship between value orientations and the traits of the Light Triad has been studied to a lesser extent, and the relationship between basic beliefs and the traits of the Dark and Light Triads has not been studied at all.

The purpose of the study is to identify the relationship between the traits of the Dark and Light Triads and the value orientations and basic beliefs of modern students, as well as the characteristics of their mutual influence on each other.

The research hypotheses are as follows:

1) based on the available literature, it can be assumed that the Dark and Light triads of personality traits are interconnected with the values of self-assertion (achievement, power) and the values of self-determination (benevolence, universalism), where the Dark triad is interconnected with the values of self-assertion and the Light triad is interconnected with the values of self-determination.

2) traits of the Dark Triad, such as Machiavellianism and psychopathy, should show a negative relationship and mutual influence with the basic beliefs in the benevolence of the world, the justice of the world, and the value of the self, while narcissism, on the other hand, should show a positive relationship and mutual influence with the belief in the value of the self; traits of the Light Triad should show a positive relationship and mutual influence with the beliefs in the benevolence, justice of the world, and the value of the self.

Methods

Sample

The study was conducted using a survey of students in March-May 2024. The study sample consisted of students from Moscow City Pedagogical University, Ivanovo State Medical University, and Cherepovets State University, representing various specialties and fields of study, with a total of 406 participants aged 17 to 25 (M = 19.03; SD = 1.27). The sample included 30.54% male participants and 69.46% female participants.

Research methods

The methodological basis of this study was formed by the theoretical provisions on value orientations of Sh. Schwartz, basic beliefs of R. Yanovoff-Bulman, the concept of the Dark Triad of D.L. Paulhus and K. M. Williams, the concept of the Bright Triad of S.B. Kaufman et al.

The following diagnostic tools were used:

1) The Short Dark Triad Questionnaire by D.N. Jones and D.L. Paulhus, adapted by M.S. Egorova, M.A. Sitnikova, and O.V. Parshikova (2015);

2) The Light Triad Questionnaire by S.B. Kaufman et al. adapted by D.S. Kornienko, V.K. Vyazovkina, and A.N. Nevryuev (2023);

3) Portrait Questionnaire (PVQ) by S. Schwartz, adapted by N.M. Lebedeva (2023), to identify students' value orientations;

4) Basic Beliefs Inventory by R. Janoff-Bulman, adapted by M.A. Padun and A.V. Kotelnikova (2012).

Statistical analysis

The raw scores on all questionnaires were converted into a standard 10-point scale. Statistical analysis was performed using descriptive statistics, correlation analysis, and regression analysis in Excel and PSPP.

Results

Let's look at the results of the study. Table 1 shows some descriptive statistics for all the variables.

Table 1

Results of descriptive statistics of value orientations, basic beliefs, and traits of the Dark and Light triads of personality in students (N = 406)

Investigated parameters	M	SD
Value orientations		
Independence	8.22	1.51
Stimulation	6.33	2.1
Hedonism	7.82	1.85
Achievement	7.58	1.81
Power	6.51	1.83
Security	7.03	1.75
Conformity	6.4	1.91
Tradition	5.25	2.12
Benevolence	7.78	1.65
Universalism	7.36	1.66
Basic beliefs		
The goodwill of the world	5.8	2.17
Justice of the world	6.05	2.27
The value of “I”	6.78	2.5
Luck	6.73	2.31
Control	6.69	2.17

Investigated parameters	M	SD
Features of the Dark Triad Personality		
Machiavellianism	6.33	1.26
Narcissism	5.86	1.3
Psychopathy	4.87	1.6
Features of the Light Triad Personality		
Faith in humanity	7.34	1.58
Humanism	7.86	1.44
Kantianism	7.66	1.51

As can be seen from Table 1, the leading role in the structure of students' value orientations is played by such values as independence (M = 8.22, SD = 1.51), hedonism (M = 7.82, SD = 1.85), benevolence (M = 7.78, SD = 1.65), achievement (M = 7.58, SD = 1.81), universalism (M = 7.36, SD = 1.66) and security (M = 7.03, SD = 1.75). The middle position is occupied by the values of power (M = 6.51, SD = 1.83) and conformity (M = 6.4, SD = 1.91). The value of tradition closes the list (M = 5.25, SD = 2.12).

The basic beliefs are generally at the average and above-average levels of expression. The dominant position is occupied by basic beliefs in the value of the "I" (M = 6.78, SD = 2.5), in luck (M = 6.73, SD = 2.31), and in control (M = 6.69, SD = 2.17). Lower scores were obtained for beliefs in justice (M = 6.05, SD = 2.27) and in the benevolence of the surrounding world (M = 5.8, SD = 2.17).

As expected, the traits of the Light Triad dominate the traits of the Dark Triad. Humanism (M = 7.86, SD = 1.44) takes the first position, followed by Kantianism (M = 7.56, SD = 1.51) and faith in humanity (M = 7.34, SD = 1.58). All the traits of the Dark Triad are less pronounced. Machiavellianism has a higher score (M = 6.33, SD = 1.26), followed by narcissism (M = 5.86, SD = 1.3), and psychopathy (M = 4.87, SD = 1.6).

Overall, the results are quite satisfactory. A study conducted at three universities in the Russian Federation shows that modern students value independence, achievement, security, benevolence, and universalism, but they also have a desire for sensual pleasure. They have basic beliefs in the value of the self, their own luck, and control, but they have lower levels of beliefs in the fairness and benevolence of the world.

They are mostly humanistic in their attitude towards other people, but in some cases they are prone to manipulation and impulsive and aggressive behavior. There are also students who believe in the exceptional and unique nature of their own personalities.

In the second stage of this study, a correlation analysis was conducted using the Pearson linear correlation coefficient. The results of the correlation analysis are presented in Table 2.

Table 2

*Matrix of correlations between value orientations and basic beliefs and the traits of the Dark and Light triads of personality**

Investigated parameters	Machia-vellyme	Narcis-sism	Psycho-pathia	Faith in humanity	Huma-nism	Kantia-nism
Value orientations						
Selfnost	-0.08	**0.21*** **	-0.07	**0.24*** **	**0.25*** **	**0.22*** **
Stimulationnie	0.03	**0.23*** **	**0.15** **	**0.13** **	**0.14** **	**0.12***
Hedonism	-0.01	**0.25*** **	-0.02	**0.18*** **	**0.19*** **	**0.10***
Achievement	0.06	**0.23*** **	-0.08	**0.25*** **	**0.23*** **	**0.11***
Power	0.07	**0.32*** **	0.03	**0.13** **	**0.12***	0.03
Safety	**-0.12***	-0.05	**-0.29*** **	**0.33*** **	**0.38*** **	**0.28*** **
Conformism	0.01	**-0.13** **	**-0.22*** **	**0.22*** **	**0.24*** **	**0.11***
Tradition	-0.01	0.01	**-0.13** **	**0.29*** **	**0.24*** **	**0.17*** **
Benevolent-ness	**-0.15** **	0.01	**-0.19*** **	**0.41*** **	**0.51*** **	**0.39*** **
Universalism	**-0.17*** **	-0.04	**-0.26*** **	**0.45*** **	**0.50*** **	**0.40*** **
Basic beliefs						
The benevolence of the world	0.03	-0.05	-0.01	**0.19*** **	**0.18*** **	**0.10***
Justice of the world	**-0.12***	0.09	**-0.11** **	**0.46*** **	**0.40*** **	**0.28*** **
Value "I"	-0.07	**0.36*** **	-0.06	**0.16*** **	**0.22*** **	0.02
Good luck	-0.01	**0.22*** **	-0.05	**0.12** **	**0.15** **	-0.07
Control	0.04	**0.19*** **	-0.09	**0.17*** **	**0.15** **	0.12

Note: ** - $p \le 0.05$; ** - $p \le 0.01$; *** - $p \le 0.001$*

As can be seen from Table 2, of the traits of the Dark Triad, Machiavellianism found three weak negative relationships with value orientations and one negative relationship with a basic belief. Negative associations were found with the values of security ($r = -0.12$, $p \le 0.05$), benevolence ($r = -0.15$, $p \le 0.01$), and universalism ($r = -0.17$, $p \le 0.001$), and with the belief in a just world ($r = -0.12$, $p \le 0.05$) among the basic beliefs.

Narcissism showed positive associations with both value orientations and basic beliefs. A moderate positive relationship was found with the value of power ($r = 0.32$, $p \le 0.001$), and weak relationships were found with independence ($r = 0.21$, $p \le 0.001$), stimulation ($r = 0.15$, $p \le 0.01$), hedonism ($r = 0.25$, $p \le 0.001$), and achievements ($r = 0.23$, $p \le 0.001$).

A weak negative correlation was found with conformity ($r = -0.13$, $p \le 0.01$). Of the basic beliefs, a moderate positive association was found with a belief in the value of "I" ($r = 0.36$, $p < 0.001$), weak positive associations with a belief in one's luck ($r = 0.22$, $p < 0.001$) and with the belief that everything is under control ($r = 0.19$, $p < 0.001$)

Psychopathy found one positive association with the value of stimulation ($r = 0.15$, $p < 0.01$) and four negative associations with the values of safety ($r = -0.29$, $p < 0.001$), conformity ($r = -0.22$, $p < 0.001$), tradition ($r = -0.13$, $p < 0.01$), benevolence ($r = -0.19$, $p < 0.001$) and universalism ($r = -0.26$, $p < 0.001$). No connections were found with basic beliefs.

Thus, narcissism has the highest number of positive associations with value orientations and basic beliefs (eight), Machiavellianism has four negative associations, and psychopathy has one positive and five negative associations.

The analysis of the relationships between the traits of the Light Triad of Personality and value orientations and basic beliefs revealed a significant number of positive correlations. Belief in humanity has a positive correlation with all the studied parameters. The highest correlation coefficients were obtained with such a basic belief as the justice of the world ($r = 0.46$, $p \le 0.001$), the values of universalism ($r = 0.45$, $p \le 0.001$), benevolence ($r = 0.41$, $p \le 0.001$), and security ($r = 0.33$, $p \le 0.001$). In addition, although weak, but a significant connection was identified with all basic beliefs.

Similar conclusions can be drawn regarding humanism. Here, moderate positive associations were found with benevolence ($r = 0.51$, $p \le 0.001$), universalism ($r = 0.5$, $p \le 0.001$), world justice ($r = 0.4$, $p \le 0.001$), and security ($r = 0.38$, $p \le 0.001$). There were also weak associations between humanism and all the core beliefs.

As for Kantianism, the general trend in the nature of the relationships identified regarding faith in humanity and humanism remains unchanged. At the same time, there are no statistically significant connections with the value of power, as well as with such basic beliefs as the value of the self and luck.

The general conclusion that follows from the analysis of the relationships between the traits of the Light Triad and the value orientations and basic beliefs of students is that all three traits are closely related to the values of benevolence, universalism, security, and the basic belief in the justice of the world.

As is known, correlation analysis makes it possible to identify relationships between the factors under study, but it does not allow us to draw conclusions about what affects what and whether it affects anything at all. Therefore, the results of the correlation analysis were supplemented by the results of the regression analysis. During the regression analysis, regression equations were constructed, where the dependent variables were the traits of the Dark and Light triads of personality, and the independent variables were the value orientations and basic beliefs. Then, on the contrary, value orientations and basic beliefs were used as dependent variables, while the traits of the Dark and Light triads were used as independent variables. As a result, a number of statistically significant regression models ($p = 0.000$) were obtained, with satisfactory coefficients of the Darbin-Watson test.

The value orientations and basic beliefs were identified as predictors of the Dark and Light triad personality traits, as well as the Dark and Light triad personality traits that, in turn, were predictors of certain value orientations and basic beliefs. The results are shown in Figures 1 and 2.

Figure 1

The influence of students' value orientations and basic beliefs on the traits of the Dark Triad personality, and the influence of the traits of the Dark Triad personality on students' value orientations and basic beliefs

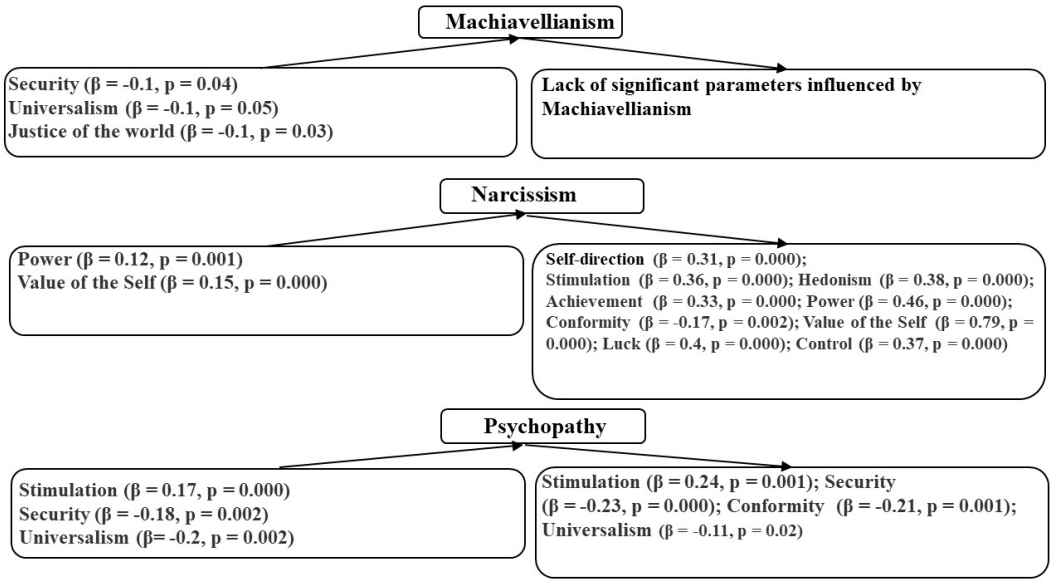
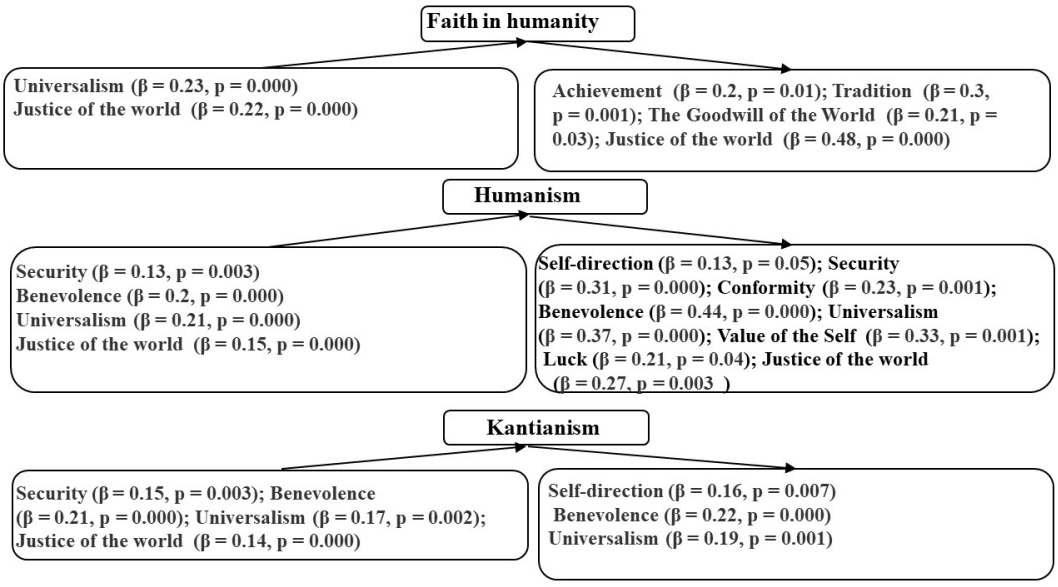


Figure 2

The influence of value orientations and basic beliefs of students on the features of the Light Triad of Personality, and the influence of the features of the Light Triad of Personality on value orientations and basic beliefs



Machiavellianism (see Fig. 1) is influenced by a low level of security values (β = -0.1, p = 0.04) and universalism (β = -0.1, p = 0.05), combined with a basic belief in the absence of a just world order (β = -0.1, p = 0.03). No significant effects of Machiavellianism were found in this study.

Narcissism is influenced by the value of power (β = 0.12, p = 0.001) in combination with a belief in a high level of self-value (β = 0.15, p = 0.000). In turn, narcissism can act as a predictor of such value orientations as independence (β = 0.31, p = 0.000), stimulation (β = 0.36, p = 0.000), hedonism (β = 0.38, p = 0.000), achievement (β = 0.33, p = 0.000), power (β = 0.46, p = 0.000), low level of conformity (β = -0.17, p = 0.002), and such basic beliefs as the value of "I" (β = 0.79, p = 0.000), luck (β = 0.4, p = 0.000) and control (β = 0.37, p = 0.000).

Psychopathy is influenced by a desire for new experiences (stimulation) (β = 0.17, p = 0.000), combined with a disregard for danger (low value for safety) (β = -0.18, p = 0.002), and a low level of universalism (β = -0.2, p = 0.002). A high level of psychopathy can, in turn, affect the development of the value of stimulation (β = 0.24, p = 0.001), the formation of a desire to ignore dangers (β = -0.23, p = 0.000), a low level of conformity (β = -0.21, p = 0.001), and a low value of universalism (β = -0.11, p = 0.02). As we can see, three factors play a leading role: the value of stimulation (positive mutual influence), the values of security and universalism (negative mutual influence).

On the other hand, the manifestations of faith in humanity (see Figure 2) are influenced by a high level of universalism (β = 0.23, p = 0.000) and a belief in a just world order (β = 0.22, p = 0.000). A high level of faith in humanity, in turn, stimulates an individual to achieve new things (β = 0.2, p = 0.01), contributes to the development of the value of traditions (β = 0.3, p = 0.001), basic beliefs in benevolence (β = 0.21, p = 0.03), and the justice of the world (β = 0.48, p = 0.000). The central idea here is the belief in the justice of the world, which affects the belief in humanity, and the belief in humanity, in turn, affects the strengthening of the belief in the justice of the world.

Similarly, the manifestations of humanism and Kantianism are influenced by the values of safety (β = 0.13, p = 0.003 and β = 0.15, p = 0.003), benevolence (β = 0.2, p = 0.000 and β = 0.21, p = 0.000), universalism (β = 0.21, p = 0.000 and β = 0.17, p = 0.002) and the belief in the justice of the world (β = 0.15, p = 0.000 and β = 0.14, p = 0.000). In turn, both humanism and Kantianism promote the development of independence (β = 0.13, p = 0.05 and β = 0.16, p = 0.007), benevolence (β = 0.44, p = 0.000 and β = 0.22, p = 0.000) and universalism (β = 0.37, p = 0.000 and β = 0.19, p = 0.001), and humanism, in addition to the above, contributes to the formation of the values of security (β = 0.31, p = 0.000) and conformity (β = 0.23, p = 0.001), basic beliefs in the justice of the world (β = 0.27, p = 0.003), the value of "I" (β = 0.33, p = 0.001) and luck (β = 0.27, p = 0.003). Humanism and Kantianism have discovered two connections based on mutual influence: benevolence and universalism. In addition, humanism was found to be related to the belief in the justice of the world.

Discussion

Various aspects of the relationship between the traits of the Dark and Light triads of personality and value orientations and basic beliefs are actively discussed in modern psychology. This interest is driven by a number of factors, primarily the desire of psychologists to understand the mechanisms of interaction between a person's value system and their behavioral patterns.

The relationship between value orientations and the Dark triad of personality has been extensively studied. Most often, the traits of the Dark Triad are positively associated with the values of self-assertion and openness to change, and negatively with the values of self-determination and preservation (see, for example, Lim & Feldman, 2020). In the present study, this pattern was generally confirmed. Narcissism showed associations based on the mutual influence of factors on each other with the value of power, and psychopathy with the value of stimulation.

All three traits of the Dark Triad were negatively correlated with the values of security, benevolence, and universalism to varying degrees.

The relationship between the traits of the Light Triad and value orientations is less studied in psychology, although the issue of the relationship between values and prosocial behavior is actively discussed in modern science. However, several studies have found that the Light Triad is positively correlated with the values of self-determination and negatively correlated with the values of self-assertion (see, for example, Kaufman et al., 2019). In this work, the

first part of this conclusion was fully confirmed, i.e., it was found that both humanism and Kantianism are influenced by the values of self-determination (benevolence and universalism), which in turn act as predictors of benevolence and humanism. However, the second part of the conclusion regarding the negative association between the traits of the Light Triad and the values of self-assertion was not confirmed.

This can be explained by the fact that for the surveyed contingent of students with traits of the Bright Personality Triad, the values of self-affirmation are important, especially for such values as achievement, which are positively correlated (see Table. 2) both with faith in humanity ($r = 0.25$, $p < 0.001$) and with humanism ($r = 0.23$, $p < 0.001$). In addition, faith in humanity acts as a predictor of the value of achievement. High achievements are an integral part of our culture, which is reflected in the results we have obtained.

The relationship between the traits of the Dark and Light triads of personality and basic beliefs has been studied even less. As for the relationship between the Dark triad and basic beliefs, we have found only one study that attempts to identify its nature.

It is a work by V.A. Pustovik and L.M. Khramtsova (2022), where the authors identified a positive association between narcissism and the belief in the value of the self and control, and a negative association between Machiavellianism and psychopathy and the belief in the justice of the world and luck. We also found a negative correlation between Machiavellianism and psychopathy and the belief in the justice of the world, but this was not confirmed by regression analysis. Only one relationship based on mutual influence was identified: the relationship between narcissism and self-worth.

We have not found any special studies that discuss the relationship between the Light Triad and basic beliefs. There is only indirect evidence that such a relationship exists. If we take into account the fact that basic beliefs are closely related to the parameters of the six-factor model of personality (Chertkova, Zyryanova, 2019), and these parameters, in turn, are closely related to the traits of the Light Triad of personality (Ilyichev, Zolotareva, 2023), then it is logical to assume that the traits of the Light Triad will also be related to the basic beliefs of personality. This assumption was confirmed by the present study, but with certain reservations. It has been established that not all, but only one basic belief plays a fundamental role in the mutual determination of faith in humanity, humanism, and basic beliefs: the belief in the justice of the world.

This fact can probably be explained by the fact that for the mentality of modern domestic students, the concept of justice is a much more significant phenomenon than other provisions that are part of the basic beliefs of the individual.

Based on the conducted research, it is possible to give brief characteristics of the traits of the Dark and Light triads of personality from the point of view of their relationship with value orientations and basic beliefs.

Machiavellianism, as is known, manifests itself in the strategy and tactics of skillful manipulation. During the manipulation, all means are widely used, flattery, deception, cunning, etc. are used. The use of these means is justified by the basic belief of the Machiavellian that

the world is unfairly arranged, so there is nothing shameful in their application. This belief is organically connected with the neglect of security against the background of intolerant attitude towards people. The data obtained in the present study are well correlated with the results of other authors.

In particular, K. Blötner and C. Bergold (Blötner & Bergold, 2022) note in their article that Machiavellianism has common links with malevolence, dishonesty, and cynicism. The same conclusions are reached by Zh.G. Garanina and N.E. Kuleshova, who, based on an empirical study, concluded that Machiavellianism in students manifests itself in an individual's ability to dominate while maintaining a low level of friendliness towards others (Garanina, Kuleshova, 2022).

Narcissism is characterized by a strong emphasis on self-importance. According to S.L. Kjaervik and B.J. Bushman (Kjaervik & Bushman, 2021), people with high levels of narcissism believe that they are special and deserve special treatment. When their expectations are not met, they tend to react aggressively. To maintain a high opinion of their own personality, they need a tool in the form of prestige, social status, or anything else that gives them a sense of dominance and control over others.

This tool is power, which was proven in our study. On the one hand, the value of the "I" and power influence the formation of narcissistic traits, and on the other hand, these traits themselves create the preconditions for the development of a specific spectrum of value orientations and beliefs not only in the uniqueness of one's personality, but also in luck and control.

Psychopathy completes the Dark Triad. M.S. Egorova and M.A. Sitnikova, summarizing research on psychopathy, identify several of its characteristics. These include: low anxiety and fearlessness; impulsivity and irresponsibility; emotional coldness, and a tendency to deceive and manipulate (Egorova, Sitnikova, 2014). The data we obtained complement this characteristic. It was found that the value of stimulation has a positive effect on psychopathy, which is based on the need for new experiences, and a negative effect on the values of security and universalism.

The traits of the Light Triad, as our study has shown, form a closer connection with each other than the traits of the Dark Triad, which indicates that they form a closer complex or even a conglomerate of personality traits that are interconnected with both value orientations and basic beliefs. For students with a predominance of Light personality traits, the values of security and a benevolent, tolerant attitude towards people (universalism) come to the fore, accompanied by the belief that the world is governed by the laws of justice. The presence of this set of qualities creates favorable conditions for the development of a number of values, including the values of achievement, adherence to traditions, and almost all of an individual's basic beliefs, with the belief in the justice of the world playing a leading role. In general, it should be noted that our hypotheses were only partially confirmed.

According to the first hypothesis, the positive relationship based on mutual influence between narcissism and the value of power, and the negative relationship between psychopathy

and the value of universalism, as well as the positive relationship between humanism and Kantianism and the value of universalism, were confirmed. However, the negative relationship based on mutual influence between narcissism and the value of self-assertion was not confirmed.

According to the second hypothesis, a positive relationship based on mutual influence between narcissism and self-esteem, as well as a positive relationship based on mutual influence between faith in humanity and humanism and the belief in the justice of the world, was confirmed. The remaining hypothesized relationships were not confirmed. However, a negative relationship was found between the belief in the justice of the world and the manifestation of Machiavellianism, and a one-sided positive relationship was found between humanism and self-esteem and luck.

The limitations of the study are due, firstly, to the specifics of the contingent, which was based on female representatives (69.46%); secondly, to the predominance of undergraduates, since by the senior years there is a reduction (especially at the medical university); thirdly, the predominance of self-assessment research methods that contribute to certain distortions in the real picture of the expression of certain personality qualities, an objective assessment of which is possible only as a result of long-term observation or expert assessment.

Nevertheless, the results obtained in this study on a significant number of students from various universities in Russia provide confidence in their reliability and potential use in practical work with students.

Conclusion

Summing up the results of the conducted research, it should be noted that the Dark and Light triads of the personality of modern students are indeed integrated characteristics that describe the uniqueness of their interactions with others, which develop and manifest themselves in close correlation and mutual influence with their value orientations and basic beliefs. In general, it was confirmed that the dominant traits are those of the Light Triad, and the dominant values are independence, achievement, hedonism, benevolence, and universalism. Among the basic beliefs, the leading role belongs to the value of one's own personality and the belief in one's own luck, which is consistent with the age characteristics of the modern student.

Correlation and regression analysis allowed us to establish complex relationships and interdependencies between the traits of the Dark and Light triads, value orientations, and basic beliefs. We identified the following: 1) a one-way relationship between low values of security and universalism, and beliefs in the injustice of the world, and Machiavellianism; 2) a one-way relationship between values of power and self-value, and narcissism; 3) values of stimulation combined with low levels of security and universalism, and psychopathy; 4) beliefs in the justice of the world, and faith in humanity; 5) values of security, benevolence, universalism, and beliefs in the justice of the world, and humanism; 6) benevolence and universalism, and Kantianism.

The general conclusion that can be drawn from this study is the recognition of the importance of developing the traits of the Bright Triad of Personality in students, especially for professions of the socionomic type that involve working with people. To achieve this, it is necessary to pay special attention to the formation of three value orientations: security, benevolence, and universalism, as well as the belief in the justice of the world, which, on the one hand, serve as predictors of the traits of the Bright Triad of Personality, and on the other hand, create a favorable environment for the development of a humanistic personality in students.

Prospects for further research

The study also raised a number of important questions, including the possible connection between the traits of the Dark and Light triads and the irrational beliefs of students, which will be the subject of further research.

The results obtained can be used both in research and in practical activities with students in the process of providing assistance in choosing a trajectory of self-development, cultivating personal qualities that contribute to building positive relationships with other people.

References

Blötner, C., & Bergold, S. (2022). To be fooled or not to be fooled: Approach and avoidance facets of Machiavellianism. *Psychological Assessment, 34(2)*, 147–158. https://doi.org/10.1037/pas0001069

Chabrol, H., Van Leeuwen, N., Rodgers, R., & Séjourné, N. (2009). Contributions of psychopathic, narcissistic, Machiavellian, and sadistic personality traits to juvenile delinquency. *Personality and Individual Differences, 47(7)*, 734–739. https://doi.org/10.1016/j.paid.2009.06.020

Chertkova, Yu. D., & Zyryanova, N. M. (2019). Relationship of basic beliefs with dispositional personality traits, locus of control, and life satisfaction. *Social and Human Sciences: Theory and Practice*, 1(3), 775–789.

Correia, I., & Dalbert, C. (2008). School Bullying: Belief in a Personal Just World of Bullies, Victims, and Defenders. *European Psychologist, 13(4)*, 248–254. https://doi.org/10.1027/1016-9040.13.4.248

Derish, F. V. (2019). Gender Differences in the Relationship between the Dark Triad of Personality and Emotional Intelligence. *Bulletin of Perm University. Philosophy. Psychology. Sociology, 3*, 356–371. https://doi.org/10.17072/2078-7898/2019-3-356-371

Egorova, M. S., & Sitnikova, M. A. (2014). The Dark Triad. *Psychological Research, 7(38)*. https://doi.org/10.54359/ps.v7i38.580

Egorova, M. S., Sitnikova, M. A., & Parshikova, O. V. (2015). Adaptation of the Short Dark Triad Questionnaire. *Psychological Research, 8(43*). https://doi.org/10.54359/ps.v8i43.1052

Ferrajão, P. C., & Elklit, A. (2020). The contributions of different types of trauma and world assumptions to predicting psychological distress. *Traumatology, 26*(1), 137–146. https://doi.org/10.1037/trm0000208

Filenko, I. A., Bogomaz, S. A., Atamanova, I. V., & Levitskaya, T. E. (2023). Basic Beliefs and Psychological Health of Modern Youth: A Mediation Analysis of Gender-Related Interactions. In Current Issues in Modern Social Psychology and Its Subfields (pp. 522–530). Moscow: Institute of Psychology of the Russian Academy of Sciences.

Garanina, Zh. G., & Kuleshova, N. E. (2022). Psychological Features of the Relationship between Manipulative Tendencies and Interpersonal Relationships of Students. *Humanitarian: Current Issues in the Humanities and Education, 22(4*), 477–486. https://doi.org/10.15507/2078-9823.060.022.202204.477-486

Gouveia, V. V., de Oliveira, I. C. V., de Moura Grangeiro, A. S., Monteiro, R. P., & de Holanda Coelho, G. L. (2021). The bright side of the human personality: Evidence of a measure of prosocial traits. *Journal of Happiness Studies, 22*(3), 1459–1480. https://doi.org/10.1007/s10902-020-00280-2

Guo, Y., Chen, X., Ma, J., Li, Y., & Hommey, C. (2022). How belief in a just world leads to prosocial behaviours: The role of communal orientation. *Personality and Individual Differences, 195*, Article 111642. https://doi.org/10.1016/j.paid.2022.111642

Ilichev, R. I., & Zolotareva, A. A. (2023). Pilot Assessment and Preliminary Psychometric Properties of the Russian Version of the Light Triad Scale. *National Psychological Journal, 2(50)*, 3–13. https://doi.org/10.11621/npj.2023.0201

Janoff-Bulman, R. (1989). Assumptive worlds and the stress of traumatic events: Applications of the schema construct. *Social Cognition, 7*(2), 113–136. https://doi.org/10.1521/soco.1989.7.2.113

Johnson, L. K. D. (2018). *The Light Triad Scale: Developing and Validating a Preliminary Measure of Prosocial Orientation* [Doctoral dissertation, Western University]. Electronic Thesis and Dissertation Repository. https://ir.lib.uwo.ca/etd/5515

Jonason, P. K., Foster, J. D., Kavanagh, P. S., Gouveia, V. V., & Birkás, B. (2018). Basic Values and the Dark Triad Traits. *Journal of Individual Differences, 39*(4), 220–228. https://doi.org/10.1027/1614-0001/a000267

Kajonius, P. J., Persson, B. N., & Jonason, P. K. (2015). Hedonism, Achievement, and Power: Universal values that characterize the Dark Triad. *Personality and Individual Differences, 77*, 173–178. https://doi.org/10.1016/j.paid.2014.12.055

Kaufman, S. B., Yaden, D. B., Hyde, E., & Tsukayama, E. (2019). The light vs. dark triad of personality: Contrasting two very different profiles of human nature. *Frontiers in Psychology, 10*, Article 467. https://doi.org/10.3389/fpsyg.2019.00467

Kjaervik, S. L., & Bushman, B. J. (2021). The link between narcissism and aggression: A meta-analytic review. *Psychological Bulletin, 147*(5), 477–503. https://doi.org/10.1037/bul0000323

Kornienko, D. S., Vyazovkina, V. K., & Nevryuev, A. N. (2023). The Bright Triad: Adaptation and Psychometric Indicators. *Psychological Journal, 44*(5), 66–75. https://doi.org/10.31857/S020595920027725-3

Lebedeva, N. M. (2023). Ethnopsychology. Moscow: Yurayt.

Li, J., Liu, C., Albertella, L., Rotaru, K., Li, K., Zhou, Y., Wei, X., Yuan, S., Liu, X., & Ren, L. (2024). Network analysis of the association between Dark Triad traits and depression symptoms in university students. *Personality and Individual Differences, 218*, Article 112495. https://doi.org/10.1016/j.paid.2023.112495

Lim, V., & Feldman, G. (2020). Values and the dark side: Meta-analysis of links between Dark Triad traits and personal values [Registered Report Stage 1]. https://doi.org/10.13140/RG.2.2.21755.05920/2

Maralov, V. G., Kudaka, M. A., & Smirnova, O. V. (2024). Choosing Interaction Positions: The Dark and Light Triads as Predictors of Behavior. *Russian Psychological Journal, 21*(2), 222–239. https://doi.org/10.21702/rpj.2024.2.13

Markina, O. S. (2023). The Role of Basic Beliefs for the Psychological Well-Being of an Individual in a Transitive Society. *Bulletin of the Moscow State Regional University. Series: Psychological Sciences, 2*, 61–73. https://doi.org/10.18384/2310-7235-2023-2-61-73

Matthews, L. T., & Marwit, S. J. (2004). Examining the Assumptive World Views of Parents Bereaved by Accident, Murder, and Illness. *OMEGA - Journal of Death and Dying, 48*(2), 115–136. https://doi.org/10.2190/KCB0-NNVB-UGY6-NPYR

Musek, J., & Grum, D. K. (2021). The bright side of personality. *Heliyon, 7*(3), Article e06370. https://doi.org/10.1016/j.heliyon.2021.e06370

Padun, M. A., & Kotelnikova, A. V. (2012). Mental Trauma and the Worldview: Theory, Empirical Research, and Practice. Moscow: Institute of Psychology of the Russian Academy of Sciences.

Paulhus, D. L., & Williams, K. M. (2002). The Dark Triad of personality: Narcissism, Machiavellianism and psychopathy. *Journal of Research in Personality, 36*(6), 556–563. https://doi.org/10.1016/S0092-6566(02)00505-6

Poulin, M., & Cohen Silver, R. (2008). World benevolence beliefs and well-being across the life span. *Psychology and Aging, 23*(1), 13–23. https://doi.org/10.1037/0882-7974.23.1.13

Pustovik, V. A., & Khramtsova, L. M. (2022). The Relationship of the Dark Triad Components with Basic Beliefs and Empathy. In Systemic Research of the Individuality of a Growing Person as an Subject of Education: Proceedings of the All-Russian Scientific and Practical Conference with International Participation, Perm, December 16, 2021 (pp. 308-313). Perm: Perm State Humanitarian Pedagogical University.

Schwartz, S. H. (1994). Are there universal aspects in the structure and contents of human values? *Journal of Social Issues, 50*(4), 19–45. https://doi.org/10.1111/j.1540-4560.1994.tb01196.x

Schwartz, S. H. (2012). An Overview of the Schwartz Theory of Basic Values. *Online Readings in Psychology and Culture, 2*(1). https://doi.org/10.9707/2307-0919.1116

Tsvetkova, N. A., & Lagvilava, K. E. (2022). Values and Basic Beliefs of Working and Non-Working Students. *University Bulletin, 8*, 203–211. https://doi.org/10.26425/1816-4277-2022-8-203-211

Zhang, M. (2021). Assessing Two Dimensions of Interpersonal Trust: Other-Focused Trust and Propensity to Trust. *Frontiers in Psychology, 12*, Article 654735. https://doi.org/10.3389/fpsyg.2021.654735

Received: September 22, 2025
Revision received: November 11, 2025
Accepted: January 12, 2026

Author Contribution

Vladimir Georgievich Maralov – formulation of the main concept of research; development of research methodology; selection of diagnostic tools, secondary processing of results, preparation of conclusions and the final version of the article text.

Marina Aleksandrovna Kudaka – participation in the literature analysis, collection and primary processing of the results on the contingent of students of Cherepovets State University, preparation of the initial version of the article text.

Vyacheslav Alekseevich Sitarov – participation in the formulation of the research concept, development of the methodology, secondary processing of the results, preparation of the conclusions and the final version of the article text.

Larisa Valerievna Romanyuk – participation in the literature analysis, collection and primary processing of the results on the contingent of students of the Moscow City Pedagogical University, preparation of the initial version of the article text.

Irina Ivanovna Koryagina – participation in the literature analysis, collection and primary processing of the results on the contingent of students of the Ivanovo State Medical University, preparation of the initial version of the article text.

Author Details

Vladimir Georgievich Maralov – Dr. Sc. (Psychology), Professor, Professor of the Department of Psychology at Cherepovets State University, Cherepovets, Russian Federation; Researcher ID: X-5925-2018, Scopus ID: 57128513900, Author ID: 633771, ORCID ID: https://orcid.org/0000-0002-9627-2304; e-mail: vgmaralov@yandex.ru

Marina Aleksandrovna Kudaka – Cand. Sc. (Psychology), Associate Professor, Head of the Department of Psychology at Cherepovets State University, Cherepovets, Russian Federation; Researcher ID: V-2277-2018, Author ID: 371039, ORCID ID: https://orcid.org/0000-0003-0352-390X, e-mail: kydakam@mail.ru

Vyacheslav Alekseevich Sitarov – Dr. Sc. (Pedagogy), Professor of the Department of Pedagogy, Moscow City University, Moscow, Russian Federation, ORCID: https://orcid.org/0000-0002-8426-7487, e-mail: sitarov@mail.ru

Larisa Valerievna Romanyuk – Dr. Sc. (Pedagogy), Professor of the Department of Pedagogy, Moscow City University, Moscow, Russian Federation, ORCID: https://orcid.org/0000-0003-2764-8205, e-mail: lora1408@mail.ru

Irina Ivanovna Koryagina – Cand. Sc. (Pedagogy), Associate Professor, Head of the Department of Psychology and Pedagogy, Ivanovo State Medical University of the Ministry of Health of the Russian Federation, Ivanovo, Russian Federation, ORCID: https://orcid.org/0000-0002-7821-6819, e-mail: koryaginairina@mail.ru

Conflict of Interest Information

The authors have no conflicts of interest to declare.

Research Article
UDC 159.99
https://doi.org/10.21702/rpj.2026.1.4

Reconstructing the Experience of Hostage-Taking Incidents Based on Narrative Analysis

Mariya O. Bulich*, Galina U. Soldatova

Lomonosov Moscow State University, Moscow, Russian Federation

*Corresponding author: mariya.bulichh@gmail.com

Abstract

Introduction. Hostage-taking is one of the most stressful extreme situations, with a long-lasting impact on the mental state of victims. Based on F.E. Vasilyuk's concept of experiencing, this paper explores the psychological phenomena of hostage experiences of terrorist attacks. This study represents the first contribution to the inductive reconstruction of the structure of hostage experiences as a complex subjective process that occurs during the hostage-taking incident. **Methods**. Using a grounded theory approach, we examined secondary qualitative sources — narratives (printed and video interviews, memoirs, and online diary entries) of survivors of the Beslan and Dubrovka hostage-taking tragedies. The study used a total of 23 documents. All interviewees and witnesses were 18 years of age or older at the time of hostage-taking. The analytical procedure included open and axial coding and the constant comparative method. To enhance reliability, double coding was used, and some materials were independently analyzed by an external expert in the psychology of extreme situations. **Results**. The main categories that reflect the subjective experience of hostages during the hostage-taking incident were identified. The characteristics and structural elements of the emotional, cognitive, and behavioral components of experience, including in the context of Stockholm Syndrome, as well as the dynamic characteristics and transitions between the identified phenomena and the structural components (from shock to hope, from numbness to mobilization) were described. **Discussion**. The results obtained deepen our understanding of individual psychological functioning in extreme situations and serve as the basis for further reconstruction of the dynamic aspects of hostage-taking as a specific internal activity in terrorist attacks.

Keywords

experience, hostages, extreme stress, narrative, Stockholm Syndrome, grounded theory

For citation

Bulich, M. O., & Soldatova, G. U. (2026). Reconstructing the experience of hostage-taking incidents based on narrative analysis. *Russian Psychological Journal, 23*(1), 61–79, https://doi.org/10.21702/rpj.2026.1.4

Introduction

Extreme situations are events associated with real threats to life, suddenness and high uncertainty (Drury, 2007). Hostage-taking represents one of the most traumatic forms of stressful situations. It involves a combination of physical and psychological violence, a threat to life, and the loss of freedom and control over events. Unlike natural or man-made disasters, aggression here comes from another person or group of people and is perceived as intentional, which dramatically violates fundamental ideas about security, predictability and trust in the world, distorts the image of reality and undermines stable personal structures, including core beliefs about oneself and the world (Zinchenko, Soldatova, Shaigerova, 2011; Soldatova, Shaigerova, Shlyapnikov, 2008; Shoigu, 2007; Shoigu, 2019).

An analysis by the international organization Hostage Aid Worldwide (2024) showed that between 2000 and 2019, the number of hostage-taking incidents by both state and non-state actors increased more than 30-fold. The analytical forecast noted that this trend will continue in 2020–2029 (Hostage Aid Worldwide, 2024). In Russia, the most serious cases remain the incidents in Budyonnovsk (1995), Dubrovka (2002), and Beslan (2004), where hundreds of civilians were captured. Despite the publications devoted to the consequences of terrorist attacks, the direct subjective experience of hostages during hostage-taking incidents remains poorly studied. However, understanding the characteristics of "acute" conditions and their dynamics plays a crucial role in planning rescue operations during and after an incident (Reshetnikov, 2006).

According to the concept of F.E. Vasilyuk, the experience of a critical situation is a special form of internal mental activity that aims to overcome the crisis and restore the integrity of the life-world (Vasilyuk, 1984; 2014). In legal terms, a "hostage-taking incident" or "hostage-taking" is generally considered to be a situation in which a person (persons) is captured or held as a hostage to force a third party to carry out or refuse to carry out any act as a condition for the release of the hostage (Criminal Code of the Russian Federation [CC RF], 1996, Article 206). This crime is considered one of the most severe in terms of the typology of crises, since it involves the emergence of serious threats to the individual, including frustration, threat to life, disorientation, loss of control, and destruction of meaning. In this study, the experience

is interpreted on the basis of the concept of F.E. Vasilyuk as an internal activity of the subject, which arises in response to the destruction of a stable order of life and aims at restoring it (Vasilyuk, 1984; 2014).

Currently, psychology lacks reconstructed descriptions of the subjective experience of hostages that help to identify their substantive and structural components. Despite the development of research on post-traumatic stress (Bisson, 2007; Brewin, Andrews & Valentine, 2000) and post-traumatic growth (Tedeschi & Calhoun, 2004), the study of the consequences of extreme situations for military personnel, victims of terrorism and hostage-taking, and their families (Easton & Turner, 1991; Favaro, 2000; Solomon, 1988; Laufer & Solomon, 2006; Otradinskaya, 2011), and the negative mental processes characteristic of the period of captivity in a "hostage-taking incident" remain poorly understood.

This study **aims** to psychologically reconstruct the experience of hostage-taking incidents by analyzing narrative data of former hostages.

We propose that the subjective experience of hostages during hostage-taking incidents has a complex internal structure and includes phenomena that reflect various aspects of a person's internal mental activity under extreme threat. These phenomena can be reconstructed through an inductive analysis of the narratives of the former hostages.

This study represents the first contribution to the inductive reconstruction of the structure of hostage experiences as a complex subjective process that occurs during the hostage-taking incident. The key components of the experience, including dynamic manifestations and possible interrelationships, are identified and described, expanding our understanding of the nature of human adaptation to extreme violence and providing grounds for further research into the dynamic aspects of the response to crises.

Methods

The study used a grounded theory approach (Strauss & Corbin, 1998; Charmaz, 2006; Clarke, 2005) to construct conceptual models based on inductive text analysis. The content included narrative data from former hostages obtained in open sources – interviews, documentaries, and online diaries. Initial, focused, and theoretical coding were used to identify key categories and their interrelations, as well as double coding to enhance validity. The ethical requirements were met by analyzing only public data without contacting the respondents directly.

To analyze psychological experiences during terrorist attacks, this study used secondary data in the form of first-person narratives of former hostages published in open sources. The decision to rely on this content was determined by ethical and methodological considerations. Direct data collection (e.g., interviews) poses a considerable risk of retraumatization for victims and is often impossible due to the temporal distance of the events (Heaton, 2004; Hinds, 1997). Personal texts, already publicly available, allow the researcher to work with real-life evidence without violating privacy or engaging individuals in re-enacting traumatic experiences (Heaton, 2004).

The use of narratives as empirical materials is based on the accepted notion in qualitative methodology that such texts are not only acceptable but also an important source of data on subjective experience (Wertsch, 2002; Ankersmit, 2005). This position is consistent with cultural and historical traditions, which consider internal mental processes to be mediated by social interaction and formed in speech (Vygotsky, 1983). According to F. Bartlett's concept of memory, remembering is a reconstructive process in which the original experience is reproduced not literally, but through the prism of cultural and personal-semantic schemas (Bartlett, 1932). This position is considered a methodological assumption in this study. Recognizing that texts do not reflect events in their objective sequence, the researcher views them as a representation of the personal processing of traumatic experience. However, when focusing on fragments containing descriptions of states and reactions that arose during hostage-taking, such texts become a possible source of information about the phenomena of experience.

The study used narrative documents from witnesses to hostage-taking incidents, including transcribed interviews, published memoirs, and first-person personal blog entries. Specifically, we chose evidence from victims of two terrorist attacks in Russia – the hostage-taking incidents at the Beslan School (2004) and the Dubrovka Theatre Centre (Nord-Ost, 2002).

To enhance the validity of research and take into account the reconstruction characteristics of memory, only texts meeting the following requirements were included in the analysis:

- a first-person narrative: The text must be presented as personal evidence of a survivor;
- descriptions of events that occurred during the hostage-taking incident (and not after liberation);
- verbalization of one's own states, impressions, and reactions associated with the immediate experience of the hostage-taking incident;
- sufficient specificity and detail of the narrative to allow for the identification of meaningful units of analysis.

Materials were excluded from the analysis if they:

- were retellings of events by third parties (journalists, relatives, researchers);
- contained exclusively post-factum reflection—reflections on lessons, meanings, moral or political conclusions;
- did not allow for a reliable temporal framework of the described experience (e.g., texts with an unclear time frame or abstract presentation);
- did not contain any internal response (for example, they were limited to a brief external presentation of the incident).

The study examined 23 texts, totaling 144 typewritten pages. These included 8 texts relating to the terrorist attack in Beslan, 15 texts relating to the Dubrovka terrorist attack, and 4 texts were video interviews containing verbal and non-verbal markers (e.g., descriptions of intonation, crying, laughter). These interviews did not contain visual materials that could be further analyzed for the phenomenon of experiencing the hostage-taking incident, and were therefore analyzed as textual data included in the total number of documents.

According to biographical information available in the sources, the age of the interviewees and witnesses at the time of the hostage-taking incidents was 18 to 63 years.

In accordance with Russian copyright law and respect for the privacy of victims, direct quotes in this document are limited to materials that are publicly available and only if justified by the research objectives. The analytical section largely uses generalized formulations and typical forms of experience are described using anonymous examples.

The grounded theory method was used in its constructivist version (Clarke, 2005; Charmaz, 2006), according to which theory is viewed as the result of the researcher's meaning-related work in the context of a specific analytical interaction with texts. This approach allowed the reconstruction of experiential phenomena as living subjective experiences that could not be reduced to predetermined explanation models.

The analysis unit during the open coding phase of the study consisted of narrative fragments that contained statements describing the internal state, reactions, and behavior patterns of the hostage at the time of capture. These fragments were subsequently subjected to initial coding and subsequent categorization. Units of similar meaning were grouped into broad categories representing stable modes of response and the content of subjective experience. During subsequent phases of axial and theoretical coding, relationships were established between categories, and the results were related to the concept of experience, allowing for the reconstruction of its structure and identification of features of internal organization. The comparison of codes with the source texts was carried out throughout the analysis, allowing a step-by-step abstraction and the formation of a conceptual framework (Khoroshilov, Mashkov, 2020; Melnikova, Khoroshilov, 2020; Busygina, 2022).

The analysis was conducted manually using a Microsoft Excel-based spreadsheet system. This approach was required both by the moderate volume of material and by the need to constantly correlate the code with the narrative context, which required a high degree of flexibility and control from the researcher.

To enhance reliability, double coding was used. Some materials were independently analyzed by an external expert in the psychology of extreme situations. The codes were compared at the level of broad categories; discrepancies were discussed until a consensus on interpretation was reached. A formal assessment of the consistency coefficient was not carried out, as the constructive approach emphasizes the qualitative interpretation and intersubjective consistency of analytical positions.

The analysis was completed at the theoretical saturation phase, when new data no longer made considerable changes to the composition and structure of categories and confirmed the stability of the proposed conceptual model.

Results

In the qualitative analysis, 401 units of analysis were identified that describe various aspects of the hostage state during the hostage-taking incident. During the focus and theoretical

understanding phase, these units were divided into three general categories presenting the conditional structure of experience – emotional, cognitive, and behavioral components. Within each of these categories, subcategories were identified that clarified the types of responses and the content of subjective experience. In addition, a separate category was created that reflected the manifestations of the mechanisms of identification with the aggressor, similar to Stockholm Syndrome. Table 1 shows all the categories identified.

Table 1

Categories derived from the analysis of hostage behaviors during a terrorist attack and their content

Categories	Subcategories / Content (if no subcategories)
Emotional component	Fear, affect, stress, calm, anger, panic, aggression, despair, emotional numbness, anxiety
Cognitive component	Distorted perception of the incident
	Attitude to the incident
Behavioral component	Interaction with hostages
	Interaction with hostage-takers
	Relationships to the external world
	Ensuring security
	Individual coping behavior
Stockholm Syndrome	Empathy and understanding towards the hostage-taker, identification with the aggressor

Emotional component

The analysis of hostage emotional reactions enables us to view them not only as direct affective manifestations, but also as part of the subject's internal process in extreme crisis conditions. According to F. E. Vasilyuk's (1984) concept of experiencing, such states reflect a special form of life activity that occurs when external action is blocked and aims to restore disturbed connections with the life-world and preserve the individual's internal integrity.

Many narratives describe intense states of fear, horror, stupor, and numbness that arise in the context of a sudden collapse of the usual meaning-related structure: "Someone, on the contrary, petrified" (BBC News Russian, 2017, paragraph 11), "Everyone was very frightened", "In the first hours, I was in a state of panic" (Stepanova, 2006, p. 1). These experiences can be understood as the initial stage of experience in an activity-based sense, in which the subject registers a base destruction and initiates a process of internal response (Vasilyuk, 1984).

Acute affective manifestations—crying, screaming, hysterical laughter—can be viewed as ways of spontaneously regulating the affective overload caused by a traumatic event. These phenomena are illustrated by the following examples: "Someone became hysterical", "People panicked and became hysterical" (BBC News Russian, 2017, paragraphs 11, 24), and "Someone started to become hysterical" (Stepanova, 2006, p. 1). According to M. Horowitz's model, such reactions can be attributed to the disorganization stage; they serve as a transition to the cognitive processing of the traumatic experience (Horowitz, 1986). From the perspective of the coping model, they can also be interpreted as emotion-oriented coping strategies to reduce subjective distress (Lazarus & Folkman, 1984). Such mechanisms do not contradict the understanding of experience, but can be integrated into its structure as part of an attempt to maintain subjective stability under blocked activity conditions.

In some cases, participants described states of emotional numbness, detachment, or internal "shutdown": "fell into a kind of numbness", "simply and emotionlessly", "just shut down" (Rokhlin et al., 2003, paragraphs 32-33). These states can be correlated with F. E. Vasilyuk's concept of experiencing, in which a critical situation is understood as an impossibility of action and the fulfillment of important needs (Vasilyuk, 1984). In this context, emotional numbness can be considered a primary reaction to this impossibility, which can subsequently develop into a process of internal activity to cope with the critical situation. In parallel, such descriptions have resonance in post-traumatic dissociation theory, where they are considered as an adaptive mechanism for temporary shutdown in extreme threats (Van der Kolk, 2014).

Episodes of anger or aggression towards terrorists or an unspecified external object can be interpreted as an attempt to mobilize and maintain activities against loss of control. In Vasilyuk's conceptual framework, such manifestations can be interpreted as an internal action—a form of resistance to the situation and restoration of the subjective position (Vasilyuk,

1984). Similarly, according to J. Janoff-Bulman, anger in traumatic situations can function as a defense of violated core beliefs and serve as a mechanism for processing powerlessness (Janoff-Bulman, 1992).

Thus, the emotional component of the experience is not limited to a list of feelings, but encompasses a complex internal dynamic—from shock to attempts at internal ordering and mobilization. These data support the understanding of experience as an activity-based process that restores the subject's connection to oneself and the world (Vasilyuk, 1984). Narratives that contain elements of state transitions require a further study of the dynamic structure of experience, including its phase-based and functional transitions.

Cognitive Component

This component includes the characteristics of perception, attention, memory, thinking, and evaluative judgments reflected in hostage narratives. Its analysis enables us to identify how cognitive processes interact with the emotional background, forming stable or, on the contrary, fragmented internal images of events. In accordance with F. E. Vasilyuk's concept of experience, such internal activity can be interpreted as a form of activity-based treatment of a critical situation that arises in conditions of impossibility of external action and aims to restore the disrupted life-world and preserve the integrity of the subject (Vasilyuk, 1984).

Many victims document episodes of derealization: What happens is described as "unreal", as in a film. These states can be interpreted as manifestations of dissociation—a defensive reaction that reduces emotional intensity through impaired perception (Van der Kolk, 2014). It is also noted that the attention is restricted to individual sensory elements (sounds, faces, movements) while the rest of the background is ignored. This focus corresponds to the phenomenon of "attentional tunneling" which occurs when perceiving a threat and is associated with the redistribution of cognitive resources to the most significant stimuli (Horowitz, 1986). In the terms of F.E. Vasilyuk, such concentration can be considered as a primary adaptive form of internal activity that allows to remain in the situation by maintaining minimum orientation towards what is happening.

Along with this, narratives often mention distortions of temporal and spatial orientation – a subjective sensation of "stopped" or "stretched" time, a disruption in the sequence of events: "I didn't understand where night was, where day was" (Lokshina, 2002, paragraph 20), "time passed very slowly", "I fell asleep for about fifteen minutes, but it seemed like I'd slept for several hours" (Stal, 2002, pp. 2-3). These phenomena are consistent with descriptions of chronoperceptual disturbances under traumatic stress conditions (Lifton, 1967) and can be considered as manifestations of the destabilization of the structure of life time. In the concept of F.E. Vasilyuk, this can be correlated with the phase of a "rupture" in the structure of

experience, when the habitual organization of the life-world is disrupted and requires internal reconstruction (Vasilyuk, 1984).

A number of narratives describe cognitive actions to understand what is happening: internal questions, mental scenarios for how events will unfold, forecasts and plans ("We specifically recalled certain everyday details and made plans"; Amelkina, Veligzhanina, Safonova, 2002, paragraph 16). These elements can be interpreted as forms of meaning-making activity, reflecting the subject's desire to restore coherence and predictability to the world (Park, 2010; Janoff-Bulman, 1992). In experience theory, such processes correspond to the "unfolding" phase—active internal work that facilitates overcoming the cognitive gap and restoring the subjective position.

Finally, the dynamics of cognitive assessment of what is happening – from shock to short-term hope, despair to internal mobilization – emphasize the close relationship between cognitive and emotional processes. In the context of experiential theory, these transitions can be interpreted as aspects of the restoration of the life-world and subjective activity interrupted by an extreme situation.

Thus, the cognitive component encompasses not only disturbances in perception, memory, and thinking, but also internal processing elements to integrate critical experience. This enables us to view experience as an active, step-by-step process of meaning-based reconstruction that occurs under the conditions of loss of external action and requires the mobilization of the internal resources of the subject.

The behavioral component includes a variety of actions taken by hostages in the context of a terrorist attack. These actions can be considered as external manifestations of the subject's internal struggle to overcome a critical situation. In the context of F.E. Vasilyuk's concept of experience, behavior reflects not only a response to a threat, but also attempts to maintain subjectivity, restore integrity and find support in conditions where previous modes of action are not available.

One of the central behavioral vectors is the desire to ensure physical safety. This includes measures to seek shelter and to comply with terrorist demands. Such manifestations can be interpreted as attempts to minimize the threat and concentrate resources on maintaining life. Despite their outward passivity, these actions can be understood as a strategy of choosing the lesser evil, reflecting adaptive activity under constraints.

In addition, there are individual coping strategies, focused not so much on the external situation as on the internal state. The use of prayer ("then I began to pray, to pray very sincerely", "we even prayed together" (Lyutykh, Okunev, 2022, paragraphs 37, 39)), fantasizing, mental distraction ("We were always playing something – words, battleship, stupid tic-tac-toe, laughing our heads off" (Rokhlin et al., 2003, paragraph 34)) and other forms of self-soothing

indicate the subject's attempt to maintain internal order, symbolic support, and coherence of consciousness. In F.E. Vasilyuk's terms, such actions can be considered as methods of "experiential work", in which a person seeks new grounds to maintain self-control in a situation that has disrupted his/her usual way of life.

The behavioral component also includes interactions with other hostages, where the desire for support, mutual assistance and joint regulation of emotional tension is evident: "We told our neighbors face to face how the events in the play have unfolded. They supported each other as much as they could" (Kichin, 2002, paragraph 28); "Everyone helped each other in some way" (Lyutykh, Okunev, 2022, paragraphs 37, 39). These behaviors suggest a collective dimension to the experience. Uniting into a minimal "we" can serve as a way of restoring a lost social structure and value-related orientation. Mutual assistance, participation, altruism, as well as ignorance or alienation, become indicators of the varying quality and depth of experiences.

Contact with the captors, although limited, also involves a behavioral load. Some hostages engaged in dialogue, tried to persuade, influence and obtain information, thus restoring at least a symbolic sense of influence on what was happening ("We tried to talk to the female terrorists", "We asked why they, Muslims, were raising their hands..." Stepanova, 2006, p. 2). In some cases, this behavior can be interpreted as a form of maintaining subjectivity, and the individual uses communication as an adaptation tool.

All of these demonstrates that hostage behavior cannot be reduced to a reactive model. It reflects dynamic transitions between the following states: from numbness to action, from submission to internal resistance, from disorganization to the search for new forms of order. These transitions are not always linear and depend on many factors, including personal resources, social environment, and symbolic support. The analysis of the behavioral component allows us to capture not only external forms of adaptation but also profound transformations in the structure of experience.

Therefore, behavior in extreme situations should be regarded as an important layer of experience reflecting both protection and transformation processes. This opens the possibility of studying the dynamic component, which captures changes in responses and methods for maintaining subjectivity under conditions that disrupt the ordinary structure of life.

Stockholm Syndrome. An analysis of the narratives revealed the presence of unique forms of identification with the captor, which can be interpreted as manifestations of a phenomenon known in the literature as 'Stockholm Syndrome'. This phenomenon is context-specific, that is, it develops mainly under conditions of violent capture, prolonged isolation, and life-threatening situations, and is described as a paradoxical form of adaptation to an extreme situation, in which hostages exhibit positive feelings, empathy, and sympathy towards their captors (Favaro, 2000; Namnyak et al., 2008; Kumar, 2022).

In this study, such manifestations were not considered a specific clinical syndrome, but as an independent component as an important part of the experience. These attitudes toward the captor can be interpreted as coping behavior aimed at reducing internal tension and restoring at least partial psychological stability in the face of complete external dependence. This is consistent with F.E. Vasilyuk's idea of experiencing as the subject's internal work to restore the disrupted life-world. Thus, in a situation in which habitual support disappears, a person can try to integrate into a new coordinate system — in this case, into the role structure imposed by the captor.

The materials reveal two directions for such adaptation:

1. The development of sympathy, empathy, and symbolic identification with the captor. This was expressed in the descriptions of compassion, attempts to understand the captor, and regret for the circumstances of their lives. This may also include understanding the motivations of terrorists and actions to establish contacts with them, help them or emotionally involve them. These reactions may represent the subject's attempt to reduce perceived threat by converting the aggressor's figure into a potentially close or justified figure. In the cultural-historical logic of experience, this transformation allows to maintain the internal coherence of experience, even at the expense of a distorted ethical perspective.
2. Negative attitudes towards authorities and the external world. In view of increased vulnerability and limited access to information, some hostages developed pronounced critical or even hostile assessments of security forces' actions. This is considered to be a shift from the immediate source of the threat (captor) to external observers, especially because authorities are often regarded as ineffective and unable to save. This shift plays a protective role, allowing the illusion of control over the situation to be maintained and minimizing the feeling of complete helplessness.

We should emphasize that such manifestations do not occur suddenly. In some cases, a dynamic relationship with the captor was observed, ranging from fear and horror to attempts at contact, empathy or even protection. These transitions emphasize the need to analyze not only the content of experiences, but also their temporal evolution — dynamic changes that can reveal a lot about how the individual copes with a critical situation.

Thus, such phenomena should be considered part of a broader process of seeking ways to maintain internal balance. They are closely related to the other components of the experience identified and can be seen as an indicator of the depth of the crisis facing the individual. Their emergence does not require mere assessment, but a careful and multidimensional analysis, including in the construction of complex models of hostage behavior and experiences.

We should also note separately that physical condition played an important role in the experiences of all hostages, including fatigue, thirst, pain from injuries and uncomfortable

postures. Although we did not identify physical exhaustion as a separate category (it is a constant background, not a mental phenomenon), its influence on the ability to unfold the experience process or, on the contrary, the choice of automatic responses plays an important role.

Discussion

The narrative analysis carried out enabled us to reconstruct the key components of the hostage-taking experience, including cognitive, emotional, behavioral, and a phenomenon similar to manifestations of Stockholm Syndrome. Each of these components demonstrates not only substantive characteristics but also dynamic changes during the hostage-taking experience. In particular, during the final phases of coding, important dynamic aspects were identified, demonstrating an understanding of the internal process of experiencing hostage-taking as an unfolding mental activity. The results obtained, which reflect these components of the experience, are consistent with the results of the review papers that describe the diversity of reactions of individual and group hostages combined in the emotional, cognitive and social spheres, and also describe possible manifestations of Stockholm Syndrome and some specific characteristics of perception (Alexander & Klein, 2009; 2010). A recent qualitative study using secondary data on the coping mechanisms of people exposed to hostage incidents in Gaza found that intrapersonal and interpersonal coping strategies are used simultaneously and change depending on the context, with maturity, experience, and age influencing the choice of mechanisms (Levkovich et al., 2025). Consequently, the coherence between these conclusions and literature supports the need to consider hostage experience as a dynamic process. Moreover, the analysis of both review papers and empirical studies demonstrates that hostage experience is not only a stage-by-stage process, but also a complex set of interrelated cognitive, emotional, behavioral, and socially significant strategies that change over time.

The cognitive component in the first phases of the experience manifested itself primarily in the form of fragmented and sensory images. Similar cognitive characteristics were described in the study by Alexander and Klein (2009), where hostages reported confusion, disorientation, concentration deficits, and intrusive memories.

Under the influence of emotional and situational stress, cognitive processing of events gradually evolved into a more organized, but often selective, interpretation of events. Attention focused on critically significant stimuli, which can be considered as a manifestation of the adaptive mobilization of cognitive resources under extreme stress conditions.

This transformation of cognitive processes is consistent with the concept of experience as activity (Vasilyuk, 1984), which involves a dynamic redistribution of attention, cognitive assessments, and meaning-related orientations, depending on the level of threat and availability of psychological base.

The emotional component also showed a clear dynamic. In the initial phase, acute stress reactions (shock, panic, and stupor) dominated, while later participants described depression, aggression, desire for humility or a search for inner balance. Similar dynamics of emotional states have been documented in studies on coping strategies among former captives, who often relied on the hope of family reunification or religious faith, which provided meaning to their suffering and reduced distress. In interviews with Israeli hostages, it was the hope of meeting loved ones and faith that served as powerful emotional resources that enabled them to survive captivity (Levkovich et al., 2025). These changes can be interpreted as manifestations of the transition from a phase of affective disorganization to mobilization and the subsequent search for internal resources. Emotional states not only influenced cognitive and behavioral spheres, but also played a regulatory role, shaping experiential phenomena and supporting a vision of the future.

The behavioral component ranged from conformist reactions and avoidance to risky active actions aimed at saving oneself and others. During the hostage-taking incident, changes in behavior patterns were observed, with passive reactions that gave rise to more active reactions or, on the contrary, actions that gave rise to adaptive freezing. Similar behavioral variations are also observed in interpersonal strategies described in other studies: hostages shifted from isolation to mutual assistance and "we-feeling", found meaning in caring for children, used professional identity as a resource, and built "recursive" relationships with their captors, which allowed them to mitigate threats and maintain group stability (Levkovich et al., 2025). These changes can be considered as successive stages of voluntary and involuntary responses, embedded in the dynamics of the experience as a specific activity aimed at restoring subjective control and meaning-related base.

A phenomenon similar to the manifestations of Stockholm Syndrome deserves special attention. In some cases, it developed alongside the preceding components. Its symptoms (empathy toward the captors, identification, and negativity towards the authorities) also revealed a dynamic nature – from initial fear and hostility to compassion, understanding, gratitude, and sometimes even a willingness to help. This phenomenon can be considered a special form of meaning construction process under conditions of loss of external control, in line with the idea of experience as a process of internal creation or restructuring of the life-world in extreme circumstances.

Therefore, the results of the analysis confirm the possibility of considering the capture experience not as a fixed reaction, but as an unfolding internal process in which each component can change over time, interact with others and contribute to the disorganization or restoration of the subjective position. This allows us to go beyond linear or stage-based models and consider dynamic complexes – stable combinations of cognitive, emotional and behavioral elements that replace each other according to the stage of events and individual

characteristics. A similar idea is evident in review papers emphasizing the multiplicity and variability of hostage reactions (Alexander & Klein, 2009; 2010), as well as in the recent work of Levkovich et al. (2025), which demonstrated that intrapersonal and interpersonal coping strategies operate simultaneously and are transformed depending on the conditions.

These results also emphasize the importance of studying the dynamics of experience – transitions between states, internal temporal unfolding of the reaction, and meanings and base formation during captivity. In the future, it appears useful not only to analyze the experience by its components, but also as a complex process unfolding over time to identify typical dynamic configurations and possible adaptation pathways.

The possibility of analyzing child samples requires special attention. Child hostages, due to their age, cognitive and emotional characteristics, may have different forms of experience.

The limitations of the study include the use of secondary data, the absence of direct contact with the respondents, and an uneven representation of age, gender, and situational variables. However, narrative material has considerable potential to reconstruct subjective experiences under conditions that are not accessible to traditional methods.

Conclusion

This study enabled us to reconstruct the structure of hostage experiences in hostage-taking incidents, based on an analysis of their narratives and a grounded theory approach. Therefore, the following four interrelated components of the experience were identified: cognitive, emotional, behavioral, and Stockholm Syndrome. Each of these components includes internal differentiation and is characterized by its own structure, manifestations and relationships with other aspects of the experience.

The results show that people continue to actively engage in internal work even under extreme external coercion and lack of control in order to understand, maintain integrity and adapt to the extreme situation. The experience in this situation is not only situational but also procedural.

We should emphasize that the analysis documented dynamic changes, including transitions between mental states, fluctuations in experience intensity and changes in dominant response patterns. Specifically, the narratives revealed emotional shifts (from shock and panic to short-term hope, from despair to humility), cognitive changes (from a fragmented and distorted perception of events to attempts to comprehend the situation and construct mental scenarios for how events might unfold), and behavioral shifts (from numbness to more active behavior patterns).

These dynamics show that experience is not a static reaction set, but a process sensitive to changes in the conditions of the situation itself. Thus, in some documents, changes in reactions were related to the unfolding of hostage-taking events, changes in the level of threat, interactions

with captors or support from other hostages. At the same time, the variability of the response patterns described also points to the role of individual personality traits such as available psychological resources, coping strategies, and personal strategies for interpreting events. Thus, even a limited description of dynamic transitions indicates the possible importance of situational and individual factors in the development of the experience of extreme situations.

Analysis of dynamic aspects was not the main objective of this study; identified transitions were only recorded in individual observations. Nevertheless, the data obtained show the potential for further research into the temporal unfolding of experience, as well as the possibility of identifying stable dynamic complexes that reflect regular sequences of changes in the structure of hostages' inner lives.

The structure of experience described in this study reflects not only the individual's inner life in a critical situation, but also his/her attitude towards others, the world and themselves. These data can be used to develop psychological interventions, rehabilitation programs and training for professionals working with victims in emergency situations.

Therefore, this study contributes to the understanding of emotional processes in extreme hostage-taking incidents and opens up new perspectives to understand the complexity, multi-layeredness and dynamism of the individual's inner world under such circumstances.

References

Alexander, D. A., & Klein, S. (2009). Kidnapping and hostage-taking: a review of effects, coping and resilience. *Journal of the Royal Society of Medicine, 102*(1), 16–21. https://doi.org/10.1258/jrsm.2008.080347

Alexander, D. A., & Klein, S. (2010). Hostage-taking: motives, resolution, coping and effects. *Advances in Psychiatric Treatment, 16*(3), 176–183. https://doi.org/10.1192/apt.bp.108.005991

Amelkina, A., Veligzhanina, A., & Safonova, M. (2002, October 31). Hostages V. Popov and S. Ilyina tell their stories. *Komsomolskaya Pravda*. https://nord-ost.org/terakt/rasskazyvayut-zalozhniki-v.popov-s.-ilina_ru.html (in Russ.)

Ankersmit, F. R. (2005). *Sublime historical experience*. Stanford University Press.

Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology*. Cambridge University Press.

BBC News Russian. (2017, October 23). *"They didn't want to kill us": The memories of a Nord Ost hostage.* BBC News Russian. https://www.bbc.com/russian/features-41711874 (in Russ.)

Bisson, J. I. (2007). Post-traumatic stress disorder. *British Medical Journal, 334*(7597), 789–793. https://doi.org/10.1136/bmj.39162.538553.BE

Brewin, C. R., Andrews, B., & Valentine, J. D. (2000). Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology, 68*(5), 748–766. https://doi.org/10.1037/0022-006X.68.5.748

Busygina, N.P. (2022). *Qualitative and quantitative research methods in psychology: A textbook for universities*. Yurait. (in Russ.).

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. Sage Publications.

Clarke, A. E. (2005). *Situational analysis: Grounded theory after the postmodern turn*. Sage Publications.

Criminal Code of the Russian Federation No. 63-FZ of June 13, 1996 (as amended on July 1, 2025). Art. 206. Hostage-taking. [ConsultantPlus]. https://www.consultant.ru/document/cons_doc_LAW_10699/ (in Russ.)

Drury, J., & Cocking, C. (2007). The mass psychology of disasters and emergency evacuations: A research report and implications for practice [Research report]. Department of Psychology, University of Sussex. https://www.researchgate.net/publication/253362722

Easton, J. A., & Turner, S. W. (1991). Detention of British citizens as hostages in the Gulf—Health, psychological, and family consequences. *British Medical Journal, 303*(6812), 1231–1234. https://doi.org/10.1136/bmj.303.6812.1231

Favaro, A., Degortes, D., Colombo, G., & Santonastaso, P. (2000). The effects of trauma among kidnap victims in Sardinia, Italy. *Psychological Medicine, 30*(4), 975–980. https://doi.org/10.1017/S0033291799001877

Heaton, J. (2004). *Reworking qualitative data*. Sage Publications.

Hinds, P. S., Vogel, R. J., & Clarke-Steffen, L. (1997). The possibilities and pitfalls of doing a secondary analysis of a qualitative data set. *Qualitative Health Research, 7*(3), 408–424. https://doi.org/10.1177/104973239700700306

Horowitz, M. J. (1986). *Stress Response Syndromes* (2nd ed.). Northvale, Jason Aronson.

Hostage Aid Worldwide. (2024). *Global Hostage Report 2024***.** Retrieved from https://hostageaid.org/wp-content/uploads/2025/03/Hostage-Aid-Global-Hostage-Report-2024-Version-V1.1.pdf

Janoff-Bulman, R. (1992). *Shattered assumptions: Towards a new psychology of trauma.* Free Press.

Khoroshilov, D. A., & Mashkov, D. S. (2020). A grounded theory approach as a tool for psychological mapping of social situations. *Vestnik of Saint Petersburg University. Psychology, 10*(1), 18–32. (in Russ.).

Kichin, V. (2002, October 29). Hostage Georgy Vasiliev tells his story. *Nord-Ost*. https://nord-ost.org/terakt/rasskazyvaet-zalozhnik-georgiy-vasilev_ru.html (in Russ.)

Kumar, P. (2022). Stockholm syndrome: An understanding. *Journal of Psychosocial Wellbeing, 3(1), 1–4*. https://doi.org/10.55242/JPSW.2022.3101

Laufer, A., & Solomon, Z. (2006). Posttraumatic symptoms and posttraumatic growth among Israeli youth exposed to terror incidents. *Journal of Social and Clinical Psychology, 25*(4), 429–447. https://doi.org/10.1521/jscp.2006.25.4.429

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York: Springer Publishing Company.

Levkovich, I., Elyoseph, Z., & Shinan-Altman, S. (2025). Coping strategies during captivity: a qualitative study on released civilian abductees in Gaza. *BMC Psychology, 13*, 883. https://doi.org/10.1186/s40359-025-03183-0

Lifton, R. J. (1967). *Death in life: Survivors of Hiroshima.* New York: Random House.

Lokshina, L. (2002, November 30). Not shot twice. *Moskovsky Komsomolets.* https://www.mk.ru/editions/daily/article/2002/11/30/130259-nerastrelennaya-dvazhdyi.html (in Russ.)

Lyutykh, S., & Okunev, D. (2022, October 26). The Dubrovka terrorist attack: Memories of Nord-Ost hostages and the storming of the theater center. *Lenta.ru.* https://lenta.ru/articles/2022/10/26/nord_ost/ (in Russ.)

Melnikova, O.T., & Khoroshilov, D.A. (2020). *Methodological issues of qualitative research in psychology*. Akropol. (in Russ.).

Namnyak, M., Tufton, N., Szekely, R., Toal, M., Worboys, S., & Sampson, E. L. (2008). 'Stockholm syndrome': Psychiatric diagnosis or urban myth? *Acta Psychiatrica Scandinavica, 117*(1), 4–11. https://doi.org/10.1111/j.1600-0447.2007.01112.x

Otradinskaya, V.V. (2011). *Socio-psychological features of experiencing and coping with the situation of losing a child in a terrorist act: A case study of Beslan mothers* (Doctoral dissertation). Russian State Social University, Moscow. (in Russ.).

Park, C. L. (2010). Making sense of the meaning literature: An integrative review of meaning making and its effects on adjustment to stressful life events. *Psychological Bulletin, 136*(2), 257–301. https://doi.org/10.1037/a0018301

Reshetnikov, M.M. (2006). *Psychological trauma*. East European Institute of Psychoanalysis. (in Russ.).

Rokhlin, A., Guzairova, A., Afanasyeva, N., & Rybkin, P. (2003, October 24). Hostages N. Lyubimov, A. Rozovskaya, M. Shumsky, M. Kazarinova, and others tell their stories. *Nord-Ost.* https://nord-ost.org/terakt/rasskazyvayut-zalozhniki-n.lyubimov-a.rozovskaya-m.shumskiy-m.kazarinova-i-dr-2_ru.html (in Russ.)

Shoigu, Yu. S. (ed.). (2007). *Psychology of extreme situations for rescuers and firefighters.* Smysl. (in Russ.).

Shoigu, Yu. S. (ed.). (2019). *Psychology of extreme situations: A textbook for universities*. Piter. (in Russ.).

Soldatova, G.U., Shaigerova, L.A., & Shlyapnikov, V.N. (2008). Psychological consequences of a terrorist act: The Beslan experience. *Psychological Journal, 29*(6), 15–25. (in Russ.).

Solomon, Z. (1988). The effect of combat-related posttraumatic stress disorder on the family. *Psychiatry (New York), 51*(3), 323–329. https://doi.org/10.1080/00332747.1988.11024407

Stal, A. (2002, December 26). Hostage A. Stal tells his story. *Nord-Ost.* https://nord-ost.org/terakt/rasskazyvaet-zalozhnik-a.stal-3_ru.html (in Russ.)

Stepanova, L. (2006, May 5). A hostage resident of Snezhinsk tells her story. *Nord-Ost.* https://nord-ost.org/terakt/rasskazyvaet-zalozhnitsa-zhitelnitsa-snezhinska_ru.html (in Russ.)

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Sage.

Tedeschi, R. G., & Calhoun, L. G. (2004). Posttraumatic growth: Conceptual foundations and empirical evidence. *Psychological Inquiry, 15*(1), 1–18.

Van der Kolk, B. A. (2014). *The body keeps the score: Brain, mind, and body in the healing of trauma*. New York: Viking.

Vasilyuk, F.E. (1984). *The psychology of experiencing*. Moscow: Moscow University. (in Russ.).

Vasilyuk, F.E. (2014). Types of spiritual coping. *Counseling Psychology and Psychotherapy, 22*(5), 139–152. (in Russ.).

Vygotsky, L.S. (1983). *Collected works: In 6 vols. Vol. 3. Problems of psyche development.* Moscow: Pedagogika. (in Russ.).

Wertsch, J. V. (2002). *Voices of collective remembering*. Cambridge University Press.

Zinchenko, Yu.P., Soldatova, G.U., & Shaigerova, L.A. (2011). Terrorist act as an extreme situation in a risk society. *National Psychological Journal, (2)*, 98–111. (in Russ.).

Received: August 06, 2025
Revision received: August 28, 2025
Accepted: January 12, 2026

Author Contribution

Mariya Olegovna Bulich contributed to the research design, collected and processed data, interpreted the results, wrote the text of the manuscript.

Galina Urtanbekovna Soldatova contributed to the research problem statement, supervised the study, consulted on research methodology, performed the critical review and edited the text of the manuscript.

Author Details

Mariya Olegovna Bulich – postgraduate student, Faculty of Psychology, Lomonosov Moscow State University, Moscow, Russian Federation; ORCID ID: https://orcid.org/0009-0001-5976-3147; e-mail: mariya.bulichh@gmail.com

Galina Urtanbekovna Soldatova – Academician, Russian Academy of Education, Dr. Sci. (Psychology), Professor, Department of Personality Psychology, Faculty of Psychology, Lomonosov Moscow State University, Moscow, Russian Federation; ResearcherID: I-6107-2012, Scopus ID: 15623581100, Author ID: 625610, ORCID ID: https://orcid.org/0000-0002-6690-7882; e-mail: soldatova.galina@gmail.com

Conflict of Interest Information

The authors have no conflicts of interest to declare.

PERSONALITY PSYCHOLOGY

Research article
UDC 159.923
https://doi.org/10.21702/rpj.2026.1.5

Individual personal determinants of coping strategies in decision-making under uncertainty

Irina G. Yurkova, Ksenia V. Farbitnik, Lyudmila S. Skripnichenko*, Yulia E. Katkova, Mikhail V. Mezuzhok

Kuban State University, Krasnodar, Russian Federation

*Corresponding author: lud-skr@mail.ru

Abstract

Introduction. The relevance of this research is driven by society's need to cultivate and develop psychologically resilient individuals capable of effective performance under conditions of uncertainty. The issue of decision-making remains insufficiently studied from the perspective of individual personal characteristics that contribute to the choice of action strategies in uncertain situations. The aim of this experimental study is to identify the individual personal determinants of coping strategies among managers when making decisions under uncertainty.

Methods. The sample consisted of heads of structural divisions in construction companies in Krasnodar (n=59). The following instruments were employed: the Melbourne decision making questionnaire (L. Mann; adapted by T. V. Kornilova), "Who am I in this world" (V. A. Sonin), "Personal factors of decision-making (LFR-25)" (T. V. Kornilova), Rotter's locus of control scale (J. Rotter), and the Eysenck personality inventory for self-assessment of mental states (H. J. Eysenck). Data analysis was conducted using methods of mathematical statistics (SPSS 27.0), including mean analysis, hierarchical cluster analysis, and Student's t-test for independent samples. **Results.** Using hierarchical cluster analysis, four main clusters of respondents were identified based on similarity of characteristics: «externals», «rational-vigilant», «emotional-vigilant», and «internals». With an increase in internal locus of control and self-esteem, managers exhibit lower levels of anxiety and frustration when making decisions in uncertain situations and are less inclined to employ coping strategies (avoidance, hypervigilance, procrastination). For managers with an external locus of control, a tendency toward low self-esteem, and pronounced anxiety and frustration, variability in

coping strategies is characteristic: depending on the circumstances, they may resort to either rational analysis (vigilance) or defensive, irrational strategies (avoidance, procrastination, hypervigilance), which is determined by their personal characteristics and emotional state at the time of use. **Discussion.** The results of this study revealed that the determinants of coping strategies in decision-making under conditions of uncertainty among young managers include the level of self-esteem, the direction of locus of control, and emotional states such as anxiety and frustration.

Keywords

Individual personal determinants, coping strategies, decision-making, uncertainty, locus of control, self-esteem level, mental states, personal factors

For citation

Yurkova, I.G., Farbitnik, K.V., Skripnichenko, L.S., Katkova, Yu.E., Mezuzhok, M.V. (2025). Individual Personal Determinants of Coping Strategies in Decision-Making under Uncertainty. *Russian Psychological Journal*, 23(1), 80–99. https://doi.org/10.21702/rpj.2026.1.5

Introduction

The contemporary socioeconomic reality is characterized by a high degree of uncertainty, which makes the ability of an individual to make effective decisions crucial at both the individual and organizational levels. In psychology, the concept of uncertainty is traditionally associated with situations of multiple choice, the absence of unambiguous algorithms for action, and the unpredictability of outcomes, which generates a state of cognitive and emotional tension in the individual (Godunov, Abakumova, Golubova, 2019). Following C. E. Shannon and W. Weaver (Shannon & Weaver, 1949), many researchers emphasize that uncertainty increases with the number of alternatives presented to the subject (Marroquín, Tennen & Stanton, 2017). Thus, the issue of decision-making is inextricably linked to the phenomenon of uncertainty, which acts not merely as an external background but as an inherent attribute of cognitive activity.

Several theoretical approaches to the study of decision-making have emerged in psychology, which can be compared based on the «role of personality versus role of rational calculation». The early, cognitively oriented approach, originating from the work of O. K. Tikhomirov (Tikhomirov, 1969) and developed in the studies of G. N. Solntseva (Solntseva, Smolyan, 2009), focused on the quantitative analysis of outcomes and probabilities. Within this tradition, decision-making was viewed primarily as a rational, algorithmizable act, while personal variables were treated largely as «interference» or unaccounted factors. In its most general interpretation, decision-making is defined as the selection of alternatives made by an individual or a group under conditions of uncertainty.

In contrast to this tradition, the subject-volitional approach, represented by S. L. Rubinstein (Rubinstein, 1999), emphasizes a fundamentally different aspect of the process. For Rubinstein, decision-making can occur in various ways: without hesitation (in the absence of volitional effort), as a purely intellectual act of decision-making, or with agonizing deliberation (involving both intellectual and volitional effort). Whereas in the cognitive approach the individual is «bracketed out», in the Rubinstein tradition, the individual is, on the contrary, placed at the very center of the choice process. This creates a theoretical tension: a decision is simultaneously a rational search for the best alternative and an existential act of self-determination.

An attempt to overcome this contradiction is represented by the integrative approach of T. V. Kornilova, who defines decision-making as a choice under conditions of uncertainty, emphasizing precisely those processes of personal self-regulation that serve as integrative variables around which measurable personality variables cluster (Kornilova, 2003). In this model, conceptions of rational goal-setting and personal regulation of choice are organically combined. This approach appears to us to be the most productive theoretical framework for studying real-world decisions made by managers, as it allows for maintaining a focus on both the objective characteristics of the situation and the subjective, personal variables. According to T. V. Kornilova, uncertainty is accounted for as a new methodological principle and a key element of science that guides psychological theories of thinking, consciousness, and personal self-regulation (Kornilova, 2003).

Foreign researchers, in turn, shift the focus to the qualitative content of uncertainty, examining how individual differences (e.g., value orientations or tolerance for uncertainty) mediate the choice process (Arieli, Sagiv & Roccas, 2020; Ceschi et al., 2019), which is substantively close to the integrative line of T. V. Kornilova and enriches it with empirical data on the role of personal dispositions.

The decision-making process can be viewed as a key component of any mental process, as well as of activity and behavior in general, because the subject is constantly faced with the task of choosing among a number of alternatives. The problem of decision-making under uncertainty is most acute for managers, whose professional activity is inherently associated with making managerial decisions under conditions of risk and time pressure. This is due to sociopolitical, administrative-legislative, operational, commercial, financial, and other factors. In management theory and practice, there is a need for accurate descriptions of the choice process-decision-making under conditions of bounded rationality. As S. V. Eremin and colleagues note (Eremin & Savonenko, 2021), constraints are primarily determined by the cognitive capabilities of the manager, specifically their perception, attention, and intellectual abilities. Therefore, in real-world practice, the management system requires coverage of the entire decision-making process as a whole and its individual stages with the necessary precision and depth.

As T. Y. Bazarov and E. D. Vashurina note, the specificity of modern management requires a manager not merely to analyze information but also to be prepared to act in a fundamentally

unpredictable environment (Vashurina, Bazarov, 2020). In this situation, coping strategies become the key regulatory mechanism-these are the conscious, purposeful actions or methods that an individual uses to manage stress or a difficult situation. Coping encompasses behavioral, cognitive, and emotional approaches aimed at solving the problem or reducing its impact on the individual. Here we again encounter the distinction between productive and unproductive patterns, which requires theoretical substantiation.

R. Lazarus and his colleague S. Folkman developed the first classification of coping strategies, identifying two main approaches: problem-focused coping and emotion-focused coping. Most subsequent classifications of coping strategies that appeared after the work of Lazarus and Folkman retained this division, defining the approaches as «working with the problem» and «working with the perception of the problem» (Lazarus & Folkman, 1984). With regard to the decision-making process, L. Mann's model identifies coping strategies such as vigilance (productive, rational analysis), as well as avoidance, procrastination, and hypervigilance (unproductive patterns leading to decision avoidance or hasty, ill-considered choices) (Mann, Burnett & Radford, 1997). The choice of Mann's typology as the theoretical framework is due to the fact that it directly describes coping strategies in the context of decision-making rather than in general life situations, which is maximally relevant to the objectives of our study. Noting the applied usefulness and productivity of the concept of coping, A. N. Demin emphasizes that coping behavior is typically situational; its scope is narrower than the life path. This is precisely why, during difficult periods of life, the subjective maturity of the individual-particularly the development of such subjective characteristics as activity and self-organization becomes especially significant for overcoming crises (Demin, 2004).

Personality psychology possesses an extensive body of knowledge regarding the influence of individual characteristics on decision-making processes. According to research by D. A. Leontiev, the effectiveness of choice depends on the level of autonomy and psychological maturity of the individual (Leontiev, 2018). Scholarly works confirm the influence of factors such as locus of control, self-esteem, and emotional reactions (e.g., anxiety and feelings of dissatisfaction) on decisions (Mironenko, 2015; Stanibula, 2018; Godunov, Akhmedova, Portnov, 2024).

Despite intensive study of the relationship between personality traits and attitudes toward uncertainty in foreign research (Dreves & Blackhart, 2019; Berzonsky & Ferrari, 1996), Russian psychology lacks empirical data that provide a detailed account of how the combination of self-esteem, type of locus of control, and emotional states determines the preference for specific coping strategies when making managerial decisions.

A review of foreign research reveals a theoretical shift from understanding uncertainty as an objective characteristic of a situation (Shannon & Weaver, 1949; Thomas, K. W. & Kilmann, R. H., 2007) to analyzing the subjective experience of uncertainty mediated by personal dispositions – value orientations, tolerance for uncertainty, and time perspective (Baroncelli, S. et al., 2024; Eager, B. et al., 2019; Shiffrin, R. M., 2022). This position substantively aligns with the integrative approach of T. V. Kornilova (Kornilova, 2003), which views decision-making as a personally mediated process.

At the same time, the majority of foreign publications are predominantly focused on studying the influence of individual psychological properties on behavioral choice in the general population, largely ignoring a comprehensive analysis of the interaction among self-esteem, type of control over circumstances, anxiety, and frustration in relation to the selection of specific coping mechanisms among managers (Li et al., 2024; Fischer et al., 2021). Thus, the aim of our research is as follows: using L. Mann's classification (Mann, Burnett & Radford, 1997) and the concept of choice self-regulation, to experimentally establish stable combinations of personal characteristics that determine effective or ineffective decision-making strategies in the field of management.

Currently, the issue of decision-making remains insufficiently studied from the perspective of the individual personal determinants that contribute to the choice of action strategies under conditions of uncertainty. In our view, this is hindered by two aspects: first, a lack of clear typologies of leaders based on stable combinations of the aforementioned factors, and second, a lack of clarity regarding which specific personal characteristics lead to the predominance of effective coping responses and which provoke the use of counterproductive approaches (such as avoidance, procrastination, or hypervigilance).

A limitation of previous research is the fact that, in most cases, only the isolated effects of specific personality traits are examined, while the mechanisms of the combined influence of these characteristics on the preference for particular coping strategies remain unexplored. There are no reliable empirical classifications that integrate different levels of personality properties, which hinders the prediction of managers' choices of effective or ineffective methods of responding to uncertainty in the management process.

The scientific novelty of this study lies in the fact that, for the first time using a sample of Russian managers (in the construction industry as an example), an attempt is made not merely to establish correlational relationships between individual personality characteristics and coping strategies, but to construct an empirical typology that integrates these variables. This will allow a transition from describing isolated influences to a holistic understanding of the personality syndromes that determine specific patterns of coping with uncertainty in the decision-making process.

The practical significance of this work lies in the possibility of applying the obtained findings in personnel selection procedures, evaluation, and further development of managerial competencies. The identified types of personality profiles prone to choosing ineffective forms of adaptation (avoidance, procrastination, hypervigilance) enable the creation of specialized programs for psychological and counseling support, enhancing stress tolerance, and developing effective decision-making abilities among managers operating in situations of heightened uncertainty.

Thus, a contradiction arises between the acknowledged theoretical and practical significance of personality factors in regulating the decision-making process and the insufficient empirical investigation of their role as determinants of specific coping strategies among managers operating under uncertainty. This contradiction defines the aim of this study:

to identify the individual personal determinants of coping strategies among managers when making decisions under uncertainty. The research hypothesis is the assumption that these determinants include the level of self-esteem, anxiety, and frustration, as well as the direction of locus of control, with their various combinations forming stable types characterized by a preference for specific coping strategies (research hypothesis).

Methods

The study involved 59 heads of structural divisions from several construction companies. Of these, 39 were male managers (66% of the total number of respondents) and 20 were female managers (34% of respondents). The age of the respondents was 32.5 ± 1.47 years (M±SD), ranging from 30 to 35 years. All respondents have higher specialized education, with an average of 10 years of work experience in the construction industry and 3 to 5 years of experience in managerial positions.

To address the research objectives, the following empirical data collection methods were employed: the Melbourne Decision Making Questionnaire by L. Mann (1997) as adapted by T. V. Kornilova, M. A. Chumakova, and S. A. Kornilov (2010); the Personal Factors of Decision-Making (LFR-25) scale by T. V. Kornilova (2003); Rotter's Locus of Control Scale by J. Rotter (1966) as adapted by V. A. Sonin (2022); and the Eysenck Personality Inventory for Self-Assessment of Mental States by H. J. Eysenck (1975) as adapted by A. I. Krupnova (1990). To study the content-related aspects of self-awareness underlying the subjective significance of decisions made, the projective technique "Who Am I in This World" by V. A. Sonin (2001) was used. This method was selected due to the need to examine the content-related aspects of self-awareness and life-meaning orientations, in contrast to standardized scales that capture only the quantitative level of self-esteem. This aligns with the theoretical framework of the study on personal regulation of decision-making.

Data collection was conducted using the Google Forms platform. For data analysis, methods of mathematical and statistical analysis available in the IBM SPSS 27.0 software package were employed. Statistical processing methods included mean analysis, hierarchical cluster analysis, and Student's t-test for independent samples, used to identify statistically significant differences in individual personal characteristics between clusters.

Results

Using hierarchical cluster analysis, four main clusters of respondents were identified based on similarity of characteristics. The clusters were formed according to the individual personal characteristics and coping strategies under study. The first cluster comprises 15% of respondents (9 individuals) of the total number surveyed, the second–31% (18 individuals), the third–19% (11 individuals), and the fourth–35% (21 individuals).

Let us examine the content-related features of the individual psychological characteristics of respondents in the identified clusters.

In the group of respondents in Cluster 1 (n=9), external locus of control (M=14.0, SD=2.1) dominates over internal locus of control (M=9.0, SD=1.8), which exceeds the normative values for externality (norm 10–12). Respondents exhibited elevated levels of anxiety (M=14.6, SD=2.3) and frustration (M=13.7, SD=2.1), corresponding to a high level on the Eysenck scale (above 15–high, 8–14–average; actual values approach the upper boundary of average/high). In terms of coping strategies in decision-making, respondents demonstrate high or above-average values on all scales of the questionnaire: avoidance (M=14.1, SD=2.2), procrastination (M=12.7, SD=1.9), and hypervigilance (M=12.8, SD=1.8) exceed the normative values (norm 8–12); vigilance (M=16.2, SD=1.9) is above average (norm 14–18), indicating the prominence of unproductive strategies. Respondents are characterized by an elevated level of rationality (M=7.4, SD=1.1) with a norm of 4–6, while self-esteem in this group of managers tends to be low (M=40.3, SD=3.8) with a norm of 45–55 points.

When analyzing the individual personal characteristics of respondents in Cluster 2 (n=18), average values of externality (M=11.5, SD=1.6) and internality (M=11.4, SD=1.7) should be noted, which correspond to normative values (10–12). This ratio describes respondents as individuals who assess various events adequately and understand that not only internal factors (skills, confidence, etc.) but also external circumstances play a significant role in the decision-making process. At the same time, they exhibit low levels of anxiety (M=5.4, SD=1.8) and frustration (M=3.9, SD=1.5), corresponding to a low level on the Eysenck scale (0–7), as well as an adequate level of self-esteem (M=45.0, SD=2.9) within the normal range (45–55). In terms of coping strategies in decision-making, respondents predominantly employ vigilance (M=15.1, SD=1.7)–at an average/above-average level–with low values for avoidance (M=9.9, SD=1.6), procrastination (M=7.7, SD=1.4), and hypervigilance (M=7.6, SD=1.3), which correspond to normative or reduced values. Consequently, managers with an average level of locus of control and adequate self-esteem choose the most productive decision-making strategies in uncertain situations.

In Cluster 3 (n=11), as in Cluster 2, average values of externality (M=11.3, SD=1.5) and internality (M=11.6, SD=1.6) were identified within the normal range. Managers in this cluster, when making decisions, equally consider the influence of both external circumstances and their own abilities and skills on the outcome. At the same time, they exhibit pronounced vigilance as the predominant coping strategy—vigilance (M=16.2, SD=1.8) at a high level–with low values for avoidance (M=8.6, SD=1.5), procrastination (M=8.5, SD=1.4), and hypervigilance (M=8.4, SD=1.4), which correspond to the lower boundary of average/norm. Respondents in Cluster 3 are characterized by adequate self-esteem (M=45.5, SD=3.1), though with a tendency toward being somewhat inflated (within the upper boundary of the norm). The levels of anxiety (M=11.0, SD=2.0), frustration (M=9.5, SD=1.9), aggressiveness (M=14.5, SD=2.4), and rigidity (M=13.4, SD=2.1) correspond to average values (8–14), with aggressiveness and rigidity scores approaching the upper boundary of the average range. Thus, this group of respondents is characterized by a productive coping strategy in decision-making (vigilance), despite the presence of moderate emotional reactions (anxiety, frustration).

In the group of respondents in Cluster 4 (n=21), internal locus of control is pronounced (internality M=14.5, SD=1.9; externality M=8.5, SD=1.7), which significantly exceeds the

normative values for internality (norm 10–12). Respondents tend to take responsibility for the outcomes of their achievements and the consequences of personal choices; they are not inclined to rely on external circumstances or other people in the decision-making process. Anxiety (M=7.6, SD=1.8) and frustration (M=5.1, SD=1.6) are at low levels (0–7). In decision-making coping, vigilance predominates (M=15.7, SD=1.8)—an above-average level—with moderate values for avoidance (M=11.1, SD=1.9), procrastination (M=8.9, SD=1.5), and hypervigilance (M=9.1, SD=1.5), corresponding to average values, while their self-esteem tends to be somewhat inflated (M=47.4, SD=3.2) within the upper boundary of the norm.

Based on the obtained data (Table 1), it can be concluded that as the level of self-esteem increases, the level of internal locus of control also increases, while the coping strategy of vigilance in decision-making under uncertain situations begins to occupy a more significant role. Respondents with lower levels of self-esteem and internal locus of control, accompanied by pronounced anxiety and frustration, exhibit all coping strategies; such managers may choose either rational or irrational strategies characterized by decision-making avoidance, procrastination, or hypervigilance depending on the circumstances.

Table 1

Mean Values of Individual Personal Characteristics and Decision-Making Coping Strategies Across All Clusters

	Mean values			
	1 cluster (9 people)	2 cluster (18 people)	3 cluster (11 people)	4 cluster (21 people)
Risk readiness	1,6	2,6	4,5	1,9
Rationality	**7,4**	**4,9**	**4,9**	**6,6**
Externality	**14**	**11,5**	**11,3**	**8,5**
Internality	**9**	**11,4**	**11,6**	**14,5**
Anxiety	**14,6**	**5,4**	**11**	**7,6**
Frustration	**13,7**	**3,9**	**9,5**	**5,1**
Aggressiveness	9,2	8,2	14,5	7,3
Rigidity	12,2	7,3	13,4	8,4
Vigilance	**16,2**	**15,1**	**16,2**	**15,7**
Avoidance	**14,1**	**9,9**	**8,6**	**11,1**
Procrastination	**12,7**	**7,7**	**8,5**	**8,9**

	Mean values			
	1 cluster (9 people)	2 cluster (18 people)	3 cluster (11 people)	4 cluster (21 people)
Hypervigilance	**12,8**	**7,6**	**8,4**	**9,1**
Self-esteem	**40,3**	**45**	**45,5**	**47,4**

Note: *the value of the characteristic tends to be inflated; the value tends to be understated; increase or decrease in the value of a characteristic from Cluster 1 to Cluster 4.*

Using Student's t-test, the following statistically significant differences between the scales in the identified clusters were identified (Table 2).

Table 2

Statistically Significant Differences in Individual Personal Characteristics of Respondents Across Clusters

	1 and 2 clusters	2 and 3 clusters	2 and 4 clusters	1 and 3 clusters	3 and 4 clusters	1 and 4 clusters
Risk readiness	2,3 (p<0,05)	-	-	5,2 (p<0,001)	-	2,5 p<0,05)
Externality	-	-	2,9 (p<0,01)	-	3,2 (p<0,01)	4,5 (p<0,001)
Internality	-	-	2,9 (p<0,01)	-	3,2 (p<0,01)	4,5 (p<0,001)
Anxiety	5,8 (p<0,001)	4,6 (p<0,001)	2,6 (p<0,05)	2,1 (p<0,05)	3,2 (p<0,01)	4,7 (p<0,001)
Frustration	4,5 (p<0,001)	4,1 (p<0,001)	-	-	3,7 (p<0,001)	4,2 (p<0,001)

	1 and 2 clusters	2 and 3 clusters	2 and 4 clusters	1 and 3 clusters	3 and 4 clusters	1 and 4 clusters
Aggressiveness	-	5,5 (p<0,001)	-	3,1 (p<0,01)	8,8 (p<0,001)	-
Rigidity	4,9 (p<0,001)	6 (p<0,001)	-		4,9 (p<0,001)	3,6 (p<0,01)
Avoidance	4,3 (p<0,001)	-	-	5,9 (p<0,001)	3,6 (p<0,01)	4,3 (p<0,001)
Procrasti-nation	5,3 (p<0,001)	-	-	4,3 (p<0,001	-	3,4 (p<0,01)
Hypervigilance	7,8 (p<0,001)	-	2,4 (p<0,05)	5,4 (p<0,001)	-	3,9 (p<0,001)
Self-esteem	2,9 (p<0,01)	-	-	2,6 (p<0,05)	-	4,8 (p<0,001)

Note: *Value – α, (p)*

Let us examine the statistically significant differences according to Student's t-test between Clusters 1 and 2 (in accordance with Table 2). Statistically significant differences were identified on the scale of readiness for risk ($\alpha = 2.3$, $p < 0.05$), anxiety ($\alpha = 5.8$, $p < 0.001$), and frustration ($\alpha = 4.5$, $p < 0.001$). Based on this, it can be concluded that in the clusters under consideration, respondents exhibit emotional reactions in the decision-making process with varying degrees of intensity and directionality. Respondents in Cluster 1, «Externals», demonstrate high levels of anxiety (M = 14.6) and frustration (M = 13.7), indicating pronounced emotional tension, uncertainty, and the experience of difficulties in uncertain situations. Their readiness for risk is low (M = 1.6), suggesting avoidance of risky decisions due to fear of failure and a desire to maintain stability. Respondents in Cluster 2, «Rational-Vigilant», are characterized by low levels of anxiety (M = 5.4) and frustration (M = 3.9), indicating emotional stability, self-confidence, and the ability to maintain composure in difficult situations. Their readiness for risk is somewhat higher (M = 2.6), though remaining within moderate values. In terms of self-esteem level, a strong statistical significance of differences ($\alpha = 2.9$, $p < 0.01$)

was found between respondents in Clusters 1 and 2. Additionally, a high level of statistical significance was observed on the decision-making style scales: procrastination ($\alpha = 5.3$, $p < 0.001$), avoidance ($\alpha = 4.3$, $p < 0.001$), and hypervigilance ($\alpha = 7.8$, $p < 0.001$). Accordingly, managers with different levels of self-esteem exhibit different decision-making strategies.

Significant statistical differences between Clusters 2 and 3 were identified on the following scales: anxiety ($\alpha = 4.6$, $p < 0.001$), frustration ($\alpha = 4.1$, $p < 0.001$), and rigidity ($\alpha = 6.0$, $p < 0.001$). Accordingly, respondents in these groups do not differ in terms of decision-making coping strategies but do differ in emotional reactions in situations of uncertainty.

Significant differences between respondents in Clusters 2 and 4 were identified on locus of control: externality ($\alpha = 2.9$, $p < 0.01$), internality ($\alpha = 2.9$, $p < 0.01$), and on the hypervigilance scale ($\alpha = 2.4$, $p < 0.05$). Based on this, it can be concluded that managers in the groups under consideration differ in the direction of locus of control and, consequently, exhibit different emotional reactions in the decision-making process (including significant differences on the anxiety scale, $\alpha = 2.6$, $p < 0.05$).

Statistically significant differences were identified between Clusters 1 and 3 on the following scales: readiness for risk ($\alpha = 5.2$, $p < 0.001$), anxiety ($\alpha = 2.1$, $p < 0.05$), avoidance ($\alpha = 5.9$, $p < 0.001$), procrastination ($\alpha = 4.3$, $p < 0.001$), hypervigilance ($\alpha = 5.4$, $p < 0.001$), and self-esteem ($\alpha = 2.6$, $p < 0.05$). Consequently, when making decisions in uncertain situations, respondents with more stable self-esteem are willing to take risks and are flexible, whereas respondents with a tendency toward low self-esteem predominantly exhibit defense mechanisms in the form of evading responsibility in the decision-making process or postponing the implementation of choice and decision-making.

Next, we analyze the differences between respondents from Clusters 3 and 4. Significant differences were identified in locus of control (externality: $\alpha = 3.2$, $p < 0.01$; internality: $\alpha = 3.2$, $p < 0.01$), anxiety ($\alpha = 3.2$, $p < 0.01$), frustration ($\alpha = 3.7$, $p < 0.001$), rigidity ($\alpha = 4.9$, $p < 0.001$), and avoidance ($\alpha = 3.6$, $p < 0.01$). Notably, no significant differences were found in self-esteem levels. Accordingly, respondents in these two groups differ in the direction of locus of control. In respondents with external locus of control, the decision-making process may exhibit avoidance strategies and a slowing of the decision implementation process, as evidenced by the strong statistical significance on the rigidity scale. Additionally, states of frustration and anxiety may contribute to the rejection of reasoned risk in favor of more conservative and safe decisions.

It should be noted that respondents in Cluster 3 demonstrated significant differences on the aggressiveness scale compared to respondents in Cluster 1 ($\alpha = 3.1$, $p < 0.001$), Cluster 2 ($\alpha = 5.5$, $p < 0.001$), and Cluster 4 ($\alpha = 8.8$, $p < 0.001$). These identified significant differences confirm that respondents in Cluster 3 differ in emotional states—which may influence the use of coping strategies in decision-making—from respondents in other clusters.

Let us examine the significant differences between Clusters 1 and 4 (in accordance with Table 2). Significant differences were identified in self-esteem level ($\alpha = 4.8$, $p < 0.001$), in locus of control—externality ($\alpha = 4.5$, $p < 0.001$), internality ($\alpha = 4.5$, $p < 0.001$)—and on the

following scales: anxiety ($\alpha = 4.7$, $p < 0.001$), frustration ($\alpha = 4.2$, $p < 0.001$), rigidity ($\alpha = 3.6$, $p < 0.01$), avoidance ($\alpha = 4.3$, $p < 0.001$), procrastination ($\alpha = 3.4$, $p < 0.01$), and hypervigilance ($\alpha = 3.9$, $p < 0.001$).

The results of correlation analysis confirm the theoretical propositions that locus of control influences the choice of coping strategies through mechanisms of self-esteem and emotional regulation. In the work of V. V. Abramov (2014), locus of control is regarded as a crucial coping resource of the individual, alongside hardiness and volitional subjective control. The author emphasizes that it is internality that enables a person to mobilize internal resources for active coping with difficulties, whereas externality is associated with passive strategies and an expectation of help from outside.

Discussion

Based on the obtained data, it was revealed that the determinants of coping strategies in decision-making under uncertainty among young managers include the level of self-esteem, the direction of locus of control, and emotional states such as anxiety and frustration.

Based on the analysis of the obtained data, each cluster was given a conditional name.

Cluster No. 1, «Externals», are characterized by adequate self-esteem with a tendency toward low self-esteem, as well as a propensity for vigilance and high rationality. All scales for decision-making coping are above average, meaning that such managers tend to employ various defensive strategies when making decisions in uncertain situations. In the decision-making process, managers with an external locus of control encounter difficulties in making a particular choice. This may manifest as avoidance of responsibility, high tension, low self-control, emotional instability, and ultimately, hasty decision-making. In such cases, the decision is made primarily with the goal of reducing emotional tension, while the choice may be made hastily without thorough analysis. The obtained data on the association of high levels of anxiety and frustration with the use of a broad range of coping strategies among externals are consistent with the transactional model of stress and coping by R. Lazarus and S. Folkman, which was developed in Russian psychology in the works of V. M. Yaltonsky and N. A. Sirota (2008). According to this model, cognitive appraisal of the situation and appraisal of one's own resources determine the choice of coping strategies.

Cluster No. 2, «Rational-Vigilant». These respondents demonstrate an average level of locus of control, low levels of anxiety and frustration, and self-esteem within the normal, adequate range. In the decision-making process, the coping strategy of "vigilance" predominates. Such managers tend to seek out information and carefully consider their decisions in advance before making a final choice. In uncertain situations, they are capable of considering risky decisions in order to achieve their intended outcomes.

Cluster No. 3, «Emotional-Vigilant». In this group of respondents, locus of control also does not exhibit a pronounced direction. However, in contrast to Cluster 2, the levels of anxiety

and frustration are average, and the other mental states aggressiveness and rigidity are also at average levels and higher in value than in other clusters. In terms of decision-making coping, there is a clear predominance of vigilance over the other scales. Thus, this group of respondents is characterized by a vigilant coping strategy in decision-making, accompanied by emotional reactions such as frustration and anxiety. It can be concluded that although decision-making in these respondents is accompanied by emotional reactions, they exhibit the most rational decision-making style-vigilance.

In the present study, respondents in Clusters 2 and 3 demonstrate similar locus of control indicators (within normative values) but differ in the level of emotional reactions. This suggests that it is emotional regulation, rather than only basic beliefs about control, that determines the choice of coping strategies in specific decision-making situations. This finding is consistent with research by E. N. Makhmutova and A. A. Chuganskaya (2021), which showed that respondents with an internal locus of control exhibit higher levels of self-control and the ability to resist stressful factors.

Cluster No. 4, «Internals». In this group, internal locus of control predominates, with a pronounced tendency toward rationality; emotional state values are low, and self-esteem tends to be somewhat inflated. At the same time, vigilance predominates among decision-making coping strategies. These findings are supported by contemporary Russian research. Specifically, in the work of E. A. Bragina and colleagues (2022), significant correlations were established between active problem-focused coping strategies and internality in the domains of achievement and failure, which fully aligns with our data: internals significantly more often employ the productive strategy of vigilance and are less likely to resort to avoidance.

The results of the analysis indicate that the study confirmed the hypothesis that the determinants of coping strategies in decision-making under uncertainty among young managers include the level of self-esteem, anxiety, frustration, and the direction of locus of control.

These findings are consistent with classical and contemporary research in the fields of stress psychology, coping behavior, and personal regulation of decision-making. In the study by S. N. Rekhovskaya and colleagues (2025), it was shown that the use of optimal coping strategies and the presence of an internal locus of control are key to psychological readiness for successful independent professional activity in extreme conditions. The authors emphasize that it is precisely emotional regulation and a well-formed professional identity that enable specialists to maintain adaptive coping strategies even in situations of high stress.

The identified differences in self-esteem levels between clusters and their relationship with the choice of coping strategies are corroborated by research conducted by S. K. Nartova-Bochaver (2005), which demonstrates that self-esteem serves as a significant predictor of mental health and coping with stress. In the context of decision-making, the work of S. A. Stanibula (2018) reveals relationships between self-esteem and decision-making styles, showing that adequate self-esteem is associated with more adaptive coping styles. In our study, managers with a tendency toward low self-esteem (Cluster 1) demonstrate variability in coping strategies, including unproductive ones, whereas respondents with adequate or a

tendency toward inflated self-esteem (Clusters 2, 3, and 4) predominantly use the productive strategy of vigilance.

Conclusion

Based on the obtained results, it can be concluded that with an increase in internal locus of control and self-esteem, managers exhibit less anxiety and frustration when making decisions in uncertain situations and are less inclined to use coping strategies such as avoidance, hypervigilance, and procrastination. Managers with an external locus of control, a tendency toward low self-esteem, and pronounced anxiety and frustration are more prone to using irrational decision-making coping strategies in uncertain situations. The variability of these coping strategies may be associated with the heterogeneous nature of the phenomenon of uncertainty and may depend on many factors, particularly on the individual's personality characteristics. This issue represents a promising direction for further research.

The conclusions obtained in the course of this study open up the possibility of implementing a comprehensive program of psychological support for novice managers, aimed at developing adaptive coping strategies and internal resources that ensure effective problem-solving under conditions of uncertainty. Since self-esteem and internal orientation are the primary factors in the choice of successful coping methods, it is advisable to incorporate into the training system for young managers such activities as coaching sessions on goal-setting, seminars on developing personal leadership effectiveness, time management courses, building self-confidence, and consciously accepting responsibility. To reduce emotional tension in uncertain situations and prevent the use of unproductive coping strategies, training in stress management, self-regulation techniques, emotional intelligence development, decision-making under uncertainty, and individual coaching sessions are recommended.

When interpreting the obtained results, it is necessary to consider a number of limitations that may affect the generalizability of the conclusions. The construction industry is characterized by a high degree of uncertainty (seasonality, dependence on economic conditions, administrative barriers), which may shape specific patterns of coping behavior that differ from those in other fields of activity. Additionally, the study did not account for the influence of the organizational culture of specific companies on the formation of preferred coping strategies. Differences in corporate standards, management styles, and motivation systems may significantly modify individual decision-making patterns. It should also be noted that this study is cross-sectional in nature, which does not allow for establishing causal relationships or tracking the dynamics of changes in the characteristics under study over time.

The results obtained and the limitations identified indicate directions for future scientific research. It is planned to conduct additional research aimed at identifying the relationships between the individual personality characteristics of managers and their decision-making processes, to expand the arsenal of diagnostic tools for studying the range of coping strategies they employ, and to supplement research methods with indicators of objective management

effectiveness (supervisor evaluation, achievement of key performance indicators, expert assessment of the quality of decisions made). Furthermore, it is intended to broaden the study's participant base by including representatives from various fields of activity (manufacturing, information technology, education, medicine) in order to identify the specific features of the influence of personal factors on the choice of coping strategies depending on the industry.

References

Abramov, V.V. (2014). Temporal orientation of personality as a factor in the formation of coping behavior. *Theoretical and experimental psychology,* 7 (1), 66-72. (in Russ.)

Amirkhan, J. H. (1990). A factor analytically derived measure of coping: The coping strategy indicator. *Journal of Personality and Social Psychology, 59*, 1066–1074.

Arieli, S., Sagiv, L., & Roccas, S. (2020). Values at work: The impact of personal values in organisations. *Applied Psychology, 69*(2), 230–275. https://doi.org/10.1111/apps.12181

Askarova, G. (2021). Basic approaches to learning coping strategies in difficult life situations. *Scientific progress, 1*(5), 308–316. (in Russ.)

Baldashev, R. M., & Romanovich, V. K. (2024). Factors influencing management decision-making in conditions of uncertainty and risk. *Economics and Business: Theory and Practice, 3*(1), 109, 46-49. (in Russ.)

Baroncelli, A., Caputo, A., Santini, E., & Theodoraki, C. (2024). Resilience and entrepreneurial decision-making: The heterogeneity among Italian innovative start-ups. *Entrepreneurship & Regional Development, 36*(5–6), 798–815. https://doi.org/10.1080/08985626.2023.2295959

Bazarov, T. Yu., & Bityutskaya, E.V. (2019). Features of the perception of life events by people with different preferred styles of responding to changes. *Questions of Psychology,* (3), 94-106. (in Russ.)

Berzonsky, M. D., & Ferrari, J. R. (1996). Identity orientation and decisional strategies. *Personality and Individual Differences, 20*(5), 597–606. https://doi.org/10.1016/0191-8869(96)00001-3

Beterev, V.V. (2024). Objective psychology. Yurayt. (in Russ.)

Bragina, E. A., Ivanova, O. N., & Petrov, S. V. (2022). Interconnection of locus of control and coping strategies in middle managers. *Psychological Research,* 15 (84), 45-52. https://doi.org/10.54359/ps.v15i84.1234 (in Russ.)

Carver, C. S., & Connor-Smith, J. (2010). Personality and coping. *Annual Review of Psychology, 61*, 679–704. https://doi.org/10.1146/annurev.psych.093008.100352

Ceschi, A., Costantini, A., Sartori, R., Weller, J., & Di Fabio, A. (2019). Dimensions of decision-making: An evidence-based classification of heuristics and biases. *Personality and Individual Differences, 146*, 188–200. https://doi.org/10.1016/j.paid.2018.07.033

Chereshkin, D. S. (2017). Model of the decision-making process in the organizational system. *Problems of Modern Science and Education,* 32 (114), 16-24. (in Russ.)

Demin, A.N. (2004). *Personality in the employment crisis: Strategies and mechanisms for overcoming*

the crisis. Kuban State University. (in Russ.)

Dobryakov, A. A., & Kobyzev, V. S. (2017). Decision methods in uncertainty. *Natural and Technical Sciences,* (108), 152-155. (in Russ.)

Doktorova, N.P. (2022). Features of management decision-making in conditions of uncertainty. *Collection of scientific works of the series "Public Administration,"* (26), 6-12. (in Russ.)

Dreves, P. A., & Blackhart, G. C. (2019). Thinking into the future: How a future time perspective improves self-control. *Personality and Individual Differences, 149*, 141–151. https://doi.org/10.1016/j.paid.2019.05.049

Eager, B., Grant, S. L., & Maritz, A. (2019). Classifying coping among entrepreneurs: Is it about time? *Journal of Small Business and Enterprise Development, 26*(4), 486–503. https://doi.org/10.1108/JSBED-02-2018-0064

Eremin, S.V., Popov, A.A., Timchenko, O.V., & Savonenko, R.A. (2021). Management decision-making challenges in an uncertain environment. *Innovative Scientific Research,* 5 (2), 146-157. (in Russ.)

Fedotova, J. E., & Khachaturova, M. R. (2017). Factors of organizational decision-making on the choice of interaction strategies in conditions of uncertainty. *Organizational Psychology,* 7 (2), 102-125. (in Russ.)

Fischer, R., Scheunemann, J., & Moritz, S. (2021). Coping strategies and subjective well-being: Context matters. *Journal of Happiness Studies, 22*(8), 3413–3434. https://doi.org/10.1007/s10902-021-00372-7

Godunov, M.V., Abakumova, I.V., & Golubova, V.M. (2019). Theoretical approaches to the study of the effects of uncertainty in the processes of semantic regulation of personality development. *Russian Psychological Journal, 16*(3), 59-71. (in Russ.)

Godunov, M.V., Akhmedova, S.N.K., & Portnov, E.A. (2024). Specifics of avoiding student behavior in various situations. *Scientific and Pedagogical Review,* 2 (54), 122-128. (in Russ.)

Gordienko, N.V. (2020). Individual-gender reactions of the individual as a coping strategy in a situation of uncertainty. *International Journal of Medicine and Psychology, 3*(2), 7-14. (in Russ.)

Gribkova, G.V. (2019). On the issue of making a management decision in conditions of uncertainty. *Economics and Society,* (56), 168-171. (in Russ.)

Grishina, N.V. (2008). *Psychology of Conflict (2nd ed.).* Piter. (in Russ.)

Gurtsky, D. A. (2023). Personal and emotional-volitional components as determinants of the decision-making process. *Scientific and Pedagogical Review,* 2 (48), 113-121. (in Russ.)

Khachaturova, M.R. (2013). Controlling repertoire of personality: a review of foreign studies. Psychology. *Journal of the Graduate School of Economics, 10*(3), 160-169. (in Russ.)

Kornilova, T.V. (2003). *Risk and decision psychology.* Aspect-Press. (in Russ.)

Kravtsova, E. N. (2019). Identifying coping strategies in student decision making. Into Youth. Intelligence. In: *Materials of the VII International Scientific and Practical Conference of Students and Undergraduates* (p. 298-299). (in Russ.)

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer.

Leontiev, A.N. (2013). *Selected psychological works.* Pedagogy. (in Russ.)

Leontiev, D. A. (2018). Synergetics and personality: towards non-equilibrium personology. *Methodology and history of psychology,* 3, 96-104. (in Russ.)

Li, T., Li, S., Li, B., Zhang, Z., Luo, Y., & Feng, C. (2023). Navigating uncertainty in human social decision-making: Consequences and coping strategies. *Social and Personality Psychology Compass, 17*(6). https://doi.org/10.1111/spc3.12756

Lopatin, D.V. (2024). The impact of information technology on decision-making in the face of uncertainty. *Herald of Science,* 5 (74), 1136-1141. (in Russ.)

Makhmutova, E. N., & Chuganskaya, A. A. (2021). Coping strategies as the basis for the choice of professional activities by women entrepreneurs: experience of psycholinguistic analysis. *Human Capital,* 12 (156), 296-303. (in Russ.)

Maletova, T. S., & Schuchman, M. E. (2023). Management decision-making methods in uncertainty and risk. *Collection of scientific works of the series "Finance, Accounting, Audit,"* 4 (32), 143-152. (in Russ.)

Mann, L., Burnett, P., & Radford, M. (1997). The Melbourne Decision Making Questionnaire: An instrument for measuring patterns for coping with decisional conflict. *Journal of Behavioral Decision Making, 10*(1), 1–19.

Marroquín, B., Tennen, H., & Stanton, A. L. (2017). Coping, emotion regulation, and well-being: Intrapersonal and interpersonal processes. In *The happy mind: Cognitive contributions to well-being* (pp. 253–274). Springer.

Melnik, N. A., & Chalenko, N. R. (2016). Making management decisions in conditions of uncertainty for the enterprise in the foreign market. *Economics, Sociology and Law, 4*(2), 33-34. (in Russ.)

Ministry of Justice, S. A. (2017). *Psychology of self-knowledge and self-development.* FLINT. (in Russ.)

Mironenko, I.A. (2015). *Modern theories in personality psychology.* Piter. (in Russ.)

Nartova-Bochaver, S.K. (2005). *Psychological personality space.* Prometheus. (in Russ.)

Podolyanets, V. A., & Demenenko, I. A. (2017). Implementation of management decisions in conditions of uncertainty and risk. *Integration of Sciences,* 10 (14), 54-55. (in Russ.)

Polushkin, O. A. (2024). Opportunities and limitations of decision support methods in uncertainty and risk. *Financial Markets and Banks,* 6, 68-73. (in Russ.)

Prokofieva, N.V. (2023). The relationship between the copying strategies of the personality of a senior manager and the manifestation of stereotypes of thinking in the process of making management decisions. *Internaca, 42*(1), 39-41. (in Russ.)

Pyrkh, E.V., Galkina, M.A., & Natalina, T.V. (2017). Features of management decision-making in a crisis and uncertainty. *Economics and Society,* 4 (35), 1136-1139. (in Russ.)

Rehovskaya, S. N., Kalach, E. A., & Sabitova, D. M. (2025). Features of coping strategies, locus of control and professional identity among cadets studying in the specialties "Fire Safety" and "Forensic Examination" of St. Petersburg University of the State Fire Service of the Ministry of Emergencies of Russia. *Psychological and pedagogical problems of human and public safety*, 3, 45-52. (in Russ.)

Rubinstein, S. L. (1999). *Fundamentals of general psychology.* Piter. (in Russ.)

Rybak, V. A., & Shokr, A. (2016). Analytical review and comparison of existing decision support technologies. *Systems Analysis and Applied Informatics*, 3, 12-18. (in Russ.)

Segerstrom, S. C., & Smith, G. T. (2019). Personality and coping: Individual differences in responses to emotion. *Annual Review of Psychology, 70*, 651–671.

Shannon, C. E., & Weaver, W. (1949). *The mathematical theory of communication*. University of Illinois Press.

Shiffrin, R. M. (2022). Is it reasonable to study decision-making quantitatively? *Topics in Cognitive Science, 14*(3), 621–633. https://doi.org/10.1111/tops.12541

Shipkova, O. T., Akimova, E. N., & Shataeva, O. V. (2022). Planning and decision-making tools in conditions of deep uncertainty as the basis for the proactive position of an economic entity. *Bulletin of the Moscow State Regional University. Series: Economics*, 2, 127-141. (in Russ.)

Solntseva, G. N., & Smolyan, G. L. (2009). Decision making in a situation of uncertainty and risk (psychological aspect). *Proceedings of the Institute for Systems Analysis of the Russian Academy of Sciences.* (in Russ.)

Sonin, V. A. (2001). *Psychodiagnostic knowledge of professional activities.* Speech. (in Russ.)

Stanibula, S. A. (2018). Biopsychosocial model of coping behavior. *Personality development,* 1, 204-215. (in Russ.)

Thomas, K. W., & Kilmann, R. H. (2007). *The Thomas–Kilmann Conflict Mode Instrument (TKI)*. APA PsycTests. https://doi.org/10.1037/t02326-000

Tikhomirov, O. K. (1969). *Structure of human thought activity.* Moscow State University. (in Russ.)

Valyavko, S. M., & Zhokina, P. A. (2016). Modern studies of the problem of self-esteem in foreign psychology. *Systems Psychology and Sociology*, 4 (20), 13-21. (in Russ.)

Vashurina, E. D., & Bazarov, T. Yu. (2020). Features of decision-making and leadership in uncertainty. *Organizational Psychology, 10*(3), 185–206. (in Russ.)

Volvich, Yu. K. (2017). Psychological resources for regulating stress-overcoming behavior of the individual as a subject of organizational processes. *Man. Community. Governance, 18*(4), 162–178. (in Russ.)

Yaltonsky, V. M., & Sirota, N. A. (2008). Psikhologiya sovladaniya: razvitie, dostizheniya, problemy, perspektivy. In *Sovladanie: sovremennoe sostoyanie i perspektivy* (pp. 21–54).

Zangiev, B. (2017). Making management decisions in the face of environmental uncertainty. *Economics and Society*, (35), 593-595. (in Russ.)

Received: September 10, 2025
Revised: March 10, 2026
Accepted: March 11, 2026

Author Contributions

Irina G. Yurkova – development of the research concept, description of results, methodological justification of the empirical investigation, writing and scientific editing of the «Results» and «Discussion» sections; critical revision of the article content.

Ksenia V. Farbitnik – formation and description of the empirical sample, conduct of the study, mathematical and statistical processing of empirical data, discussion of the results and their practical significance, writing of the review section of the article.

Lyudmila S. Skripnichenko – theoretical substantiation, writing of the «Abstract» section, writing of the «Introduction» section, participation in the preparation of the final text of the article.

Yulia E. Katkova – participation in data collection and analysis of results, work with literary sources on the research topic.

Mikhail V. Mezuzhok – preparation and formatting of the article text, selection and administration of psychodiagnostic procedures, presentation of primary statistics.

Author Information

Irina G. Yurkova – Candidate of psychological sciences, associate professor, associate professor at the department of personnel management and organizational psychology, Kuban State University, Krasnodar, Russian Federation; SPIN code: 4230-4384, AuthorID: 673993, ORCID ID: https://orcid.org/0009-0009-8181-0390; e-mail: shelig@rambler.ru

Ksenia V. Farbitnik – Master's degree in the field of study 37.04.01 Psychology, «Psychology of personality» program, Kuban State University, Krasnodar, Russian Federation; ORCID ID: https://orcid.org/0009-0003-4440-4437, e-mail: farbitnikk@yandex.ru

Lyudmila S. Skripnichenko – Candidate of sociological sciences, associate professor, associate professor at the department of personnel management and organizational psychology, Kuban State University, Krasnodar, Russian Federation; Scopus ID: 57254358000, SPIN code: 7391-7547, AuthorID: 674971; ORCID ID: https://orcid.org/0000-0002-8379-6256, e-mail: lud-skr@mail.ru

Yulia E. Katkova – Lecturer at the department of personnel management and organizational psychology, Kuban State University, Krasnodar, Russian Federation; SPIN code: 9731-4482, AuthorID: 734123; ORCID ID: https://orcid.org/0009-0006-8647-0661, e-mail: emylife_mk@mail.ru

Mikhail V. Mezuzhok – Lecturer at the department of personnel management and organizational psychology, Kuban State University, Krasnodar, Russian Federation; ORCID ID: https://orcid.org/0009-0005-5305-4410, e-mail: mike93.m@mail.ru

Conflict of Interest Information

The authors declare no conflict of interest.

Research article
UDC 159.9.072.432
https://doi.org/10.21702/rpj.2026.1.6

Gender and Age Differences of Cyberbullying Coping Strategies Among Adolescents: A Cross-Cultural Study (Russia and Kazakhstan)

Gulmira U. Utemisova[1*], Anastasiya V. Miklyaeva[2]

[1] L.N. Gumilyov Eurasian National University, Astana, Kazakhstan
[2] Herzen State Pedagogical University of Russia, St. Petersburg, Russian Federation

[*]Corresponding author: arimlug_@mail.ru

Abstract

Introduction. Cyberbullying poses a serious threat to adolescents' psychological well-being. However, the influence of gender, age, and cultural factors on adolescents' coping strategies remains insufficiently studied, particularly in the post-Soviet context. The novelty of this study lies in its cross-cultural analysis of cyberbullying coping strategies. The study aims to identify gender- and age-related aspects of cyberbullying coping strategies demonstrated by adolescents from two different cultures (Kazakhstan and Russia). **Methods.** The study employed an adapted version of the Coping with Cyberbullying Questionnaire (CWCBQ), which demonstrates satisfactory psychometric properties: expert consensus (consistency ≥ 80%), exploratory factor analysis ($KMO = 0.85$; $\chi^2 = 13{,}691.213$, $p < 0.001$), and confirmatory factor analysis ($CFI = 0.955$, $RMSEA = 0.036$), confirming measurement invariance across the Russian and Kazakhstani samples ($\Delta CFI < 0.01$). The participants included 404 adolescents (206 from Russia and 198 from Kazakhstan; 43% boys and 57% girls) aged 11–17 years. **Results.** Notable gender differences emerged: girls tended to rely on *close support* more frequently ($M = 24.8$ / 21.2; $p < 0.01$) and *distal advice* ($M = 15.8$ / 13.9; $p < 0.001$), whereas boys more often preferred *establishing boundaries* ($M = 12.8$ / 12.0; $p < 0.01$). Age-related dynamics revealed a *U*-shaped pattern for *distal advice*, with peaks at ages 12 and 16, as well as an increase in *close support* toward age 17. Cross-cultural differences indicated a stronger orientation toward formal coping strategies in the Kazakhstani sample and a greater

preference for digital autonomy in the Russian sample. **Discussion.** The findings highlight the role of cultural norms of collectivism and individualism in shaping cyberbullying coping strategies. In the Kazakhstani sample, clan-based social structures appear to mitigate the consequences of cyberbullying, whereas in the Russian sample, the dominance of digital autonomy may mask emotional avoidance. Cyberbullying coping strategies are thus shaped by gender, age, and cultural context. The findings highlight the need for differentiated prevention programs, emphasizing emotional regulation in early adolescence, digital literacy in middle adolescence, and the strengthening of social support networks in late adolescence. Family-oriented approaches are recommended for the Kazakhstani sample, whereas technological self-efficacy training is emphasized for the Russian sample.

Keywords

cyberbullying, coping strategies, adolescents, gender differences, age aspects, cross-cultural study, Russia, Kazakhstan

For citation

Utemisova, G. U., & Miklyaeva, A. V. (2025). Gender and age aspects of cyberbullying coping strategies among adolescents: A cross-cultural study (Russia and Kazakhstan). *Russian Psychological Journal*, *23*(1), 100–117, https://doi.org/10.21702/rpj.2026.1.6

Introduction

Cyberbullying, as a social phenomenon of the digital age, transforms not only the forms of aggression but also the patterns of coping with it. While early studies (Wolke et al., 2017) emphasized its secondary nature in relation to offline bullying, contemporary research (Soldatova & Rasskazova, 2023) highlights the uniqueness of the digital context—anonymity, virality and round-the-clock availability. These features necessitate a reconsideration of classical coping models (Lazarus & Folkman, 1984) through the lens of hybrid reality (McLuhan, 1964), in which digital tools function as an *extension* of personality. This shift has led to the emergence of specific coping strategies, such as establishing digital boundaries—blocking aggressors, adjusting privacy settings, and developing emotional self-regulation skills (Boyd, 2015).

The hybrid nature of digital identity, shaped by algorithmic systems, not only expands opportunities for self-presentation but also generates new vulnerabilities, particularly in the context of cyberbullying. Platform algorithms, acting as crystalline mirrors reconstruct self-perception through content personalization (Ionescu & Licu, 2023). As a result, cyberbullying within hybrid reality acquires the characteristics of a chronic stressor that disrupts the integrity of the digital self. Low algorithmic literacy, which intensifies cognitive biases, alters the very mechanisms of coping with cyberbullying. Teenagers growing up in our

digitally hyperconnected world must find ways to balance guarding their emotions in real life while staying active online. This explains the relevance of studying gender and age differences in coping strategies, where establishing digital boundaries functions not merely as a technical action but as a form of self-regulation within a hybrid personality structure.

Furthermore, the synthesis of social and personal categories in adolescents' self-descriptions (Soldatova et al., 2017) correlates with preferences for distal or close coping strategies. The stronger the integration of online and offline identities, the greater the need for combined methods of coping, ranging from emotional support to institutional assistance. Consequently, cross-cultural analysis of cyberbullying coping strategies requires consideration of the specific features of digital socialization, which can both constrain the coping repertoire and stimulate innovative forms of protecting the "extended" self.

Additionally, differences between cultures in how people handle cyberbullying aren't just explained by their digital skills or how familiar they are with technology. If hybrid reality, according to McLuhan, sets the general framework for the "extension" of personality through digital tools, then the cultural-historical context determines how exactly these tools reconstruct social practices. Thus, the empirically identified differences between Russian and Kazakhstani adolescents—digital autonomy versus clan support—reflect a profound contradiction between technological determinism and cultural tradition. For example, among adolescents in the Kazakhstan sample, the support of clan structures helps restore boundaries by the ages of 15–17, whereas in the Russian sample, digital autonomy dominates, which aligns with the theory of individualism (Görzig & Macháčková, 2015). These differences underscore the need to adapt anti-bullying strategies to local contexts that form the "framework of acceptability" for the digital generation, where clan ties and individualism become complementary elements of a new coping ecosystem rather than antagonists.

The identified cross-cultural differences in coping strategies expose a deeper methodological problem: the contradictory data on the prevalence of cyberbullying may not be a statistical error, but a marker of culturally determined mechanisms of trauma representation. Unlike the findings of the global Ipsos survey (McCarthy, 2018), where 0% of Russian parents reported incidents of cyberbullying, the current study revealed a significant prevalence of the problem among adolescents (N=404). This indicates that cyberbullying in individualistic societies often remains latent due to the stigmatization of victims, whereas in collectivistic cultures (Kazakhstan), clan structures provide open discussion and support. This creates a contradictory dynamic: technologies that standardize forms of cyber - aggression (e.g. anonymity and virality) often come into conflict with cultural differences, which can significantly change how an issue is viewed. In the Russian sample, digital autonomy, corresponding to the values of individualism (Görzig & Macháčková, 2015), acts as a "double screen": on the one hand, it provides tools for blocking aggressors (Boyd, 2015), and on the other, it conceals the scale of bullying, as victims "silence" the problem due to fear of judgment. In the Kazakhstani sample, clan ties transferred to the digital space do not reduce the frequency of bullying but change its essence: from a personal trauma, it turns into a topic for collective discussion. Thus, discrepancies in the data from global and local studies are not an error but

a result of cultural differences in the perception of the problem. Hybrid identity (McLuhan, 1964) affects not only how adolescents overcome aggression but also their willingness to talk about it at all. This challenges universal strategies for addressing cyberbullying, as programs need to account for cultural norms that determine what is seen as "private" versus "public" even though technologies may impose uniform rules of conduct online.

However, synchronizing anti-bullying programs with cultural codes requires not only recognizing the latency of the problem in individualistic societies but also rethinking the very methodology of studying it. While Wolke et al. (2017) interpret cyberbullying as a "ripple on the surface of the ocean of traditional aggression" the work of Soldatova & Rasskazova (2023) demonstrates that digital anonymity and content virality transform it into an independent phenomenon. Technological determinants (algorithms, platforms) become catalysts for a "tsunami" of trauma that erases the boundaries between online and offline reality. This contradiction between classic models (Wolke et al., 2017) and modern realities of hybrid reality actualizes the synthesis of developmental theories. Integrating Steinberg's (2017) concepts of the adolescent brain's cognitive plasticity, Lerner's (2018) concept of positive development through interaction with context, and Arnett's (2016) concept of "emerging adulthood" allows for proposing strategies that consider the dual nature of digital tools—both as "psychological tools" (Vygotsky, 1984) and sources of a "digital divide" (Smirnov, 2023). For example, Kazakhstani "family digital patches" (video messages from elders in chats) can not only increase empathy, as shown in the study by Brewer & Kerslake (2015), where a statistically significant increase in indicators was recorded (Δ = +15%, $p<0.05$), but also redefine the role of technologies—transforming them from algorithmic mediators into conduits of cultural authority. This helps compensate for the "divide" in adult-child communication (Smirnov, 2023) by integrating traditional values into the digital space. In the Russian sample, technological self-efficacy training (activation of the prefrontal cortex, $p<0.01$) becomes a tool for internalizing digital boundaries, where blocking aggressors (Boyd, 2015) evolves from a technical action into an act of personal self-affirmation, mitigating the risks of "functional inversion" (Smirnov, 2023). At the same time, the gender aspect, revealed by Eagly & Wood (2012) within the framework of social role theory, adds a critical dimension: while girls use platforms to strengthen connections, following empathy patterns, boys, as shown by Wright (2017), more often transform technologies into tools for avoidance or aggression, reproducing masculine stereotypes even in a hybrid reality.

Research Aim and Hypotheses

The aim of the study is to reveal the patterns of adolescents' choice of cyberbullying coping strategies through the lens of their gender, ontogenetic, and cross-cultural determination.

The research hypothesis assumes that coping behavior in digital environments is marked by complex differentiation:

Gender specificity manifests itself in the dichotomy between socio-institutional mechanisms in girls *("close support" "distal advice"*) and instrumental-autonomous methods of self-regulation in boys ("*establishing boundaries*").

Age dynamics follow a non-linear *U*-shaped pattern, which highlights unique aspects of cognitive flexibility and the stages of psychosocial development during adolescence.

Cross-cultural variability (Russian and Kazakhstani samples) acts as a significant predictor of the choice of coping resources, determining the priority of either collectivistic (socio-clan) support networks or individualistic strategies of digital autonomy.

The interrelation of strategies is determined by their functional conjugacy, which has specific correlational profiles depending on the adolescents' gender.

Methods

The article presents the results of an empirical study aimed at examining cyberbullying coping strategies among adolescents, considering gender and age differences. The analysis focuses on a comparative assessment of adolescents' preferences in the Russian sample (N=206) and the Kazakhstani sample (N=198) in choosing four key strategies:

1. **distal advice** (appealing to formal institutions or authorities);
2. **establishing boundaries** (digital self-regulation and limiting interaction).
3. **close support** (seeking help from the immediate environment);
4. **active ignoring** (conscious conflict avoidance).

The empirical sample consisted of 404 adolescents aged 11–17 (M = 13.7, SD = 1.73), of which 57.2% were girls (n=231) and 42.8% were boys (n=173). The socio-demographic profile of the participants, students in grades 5–11 of Russian-language schools, is representative of the adolescent population of the studied regions: Orsk (Russian Federation), as well as Aktau, Semey, Ust-Kamenogorsk, and Aktobe (Republic of Kazakhstan). The inclusion criterion was the experience of active use of the Internet and social networks with a history of online activity of at least one year. The data collection procedure complied with international ethical standards, including principles of anonymity, confidentiality, and obtaining voluntary written consent from parents.

The empirical basis of the work was survey data using the adapted Russian-language version of the Coping with Cyberbullying Questionnaire (CWCBQ) (Sticca et al., 2015; adaptation: Utemissova, 2024). Psychometric validity and invariance between the samples of Russia and Kazakhstan (ΔCFI<0.01) ensured strict data comparability at the cross-cultural level (Cheung & Rensvold, 2002) and satisfactory psychometric characteristics: expert consensus (consistency ≥80%); exploratory factor analysis (KMO=0.85; χ^2=13691.213, p<0.001); confirmatory factor analysis (CFI=0.955, $RMSEA$=0.036). The cross-cultural equivalence of the questionnaire increases its validity. These results confirm the applicability of the questionnaire in cross-cultural studies (Utemissova, 2024).

SPSS 26.0 was used for statistical analysis. To evaluate the hypotheses, quantitative methods were applied: Pearson correlation analysis, Mann-Whitney U test for comparing independent samples, Kruskal-Wallis test to examine age dynamics, and multivariate analysis

of variance (ANOVA) to determine how age, gender, and country affect strategy selection. The choice of parametric (ANOVA) and nonparametric tests (Mann-Whitney, Kruskal-Wallis) was determined by checking the data for compliance with the assumptions of normal distribution (Shapiro-Wilk test) and homogeneity of variances. If variables did not meet the assumptions of parametric tests (p<0.05), nonparametric alternatives were used instead. The Mann-Whitney U test was used to compare strategies between gender groups because the distribution of data for the *"close support"* and *"active ignoring"* scales was not normal. The Kruskal-Wallis test was employed to examine age dynamics because the age subgroups were not evenly distributed. Multivariate ANOVA was used to evaluate cross-cultural differences whenever variances were homogeneous, as indicated by a Levene's test p-value greater than 0.05. The reason for using both parametric and nonparametric methods together is to ensure that statistical assumptions are met. ANOVA's assumptions of normality and equal variances were satisfied in cross-cultural comparisons (strategy "*distal advice*": F=3.281, p=0.039), but not within gender groups.

Results

An analysis of the correlations between cyberbullying coping strategies (Table 1) revealed gender-specific patterns. Statistically significant relationships between all strategies were found in boys: a strong correlation of "*close support*" with "*active ignoring*" (r=0.730; p<0.001), and moderate relationships of "*distal advice*" with "*close support*" (r=0.560; p<0.001) and "*active ignoring*" (r=0.481; p<0.001). In girls, the relationship between "*close support*" and "*active ignoring*" dominates (r=0.603; p<0.001), whereas the connection between "*distal advice*" and "*close support*" is weaker (r=0.391; p<0.001) and there is no significant correlation with "*active ignoring*".

Gender differences in the use of strategies are expressed as follows (Table 2): girls use "*close support*" more often (M = 24.8 / 21.2; U=16604, p=0.004) and "*distal advice*" (M=15.8/13.9; U=13540, p<0.001), whereas boys prefer "*establishing boundaries*" (boys: M=12.8/12.0; U=17337, p=0.022).

Age dynamics demonstrate a U-shaped pattern for "*distal advice*" with peaks at 12 and 16 years. Cross-cultural comparisons revealed an orientation among adolescents in the Kazakhstani participants toward formal strategies, in contrast to Russians, who prefer digital autonomy. Boys demonstrate a tendency to prefer "*active ignoring*" (U=17797.500, p=0.059), which, although it does not reach the standard level of significance, aligns with the theory of masculinity encouraging the avoidance of demonstrating vulnerability (Cornwall et al., 2016).

Table 1
Correlations between cyberbullying coping strategies in groups of boys and girls (Spearman's ρ)

Group	Strategy Pairs	*r*	*p*
Girls (*n*=231)	Distal advice — Close support	0.391	<0.001
	Close support — Active ignoring	0.603	<0.001
Boys (*n*=173)	Distal advice — Close support	0.56	<0.001
	Close support — Active ignoring	0.73	<0.001
	Distal advice – Active ignoring	0.481	<0.001

Table 2
Comparative analysis of cyberbullying coping strategies depending on adolescents' gender (Mann-Whitney U test)

Coping Strategy	Boys (*n*=173), *M±SD*	Girls (*n*=231) *M±SD*	*U*	*p*
Distal advice (DA)	13.9±0.4	15.8±0.3	13540	<0.001***
Establishing boundaries (EB)	12.8±4.0	12.0±3.6	17337.5	0.022*
Close support (CS)	21.2±0.4	24.8±0.3	16604	0.004**
Active ignoring (AI)	13.9±0.3	15.8±02	17797.5	0.059

Note: *M±SD — mean ± standard deviation; U — Mann-Whitney U test; *p<0.05, **p<0.01, **p<0.001.*

In addition to pronounced gender differences in the choice of coping strategies, data analysis revealed complex age dynamics demonstrating the relationship between the stages of psychosocial development and the digital adaptation of adolescents. The "*distal advice*" (DA) strategy demonstrates a *U*-shaped trajectory with peaks at 12 (*M*=15.27±6.35) and 16 years (*M*=17.05±4.82), a decrease toward 14 years (*M*=13.87±4.77), and stabilization by 17 (*M*=16.22±4.35) (Table 3). The "*close support*" (CS) strategy shows an increase from 11 (*M*=22.69±5.41) to 17 years (*M*=26.09±2.78), with minimum values at 14 years (*M*=21.99±5.87).

The "*establishing boundaries*" (EB) strategy demonstrates stable values in the age range of 11–17 years (*M*=11.78–12.78) without statistically significant differences (*H*=3.125; *p*=0.793). The lowest values appeared at age 12 (*M*=11.78±4.50), followed by an increase at ages 13 and 14 (*M*=12.46±3.99 and 12.41±3.98, respectively). The highest values occur at age 16 (*M*=12.78 ± 3.13), although changes with age are not statistically significant. The "*active ignoring*" (AI) strategy demonstrates an age-related increase from 11 years (*M*=14.48±3.53) to 17 years (*M*=17.00±2.32).

Table 3
Age dynamics of cyberbullying coping strategies (M±SD)

Strategy	11 years	12 years	13 years	14 years	15 years	16 years	17 years	*H* (*p*-value)
Distal advice (DA)	14.23±4.91	15.27±6.35	15.04±4.89	13.87±4.77	15.73±4.62	17.05±4.82	16.22±4.35	17.806 (0.007**)
Establi-shing boundaries (EB)	11.90±3.54	11.78±4.50	12.46±3.99	12.41±3.98	12.45±3.29	12.78±3.13	12.48±3.59	3.125 (0.793)
Close support (CS)	22.69±5.41	24.61±4.96	22.76±5.69	21.99±5.87	23.12±4.58	24.93±4.03	26.09±2.78	22.866 (0.001***)
Active ignoring (AI)	14.48±3.53	15.98±3.44	14.67±3.37	14.63±3.87	14.78±3.42	15.05±3.32	17.00±2.32	15.878 (0.014*)

Note: *M±SD — mean ± standard deviation; H — Kruskal-Wallis test; *p<0.05, **p<0.01, **p<0.001.*

Table 4
Cross-cultural differences in cyberbullying coping strategies (M±SD)

Strategy	Age	Russia	Kazakhstan	*F* (*p*-value)
Distal advice (DA)	11–12 years	15.3±4.6	16.1±4.4	3.281 (0.039*)
	13–14 years	13.0±4.7	16.6±5.1	
	15–17 years	13.2±5.0	17.1±5.0	
Establishing boundaries (EB)	11–12 years	13.4±3.3	13.2±3.6	0.750 (0.473)
	13–14 years	11.8±3.4	12.1±4.1	
	15–17 years	11.6±3.7	12.6±4.5	
Close support (CS)	11–12 years	23.8±4.5	24.7±4.0	4.282 (0.014*)
	13–14 years	22.8±5.5	24.0±4.8	
	15–17 years	23.2±5.6	25.0±3.5	
Active ignoring (AI)	11–12 years	15.1±3.0	15.8±2.8	1.891 (0.059)
	13–14 years	14.8±3.8	15.6±3.2	
	15–17 years	15.1±3.7	17.0±2.3	

Note: *M±SD — mean ± standard deviation; F — ANOVA test; *p<0.05, **p<0.01, **p<0.001.*

An analysis of cross-cultural differences in cyberbullying coping strategies (Table 4) revealed statistically significant differences between adolescents in the Russian sample (N=206) and the Kazakhstani sample (N=198) in the strategies of *distal advice* (F=3.281; p=0.039) and *close support* (F=4.282; p=0.014). In the Kazakhstani sample, adolescents demonstrate a higher orientation toward formal strategies:

***Distal advice*:** maximum values in the 15–17 age group (M=17.1±5.0) versus 13.2±5.0 in the Russian sample (p<0.05), which aligns with cultural norms of collectivism and clan support (Lerner et al., 2018; Markus & Kitayama, 1991).

***Close support*:** stable growth toward 15–17 years (M=25.0±3.5 / 23.2±5.6 in the Russian sample; p<0.05), confirming the role of family networks in the post-Soviet context (Balpeisova et al., 2019).

In the Kazakhstani sample, the strategy of "*active ignoring*" dominates, especially in the older age group (M=17.0±2.3 / 15.1±3.7; p=0.059), reflecting a tendency toward digital autonomy (Hofstede, 2011; Soldatova & Rasskazova, 2023). The overall sample shows that "*active ignoring*" rises as children grow older, increasing from 14.48 at age 11 to 17.00 at age 17. However, cross-cultural analysis highlights subtle differences in this trend. In the Russian sample, the values for older adolescents (15–17 years: M=15.1±3.7) demonstrate a smaller increase compared to the Kazakhstani sample (M=17.0±2.3), where the strategy is more pronounced and homogeneous. The partial intersection of standard deviations indicates significant intra-group variability in the Russian sample, which may be due to differences in digital autonomy and cultural norms.

Age dynamics (Table 4) show: for *distal advice* in the Kazakhstani sample, there is a linear increase from 11–12 years (M=16.1±4.4) to 15–17 years (M=17.1±5.0), whereas in the Russian sample, there is a decrease (15.3±4.6 — 13.2±5.0), confirming the U-shaped pattern described in Table 3. *Establishing boundaries* shows insignificant changes (F=0.750; p=0.473), with a tendency to decrease in the Russian sample (13.4±3.3 — 11.6±3.7) and a slight increase in the Kazakhstani sample from 13 years (12.1±4.1 — 12.6±4.5), which may be associated with the crisis of autonomy in individualistic cultures (Erikson, 1968).

Gender differences complement the picture: girls use *close support* and *distal advice* significantly more often, which corresponds to the theory of gender socialization (Eagly & Wood, 2012; Tamres et al., 2002). Among boys, "*active ignoring*" dominates, correlating with instrumental coping (Lazarus & Folkman, 1984).

Discussion

This study's results show that cyberbullying is influenced by several factors, including neurobiology, age, gender, and culture. At the age of 12–14, a period characterized by a neurobiological imbalance between the limbic system and the prefrontal cortex (Crone & Dahl, 2012), adolescents exhibit heightened impulsivity. Nonetheless, cultural context shapes how this impulsivity appears: among Kazakhstani participants, it is moderated by the use

of "*active ignoring*" strategies and seeking "*close support*" while Russian participants, lacking these moderating factors, face a higher risk of maladaptation (Fahy et al., 2016). The cultural norms of individualism, which dominate the Russian sample, reinforce the tendency toward autonomy, thereby masking emotional needs. This is illustrated by a *U*-shaped trend where the importance of "*distal advice*" peaks at age 12 and then decreases by age 14. By the ages of 15–17, neurocognitive maturation facilitates the development of more adaptive strategies (Crone & Dahl, 2012): Kazakhstani adolescents effectively utilize family resources, while in the Russian sample, the previously established emphasis on "*establishing boundaries*" may conceal emotional avoidance, elevating the risks of social isolation (Fahy et al., 2016).

Gender differences remain a consistent pattern: girls significantly more often turn to "*close support*" aligning with gender socialization theories that emphasize the role of empathy and social connectedness (Eagly & Wood, 2012). Conversely, boys prefer instrumental strategies such as "*active ignoring*" reflecting norms of masculinity that encourage the avoidance of displaying vulnerability (Gutmann & Vigoya, 2018). The observed correlations indicate that social expectations influence gender differences in how individuals cope with cyberbullying, which can be explained using social role theory (Eagly & Wood, 2012).

Distinct gender-related trends in cyberbullying coping methods can be understood through the lens of **social role theory** (Eagly & Wood, 2012). For instance, among boys, the strong correlation between "*close support*" and "*active ignoring*" may reflect an internal contradiction inherent in masculine norms: the need to seek assistance is combined with the maintenance of a *facade* of independence. The moderate correlation between "*distal advice*" and "*active ignoring*" suggests a pragmatic shift toward avoidance once formal support resources have been exhausted.

Among girls, the moderate association between "*close support*" and "*active ignoring*" may reflect a balance between empathic engagement and self-protective behavior. At the same time, the weak correlation between "*distal advice*" and other strategies indicates a greater reliance on informal and emotionally supportive networks. Thus, boys appear to adapt to masculine norms primarily through instrumental and avoidant coping strategies, whereas girls tend to employ strategies that emphasize interpersonal connection and emotional support.

These findings are consistent with Wright's (2017) research, which demonstrates that adolescents with stronger masculine traits are more likely to engage in cyber-verbal aggression in online gaming environments, whereas feminine traits are more commonly associated with relational forms of cyber aggression on social networking platforms. This convergence suggests that digital environments not only amplify aggressive behaviors but also reproduce and reshape traditional gender-role expectations within online interactions.

Taken together, these findings highlight the importance of **gender-sensitive approaches to cyberbullying prevention**, particularly given the established association between avoidance-based coping and increased long-term emotional vulnerability among adolescents (Karaush et al., 2020).

The cultural context plays a pivotal role in shaping adolescents' selection of coping strategies. In the Kazakhstani sample, characterized by the predominance of collectivistic values (Hofstede, 2011), adolescents more frequently seek support from formal institutions and family networks. This pattern is consistent with research highlighting the role of clan-based social structures in post-Soviet societies (Balpeisova et al., 2019). The findings suggest that clan networks in Kazakhstan function as a form of digital extension of collectivistic values within the framework of hybrid identity (McLuhan, 1964). Kazakhstani adolescents aged 15–17 show high levels of both "close support" and "distal advice", illustrating how their online and offline behaviors blend together. For these teens, asking authority figures for help feels like an ordinary extension of their routine social interactions.

In contrast, the Russian participants demonstrates a different pattern. The greater prevalence of "*active ignoring*" and the decline in "*establishing boundaries*" among adolescents aged 15–17 suggest a tendency toward digital autonomy as a strategy for distancing from emotional risks. This tendency fits well within a society that values individualism, where people often see their online identities as distinct from their offline responsibilities. From this perspective, the observed pattern may reflect a broader challenge of digital self-regulation, consistent with the *digital divide* framework described by Smirnov (2023), which emphasizes disparities in the development of digital competencies and emotional regulation. These findings underscore the importance of integrating emotional competence and digital literacy training into educational programs (Soldatova et al., 2017).

The study's findings on differences across cultures and age groups can also be understood by looking at how algorithm-based identity formation interacts with social and cultural expectations. For example, Ehn and Pita (2023) demonstrate that platform algorithms contribute to the formation of dynamic identity structures in which users negotiate between stable and flexible aspects of self-presentation. However, as noted by Ionescu and Licu (2023), the ethical opacity of algorithmic systems—the so-called "black box" effect—may influence coping processes indirectly. In these situations, adolescents engage with environments curated by algorithms as interpreted through their own culturally influenced viewpoints and expectations, rather than interacting directly with the algorithms themselves.

The age dynamics of the strategies exhibit non-linear patterns. The *U*-shaped trajectory of "*distal advice*" (with peaks at 12 and 16 years) mirrors Erikson's (1968) stages of psychosocial development: the search for external authorities in early puberty and their re-evaluation in late adolescence. The decrease in "*establishing boundaries*" around 13–14 years may be linked to a crisis of autonomy, which is exacerbated by conditions of digital hyperconnectivity (Soldatova & Voiskounsky, 2021), a finding consistent with international research on the role of technology in transforming social interactions (Boyd, 2014; Smahel et al., 2020).

The results of this study expand upon the findings of the EU Kids Online project (Smahel et al., 2020) by illustrating how cultural context modifies both the manifestations of cyberbullying and the corresponding coping strategies. While EU Kids Online identified a high prevalence of cyberbullying across Europe and emphasized gender equality in the use of formal

strategies, our data revealed significant cross-cultural and gender differences. For instance, the rate of appealing for "*distal advice*" in the Kazakhstani participants exceeded the European average, and girls used "*close support*" significantly more often. This stands in contrast to the broader European movement toward gender neutrality, likely due to the enduring influence of traditional roles in post-Soviet societies. Furthermore, while European studies describe a linear growth in digital autonomy, the Russian participants exhibited a *U*-shaped pattern for "*distal advice*" which is associated with adolescent identity crises within an individualistic context. Consequently, cultural and age factors do not merely supplement but complicate pan-European conclusions, thereby demanding localized solutions. Thus, cyberbullying represents an independent phenomenon of hybrid reality, rather than a secondary offshoot of offline aggression (Wolke et al., 2017). Digital identity consists of layers of attributes, with algorithmically generated traits (Ehn & Pita, 2023) layered over conventional social roles (Soldatova et al., 2022). This structure means that the ability to withstand cyber aggression is an important measure of adaptability.

Limitations and Future Research

The limitations of the study include the risk of bias associated with the use of self-reports, the uneven distribution of age subgroups (e.g., 17-year-olds), and the cultural specificity of the sample, which limits the generalizability of the findings. Despite the consistency with the findings from the EU Kids Online (Smahel et al., 2020) and "Children of Russia Online" (Soldatova et al., 2017) projects, longitudinal studies are required to assess the long-term effects of the identified strategies, particularly "*active ignoring*" which, according to Fahy et al. (2016), may exacerbate the risks of maladaptation. A promising direction for future research is exploring how algorithmic changes in digital platforms (e.g., TikTok's transition to 10-minute videos) dynamically transform identity matrices and coping strategies, especially in conditions of cultural diversity. On a global scale, a promising avenue is the implementation of VR simulators for emotional regulation training, as supported by meta-analytical data (Steinberg et al., 2018). These measures can serve as a foundation for developing comprehensive prevention systems that account for both universal and culture-specific aspects of cyberbullying.

For the Kazakhstani sample, family-oriented approaches integrating clan structures into digital platforms are effective, whereas in the Russian sample, prioritizing the development of critical thinking and technological self-efficacy is essential (Soldatova et al., 2017). However, as Smirnov (2023) cautions, digital tools must play an auxiliary role without replacing live, face-to-face interaction, to prevent an "event shift" — the transfer of value emphases into virtual reality (Smirnov, 2023, p. 49).

Key Findings

Girls significantly more often use *close support* and *distal advice* as cyberbullying coping strategies, whereas boys more frequently use *establishing boundaries* and demonstrate a tendency to prefer *active ignoring*.

Age trends show a non-linear pattern: young teens display the highest use of *distal advice*, which drops during mid-adolescence but rises again late in adolescence. *Close support* reaches its maximum value towards the end of adolescence, whereas *active ignoring* gradually increases with age.

Cultural differences play a key role: *distal advice* and *close support* dominate in the Kazakhstani sample, reflecting the influence of collectivist values and clan networks. The Russian participants shows a tendency toward *active ignoring*, particularly among older adolescents, against the backdrop of a decline in *establishing boundaries*, which may be associated with a crisis of digital self-regulation in an individualistic context.

Gender interrelations between strategies also vary boys show a strong correlation between *close support* and *active ignoring*, as well as a moderate correlation between *distal advice* and *active ignoring*. In girls, a moderate correlation between *close support* and *active ignoring* predominates, whereas *distal advice* correlates weakly with other strategies.

Conclusion

Practical implications highlight the need for:

1. For the Kazakhstan sample: programs integrating clan structures into digital support.
2. For the Russian sample: technological self-efficacy training.

Thus, the study contributes to the research on digital socialization and confirms that cultural norms and age-related changes decisively shape cyberbullying coping strategies in a hybrid reality.

References

Arnett, J. J. (2016). Does emerging adulthood theory apply across social classes? National data on a persistent question. *Emerging Adulthood, 4*(4), 227–235. https://doi.org/10.1177/2167696815613000

Balpeisova, S. A., Utemissova, G. U., Kushzhanov, N. V., Maidangalieva, Z. A., & Summers, D. G. (2019). Mediation in the education system. Bulletin of the National Academy of Sciences of the Republic of Kazakhstan. *Series of Social and Humanitarian Sciences,* 1(323), 23–31. URL: Balpeisova. Utemisova.pdf (in Russ.).

Boyd, D. & Deogracias, A. (2015). It's Complicated: The Social Lives of Networked Teens. *J Youth Adolescence,* 44, 1171–1174. https://doi.org/10.1007/s10964-014-0223-7

Brewer, G., & Kerslake, J. (2015). Cyberbullying, self-esteem, empathy and loneliness. *Computers in Human Behavior, 48*, 255–260. https://doi.org/10.1016/j.chb.2015.01.073

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233–255. https://doi.org/10.1207/S15328007SEM0902_5

Cornwall, A., Karioris, F. G., & Lindisfarne, N. (Eds.). (2016). *Masculinities Under Neoliberalism.* Zed Books. http://dx.doi.org/10.5040/9781350221307

Hofstede, G. (2011). Dimensionalizing cultures: The Hofstede model in context. *International Journal of Behavioral Medicine, 18*(4), 403–404. https://scholarworks.gvsu.edu/cgi/viewcontent.cgi?article=1014&context=orpc

Crone, E. A., & Dahl, R. E. (2012). Understanding adolescence as a period of social–affective engagement and goal flexibility. *Nature Reviews Neuroscience, 13*(9), 636–650. https://doi.org/10.1038/nrn3313

Eagly, A. H. (1987). *Sex differences in social behavior: A social-role interpretation*. Psychology Press.

Eagly, A. H., & Wood, W. (2012). Social role theory of sex differences. In J. C. Chrisler & D. R. McCreary (Eds.), *The Wiley-Blackwell handbook of the psychology of gender and sexuality* (pp. 31–55). Wiley Blackwell. https://doi.org/10.4324/9780203781906

Ehn, K., & Pita, M. M. (2023). Algorithmic Influence of TikTok: Mixed method study of digital nomads and their online identity attributes [Conference abstract]. *3rd World Conference on Media and Communication*. https://www.dpublication.com/abstract-of-3rd-worldcmc/w29-837/

Erikson, E. H. (1968). *Identity: Youth and crisis*. W.W. Norton & Company.

Fahy, A. E., Stansfeld, S. A., Smuk, M., Smith, N. R., Cummins, S., & Clark, C. (2016). Longitudinal associations between cyberbullying involvement and adolescent mental health. *Journal of Adolescent Health, 59*(5), 502–509. https://doi.org/10.1016/j.jadohealth.2016.06.006

Görzig, A., & Macháčková, H. (2015). *Cyberbullying from a socio-ecological perspective: A contemporary synthesis of findings from EU Kids Online*. EU Kids Online.

Hofstede Insights. (2024). Country Comparison Tool. The Culture Factor. Retrieved March 3, 2026, from https://www.theculturefactor.com/country-comparison-tool

Ionescu, C. G., & Licu, M. (2023). Are TikTok Algorithms Influencing Users' Self-Perceived Identities and Personal Values? *A Mini Review. Social Sciences*, 12(8), 465. https://doi.org/10.3390/socsci12080465

Karaush, I. S., Kupriyanova, I. E., & Kuznetsova, A. A. (2020). Cyberbullying and suicidal behavior of adolescents. *Suicidology*, *11*(1), 1–15. (in Russ.).

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer Publishing Company.

Lerner, R., Lerner, J., von Eye, A., Ostrom, C., Nitz, K., Talwar-Soni, R., & Tubman, J. (2018). Continuity and discontinuity across the transition of early adolescence: A developmental contextual perspective. In J. A. Graber, J. Brooks-Gunn, & A. C. Petersen (Eds.), *Transitions through adolescence: Interpersonal domains and context* (pp. 3–22). Routledge. https://doi.org/10.4324/9781315789286-1

Livingstone, S., & Helsper, E. J. (2008). Parental mediation of children's internet use. *Journal of Broadcasting & Electronic Media*, 52(4), 581–599. https://doi.org/10.1080/08838150802437396

Markus, H. R., & Kitayama, S. (1991). Culture and self: Implications for cognition, emotion, and motivation. *Psychological Review, 98*(2), 224–253. https://doi.org/10.1037/0033-295X.98.2.224

McCarthy, N. (2018, October 10). Where cyberbullying is most prevalent [Infographic]. *Statista*. Retrieved from https://www.statista.com/chart/15926/the-share-of-parents-who-say-their-child-has-experienced-cyberbullying/

McLuhan, H. M. (1964). *Understanding media: The extensions of man*. McGraw-Hill: MIT Press.

Smahel, D., Machackova, H., Mascheroni, G., Dedkova, L., Staksrud, E., Ólafsson, K., Livingstone, S., & Hasebrink, U. (2020). *EU Kids Online 2020: Survey results from 19 countries*. LSE Publishing. https://doi.org/10.21953/lse.47fdeqj01ofo

Smirnov, S. A. (2023). L. S. Vygotsky and the digital: A challenge for cultural-historical psychology. *Cultural-Historical Psychology*, *19*(2), 41–51. https://doi.org/10.17759/chp.2023190205 (in Russ.).

Soldatova, G. U., & Rasskazova, E. I. (2023). Digital socialization of Russian adolescents: Through the prism of comparison with adolescents in 18 European countries. *Social Psychology and Society*, *14*(3), 11–30. https://doi.org/10.17759/sps.2023140302 (in Russ.).

Soldatova, G. U., & Voiskounsky, A. E. (2021). Socio-cognitive concept of digital socialization: A new ecosystem and social evolution of the mind. *Psychology. Journal of the Higher School of Economics*, *18*(3), 45–67. (in Russ.).

Soldatova, G. U., Rasskazova, E. I., & Nestik, T. A. (2017). *Digital generation of Russia: Competence and safety*. Smysl. (in Russ.).

Steinberg, L., Icenogle, G., Shulman, E. P., Breiner, K., Chein, J., Bacchini, D., Chang, L., Chaudhary, N., Di Giunta, L., Dodge, K. A., Fanti, K. A., Lansford, J. E., Malone, P. S., Oburu, P., Pastorelli, C., Skinner, A. T., Sorbring, E., Tapanya, S., Uribe Tirado, L. M., . . . Takash, H. M. S. (2017). Around the world, adolescence is a time of heightened sensation seeking and immature self-regulation. *Developmental Science*. Advance online publication. https://doi.org/10.1111/desc.12532

Sticca, F., Machmutow, K., Stauber, A., Perren, S., Palladino, B., Nocentini, A., Menesini, E., Corcoran, L., & Mc Guckin, C. (2015). The coping with cyberbullying questionnaire: Development of a new measure. *Societies, 5*(2), 515–536. https://doi.org/10.3390/soc5020515

Tamres, L. K., Janicki, D., & Helgeson, V. S. (2002). Sex differences in coping behavior: A meta-analytic review and an examination of relative coping. *Personality and Social Psychology Review, 6*(1), 2–30. https://doi.org/10.1207/S15327957PSPR0601_1

Utemissova, G. U. (2024). Coping with Cyberbullying Questionnaire: Structure and primary psychometric characteristics. *Human Psychology in Education*, *6*(3), 362–383. https://doi.org/10.33910/2686-9527-2024-6-3-362-383 (in Russ.).

Utemissova, G. U. (2024). Cyberbullying Coping Strategies Questionnaire: Primary psychometric characteristics In *VII International Scientific and Practical Conference Herzen Readings: Psychological Research in Education* (p. 7). https://herzenpsyconf.ru/wp-content/uploads/2024/12/80-utemissova.pdf (in Russ.).

Vygotsky, L. S. (1984). *Collected works: In 6 volumes. Vol. 4*. State Pedagogical Publishing House. (in Russ.).

Wolke, D., Lee, K., & Guy, A. (2017). Cyberbullying: A storm in a teacup? *European Child & Adolescent Psychiatry, 26*(8), 899–908. https://doi.org/10.1007/s00787-017-0954-6

Wright, M. F. (2017). The role of technologies, behaviors, gender, and gender stereotype traits in adolescents' cyber aggression. *Journal of Interpersonal Violence, 35*(7-8), 1719–1738. https://doi.org/10.1177/0886260517696858

Received: September 11, 2025
Revised: December 24, 2025
Accepted: January 12, 2026

Author Contributions

Gulmira U. Utemissova – conceptualization of the study, statistical analysis, interpretation of the results, writing the initial text (literature review and discussion), preparation of the article text, formatting the article in accordance with the journal requirements.

Anastasiya V. Miklyaeva – scientific supervision of the study, data collection coordination, formation of the theoretical review, development of the methodology, critical revision of the manuscript with significant intellectual contribution, approval of the final version of the article.

Author Details

Gulmira U. Utemissova – Applicant for Cand. Sci. (Psychology), Senior Researcher, L. N. Gumilyov Eurasian National University, Astana, Kazakhstan; SPIN: 4417-7948; ResearcherID: Q-7062-2017, C-5850-2018; ORCID: https://orcid.org/0000-0003-3229-5256; e-mail: arimlug_@mail.ru

Anastasiya V. Miklyaeva – Dr. Sci. (Psychology), Associate Professor, Professor of the Department of Human Psychology, Herzen State Pedagogical University of Russia, St. Petersburg, Russian Federation; Scopus Author ID: 53984860100, ResearcherID: D-4700-2017, SPIN-код: 9471-8985; e-mail: a.miklyaeva@gmail.com

Conflict of Interest Information

The authors have no conflicts of interest to declare.

Research Article
UDC: 159.9.075
https://doi.org/10.21702/rpj.2026.1.7

Diagnosis of scientific-professional thinking in psychology students: An Initial Psychometric Validation of the Methodology

Elena V. Zabolotnaya*, Tatiana D. Dubovickaya

Sochi State University, Sochi, Russian Federation

*Corresponding author: ozhereleva.rita@bk.ru

Abstract

Introduction. The need to ensure the technological leadership of our country in modern conditions requires, among other things, an effective system of training personnel for scientific activities, including the formation of scientific-professional thinking among its subjects. Scientific-professional thinking of psychologists is a cognitive process that consists of identifying objective essential properties, connections, and patterns of psychological phenomena studied by a psychologist, manifested in behavior and activity, as well as determining the formulation and solution of scientific and applied psychological problems by a psychologist. The purpose of the article is to present the results of the primary psychometric verification of the methodology to diagnose scientific-professional thinking in psychology students. **Methods.** In its structure, the proposed method correspondes to the established standards of thinking research methods and includes tasks that reveal: 1) respondents' knowledge of basic scientific concepts denoting mental phenomena, knowledge of their essential characteristics and patterns; 2) formation of mental operations of analysis, synthesis, comparison, generalization, classification of psychological concepts; 3) ability to adequately and logically use psychological concepts in judgments and conclusions. Reliability (internal consistency) was checked by using the Cronbach alpha coefficient; the normality of the sample distribution was determined using the λ-Kolmogorov-Smirnov criterion; the validity of the content was checked using expert evaluation; during the validity check, indicators of the relationship between the indicators of the subtests of our methodology and other methods that were used to study thinking were calculated. **Results.** The methodology was tested on

230 respondents studying in the following areas of study: "Psychology", "Psychological and pedagogical education". Psychometric verification of both forms (A and B) of the diagnostic technique showed their similarity in identifying the levels of scientific-professional thinking formation in all subtests. **Discussion.** The data obtained indicate that the proposed diagnostic procedure meets the basic requirements for test methods. The results of psychometric tests serve as a basis for using the diagnostic methodology of scientific-professional thinking of psychology students for research and applied purposes as a reliable diagnostic tool.

Keywords

scientific-professional thinking of psychologists, psychodiagnostic methodology, psychometric verification, normality of sample distribution, correlation analysis, reliability-consistency, validity

For citation

Zabolotnaya, E. V., Dubovickaya, T. D. (2026). Diagnosis of scientific-professional thinking in psychology students: An initial psychometric validation of the methodology. *Russian Psychological Journal, 23*(1), 118–139. https://doi.org/10.21702/rpj.2026.1.7

Introduction

According to the Presidential Decree "On the national development goals of the Russian Federation for the period up to 2030 and for the future up to 2036 " (Presidential Decree “On National Development Goals of the Russian Federation: 2030 and Outlook to 2036” // http://www.kremlin.ru/events/president/news/73986) (dated 07.05.2024), by 2030 the Russian Federation should be among the top 10 countries in the world in terms of research and development. An important factor in solving this problem is the broad involvement of young people in scientific activities, carried out through master's, postgraduate, doctoral studies, the creation of experimental sites, scientific and educational centers, holding competitions for research projects, etc. (Senko, 2015; Eremin, 2019; Varushchenko & Vladimirov, 2021; Panamareva, 2021; Zabolotnaya, 2023; Sorokoumova et al., 2024; Marupova & Shadiev, 2025). All this implies the purposeful formation *of psychological readiness among their participants not just for scientific activities*, but for scientific and professional activities, when doing science becomes a profession aimed at the development of science itself (Dubovickaya, Zabolotnaya, 2022; Zabolotnaya, Dubovickaya, 2022b).

International studies highlight the role of creating an enabling environment for the introduction of artificial intelligence and digital literacy in higher education (Frolova et al., 2020; Valdés, Cerdá Suárez, 2021; Ebn Saifudin et al., 2024; Sun et al., 2024; Mieg, Odebiyi, 2024), which can facilitate the research activities of undergraduates and postgraduates. It emphasizes the productivity of using pedagogical innovations in the form of video conferences,

discussion forums, symposia, etc. (Khatri et al., 2017; Walder, 2017; Kim, & Wilkinson, 2019; Guardia et al., 2021), which lay the foundations for the development of innovative (Sun et al., 2024) and scientific thinking (Bezuidenhout, 2011; Barz, & Achimas-Cadariu, 2016; Koes Handayanto et al., 2024). The introduction of scientific approaches to the education system in the digital age contributes not only to the development of science, but also to the formation of students' and schoolchildren's interest in engaging in scientific activities (Ainley & Ainley, 2011; Xiao & Sandoval, 2017; Akhmetova et al., 2025).

A special role in the development of a professional scientist should be assigned, in our opinion, to the purposeful formation of a special mindset, which manifests itself in the form of scientific-professional thinking, which, as applied to the scientific activity of a psychologist, was previously defined by us as "*a cognitive process that consists in establishing objective essential properties, connections and patterns of mental phenomena manifested in behavior and activity, as well as determining the formulation and solution of scientific and applied psychological problems*" (Zabolotnaya, Dubovickaya, 2022a; Dubovickaya, Grishina, Zabolotnaya, 2024).

The activity of forming scientific-professional thinking involves understanding the mechanisms of its functioning, conditions for purposeful development, as well as identifying the level of its formation, which determined the *purpose of our research*: developing a methodology for diagnosing the formation of scientific-professional thinking. To achieve this goal, we relied on the traditional procedures and methods of studying thinking presented in psychological science.

As is well known, the main forms in which thinking is manifested and realized are concepts, judgments, and inferences that are verbal in nature. L.S. Vygotsky, in particular, compared everyday (spontaneous) and scientific concepts (Vygotsky, 1982). The highest stage of development of thinking is verbal-logical (abstract, theoretical, conceptual) thinking. For its research, the following diagnostic procedures are used, in particular: "exclusion of concepts", "classification of concepts", "comparison of concepts", "simple / complex analogies", etc.

Each branch of science is characterized by its own conceptual and categorical apparatus (Arsenyev et al., 1967; Yakovlev and Yakovleva, 2010). At the same time, a distinctive feature of psychological terminology is that in its everyday application, it is widely found and used in everyday speech, thereby creating a sense of ease of understanding its essence and the psychological science itself. In everyday speech, many psychological concepts are synonymous, interchangeable, although they differ in scientific terminology. For example, this applies to the following concepts: "sensation", "perception", "sensitivity"; "communication", "communication"; "management", "leadership"; "language", "speech"; "motive", "stimulus"; "work", "activity", "work". In the psychological science itself, within the framework of various directions, schools, and approaches, the same concepts have many definitions. Nevertheless, professionals understand each other, mutually expand the categorical apparatus of science, presenting it in their scientific articles, psychological dictionaries, encyclopedias, from where it gets into textbooks and textbooks with small variations. At the same time, unfortunately, our analysis showed that despite the existing differences in the definitions of concepts/categories, their essential characteristics and key terms, as a rule, are identical.

As an example, there are several definitions of the category "activity".

1) Activity – "*purposeful activity* that fulfills *the needs* of the subject" (Asmolov, 2005, p. 10).
2) Activity is "a dynamic system *of active* interactions of the subject with the outside world, during which the subject *purposefully* affects the object, thereby satisfying its *needs"* (Golovin, 1998, p. 100).
3) Activity is "*active* interaction with the surrounding reality, during which a living being acts as a subject *that purposefully* affects the object and thus satisfies its *needs*" (Meshcheryakov and Zinchenko, 2002, p. 122).

After comparing the presented definitions, you can note the so-called "key terms" that are found in all definitions. Such terms in the proposed example are: *activity, needs, and goal/purposefulness*. Relying on key terms makes it easy to remember the definition of the corresponding concept and formulate your own definition. For example, an *activity is a form of human activity aimed at achieving a goal and meeting a need.*

In our opinion, the objective basis for studying the formation of scientific-professional thinking is the possession of the conceptual and categorical apparatus of science and the ability to correctly formulate your thoughts. So, it is known that tests of intelligence, defined, in particular, as "a relatively stable structure of an individual's mental abilities"(Golovin, 1998, p. 147), often contain the following scales:" General awareness "(Wexler's test; STMD – "School Test of Mental Development"),"Vocabulary subtest" (Wexler's test); "Addition of sentences"(Amthauer's test).

All this served as the basis for the development of the author's methodology for diagnosing scientific-professional thinking of psychology students and its psychometric verification.

Methods

Description of the method

The methodology has two forms (form A and Form B), each of which includes three subtests with equivalent tasks. In terms of content, the methodology was based on the conceptual framework of the course "General Psychology". Well-known dictionaries (Asmolov, 2005; Golovin, 1998; Meshcheryakov and Zinchenko, 2002) and textbooks (Kornilova, 2002; Maklakov, 2008) were used as sources of the conceptual framework.

At the preliminary stage of the psychometric check, some of the questions were removed. Initially, the forms (A and B) of the methodology included 68 questions. Subtest 1 had 14 questions in each form and subtest 2 and subtest 3 had 10 questions each. During the methodology testing, it was decided to reduce the number of tasks in both forms of the methodology. As a result, subtest 1 contains – 9 questions each, subtest 2 – 8 questions each, and subtest 3-5 questions each. So Forms A and B consist of 22 questions each.

Subtest 1. Knowledge of concepts. The subtest consists of 9 tasks that are aimed at identifying the mastery of psychological concepts/categories.

In each task, the examinee must determine the definition of which psychological concept / category the proposed "keywords" correspond to. And, if possible, formulate this definition.

Example. Keywords: "motivation", "need", "activity".

Possible answers: goal; mood, image, motivation.

Correct answer: Motive.

Definition: "Motive – an incentive to activity related to the satisfaction of the subject's needs" (Golovin, 1998, p. 230).

Other concepts stated in the methodology were also the following: "Psyche", "Personality", "Intelligence", etc.

Subtest 2. Exclusion of concepts. It consists of 8 tasks; each task contains 5 concepts. The subtest is designed to study the ability to analyze and generalize on essential features, and to abstract from non-essential ones.

In each task, the examinee must indicate an "extra" concept that does not fit the meaning of the rest ("fifth extra").

Example: "credibility", "conviction", "validity", "reliability", "representativeness".

Correct answer: The word "conviction" is "superfluous", and the remaining terms are parameters of psychometric verification of diagnostic techniques.

Subtest 3. Making a meaningful sentence / utterance. It consists of 5 tasks, each of which is represented by a set of words (from 3 to 5) related to psychological research. The subtest is designed to identify the ability to formulate a thought using scientific terminology, to build a logical statement or text.

The examinee should use the suggested words/phrases, as well as supplement their own words, if necessary, to make a meaningful sentence.

Example: "language", "sign", "communication".

Answer option: "Language is a system of signs that is a means of communication."

Based on the received answers, standard results are processed, where the subject receives 1 point for each correct answer.

The sample used for the psychometric testing of the methodology consisted of 230 psychology students and postgraduates from several Russian universities. Of these, 9.1% were graduate students,12.2 % - specialty students, 33.9 % - undergraduates, 44.8 % - bachelors, second-and third-year students in the areas of "Psychology", "Psychological and pedagogical education".

Psychometric verification of our proposed methodology included:

1) checking the reliability (internal consistency) of each individual subtest and the methodology as a whole (Table 1). 3), using the Cronbach's alpha coefficient;

2) determination of the normality of the sample distribution, using the λ-Kolmogorov-Smirnov criterion;
3) verify the validity of the content, which was carried out using expert evaluation.
4) verification of constructive validity, during which indicators of the relationship between the results of the subtests of our methodology and the scales of other methods that diagnose the corresponding abilities related to success in scientific and professional activities were calculated: the "Addition of sentences" subtest from R. Amthauer test (Amthauer, 1953; Amthauer et al., 1999; Amthauer et al., 2001; Gurevich et al., 1993);methodology for the diagnosis of personal creativity (Tunik, 2003, 2013);methodology for determining the thinking style (Belousova, 2011);Questionnaire "Differential type of reflection" (Leontiev et al., 2009)".

Results

Reliability assessment

The reliability of both forms of the method was tested using the "splitting" method and further calculation of the corresponding correlation coefficients for odd and even responses (Orel and Senin, 2007). The obtained correlation coefficient of odd and even responses of form A subtest 1 was 0.717 ($p<0.001$), indicating the reliability of this relationship. Considering the correlation of the methodology total score of the subtests with each question, we obtained a high positive significant correlation from 0.408 to 0.741 ($p<0.001$), which confirms the high level of internal consistency of this methodology (Table 1).

Table 1
Correlation of indicators of questions/tasks of subtests with the total score on scales (Form A)

#	Correlation Coefficients Subtest 1	Correlation Coefficients Subtest 2	Correlation Coefficients Subtest 3
1	0.519	0.640	0.548
2	0.489	0.653	0.606
3	0.715	0.710	0.670
4	0.576	0.648	0.704
5	0.741	0.630	0.705
6	0.727	0.685	
7	0.745	0.572	
8	0.677	0.408	
9	0.636		

Note. *The correlation is significant at the level of $p<0.001$.*

The correlation coefficient of odd and even responses of form B subtest 1 is 0.637 ($p<0.001$), which confirms the high reliability of this relationship. There was also a high positive significant correlation of the methodology total score of the subtests with each question in the range of 0.346 to 0.756 ($p<0.001$), which indicates a high level of internal consistency of the methodology. The results for this form are presented in Table 2.

Table 2

Correlation of indicators of questions/tasks of subtests with the total score on scales (Form B)

#	Correlation Coefficients Subtest 1	Correlation Coefficients Subtest 2	Correlation Coefficients Subtest 3
1	0.560	0.516	0.751
2	0.661	0.533	0.756
3	0.445	0.676	0.656
4	0.728	0.546	0.621
5	0.630	0.543	0.749
6	0.346	0.634	
7	0.744	0.586	
8	0.668	0.707	
9	0.656		

Note. *The correlation is significant at the level of $p<0.001$.*

Reliability-consistency of subtests of both forms of the methodology was calculated using the formula of L. Cronbach (Muslov, 2023). The data obtained indicate a high internal consistency of the scales. The results of the tests of the methodology to diagnose scientific-professional thinking of psychologists are presented in Table 3.

Table 3
Reliability of subtests of the method of diagnostics of scientific-professional thinking of psychologists

#	Subtest name	Number of points	Cronbach's alpha coefficient	
			value Form A	Form B
1	Subtest 1	9	0.859	0.850
2	Subtest 2	8	0.865	0.853
3	Subtest 3	5	0.870	0.881

We also tested the internal reliability of the diagnostic tool, which was determined by the internal consistency method using the correlation of three subtests of the form A and B methods with each other (Table 4, Table 5).

Table 4
Significant correlations of subtests of the method of diagnostics of scientific-professional thinking of psychologists (form A), N = 98

	Subtest 1	Subtest 2	Subtest 3
Subtest 1	1		
Subtest 2	0.414**	1	
Subtest 3	0.434**	0.454**	1

Note. *The correlation is significant at the level of p<0.001.*

Table 5
Significant correlations of the subtests of the method of diagnostics of scientific-professional thinking of psychologists (Form B), N=98

	Subtest 1	Subtest 2	Subtest 3
Subtest 1	1		
Subtest 2	0.218*	1	
Subtest 3	0.288**	0.561561***	1

Note. ** – Correlation is significant at p<0.05; * * - Correlation is significant atp<0.01; * * * - Correlation is significant atp<0.001.*

As can be seen in Tables 4 and 5, all three subtests of the Form A and B methods have a positive correlation with each other. This relationship of subtests shows the internal reliability of the test.

The distribution of values is normal for all scales/subtests of the methodology of both forms (calculations were made using the λ-Kolmogorov-Smirnov criterion). As can be seen in Table 6, the Kolmogorov-Smirnov test using the distribution showed that there was no significant difference from normality (p = 0.07298 and p = 0.08454, where p>0.05), and it can be argued that the empirical values correspond to the normal distribution.

Table 6
Distribution normality indicators

Kolmogorov-Smirnov p-values	
Form A (p-value)	Form B (p-value)
0.07298	0.08454

Note. *The correlation is significant at the level of 0.05.*

Validity assessment

Content validity was evaluated taking into account the correspondence of the content of tasks/questions of subtests to the type of thinking that was supposed to be evaluated within the framework of the developed methodology.

This technique is designed to study the formation of scientific-professional thinking among psychology students by performing the following tasks.

- In subtest 1-these are tasks that are based on the conceptual apparatus of psychological science, with their help, the level of proficiency in psychological concepts / categories is revealed.
- In subtest 2, tasks are designed to study the formation of mental operations: analysis, comparison, generalization.
- In subtest 3, tasks are designed to identify the ability to formulate a logical thought using a given scientific terminology.

Seven specialists-psychologists (university teachers, candidates and doctors of psychological sciences) were involved. Experts were asked to complete the tasks of the methodology and assess their compliance with the stated criteria for the formation of scientific-professional thinking of psychologists. Expert evaluations confirmed the correspondence of the questions of form A and B with each other in relation to their internal content, as well as their prognosticality in relation to the criteria for the formation of scientific-professional thinking. Experts generally gave a positive assessment of the methodology. The correlation coefficients (from 0.64 to 0.94) are statistically significant. Therefore, the degree of representativeness of the the content of questions in each subtest of the methodology meets the requirements of the measured area.

The constructive validity of the methodology was determined by identifying correlations of the developed methodology for diagnosing the formation of scientific-professional thinking with indicators of such methods as:

1) The "Addition of sentences" subtest is R. Amthauer's test (Amthauer, 1953; Amthauer et al., 1999; Amthauer et al., 2001; Gurevich et al., 1993).
2) "Personal Creativity Assessment" Method (Tunik, 2003, 2013);
3) "Thinking Style Identification" Method (Belousova, 2011);
4) "Differential Type of Reflection" Questionnaire (Leontiev et al., 2009)" (Table 7).

Table 7
Indicators of correlation between the methodology and external criteria

Methods and their scales	Form A	Form B
R. Amthauer Intelligence Structure Test (IST)". subtest 1 "Addition of sentences"	Correlation coefficient	
General awareness. amount of available knowledge. breadth of cognitive interests. Ability to extract information from long-term memory	0.431***	0.564***

Methods and their scales	Form A	Form B
Scales of the "Personal Creativity Assessment Method"	Correlation coefficient	
Risk	Appetite 0.377 ***	0.192*
Curiosity	0.205*	0.187*
Difficulty	0.293***	0.226**
Imagination	0.255**	0.200*
Total score	0.262**	0.176*
Scales of the "Personal Creativity Assessment" method	Correlation coefficient	
Initiative thinking style	0.197*	0.330 ***
Critical thinking style	0.206*	0.290**
Managerial thinking	style 0.359 ***	0.216*
Practical thinking style	0.225**	0.270**
Scale of the "Differential Type of Reflection"	Correlation coefficient	
System reflection	0.316 ***	0.248**
Introspection	0.021	0.008
Quasi-reflection	Quasi-reflection 0.147	-0.159

Note. – Correlation is significant at p<0.05, * * - Correlation is significant atp<0.01, * * * - Correlation is significant atp < 0.001.*

The obtained correlation coefficients, presented in Table 7, demonstrate a positive and statistically significant relationship of the total scores of both forms of the developed methodology with the addition of sentences of Amthauer's Intelligence Structure Test (IST; Amthauer, 1953; Amthauer et al., 1999; Amthauer et al., 2001; Gurevich et al., 1993), the creativity property scales ("Risk Tolerance", "Curiosity", "Complexity", "Imagination") of the

Personal Creativity Assessment Method (Tunik, 2003, 2013), the initiative, critical, managerial, and practical thinking styles of the Thinking Style Identification Method (Belousova, 2011), and the "System Reflection" scale of the Differential Type of Reflection Questionnaire (Leontiev et al., 2009). The revealed interrelations of scientific-professional thinking of psychology students correspond to well-established studies that have examined correlated qualities as professionally important characteristics of psychologists (Achina, 2012; Badalova, 2015; BeniBeniova, 2021; Bakhshalieva, 2022; Medvedeva & Osin, 2023; Li et al., 2024; Zhong et al., 2024).Thus, the analysis showed a good correlation and internal consistency of the construct of the psychodiagnostic methodology of scientific-professional thinking with the scales of external methods.

Discussion

During the study, the author's method of diagnosing the formation of scientific-professional thinking of psychologists was developed and its psychometric verification was carried out, which showed compliance with the basic requirements for diagnostic tests (Orel & Senin, 2007). Subtests of the method showed internal consistency among themselves (correlation coefficient from 0.346 to 0.756; significant at $p<0.001$), which confirms the internal reliability of the method. We also received confirmation of the constructive validity of the methodology, where statistically significant correlations with external scales (from 0.216 to 0.564) indicate the ability of the construct of the tested methodology to determine the level of formation of scientific-professional thinking.

The proposed methodology diagnoses the research potential of psychology students, their ability to conduct research in the field of psychology, but does not reflect their interest and motivation for this activity. It is also known that scientific activity in the field of psychology differs from the practical activity of a psychologist working with real psychological problems of people, which requires other personal qualities. Therefore, the question of psychological diagnostics of professional competence of future psychologists at the stage of training in higher education remains open.

The correlations obtained during the study between the methodology for diagnosing the formation of scientific-professional thinking with indicators of other diagnostic methods, the reliability and validity of which have already been proven, demonstrate the validity of the author's methodology, the possibility of introducing this diagnostic tool into the practice of training future professionals and applying it for research purposes (Zabolotnaya, Dubovickaya, 2022b; Zabolotnaya, 2023; Dubovickaya et al., 2024).

Conclusion

The focus of our country on ensuring technological leadership implies the training of scientific personnel in higher education institutions who possess the appropriate technologies and have the necessary cognitive prerequisites, including scientific-professional thinking. All this sets

special tasks for the higher education system, which should create conditions for the formation of appropriate competencies and competencies of future scientific personnel.

The diagnostics of scientific-professional thinking of psychology students presented in the article, which is based on the theory and practice of thinking research that has developed in psychological science, can serve as a basis for developing a similar procedure for studying scientific-professional thinking of other categories of specialists.

The proposed methodology can be expanded by developing and supplementing it with other diagnostic procedures (subtests), in particular, tasks for classifying concepts. A special approach is required to diagnose the readiness of future scientific personnel to conduct empirical research.

The modern practice of assessing the quality of training of future professionals for scientific, analytical and productive activities cannot be limited to traditional procedures in the form of examination and test questions and so-called achievement tests aimed at checking the level of mastering knowledge in academic disciplines and proficiency in certain applied skills. They should be supplemented by research on the formation of professionally significant personal qualities and cognitive abilities, which means that appropriate technologies for their formation and diagnosis in students are needed.

References

Achina, A.V. (2012). Analysis of interrelations between thinking styles and parameters of solving psychodiagnostic problems in students of psychology and practical psychologists. *Russian Psychological Journal, 9*(3), 65-71. (In Russ.) https://psy.su/feed/4160/

Ainley, M., & Ainley, J. (2011). A cultural perspective on the structure of student interest in science. *International Journal of Science Education, 33*(1), 51–71. https://doi.org/10.1080/09500693.2010.518640

Akhmetova, B. S., Berikkhanova, A. E., Mukhamedkhanova, A. K., & Zhakiyanova, Z. G. (2025). On improving the quality of natural science education in Kazakhstan. *The Education and science journal,* 27(3), 36-53. https://doi.org/10.17853/1994-5639-2025-3-36-53

Amtchauer, R. (1953). Intelligenz und Beruf. *Zeitschrift für experimentelle und angewandte Psychologie, 1*, 102–136.

Amthauer, R., Brocke, B., Liepmann, D., & Beauducel, A. (1999). *Intelligenz-Struktur-Test 2000*. Göttingen: Hogrefe.

Amthauer, R., Brocke, B., Liepmann, D., & Beauducel, A. (2001). *Intelligenz-Struktur-Test 2000 R (erweiterte und revidierte Auflage)*. Göttingen: Hogrefe.

Arsenyev, A. S., Bibler, V. S., & Kedrov, B. M. (1967). *Analysis of a developing concept.* Moscow: Science. (In Russ.)

Asmolov, A. G. (2005). *Psychological lexicon. Encyclopedia in six volumes: general psychology.* L. A. Karpenko (ed. - comp.), A. V. Petrovsky (under the general ed.). Moscow: PER SE. (In Russ.)

Badalova, M. V. (2015, November). Intellectual culture of a psychologist: approaches to the organization of research. In V. T. Kudryavtsev (ed.), *Training and Development: modern theory and practice.* Materials of the XVI International Readings in memory of L. S. Vygotsky (pp. 234-240). At 2 o'clock Moscow: Lev. (In Russ.) https://www.persev.ru/bibliography/intellektualnaya-kultura-psihologa-podhody-k-organizacii-issledovaniya

Bakhshalieva, Y. A. (2022). Development of psychology students' creativity. *Voronezh State Pedagogical University Journal.*, 4(297), 125–128. (In Russ.)

Barz, D. L., & Achimas-Cadariu, A. (2016). The development of scientific reasoning in medical education: A psychological perspective. *Clujul Medical, 89*(1), 32–37. https://doi.org/10.15386/cjmed-530

Belousova, A. K. (2011). *Thinking style: a textbook*. Rostov-on-Don: Southern Federal University.

Benić, M. (2021). Translation and validation of the Kaufman Domains of Creativity Scale on a Croatian sample of early childhood and preschool education students. *Center for Educational Policy Studies Journal*, *11*(3), 163–179. https://doi.org/10.26529/cepsj.708

Bezuidenhout, S. (2011). *Toward assessing scientific thinking: A qualitative analysis of student reasoning among psychology undergraduates* (Doctoral dissertation). Stellenbosch University.

Dubovickaya, T. D., & Zabolotnaya, E. V. (2022). Scientific-professional thinking of psychologists in the context of training of highly qualified personnel. *Pedagogy and Psychology of Education, 2*, 74–86. (In Russ.) https://doi.org/10.31862/2500-297X-2022-2-74-86

Dubovickaya, T. D., Grishina, A. V., & Zabolotnaya, E. V. (2024). Scientific-professional thinking in the context of training highly qualified personnel. In E. P. Komarova (ed.), *Innovative vector of professional education development: a collective monograph* (pp. 94–109). Voronezh: Publishing and Printing Center "Scientific book". (In Russ.)

Ebn Saifudin, N. A. M., Anwar, N., Hashim, H., & Kurniawan, Y. (2024). Artificial intelligence in education: An exploratory study. *Open Journal of Social Sciences, 12*(11), 565–581. https://doi.org/10.4236/jss.2024.1211039

Eremin, A.V. (2019). Science in the system of priorities of the Russian state in the XXI century. *Socio-political Research, 2*, 33–44 (In Russ.) https://doi.org/10.24411/2658-428X-2019-10439

Frolova, E. V., Rogach, O. V., & Ryabova, T. M. (2020). Digitalization of education in modern scientific discourse: new trends and risk analysis. *European Journal of Contemporary Education*, 9(2), 313–336.

Golovin, S. Yu. (1998). *Dictionary of practical Psychology*. Moscow: AST, Harvest. (In Russ.)

Guardia, L., Clougher, D., Anderson, T., & Maina, M. (2021). IDEAS for transforming higher education: An overview of ongoing trends and challenges. *International Review of Research in Open and Distributed Learning, 22*(2), 166–184. https://doi.org/10.19173/irrodl.v22i2.5206

Gurevich, K. M., Akimova, M. K., Borisova, E. M., Kozlova, V. T., & Loginova, G. P. (1993). *Guide to the application of the R. Amthauer Intelligence Structure Test*. Obninsk: Printer. (In Russ.)

Khatri, R., Henderson, C., Cole, R., Froyd, J. E., Friedrichsen, D., & Stanford, C. (2017). Characteristics of well-propagated teaching innovations in undergraduate STEM. *International Journal of STEM Education, 4*(2), Article 2. https://doi.org/10.1186/s40594-017-0056-5

Kim, M.-Y., & Wilkinson, I.A.G. (2019). What is dialogic teaching? Constructing, deconstructing, and reconstructing a pedagogy of classroom talk. *Learning, Culture and Social Interaction*, 21, 70–86. https://doi.org/10.1016/j.lcsi.2019.02.003

Koes Handayanto, S., Fawaiz, S., & Taufiq, A. (2024). Using e-scaffolding to develop students' scientific reasoning through inquiry-based learning. *The Education and Science Journal. Scholarly journal*. *26*(3), 69–90. https://doi.org/10.17853/1994-5639-2024-3082

Kornilova, T. V. (2002). *Experimental psychology. Theory and methods: textbook for universities*. Moscow: Aspect Press. (In Russ.)

Leontiev, D. A., Lapteva, E. M., Osin, E. N., & Salikhova, A. J. (2009). Development of a method for differential diagnosis of reflexivity. In V. E. Lepsky (ed.), *Reflexive processes and management: proceedings of the VII International Symposium* (pp. 145-150). Moscow: Kogito-Center. (In Russ.)

Li, G., Chu, R., & Tang, T. (2024). Creativity self-assessments in design education: a systematic review. *Thinking Skills and Creativity*. 52, 101494. https://doi.org/10.1016/j.tsc.2024.101494

Maklakov, A. G. (2008). *General psychology*. St. Petersburg: Piter. (In Russ.)

Marupova, N. I., & Shadiev, S. S. (2025). The formation of scientific thinking of graduate students.

«Journal of science-innovative research in Uzbekistan» Jurnali. *3*(01), 495–504. https://universalpublishings.com/index.php/jsiru/article/view/9728/18917

Medvedeva, I. A., & Osin, R. V. (2023). Reflexivity and its research in consultant psychologists. *World of Pedagogy and Psychology: International Scientific and Practical Journal*, 5(82). (In Russ.) https://scipress.ru/pedagogy/articles/refleksivnost-i-ee-issledovanie-u-psikhologov-konsultantov.html

Meshcheryakov, B. G., & Zinchenko, V. P. (2002). *A large psychological dictionary*. Saint Petersburg: Prime Euro Sign. (In Russ.)

Mieg, H.A., Odebiyi, F., & Haberstroh, S. (2024). Toward an undergraduate research network in Europe and beyond. *Scholarship and Practice of Undergraduate Research*, *7*(3), 34–40. https://doi.org/10.18833/spur/7/3/2

Muslov, S. A. (2023). Calculation of Cronbach's alpha in testing and surveys on the study of quality of life in statistics classes in medical universities. In *Modern trends in the development of science and the world community in the era of digitalization: proceedings of the XI International scientific-practical conference* (pp. 651-657). Moscow: Limited Liability Company "ALEF Publishing House". (In Russ.)

Orel, V. E., & Senin, I. G. (2007). *Fundamentals of psychodiagnostic: a textbook* (2nd ed.). Yaroslavl: Yaroslavl State University. (In Russ.)

Panamareva, O. N. (2021). Science and innovation activity in Russia at the beginning of the xxi century. *Herald of the Moscow University of Finances and Law, 1*, 89–111. (In Russ.) https://doi.org/10.52210/2224669X_2021_1_89

Senko, E. V. (2015). Science as a component of the higher education system. *Higher Education in Russia, 10*, 105–111. (In Russ.)

Sorokoumova, E. A., Puchkova, E. A., & Ferapontova, M. V. (2024). The formation of scientific thinking of graduate students. *Pedagogy and Psychology of Education*, 3, 231–245. (In Russ.) https://doi.org/10.31862/2500-297X-2024-3-231-245

Sun, P., Huang, T., Ma, W., Gao, Z., & Cai, J. (2024). Artificial intelligence assisting education management: Value orientation, key issues, path optimization. *Open Journal of Social Sciences, 12*(11), 299–314. https://doi.org/10.4236/jss.2024.1211015

Tunik, E. E. (2003). *Modified creative Williams tests*. St. Petersburg: Speech. (In Russ.)

Tunik, E. E. (2013). *The best tests for creativity. Diagnostics of creative thinking*. St. Petersburg: Piter. (In Russ.)

Valdés, K. N., & Cerdá Suárez, L. M. (2021). An Institutional Perspective for Evaluating Digital Transformation in Higher Education: Insights from the Chilean Case. *Sustainability*, *13*(17), 9850. https://doi.org/10.3390/su13179850

Varushchenko A.A., & Vladimirov N.A. (2021). The State and the Prospects of the Development of Innovative Activity in the Russian Federation in the XXI Century. *Statistics and Economics, 18*(2), 34–44. (In Russ.) https://doi.org/10.21686/2500-3925-2021-2-34-44

Vygotsky, L. S. (1982). Thinking and Speech. In L. S. Vygotsky, *Collected Works* (vol. 2). Moscow: Pedagogy. (In Russ.)

Walder, A. M. (2017). Pedagogical innovation in Canadian higher education: Professors' perspectives on its effects on teaching and learning. *Studies in Educational Evaluation, 54*, 71–82. https://doi.org/10.1016/j.stueduc.2016.11.001

Xiao, S., & Sandoval, W. (2017). Associations between attitudes towards science and children's evaluations of information about socio-scientific issues. *Science & Education, 26*(3–4), 247–269. https://doi.org/10.1007/s11191-017-9888-0

Yakovlev, E. V., & Yakovleva, N. O. (2010). Conceptual and categorical apparatus of pedagogical research. *Modern Higher School: an Innovative Aspect, 2*, 52–60. (In Russ.)

Zabolotnaya, E. V. (2023, March). Scientific-professional thinking of psychologists in the context of

the development of scientific thought. In *XXXVI International Plekhanov Readings. Collection of articles by postgraduates and young scientists* (pp. 490–493). Moscow: Plekhanov Russian University of Economics. (In Russ.)

Zabolotnaya, E. V., & Dubovickaya, T. D. (2022, April, b). Psychological mechanisms of formation of scientific-professional thinking. In *Man in the Context of Social Changes: Proceedings of the International Scientific and Practical Conference (pp. 101–103). Ufa: Bashkir State Pedagogical University named after M. Akmulla.* (In Russ.)

Zabolotnaya, E. V., & Dubovickaya, T. D. (2022, March, a). Formation of scientific-professional thinking in highly qualified psychological personnel: problem statement. In *Psychotechnology in business and education. VII International Scientific and Practical Conference. Proceedings of the Conference* (c. 39–42). Moscow: World of Science. (In Russ.)

Zhong, X., Qu, K., & Zhang, D. (2024). Examining influencing factors of teacher education students' creativity in Chongqing Municipality. *Cogent Education*, *11*(1), https://doi.org/10.1080/2331186X.2024.2351268

Appendix

Methods of diagnostics of scientific-professional thinking of psychology students

Subtest 1-Proficiency in concepts

Instruction manual. In each proposed task, write the psychological concept or category that corresponds to the proposed "keywords". If you don't have a clear answer, write "I can't answer".

No. p / p	Keywords	Concept / category
1	Property of the brain, reflection of the objective world	
2	Activity, goal, need	
3	Unconscious readiness, predisposition to activity	
4	Foresight, result of actions, anticipation	
5	Perception, past experience, addiction	

No. p / p	Keywords	Concept / category
6	Mental state, need, source of activity	
7	Concentration, focus, clarity of consciousness	
8	Holistic reflection, subject, sense organs	
9	Mental abilities, problem solving	

Subtest 2 - Exclusion of concepts

Instruction manual. In each proposed task, specify an "extra" concept that has a different meaning in relation to other concepts, as well as what unites the remaining concepts.

No. p / p	Words	Excluded concept / what unites the remaining
1	Selectivity, distribution, switching, implementation, volume	
2	Quality, volume, intensity, duration, localization	
3	Objectivity, integrity, concentration, constancy, structure	
4	Activity, reactivity, emotionality, logic, introversion-extraversion	
5	Analysis, comparison, switching, generalization, classification	
6	Systematization, schematization, agglutination, hyperbolization, typing	
7	Orientation, sensitivity, activity, plasticity, extraversion	
8	Rigidity, introversion, simultaneity, reactivity,	

Subtest 3-Making a meaningful sentence/utterance

Instruction manual. In each row, you need to make a meaningful statement using all the suggested words/phrases, changing their endings if necessary, and also adding your own words to them. If you find it difficult to answer/explain, then write "I can't answer".

Example

Words: "understanding", "sudden", "problem solving".

Variants of sentences: "Insight –"*a sudden*, instantaneous and non-deducible new *understanding*, comprehension of essential relationships, tasks, problems and the structure of the situation as a whole, through which a meaningful *solution to the problem* is achieved" (Golovin, 1998, p.269). Insight – "sudden understanding," grasping "the relationships and structure of the problem situation, finding a solution to the problem" (Meshcheryakov and Zinchenko, 2002, p. 180).

No. p / p	Words	Examples of utterances
1	Personality, consciousness, activity	
2	Principle of conscience, "Ego", reality principle	
3	"Third force", Behaviorism, Freudianism	
4	Edge effect, memorization, middle of a number of elements	
5	Statistical method, relationship assessment, correlation analysis	

1 point is awarded for each correct answer.

Key to the methodology

Subtest 1-Proficiency in concepts

No. p / p	Keywords	Concepts / Categories
1	Property of the brain, reflection of the objective world	Psyche
2	Activity, goal, need	Activity
3	Unconscious readiness, predisposition to activity	Attitude

No. p / p	Keywords	Concepts / Categories
4	Foresight, result of actions, anticipation	Anticipation
5	Perception, past experience, addiction	Apperception
6	Mental state, need, source of activity	Need
7	Concentration, focus, clarity of consciousness	Attention
8	Holistic reflection, subject, sense organs	Perception
9	Mental abilities, problem solving	Intelligence

Subtest 2 - Exclusion of concepts

No. p / p	Words	Excluded concept
1	Selectivity, distribution, switching, implementation, volume	Implementation / others – properties of attention
2	Quality, volume, intensity, duration, localization	Volume / others – properties of sensations
3	Objectivity, integrity, concentration, constancy, structure	Concentration / others – properties of perception
4	Activity, reactivity, emotionality, logic, introversion-extraversion	Logic/other-properties of temperament
5	Analysis, comparison, switching, generalization, classification	Switching / other – mental operations / processes
6	Systematization, schematization, agglutination, hyperbolization, typing	Systematization / other - mechanisms for creating images of the imagination
7	Orientation, sensitivity, activity, plasticity, extraversion	Orientation / the rest – psychological properties of temperament
8	Rigidity, introversion, simultaneity, reactivity,	Simultaneity / the rest – psychological properties of temperament

Subtest 3-Making a meaningful sentence/utterance

No. p / p	Words	Examples of utterances
1	Personality, consciousness, activity	Personality is a person as a carrier of consciousness and a subject of activity (copyright). Personality is an individual as a subject of social relations and conscious activity (Golovin, S. Y. Dictionary of Practical Psychology, Moscow: AST, Harvest, 1998, p. 191).
2	Principle of conscience, "Ego", reality principle	"Ego" is guided by the principle of reality, "Super-Ego" – the principle of conscience. According to Freud, the personality structure consists of the following instances: It (Id), I (Ego) and Super-I (Super-Ego) (Meshcheryakov, B. G., Zinchenko, V. P. Bolshoy psikhologicheskiy slovar'. 3rd ed., Moscow. - 2002. - 632 p. - p. 524).
3	"Third force", Behaviorism, Freudianism	Humanistic psychology positioned itself as a "third force", contrasting itself with behaviorism and psychoanalysis (Meshcheryakov, B. G., Zinchenko, V. P. Bolshoy psikhologicheskiy slovar'. 3rd ed., Moscow. - 2002. - 632 p. - p. 104).
4	Edge effect, memorization, middle of a number of elements	"The edge effect is a phenomenon that when memorizing a row of material, the elements at the beginning and end are remembered faster than the elements in the middle." (L. A. Karpenko. // General psychology. Psychological lexicon. Encyclopedic dictionary in six volumes: Developmental Psychology / Ed. - comp. by L. A. Karpenko. Under the general editorship of A.V. Petrovsky. Moscow-PER SE, 2005. p. 202).
5	Statistical method, relationship assessment, correlation analysis	"Correlation analysis is a statistical method widely used in empirical psychological research to assess the measure, form and nature of the relationship of the studied properties or attributes" (Avanesov, V. S., Shmelev, A. G. General psychology: A psychological lexicon. Encyclopedic dictionary in six volumes / Ed. - comp. by L. A. Karpenko. Under the general editorship of A.V. Petrovsky, Moscow: PER SE, 2005, p. 229).

Analysis of results

Due to the normal distribution of the methodology indicators, the standard deviation (σ) is used to determine the standard test indicators. The Xsr index ± 1/2σ is used as the norm limits. Accordingly, indicators above or below these limits reflected a high or low level of development of scientific-professional thinking. The final distribution of the boundaries of the levels of development of scientific-professional thinking is as follows.

1) 0–7 points – low level of formation of scientific-professional thinking;
2) 8–15 – average level of formation of scientific-professional thinking;
3) 16–22 – high level of formation of scientific-professional thinking.

Interpretation of results

The low level of scientific-professional thinking indicates a weak command of the conceptual and categorical apparatus of psychological science, significant difficulties in thinking operations using psychological concepts (difficulties in their analysis, comparison, generalization) and inability to build a logically correct thought.

The average level of scientific-professional thinking reflects an acceptable level of proficiency in the conceptual and categorical apparatus of psychological science and the formation of mental operations (analysis, comparison, generalization) carried out using psychological concepts; it indicates that the ability to formulate a logically constructed thought based on scientific psychological terminology is sufficient for scientific activity.

A high level of scientific-professional thinking indicates a full-fledged mastery of the conceptual and categorical apparatus of psychological science, its adequate use in scientific and professional activities when describing the results of research on mental phenomena, and high professional competence in the field of psychological science.

Received: December 25, 2024
Revised: August 18, 2025
Accepted: January 12, 2026

Authors Contribution

Elena V. Zabolotnaya – conducting an empirical study, collecting and analyzing information, interpreting experimental results, compiling tables, reviewing literature, writing an article.

Tatyana D. Dubovickaya – general management of the research direction, verification and making edits to the text of the article, final approval of the version for publication.

Authors Details

Elena V. Zabolotnaya – Post-graduate student of the Federal State Budgetary Educational Institution of Higher Education "Sochi State University", Sochi, Russia; Author ID(RSCI): 1265807; RSCI SPIN code: 5444-3493; e-mail: ozhereleva.rita@bk.ru

Tatyana D. Dubovickaya – Dr. Sci (Psychology), Professor, Head of the Department of Psychology and Defectology of the Federal State Budgetary Educational Institution of Higher Education "Sochi State University", Sochi, Russia; Researcher ID: ABE-3434-2020, Scopus ID: 6504755962, Author ID: 693207, ORCID ID: https://orcid.org/0000-0002-9604-2672; e-mail: tatdm@mail.ru@mail.ru

Conflict of Interest Information

The authors have no conflicts of interest to declare.

Research Article
UDC 159.9.072
https://doi.org/10.21702/rpj.2026.1.8

Eye-tracking study of visual attention in schoolchildren while watching educational videos

Sergei V. Moiseev*, Elena A. Esipenko, Valeria V. Nesterenko

National Research Tomsk State University, Tomsk, Russian Federation

*Corresponding author: kaungreat@gmail.com

Abstract

Introduction. Creating engaging and effective educational videos for adolescents requires not only an understanding of how visual attention operates, but also knowledge of the principles underlying lesson structure with diverse content components. Eye-tracking technology provides objective data on the distribution of attention and its dynamics during the perception of visual content. The aim of this article was a comparative analysis of the component composition of attention indicators when watching three thematically distinct videos. **Methods.** Using eye-tracking methodology, attention indicators were analyzed in 45 middle- and high-school students while they watched 7-minute educational videos on Russian language, mathematics, and biology. Visual attention measures were studied in relation to the following stimuli: image, text, diagram, on-screen lecturer, and their combinations. **Results.** Analysis of each video's structure revealed that in the biology video, “diagrams and images” were the most prevalent element, with “diagrams” attracting the greatest attention. For mathematics and Russian language, the dominant component was “lecturer + text”. The components “lecturer + diagram” and “lecturer + image” indicate limited effectiveness of these didactic techniques in the mathematics video. **Discussion.** The most effective approach proved to be the use of diverse illustrative components accompanied by parallel audio explanations from the lecturer, as demonstrated in the biology video. The combination of the lecturer on screen with slide text also proved effective (Russian language and mathematics videos), whereas the presence of the lecturer alongside other illustrative components was less so. The use of varied and vivid stimuli generates greater attention in adolescents. By understanding the specifics of each subject area

and the effective combination of lesson components, teachers can create educational videos that are both comprehensible and engaging for adolescent learners.

Keywords

visual attention, visual components, eye-tracking, adolescents, career guidance

Funding

This research was supported by the TSU Development Program ("Priority–2030"), grant No. 2.3.1.24 ML.

For citation

Moiseev, S. V., Esipenko, E. A., & Nesterenko, V. V. (2026). Eye-tracking study of visual attention in schoolchildren while watching educational videos. *Russian Psychological Journal, 23*(1), 140–155. https://doi.org/10.21702/rpj.2026.1.8

Introduction

Contemporary society is witnessing a significant transformation in the mechanisms by which the younger generation engages with the educational process, driven by the rapid development of digital technologies. Since the onset of the computer age, there have been fundamental changes in the tools through which knowledge is transmitted and conveyed. The information environment has emerged as a crucial factor in the formation of values and attitudes, influencing the development of the socio-psychological type of personality (Bardetsky, 2019). This transformation has also affected pedagogy; the trend became especially pronounced during the pandemic (Gu et al., 2024), when the mass transition to online learning took place. At present, online learning is commonplace. However, the effects of online education on the psychology and physiology of learners remain insufficiently studied, and convincing data on the quality of this approach are lacking (Dozhdikov, 2020). For this reason, non-classical methods drawn from psychophysiology have come to the aid of traditional pedagogy. Research within this framework allows the physiological responses to online content to be examined from an entirely new perspective; one such method is eye-tracking technology, which is employed to study video materials (Cao & Nishihara, 2012; Stull et al., 2018; Wang et al., 2020). Researchers have demonstrated that data related to eye movement tracking – including fixations, saccades, pupil dilation, and gaze duration (Cao & Nishihara, 2012) –are reliable indicators of human responses to emotional arousal and cognitive load (Ababkova & Rozova, 2022), as well as previously inaccessible aspects of such cognitive processes as memory and attention (Krotkova et al., 2018). The study of visual attention is particularly relevant in the context of the contemporary transformation of education, which increasingly incorporates

large amounts of video content. The advantage of eye-tracking research is that it is suited to the study of individual visual stimuli (Becker et al., 2022), to the individual processing of multimodal information (Cao & Nishihara, 2012), and to understanding cognitive processes, thereby providing additional information about task execution strategies or difficulties encountered (Becker et al., 2022).

The evolution of educational technology has given rise to video-based learning (VBL), a field concerned with identifying the formula for creating successful educational videos for instructional purposes (Garcia & Yousef, 2023). Drawing on this approach, it is possible to investigate combinations of video parameters with the aim of enhancing student engagement, which is itself a current research direction within the domain of online learning (Yolkina, 2022).

In the search for the optimal formula for educational video, the following parameters can be identified: video duration (Garcia & Yousef, 2023), lecturer speech rate and the learner's degree of preparedness for educational content (Guo et al., 2014), the presence of interactivity (Jacob & Centofanti, 2024), the on-screen presence of the lecturer (Bialowas & Steimel, 2019; Kizilcec et al., 2015), and others. A number of theoretical constructs have been established, yet they lack adequate empirical grounding; as the findings of Jacob & Centofanti (2024) demonstrate, theoretical expectations of positive effects were not borne out in practice. Students who had access to interactive resources showed no significant improvement in outcomes compared to those without such access (Jacob & Centofanti, 2024). This underscores the relevance of studying the component structure of online lessons. Accordingly, the question of how to effectively create educational content within the VBL framework remains open. Analysis of reliable physiological responses may help clarify certain aspects of how educational content is processed at different levels of multimedia (Zalata & Eremenko, 2020), a pursuit that is already being actively pursued abroad (Yıldırım & Sönmez, 2024).

In Russian science, the application of neuroimaging tools to the study of the educational process and online learning is still in a developmental phase. The literature describes studies conducted with university students; for example, Ababkova & Rozova (2022) examined the perceptual features of Russian and international students viewing presentations containing visual and textual elements; Kloktunova et al. (2019) analyzed eye movement responses in students reading educational information on screen; and Merkulova & Kalinina (2017) studied these responses in flight cadets during preflight preparation. Eye-tracking research is also being conducted for the psycho-pedagogical assessment of students with disabilities (Robin & Kruzhkova, 2024); the visual attention features of preschool children with hearing impairments are being analyzed (Smirnova, 2022; Smirnova, 2024); and eye-tracking is used to study the eye movement patterns of primary school children when composing stories from picture sequences (Efimova et al., 2023). Despite this partial coverage of the topic, the study of visual attention during online learning in adolescents remains largely unexplored. This age group is of particular interest, as adolescents frequently study material independently at home using educational video lectures. Furthermore, the lives of this age group are closely intertwined with the online environment and social networks (Konstantinova, 2023). Research devoted to the influence of digital technologies on cognitive processes and communication

does exist, but the findings are contradictory (Ageev et al., 2023). Studies examining attention and working memory in adolescents engaged in virtual activities are emerging (Kamenskaya & Tatyanina, 2024), yet reliable data obtained through a psychophysiological approach are still lacking.

The importance of addressing this question provided the rationale for the present study, the aim of which was a comparative analysis of visual attention in adolescents watching three different educational videos using eye-tracking. It was hypothesized that attention is influenced by different combinations of video content components. For instance, Garcia & Yousef (2023) identify the following elements: (1) slide presentation with narration, (2) lecturer-only lecture, (3) real-time lecture recording, (4) picture-in-picture, (5) hand-drawn videos, and (6) screencasting.

In the practice of online education in Russia, the components most commonly used in preparing video materials are: text, diagram, image, and the presence of the lecturer on screen; accordingly, these were selected as the primary objects of analysis. It is also known that when creating videos that include text and images, it is necessary to consider learner strategies and the features of on-screen information processing, as the ratio of text to illustrative material may influence learners' attentional characteristics (Ababkova & Rozova, 2022). Based on these considerations, the research question can be formulated as follows: "How, and to what extent, will the combination of visual design components in educational videos affect the characteristics of schoolchildren's visual attention?"

Methods

The study involved 45 participants (19 male, 26 female; aged 13 to 17 years, mean age = 15.1), with normal or corrected-to-normal vision, who were students at the middle and upper levels of secondary school. The study was conducted in full compliance with ethical standards; informed consent was obtained from parents or legal guardians of all minors, and approval was granted by the Research Ethics Committee of NR TSU.

Procedure

Participants came to the laboratory of Tomsk State University (TSU), completed an intake questionnaire including questions on sex and age, and then participated in the main study, which comprised equipment setup, calibration, and viewing of the videos. At the end of the study, participants completed a brief exit questionnaire, answering open-ended questions about the nature of the videos and the attractiveness of the stimulus materials. Additionally, participants were invited to suggest modifications to the structural components of the presented videos.

Stimulus Materials

Each participant was shown three videos from the TSU archive, covering the following subjects: Russian language, mathematics, and biology. The mean duration of each video was 7 minutes. This duration was established as optimal for preparatory educational videos on school subjects (Grishin et al., 2020). Each video consisted of a set of slides containing text, diagrams, images, and an on-screen lecturer in various combinations or separately, with a simultaneous audio track providing the teacher's explanations. Each video had its own unique structural composition.

The biology video covered the topic of DNA and genes. In this video, emphasis was placed on visual components – images and diagrams – which were present throughout the video, while the lecturer's image was largely absent. The mathematics video was devoted to the Lischerel number. In it, the text component dominated, combined with the audiovisual presence of the lecturer. The Russian language video presented material on phonetics. It combined text with the audiovisual presence of the lecturer, as well as standalone text-only segments. The biology lecturer was male; in the other two videos, lecturers were female.

The following structural components were selected for analysis, appearing either independently or in combination: text, image, text + image, lecturer + text, diagram, lecturer + diagram, lecturer + image (all components listed engage primarily visual attention). To avoid cognitive load effects on the final video, and to eliminate a potential order effect, participants were randomly assigned one of three video presentation sequences.

Eye movement activity was recorded using the NTrend-ET500 video-oculograph (scanning frequency: 500 Hz; gaze direction accuracy: 0.4°; built-in IR camera capturing the participant's face at HD resolution – 1280×720 – at 25 frames per second; eye-to-IR-camera distance: 0.5–0.8 m). Data recording was performed using the “Neurobarometer” software.

Measures

In preparation for data analysis, the primary areas of interest (AOIs) were identified for each video separately. The following were analyzed: (1) mean dwell time in the area of interest (ms) across the group of respondents; (2) distributed attention indicators; (3) relevant and irrelevant AOIs (Sáiz-Manzanares et al., 2023).

The main data analysis was based on the key parameter of distributed attention across all participants, defined as the sum of individual attention distribution scores divided by the total number of participants, where the attention distribution score for a single participant is the ratio of total fixation duration within the zone to the duration of the zone of interest. This attention parameter (n) was calculated automatically using the “Neurobarometer” hardware-software complex. The method of attention assessment based on oculomotor indices was applied in accordance with a registered patent (Latanov et al., 2020). For clarity, results are presented using the distributed attention indicator across all participants (n), where $n < 0.1$ indicates a very low level of distributed attention; $0.1 < n < 0.2$* – low; $0.2 < n < 0.3$** – moderate; $0.3 < n$*** – high. Asterisks are used to denote attention levels in the tabular results.

Results

Analysis of dwell time within areas of interest (excluding the lecturer) for each video showed: biology – 571,655 ms; mathematics – 560,481 ms; russian language – 410,467 ms. In the subsequent stage, each video was divided into slides and analyzed individually by key parameters.

The analyzed data are presented in three tables, one for each subject. In each table, the first row lists the different combinations of elements associated with specific slides. The rows below contain quantitative parameters reflecting the distribution of attention by the group of respondents across each zone, corresponding to the degree of their engagement with the relevant material. The higher the value of this parameter, the greater the attention directed to that zone. The distribution of attention is important to investigate because learners may experience difficulty when required to simultaneously integrate multiple sources of information, such as text and illustrations (Ozcelik et al., 2009).

Table 1 presents the component composition and the audience attention distribution indicator during viewing of the biology video.

Table 1

Attention Distribution Across Areas of Interest: Biology

Biology	Text	Image	Diagram	Diagram +Text
			0,125*	
				0,207**
Slide 1			0,139*	
	0,0273	0,048		
		0,048		
Slide 2		0,191*		
			0,159*	
			0,349* **	
	0,0102			
Slide 3		0,040		
		0,0283		
			0,120*	
		0,156*		
Slide 4			0,092	
		0,119*		
	0,011			
	0,032			
			0,059	
Slide 5			0,280**	
	0,006			
			0,206**	
		0,025		
Slide 6	0,017			
		0,092		
			0,064	

This video is characterized by: (a) an emphasis on visualization (diagrams, images); (b) effective combination of text and diagrams; (c) the inclusion of a historical figure (e.g., a portrait of Mendel). Moreover, each slide in this video contained multiple visual components, which was reflected in the distribution of attention. Moderate and above-moderate attention values in the biology video were attracted by diagrams both independently and in combination with text (0.1 < n < 0.2*, 0.2 < n < 0.3**, 0.3 < n***). Text blocks attracted less attention (n < 0.1). Of the multiple images on a slide, those related to historical figures elicited the least interest. For example, the attention indicator for the portrait of Mendel was n = 0.048, compared to n = 0.191 for the image of a plant (Slide 2, Table 1); the indicator for the portrait of Morgan was n = 0.03, compared to n = 0.09 for the crossing-over illustration (Slide 6, Table 1).

Table 2 presents the component composition of the mathematics video along with the distributed visual attention indicators.

Table 2

Attention Distribution Across Areas of Interest: Mathematics

Mathematics	Lecturer +Text	Lecturer + Diagram	Lecturer +Image	Diagram+Text
	0,112*			
Slide 1	0,179*			
			0,053	
	0,289			
Slide 2	0,099			
	0,134*			
Slide 3	**0,313*** **			
	0,242**			
Slide 4				0,137*
			0,043	
Slide 5	**0,391*** **			
	0,021			
Slide 6	0,265**			
		0,033		

Key features of this video include: (a) an emphasis on practical tasks and examples; (b) a lesser role of visual stimuli compared to the biology video; (c) greater prominence of the lecturer; (d) clarity in the formulation of tasks on slides. Of the six slides presented, 60% contained the "lecturer + text" component, with attention distribution ranging from low (0.1 < n < 0.2*) to high (0.3 < n***). The "lecturer + text" component on Slide 3 demonstrates a high level of distributed attention (0.3 < n***), suggesting that the audience was actively

engaged in the learning process at that moment. The "lecturer + image" components (Slides 1 and 5, Table 2) and "lecturer + diagram" (Slide 6, Table 2) perform less well than the "lecturer + text" component (Table 2).

Table 3 presents the component composition of the Russian language video along with the attention distribution indicators.

Table 3

Attention Distribution Across Areas of Interest: Russian Language

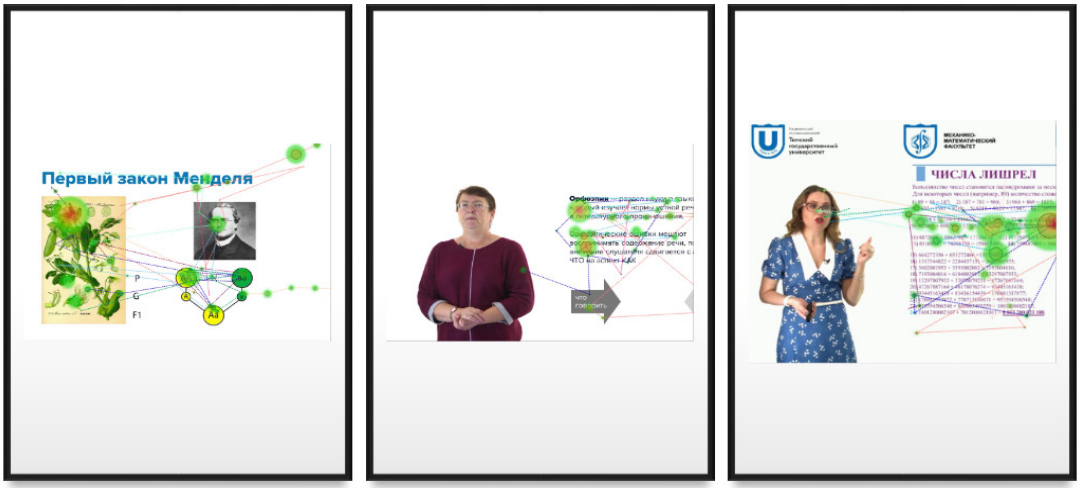
Russian language	Lecturer+Text	Text
Slide 1	0,306***	
	0,088	
	0,033	
Slide 2	0,020	
	0,266**	
Slide 3	0,255**	
Slide 4	0,380***	
Slide 5	0,392***	
Slide 6		0,232**
		0,225**
Slide 7		0,251**
		0,143*
Slide 8		0,261**
		0,144*
Slide 9	0,096	

In this video, the emphasis was placed on: (a) the combination of theory and practice; (b) the smallest role of visualization among all subjects; (c) a focus on language-based tasks (combinations of words and syllables). Analysis revealed that stimuli on Slides 4 and 5, which show a high level ($0.3 < n^{***}$) of engagement, appear on slides with the lecturer, while slides with text only and no audiovisual accompaniment show moderate-to-low ($0.1 < n < 0.3^{**}$) attention.

For visual clarity, Figure 1 presents examples of heat maps with the engaging component sets, evaluating gaze fixation by study participants in the biology, Russian language, and mathematics videos.

Figure 1

Examples of heat maps with engaging component sets



Note. *First slide from the biology video; second slide from the Russian language video; third slide from the mathematics video.*

The results shown in the figures (heat maps and fixation zone diameters) illustrate successful combinations of components in each video that captured participants' attention. With respect to the slides whose component compositions were least engaging for participants, Figure 2 presents examples from the Russian language video.

Figure 2

Examples of heat maps with non-engaging component sets

The analysis of images for this subject is grounded in the parameter of low distributed attention levels, as well as criteria relating to the sparse stimulus content of the video, as noted by participants. The heat map demonstrates that rather than analyzing the text, respondents performed prolonged fixations on the lecturer's face.

Discussion

As noted above, each analyzed video had its own didactic model, differing in structure both in terms of subject-specific requirements and the intentions of the course author. Based on the results for dwell time within areas of interest (in ms), participants devoted the greatest attention to the biology video, in which schematic representations of material constituted the key component engaging audience attention. The observed reduction in attention toward the portrait of a historical figure (Mendel's portrait) relative to another illustration on the same slide (Figure 1) may be attributable to the portrait having been presented in black and white, thereby attracting less attention.

In the mathematics video, the highest visual attention score was obtained for the "lecturer + text" component, which is consistent with findings showing that the joint use of words and images in video-based learning produces sustained attention and heightened motivation through dynamic engagement (Gu et al., 2024). Furthermore, the image of the teacher engages more synchronized eye movements, additional attentional control, and deeper socio-emotional processing; learners devote substantial attention to the image of the teacher (up to 27% of total visual attention during video-based learning; Gu et al., 2024). In the case of "lecturer + diagram" and "lecturer + image" components, a reduction in the distributed attention indicator is observed; this may be attributable to the superimposition of two stimuli of the same modality – the lecturer – alongside another complex visual object.

In the Russian language video, a high attention score ($0.3 < n$) was also identified for the "lecturer + text" component, which may be explained by the fact that primary attention was drawn to the lecturer's face and that participants had no opportunity to direct attention elsewhere (Figure 2). In support of this interpretation, analysis of the post-study questionnaire showed that five participants, in response to the question "What would you suggest changing in the videos?", noted the sparse content of the Russian language video and reported rapid fatigue and low engagement in learning. Zones lacking specific tasks or examples received the least attention ($n < 0.1$).

The fixation distributions observed across different regions of visual components, obtained from the analysis of all slides for all participants (Figure 1), are most pronounced on color images (pictures and diagrams) and indicate deep processing of the information

presented. Furthermore, the results show that the most effective approach was the use of diverse illustrative components with simultaneous verbal explanations by the lecturer, as demonstrated in the biology video; and that the combination of the lecturer on screen with slide text (Russian language and mathematics videos) proved maximally effective. The presence of the lecturer alongside other illustrative components was comparatively less effective.

It is important to acknowledge certain limitations of the study. The sample was limited to one region (Tomsk) and specific schools, which precludes generalization of the findings to the broader student population and necessitates further investigation.

Taking all of the above into consideration, it is possible to develop a lesson structure allowing for effective delivery of video material for each subject individually, with due regard for its specific characteristics; this may facilitate learners' comprehension and assist those who experience difficulties in one or another subject. Accordingly, the study of the effects of visual stimuli on the learning process represents a relevant and promising field of scientific inquiry (Li et al., 2022). The findings obtained are of considerable importance for the development of contemporary pedagogy and psychology, and may be integrated into the initial stage of career guidance activities through the addition of a component of emotional engagement and individual personality characteristics, where the relationships between objective (psychophysiological) and subjective (questionnaire-based) indicators of physiological predispositions and tendencies toward different subject domains will be examined.

The topic of online learning formats is a matter of ongoing discussion among all participants in the educational process. It is a reality that requires an ongoing effort to identify the advantageous aspects of such a transition or mode of interaction. The advantages of distance learning technologies are extensive: (1) accessibility of education (for people of various ages, for those from small communities, with the possibility of saving time and money); (2) the ability to build one's own learning trajectory and to study independently at a convenient time, among others (Kislukhina, 2017). Questions about how to properly create educational video materials within the framework of contemporary twenty-first-century learning theory – video-based learning (VBL) – remain open. It is known that optimizing the visual design process and selecting appropriate stimuli helps retain respondents within areas of interest and may lead to more active engagement with the presented information (Wang et al., 2020). This experimental study, which seeks the most optimal parameters for educational video lectures for adolescents, contributes to the VBL approach that is actively developing in other countries and to a lesser extent in Russia.

On the basis of the findings obtained, the following recommendations for creating videos for adolescents can be proposed:

1. It is important to carefully consider the visual design of slides and fill them with diverse diagrams, charts, and images (taking into account image format – black-and-white or color), as these prove more effective in attracting and sustaining learners' attention than text blocks.
2. Interactive elements such as tasks and questions promote deeper immersion in the material and enhance the effectiveness of retention. It should be noted, however, that an excessive number of visual elements may give rise to cognitive overload, thereby reducing the effectiveness of learning.

The biology video, rich in visual stimuli, demonstrates a higher level of viewing engagement and intensifies the exploratory function of oculomotor activity during learning, as evidenced by an increased number of saccades and gaze fixations on different elements of the video. The optimization of visual design and the selection of appropriate stimuli contribute to retaining respondents within areas of interest and may lead to more active engagement with the presented information. Further research in this area will enable the development of new educational methodologies conducive to the effective development of key competencies.

References

Ababkova, M. Yu., & Rozova, N. K. (2022). Eye tracking as a tool for evaluating electronic presentations by Russian and foreign students. *Journal of Pedagogical Innovations, 4*(68), 106–121. https://doi.org/10.15293/1812-9463.2204.10 (in Russ.).

Ageev, N. Ya., Tokarchuk, Yu. A., Tokarchuk, A. M., & Gavrilova, E. V. (2023). The relationship between digital technologies and the development of cognitive and communicative processes in adolescents and young adults: A review of empirical research. *Psychological Science and Education, 15*(1), 37–55. https://doi.org/10.17759/psyedu.2023150103 (in Russ.).

Bardetsky, S. S. (2019). The impact of media information on the consciousness and behavior of primary school children in the context of pedagogical issues. In *Science and innovations – contemporary concepts: Proceedings of the International Scientific Forum* (pp. 21–28). (in Russ.).

Becker, S., Küchemann, S., Lichtenberger, K. P. A., & Kuhn, J. (2022). Gaze patterns enhance response prediction: More than correct or incorrect. *Physical Review Physics Education Research, 18,* 020107. https://doi.org/10.1103/PhysRevPhysEducRes.18.020107

Bialowas, A., & Steimel, S. (2019). Less is more: Use of video to address the problem of teacher immediacy and presence in online courses. *International Journal of Teaching and Learning in Higher Education, 31*(2), 354–364.

Cao, J., & Nishihara, A. (2012). Understand learning style by eye tracking in slide video learning. *Journal of Educational Multimedia and Hypermedia, 21*(4), 335–358.

Dozhdikov, A. V. (2020). Online learning as e-learning: Quality and outcomes (critical analysis). *Higher Education in Russia, 29*(12), 21–32. https://doi.org/10.31992/0869-3617-2020-29-12-21-32 (in Russ.).

Efimova, V. L., Buynov, L. G., Novozhilov, A. V., & Khasnutdinova, A. L. (2023). Eye-tracking study: Composing an oral narrative from a series of pictures by primary school children with learning difficulties. *World of Science. Pedagogy and Psychology, 11*(2). (in Russ.).

Garcia, M. B., & Yousef, A. M. F. (2023). Cognitive and affective effects of teachers' annotations and talking heads on asynchronous video lectures in a web development course. *Research and Practice in Technology Enhanced Learning, 18,* 020. https://doi.org/10.58459/rptel.2023.18020

Grishin, A. S., Ilyina, S. A., Pichugina, M. V., & Turnova, Yu. I. (2020). Cognitive assessment of information perception during alternation of different types of video content. *Kazan Pedagogical Journal, 5*(142), 224–229. https://doi.org/10.34772/KPJ.2020.142.5.033 (in Russ.).

Gu, C., Peng, Y., Nastase, S. A., Mayer, R. E., & Li, P. (2024). Onscreen presence of instructors in video lectures affects learners neural synchrony and visual attention during multimedia learning. *Proceedings of the National Academy of Sciences, 121*(12), e2309054121. https://doi.org/10.1073/pnas.2309054121

Guo, P. J., Kim, J., & Rubin, R. (2014). How video production affects student engagement: An empirical study of MOOC videos. In Proceedings of the First ACM Conference on Learning at Scale (pp. 41–50). Association for Computing Machinery. https://doi.org/10.1145/2556325.2566239

Jacob, T., & Centofanti, S. (2024). Effectiveness of H5P in improving student learning outcomes in an online tertiary education setting. *Journal of Computing in Higher Education, 36*(2), 469–485. https://doi.org/10.1007/s12528-023-09361-6

Kamenskaya, V. G., & Tatyanina, E. V. (2024). Experimental study of working memory and attention in adolescents with different degrees of engagement in virtual activity during the COVID-19 pandemic. *Experimental Psychology, 17*(2), 52–67. https://doi.org/10.17759/exppsy.2024170203 (in Russ.).

Kislukhina, I. A. (2017). The use of distance educational technologies in higher education: Problems and prospects. *Management of Economic Systems: Electronic Scientific Journal, 9*(103), 7–14. (in Russ.).

Kizilcec, R. F., Bailenson, J. N., & Gomez, C. J. (2015). The instructor's face in video instruction: Evidence from two large-scale field studies. *Journal of Educational Psychology, 107*(3), 724–739. https://doi.org/10.1037/edu0000013

Kloktunova, N. A., Solovieva, V. A., Barsukova, M. I., & Kuzmin, A. M. (2019). Study of cognitive processes of students when searching for educational information on screen. *Perspectives of Science and Education, 3*(39), 326–340. https://doi.org/10.32744/pse.2019.3.25 (in Russ.).

Konstantinova, O. B. (2023). Possibilities of using video in the educational process from the perspective of teachers and adolescents. *Psychological Science and Education, 15*(2), 106–130. https://doi.org/10.17759/psyedu.2023150207 (in Russ.).

Krotkova, O. A., Danilov, G. V., Kaverina, M. Yu., Kulyova, A. Yu., Gavrilova, E. V., & Enikolopova, E. V. (2018). The volume of visual attention in normal aging: An eye-tracking study. *Moscow University Psychology Bulletin, 1*, 21–36. https://doi.org/10.11621/vsp.2018.01.21 (in Russ.).

Latanov, A. V., Anisimov, V. N., Boiko, L. A., & Galkina, N. V. (2020). Russian Federation Patent No. 2722447. Filed November 14, 2019; published June 1, 2020, Bulletin No. 16.

Li, W., Wu, J., Yin, K., Jiang, G., Yu, C., & Li, L. (2022). A method of attention analysis on video.

Journal of Physics: Conference Series, 2253(1), 012032. https://doi.org/10.1088/1742-6596/2253/1/012032

Merkulova, A. G., & Kalinina, S. A. (2017). Distribution of visual attention in the preparation of student pilots for flight activity. *Hygiene and Sanitation, 96*(8), 752–755. https://doi.org/10.18821/0016-9900-2017-96-8-752-755 (in Russ.).

Ozcelik, E., Karakus, T., Kursun, E., & Cagiltay, K. (2009). An eye-tracking study of how color coding affects multimedia learning. *Computers & Education, 53*(2), 445–453. https://doi.org/10.1016/j.compedu.2009.03.002

Robin, S. D., & Kruzhkova, O. V. (2024). Possibilities of applying eye-tracking technology in the psycho-pedagogical assessment of students with disabilities and children with attention deficit hyperactivity disorder. *Special Education, 4*(75), 53–67. (in Russ.).

Sáiz-Manzanares, M. C., Marticorena-Sánchez, R., Martín Antón, L. J., González-Díez, I., & Carbonero Martín, M. Á. (2023). Using eye tracking technology to analyse cognitive load in multichannel activities in university students. *International Journal of Human-Computer Interaction, 39*(19), 3816–3834. https://doi.org/10.1080/10447318.2023.2188532

Smirnova, Ya. K. (2022). Eye-tracking studies of the use of different forms of instruction in teaching children. *Moscow University Psychology Bulletin, 2*, 192–222. https://doi.org/10.11621/vsp.2022.02.09 (in Russ.).

Smirnova, Ya. K. (2024). Eye-tracking study of the features of perceptual activity of preschool children with hearing impairment when working with visual educational material in the learning process. *Experimental Psychology, 17*(1), 17–43. https://doi.org/10.17759/exppsy.2024170102 (in Russ.).

Stull, A. T., Fiorella, L., & Mayer, R. E. (2018). An eye-tracking analysis of instructor presence in video lectures. *Computers in Human Behavior, 88*, 263–272. https://doi.org/10.1016/j.chb.2018.07.019

Wang, J., Antonenko, P. D., & Dawson, K. (2020). Does visual attention to the instructor in online video affect learning and learner perceptions? An eye-tracking analysis. *Computers & Education, 146*, 103779. https://doi.org/10.1016/j.compedu.2019.103779

Wang, X., Han, M., Lipsmeyer, L. L., & Spector, J. M. (2020). Impacts of cues on learning: Using eye-tracking technologies to examine the functions and designs of added cues in short instructional videos. *Computers in Human Behavior, 107*, 106279. https://doi.org/10.1016/j.chb.2020.106279

Yıldırım, Ş. U., & Sönmez, D. (2024). A bibliometric look at eye tracking research in video-based learning. *Yüzyüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi.* https://doi.org/10.33711/yyuefd.1378898

Yolkina, I. Yu. (2022). Factors of student engagement in the educational process under distance learning conditions. *Educational Resources and Technologies, 1*(38), 7–13. https://doi.org/10.21777/2500-2112-2022-1-7-13 (in Russ.).

Zalata, O. A., & Eremenko, Yu. A. (2020). Assessment of the perception of educational content at different levels of multimedia. *Integration of Education, 24*(4), 678–691. https://doi.org/10.15507/1991-9468.101.024.202004.678-691 (in Russ.).

Received: December 4, 2024
Revised: March 14, 2025
Accepted: January 12, 2026

Author Contributions

Sergei V. Moiseev – development of the research design; preparation and conduct of the empirical study; collection of materials on domestic and international practices; data collection, entry, processing, and analysis; methodological foundations of the article; visualization/presentation of data in the text; revision of the initial draft; interpretation of research data; formulation of conclusions.

Elena A. Esipenko – expert review of the study; formulation of the research objectives; development of the article concept; collection of materials on domestic and international practices; interpretation of research data; preparation of the final version of the text.

Valeria V. Nesterenko – preparation and conduct of the empirical study; data collection, entry, processing, and analysis; development of the article concept; preparation of the final version of the text.

Author Details

Sergei V. Moiseev – Junior Researcher, Center for Cognitive Research and Neuroscience, National Research Tomsk State University, Tomsk, Russia; ORCID ID: https://orcid.org/0009-0003-4567-3241; e-mail: kaungreat@gmail.com

Elena A. Esipenko – Cand. Sci. (Biology), Associate Professor, Department of Genetic and Clinical Psychology, Faculty of Psychology, National Research Tomsk State University, Tomsk, Russia; Scopus ID: 31267491800; ORCID ID: https://orcid.org/0000-0001-7088-0195; e-mail: esipenkoea@gmail.com

Valeria V. Nesterenko – Junior Researcher, Center for Cognitive Research and Neuroscience, National Research Tomsk State University, Tomsk, Russia; ORCID ID: https://orcid.org/0009-0003-3353-8528; e-mail: valerie2602000@gmail.com

Conflict of Interest Information

The authors have no conflicts of interest to declare.

Research article
UDC 159.9
https://doi.org/10.21702/rpj.2026.1.9

CRAT-RUS: A Set of Compound Remote Associates Test Items for Insight Research. Theoretical Foundations and Validation Results

Nadezhda V. Moroshkina[1], Anna V. Kosyakova[1*], Alena P. Oshkanova[2], Irina S. Knyazeva[1]

[1] N.P. Bekhtereva Institute of the Human Brain, Russian Academy of Sciences, St. Petersburg, Russia

[2] St. Petersburg State University, St. Petersburg, Russia

[*]Corresponding author: annakos.1811@gmail.com

Abstract

Introduction. Remote associate test is a convenient and widely used tool for studying insight and creative thinking. However, numerous versions of this test exhibit considerable linguistic heterogeneity—both within Russian-language sets and across versions in different languages—which hinders the comparison of research results and further progress in understanding the mechanisms of insightful problem solving. **Methods.** In the present study, a new set of 60 tasks in Russian of two types (semantically convergent and divergent) was developed and tested. The criteria for constructing the task set are described in detail, based on current theoretical conceptions of the cognitive and metacognitive processes involved in insight. Task selection was based on metrics extracted from the Russian National Corpus. The study was validated on a sample of 71 participants (mean age = 23 years). **Results.** Convergent and divergent triads were shown to be balanced in objective difficulty, while an Aha-experience (the affective marker of insight) occurred significantly more often upon finding the correct solution for divergent triads than for convergent ones. The probability of successfully solving a task increased with higher target word frequency and higher strength of target collocations (formed by the triad words with the target word). At the same time, the probability of a correct answer was lower when the frequency of the first triad word was higher. Solution time decreased for triads with higher target word frequency. The probability of an Aha-experience

was related to the metric of semantic distance among triad words—the greater this distance, the more often an Aha-experience occurred upon finding the correct answer. Low target word frequency also increased the probability of an Aha-experience. **Discussion.** Thus, a task set of two types has been created that are equivalent in difficulty but differ in the probability of inducing an Aha-experience. Linguistic predictors of both objective task difficulty and the occurrence of an Aha-experience have also been identified.

Keywords

Compound Remote Associates Test, insight, Aha-experience, semantic coherence, processing fluency, metacognitive prediction error

Funding

This research was supported by Russian Science Foundation grant project No 25-18-01018 "Sources and functions of metacognitive experiences in creative problem solving and remembering", https://rscf.ru/project/25-18-01018/

For citation

Moroshkina, N. V., Kosyakova, A. V., Oshkanova, A. P., Knyazeva, Irina S. (2026). CRAT-RUS: A Set of Compound Remote Associates Test Items for Insight Research. Theoretical Foundations and Validation Results. *Russian Psychological Journal, 23*(1), 156–194, https://doi.org/10.21702/rpj.2026.1.9

Introduction

Research on creative thinking occupies an important place in cognitive science. For over a century, one of the most enigmatic phenomena attracting scientists has been the phenomenon of insight. Insight is generally understood as a subjectively sudden shift from incomprehension to comprehension when solving a creative problem. Insightful problem solving is often contrasted with analytical, step-by-step solving, which uses familiar approaches and procedures and/or involves trying out different options. Insight is also characterised by a specific phenomenology—namely, the occurrence of an Aha-experience—which includes a sense of the sudden emergence of a solution, confidence in its correctness, and positive emotions (Danek et al., 2014; Stuyck et al., 2021).

One of the most widely used methods for studying creative thinking processes in recent years has been the Remote Associates Test, originally developed by S. A. Mednick to assess creativity (Remote Associates Test (RAT), Mednick, 1962) and later adapted by E. M. Bowden

and colleagues to study insight (Compound Remote Associates Test; CRAT, Bowden & Jung-Beeman, 2003; Bowden et al., 2005). Remote associate tasks are used to explore the phenomenology of insight (Stuyck et al., 2021), its neurophysiological mechanisms (Bowden et al., 2005), its influence on long-term memory formation (Kizilirmak, Wiegmann, & Richardson-Klavehn, 2016; Gershkovich, Moroshkina, & Fedosova, 2021), and many other aspects. However, further progress is impeded by the significant diversity of task sets across different languages (Behrens & Olteţeanu, 2020) and the lack of specification regarding the properties of the tasks themselves and the cognitive processes involved in solving them (Wu, Huang, Chen, & Chen, 2020; Afanasieva & Spiridonov, 2024; Lukianova, 2024). Despite isolated attempts to establish the validity of the Remote Associates Test, most task sets are developed without a clear explanation of the criteria for their selection. The theoretical basis for the developed methods remains unclear—what hypothetical mechanisms underpin the solving of problems of this type? What determines whether the solution to a problem will be accompanied by an Aha-experience?

The aim of this study was to develop and validate a new set of remote associate tasks in Russian for use in research on creative thinking and the phenomenon of insight. To achieve this aim, the following objectives were set—

- to establish the key criteria for task selection, based on existing theoretical concepts regarding the cognitive and metacognitive processes that underpin insightful problem solving in remote associate tasks;
- to select and empirically validate a set of tasks of two types (potentially insightful and potentially non-insightful) with the participation of native Russian speakers;
- to describe the linguistic properties of the tasks that determine their difficulty and the likelihood of inducing an Aha-experience during the solution process.

In this work, we develop an approach based on Mednick's methodology and its later version (Bowden & Jung-Beeman, 2003). Mednick originally proposed that creative thinking is based on the ability to find new combinations of distant elements of experience. As a method for assessing creativity, Mednick developed a test consisting of 30 tasks in which participants were presented with a triad of words and asked to find a fourth target word that linked them all (Mednick, 1962). The RAT has demonstrated fairly high validity and reliability. However, it was subsequently shown that scores on this test correlate positively with scores on standard intelligence tests—particularly verbal intelligence tests (for further details, see Valueva & Belova, 2011).

In recent years, the RAT and its variants have come to be used not only to assess associative thinking abilities but also to study the phenomenon of insight experimentally. It has been shown that these tasks are very likely to trigger an Aha-experience in the solver. It has also been shown that even a simple demonstration of the tasks together with the answer can induce hindsight (the “I knew it all along” effect) (Kizilirmak et al., 2016; Moroshkina et al., 2020). However, the original version of the test contained a small number of tasks, and the tasks themselves were quite heterogeneous from a linguistic point of view. Consequently, a new version—the CRAT—was developed, comprising 144 tasks in English (Bowden &

Jung-Beeman, 2003). All tasks in the CRAT set consist of triads of words that always form a compound word or phrase with a target word (for example, for the triad ***age / mile / sand***, the answer is ***stone***—*Stone Age, milestone, sandstone*). Another key feature of these tasks is that each has only one correct answer, which distinguishes them from divergent thinking tests that require multiple answers to a single question (for further details, see Valueva & Belova, 2011).

The creators of the CRAT set point out the following advantages of these tasks compared to the classic puzzles previously used to study insight (Bowden et al., 2005):

- they are relatively easy, take less time to solve, and allow for more data to be collected at a time;
- they are sufficiently homogeneous, allowing researchers to study insight by comparing not solutions to different task types but different types of solutions to similar tasks;
- they allow for more experimental manipulations within a single research design;
- they are easy to display, and responses can be entered easily using a computer;
- they are adaptable to physiological methods (e.g., EEG, fMRI).

Russian-language versions of the Remote Associates Test

To date, several attempts have been made to develop a set of remote associate tasks in Russian. The first version of the Remote Associates Test was developed by A. N. Voronin and T. V. Galkina (Voronin & Galkina, 1994). However, this version differs significantly from Mednick's original test, as the tasks do not require finding a single correct answer; and the test is designed to assess divergent associative thinking by analysing the frequency of proposed response associations. Nevertheless, tasks from this test have been used in cross-cultural studies of the Remote Associates Test (Toivainen et al., 2019).

Later, D. V. Ushakov and E. A. Valueva developed an adaptation of Mednick's original test, which was validated on a sample of 357 participants; the internal consistency of the test items, as measured by Cronbach's alpha, was 0.87 (Valueva & Belova, 2011). The test items were based on idiomatic expressions and collocations in Russian (for example, for the triad ***кожа / слоновый / лечь*** *(skin / elephant / to lie down)*; the answer is ***кость*** *(bone)—кожа да кости, слоновая кость, лечь костьми (skin and bones —very thin, elephant bone—ivory, to lie down with bones—to do the impossible)*). Based on this test, N. V. Moroshkina and colleagues (Moroshkina et al., 2022) developed an expanded set of tasks for studying insight, comprising 100 items (RAT-RUS). The tasks were tested on a sample of 120 participants; data were collected on both task difficulty (mean solution rate = 0.52) and their ability to induce an Aha-experience during problem solving and upon presentation of the correct answer (the probability of inducing an Aha-experience during problem solving is comparable to that reported for similar task sets in other languages, at approximately 0.5).

Another version of a set of remote associate tasks was developed by a team from the Russian Presidential Academy of National Economy and Public Administration under the leadership of V. F. Spiridonov (Spiridonov, Loginov, & Ardislamov, 2021). The authors do not report any validity or reliability testing, as the task set was originally created not as a

psychodiagnostic test but as a set of tasks for experimental research. Perhaps partly for this reason, the majority of the tasks in the set turned out to be highly difficult (with a mean solution probability of about 0.20). The set contains 40 tasks based on Russian word combinations (for example, for the triad ***палитра / яркость / оттенок*** *(palette, brightness, hue)*, the answer is ***цвет*** *(colour)—цветовая палитра, яркий цвет, оттенок цвета (colour palette, bright colour, colour hue)*). However, the title of the set uses the abbreviation CRA (Compound Remote Associates), although the target word typically does not form compound words, terms, or fixed expressions with the words of the triad, unlike in the original English-language CRAT set (Bowden & Jung-Beeman, 2003).

Finally, another version of a remote associate task set—the Russian Language Compound Remote Associates Test (RLCRAT)—was proposed in M. S. Vlasov's master's thesis (Vlasov, 2021). The test includes 20 tasks constructed according to a single principle based on compound words in Russian (for example, for the triad ***колоть*** / ***резать*** / ***ходить*** *(to break, to cut, to drift)* answer is ***лед*** *(ice)—ледокол, ледорез, ледоход (icebreaker, ice cutter, ice drift)*). The average solution rate is 0.63, and the internal consistency (Cronbach's alpha) is 0.88; no information is provided regarding the probability of inducing an Aha-experience. Since compound words are not very widespread in Russian, it is unlikely that the task set for this version of the test can be substantially expanded, which poses a problem for experimental and especially psychophysiological studies.

It is not the aim of this article to provide a detailed comparison of all the mentioned versions of the RAT; we merely note that their existence indicates a high demand for this methodology in psychological research on insight and creativity. At the same time, researchers are constantly striving to improve the proposed versions of the task sets. One of the main problems is the linguistic heterogeneity of the tasks, which introduces various sources of difficulty—including non-semantic ones—and complicates the interpretation of the obtained results. A second difficulty is that, currently, the properties of tasks that facilitate an Aha-experience upon solution discovery remain largely unexplored. When using existing versions of the test, one must rely on solvers' self-reports regarding the presence or absence of an Aha-experience in order to distinguish between insightful and non-insightful trials post hoc, which leads to a quasi-experimental research design. This approach raises a number of methodological issues in studying the mechanisms of insight, as well as limitations in the interpretation and generalisability of the results obtained.

Mechanisms of solving remote associates tasks

Factors contributing to task difficulty

The solving process for remote associate tasks can be viewed as comprising two stages: an initial idea-generation stage, followed by a stage of comparison and evaluation of the solution (Smith, Huber, & Vul, 2013). In the first stage, when the participant is presented with the triad words,

close associations are activated in semantic memory according to network models (Collins & Loftus, 1975). These activation processes spread in parallel across the semantic network and at some point converge on the target word, which, due to the summation of activation, becomes accessible for retrieval (Bowers et al., 1990; Bolte & Goschke, 2005; Topolinski & Strack, 2008). However, the retrieved word is merely a guess, which may not be the correct answer to the task. Since the instructions typically require finding a word that forms a specific type of connection with the three words (for example, one that forms fixed expressions or common combinations/strong collocations) an explicit check is needed to ensure that the guessed word meets the task's requirements. At this stage, the solver may attempt to assess the "stability" of the resulting expressions with the target word, which, according to some hypotheses, is associated with backward spread of activation from the target word to the triad words (Moroshkina et al., 2022).

According to the approach proposed by K. S. Bowers and colleagues (Bowers et al., 1990), the idea-generation stage is driven by intuitive processes that sequentially perform the functions of search navigation (guiding stage) and integration of accumulated evidence (integrative stage). At the same time, even in the early stages of search, the solver experiences an intuitive sense of coherence (perception of coherence), which reflects patterns of activation in semantic memory and can serve as an indirect signal of a task's potential solvability. Thus, in Bowers and colleagues' experiments (Bowers et al., 1990) and in a series of subsequent studies (Bolte & Goschke, 2005; Topolinski & Strack, 2010), it was shown that when participants were presented with triads from the RAT, they were able to distinguish between solvable and unsolvable tasks (i.e., triads with a common target word and those without one) with a probability higher than chance after just 1.5—2 seconds.

Later, M. Öllinger and A. von Müller (Öllinger & von Müller, 2017) expanded on Bowers' ideas by proposing a four-stage model in which they explicitly describe the stage of insightful problem solving (restructuring). According to their model, in the first stage (just as in Bowers's model) activation spreads through semantic memory. However, they note that, to prevent the search from becoming endless, it must be constrained in advance by a hypothesis or prior knowledge. In the second stage, activation accumulates, and the system transits to a state of balance (coherence), characterised by increased processing fluency; at this stage, a specific intuitive guess about the solution emerges. The third stage involves the evaluation of this intuitive guess; if the evaluation is successful, a solution is produced. In the case of an unsuccessful evaluation, the system moves to the fourth stage (restructuring), triggering a change in the problem representation and a return to the first stage, but with different constraints on the spread of activation. The system cycles through these four stages until a solution is found.

In his work, E. J. Davelaar (Davelaar, 2015) attempted to model the processes of semantic search when solving RAT tasks. The results of the study showed that the problem solving process in tasks of this type is non-linear in nature. As a rule, the connection between the target word and the triad words is too weak for the summed activation from the triad to lead directly to its conscious retrieval. Reading cue words leads to the activation of their strong

associates, which must be rejected (suppressed) during the search process. As a result, participants demonstrate what the author calls a superadditive search model; they explore the associative fields of each word in the triad, including both elements at the intersection of these fields and the strongest associates outside the intersection. In doing so, they do not explore the associative fields through a sequential exhaustive search, but rather switch between them, which allows them to enhance the activation of the target word (weakly associated with all words in the triad) and weaken the activation of distracting associations (strongly associated with one of the triad words and almost unrelated to the others), thereby maximising the difference between them and ultimately leading to the retrieval of the target word.

What factors contribute to the difficulty of RAT tasks, based on the proposed models of the processes involved in solving them? According to Bowers' model, finding the answer and the time required to do so depend on how strongly the words in the triad are linked to the target word (so-called semantic coherence). The stronger the link, the faster the activation of the target word accumulates, reaching a level sufficient to overcome the threshold of awareness. Davelaar's model points to a second important factor—the presence of strong but irrelevant associates for cue words, as they are activated quickly and distract the search process, increasing the time needed to solve the task. It can also be assumed that, in general, the higher the frequency of cue words, the more associates they have and, consequently, the larger the search space.

In a study by Sio, Kotovsky, and Cagan (Sio, Kotovsky, & Cagan 2021), the stronger the semantic coherence between triad words and the target word—calculated based on association norms—the faster participants solved the task. Furthermore, as the number of strong irrelevant associates to the triad words increased, search times slowed down. Similar results were obtained in another study (Becker, Davis, & Cabeza, 2022)—the authors showed that the higher the semantic coherence between triad words and the target word (cue-solution similarity), the faster participants found the target word. In addition, the researchers hypothesised that semantic coherence among the triad words themselves (cue-cue similarity) would also affect the search for the answer. Triads with strong semantic coherence activate many closely related common associates, leading participants to expect the solution word to also be located nearby. Thus, the higher the semantic coherence, the narrower the constraints participants impose on the search space—a finding consistent with the Öllinger-Müller model. On this basis, the authors predicted that strong semantic coherence among triad words would facilitate solution finding when semantic coherence with the target word is also strong, but impede it when semantic coherence with the target word is weak. Both predictions were confirmed.

In a study by Bowers and colleagues (Bowers et al., 1990), another factor presumably influencing the search processes in RAT tasks was identified—the type of triad itself. The authors observed that in some triads, the words are associated with the target word through its different meanings (e.g., in the triad ***strike / same / tennis***, the words relate to different senses of the target word ***match***). The authors termed these triads semantically divergent. In other triads, all words are associated with the target word through a single shared meaning (e.g., the triad ***goat / pass / green*** and the target word ***mountain***); such triads were

termed semantically convergent. Since most of the triads were originally taken by Bowers and colleagues from Mednick's set, the classification of triads into types was post hoc. The authors found that semantically divergent tasks had a lower solution rate, and participants were less likely to rate them as coherent—that is, as potentially solvable. Bowers concluded that divergent triads appear to induce only a weak sense of coherence, or perhaps none at all. However, in subsequent studies using the RAT and CRAT, the distinction between semantically convergent and divergent triads has not been discussed or taken into account—which, in our view, is a serious gap. We will return to this distinction in more detail below when discussing the criteria for creating a new set of tasks.

In addition to semantic factors, other task features may influence the difficulty of RAT tasks, including the syntactic relations between the target word and the triad words within the resulting word combinations (Afanasieva, Spiridonov, 2024). Furthermore, a number of studies have shown that the strategy used by the participant can affect both solution accuracy and solution time (Smith, Huber, & Vul, 2013). For example, a common strategy involves beginning the search by generating associations to the first word in the triad. As a result, the frequency of the first word itself becomes one of the factors contributing to task difficulty (Moroshkina et al., 2020).

Factors underlying Aha-experience during problem solving

When examining the mechanisms of solving remote associate tasks, another important question arises—what determines whether a solution will be reached through insight or through analytical processes? What factors influence the likelihood of an Aha-experience occurring during problem solving? In most insight studies using RAT tasks, researchers ask participants to provide subjective reports of whether they experienced an Aha-experience at the moment of solving. Typically, the proportion of solutions accompanied by an Aha-experience averages about 50% of all correct answers; however, for some tasks this percentage may be higher, while for others it may be lower. The question of which task properties this might depend on has received virtually no discussion in the literature.

According to the Öllinger-Müller model (Öllinger & von Müller, 2017), the defining feature of engaging insight mechanisms in problem solving is the solver's transition to the fourth stage—restructuring—following unsuccessful validation of a prior guess. If the solution is found within the first three stages, it will be non-insightful. However, existing evidence suggests that this is not the case, at least when insight is defined by its affective component—the Aha-experience. E.A. Cranford and J. Moss (Cranford & Moss, 2012) used a verbal protocol analysis, asking participants in their study to solve compound remote associate tasks (CRAT), to verbalise any guesses that occurred to them, and to report whether they experienced an Aha-experience upon finding the solution. Data analysis showed that participants reported Aha-experiences both when their very first guess was correct and when the process was characterised by prolonged search with impasse and a subsequent representational change—the latter corresponding more closely to the Öllinger-Müller model.

In a number of recent studies, it has been proposed that the Aha-experience is not necessarily associated with a change in problem representation, but may instead reflect a positive metacognitive prediction error regarding task difficulty—that is, the probability and/or time required to find a solution (Dubey et al., 2021; Becker, Wang, & Cabeza, 2024; Moroshkina, 2024). Consequently, the probability of an Aha-experience and its intensity in RAT-type tasks will depend on the combination of two groups of factors: (1) task characteristics that influence the formation of an intuitive sense of coherence in the early stages of problem solving—since these largely determine the metacognitive prediction of solution probability; and (2) characteristics of the target word that determine the actual fluency of its retrieval from memory and/or are associated with backward spread of activation from the target word to the triad words — since these characteristics will influence retrospective assessments of task difficulty.

However, until recently, no attempts have been made to link the probability of inducing an Aha-experience to the linguistic properties of RAT/CRAT tasks. Building on Bowers' distinction between semantically convergent and divergent triads, we hypothesised in our previous study (Savina, Moroshkina, & Oshkanova, 2021) that divergent triads should lead participants to lower their expectations regarding the potential solvability of a given task—due to the weak coherence of divergent triads—and that precisely in divergent triads, finding a solution would be more likely to trigger an Aha-experience. We selected triads of three types—solvable convergent triads, solvable divergent triads, and unsolvable triads. Participants were first asked to intuitively judge within seconds whether each triad had a solution. After making all predictions, participants were asked either to find solutions for all triads or to indicate that a triad had no solution. Analysis of the results showed that the probability of an Aha-experience upon finding a solution was higher for tasks that participants had judged as unsolvable (incoherent) during the intuitive judgment stage. This finding supports the hypothesis linking the Aha-experience to a metacognitive prediction error. However, no relationship was found between Bowers' triad type (convergent vs. divergent) and the probability of an Aha-experience. It is possible that participants' predictions of task solvability were influenced not only by triad type but also by other task characteristics. For example, in the aforementioned study by Becker and colleagues (Becker, Davis, & Cabeza, 2022), it was shown that the Aha-experience may be associated with measures of semantic coherence among words within a triad and semantic coherence between the target word and the triad.

Thus, it can be argued that RAT-type tasks allow for a deeper understanding of the associative search processes in human semantic memory during problem solving. Drawing on advances in computational linguistics, the tasks included in the test can be described in terms of their various linguistic properties and, in turn, be linked to participants' solution success and the probability of an Aha-experience—shedding light on the nature of both the cognitive and affective components of insight.

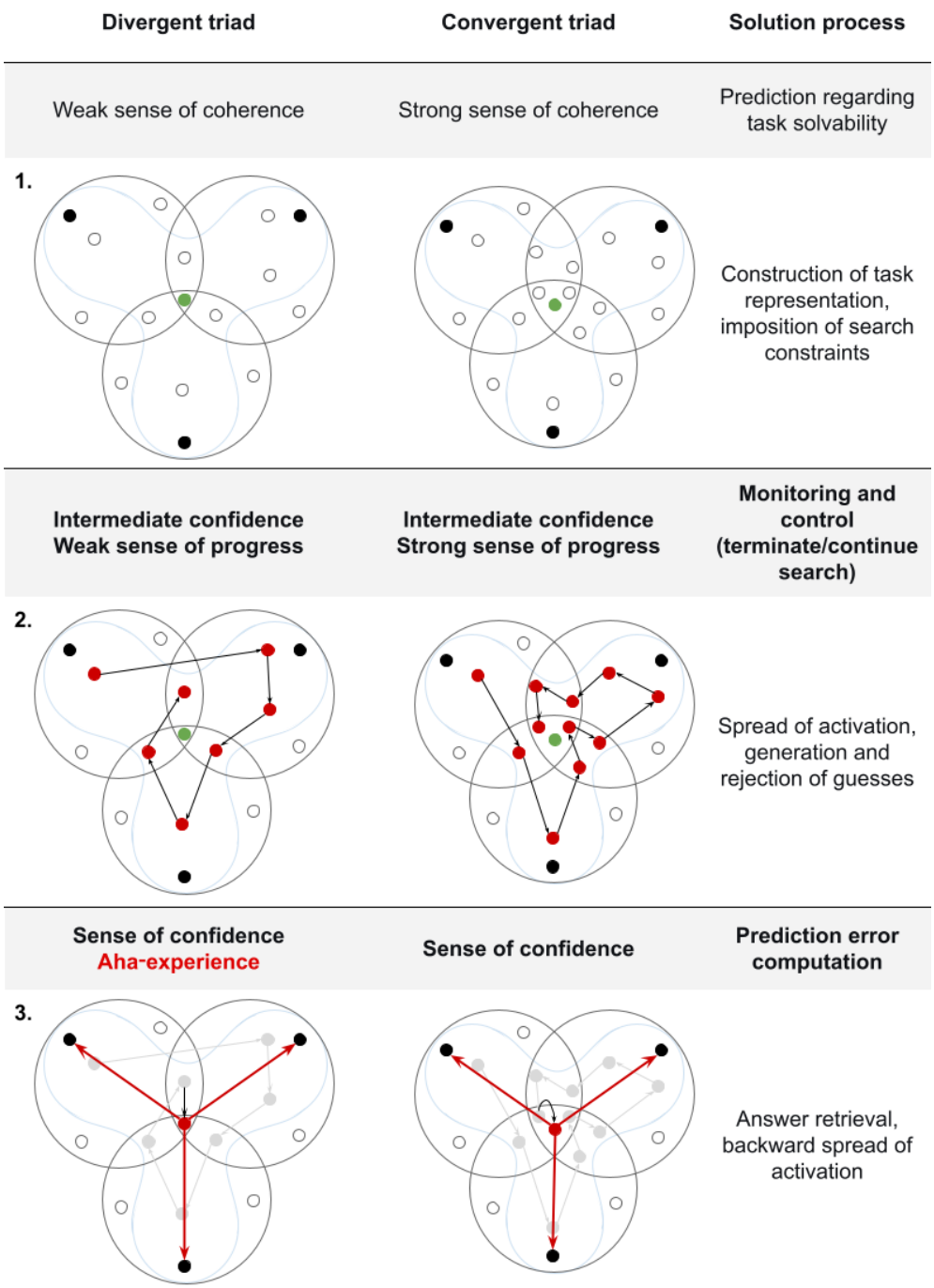
The present study

The main aim of the present study was to create potentially insightful and non-insightful remote associate tasks. Building on Bowers' approach (Bowers et al., 1990), which we previously implemented (Savina, Moroshkina, & Oshkanova, 2021) but which did not reveal the expected relationship between task type and Aha-experience, we sought to develop a new set of triads of two types (semantically divergent and convergent), while additionally identifying their linguistic properties associated with objective task difficulty and the probability of inducing an Aha-experience.

Our hypothesis is that the Aha-experience, being a metacognitive phenomenon, arises from a metacognitive prediction error regarding task difficulty (the probability and/or time required to solve it). When a task is presented, the metacognitive system generates a prediction about how the solution process will unfold, based on a sense of coherence reflecting one's unique semantic network activation pattern—its structural and dynamic characteristics. The intensity of the sense of coherence changes during the solution process (alongside the dynamics of activation spread across the network) and can increase sharply when the answer is discovered, at the stage of backward spread of activation from the found solution to the task elements. An especially pronounced shift may occur when the speed of activation spread from the task elements to the answer is slower than the backward—from the answer to the task elements (backward activation spread serves to evaluate whether the answer fits the task requirements). In this situation, a positive metacognitive prediction error occurs—the answer is retrospectively judged as more obvious than initially predicted—and the Aha-experience arises. According to our approach, the process of solving remote associate tasks and the accompanying metacognitive experiences are illustrated in Figure 1.

Figure 1.

Solution process for two types of remote associate tasks



Note: *The figure illustrates the solution process for semantically divergent and convergent types of remote associate tasks. It is based on Davelaar's model of superadditive associative search (Davelaar, 2015), extended with a metacognitive level of regulation to account for insightful problem solving. On a white background, from top to bottom, the processes occurring at the cognitive level are shown; on a grey background, the corresponding metacognitive processes and experiences are displayed. The three triad words are indicated by black dots, and their associative fields by large black circles; the solution—represented by a green dot—lies at the intersection of these fields. White dots represent associates of the triad words. The search space, formed in response to task presentation, is outlined in blue. In the central part of the figure, black arrows represent the sequence of generated solution candidates (shown as red dots) produced during the solution process. In the lower part of the figure, red arrows depict the process of backward spread of activation from the solution (red dot) to the triad words, which serves as a mechanism for verifying the solution's consistency with the task requirements.*

Based on the above, potentially insightful tasks should induce a weak sense of coherence in the early stages of the solution process and a stronger sense upon discovery of the answer. With respect to remote associate tasks, this can be achieved by creating triads in which semantic coherence *among* the triad words is weak—specifically, weaker than the semantic coherence between the triad words and the answer. Bowers' criterion of triad divergence, which implies multiple meanings for the target word, ensures weaker coherence among the triad words. However, our previous experience (Savina, Moroshkina, & Oshkanova, 2021) showed that this may not be sufficient. Therefore, when creating the set of triads of two types, we additionally took into account semantic coherence metrics (based on corpus data). For divergent (insightful) triads, semantic coherence *among the words* was required to be weaker than for convergent triads. Semantic coherence between the triad words and the answer was required to be approximately equal for convergent and divergent triads.

In summary, our aim was to create insightful and non-insightful tasks, with a particular focus on linguistic properties associated with the probability of an Aha-experience. Therefore, we sought to ensure that the sets of divergent and convergent triads were approximately balanced in terms of difficulty (i.e., that the mean solution rate did not differ significantly between them). To this end, we controlled for the strength of collocations between each triad word and the answer, as well as the frequency of the first triad word and the target word, so that these were similar for convergent and divergent triads. Thus, our research hypotheses were as follows:

1. The linguistic predictors of difficulty of remote associate tasks are the frequency of the first word in the triad and the frequency of the target word—the proportion of correct answers for a triad will be negatively related to the frequency of the first triad word and positively related to the frequency of the target word. The time required to find the correct answer will increase with higher frequency of the first triad word and lower frequency of the target word.

2. When solving convergent triads, intrusions (incorrect answers) will be more frequent due to higher semantic coherence among the words of convergent triads compared to divergent triads. Accordingly, when solving divergent triads, omission errors will be more frequent.

3. Discovery of the correct answer for divergent triads will be more often accompanied by an Aha-experience compared to convergent triads. Moreover, the probability of an Aha-experience will be negatively related to semantic coherence among the triad words.

Methods

Task bank development criteria

In accordance with the aims of the present study, 60 remote associate tasks were created. Each task consists of three nouns for which a common adjective must be found such that the nouns and the adjective form strong (*stable)* collocations in Russian. As a metric of collocation strength when creating the triads, we used the LogDice, extracted from the Russian National Corpus (RNC, Main Corpus (https://ruscorpora.ru/en/)), which reflects the strength of the syntagmatic relationship between two words (see Table 1). This metric is calculated based on the co-occurrence of words in a text corpus, taking into account their individual frequencies. The triads were constructed so that each had only one correct answer.

Based on the distinction proposed by Bowers and colleagues (Bowers et al., 1990) and on our previous study (Savina et al., 2021), we selected 30 semantically convergent (potentially non-insightful) and 30 semantically divergent (potentially insightful) triads. In convergent tasks, the target adjective was required to have a single meaning. For example, for the triad ***приз / козырь / герой*** (*prize / trump card / hero)*, the target adjective ***главный*** (*main)* has one meaning—most important, primary, central. In divergent triads, the adjective was required to have different meanings (at least two) when combined with the nouns. For example, for the triad ***дата / печать / сирота (****date / seal / orphan)*, the adjective ***круглый (****round)* has three meanings— (1) calculated without smaller units of counting (*a round date*—an anniversary measured in decades or centuries); (2) having the shape of a circle *(a round seal)*; (3) complete,utter (*a round orphan*—a child with neither father nor mother). The number of meanings for each adjective was verified using The Large Explanatory Dictionary of the Russian Language edited by S. A. Kuznetsov (Kuznetsov et al., 1998).

Additionally, convergent and divergent triads were selected based on a metric of semantic coherence among the triad words. This metric was extracted from the RusVectores distributional semantic model (Kutuzov & Kuzmenko, 2017), which is based on the Russian National Corpus (RNC, 2018 version). It reflects the degree of similarity between the contexts in which words appear in the text corpus and is calculated as the cosine similarity between the vectors of two words in the model. Triads were selected so that semantic coherence among the words of convergent triads was higher (M = 0.196, SD = 0.111) than in divergent triads (M = 0.044, SD = 0.065). For each task, three semantic coherence metrics were extracted for

the three possible pairwise combinations of triad words. At the same time, the strength of semantic coherence between the target word and the triad (*Collocation strength of target word combinations*) was balanced across the two triad types. As a metric of this strength, we used the LogDice mentioned above (see Table 1).

For the purposes of further analysis, we needed to create a single unified metric of semantic coherence among the words within a triad. We termed this metric *semantic distance among triad words* (*SemDist among triad words*). It was calculated as the cluster density of the three vectors corresponding to the three triad words. The higher the value of this measure, the farther apart the vectors are located in the model space. A comparison of convergent and divergent triads on this metric confirmed that divergent triads have greater semantic distance among words within the triad compared to convergent triads—that is, the words within divergent triads have weaker semantic coherence (see Table 1).

Additionally, to balance task difficulty between the two triad types, we sought to equate the frequency of the first word of the triad and the frequency of the target word across the sets of convergent and divergent triads. Statistical analysis revealed no significant differences between the triad types on these metrics. Mean values for all metrics, independent-samples t-test and Welch's t-test values, and corresponding significance levels are presented in Table 1. A complete list of all tasks and their corresponding linguistic properties is provided in Appendix 1.

Table 1

Linguistic properties of the CRAT-RUS tasks

Triad type	Convergent		Divergent				
	Mean	SD	Mean	SD	t-test, df	Effect size	p-value
First triad word frequency	48413	53495	37854	61872	t = 1.14, df = 58	0.294	p = 0.259
Target word frequency	31494	33444	32957	36750	t = -0.204, df = 58	-0.0527	p = 0.839
Collocation strength of target word combinations (LogDice)	9.01	0.398	9.00	0.736	t = 0.0812, df = 159	0.0121	p = 0.935
SemDist among triad words	22.9	2.38	24.6	2.10	t = -2.92, df = 58	-0.754	p = 0.005

Note: *Mean values are presented for the final set of tasks (30 divergent and 30 convergent triads).*

Sample

Seventy-one volunteers (35 women) aged 18 to 35 years (M = 23.1, SD = 4.2) took part in the present study. All participants were native speakers of Russian. Participants were recruited through online advertisements. The study was approved by the local ethics committee of the N.P. Bekhtereva Institute of the Human Brain, Russian Academy of Sciences.

The sample was collected in two stages. First, a pilot study was conducted with 18 participants (11 women), mean age 26.9 years. The main data collection stage followed later. The procedure did not differ between the pilot and the main stages; however, in the pilot, participants were asked to solve 70 tasks (35 convergent, 35 divergent), whereas the remaining participants solved 59 tasks from the original set plus one new task (60 tasks in total: 30 convergent, 30 divergent). From the initial set of 70 tasks, 11 tasks that were either too easy or too difficult according to the pilot results were excluded, and one new task was created. Due to technical reasons, data from two participants were preserved for only 45 and 43 tasks, respectively.

Procedure

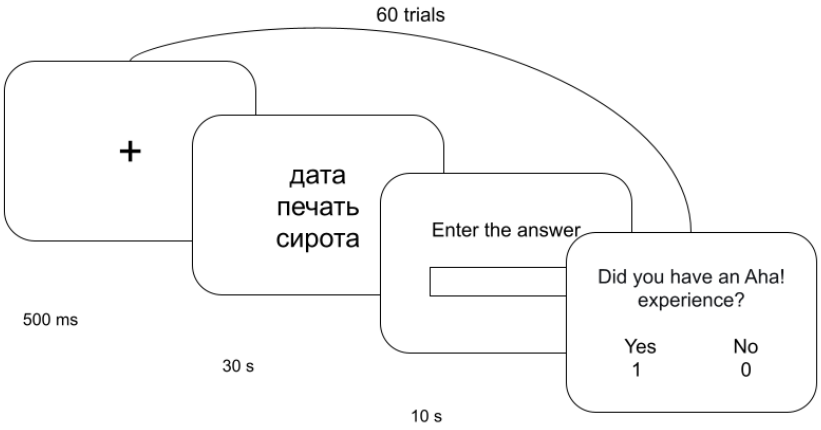
The study procedure was created using the online builder lab.js (Henninger, Shevchenko, Mertens, Kieslich, & Hilbig, 2021). The OpenLab platform (https://open-lab.online/) was used to implement the procedure online. Participants used their personal computers to complete the study. Audio communication between the participant and the researcher was maintained throughout the session.

First, participants read the instructions for completing the remote associate tasks and a description of what the researchers mean by an Aha-experience. Participants then completed a practice session consisting of three tasks to familiarise themselves with the experimental interface. After this, participants were given the opportunity to ask the researcher questions about the procedure. The main session, comprising 60 tasks, then began.

Each new trial began with the presentation of a fixation cross for 500 ms. Following this, the triad appeared—three nouns were displayed one below the other in the centre of the screen. Participants had a maximum of 30 seconds to solve each task. At any point when they identified a common adjective, they could move to answer input with the spacebar. Additionally, after 30 seconds, the answer input field appeared automatically. Participants were required to type the adjective into the answer input field using the keyboard. If a participant could not find a common word, they were required to type “no” into the answer input field. After entering their answer, participants pressed the “Enter” key. The time allowed for answer entry was limited to 10 seconds. After that, participants were asked to indicate whether they had an Aha-experience (“Yes”—press “1”, “No”—press “0”).

Figure 2.

Study procedure



Data analysis

The data were processed using the Python programming language (version 3.9). At the first stage, descriptive statistics were calculated, and the balance between convergent and divergent triads was assessed on metrics of objective task difficulty (proportion of correct solutions and mean solution time for correct answers). Additionally, the two triad types were compared on the probability of inducing an Aha-experience and on the distribution of error types (proportion of intrusions relative to the total number of errors). Independent-samples t-tests were used to assess differences between the two triad types.

At the second stage, we analysed the contribution of linguistic predictors to the probability of a correct solution, the time to discover the correct answer, and the probability of an Aha-experience. To this end, Bayesian hierarchical models were constructed. The advantages of Bayesian methods include greater flexibility in modelling the dependent variable (e.g., using censored distributions and the exponentially modified Gaussian distribution for response times), as well as the ability to quantify evidence in favour of the proposed hypotheses and to use the resulting posterior distributions as prior knowledge in subsequent studies employing the developed stimulus material (Whelan, 2008; Wagenmakers et al., 2018). The hierarchical approach allows for the identification of general patterns in the data while accounting for individual differences (in the present study, a participant-level hierarchical structure was

used—specifically, a model with random intercepts capturing variability between participants) (Casella, Fienberg & Olkin, 2006). The structure of the constructed models is briefly described below.

Before model construction, data from three participants who never reported an Aha-experience during the study were excluded from the full dataset. The following predictors were included in all three models—triad type (convergent vs. divergent), frequency of the first triad word, frequency of the target word, semantic distance among triad words, and the highest collocation strength between the target word and the triad words ($\text{LogDice}_{\text{max}}$). Initially, triads were selected such that LogDice was high on average (approximately 9 for both triad types); however, in some cases it varied over a fairly wide range, so it was decided to include it in the model. Moreover, we decided to use the highest collocation strength between the target word and any word within a triad, as we hypothesised that this metric would most strongly influence the speed with which a correct guess occurs. Visual inspection of the distributions of the linguistic predictors revealed extremely high variability in the frequency metrics, with values spanning several orders of magnitude. Consequently, the frequency of the first triad word and the frequency of the target word were log-transformed, and all linguistic predictors were scaled to a common scale through standardisation.

To assess the relationship between the linguistic properties of the tasks and the probability of finding the correct answer and the probability of an Aha-experience, we constructed Bayesian regression models with a binomial likelihood function and a participant-level hierarchy. To assess the relationship between the linguistic predictors and the time to find the correct answer, we constructed a Bayesian hierarchical regression with an exponentially modified Gaussian (ExGaussian) likelihood function. The ExGaussian distribution is defined by three parameters: μ—the mean of the Gaussian component, σ—its standard deviation, and ν—the rate of the exponential component. The first two parameters reflect the main fast and relatively symmetric part of the response time distribution, while the latter reflects longer responses (it forms the "tail" of the distribution). The response time distribution was right-censored by the study design (maximum 30 seconds), which was also accounted for in the model using a censoring procedure. The models for response time and Aha-experience probability were built only for trials in which the correct answer was found.

Because the Bayesian approach does not rely on classical significance tests, inferences about model parameters were made based on Bayesian credible intervals (HDI, highest density intervals). A parameter was considered significant if its 94% credible interval (3%–97% HDI) lay entirely on one side of zero (if it did not contain zero).

To ensure that the estimates of all models were primarily determined by the data, weakly informative priors were used. Modelling was performed using the PyMC library (version 5.3) in Python. Convergence of the models was assessed using the R-hat and the effective sample size (ESS) statistics. All models showed good convergence (*see more details in the online repository*, https://osf.io/6afmw).

Results

Comparison of convergent and divergent triads on objective difficulty, probability of an Aha-experience, and error type distribution

To test whether convergent and divergent triads were balanced on objective difficulty metrics (proportion of correct answers and mean solution time for correct answers), and to compare the two triad types on the probability of an Aha-experience and on error type distribution, the data were averaged by triad. The probability of an Aha-experience was calculated as the proportion of Aha! reports out of the total number of trials in which a correct answer was given. The proportion of intrusions was calculated as the number of intrusions divided by the total number of errors (for each triad). The results of the mean comparisons using independent-samples t-tests are presented in Table 2; a full table with data for each triad is provided in Appendix 2.

According to the analysis, the resulting sets of convergent and divergent triads showed no significant differences in either the probability or the mean solution time for correct answers, so they were approximately balanced in difficulty. At the same time, the probability of a correct solution accompanied by an Aha-experience was significantly higher for divergent triads compared to convergent triads, which corresponds to our expectations. Another significant difference was found when analysing errors. For convergent triads, intrusions predominated (participants frequently provided incorrect alternative answers). In contrast, for divergent triads, omission errors predominated (when unable to find the correct answer, participants more often left the answer field blank rather than providing an incorrect alternative).

Table 2

Comparison of convergent and divergent triads on objective difficulty, probability of an Aha-experience, and error type distribution

Triad type	Convergent		Divergent				
	Mean	SD	Mean	SD	Effect size	t-test, df	p-value
Proportion of correct answers (solvability)	0.46	0.25	0.50	0.20	-0.192	t = -0.745, df = 58	p = 0.459
Time to find the correct answer (in seconds)	10,75	2,68	11,09	2,75	-0.124	t = -0.480, df = 58	p = 0.633

Triad type	Convergent		Divergent				
	Mean	SD	Mean	SD	Effect size	t-test, df	p-value
Proportion of Aha-reports for correct-answer trials	0.42	0.11	0.57	0.12	-1.321	t = - 5.115, df = 58	p < 0.001
Proportion of intrusions out of total errors	0.67	0.13	0.42	0.15	1.734	t = 6.717, df = 58	p < 0.001

Analysis of the relationship between the probability of finding the correct answer and the linguistic properties of triads

In the model constructed to analyse the relationship between the probability of a correct answer and triad linguistic properties, the binary dependent variable was answer correctness (correct/incorrect). The fixed factors were—triad type (convergent vs. divergent), semantic distance among triad words, maximum collocation strength of target word combinations ($LogDice_{max}$), frequency of the first triad word, and frequency of the target word. The random factor was participant.

It was found that target word frequency and $LogDice_{max}$ were significant positive predictors of the probability of finding the correct answer. Thus, the higher the target word frequency and the stronger the collocations formed by the triad words with the target word, the higher the probability of finding the correct answer for a given triad. First-word frequency, in contrast, turned out to be a negative predictor of correct answer probability—the higher the frequency of the first triad word, the lower the probability of finding the correct answer. No evidence was found for an effect of triad type or semantic distance among triad words on correct answer probability.

Table 3 presents the posterior means (mean), standard deviations (sd), and 94% Bayesian credible intervals (HDI 3%–97%) for the key model parameters. For visualisation, partial dependence plots were constructed showing the average predicted probability of finding the correct answer at different values of each linguistic predictor (all other predictors held at their means), separately for convergent and divergent triads. These are presented in Figure 3.

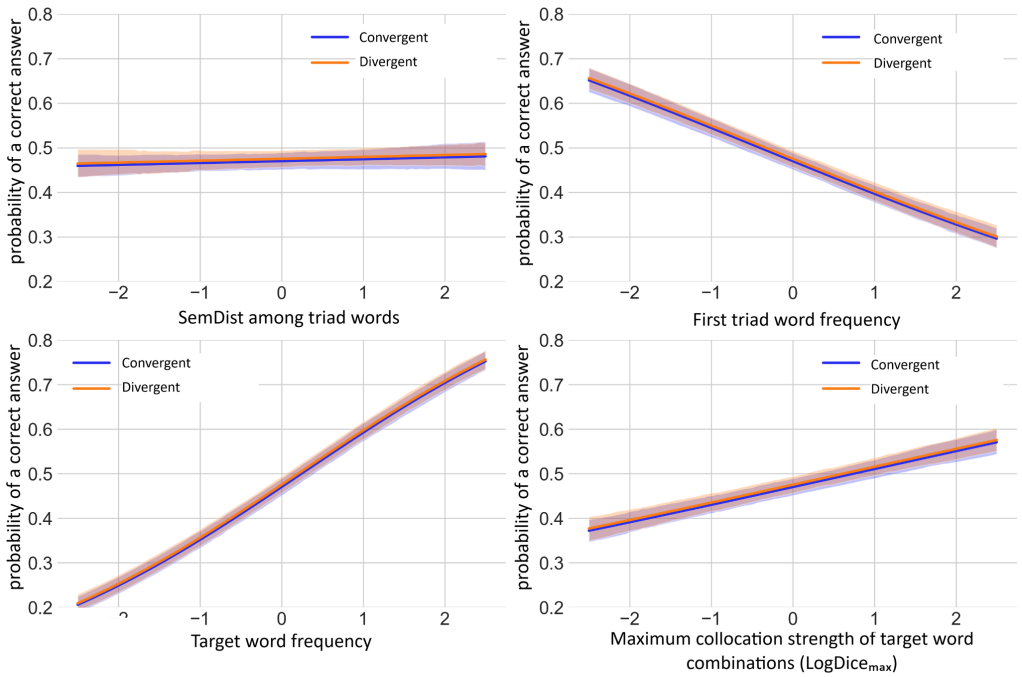
Table 3

Model parameters and posterior distribution metrics for the probability of a correct answer

a	mean	sd	hdi 3%	hdi 97%
Group-level intercept	-0.120	0.079	-0.266	0.032
Triad type	0.020	0.073	-0.113	0.156
SemDist among triad words	0.017	0.037	-0.049	0.092
Maximum collocation strength of target word combinations ($LogDice_{max}$)	0.161	0.034	0.097	0.224
First triad word frequency	-0.298	0.036	-0.364	-0.228
Target word frequency	0.492	0.036	0.426	0.562
Participant-level standard deviation	0.517	0.061	0.406	0.633

Figure 3

Partial dependence plots for the probability of a correct answer as a function of the linguistic properties of triads



Analysis of the relationship between time to find the correct answer and the linguistic properties of triads

To analyse the relationship between time to find the correct answer and the linguistic properties of triads, a series of models was constructed incorporating individual and linguistic predictors into the Gaussian, exponential, and both components of the response time distribution. Model evaluation and comparison (*see the online repository,* https://osf.io/6afmw) revealed that participant effects and the effects of linguistic predictors were captured by the exponential part of the distribution (they were associated with the ν parameter). In the final model, the dependent variable was time to find the correct answer. The fixed factors were—triad type (convergent vs. divergent), semantic distance among triad words, maximum collocation strength of target word combinations ($LogDice_{max}$), frequency of the first triad word, and frequency of the target word. The random factor was participant.

The linguistic predictor that showed a statistically significant effect on time to find the correct answer was target word frequency—its posterior distribution lay entirely in the negative region (3%–97% HDI < 0), indicating that more frequent words are discovered more quickly. In addition, a significant difference in time to find the correct answer was found between divergent and convergent triads—divergent triads on average required more solution time (96.8% of the posterior distribution of the coefficient lay to the right of zero). These patterns are illustrated in the partial dependence plots showing the relationship between solution time and triad properties in Figure 4. For the remaining linguistic predictors (first word frequency and $LogDice_{max}$), the posterior distributions included zero, which does not allow us to confidently infer their contribution to the model. Posterior means, standard deviations, and credible intervals for the model parameters are presented in Table 4.

Table 4

Model parameters and posterior distribution metrics for time to find the correct answer

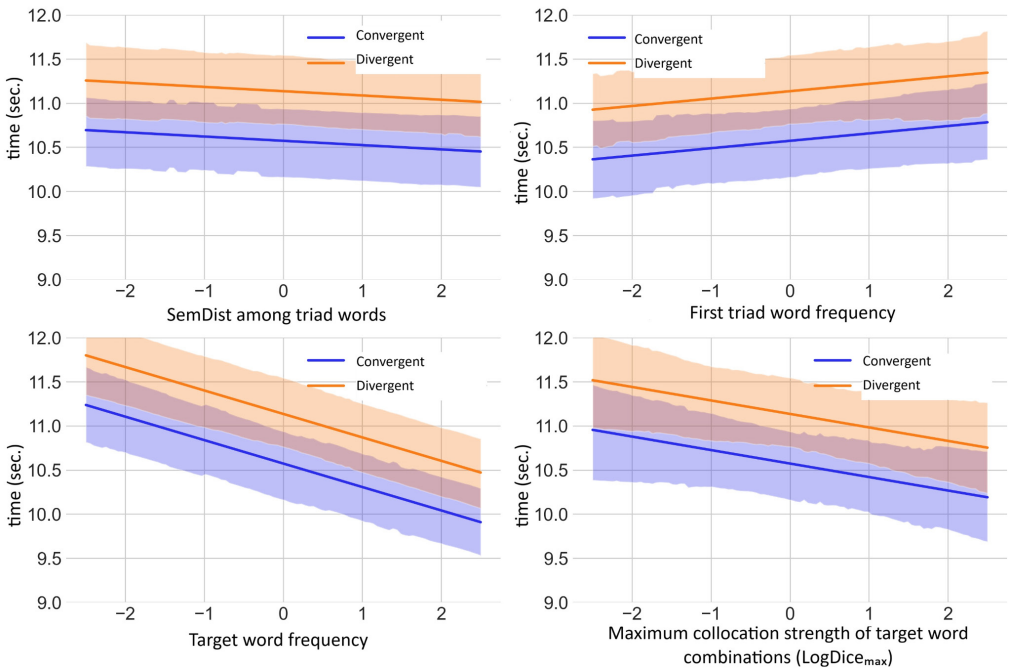
	mean (sec.)	sd	hdi 3%	hdi 97%
Group-level intercept for μ (Gaussian component)	2.423	0.068	2.293	2.550
Group-level intercept for σ (Gaussian component)	0.630	0.059	0.519	0.739
Group-level intercept for ν (exponential component)	8.161	0.427	7.405	9.016
Triad type	0.560	0.307	-0.015	1.124

	mean (sec.)	sd	hdi 3%	hdi 97%
SemDist among triad words	-0.048	0.039	-0.117	0.029
Maximum collocation strength of target word combinations ($LogDice_{max}$)	-0.152	0.156	-0.432	0.148
First triad word frequency	0.082	0.084	-0.078	0.239
Target word frequency	-0.264	0.056	-0.371	-0.161
Participant-level standard deviation	2.692	0.300	2.137	3.256

Note: All linguistic predictors, as well as the participant effect, load onto the ν parameter (onto the exponential component of the response time distribution).

Figure 4.

Partial dependence plots for time to find the correct answer as a function of triad properties



Analysis of the relationship between the probability of an Aha-experience upon finding the correct answer and the linguistic properties of triads

To analyse the relationship between the probability of an Aha-experience and the linguistic properties of triads, a model was constructed in which the binary dependent variable was the presence of an Aha-experience upon finding the correct answer. The fixed factors were: triad type (convergent vs. divergent), semantic distance among triad words, maximum collocation strength of target word combinations ($\text{LogDice}_{\text{max}}$), frequency of the first triad word, and frequency of the target word. The random factor was participant.

Triad type proved to be a significant predictor of Aha-experience probability. Aha-experience occurred more frequently for divergent triads compared to convergent ones. Semantic distance among triad words was also positively related to Aha-experience probability. The farther apart the triad words are located in semantic space, the more likely an Aha-experience is to occur when the answer is found. No convincing evidence was found for a relationship between first word frequency or $\text{LogDice}_{\text{max}}$ and Aha-experience probability. Target word frequency was a negative predictor of Aha-experience probability. The more frequent the target word, the lower the probability of an Aha-experience upon its discovery.

Table 5 presents the posterior means, standard deviations, and credible intervals for the parameters of the model described above. Figure 5 shows partial dependence plots of Aha-experience as a function of the linguistic properties of triads, with convergent and divergent triads distinguished by colour.

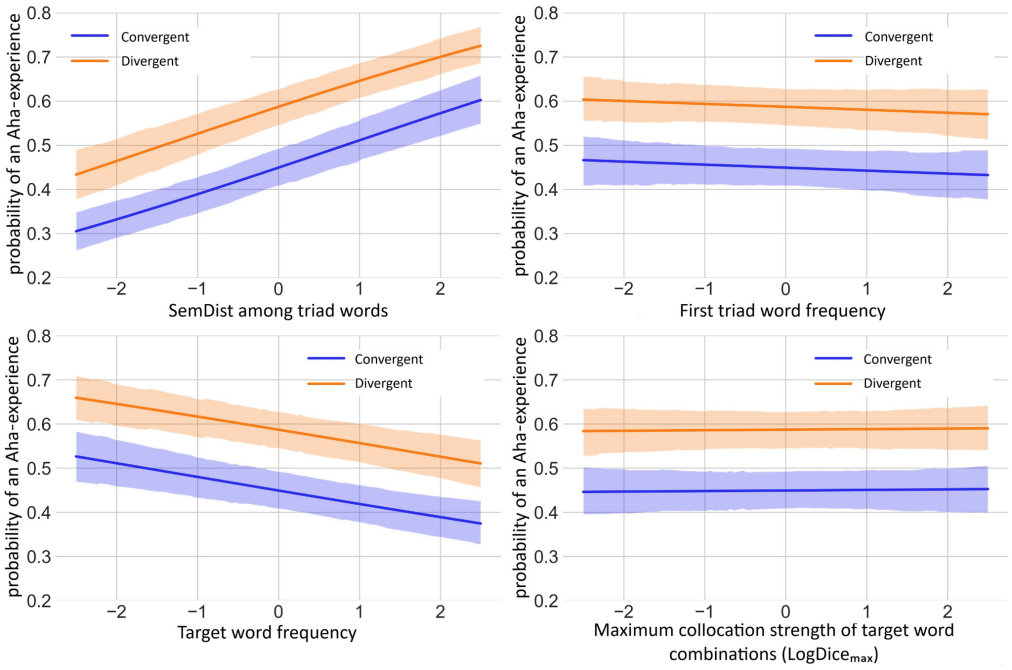
Table 5

Model parameters and posterior distribution metrics for the probability of an Aha-experience upon finding the correct answer

	mean	sd	hdi 3%	hdi 97%
Group-level intercept	-0.207	0.180	-0.555	0.125
Triad type	0.557	0.117	0.341	0.777
SemDist among triad words	0.248	0.058	0.138	0.354
Maximum collocation strength of target word combinations ($\text{LogDice}_{\text{max}}$)	0.006	0.055	-0.098	0.110
First triad word frequency	-0.028	0.061	-0.144	0.086
Target word frequency	-0.125	0.060	-0.233	-0.009
Participant-level standard deviation	1.329	0.143	1.058	1.585

Figure 5.

Partial dependence plots for the probability of an Aha-experience upon finding the correct answer as a function of triad properties



Discussion

The aim of the present study was to develop and validate a new set of remote associate tasks in Russian for insight research, as well as to identify and describe the linguistic properties of the tasks that serve as predictors of objective task difficulty (probability and time of solution) and the probability of an Aha-experience during problem solving. In developing the task set, we sought to select semantically divergent and convergent triads (potentially insightful and non-insightful, respectively), while balancing the two task types by difficulty as far as possible.

We hypothesised that the frequency of the first triad word and the frequency of the target word could serve as sources of difficulty in remote associate tasks. The first word plays an important role because participants' spontaneous strategy typically involves generating associations to the first word and then checking whether the resulting guesses fit the remaining triad words. Our hypothesis was confirmed—first-word frequency was negatively related to the probability of a correct solution. This finding is consistent with the results of our previous study (Moroshkina et al., 2020) and with the study by Sio and colleagues Sio,

Kotovsky, & Cagan 2021), who showed that as the number of strong irrelevant associates to the triad words increases, solution time slows down. According to corpus data, word frequency is strongly positively correlated with the number of collocates with which the word has high co-occurrence frequency. At the same time, consistent with previous studies (Vlasov, 2021), target word frequency was positively related to the probability of its discovery.

Although we balanced the triads on the collocation strength between the triad words and the target word (LogDice), thereby reducing the variance of this metric, we found that the maximum collocation strength of target word combinations was positively related to the probability of finding the correct answer. This finding is consistent with previous results by M. Marko and colleagues, who showed that syntagmatic distance between triad words and the target word (also calculated using LogDice) was positively related to task difficulty (Marko, Michalko, & Riečanský, 2019). The authors also reported that syntagmatic distance, calculated from a text corpus, and associative distance, obtained from an association experiment, correlated rather strongly positively (r = 0.64). This may indicate that corpus-based linguistic metrics and distributional models derived from texts can adequately reflect the solver's mental lexicon.

The analysis also showed that we succeeded in balancing convergent and divergent triads by difficulty. The mean proportion of correct answers was 0.46 for convergent triads and 0.50 for divergent triads (difference not significant). At the same time, as we expected, triad type was strongly associated with the predominant error type. We hypothesised that for convergent triads — in which all three triad words are related to the target word through a single shared meaning — these words might also share many common associates, creating greater competition between the target word and other associations. For example, for the triad ***губы*** / ***парус*** / ***знамя*** *(lips / sail / banner)*, the correct answer is ***алый*** *(scarlet)*, while a frequent intrusions is ***красный*** *(red)*. However, the word ***красный*** *(red)* cannot be considered correct because, according to the instructions, the answer must form a strong/stable collocation; “red sails” is not such a collocation, whereas “scarlet sails” is. In contrast to convergent triads, for divergent triads we expected omission errors to predominate, because the triad words share virtually no common contexts of use and combine with the target word through its different meanings. This hypothesis was confirmed—the proportion of intrusions out of total errors was 0.67 for convergent triads, compared to 0.42 for divergent triads.

Our main hypothesis was that the semantically divergent triads we selected would trigger an Aha-experience upon finding the correct solution more often than convergent triads. This hypothesis was confirmed, although the difference cannot be described as large (mean proportion of Aha-solutions for divergent triads—0.57; for convergent triads—0.42). Nevertheless, the difference is significant, and the effect size is quite high by statistical standards (Cohen's d = 1.321). Unlike objective task difficulty, the probability of reporting an Aha-experience is determined to a much greater extent by subjective factors. It is important to note that the study included separate participants who almost always reported an Aha-experience when they found the answer, as well as those who almost never reported an Aha-experience. This depends not only on the properties of the tasks themselves, but also on

how developed participants' reflection is and how they relate their subjective experience in the study to their own lay theories of insight.

Nevertheless, despite the subjectivity of the Aha-experience phenomenon, we also succeeded in confirming the hypothesis that the linguistic properties of the tasks contribute significantly to its probability. As expected, semantic distance among triad words was positively related to reports about Aha-experience. According to our hypothesis, the greater the semantic distance among triad words, the weaker the intuitive sense of coherence in the early stages and the lower the participant's expectations (based on that sense) regarding the ease/fluency of retrieving the solution. This prediction turns out to be erroneous when the participant, upon discovering the solution, retrieves all the collocations embedded in the triad relatively quickly. Consequently, the actual processing fluency of the target word and its associations with the triad significantly exceeds the expected fluency (retrospectively, the solution seems obvious), and an Aha-experience occurs.

Our results are partially consistent with those of Becker and colleagues (Becker et al., 2022), who showed that the subjective suddenness of the solution—a component of the Aha-experience—is higher when semantic coherence among the triad words is weaker. At the same time, the authors also found a positive relationship between subjective suddenness and the semantic coherence between the target word and the triad. In our study, the relationship between the target word and the triad was controlled using a syntagmatic distance metric (LogDice), and we did not find a relationship between this metric and the Aha-experience. This may be due to the fact that this metric was uniformly high for all triads (its variance was severely restricted from the outset).

Furthermore, we found that the probability of an Aha-experience was negatively related to the frequency of the target word. Target word frequency was also negatively related to the time to find the correct answer. Taken together, these findings suggest that for an Aha-experience to occur, the task must not be too easy, and the solver must have time to experience incomprehension before the answer emerges. This result is consistent with previous studies (Ishikawa et al., 2019; Moroshkina et al., 2022).

Overall, the results of the conducted analysis allow us to conclude that the main aim of the study has been achieved. We have developed remote associate tasks of two types (potentially insightful and potentially non-insightful). This does not eliminate the need to use subjective reports of Aha-experiences, but it does allow for better control over the variation/manipulation of factors associated with the potential insightfulness of the solution. Furthermore, the task set we have developed contains a clear specification of the tasks and a description of their linguistic properties related to objective task difficulty; the tasks are balanced on a number of additional parameters (such as the type of word relations in the resulting collocations, the strength of those relations, and grammatical uniformity). The proposed approach can be scaled to create new task sets for specific research purposes.

References

Afanasieva, V., & Spiridonov, V. (2024). Sources of difficulty in the compound remote association task. *Psychological Studies,* 17(93), 5. https://doi.org/10.54359/ps.v17i93.1518 (in Russ.).

Becker, M., Davis, S., & Cabeza, R. (2022). Between automatic and control processes: How relationships between problem elements interact to facilitate or impede insight. *Memory & Cognition, 50*(8), 1719–1734. https://doi.org/10.3758/s13421-022-01277-3

Becker, M., Wang, X., & Cabeza, R. (2024). Surprise!—Clarifying the link between insight and prediction error. *Psychonomic Bulletin & Review.* https://doi.org/10.3758/s13423-024-02517-0

Behrens, J. P., & Olteţeanu, A. M. (2020). Are all remote associates tests equal? An overview of the remote associates test in different languages. *Frontiers in Psychology*, 11, 1125. https://doi.org/10.3389/fpsyg.2020.01125

Bolte, A., & Goschke, T. (2005). On the speed of intuition: Intuitive judgments of semantic coherence under different response deadlines. *Memory & Cognition,* 33, 1248–1255. https://doi.org/10.3758/BF03193226

Bowden, E. M., & Jung-Beeman, M. (2003). Normative data for 144 compound remote associate problems. Behavior Research Methods, Instruments, & Computers, 35, 634–639. https://doi.org/10.3758/BF03195543

Bowden, E. M., Jung-Beeman, M., Fleck, J., & Kounios, J. (2005). New approaches to demystifying insight. *Trends in Cognitive Sciences, 9*(7), 322–328. https://doi.org/10.1016/j.tics.2005.05.012

Bowers, K. S., Regehr, G., Balthazard, C., & Parker, K. (1990). Intuition in the context of discovery. *Cognitive Psychology, 22*(1), 72–110. https://doi.org/10.1016/0010-0285(90)90004-N

Casella, G., Fienberg, S., & Olkin, I. (2006). *Time series analysis and its applications: With R examples.* New York: Springer. https://doi.org/10.1007/978-1-4419-9634-3

Collins, A. M., & Loftus, E. F. (1975). A spreading-activation theory of semantic processing. *Psychological Review, 82*(6), 407–428. https://doi.org/10.1037/0033-295X.82.6.407

Cranford, E. A., & Moss, J. (2012). Is insight always the same? A protocol analysis of insight in compound remote associate problems. *The Journal of Problem Solving, 4*(2), Article 8. https://doi.org/10.7771/1932-6246.1129

Danek, A. H., Fraps, T., von Müller, A., Grothe, B., & Öllinger, M. (2014). It's a kind of magic—What self-reports can reveal about the phenomenology of insight problem solving. *Frontiers in Psychology*, 5, 1408. https://doi.org/10.3389/fpsyg.2014.01408

Davelaar, E. J. (2015). Semantic search in the remote associates test. *Topics in Cognitive Science, 7*(3), 494–512. https://doi.org/10.1111/tops.12146

Dubey, R., Ho, M. K., Mehta, H., & Griffiths, T. (2021). *Aha! moments correspond to metacognitive prediction errors.* PsyArXiv. Advance online publication. https://doi.org/10.31234/osf.io/c5v42

Gershkovich, V. A., Moroshkina, N. V., & Fedosova, V. I. (2021).Memory for the solutions sources in remote associate tasks: The role of generation effect and Aha!-experience. *Vestnik of Saint Petersburg University. Psychology, 11*(1), 72–88. https://doi.org/10.21638/spbu16.2021.105 (in Russ.).

Henninger, F., Shevchenko, Y., Mertens, U. K., Kieslich, P. J., & Hilbig, B. E. (2021). lab.js: A free, open, online study builder. *Behavior Research Methods,* 1–18. https://doi.org/10.3758/s13428-019-01283-5

Ishikawa, T., Toshima, M., & Mogi, K. (2019). How and when? Metacognition and solution timing characterize an "aha" experience of object recognition in hidden figures. *Frontiers in Psychology,* 10, 1023. https://doi.org/10.3389/fpsyg.2019.01023

Kizilirmak, J. M., Wiegmann, B., & Richardson-Klavehn, A. (2016). Problem solving as an encoding task: A special case of the generation effect. *The Journal of Problem Solving, 9*(1), Article 5. https://doi.org/10.7771/1932-6246.1182

Kutuzov, A., & Kuzmenko, E. (2017, April). Building web-interfaces for vector semantic models with the WebVectors toolkit. In T. Erjavec, J. Piskorski, L. Pivovarova, J. Šnajder, J. Steinberger, & R. Yangarber (Eds.), *Proceedings of the Software Demonstrations of the 15th Conference of the European Chapter of the Association for Computational Linguistics* (pp. 99–103). https://doi.org/10.18653/v1/W17-1402

Kuznetsov, S. A. (Ed.). (1998). *The Great Explanatory Dictionary of the Russian language.* Norint. (in Russ.).

Lukianova, V. K. (2024). RAT Association's Structure: Measuring Fluency and Flexibility of Thinking. *Experimental Psychology, 17*(4), 90–102. https://doi.org/10.17759/exppsy.2024170406 (in Russ.).

Marko, M., Michalko, D., & Riečanský, I. (2019). Remote Associates Test—Slovak version. *Behavior Research Methods.* [Database record]. APA PsycTests. https://doi.org/10.1037/t74591-000

Mednick, S. A. (1962). The associative basis of the creative process. *Psychological Review, 69*(3), 220–232. https://doi.org/10.1037/h004885

Moroshkina, N. V. (2024). Insight in the context of metacognitive regulation: Sources and functions of the Aha-experience. *Voprosy Psychologii, 70*(4), 28–34. (in Russ.).

Moroshkina, N. V., Gershkovich, V. A., Ammalainen, A. V., Lvova, O. V., Savina, A. I., & Zverev, I. V. (2020, September). Predictors of "Aha!" and "Oh, yes!" experiences in solving remote associate tasks. In D. V. Ushakov, I. Yu. Vladimirova, & A. A. Medyntseva (Eds.) *Creativity in the modern world: Human, society, technology:* Proceedings of the All-Russian scientific conference dedicated to the 100th anniversary of Ya. A. Ponomarev (pp. 183–184). Institute of Psychology of the Russian Academy of Science. https://lib.ipran.ru/public/upload/papers/paper_44312497.pdf#page=183 (in Russ.).

Moroshkina, N. V., Savina, A. I., Ammalainen, A. V., Gershkovich, V. A., Zverev, I. V., & Lvova, O. V. (2022). How difficult was it? Metacognitive judgments about problems and their solutions after the Aha moment. *Frontiers in Psychology,* 13, 911904. https://doi.org/10.3389/fpsyg.2022.911904

Öllinger, M., & von Müller, A. (2017). Search and coherence-building in intuition and insight problem solving. *Frontiers in Psychology,* 8, 827. https://doi.org/10.3389/fpsyg.2017.00827

Savina, A. I., Moroshkina, N. V., & Oshkanova, A. P. (2021). Intuition and insight: The connection between an intuitive sense of coherence and the Aha! experience in solving problems of the Remote Associates Test. In E. V. Pechenkova, M. V. Falikman, & A. Ya. Koyfman (Eds.) *Cognitive science in Moscow: New research* (pp. 375–380). BukyVede; Institute of Practical Psychology and Psychoanalysis. (in Russ.).

Sio, U. N., Kotovsky, K., & Cagan, J. (2022). Determinants of creative thinking: The effect of task characteristics in solving remote associate test problems. *Thinking & Reasoning, 28*(2), 163–192. https://doi.org/10.1080/13546783.2021.1959400

Smith, K. A., Huber, D. E., & Vul, E. (2013). Multiply-constrained semantic search in the Remote Associates Test. *Cognition, 128*(1), 64–75. https://doi.org/10.1016/j.cognition.2013.03.001

Spiridonov, V., Loginov, N., & Ardislamov, V. (2021). Dissociation between the subjective experience of insight and performance in the CRA paradigm. *Journal of Cognitive Psychology, 33*(6–7), 685–699. https://doi.org/10.1080/20445911.2021.1900198

Stuyck, H., Aben, B., Cleeremans, A., & Van den Bussche, E. (2021). The Aha! moment: Is insight a different form of problem solving? *Consciousness and Cognition,* 90, 103055. https://doi.org/10.1016/j.concog.2020.103055

Toivainen, T., Olteteanu, A. M., Repeykova, V., Likhanov, M., & Kovas, Y. (2019). Visual and linguistic stimuli in the remote associates test: A cross-cultural investigation. *Frontiers in Psychology,* 10, 926. https://doi.org/10.3389/fpsyg.2019.00926

Topolinski, S., & Strack, F. (2008). Where there's a will—There's no intuition: The unintentional basis of semantic coherence judgments. *Journal of Memory and Language, 58*(4), 1032–1048. https://doi.org/10.1016/j.jml.2008.01.002

Topolinski, S., & Strack, F. (2010). False fame prevented: Avoiding fluency effects without judgmental correction. *Journal of Personality and Social Psychology, 9*8(5), 721–733. https://doi.org/10.1037/a0019260

Valueva, E. A., & Belova, S. S. (2011). Diagnostics of creative abilities: Methods, problems, perspectives. In D. V. Ushakov (Ed.) *Creativity: from the Biological Foundations to the Social and Cultural Phenomena* (pp. 625–648). Institute of Psychology of the Russian Academy of Sciences. (in Russ.).

Vlasov, M. S. (2021). *The development and validation of the Russian language compound Remote Associates Test (Master's thesis).* National Research Tomsk State University, Tomsk.

Voronin, A. N., & Galkina, T. V. (1994). Diagnostics of verbal creativity (adaptation of the Mednick test). In A. N. Voronin (Ed.) *Methods of psychological diagnostics* (pp. 40–81). (in Russ.).

Wagenmakers, E. J., Marsman, M., Jamil, T., Ly, A., Verhagen, J., Love, J., ... Morey, R. D. (2018). Bayesian inference for psychology. Part I: Theoretical advantages and practical ramifications. *Psychonomic Bulletin & Review,* 25, 35–57. https://doi.org/10.3758/s13423-017-1343-3

Whelan, R. (2008). Effective analysis of reaction time data. *The Psychological Record*, 58, 475–482. https://doi.org/10.1007/BF03395630

Wu, C.-L., Huang, S.-Y., Chen, P.-Z., & Chen, H.-C. (2020). A systematic review of creativity-related studies applying the remote associates test from 2000 to 2019. *Frontiers in Psychology*, 11, 573432. https://doi.org/10.3389/fpsyg.2020.573432

Supplementary materials

Online repository: https://osf.io/6afmw

Appendix 1

Complete list of CRAT-RUS tasks and their linguistic properties

№	Answer	Word 1	Word 2	Word 3	Type	Sem-Dist	Freq1	FreqAns	Log-Dice$_{max}$
1	алый	парус	губы	знамя	conv	27,02	8618	5467	10,82
2	божий	дар	суд	промысел	conv	24,05	20182	53122	10,13
3	взаимный	помощь	обяза-тельства	доверие	conv	19,33	100778	14049	10,14
4	военный	госпиталь	училище	отряд	conv	23,91	11532	102056	9,82
5	высший	проба	сорт	пилотаж	conv	21,43	7133	61862	9,20
6	газовый	баллон	котел	колонка	conv	17,15	1899	7176	10,11
7	главный	приз	козырь	герой	conv	21,85	5088	154634	10,26
8	глубокий	колодец	рана	след	conv	22,82	7695	60780	9,16
9	горный	река	тропа	вершина	conv	19,62	101228	22310	10,26
10	детский	страхи	книги	игры	conv	23,77	58080	48209	9,77
11	жирный	крем	свинья	пища	conv	24,41	3511	9676	8,84
12	идеальный	чистота	вариант	форма	conv	22,50	13870	11615	9,25
13	косми-ческий	простран-ство	спутник	пыль	conv	23,10	47473	17916	10,37
14	летний	платье	лагерь	кафе	conv	25,32	39847	21325	9,30
15	личный	пример	разговор	просьба	conv	23,72	68241	59604	8,69
16	массовый	протест	безра-ботица	меро-приятие	conv	22,58	11465	19925	8,84
17	мокрый	снег	нос	асфальт	conv	21,64	63519	22723	10,37

№	Answer	Word 1	Word 2	Word 3	Type	Sem-Dist	Freq1	FreqAns	Log-Dice$_{max}$
18	ответный	письмо	реакция	удар	conv	26,88	184226	4611	9,70
19	пламенный	речь	призыв	привет	conv	21,54	107837	4596	9,13
20	преступный	замысел	деятель-ность	халатность	conv	20,97	10683	7834	9,67
21	пустой	бутылки	карманы	улицы	conv	22,81	33042	51783	10,40
22	рабочий	стол	стаж	кабинет	conv	24,34	154690	46840	9,27
23	семейный	портрет	бюджет	очаг	conv	26,85	34886	24364	10,20
24	стойкий / сильный	ощущение	запах	иммунитет	conv	24,37	32630	2984	9,35
25	стройный	ноги	талия	кипарис	conv	21,88	189325	11470	9,05
26	тайный	агент	свидание	голо-сование	conv	23,85	14052	24807	10,14
27	тихий	шорох	шепот	стон	conv	17,54	5071	46347	8,90
28	учебный	центр	план	нагрузка	conv	23,71	68601	21384	9,46
29	шахматный	король	турнир	партия	conv	23,64	45049	3801	10,52
30	экстре-мальный	туризм	условия	ситуация	conv	23,53	2132	1551	9,71
31	беглый	раб	чтение	взгляд	div	25,61	16315	5579	9,15
32	белый	танец	стих	флаг	div	24,10	6689	149048	8,92
33	верный	слуга	догадка	гибель	div	22,51	19047	54153	10,37
34	горький	пьяница	обида	шоколад	div	20,25	5894	16956	10,09
35	грудной	молоко	клетка	ребенок	div	23,28	23191	4769	11,02
36	деловой	переписка	круги	колбаса	div	23,67	11178	13555	9,12

№	Answer	Word 1	Word 2	Word 3	Type	Sem-Dist	Freq1	FreqAns	Log-Dice$_{max}$
37	домашний	скот	задание	арест	div	25,26	14148	27128	10,22
38	железный	дорога	занавес	логика	div	24,53	172179	48856	12,13
39	звездный	час	карта	болезнь	div	26,56	242654	6999	8,54
40	золотой	молодежь	руки	век	div	30,35	27596	54946	9,63
41	каменный	джунгли	лицо	уголь	div	24,91	1749	33224	10,86
42	крепкий	чай	сон	дружба	div	24,54	63003	32867	9,92
43	круглый	дата	печать	сирота	div	24,01	10836	28389	10,46
44	крутой	нрав	яйцо	поворот	div	24,26	13860	17782	10,97
45	мягкий	обложка	знак	посадка	div	23,40	4822	32978	9,68
46	нату-ральный	блондинка	логарифм	хозяйство	div	23,12	3297	8136	9,09
47	простой	карандаш	число	предло-жение	div	24,77	12942	93373	7,76
48	свинцовый	пуля	тяжесть	небо	div	24,54	11917	3522	9,26
49	сердечный	клапан	приступ	благодар-ность	div	25,20	2798	12309	11,15

№	Answer	Word 1	Word 2	Word 3	Type	Sem-Dist	Freq1	FreqAns	Log-Dice$_{max}$
50	слабый	пол	звено	надежда	div	25,59	69519	45334	9,23
51	сладкий	перец	жизнь	парочка	div	23,48	4584	16983	9,34
52	служебный	долг	роман	вход	div	26,29	39423	11520	9,50
53	собачий	холод	чушь	вальс	div	20,80	21322	7755	9,75
54	сонный	царство	артерия	муха	div	23,69	23457	7330	10,69
55	строгий	костюм	учитель-ница	ошейник	div	21,02	28245	29547	8,48
56	сухой	вино	климат	закон	div	27,23	42805	16983	8,97
57	туалетный	вода	бумага	столик	div	26,89	219771	1664	10,36
58	холодный	закуска	душ	война	div	27,03	6358	54328	9,71
59	цветной	капуста	металл	фото-графия	div	23,11	7969	12393	10,90
60	черный	юмор	список	лестница	div	26,90	8040	140305	8,90

Note: *Type—triad type; SemDist—semantic distance among triad words; Freq1–frequency of the first triad word; FreqAns—frequency of the target word; LogDice$_{max}$—maximum collocation strength among the three target word combinations.*

Appendix 2

Complete list of CRAT-RUS tasks and validation data

№	Answer	Word 1	Word 2	Word 3	Type	N	Prop. corr	RT, sec.	Prop. Aha	Prop. Intr
1	алый	парус	губы	знамя	conv	69	0,41	9,37	0,46	0,76
2	божий	дар	суд	промысел	conv	69	0,58	8,63	0,25	0,66
3	взаимный	помощь	обяза-тельства	доверие	conv	71	0,13	10,66	0,22	0,48
4	военный	госпиталь	училище	отряд	conv	71	0,78	10,26	0,42	0,81
5	высший	проба	сорт	пилотаж	conv	71	0,85	5,73	0,48	0,73
6	газовый	баллон	котел	колонка	conv	71	0,54	12,01	0,34	0,64
7	главный	приз	козырь	герой	conv	70	0,66	8,49	0,35	0,67
8	глубокий	колодец	рана	след	conv	70	0,91	7,20	0,45	1,00
9	горный	река	тропа	вершина	conv	70	0,36	9,34	0,48	0,69
10	детский	страхи	книги	игры	conv	70	0,56	12,47	0,39	0,48
11	жирный	крем	свинья	пища	conv	71	0,62	9,72	0,43	0,44
12	идеальный	чистота	вариант	форма	conv	70	0,17	18,92	0,25	0,50
13	косми-ческий	простран-ство	спутник	пыль	conv	70	0,51	11,27	0,36	0,62
14	летний	платье	лагерь	кафе	conv	71	0,61	8,85	0,47	0,79
15	личный	пример	разговор	просьба	conv	53	0,17	11,89	0,44	0,68

№	Answer	Word 1	Word 2	Word 3	Type	N	Prop. corr	RT, sec.	Prop. Aha	Prop. Intr
16	массовый	протест	безработица	мероприятие	conv	70	0,14	13,84	0,30	0,63
17	мокрый	снег	нос	асфальт	conv	71	0,49	10,81	0,49	0,78
18	ответный	письмо	реакция	удар	conv	71	0,16	7,80	0,64	0,70
19	пламенный	речь	призыв	привет	conv	71	0,34	9,07	0,42	0,64
20	преступный	замысел	деятельность	халатность	conv	71	0,18	11,45	0,54	0,59
21	пустой	бутылки	карманы	улицы	conv	71	0,79	11,69	0,32	0,80
22	рабочий	стол	стаж	кабинет	conv	71	0,47	12,43	0,61	0,82
23	семейный	портрет	бюджет	очаг	conv	71	0,54	12,05	0,61	0,55
24	стойкий / сильный	ощущение	запах	иммунитет	conv	70	0,11	14,98	0,50	0,90
25	стройный	ноги	талия	кипарис	conv	70	0,23	13,05	0,31	0,67
26	тайный	агент	свидание	голосование	conv	71	0,66	7,76	0,40	0,63
27	тихий	шорох	шепот	стон	conv	71	0,87	10,69	0,27	0,78
28	учебный	центр	план	нагрузка	conv	70	0,11	7,14	0,25	0,47
29	шахматный	король	турнир	партия	conv	70	0,49	11,60	0,50	0,72
30	экстремальный	туризм	условие	ситуация	conv	71	0,28	13,35	0,55	0,51

№	Answer	Word 1	Word 2	Word 3	Type	N	Prop. corr	RT, sec.	Prop. Aha	Prop. Intr
31	беглый	раб	чтение	взгляд	div	71	0,17	12,63	0,92	0,53
32	белый	танец	стих	флаг	div	70	0,40	8,22	0,64	0,64
33	верный	слуга	догадка	гибель	div	71	0,49	12,71	0,54	0,36
34	горький	пьяница	обида	шоколад	div	70	0,87	13,40	0,39	0,33
35	грудной	молоко	клетка	ребенок	div	70	0,23	12,67	0,56	0,39
36	деловой	переписка	круги	колбаса	div	70	0,16	19,23	0,82	0,25
37	домашний	скот	задание	арест	div	71	0,69	9,75	0,55	0,14
38	железный	дорога	занавес	логика	div	71	0,39	8,92	0,61	0,40
39	звездный	час	карта	болезнь	div	70	0,26	6,15	0,33	0,52
40	золотой	молодежь	руки	век	div	70	0,63	11,64	0,66	0,35
41	каменный	джунгли	лицо	уголь	div	70	0,33	12,84	0,57	0,51
42	крепкий	чай	сон	дружба	div	70	0,86	7,04	0,45	0,70
43	круглый	дата	печать	сирота	div	71	0,54	10,58	0,63	0,36
44	крутой	нрав	яйцо	поворот	div	71	0,89	8,10	0,49	0,25
45	мягкий	обложка	знак	посадка	div	70	0,39	14,10	0,56	0,47
46	натураль-ный	блондинка	логарифм	хозяйство	div	71	0,39	14,08	0,46	0,28

№	Answer	Word 1	Word 2	Word 3	Type	N	Prop. corr	RT, sec.	Prop. Aha	Prop. Intr
47	простой	карандаш	число	предло-жение	div	71	0,55	8,56	0,59	0,63
48	свинцовый	пуля	тяжесть	небо	div	71	0,49	13,49	0,54	0,14
49	сердечный	клапан	приступ	благодар-ность	div	71	0,70	11,48	0,64	0,33
50	слабый	пол	звено	надежда	div	70	0,50	11,82	0,43	0,46
51	сладкий	перец	жизнь	парочка	div	70	0,64	9,55	0,51	0,68
52	служебный	долг	роман	вход	div	70	0,39	10,20	0,56	0,42
53	собачий	холод	чушь	вальс	div	71	0,37	10,94	0,58	0,27
54	сонный	царство	артерия	муха	div	70	0,56	7,76	0,67	0,35
55	строгий	костюм	учитель-ница	ошейник	div	70	0,56	15,12	0,49	0,52
56	сухой	вино	климат	закон	div	71	0,49	9,95	0,74	0,44
57	туалетный	вода	бумага	столик	div	70	0,21	12,51	0,53	0,62
58	холодный	закуска	душ	война	div	71	0,78	8,70	0,62	0,63
59	цветной	капуста	металл	фот-ография	div	70	0,44	10,07	0,58	0,38
60	черный	юмор	список	лестница	div	71	0,65	10,41	0,46	0,36

Note: *Type—triad type; N—number of participants who solved the triad; Prop.corr—proportion of correct answers for the triad out of total trials; RT—mean time to find the correct answer in seconds; Prop.Aha—proportion of correct-answer trials in which an Aha-experience occurred; Prop.Intr—proportion of intrusions out of total errors.*

Received: June 28, 2025
Revised: September 26, 2025
Accepted: January 12, 2026

Author Contributions

Nadezhda V. Moroshkina — overall project supervision, conceptualisation, development of stimulus materials and research methodology, analysis and interpretation of results, writing and editing of the manuscript

Anna V. Kosyakova — development of stimulus materials and research methodology, data collection, data analysis and interpretation, visualisation, writing and editing of the manuscript

Alena P. Oshkanova — development of stimulus materials and research methodology, data collection, editing of the manuscript

Irina S. Knyazeva — data analysis and interpretation, visualisation, writing and editing of the manuscript

Author Details

Nadezhda V. Moroshkina — Cand.Sci. (Psychology), Senior Researcher, Head of the Laboratory of Cognitive Psychology and Psychophysiology, N.P. Bekhtereva Institute of the Human Brain, Russian Academy of Sciences (IHB RAS), St. Petersburg, Russia; ResearcherID: H-3841-2015; Scopus ID: 57128586400; Author ID: 157210; ORCID ID: https://orcid.org/0000-0002-4778-379X; e-mail: moroshkina.n@gmail.com

Anna V. Kosyakova — Junior Researcher, Laboratory of Cognitive Psychology and Psychophysiology, N.P. Bekhtereva Institute of the Human Brain, Russian Academy of Sciences (IHB RAS), St. Petersburg, Russia; Author ID: 1265894; ORCID ID: https://orcid.org/0009-0004-2151-2037; e-mail: annakos.1811@gmail.com

Alena P. Oshkanova — Graduate of the Master's Programme, Institute for Cognitive Studies, St. Petersburg State University, St. Petersburg, Russia; Author ID: 1166025; e-mail: oshkanova12@mail.ru

Irina S. Knyazeva — Cand.Sci. (Physics and Mathematics), Senior Researcher, Head of the Laboratory of Mathematical Methods for Processing Neurodata, N.P. Bekhtereva Institute of the Human Brain, Russian Academy of Sciences (IHB RAS), St. Petersburg, Russia; ResearcherID: C-7222-2014; Scopus ID: 36186924900; Author ID: 560946; ORCID ID: https://orcid.org/0000-0003-0026-6047; e-mail: knyazeva@ihb.spb.ru

Conflict of Interest Information

The authors have no conflicts of interest to declare.

Research Article
UDC 612.821.6
https://doi.org/10.21702/rpj.2026.1.10

Coupling of EEG Rhythms in the Cerebral Hemispheres as a Neurophysiological Basis for Awakening

Irina A. Yakovenko, Evgenii A. Cheremushkin*, Vladimir B. Dorokhov

Institute of Higher Nervous Activity and Neurophysiology, Russian Academy of Sciences, Moscow, Russian Federation

*Corresponding author: ivnd@mail.ru

Abstract

Introduction. The study of interhemispheric asymmetry during awakening from different sleep stages remains relevant. This study is the first effort to identify interactions of cortical-subcortical systems that function simultaneously. This study aims to detect interhemispheric asymmetry during awakening from Stage 2 daytime sleep using amplitude-amplitude coupling of EEG rhythms. We examined cognitive awakening with varying task performance using a psychomotor test model. **Methods**. A multichannel EEG was recorded simultaneously with task performance. The EEG was evaluated using the complex Morlet wavelet. The Kendall correlation coefficient was as a measure of the amplitude-amplitude coupling of EEG rhythms. **Results**. A large area of asymmetric processes was observed in the left hemisphere during full performance recovery (compared to partial recovery) in the segment closest to the onset of button pressing. Awakening, accompanied by full performance recovery, was characterized by a predominance of delta-range coupling in both hemispheres in the interval of 8-5 sec. The theta and gamma rhythms became dominant in the interval of 4-1 sec. During partial performance recovery, an increase in the number of delta-range coupling was observed in the interval of 4-1 sec compared to the interval of 8-5 sec. **Discussion**. Cognitive awakening, accompanied by varying task performance, is characterized by interhemispheric asymmetry as measured by EEG rhythms coupling. This asymmetry is determined by both different localization areas of coupling patterns across the cerebral cortex and different sets of coupling

patterns. In two experimental situations, different coupling patterns of EEG rhythms were revealed. Therefore, in a number of regions, unequal interactions between the thalamocortical and cortico-hippocampal systems were found.

Keywords

interhemispheric brain asymmetry, awakening, psychomotor test, amplitude-amplitude coupling of EEG rhythms

Funding

This study was supported by the Institute of Higher Nervous Activity and Neurophysiology, Russian Academy of Sciences, Ministry of Education and Science of the Russian Federation, 2025–2027.

For citation

Yakovenko, I. A., Cheremushkin, E. A., Dorokhov, V. B. (2026). Coupling of EEG Rhythms in the Cerebral Hemispheres as a Neurophysiological Basis for Awakening. *Russian Psychological Journal, 23*(1), 195–207. https://doi.org/10.21702/rpj.2026.1.10

Introduction

The human circadian cycle consists of sleep and wakefulness during the day. Wakefulness includes various activities, sometimes interspersed with sleep. Based on his observations, A.R. Luria formulated the concept of three structural and functional blocks of the brain. Various mental functions are supported by the combined dynamic work of these blocks in both hemispheres of the brain. Block 1 is the “energetic” block, which maintains an optimal level of mental activity. This block regulates, in particular, the sleep-wake cycle and consciousness (Luria, 1973). Daytime sleep improves cognitive abilities and promotes performance restoration (Ficca et al., 2010). Sleep disturbances, manifested in particular by the need to work at night, as well as in conditions of sleep deprivation during the day, can lead to drowsiness and falling asleep. In emergency or spontaneous awakenings, performance recovery occurs in the context of slower motor reactions and decision-making, which affects its effectiveness. The period immediately preceding the onset of activity during sleep inertia (Santhi et al., 2013), as well as the accompanying objective neurophysiological characteristics, have been insufficiently studied. However, uneven recovery may be observed, leading to varying task performance. What manifestations of brain activity underlie this phenomenon? Awakening is a prolonged process. During this period, some changes in brain function occur, allowing the continuation of activity that began before being interrupted by sleep.

U. Voss (2010) divides awakening into two stages: (a) Stage 1—cognitive awakening, when a person perceives incoming information but is not yet able to perform a motor response; (b) Stage 2—behavioral awakening, when a person not only perceives stimuli but also performs a motor response. Awakening is associated with the transition of consciousness from the level observed during sleep to the level of wakefulness. The authors (Horton, 2017; Windt, 2020) hypothesize the existence of consciousness during sleep. (Liu, Li & Bai, 2023) examined EEG parameters in the frontal and parietal regions, which, in their opinion, demonstrated high relevance to consciousness. The authors argue that a decrease in consciousness is accompanied by an increase in low-frequency rhythms, a suppression of high-frequency rhythms, a decrease in dynamic complexity, and the destruction of networks. Thus, the study of the neurophysiological basis of the cognitive awakening stage to some extent answers the question of what performance will be after awakening. At the same time, it is necessary to consider the contribution of the cerebral hemispheres to the awakening process. (Casagrande & Bertini, 2008) in their work on the studied parameters demonstrated a sustainable advantage of the right hemisphere during awakening from both REM and NREM sleep, as well as during the transition from sleep to wakefulness. Results (Aritake et al., 2012) demonstrate a correlation between spontaneous awakening and a preceding increase in hemodynamic activation in the right prefrontal cortex, suggesting this structure's contribution to time estimation.

This study **aims** to detect interhemispheric asymmetry during awakening from Stage 2 daytime sleep.

The **objective** of the study is to identify cross-frequency coupling of EEG rhythms in the cerebral hemispheres when awakening with varying task performance.

Methods

This study complies with the ethical standards of the World Medical Association Declaration of Helsinki, Ethical Principles for Medical Research Involving Human Subjects, as amended in 2000, and was approved by the Ethics Committee of the Institute of Higher Nervous Activity and Neurophysiology, Russian Academy of Sciences (Protocol No. 2, dated June 3, 2019).

In our experiment, 83 students participated. The participants in the study were apparently healthy young adults aged 18 to 22. The selection criteria for this study were: a) awakening from Stage 2 daytime sleep, b) the onset of button pressing with the right hand after awakening, and c) situations of full and partial recovery of psychomotor activity in the same subject. Fifteen subjects were recruited, and the number of situations studied varied from 2 to 8.

The experiment was conducted during the daytime, from 1:00 PM to 2:00 PM. It was conducted in a darkened, soundproof room. The subject was positioned on a couch. The experimental model was a bimanual psychomotor test (Dorokhov et al., 2021). The subject was instructed to press buttons 10 times with his/her right and left hands, alternately, until falling asleep. It was specified that if the subject fell asleep and was spontaneously awakened, he/she would continue to press the buttons.

During the task, an EEG was recorded from 19 silver chloride electrodes using a 10–20% scheme (reference electrodes were placed on the mastoids, impedance up to 5 kOhm, sampling frequency 500 Hz, amplifier bandwidth 0.5–40 Hz). An electrooculogram and mechanograms of button presses were also recorded.

The EEG was analyzed before awakening, followed by partial and full recovery of task performance. In the partial condition, the subject pressed the button with the right hand, then the left, 7 to 9 times; in the full condition, the subject pressed the button 10 times each. Two 4-second epochs of analysis were identified prior to awakening.

Based on the complex Morlet wavelet (Matlab 78.01), the absolute value of wavelet transform coefficients (AWTC) was calculated. The resulting parameter was considered the amplitude characteristic of the EEG. The AWTC was calculated in the range of 0.5–40 Hz with the 0.5 Hz step size and a time resolution of 0.01 sec. The delta (1–3 Hz), theta (4–7 Hz), alpha-1 (8–10 Hz), alpha-2 (11–13 Hz), beta (14–20 Hz), and gamma (21–40 Hz) spectral ranges of individual EEG leads were analyzed.

We used cross-frequency coupling of EEG rhythms, which enabled us to assess the functional interactions of brain structures or systems (Knyazev et al., 2019; Salimpour & William, 2019; Siems & Siegel, 2020; Schanze & Eckhorn, 1997; Rodriguez-Martinez et al., 2015; Canolty & Knight, 2010; Yakovenko et al., 2022; Yakovenko et al., 2024). The Kendall rank correlation coefficient (KC) was a measure of the amplitude-amplitude coupling of EEG rhythms. This calculation was performed for all pairs of rhythms.

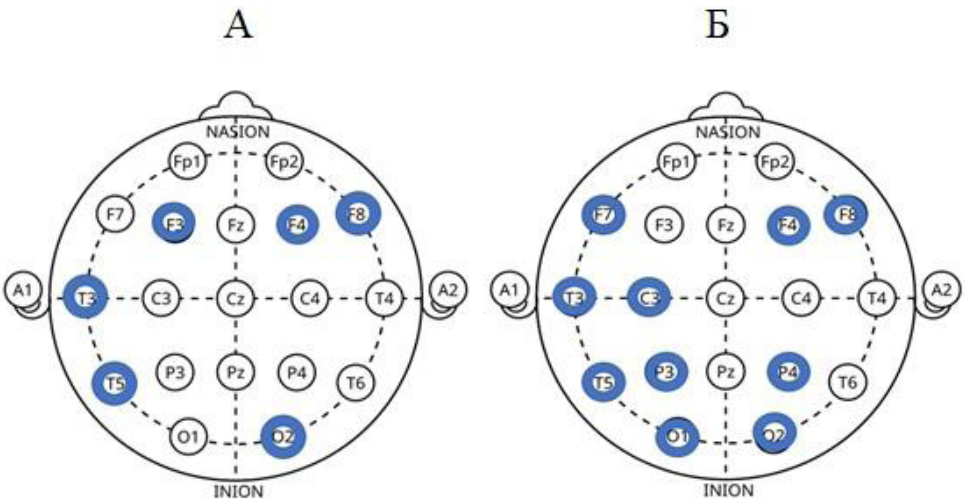
Data were analyzed using the statistical software package SPSS v. 12

Results

Cognitive awakening with full performance recovery, characterized by 10 button presses with both hands, was accompanied by the presence of asymmetric coupling in both the left and right hemispheres in the two time periods studied. Despite similar localization in the hemispheres, the coupling patterns are asymmetrical in their content – EEG coupling patterns are not duplicated. In the interval of 8-5 sec before the onset of button pressing, the asymmetry of coupling patterns is formed in the frontal and temporal regions of the left hemisphere, and in the frontal and occipital regions of the right hemisphere. Moreover, a somewhat greater distribution of coupling patterns of EEG rhythms in the frontal regions is observed in the right hemisphere compared to the left one. Coupling patterns are observed in the temporal regions in the left hemisphere, which are not observed in the right one. Coupling patterns in the occipital region are also noted in the right hemisphere. Leads F3 and F4 deserve special attention. They are symmetrical in localization but asymmetrical in their sets of EEG coupling patterns. In the interval of 4-1 sec, the distribution area of asymmetric coupling increases – coupling patterns in the central region of the left hemisphere and the parietal regions of both hemispheres are added to the existing coupling patterns of EEG rhythms (Figure 1).

Figure 1

Asymmetric coupling patterns of EEG rhythms in the cerebral hemispheres during full cognitive awakening

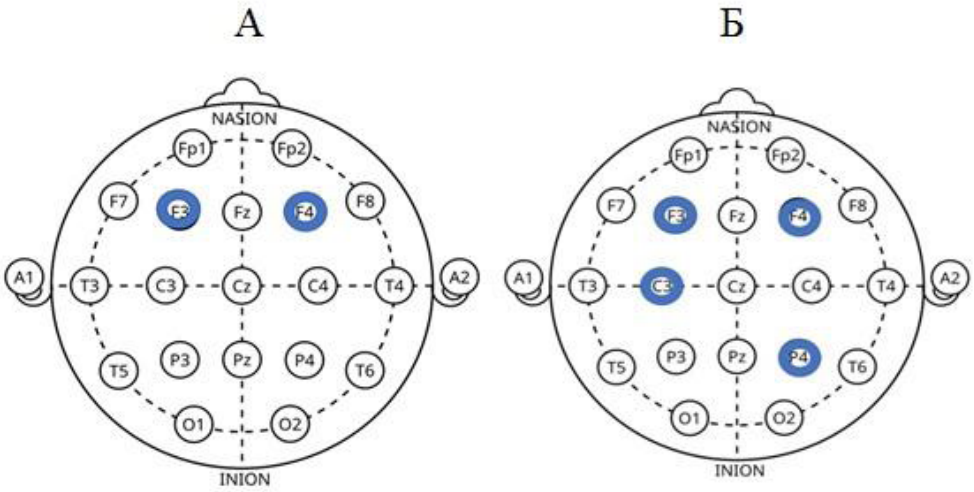


Notes: *A – full awakening in the interval of 8-5 sec; B – full awakening in the interval of 4-1 sec. Circles with borders indicate the presence of reliable coupling patterns of EEG rhythms. The EEG leads are shown on the schematic maps.*

Cognitive awakening, followed by full performance recovery (the subject pressed the button with the right hand, then the left hand, 7 to 9 times), is characterized by a similar localization (leads F3 and F4) of asymmetric coupling patterns of EEG rhythms in the interval of 8-5 sec before the onset of button pressing with the right hand. The interval closest to awakening (4-1 sec) demonstrates the activation of the left central and right parietal regions of the brain (Figure 2).

Figure 2

Asymmetric coupling patterns of EEG rhythms in the cerebral hemispheres during partial cognitive awakening



Notes: *A – partial awakening in the interval of 8-5 sec; B – partial awakening in the interval of 4-1 sec. Circles with borders indicate the presence of reliable coupling patterns of EEG rhythms. The EEG leads are shown on the schematic maps.*

Therefore, different types of cognitive awakening are associated with different hemispheric localization of asymmetric coupling patterns of EEG rhythms and differ in the extent of these interactions across the cortex.

Which coupling patterns of EEG rhythms create this asymmetry? Table 1 shows that the vast majority of delta-range coupling patterns are observed in both hemispheres during the interval of 8-5 sec before the onset of button pressing during full awakening. During partial awakening, asymmetric coupling patterns of EEG rhythms are fewer and more varied – in addition to delta-range coupling, there are theta-gamma and beta-gamma coupling.

Table 1

Reliable coupling patterns of EEG rhythms in individual leads of the left and right hemispheres during different types of awakening in the interval of 8-5 sec

Full cognitive awakening		Partial cognitive awakening	
Leads	Coupling of EEG rhythms	Leads	Coupling of EEG rhythms
F3	Δ–α1	F3	Δ– γ, θ– γ
F4	Δ–β, α2–γ	F4	β–γ

Full cognitive awakening Partial cognitive awakening Leads Coupling of EEG rhythms Leads Coupling of EEG rhythms	
F8	Δ–β, Δ–γ
T3	Δ–γ
T5	Δ–α2, Δ–β, Δ–γ
O2	Δ–β

Notes. *Δ, θ, α1, α2, β, γ – delta, theta, alpha1, alpha2, beta, and gamma EEG rhythms, respectively.*

Therefore, in the interval of 8-5 sec before the onset of button pressing, the types of awakening differ in the set of coupling of EEG rhythms.

In the interval of 4-1 sec, with full awakening, theta and alpha rhythm coupling predominate, almost always associated with the gamma rhythm in both hemispheres. Delta-range coupling is somewhat less common. The asymmetry is formed primarily due to the greater number of theta, alpha, and gamma coupling in the left hemisphere. With partial awakening, delta-range coupling predominates. The asymmetry is formed due to both the qualitative difference in coupling patterns and their localization (see Table 2).

Table 2

Reliable coupling patterns of EEG rhythms in individual leads of the left and right hemispheres during different types of awakening in the interval of 4-1 sec

Full cognitive awakening Partial cognitive awakening Leads Coupling of EEG rhythms Leads Coupling of EEG rhythms			
		F3	Δ–α1, Δ–α2
F4	θ–β, θ–γ	F4	α2–γ
F7	θ–β, θ–γ, α1–γ		
F8	β–γ		
C3	α1–γ, α2–γ, β–γ	C3	Δ–α1, Δ–α2, θ–α1, α1–γ, α2–γ
T3	Δ–γ, θ–γ, α2–γ		
T5	Δ–γ, θ–γ		

Full cognitive awakening Leads	Coupling of EEG rhythms	Partial cognitive awakening Leads	Coupling of EEG rhythms
P3	θ–γ, α1–γ, α2–γ		
P4	Δ–α1, θ–α1, θ–α2, θ–β	P4	Δ–α1, Δ–α2, Δ–β, θ–α2
O1	θ–α1, θ–α2, θ–γ		
O2	Δ–α2		

Notes. *Δ, θ, α1, α2, β, γ – delta, theta, alpha1, alpha2, beta, and gamma EEG rhythms, respectively.*

Therefore, in addition to the different localization areas of the coupling patterns of EEG rhythms in the cerebral hemispheres, differences in the coupling structure have also been shown for different types of cognitive awakening.

Discussion

Full awakening is accompanied by a broader distribution of asymmetric coupling patterns across the cortex compared to partial awakening. In the interval of 4-1 sec, reliable coupling patterns of EEG rhythms involve the frontal and temporal regions of the left hemisphere cortex, as well as the frontal and occipital regions of the right hemisphere. These data are somewhat consistent with the results of (Yang et al., 2015). The time interval closest to the onset of button pressing (4-1 sec) is characterized by a greater involvement of the cerebral cortex. With partial awakening, asymmetry in the interval of 8-5 sec is observed only in the frontal regions. In the interval of 4-1 sec, asymmetric coupling patterns were observed not only in the frontal regions, but also in the left central and right parietal regions. We can assume that the presence of a greater number of asymmetric coupling patterns of EEG rhythms across broader areas of the cerebral cortex is associated with the possibility of a fuller awakening and readiness for task performance. In partial awakening, the presence of a smaller number of asymmetric coupling patterns of EEG rhythms probably prevents the maintenance of the level of structural activation necessary for successful task performance.

A comparison of the distribution of coupling patterns of EEG rhythms during full and partial awakenings at the cognitive and behavioral stages (Yakovenko et al., 2024) suggests the involvement of the frontal lobes of both hemispheres in any type of awakening. In both full and partial cognitive awakenings, the frontal lobes of both hemispheres are symmetrical in localization but asymmetrical in their coupling patterns. During full behavioral awakening, the

same distribution of coupling patterns of EEG rhythms is maintained. The frontal lobes of the two hemispheres are involved in partial cognitive awakening, while only the left hemisphere frontal lobe is involved in behavioral awakening. This indicates the involvement of the right frontal lobe not only in awakening, but also in maintaining wakefulness for longer periods of time. A study (Aritake et al., 2012) reported a link between voluntary awakening and a preceding increase in hemodynamic activation in the right prefrontal cortex. These data are somewhat consistent with our results.

Let us consider which coupling patterns of EEG rhythms are involved in the formation of interhemispheric asymmetry during cognitive awakening. Awakening with full performance recovery is accompanied by a large number of delta-range coupling patterns in both hemispheres 8-5 s before the onset of button pressing. The study (Hilditch et al., 2021) suggests that the delta and beta bands play a decisive role in network changes during the transition from sleep to wakefulness. The delta rhythm reflects the functioning of the thalamocortical system (Steriade, 2006; Faber & Novak, 2011; Manyukhina et al., 2020). Moreover, in the left hemisphere, it is associated not only with high-frequency (beta and gamma) rhythms, but also with the alpha rhythm. The alpha rhythm, like the delta rhythm, reflects the functioning of the thalamocortical system (Faber & Novak, 2011). Based on this, it can be assumed that delta-range coupling with high-frequency rhythms may indicate greater activation of the aforementioned cortical-subcortical system. Delta-range coupling with the alpha rhythm probably indicates a greater involvement of this system in the awakening process. The delta rhythm is characteristic of both sleep and wakefulness (Harmony, 2013). Perhaps a “transfer of authority” occurs here from the part of the thalamocortical system involved in sleep to the part that ensures wakefulness. The interval of 4-1 sec before the onset of button pressing demonstrates the predominance of theta-range coupling in both hemispheres, mainly with beta and gamma rhythms. The theta rhythm reflects the functioning of the cortico-hippocampal system, which is involved in memory processes (Vertes, Hoover & Di Prisco, 2004; Barnett et al., 2021). This suggests greater activation of this cortical-subcortical system and the retrieval of instructions from memory. During the same time interval, a greater representation of theta, alpha, and gamma coupling patterns in the left hemisphere can be observed. All this may indicate preparation for button pressing with the right hand. A study (Dos Santos Lima et al., 2019) described a dynamic pattern of hippocampal and cortical activation associated with microarousal during sleep in mice. An increase in cortico-hippocampal coherence was noted, in the delta and theta ranges and peaks (2.5–5.5 Hz).

Awakening with partial performance recovery demonstrates significantly fewer asymmetric coupling patterns between the hemispheres, which are observed only in the frontal regions in the interval of 8–5 sec before the onset of button pressing. Here, only two coupling patterns are noted: delta-gamma and theta-gamma in the left hemisphere and beta-gamma in the right hemisphere. We can assume that in the frontal regions a more constrained activation process of the thalamocortical and cortico-hippocampal systems is observed. The next interval (4-1 sec) was accompanied mainly by delta-alpha and alpha-gamma coupling patterns. At this time, greater involvement of the cerebral cortex by asymmetric processes

is observed. The increase in the number of delta-alpha coupling may indicate a broader involvement of the thalamocortical system in the awakening process. Theta range coupling patterns, which ensure the reproduction of instructions, are less represented.

Gamma range coupling deserves special attention. A comparison of gamma range coupling during full and partial cognitive awakening revealed its greatest presence in the interval of 4-1 sec in the left hemisphere during full performance recovery. The authors (Danilova et al., 2002) describe the presence of the gamma rhythm in various brain structures. They believe that this rhythm is a functional building block associated not only with various cognitive processes but also with consciousness. The study (Doesburg et al., 2009) suggests that conscious perception is accompanied by the presence of large-scale ensembles of gamma-synchronous neuronal populations associated with the theta rhythm. Based on these studies, we can assume that during this time interval, consciousness reaches a new level. In other words, preparation for task performance occurs.

Cognitive awakening, accompanied by varying task performance, is characterized by interhemispheric asymmetry by coupling patterns of EEG rhythms. This asymmetry is determined by both different localization areas of coupling patterns across the cerebral cortex and the set of coupling patterns within cortical regions. We hypothesize that these results characterize different levels of consciousness manifested during cognitive awakening.

Conclusion

Cognitive awakening with full and partial performance recovery differs in the range of asymmetric processes in the hemispheres. A greater area is observed in the left hemisphere with full performance recovery in the segment closest to the onset of button pressing. The types of awakening differ in the number of coupling patterns. The number of coupling patterns of EEG rhythms is significantly greater during full awakening compared to partial awakening. The greatest number of coupling patterns is observed in the left hemisphere in the interval of 4-1 sec before awakening with full performance recovery. Awakening, accompanied by full performance recovery, was characterized by a predominance of delta-range coupling in both hemispheres in the interval of 8-5 sec. Theta- and gamma-range coupling became dominant in the interval of 4-1 sec. With partial performance recovery, an increase in the number of delta-range coupling was noted in the interval of 4-1 sec compared to the interval of 8-5 sec.

References

Aritake, S., Higuchi, S., Suzuki, H., Kuriyama, K., Enomoto, M., Soshi, T., Kitamura, S., Hida, A., & Mishima, K. (2012). Increased cerebral blood flow in the right frontal lobe area during sleep precedes self-awakening in humans. *BMC Neuroscience, 13*(1), 153–163. https://doi.org/10.1186/1471-2202-13-153

Barnett, A. J., Reilly, W., Dimsdale-Zucker, H. R., Mizrak, E., Reagh, Z., & Ranganath, C. (2021). Intrinsic connectivity reveals functionally distinct cortico-hippocampal networks in the human brain. *PLOS Biology, 19*(6), e3001275. https://doi.org/10.1371/journal.pbio.3001275

Canolty, R. T., & Knight, R. T. (2010). The functional role of cross-frequency coupling. *Trends in*

Cognitive Sciences, 14(11), 506–517. https://doi.org/10.1016/j.tics.2010.09.001

Casagrande, M., & Bertini, M. (2008). Laterality of sleep onset process: Which hemisphere goes to sleep first? *Biological Psychology, 77*, 76–80. https://doi.org/10.1016/j.biopsycho.2007.09.007

Danilova, N. N., Bykova, N. B., Anisimov, N. V., Pirogov, Yu. A., & Sokolov, E. N. (2002). Gamma rhythm of electrical activity of the human brain in sensory coding. *Biomedical Technologies and Radioelectronics, 3,* 34-41. (in Russ.).

Doesburg, S. M., Green, J. J., McDonald, J. J., & Ward, L. M. (2009). Rhythms of consciousness: Binocular rivalry reveals large-scale oscillatory network dynamics mediating visual perception. *PLoS ONE, 4*(7), e6142. https://doi.org/10.1371/journal.pone.0006142

Dorokhov, V. B., Tkachenko, O. N., Ushakov, V. L., & Chernorizov, A. M. (2021). Neuronal correlates of spontaneous awakening and recovery of psychomotor performance. In B. M. Velichkovsky, P. M. Balaban, & V. L. Ushakov (Eds.), *Advances in cognitive research, artificial intelligence and neuroinformatics. InterCoWorks 2020. Advances in intelligent systems and computing* (Vol. 1358). Springer. https://doi.org/10.1007/978-3-030-71637-0_49

Faber, J., & Novak, M. (2011). Thalamo-cortical reverberation in the brain produces alpha and delta rhythms as iterative convergence of fuzzy cognition in an uncertain environment. *Neural Network World, 21*(2), 169–192. https://doi.org/10.14311/NNW.2011.21.011

Ficca, G., Axelsson, J., Mollicone, D. J., Muto, V., & Vitiello, M. V. (2010). Naps, cognition and performance. *Sleep Medicine Reviews, 14*(4), 249–258. https://doi.org/10.1016/j.smrv.2009.09.005

Harmony, T. (2013). The functional significance of delta oscillations in cognitive processing. *Frontiers in Integrative Neuroscience, 7*, Article 83. https://doi.org/10.3389/fnint.2013.00083

Hilditch, C. J., Bansal, K., Chachad, R., Wong, L. R., Bathurst, N. G., Feick, N. H., Santamaria, A., Shattuck, N. L., Garcia, J. O., & Flynn-Evans, E. E. (2021). Reconfigurations in brain networks upon awakening from slow wave sleep: Interventions and implications in neural communication. *bioRxiv*. https://doi.org/10.1101/2021.12.07.471633

Horton, C. L. (2017). Consciousness across sleep and wake: Discontinuity and continuity of memory experiences as a reflection of consolidation processes. *Frontiers in Psychiatry, 8*, Article 159. https://doi.org/10.3389/fpsyt.2017.00159

Knyazev, G. G., Savostyanov, A. N., Bocharov, A. V., & Tamozhnikov, S. (2019). Cross-frequency coupling in developmental perspective. *Frontiers in Human Neuroscience, 13*, Article 158. https://doi.org/10.3389/fnhum.2019.00158

Liu, Y., Li, Z., & Bai, Y. (2023). Frontal and parietal lobes play crucial roles in understanding the disorder of consciousness: A perspective from electroencephalogram studies. *Frontiers in Neuroscience, 16*, 1024278. https://doi.org/10.3389/fnins.2022.1024278

Luria, A. R. (1973). *Foundations of Neuropsychology*. Moscow: Moscow University Publ. (in Russ.).

Manyukhina, V. O., Tomyshev, A. S., Kaleda, V. G., & Lebedeva, I. S. (2020). Structural characteristics of the thalamocortical system and α-rhythm in mentally healthy subjects and schizophrenic patients. *Human Physiology, 46*(6), 50–59. (in Russ.). https://doi.org/10.31857/S0131164620050082

Salimpour, Y., & Anderson, W. S. (2019). Cross-frequency coupling-based neuromodulation for treating neurological disorders. *Frontiers in Neuroscience, 13*, 125. https://doi.org/10.3389/fnins.2019.00125

Santhi, N., Groeger, J. A., Archer, S. N., Gimenez, M., Schlangen, L. J. M., & Dijk, D.-J. (2013). Morning sleep inertia in alertness and performance: Effect of cognitive domain and white light conditions. *PLoS ONE, 8*(11), e79688. https://doi.org/10.1371/journal.pone.0079688

Dos Santos Lima, G. Z., Lobão-Soares, B., Corso, G., Belchior, H., Lopes, S. R., de Lima Prado, T., Nascimento, G., de França, A. C., Fontenele-Araújo, J., & Ivanov, P. C. (2019). Hippocampal and cortical communication around micro-arousals in slow-wave sleep. *Scientific Reports, 9*(1), 5876–5889. https://doi.org/10.1038/s41598-019-42100-5

Schanze, T., & Eckhorn, R. (1997). Phase correlation among rhythms present at different frequencies: Spectral methods, application to microelectrode recordings from visual cortex and functional implications. *International Journal of Psychophysiology, 26*, 171–189. https://doi.org/10.1016/S0167-8760(97)00763-0[3]

Siems, M., & Siegel, M. (2020). Dissociated neuronal phase- and amplitude-coupling patterns in the human brain. *NeuroImage, 209*, 116538. https://doi.org/10.1016/j.neuroimage.2020.116538

Steriade, M. (2006). Grouping of brain rhythms in corticothalamic systems. *Neuroscience, 137*(4), 1087–1106. https://doi.org/10.1016/j.neuroscience.2005.10.029

Rodriguez-Martinez, E. I., Barriga-Paulino, C. I., Rojas-Benjumea, M. A., & Gomez, C. M. (2015). Co-maturation of theta and low-beta rhythms during child development. *Brain Topography, 28*, 250–260. https://doi.org/10.1007/s10548-014-0369-3

Windt, J. M. (2020). Consciousness in sleep: How findings from sleep and dream research challenge our understanding of sleep, waking, and consciousness. *Philosophy Compass, 15*(6), e12661. https://doi.org/10.1111/phc3.12661

Vertes, R. P., Hoover, W. B., & Di Prisco, G. V. (2004). Theta rhythm of the hippocampus: Subcortical control and functional significance. *Behavioral and Cognitive Neuroscience Reviews, 3*(3), 173–200. https://doi.org/10.1177/1534582304273594

Voss, U. (2010). Changes in EEG pre and post awakening. *International Review of Neurobiology, 93*, 23–56. https://doi.org/10.1016/S0074-7742(10)93002-X[6

Yakovenko, I. A., Petrenko, N. E., Cheremushkin, E. A., & Dorokhov, V. B. (2022). Dynamics of interaction of EEG rhythms preceding the moment of awakening, with subsequent recovery of activity after short-term episodes of falling asleep. *Russian Journal of Physiology, 108*(4), 443–454. (in Russ.). https://doi.org/10.31857/S0869813922040094

Yakovenko, I. A., Petrenko, N. E., Cheremushkin, E. A., & Dorokhov, V. B. (2024). Interhemispheric differences in coupling patterns of EEG rhythms during full and partial awakening. *Psychological Journal, 45*(6), 73–84. (in Russ.). https://doi.org/10.31857/S0205959224060078

Yakovenko, I. A., Petrenko, N. E., Tkachenko, O. N., Gandina, E. O., Puchkova, A. N., & Dorokhov, V. B. (2024). Interhemispheric asymmetry of the EEG rhythms coupling accompanies cognitive awakening during bimanual performance of a psychomotor test. *The European Physical Journal Special Topics, 233*, 607–614. https://doi.org/10.1140/epjs/s11734-023-01060-8

Yang, L., Leung, H., Plank, M., Snider, J., & Poizner, H. (2015). EEG activity during movement planning encodes upcoming peak speed and acceleration and improves the accuracy in predicting hand kinematics. *IEEE Journal of Biomedical and Health Informatics, 19*(1), 22–28.

Received: June 03, 2025
Revision received: September 26, 2025
Accepted: January 12, 2026

Author Contribution

Irina Anatol'evna Yakovenko conducted a theoretical analysis of the research problem, interpreted and described quantitative and qualitative results

Evgenii Alekseevich Cheremushkin performed quantitative and qualitative data processing and presented the results in figures and tables

Vladimir Borisovich Dorokhov contributed to the research concept and prepared the text of the manuscript.

Author Details

Irina Anatol'evna Yakovenko – Cand. Sci. (Biology), Senior Researcher, Laboratory of Sleep and Wakefulness Neurobiology, Institute of Higher Nervous Activity and Neurophysiology, Russian Academy of Sciences, Moscow, Russian Federation; Researcher ID: AAC-3123-2022, Scopus ID: 6601985071, Author ID: 94039, ORCID ID: https://orcid.org/0000-0002-0391-7266; e-mail: irinayakovenko@mail.ru

Evgenii Alekseevich Cheremushkin – Cand. Sci. (Biology), Senior Researcher, Laboratory of Sleep and Wakefulness Neurobiology, Institute of Higher Nervous Activity and Neurophysiology, Russian Academy of Sciences, Moscow, Russian Federation; Researcher ID: AAC-4483-2022, Scopus ID: 7004108942, Author ID: 82931, ORCID ID: https://orcid.org/0000-0001-6902-8077; e-mail: ivnd@mail.ru

Vladimir Borisovich Dorokhov – Dr. Sci. (Biology), Head of the Laboratory of Sleep and Wakefulness Neurobiology, Institute of Higher Nervous Activity and Neurophysiology, Russian Academy of Sciences, Moscow, Russian Federation; Researcher ID: O-1030-2017, Scopus ID: 55230058000, Author ID: 89361, ORCID ID: https://orcid.org/0000-0003-3533-9496; e-mail: vbdorokhov@mail.ru

Conflict of Interest Information

The authors have no conflicts of interest to declare.

Research article
UDC 159.9.07
https://doi.org/10.21702/rpj.2026.1.11

Development and validation of a psychodiagnostic technique for assessing the rehabilitation potential of an individual

Natalya M. Borozinets, Olga V. Solovyova*, Margarita G. Vodolazskaya, Alexey S. Lukyanov, Tatyana S. Shekhovtsova, Olesya D. Salnikova, Anna A. Dargan

North Caucasus Federal University, Stavropol, Russian Federation

*Corresponding author: olga.vl.soloveva@gmail.com

Abstract

Introduction. A psychodiagnostic technique for a comprehensive assessment of an individual's rehabilitation potential has been developed. The content of the rehabilitation potential includes components and scales for diagnostics: a psychophysiological component – a scale of the index of deep-seated aggression, a professional and pedagogical component – scales of training, learning ability, motivation for retraining and work, awareness of the possibilities of secondary professionalization; a social environment component – scales of external-environmental factors, socio-environmental factors and socio-anthropological factors.
Each scale is contains with a set of indicators that reflect levels of rehabilitation potential. The validity of this approach is confirmed by the results of the psychodiagnostic instrument formalization procedures. **Methods.** The study involved 345 respondents aged 18 to 42 years, 54% of whom were female and 46% male. Standardized methods were used for validation: the A. Buss and A. Durkee test (adapted by A.K. Osnitsky), the "Motivation for learning: levels and types" method (I.S. Dombrovskaya), the WHOQOL-26 Quality of Life Questionnaire, the Tromso Social Intelligence Scale, and the Multidimensional Scale of Perceived Social Support (N.A. Sirota, V.M. Yaltonsky). The obtained data were processed using relevant statistical methods. **Results.** The developed instrument has been tested for reliability. The optimal number of indicators is 85 items. Based on exploratory and subsequent confirmatory factor

analysis, these items were combined into factor models for the components of rehabilitation potential, which exhibit high values for the validation indicators of these models' fit to empirical data. High rates of convergent and divergent validity were obtained. **Discussion.** A two-factor model was obtained for the psychophysiological component (factors "Resentment" and "Guilt" of the index of deep-seated aggression), a four-factor model for the professional-pedagogical component (factors "Training", "Trainability", "Motivation for retraining and work" and "Awareness of secondary professionalization"), and a three-factor model for the social environment component (factors "External-environmental factors", "Socio-environmental factors" and "Socio-anthropological factors"). Levels of assessment for individual factors and complex indicators for the components of an individual's rehabilitation potential were identified.

Keywords

rehabilitation potential, components of rehabilitation potential, psychodiagnostic methodology, scales of the structure of rehabilitation potential, factor models

Funding

The study was carried out within the framework of state assignment 1022101100016-7-5.1.1;5.3.2 Professional and psychological rehabilitation of persons with disabilities acquired during the performance of official duty in combat operations and special operations (FSRN 2023-0012), funded by the Ministry of Science and Higher Education of the Russian Federation.

For citation

Borozinets, N.M., Solovieva, O.V., Vodolazhskaya, M.G., Lukyanov, A.S., Shekhovtsova, T.S., Salnikova, O.D., Dargan, A.A. (2026). Development and validation of a psychodiagnostic technique for assessing the rehabilitation potential of an individual. *Russian Psychological Journal*, 22(1), 208–225. https://doi.org/10.21702/rpj.2026.1.11

Introduction

Modern society faces a complex set of challenges associated with the growing number of individuals in need of rehabilitation and reintegration. This category includes not only people with disabilities due to illness or injury, but also combat veterans with disabilities, whose lives are often complicated by a combination of combat-related psychophysical injuries and the need to adapt to civilian life after extreme experiences.

The effectiveness of rehabilitation processes largely depends on the individual psychological characteristics of the subject, his resource capabilities necessary to overcome the negative consequences of the injury, in the limit - the person’s disability (Gudilina, 2012;

Rogacheva, 2008; Porokhina, 2004; Bazanova, Auer & Sapina, 2018; Burtonetal., 2015; Goodwin & Allan, 2019; Wade, 2023) and the rehabilitation potential of the individual (Kulagina, Senkevich, 2015; Khokhlova, 2020).

In the author's interpretation, rehabilitation potential is considered by us as a dynamic combination of conscious and unconscious psychophysical, personal and environmental resources of a person, which determine his capabilities and risks in overcoming the state of disability and restoring his social and professional status in the process of rehabilitation interventions (Borozinets et al., 2025).

The assessment of rehabilitation potential will be effective if based on a comprehensive interdisciplinary approach, when in the process of professional and psychological rehabilitation it is important to provide prompt assistance not in a separate area - psychophysiological, psychological, pedagogical or social, but in their unity, comprehensively and synchronously (Bonkalo, 2023; Borozinets et al., 2023; Vodolazhskaya, Vodolazhsky, 2018; Bruner & Woll, 2011; Cogan et al., 2019; Damasio et al., 2000; Knyazev, 2012; Petrie et al., 2014). This requires an operational diagnosis of various aspects of a person's initial capabilities to perceive this type of assistance, which at a theoretical level is defined as the phenomenon of rehabilitation potential.

At the same time, reliable, valid and at the same time convenient in practical use methods for comprehensive diagnostics of rehabilitation potential, on the basis of which it is possible to build an individual rehabilitation trajectory, have not yet been developed (Solovyeva, 2023; Rogacheva, 2008; Facione, Thomas-Pohl & Borrini, 2016; Simpson & Tate, 2007; Mosqueda, 1993; Wade, 2023). Such tools could help us move closer to solving the problem of rehabilitation, for example, for combat veterans, since a comprehensive interdisciplinary approach would allow us not only to assess a person's current condition during the recovery period but also to formulate a prognosis for their future life and the realization of their abilities in the face of acquired disability. In this regard, the prognostic value of assessing rehabilitation potential is particularly valuable for individuals. It allows us to actualize the resources that underlie rehabilitation and full resocialization.

This article presents a description of the evidence supporting the suitability of a comprehensive assessment tool for an individual's rehabilitation potential in terms of its standardization for three of the four components of rehabilitation potential: psychophysiological (Vodolazhskaya, 2023), professional and pedagogical (Borozinets, 2023), and social environmental (Dargan, 2024). These components are identified at the theoretical level. The procedure and results of the corresponding analysis for the psychological component are presented in an earlier work by the authors (Solovyeva, 2024). We describe the results for the three remaining components.

Methods

For the purposes of standardizing the methodology, 345 respondents aged 18 to 42 years (M = 27.4, SD = 9.23) took part in the study, of which 54% were female and 46% were male.

Data collection was carried out using the Webanketa service.

Reflection on the experience of practical psychodiagnostics allowed us to develop a methodology that includes blocks, scales, indicators, and measures aimed at revealing the parameters related to the components of an individual's rehabilitation potential.

The methodology was developed in the form of a questionnaire, including a series of statements (indicators) relevant to the blocks, corresponding components of rehabilitation potential, and the indicators into which the blocks are divided. Each statement required a multi-level assessment by the respondent, ranging from "yes," "mostly yes," "sometimes," "mostly no," and "no" (Borozinets, 2025).

First of all, the selected indicators of the methodology were analyzed for reliability using Cronbach's α coefficient (Cronbach, 1951; Noss, 2019) to optimize the model within each of the components.

Next, the optimal models were subjected to confirmatory analysis to identify the required number of factors explaining the overall variance of the studied feature.

Following this, a test for convergent and divergent validity was conducted using diagnostic data from existing standardized methods, the scales of which may reflect similar content. The following measurement instruments served as the basis for validation:

- for the psychophysiological component – the A. Buss and A. Durkee test, adapted by A.K. Osnitsky (Buss & Durkee, 2005);
- for the professional and pedagogical component – the "Motivation for learning activity: levels and types" method (Dombrovskaya, 2007);
- or the social environment component – the WHOQOL-26 Quality of Life Questionnaire (World Health Organization, 1995), the Tromso Social Intelligence Scale (Silvera, Martinnussen & Dahl, 2001), and the Multidimensional Scale of Perceived Social Support (MSPSS) (Sirota & Yaltonsky, 2011).

At the final stage of data analysis, quartile standardization was carried out, which made it possible to designate the boundaries of the feature values, reflecting the levels of its expression.

IBM SPSS Statistics 23 software was used for data processing (Nasledov, 2011).

Results

To test the reliability of the methodology, we used a traditional analytical method—Cronbach's α coefficient—to assess the contribution of each indicator to the internal consistency of the scale. The following data were obtained for each component.

Psychophysiological component. The initial model included 20 indicators. The results of the analysis for the original set of indicators are as follows: $\alpha = 0.589$ for $N = 20$. Excluding scale items with low and underestimated correlation coefficient values resulted in an increase in Cronbach's α for the adjusted model ($\alpha = 0.911$ for $N = 17$).

Professional and pedagogical component. The initial model included 25 indicators. The obtained α = 0.489 for N = 25. Excluding scale items with low and underestimated correlation coefficient values resulted in an increase in Cronbach's α for the adjusted model (α = 0.849 for N = 22).

Social environment component. The initial model included 28 indicators. The obtained α = 0.526 for N = 28. Excluding scale items with low and underestimated correlation coefficient values resulted in an increase in Cronbach's α for the adjusted model (α = 0.876 for N = 24).

The results demonstrate satisfactory and good internal consistency across the methodology blocks aimed at assessing the components of rehabilitation potential. Based on the data obtained, 85 indicators remained in the final version of the methodology.

To determine the effectiveness of a comprehensive assessment of rehabilitation potential, we identified and validated factors within the components that assessed their various aspects. We used exploratory factor analysis (principal component analysis, varimax rotation with Kaiser normalization; the models converged within 3-5 iterations). The results of this analysis for the optimal factor models for each component of rehabilitation potential are presented in Table 1.

Table 1

Factor loadings of questionnaire items on an individual's rehabilitation potential (optimal models for three components, N=345)

Indicators	Factors			
	1	2	3	4
Psychophysiological component				
Touchiness				
Not receiving what was due	.651			
Underestimation of one's capabilities	.674			
Disappointment with fate	.601			
Anattractive communication	.802			
Envy	.829			
Hidden "labor asociality"	.643			
The injustice of life	.638			
Hatred of people	.614			

Indicators	Factors			
	1	2	3	4
Guilt				
Conscience from deception		.778		
Shame from thoughts		.674		
Blaming the unemployed		.712		
Depression from lack of help for parents		.783		
Desire for forgiveness of sins		.576		
Actions to regret		.564		
Disappointment from failures		.535		
Conscience from a wrong act		.611		
The wrongness of a life lived		.713		
Professional and pedagogical component				
Training				
Good study	.546			
High professionalism	.904			
High praise at work	.673			
Self-presentation skills	.661			
Learning ability				
Ease of learning new things		.689		
Willingness to learn new things		.681		
Desire to improve professional qualifications		.549		

Indicators	Factors			
	1	2	3	4
Motivation for retraining and work				
Benefit to society			.589	
Opportunity for personal growth and creativity			.673	
High social status and career			.640	
Opportunity to earn good money			.598	
Desire to retrain in the presence of a disability			.744	
Willingness to learn again			.734	
Availability of own resources for retraining and employment			.675	
Readiness to change professions			.733	
Applying effort when retraining			.743	
Desire for career guidance assistance			.562	
Interest in retraining			.654	
Awareness of secondary professionalization				
Knowledge of professions in the presence of disabilities				.576
Knowledge about retraining in the presence of a disability				.643
Preferred professional field for retraining				.578
Knowledge of the place of retraining				.672

Indicators	Factors			
	1	2	3	4
Social environment component				
External environmental factors				
Satisfaction with government support	.823			
Satisfaction with financial situation	.698			
Satisfaction with rehabilitation means	.661			
Satisfaction with medical care	.765			
Free mobility	.536			
Availability of facilities and services	.559			
Everyday adaptation	.667			
Treating others as equals	.653			
Treating others with respect	.599			
Social and environmental factors				
Work as an increase in social status		.734		
More respect for the disabled worker		.765		
The usefulness of combat experience		.730		
The value of good work in the immediate environment		.699		
A good job to support a family		.674		
Financial independence from loved ones		.670		
Family support in employment matters		.711		
Socio-anthropological factors				
Work as a way to solve personal problems			.659	
Work as an imperative			.640	
Personal employment as an example to others			.655	
Active contacts with social organizations			.589	
Reflection on the actions of other people			.576	
Reflection on one's actions			.540	
Adaptations to stressful situations			.711	
Effective communication			.659	

As shown in Table 1, the factor models for the components of an individual's rehabilitation potential are as follows:

- psychophysiological component – two-factor model (factors – "Resentment" and "Guilt" as components of the index of deep-seated aggression);
- professional and pedagogical component – four-factor model (factors – "Learning", "Learnability", "Motivation for retraining and work", "Awareness of secondary professionalization");
- social environment component – three-factor model (factors – "External-environmental factors", "Socio-environmental factors", "Socio-anthropological factors").

A confirmatory factor analysis was then conducted. The results are presented in Table 2.

Table 2

Parameters of the models for three components of the methodology for diagnosing the rehabilitation potential of an individual

Components	CFI	TLI	chi-sq		RMSEA	SRMR
			χ^2	p		
Psychophysiological component (two-factor model)	0.931	0.952	64.320	0.001	0.034	0.028
Professional and pedagogical component (four-factor model)	0.847	0.905	40.243	0.038	0.057	0.071
Social environment component (three-factor model)	0.910	0.879	43.287	0.019	0.045	0.056

As can be seen from Table 2, the models for the components suggest the following fitness indices:

- two-factor model of the psychophysiological component – indices CFI = 0.931, TLI = 0.952, χ2 = 64.320 (p = 0.001), RMSEA indices = 0.034 (90% CI [0.027; 0.056]), SRMR = 0.028 are at a high level of significance, which indicates the conformity of the model with the empirical data;
- four-factor model of the professional-pedagogical component – indicators CFI = 0.847, TLI = 0.905, χ2 = 40.243 (p = 0.038), RMSEA indices = 0.057 (90% CI [0.039; 0.069]),

SRMR = 0.071 are at a satisfactory and good level of significance, which indicates the conformity of the model with empirical data;

- three-factor model of the social environment component – indicators CFI = 0.910, TLI = 0.879, $\chi 2$ = 43.287 (p = 0.019), RMSEA indices = 0.045 (90% CI [0.037; 0.061]), SRMR = 0.056 are at good and satisfactory levels of significance, which indicates the conformity of the model with empirical data.

The convergent and divergent validity of the method for assessing the components of individual rehabilitation potential was assessed using previously tested standardized methods for assessing aggression, learning motivation, and social and communicative traits. Table 3 displays the factors for the three components of rehabilitation potential, represented by a set of scales for each factor, in columns. The scales of the standardized methods are given in rows.

Table 3

The relationship between the scales of the developed methodology for measuring the components of the individual's rehabilitation potential and existing standardized methods

Scales	Touchiness	Guilt	Training	Learning ability	Motivation	Awareness	External environmental factors	Social environmental factors	Socio-anthropological factors
Remorse	.611**	.758**	-.278	-.211	.103	.139	.234	.119	.167
Resentment	.689**	.512**	.089	-.101	.120	.082	.021	-.141	.019
Cognition	.177	.220	.431**	.398*	.378*	.123	.170	.029	-.103
Personal motivation	-.219	.152	.389*	.506**	.432**	.328*	-.032	.049	.122
Cognitive motive	-.121	.017	.231	.544**	0,368*	.229	-.032	.187	.287
Sociality of knowledge	-.190	-.254	.369*	.378*	.432**	.511**	.137	-.128	.206
Quality of life	.116	.128	-.182	-.221	.233	-.188	.634**	.539**	.367*
Social support	.008	.193	-.036	.002	-.061	.227	.337*	.478**	.439**
Social skills	-.132	.201	.217	.108	-.198	.231	.289	.389*	.334*

Note. ** – p <0.05, ** – p <0.01,*

As can be seen from Table 3, the scales of remorse and resentment directly correlate with the corresponding scales of our method related to the psychophysiological component: r = 0.611, r = 0.758 and r = 0.689, r = 0.512; however, for the remaining components, no connection was found between these scales. For the scales "Cognition", "Personal motivation", "Cognitive motive" and "Sociality of knowledge" from the methodology for motivation for learning, there are direct significant connections with the scales of our methodology related to the professional-pedagogical component: r = 0.431, r = 0.398, r = 0.378 and r = 0.123 (no connection) for the first scale, r = 0.389, r = 0.506, r = 0.432 and r = 0.328 for the second scale, r = 0.231 (no connection), r = 0.544, r = 0.368 and r = 0.229 (no connection) for the third scale, r = 0.369, r = 0.378, r = 0.432 and r = 0.511 for the fourth scale in relation to the factors "Learning", "Trainability", "Motivation for retraining and work" and "Awareness of secondary professionalization", respectively.

For the scales "Quality of life" (WHOQOL-26 method), "Social support" (Multidimensional Scale of Perceived Social Support) and "Social skills" (Tromso social intelligence scale) significant direct relationships with the scales of our method were revealed: r = 0.634, r = 0.539 and r = 0.367 for the first scale, r = 0.337, r = 0.478 and r = 0.439 for the second scale and r = 0.289 (no relationship), r = 0.389 and r = 0.334 for the third scale in relation to the factors "External-environmental factors", "Socio-environmental factors" and "Socio-anthropological factors" from our method, respectively.

Thus, convergent and divergent validity is observed – there are connections between similar scales of the new method and existing standardized methods, and no connections with dissimilar scales.

To determine the general level of expression of the components of the individual's rehabilitation potential, we used quartile standardization for the initial data, which made it possible to identify high, medium, and low values of the indicator, represented by specific points, which is convenient for the purposes of computerization of the methodology and the corresponding accelerated processing of the results of the psychodiagnostic examination (Table 4). Overall, the methodology yielded ranges of values for low, medium, and high levels of trait expression for each individual scale, based on aggregated indicators within components and for the components as a whole. For convenience, we'll only present four sets of indicators.

Table 4

Levels of expression of four large blocks of indicators of the method for diagnosing rehabilitation potential

Levels/ Parameters	Index of psycho-physiological resourcefulness (deep aggression)	Index of psycho-logical resour-cefulness	Index of professional and pedagogical resources	Index of socio-environmental resources
Short	0 – 25.7	0 – 9.1	0 – 6.3	0 – 11.7

Levels/ Parameters	Index of psycho-physiological resourcefulness (deep aggression)	Index of psycho-logical resour-cefulness	Index of professional and pedagogical resources	Index of socio-environmental resources
Average	25.8 – 33.9	9.2 – 13.6	6.4 – 9.4	11.8 – 16.6
High	34.0 and above	13.7 and above	9.5 and above	16.7 and above

In the final version of the methodology, each level of the corresponding component is interpreted in the context of explanations and recommendations aimed at the perception of both participants in the rehabilitation process: the rehabilitator and the specialist. For rehabilitation patients, interpretation is presented in terms of speech patterns and associations accessible at a common level. For specialists, it is presented in professional terms and professionally oriented content (Borozinets et al., 2025).

Discussion

The obtained results indicate that the rehabilitation potential of an individual can be diagnosed using an original author's methodology, which includes 85 indicators relevant to four components - psychological, psychophysiological, professional-pedagogical and social environment. These findings are consistent with studies describing the specifics of assessing an individual's rehabilitation potential (Rogacheva, 2008; Khokhlova, 2020; Wade, 2023). Taking into account the previously conducted analysis concerning the psychological component of rehabilitation potential (Solovyeva, 2024), the results of which are consistent with the data of existing studies (Gudilina, 2012; Kulagina & Senkevich, 2015; Porokhina, 2004), it can be said that the holistic methodology involves consolidation into four blocks of indicators, , including:

- psychological (the indicators "Adaptability", "Quality of life", "Optimism" of the "Behavioral sphere" scale, the indicators "Intrapersonal conflict", "Neurosensory stability" of the "Affective sphere" scale, the indicators "Intelligence", "Attention", "Memory" of the "Cognitive component" scale, which meaningfully reflect the psychological resourcefulness of the subject);
- psychophysiological (indicators "Resentment" and "Guilt", scales "Index of Deep Aggressiveness", which meaningfully reflect the psychophysiological resourcefulness of the subject);
- professional and pedagogical (the indicators "Educational and professional competence", "Self-presentation" of the "Learning" scale, the indicators "Ability to learn new things", "Readiness to learn" of the "Learning ability" scale, the indicators "Motives for choosing a profession", "Self-motivation for retraining and work activity", "Readiness to change profession", "Position regarding retraining and employment" of the "motivation

for retraining and work" scale, the indicators "General awareness", "Understanding of methods" of the "Awareness of secondary professionalization" scale, which meaningfully reflect the professional and pedagogical resourcefulness of the subject);

- social environment (indicators "Satisfaction with social policy and social protection of the state", "Satisfaction with the accessibility of the environment", "Inclusive and social culture" of the scale "External environmental factors", indicators "Influence of the formal social environment", "Influence of the informal social environment" of the scale "Socio-environmental factors", indicators "Social motivation and activity", "Social communication and social interaction" of the scale "Socio-anthropological factors", substantively reflecting the socio-environmental resourcefulness of the subject).

Thus, the developed psychodiagnostic method can be used to assess an individual's rehabilitation potential within the context of a four-component, integrated, interdisciplinary framework, with the ability to distinguish assessment levels for each component separately or as a whole. Based on the obtained results, it is possible to develop individualized trajectories for professional and psychological rehabilitation, both as interpreted by the respondent and as part of a rehabilitation strategy for the specialist.

Conclusions

We define rehabilitation potential as a dynamic combination of conscious and unconscious psychophysical, personal and environmental resources of a person, consisting of a psychophysiological component associated with deep diencephalically generated autoaggression, a psychological component encompassing behavioral, affective and cognitive characteristics, a professional and pedagogical component implying preserved professional competencies, the ability to learn and retrain, and a social environment component taking into account the support of the state, the social environment, the availability of rehabilitation infrastructure and the socio-cultural conditions of adaptation.

The developed diagnostic method demonstrated strong psychometric properties, confirmed by a comprehensive statistical analysis. The study results demonstrate the instrument's significant reliability, as evidenced by high Cronbach's alpha values for the optimized models.

The construct validity of the method was consistently substantiated in the course of a multi-stage analysis: the initial exploratory factor analysis using the principal components method and varimax rotation revealed stable factor structures, which were subsequently verified by confirmatory factor analysis, which showed a good fit of the models to the empirical data.

Evidence of convergent validity was obtained through significant correlations ($r = 0.334$-0.758 at $p < 0.05$) with similar scales of standardized methods, while divergent validity was confirmed by the absence of significant relationships ($r < 0.278$ at $p > 0.05$) with methods measuring fundamentally different constructs.

A standardization procedure based on quartile analysis allowed for the establishment of clear normative boundaries—high, medium, and low levels. Normative indicators were

developed for both individual factors within the components (taking into account their specific characteristics) and for the integrated indicator of rehabilitation potential, enabling differentiated interpretation of diagnostic results.

Based on the results of the pilot study, this psychodiagnostic tool is suitable for use in research and practice and can be recommended for use by professionals working with individuals with disabilities to assess their rehabilitation potential.

References

Buss, A., & Durkee, A. (2005). Methodology for diagnosing indicators and forms of aggression (adapted by A. K. Osnitsky). In A. A. Karelin (Ed.), *Psychological Tests,* 1, 144–152. (In Russ.)

Bonkalo, T. I. (2023). *Comprehensive rehabilitation of participants in a special military operation in Ukraine: digest January-February 2023.* GBU "NIIOZMM DZM" (In Russ.)

Borozinets, N. M., Solovieva, O. V., Salnikova, O. D., et al. (2025). *Computer-aided methodology for diagnosing the rehabilitation potential of individuals with disabilities acquired during combat and special military operations* [Electronic resource]. Copyright holder: North Caucasus Federal University. No. 2025615116; declared 13.03.2025; registered 03.04.2025. Access mode: https://ncfu-test-rehab.ru/ (accessed: 27.04.2025). (In Russ.)

Borozinets, N. M., Vodolazhskaya, M. G., Salnikova, O. D., Solovyova, O. V., & Shekhovtsova, T. S. (2023). The concept of professional and psychological rehabilitation of persons with disabilities acquired during combat operations and special military operations in the context of the resource potential of educational institutions of higher education. *Psychological Science and Education,* 28(6), 53–61. https://doi.org/10.17759/pse.2023280605 (In Russ.)

Borozinets, N. M., Kozlovskaya, G. Yu., Vodolazhsky, G. I., Vodolazhskaya, M. G., Solovieva, O. V., Prilepko, Yu. V., Brakker, E. L., Shekhovtsova, T. S., Em, E. A., Kukhleeva, A. V., Salnikova, O. D., Dargan, A. A., & Kolokolnikova, M. V. (2025). *Rehabilitation potential of persons with acquired disabilities: meanings, discourses, approaches: monograph.* Stavropol: Publishing house of NCFU. (In Russ.)

Vodolazhskaya, M. G., & Vodolazhsky, G. I. (2018). Neurophysiological prerequisites for a new classification of negative emotional states. *Bulletin of Adyghe State University. Series 4: Natural, mathematical and technical sciences*, 2(221), 57–63. (In Russ.)

Vodolazhskaya, M. G., Vodolazhsky, G. I., & Filippov, Yu. A. (2023). Psychophysiological prerequisites for identifying the corrective properties of eSports. *Human. Sport. Medicine,* 23(1), 59–65. https://doi.org/10.14529/hsm230108 (In Russ.)

Vodolazhskaya, M. G., Vodolazhsky, G. I., Borozinets, N. M., et al. (2025). Comparative analysis of the corrective effect of training stages of eSports for persons with disabilities who participated and did not participate in military operations. *Human. Sport. Medicine,* 25(1), 169–175. https://doi.org/10.14529/hsm250121 (In Russ.)

World Health Organization. (1995). *WHOQOL-26 Quality of Life Questionnaire* [Electronic resource]. URL: https://www.who.int/ (In Russ.)

Gudilina, O. N. (2012). The specifics of the personal rehabilitation potential of adolescents with impaired statodynamic function in connection with the time of occurrence of the disorder and the degree of its severity. *Psychological science and education psyedu.ru*, 4(4). (In Russ.)

Dargan, A. A., & Salnikova, O. D. (2024). The Need of Persons with Disabilities Acquired During Participation in a Special Military Operation for Vocational Education and Professional Retraining. *Bulletin of the North Caucasus Federal University, 5*(104), 130–138. https://doi.org/10.37493/2307-907X.2024.5.14 (In Russ.)

Dombrovskaya, I. S. (2007). *Motivation of educational activity: levels and types* [Electronic resource]. URL: https://psylist.net/praktikum/00458.htm (In Russ.)

Kulagina, I. Yu., Senkevich, L. V. (2015). The rehabilitation potential of the individual in various chronic diseases. *Cultural and Historical Psychology*, 11, 1, 50–60. (In Russ.)

Cronbach, L. J. (1951). Cronbach's alpha: A method for assessing the reliability of psychological tests. *Psychometrika,* 16(3), 297–334. https://doi.org/10.1007/BF02310555 (In Russ.)

Nasledov, A. D. (2011). *(2011) SPSS 19: professional statistical data analysis.* Saint Petersburg: Piter. (In Russ.)

Noss, I. N. (2019). *Psychodiagnostics: Quality Criteria for Measurements* (Chapter 5, "Reliability of Methods," pp. 178–215). Moscow: Cogito-Center. (In Russ.)

Porokhina, J. V. (2004). *Psychological rehabilitation potential of a disabled person (on the example of patients with coronary heart disease).* Dissertation for the degree of Candidate of Sciences. Moscow. (In Russ.)

Rogacheva, T. V. (2008). Problems of assessing the psychological rehabilitation potential of children with disabilities. In: *Social work and nursing in the health care system and social protection of the population: problems of professional activity and prospects of personnel training: Materials of the Interregional scientific and practical conference*. Ekaterinburg. (In Russ.)

Silvera, D. H., Martinnussen, M., & Dahl, T. I. (2001). The Tromso Social Intelligence Scale (TSIS). *Psychological Diagnostics*, 3, 56–67. (In Russ.)

Sirota, N. A., & Yaltonsky, V. M. (2011). Multidimensional Scale of Perceived Social Support (MSPSS). *Social and Clinical Psychiatry*, 21(2), 34–42. (In Russ.)

Solovieva, O. V., Lukyanov, A. S., Borozinets, N. M., Prilepko, Yu. V., & Brakker, E. L. (2024*).* Complex Express-Diagnostics of Rehabilitation Potential of Combatants With Disabilities. *Russian Psychological Journal, 21*(4), 188–310. https://doi.org/10.21702/xd8egt80 (In Russ.)

Solovyova, O. V. (2023). The basics of studying the rehabilitation potential of a person disabled during combat operations and special military operations. In: *Inclusive processes in the international educational space: proceedings of the VIII International Internet Symposium*, Stavropol. (In Russ.)

Khokhlova, O. I. (2020). Rehabilitation potential of the personality and functional independence of persons with traumatic spinal cord disease. *Polytrauma,* (3). (In Russ.)

Bazanova, O. M., Auer, T., & Sapina, E. A. (2018). On the efficiency of individualized theta/beta ratio neurofeedback combined with forehead EMG training in ADHD children. *Frontiers in Human Neuroscience, 12*, Article 3. https://doi.org/10.3389/fnhum.2018.00003

Bruner, V. E., & Woll, P. (2011). The battle within: Understanding the physiology of war-zone stress exposure. *Social Work in Health Care, 50*, 19–33.

Burton, C. R., Fischer, A., Green, T., & Booth, J. (2015). What is rehabilitation potential? Development of a theoretical model through the accounts of healthcare professionals working in stroke rehabilitation services. *Disability and Rehabilitation, 37*(21), 1955–1960. https://doi.org/10.3109/09638288.2014.991454

Cogan, A. M., Haines, C. E., Devore, M. D., et al. (2019). Occupational challenges in military service members with chronic mild traumatic brain injury. *American Journal of Occupational Therapy, 73*(3), 112–119.

Damasio, A. R., Gradowski, T. J., & Bechara, A. (2000). Subcortical and cortical brain activity during the feeling of self-generated emotions. *Nature Neuroscience, 3*(10), 1049.

Facione, J., Thomas-Pohl, M., & Borrini, L. (2016). Rehabilitation after a war injury. *Revue du Praticien, 66*(7), 799–803.

Goodwin, V. A., & Allan, L. M. (2019). "Mrs Smith has no rehab potential": Does rehabilitation have a role in the management of people with dementia? *Age and Ageing, 48*(1), 5–7. https://doi.org/10.1093/ageing/afy152

Knyazev, G. G. (2012). EEG delta oscillations as a correlate of basic homeostatic and motivational processes. *Neuroscience & Biobehavioral Reviews, 36*(1), 677–695.

Mosqueda, L. A. (1993). Assessment of rehabilitation potential. *Clinics in Geriatric Medicine, 9*(4), 689–703.

Petrie, E. C., Cross, D. J., Yarnykh, V. L., Richards, T., Martin, N. M., Pagulayan, K., Hoff, D., Hart, K., Mayer, C., Tarabochia, M., Raskind, M. A., Minoshima, S., & Peskind, E. R. (2014). Neuroimaging, behavioral, and psychological sequelae of repetitive combined blast/impact mild traumatic brain injury in Iraq and Afghanistan war veterans. *Journal of Neurotrauma, 31*(5), 425–436. https://doi.org/10.1089/neu.2013.2952

Simpson, G., & Tate, R. (2007). Sociality in people surviving a traumatic brain injury: Prevalence, risk factors and implications for clinical management. *Brain Injury, 21*(13–14), 1335–1351.

Wade, D. T. (2023). Rehabilitation potential: A critical review of its meaning and validity. *Clinical Rehabilitation, 37*(7), 869–875. https://doi.org/10.1177/02692155221147606

Appendix

Full version of the questionnaire: Access mode: https://ncfu-test-rehab.ru/

Borozinets, N. M., Solovieva, O. V., Salnikova, O. D., et al. (2025). Computer-aided methodology for diagnosing rehabilitation potential in individuals with disabilities acquired during combat and special military operations [Electronic resource]. Copyright holder North Caucasus Federal University. № 2025615116; declared 13.03.2025; registered 03.04.2025. Access mode: https://ncfu-test-rehab.ru/ (date of access: 25.03.2026).

Received: June 02, 2025
Revised: November 11, 2025
Accepted: December 16, 2025

Author Contributions

Natalya M. Borozinets — conceptual idea and design of a study on the rehabilitation potential of individuals with disabilities acquired during military actions and special operations.

Olga V. Solovyova — justification of the relevance and theoretical and methodological foundations of the comprehensive study.

Margarita G. Vodolazskaya — justification of the relevance and theoretical and methodological foundations of the study concerning the psychophysiological component.

Alexey S. Lukyanov — Conducting secondary mathematical processing of the data obtained during the diagnostic process. Testing the diagnostic instrument for validity and reliability. Editing the final version of the article.

Tatyana S. Shekhovtsova — justification of the relevance and theoretical and methodological foundations of the study concerning the professional and pedagogical component.

Olesya D. Salnikova — justification of the relevance and theoretical and methodological foundations of the study concerning the social environment component.

Anna A. Dargan — collection, processing, primary analysis and interpretation of diagnostic data necessary for validation of diagnostic methods.

Author Details

Natalya M. Borozinets – Cand. Sci. (Psychology), Associate Professor, Head of the Department of Correctional Psychology and Pedagogy of the North Caucasus Federal State Educational Institution, Stavropol, Russian Federation; Researcher ID: GWM-4926-2022, Scopus ID: 55982134100, RSCI Author ID: 279227, RSCI SPIN code: 8853-7798, ORCID ID: https://orcid.org/0000-0003-1167-7132; e-mail: nataboroz@yandex.ru

Olga V. Solovyova – Dr. Sci. (Psychology), Professor, Professor of the Department of Correctional Psychology and Pedagogy, North Caucasian Federal University, Stavropol, Russian Federation; Researcher ID: GWM-5158-2022, Scopus ID: 57223136716, RSCI Author ID: 654505, RSCI SPIN code: 3073-0484, ORCID ID: https://orcid.org/0000-0003-4210-3334; e-mail: olga.vl.soloveva@gmail.com

Margarita G. Vodolazskaya – Dr.Sci. (Biology), Professor, Professor of the Department of Correctional Psychology and Pedagogy, North Caucasian Federal University, Stavropol, Russian Federation; Researcher ID: G-3096-2015, Scopus ID: 6603291828, RSCI Author ID: 121411, RSCI SPIN code: 2948-8054, ORCID ID: https://orcid.org/0000-0002-3934-6733; e-mail: domabiomed@yandex.ru

Alexey S. Lukyanov – Cand. Sci. (Psychology), Associate Professor, Associate Professor of the Department of Social Psychology and Security Psychology of the North Caucasus Federal State Educational Institution, Stavropol, Russian Federation; Researcher ID: C-2197-2017, Scopus ID: 57224894988, RSCI Author ID: 371173, RSCI SPIN code: 5505-2824, ORCID ID: https://orcid.org/0000-0002-6799-6215; e-mail: vspikul@yandex.ru

Tatyana S. Shekhovtsova – Cand. Sci. (Pedagogy), Associate Professor, Associate Professor of the Department of Correctional Psychology and Pedagogy, North Caucasian Federal University, Stavropol, Russian Federation; Scopus ID: 58845244700, RSCI Author ID: 702688, RSCI SPIN code: 7445-4505, ORCID ID: https://orcid.org/0009-0005-0910-4919; e-mail: gts1802@yandex.ru

Olesya D. Salnikova – Cand. Sci. (Pedagogy), Associate Professor, Associate Professor of the Department of Correctional Psychology and Pedagogy, North Caucasian Federal University, Stavropol, Russian Federation; Researcher ID: LOS-1497-2024, Scopus ID: 57224321919, RSCI Author ID: 753701, RSCI SPIN code: 7115-3157, ORCID ID: https://orcid.org/0000-0002-6607-3312; e-mail: djjanna@yandex.ru

Anna A. Dargan – Cand. Sci. (Sociology), senior lecturerof the Department of Correctional Psychology and Pedagogy, North Caucasian Federal University, Stavropol, Russian Federation; RSCI Author ID: 887188, RSCI SPIN code: 8153-1680, ORCID ID: https://orcid.org/0009-0009-7387-0449; e-mail: annadargan@mail.ru

Conflict of Interest Information

The authors have no conflicts of interest to declare.