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

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b. 13, 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

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Russian Psychological Journal

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Psychological Status of the Individual among Military Pensioners

Zinaida I. Ryabikina, Elena R. Mironova, Olga A. Lavrova*

Kuban State University, Krasnodar, Russian Federation

*Corresponding author: lavloa@yandex.ru

Abstract

Introduction. The study addresses the relevance of preserving psychological resources in late adulthood to ensure continued productive engagement with the surrounding world. Methodologically, the construct of *psychological status of the individual* is justified as a framework for examining personality in terms of integrity, unity of being, and agency. Essential parameters of the psychological status of military pensioners are theoretically grounded as value-semantic, affective-cognitive, and subjective (agentic) characteristics, with agency serving as a differentiating feature that shapes the individual's interaction with existential reality. **Methods.** The research involved 96 military pensioners. Assessment instruments included the Schwartz Value Survey, Kuhl's Motivational Orientation Questionnaire, Hall's Emotional Intelligence Test, the Hardiness Survey (Russian adaptation by Leontiev & Rasskazova), the Short Index of Self-Actualization (Jones & Crandall), the Professional Demand Assessment (Kharitonova & Yasko), and the Dembo-Rubinstein Self-Perception Scale. **Results**. Three distinct types of psychological status were identified, each characterized by a unique configuration of value-semantic, affective-cognitive, and agentic features. The first type, predominant among non-working male pensioners, is marked by underdeveloped resources for self-realization, resulting in compromised agency. The second type, observed among pensioners aged 60+ and female pensioners, exhibits preserved retrospective agency, which manifests either as preoccupation with the past or as constructive utilization of prior experience to navigate current existential conditions. The third type, characteristic of employed pensioners, demonstrates well-formed psychological resources supporting active transformation of present life circumstances and sustained agentic functioning. **Discussion.** These typological distinctions highlight

the need for differentiated approaches to psychological support, emphasizing the tailoring of interventions to the individual's typology and stage of life.

Keywords

psychological status of the individual, value-semantic characteristics; affective-cognitive characteristics, subjective (agentic) characteristics, types of status presentation

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Introduction

Rationale for the Study

The importance of studying the later stages of the human lifespan is increasingly recognized in light of profound changes in the socio-demographic structure of contemporary society, including population aging and increased longevity. Growing attention to the psychological dimensions of late adulthood reflects a shift in conceptual perspectives: this life stage is no longer viewed solely as a period of decline, but rather as a phase of continued engagement, adaptation, and meaningful interaction with the external environment (Golovey, 2024; Strizhitskaya, 2022; Westerhof et al., 2023; Diehl et al., 2021; Ingrand et al., 2018; Martinson & Berridge, 2015; Nilsson, Bülow & Kazemi, 2015; Rowe & Kahn, 2015). As L. I. Antsiferova notes, late adulthood is marked by "new formations of a progressive nature, aimed at overcoming destructive phenomena in gerontogenesis and achieving a new level of self-realization of the individual in the world" (Antsiferova, 2000, p. 89).

Chronologically, late adulthood often coincides with the end of one's professional career and the transition into retirement. While this stage is an expected, age-normative event, it is also frequently experienced as one of the most significant psychosocial crises of aging, requiring individuals to mobilize psychological resources to maintain a sense of self amid rapidly changing life circumstances. The paths through which individuals navigate this stage are shaped by their previous life experiences and by their positions within the social structure, with its norms, rules, and customary ways of life. This distinction is particularly relevant when comparing military and civilian populations.

This theoretical and empirical study examines the personality characteristics of military pensioners—a socio-demographic group comprising citizens of the Russian Federation who have completed service in the Ministry of Defence, the Ministry of Internal Affairs

(MVD), the Ministry for Civil Defence, Emergencies and Elimination of Consequences of Natural Disasters (EMERCOM), the Federal Penitentiary Service (FSIN), the National Guard (Rosgvardiya), and the Federal Drug Control Service (FSKN). After leaving military service, these individuals face the challenge of establishing a new social status amid a rapid transformation of their living environment and broader social conditions. Many stable elements of their prior life reality—norms, rules, and routines that had structured daily functioning—are lost (Lavrova, 2020). Equally important are the internal psychological adjustments required to identify opportunities, develop strategies, and mobilize personal resources to build a fulfilling existence under these new circumstances.

Psychological Status as an Integral Characteristic of the Individual in Specific Social Circumstances

The choice of the main construct in this study is determined by the theoretical and methodological relevance of several fundamental methodological principles: the principle of *integrity* (Ananyev, 2000; Merlin, 1986; Vyatkin, 2011; Loginova, 2016; Panferov & Miklyaeva, 2019), the *unity of personality and being* (Rubinstein, 2000; Leontiev, 2005; Lomov, 1984; Znakov & Ryabikina, 2017), and *subjectivity* (Abulkhanova-Slavskaya, 2001; Antsiferova, 2000; Znakov, 2003; Znakov & Ryabikina, 2017; Fominykh, 2024; Holondrovich, 2018). These principles determined the selection of conceptual categories, the approach to theoretical constructs, and the orientation adopted in interpreting the collected empirical material.

The principal theoretical construct in this study is the *psychological status of the individual*, understood as an integral set of essential psychological parameters that emerge from the "individual–environment" system, retain relative stability over a certain period, determine the level of mental activity in interaction with specific external factors, and shape an individual's capacity to transform both the surrounding reality and themselves.

The application of this scientific concept allows for the implementation of the principle of *integrity*, as it denotes the cohesive wholeness of cumulative psychological (and other) characteristics.

The concept of the *psychological status of the individual* has been theoretically substantiated and is employed by researchers primarily within an ecopsychological framework, understood as an integral characteristic of the human psyche at a given point in time, in interaction with specific environmental factors (Karabanova, 2014; Panov, 2022; Panov & Saraeva, 2011; Stuzhuk et al., 2020; Bronfenbrenner, 1979; Shoda & Mischel, 2000).

In a sense, the psychological status of the individual can be seen as a projection of a person's social status, reflecting the position they occupy within the social system. Accordingly, it can only be interpreted within the context of the circumstances of social existence, which imply conformity to the norms, requirements, and expectations that society assigns to particular categories of social actors.

By defining the social status of a retiree as the position an elderly individual occupies within the system of social relations, society formally removes them from the list of active social actors. At the same time, within the context of the evolving paradigm of late life—which proclaims as the "age norm" the preservation of an active engagement with oneself and the world—modern society expects retirees to maintain an active role in constructing their own existence (Ryabikina, Mironova, Lavrova, 2024).

Subjectivity—a construct manifested primarily through the notion of activity, "which integrates and regulates the dynamics and functioning of the entire personal structure, serving as the design and organization of one's own life as well as the construction of social reality"—functions as a key parameter characterizing an individual's contribution to the state of a given human–environment system (Ryabikina et al., 2024, p. 13). Subjectivity is considered from the perspective of personal activity and initiative in life processes, serving as the basis for establishing interaction with the surrounding world and the creative transformation of one's life space (Fominykh, 2024). A subjectivity-based approach to personality and to the study of its distinct age-related periods—including late life—enables the elucidation of human functioning as an individual actively shaping their own existence, oriented toward maintaining their psychological status and preserving themselves "as a sovereign source of activity, capable, within certain limits, of deliberately effecting changes in both the external environment and the self" (Antsiferova, 2000, p. 211).

Rationale for the Essential Parameters of the Psychological Status of a Military Retiree

The study of the *psychological status of the individual* involves identifying and describing the set of essential psychological parameters that are relevant to the context of a specific investigation and to the theoretical or applied tasks addressed by the researcher. In accordance with the principle of the unity of personality and being, it is crucial to consider the specific contexts and environmental conditions that shape the formation of these individual parameters. This underscores the need to account for the deterministic influence of factors within the military professional environment when determining the essential parameters of a *military retiree's psychological status*.

One of the distinctive environmental factors of military service is its value-laden, moral, and ethical content. The acceptance and internalization of the value system of military service by personnel constitute a central aspect of professional socialization, whereas its rejection often results in various forms of professional maladaptation. We posit that the system of individual and personal values of military personnel, shaped under the influence of their unique environment, is largely distinctive and differs in many respects from the value systems of other social groups.

The *value-semantic sphere* of personality assumes paramount significance during the later stages of socialization. Retirement represents a critical transitional milestone in the late phase of the human life cycle and is often experienced as a developmental

crisis. Scholars describe the crisis of old age as a period characterized by transformations in values and processes of meaning-making (Antsiferova, 2001; Levasseur et al., 2020; Sobol-Kwapinska, Przepiorka, & Zimbardo, 2019). A defining feature of meaning-making involves a personalized, internalized perspective—integrated through subjective experience and fully internalized—which comprises a specific viewpoint, evaluative stance, and predisposition to perceive and interpret events in particular ways, thereby shaping the individual's interaction with the world (Abakumova, Godunov, & Gurtskoy, 2019, p. 414).

The acquisition of new life meanings determines the trajectory of an individual's subsequent life course and provides opportunities for self-realization under changing life circumstances (Abakumova, Godunov, & Gurtskoy, 2019; Pochtareva, 2017). Thus, the significance and specificity of the value-semantic sphere within a military retiree's personality are shaped by prior engagement with the military-professional environment. The influence of value orientations on the particular trajectory of late-life adaptation following the completion of a military career justifies positioning this sphere among the essential parameters constituting a military retiree's psychological status.

The demanding nature of the military-professional environment requires the development of characteristics that regulate behavior under adverse conditions and ensure the capacity to withstand deleterious environmental influences. Stressful and challenging life events, circumstances, and situations are substantially mediated by personal emotions and are primarily appraised and interpreted through an emotional lens. Human behavior in such conditions is fundamentally guided by emotional coping mechanisms.

At the same time, given the role of emotions in regulating behavior, researchers also refer to the concept of the unity of affect and intelligence (Vygotsky, 1968; Rubinstein, 2000). Within the framework of activity theory, the notion of a functional system of integrated emotional and cognitive processes was developed, through which emotions become "intelligent," and thinking is inextricably linked with the value-semantic sphere of personality (Leontiev, 2005).

Researchers emphasize the importance of affective and cognitive characteristics of the individual as resources for regulating behavior in later life, particularly during periods of critical change associated with the completion of active professional socialization (Lavrova, 2020; Sergiyenko et al., 2020; Ponomareva, 2019; Le Vigouroux et al., 2017). Taken together, these considerations support viewing affective and cognitive personality characteristics as a key parameter of the psychological status of military pensioners.

The successful performance of tasks in the context of military service depends not only on the development of certain professionally important qualities of the individual, but also on the ability to construct psychological strategies and tactics for cultivating subjective qualities in oneself that support active engagement in one's own life. In the later stages of personality socialization, *subjectivity* as a complex, systemic quality continues

to play a central role (Markelova, Dunaeva, & Shutkina, 2017). When this period of life is viewed as a time of significant change, an elderly individual (pensioner) assumes the role of a subject of vital activity, actively shaping and adapting to new conditions of existence.

Accordingly, the theoretical analysis conducted allows for the identification of the following essential parameters that constitute the psychological status of military pensioners, which are shaped by professional-environmental factors and function as psychological resources during this stage of socialization:

- value-semantic characteristics of the individual;
- affective-cognitive characteristics of the individual, supporting behavioral regulation under challenging conditions;
- subjective (agentic) characteristics of the individual.

Methods

In accordance with the study's objectives, a purposive sample was assembled comprising 96 military pensioners ranging in age from 39 to 82 years, residing in Krasnodar Krai and the Republic of Crimea.

The empirical investigation employed a battery of psychodiagnostic methods aligned with the essential parameters constituting the psychological status of military pensioners:

1. Assessment of value-related dimensions was conducted using the *Schwartz Value Survey* (SVS) by S. H. Schwartz (1992) in Russian adaptation by V. N. Karandashev (2004) and *Kuhl's Motivational Orientation Questionnaire* in Russian adaptation by A. A. Rean (2001).
2. Assessment of affective-cognitive regulators of personal behavior was performed using the *Hall's Emotional Intelligence Test* in Russian adaptation by N. P. Fetiskin et al. (2002) and the *Hardiness Survey* (Dispositional Resilience Scale) in Russian adaptation by A. G. Leontyev & E. I. Rasskazova (2006).
3. Agency characteristics were assessed using the *Short Index of Self-Actualization* (SISA) by A. L. Jones and R. E. Crandall (1986) in Russian adaptation by L. Hjeelle & D. J. Ziegler (2008), the *Professional Demand Assessment* by E. V. Kharitonova & B. A. Yasko (2009), and the *Dembo-Rubinstein Self-Perception Scale* with three temporal dimensions: "Self in the past," "Self in the present," and "Self in the future" (Sidorov, 2013).

The implementation of the principle of integrity in the study of the psychological status of military pensioners as an integral characteristic was achieved through *clustering procedures*. This approach is based on the notion that the content of clusters represents a cohesive whole, composed of interconnected homogeneous elements, each of which can be regarded as an independent unit with specific properties.

Results

The results of the cluster analysis allow for the identification of three distinct presentations of *individual psychological status* among military pensioners (three clusters). These clusters differ in specific combinations of socio-demographic markers of the participants (age, gender, employment), as well as in the associated configurations of *value-semantic characteristics*, *affective-cognitive characteristics*, and *subjective (agentic) characteristics* of the retirees' personalities.

Cluster 1

The socio-demographic profile of Cluster 1 is characterized by the predominance of *relatively younger, exclusively non-working male military pensioners*. Within the structure of normative ideals, respondents in this cluster exhibit the highest expression of *Conformity* (the desire to comply with social expectations), *Tradition* (respect, recognition, and adherence to traditions), and *Self-Direction*. Table 1 presents the lowest mean ranks of values at the level of normative ideals for respondents in this cluster.

Table 1
Lowest Mean Ranks of Values at the Level of Normative Ideals (Cluster 1)

Normative Ideals	M($\bar{x}$)±σ
Conformity	2.69±1.341
Tradition	1.35±1.348
Self-Direction	4.39±1.603

At the level of motivational orientation derived from these value orientations, only *Tradition* is actualized (M = 3.74 ± 0.783). At the level of individual value priorities shaping behavioral patterns, respondents display a pronounced inclination toward *security, harmony, and stability* in interpersonal relationships both within society and in their immediate social environment (M = 2.99 ± 0.651).

Among the least salient value orientations in this cluster is a reduced striving for *power and achievement*, encompassing the pursuit of social status, prestige, control, or dominance (M = 6.84 ± 1.378). Correspondingly, at the behavioral level, there is a lack of motivation toward the attainment of personal success (M = 7.46 ± 0.552).

Respondents in this cluster are characterized by a *situational orientation*, which manifests in heightened sensitivity to various life events, emotional vulnerability, "emotional fixation" on specific situations, low self-confidence, and limited willingness to take action to change circumstances. Data on the individual scales are presented in Table 2.

Table 2
Mean Group Values for Motivational Orientation Parameters (Cluster 1)

Scales	M($\bar{x}$)±σ
Control of Action under Failure	5.83±3.563
Control of Action under Success	6.48±3.396
Control of Action in Planning	6.30±4.117

Among the characteristics of respondents in this group, a notably low level of *integral emotional intelligence* is observed. This is manifested in a limited understanding of their own emotions, emotional rigidity, an inability to self-motivate using their emotions, difficulty in understanding and empathizing with the emotions of others, and a reluctance to influence others' feelings or to use emotions to achieve personal goals. Data are presented in Table 3.

Table 3
Mean Group Values of Hall's Emotional Intelligence Test Parameters (Cluster 1)

Scales	M($\bar{x}$)±σ
Emotional Intelligence (EQ)	-6.00±6.481
Emotional awareness	-0.30±4.269
Emotional control	0.91±3.161

Scales	M($\bar{x}$)±σ
Self-motivation	-1.13±3.455
Empathy	-2.78±2.812
Emotion recognition	-2.57±2.858

Another characteristic of respondents in this group is a low level of *Commitment*, one of the parameters of *hardiness*. This is manifested in a sense of being "outside of life" and an unwillingness to enjoy the present moment (M = 26.87 ± 6.327).

As a subject of late professional socialization, a military pensioner possesses a certain degree of development of subjective characteristics such as *self-actualization*, *personal maturity*, and *self-esteem* across different life periods and domains. Respondents in this group exhibit a low level of *self-actualization* (M = 12.35 ± 5.749), which may manifest as a lack of motivation to realize their potential, absence of personal goals, fear of failure, difficulties in decision-making, dependence on others' opinions, and a pronounced need for external approval. Across different life periods, respondents exhibit consistently low levels of *self-esteem*: *self-esteem in the past* (M = 5.57 ± 1.085), *self-esteem in the present* (M = 4.98 ± 0.667), and *self-esteem in the future* (M = 4.71 ± 0.434). In addition, respondents in this group demonstrate a low level of *satisfaction with the professional realization of their potential* (M = 6.09 ± 2.795).

Cluster 2

The distinctive socio-demographic characteristics of Cluster 2 include a higher average age of respondents (69.86 ± 5.47 years) and the exclusive representation of female participants. The professional status of members in this cluster is heterogeneous, encompassing both working and non-working military pensioners.

Within the value-semantic sphere of military pensioners in Cluster 2, as in Cluster 1, discrepancies are observed between two levels of value functioning: normative ideals and personal values, which are reflected in beliefs, priorities, and actual behavioral manifestations.

A characteristic feature of the structure of normative ideals among respondents in this cluster is a low level of Conformity, reflecting a limited desire to comply with social expectations (M = 6.15 ± 1.181). At the level of values as guides to action, this value is

more strongly expressed, manifesting in real behavior as a tendency to meet social expectations (M = 3.03 ± 0.653). Furthermore, at the level of individual value priorities that shape behavior, respondents demonstrated a pronounced emphasis on Universalism, characterized by understanding, tolerance, and concern for the well-being of people and the world around them (M = 3.6 ± 0.738), and Self-Direction, expressed as independence in thinking and choosing actions (M = 4.56 ± 0.622).

Respondents in this group are characterized by an *activity orientation*, which manifests in their ability to act proactively in various conditions, set goals, and strive to achieve them. These characteristics are particularly pronounced in situations of success (M = 10.45 ± 4.539). In contrast, in situations of failure, respondents may exhibit a situational orientation, manifested as "emotional fixation" on the specific failure, low self-confidence, and a limited willingness to act to overcome the setback (M = 9.25 ± 4.847).

Among the features of the emotional sphere in respondents of this group, a low mean level of integral emotional intelligence—similar to that observed in Cluster 1—should be noted (M = 26.25 ± 17.960). This may manifest as emotional rigidity, difficulty in self-motivation through one's own emotions, limited ability to understand and emotionally empathize with others, and an unwillingness to influence the emotions of others or use emotions to achieve personal goals. At the same time, compared with Cluster 1, respondents in this group exhibit greater variability in individual scores of integral emotional intelligence. Additionally, the emotional intelligence structure of military pensioners in this cluster is characterized by a higher average level of emotion management—the ability to regulate one's own emotions and employ them to accomplish specific objectives—compared with Cluster 1 (M = 8.66 ± 4.165).

As in Cluster 1, respondents in Cluster 2 exhibit a low level of Commitment (M = 24.32 ± 5.366), one of the parameters of hardiness, which may manifest as a sense of being "outside of life" and an unwillingness to enjoy the present moment.

Analysis of the subjective (agentic) characteristics of respondents indicates an average level of *self-actualization*, reflected in certain aspirations to realize themselves and their potential (M = 29.98 ± 5.271). Low levels of self-assessment are typical for various periods of life, including the present (Present — Success: M = 5.26 ± 1.071; Present — Self-realization: M = 5.05 ± 0.957) and the future (Future — Success: M = 5.85 ± 1.598; Future — Self-realization: M = 5.87 ± 1.359), as well as for assessing success and self-realization in the past (Past — Success: M = 5.85 ± 1.598; Past — Self-realization: M = 5.87 ± 1.359). Respondents reported a higher level of perceived happiness in the past (Past — Happiness: M = 6.25 ± 1.207). The level of satisfaction with the self-realization of professional potential among respondents in this cluster is also low (M = 14.62 ± 3.564).

Cluster 3

The primary socio-demographic characteristic of Cluster 3 is the professional status of its respondents, as it exclusively comprises *working military pensioners*.

At the level of normative ideals, the dominant value among respondents is *Power* (encompassing social status, prestige, authority, and public recognition) (M = 4.00 ± 1.106). At the level of individual value priorities that guide actual behavior, respondents exhibit a pronounced orientation toward *Achievement*—the pursuit of personal success through the demonstration of competence (M = 6.02 ± 0.352)—as well as *Stimulation*, reflecting the need for variety and maintaining a high level of activity (M = 6.01 ± 0.583). Additionally, values related to *Benevolence*, such as concern for the well-being of loved ones, usefulness, loyalty, honesty, and responsibility, are moderately expressed (M = 4.31 ± 0.816).

The dominant type of orientation among respondents in this group, *Action Orientation*, implies active engagement both in conditions where active behavior is necessary for problem-solving and when all current needs are satisfied (M = 14.30 ± 2.105); readiness to be active, including in situations of failure (M = 14.15 ± 2.870); and readiness to quickly shift to another goal (M = 14.30 ± 2.922).

Among the features of the emotional sphere of respondents in this group, it should be noted that they exhibit an average level of integral emotional intelligence, which reflects an average development of most of its components—self-motivation, the ability to motivate oneself through one's own emotions, empathy, and the willingness to influence others' emotions and use them to achieve personal goals—combined with a high level of emotion control (the ability to regulate one's own emotions and employ them to accomplish specific objectives). The data are presented in Table 4.

Table 4
Mean Group Values of Hall's Emotional Intelligence Test Parameters (Cluster 3)

Scales	M($\bar{x}$)±σ
Emotional Intelligence (EQ)	60.75±13.090
Emotional awareness	13.65±2.777
Emotional control	15.25±1.164
Self-motivation	12.70±3.585
Empathy	10.60±4.418
Emotion recognition	8.55±5.356

Among the distinctive features of respondents in Cluster 3 is the average level of all hardiness parameters (Commitment, Control, Challenge). Data are presented in Table 5.

Table 5
Mean Group Values of Hardiness Survey Parameters (Cluster 3)

Scales	M($\bar{x}$)±σ
Commitment	39.10±4.667
Control	39.65±4.146
Challenge	17.40±2.062
Hardiness	96.15±7.422

The subjective characteristics of respondents in Cluster 3 are marked by higher levels of development, including greater self-actualization (M = 46.4 ± 6.253) and higher average self-esteem across all life periods for all assessed parameters: Success, Self-Realization, and Happiness. Data are presented in Table 6.

Table 6
Mean Group Values of Self-Esteem Parameters (Cluster 3)

Scales	M ± σ
Past — Success	7.35 ± 1.927
Past — Self-realization	7.55 ± 1.638
Past — Happiness	7.85 ± 1.387
Present — Success	5.25 ± 0.716
Present — Self-realization	6.55 ± 1.276

Scales	M ± σ
Present — Happiness	8.05 ± 1.234
Future — Success	4.90 ± 0.553
Future — Self-realization	5.20 ± 0.696
Future — Happiness	7.65 ± 1.424

Among the indicators of professional demand, both the assessment of professional performance (M = 1.424 ± 3.567) and self-evaluation, reflecting awareness of one's importance as a professional (M = 18.80 ± 2.668), correspond to an average level.

Discussion

Based on the present study of military retirees' personalities, the relevance of the theoretical construct of *psychological status of the individual* has been substantiated, as it enables the implementation of the methodological principles of integrity (Ananyev, 2000; Merlin, 1986; Vyatkin, 2011; Loginova, 2016; Panferov & Miklyaeva, 2019), the unity of personality and its being (Rubinstein, 2000; Leontiev, 2005; Lomov, 1984; Znakov & Ryabikina, 2017), and subjectivity (Abulkhanova-Slavskaya, 2001; Antsiferova, 2000; Znakov, 2003; Znakov & Ryabikina, 2017; Fominykh, 2024; Holondrovich, 2018).

Within this study, the *psychological status of the individual* is conceptualized as an integral set of essential psychological parameters that emerge from the *individual–environment* system, retain relative stability over time, determine the level of mental activity in interaction with specific external factors, and shape an individual's capacity to transform both the surrounding reality and themselves. The significance of examining the psyche within the *individual–environment* framework was emphasized by A. N. Leontiev and B. F. Lomov, who defined the psyche as a subsystem within the organization of the integral individual, enabling the establishment of necessary relationships with the environment at both psychological and social levels, while remaining inextricably linked to the biological level of this organization (Leontiev, 2005; Lomov, 1984).

The consonance between an individual's psychological characteristics and the conditions of their environment (their circumstances of being) is particularly emphasized

within the ecopsychological framework, which considers the psyche not only as an inherent attribute of the person but also as a product of the broader *person–environment* system, encompassing both natural and social contexts (Bronfenbrenner, 1979; Shoda & Mischel, 2000; Panov, 2022; Panov & Saraeva, 2011).

We identified and described the essential parameters of military retirees' psychological status—parameters shaped, on the one hand, by the specific trajectories of prior life stages, namely the prolonged influence of professional and environmental factors encountered during military service, and, on the other hand, by the factors that determine their activity as subjects interacting with new external conditions after completing active professional duty.

The psychological status of military retirees encompasses *value-semantic characteristics of the individual* (Pochtareva, 2017; Martinson & Berridge, 2015), *affective-cognitive characteristics of the individual*, supporting behavioral regulation under challenging conditions (Sergiyenko et al., 2020; West & Glynos, 2016; Veenstra, Daatland & Aartsen, 2021; Blöchl, Nestler & Weiss, 2021), and *subjective (agentic) characteristics of the individual* (Antsiferova, 2001).

In this study, *subjective (agentic) characteristics* serve as the central focus for examining personality. They function as a key parameter of the psychological status of the individual, capturing the ways in which a person positions themselves in relation to the current external environment. This perspective aligns with the understanding of subjectivity as a complex systemic quality that becomes particularly significant in the later stages of personality socialization (Markelova, Dunaeva, Shutkina, 2017).

The theoretical grounding of the parameters of an individual's psychological status, exemplified by military pensioners, informed the approach to its empirical investigation. Three distinct types of psychological status were identified, each defined by a characteristic configuration of key parameters and associated with a specific socio-demographic profile.

The first type, most prominently represented among non-working male military pensioners, is characterized by a constellation of features reflecting an orientation toward stability and security at the level of value regulation, low emotional competence, emotional vulnerability, dependency, and limited readiness to confront challenging life situations. A defining aspect of this type is a diminished sense of subjectivity, manifested as reduced personal agency and limited willingness to engage in intentional change. Collectively, these features indicate that individuals exhibiting this type of psychological status possess underdeveloped personal resources for self-realization under altered life circumstances. Consequently, this configuration allows for the anticipation of unfavorable trajectories of subjectivity, including its potential suppression under the negative influence of environmental factors.

The second type of psychological status is predominantly represented among older (60+) and female military pensioners. It is characterized by a paradoxical structure within the value-semantic sphere: on one hand, there is a rejection of conformity at the level of values and an individually salient emphasis on independent thinking and action; on

the other hand, behavioral tendencies reflect compliance with social expectations. This type is further distinguished by emotional competence primarily expressed through effective emotion regulation, an average level of development of subjective (agentic) characteristics, and a predominant orientation toward the past, reflecting *positive retrospective subjectivity*. Such a configuration can shape specific patterns of interaction with a transformed external environment. For a "subject of the past," past life events—and the self in earlier periods—are often evaluated more positively than the present, which may create a risk of becoming "stuck" in established behavioral patterns that may prove maladaptive in changed conditions. Conversely, preserved positive retrospective subjectivity—the capacity to constructively analyze past experiences and relate them to current circumstances—may enable the individual to draw on psychological resources to maintain identity continuity, generate new meanings, and seek novel domains and opportunities for self-realization within the context of current existential reality.

The third type of psychological status, most prominently represented among working military pensioners, is characterized by activity-oriented value patterns (motivation for achievement, a need for engagement, and an overall action orientation), a high level of emotional competence, particularly in emotion regulation, and a well-developed system of subjective (agentic) characteristics, including features of professional subjectivity (*preserved subjectivity*). This type of psychological status predicts a favorable trajectory for the realization of subjectivity, as the established personal resources of these individuals support proactive engagement with and transformation of the actual conditions of their present existential reality.

Conclusion

The scientific novelty of the present study lies in the operationalization of the concept of *psychological status of the individual* in accordance with the methodological principles of integrity, the unity of personality and its being, and subjectivity. Theoretically, the study substantiates the identification of core parameters of psychological status in military pensioners, taking into account both the influences of prior socialization and the determinants of the current external environment at a specific life stage. Empirically, the investigation of these essential personality parameters, coupled with the application of multidimensional statistical analyses, enabled the differentiation of typological manifestations of psychological status among military retirees.

The results obtained align with contemporary perspectives on the diversity of being and trajectories of personal development in the later stages of the life course (Nikiforov, Vodopyanova, Hoffman, 2018; Severin, 2020; Charles & Arockiam, 2020a, 2020b) and extend existing conceptualizations by elucidating the differentiation of strategies and pathways for the realization of subjectivity. They underscore the necessity of adjusting approaches to the actualization of subjectivity in accordance with typological variations in the psychological status of individuals.

This study provides a solid foundation for further theoretical and empirical investigations into the psychological status of the individual, its core parameters, and their manifestation across diverse social groups and specific contextual conditions of existence.

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Author Contributions

Zinaida I. Ryabikina — conceptualization of the study, formulation of research objectives, development of the methodological framework, interpretation of findings, scientific supervision, and oversight of the research process.

Elena R. Mironova — development of the manuscript structure, research design, theoretical analysis of the research problem, literature review, presentation of results, scientific editing and refinement of the manuscript, and formulation of conclusions.

Olga A. Lavrova — management of Russian and international literature sources, data collection, data preparation for analysis, statistical processing of empirical data, drafting the abstract, keywords, and main statements, writing the manuscript, interpretation of results, formulation of conclusions, and preparation of the reference list.

Author Details

Zinaida I. Ryabikina — Dr. Sci. (Psychology), Professor of the Department of Personality Psychology and General Psychology, Faculty of Management and Psychology, Kuban State University, Krasnodar, Russian Federation, ORCID ID: https://orcid.org/0000-0001-7396-0115; e-mail: z.ryabikina@yandex.ru

Elena R. Mironova — Cand. Sci. (Psychology), Associate Professor at the Department of HR Management and Organizational Psychology, Faculty of Management and Psychology, Kuban State University, Krasnodar, Russian Federation; ORCID ID: https://orcid.org/0009-0002-8424-7942; e-mail: jelenamironova@rambler.ru

Olga A. Lavrova — applicant for Cand. Sci. (Psychology) at the Department of Personality Psychology and General Psychology, Faculty of Management and Psychology, Kuban State University, Krasnodar, Russian Federation; ORCID ID: https://orcid.org/0000-0002-7341-3653; e-mail: lavloa@yandex.ru

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Life Experience and Its Transformation: A Model of Transition from Situations to Events

Yana S. Platonova*, Elena V. Zinovyeva, Svetlana N. Kostromina

St. Petersburg State University, Saint Petersburg, Russian Federation

*Corresponding author: y.platonova@spbu.ru

Abstract

Introduction. The relevance of life-related issues, including the concept of life experience, stems from the interest of contemporary personality psychology in changing individuals in a changing world. This study aims to present a new perspective on the relationship between the concepts of "situation" and "event" in human lived experience. We propose the concept of a dynamic "situation–event" system developing in life experience, transforming it as a result of the transition from the situation-related level to the event-related one. Experience is considered the primary mechanism for this transition. **Methods.** To empirically verify the proposed two-level "situation–event" model, a qualitative study using a "self-disclosure" situation was conducted. Fifty participants (M = 21.6 ± 7 years) from various Russian cities participated in the study. They were asked to write about their experiences in which they confessed something intimate and important about themselves to others, and how this situation influenced them and their lives. Content analysis, frequency analysis, descriptive statistics, testing the differences between two independent samples (the Mann-Whitney U-test), and cluster analysis were used to process the results. **Results.** The results showed the differences between experiences of self-disclosure as a "situation" and as an "event". The experience of self-disclosure at the event-related level is associated with a sphere of individual meanings and values and is characterized by the emotional richness of experiences and the creation of new meanings that lead to changes in life experience. **Discussion.** The study enabled us to propose a dynamic "situation–event" system based on human lived experience. Within this model, an event is a kind of "pivotal moment" in the individual's life, enabling the transformation

of lived experience by generating new meanings through the mechanism of experience. The proposed model expands existing understanding of situations and events in the context of the individual's life experience and considers them to be interrelated concepts where one can be transformed into another under certain conditions.

Keywords

life experience, situation, event, experience, situation-related level, event-related level, "self-disclosure" situation, meanings

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Introduction

The concept of "life experience" is part of a conceptual system associated with the study of ontological issues of personality (such as life course, life scenario, life model, etc.). Without this concept, no description of the life of an individual in the context of his or her development can be complete, which reflects the existential nature of the interaction between the individual and the world around him or her in all its diversity of actions, thoughts, and feelings.

The definition of "life experience" is most often used to describe various life situations that can influence changes in both the inner world of the individual and his/her life (Ananyev, 2010; Vasilyuk, 2005; Abulkhanova-Slavskaya, 1999, et al.).

At the same time, according to S. L. Rubinstein, when we talk about life experience, it makes sense to use the concept of "event" (Rubinstein, 2003) as a "pivotal moment" that initiates both the process of change in life and the changes in the individual.

S. L. Rubinstein emphasized that the existential status of an event is the basis for its distinction from a situation that usually occurs in the context of the individual's everyday life. A situation becomes an event because the individual makes it a personally significant moment in his/her life (Grishina, 2020), memorizing it by creating a "special imprint" in their life experience that impacts the perception and interpretation of other situations in the future (Shors, 2006). In other words, to turn a situation into an event, it must resonate in the inner world of the individual.

It is the experience of a life event that forms the individual's life experience (Schwaba, 2023), which determines how it is processed within the experience and becomes part of it. It can be said that the whole diversity of events experienced in life provides a reference

framework for understanding the processes of integration and transformation of the individual's life experience.

Events and Situations

In literature, the concepts of "situation" and "event" are traditionally synonymous and have no distinction (Gasparyan, 2005; Goncharova & Pergamenshchik, 2007, etc.), or events are described as fragments of a situation (Filippov & Kovalev, 1986; Savitsky, 2013), which is actually incorrect.

In the context of life experience, the concepts of "situation" and "event" cannot be considered identical. This raises questions of when should we talk about a situation, when should we talk about an event, and how does a situation become an event for an individual?

Furthermore, if we consider an event "a pivotal moment in life" (according to S. L. Rubinstein), it cannot be part of a situation. An event for an individual can encompass a variety of life situations, not only current ones, but also unified (link) situations of the present, past and future, which, when combined or layering against each other, form a complex life event that becomes a turning point — a point of choice in the trajectory of an individual's life (for example, the birth of a child, accompanied by a multitude of situations — external conditions, relationships with loved ones, changes at work. These may relate not only to family relationships, but also to the circumstances of the birth of the child, the difficulties of the first days, changes in living conditions, etc.).

Although the authors use the concepts of "situation" and "event" as synonyms, in scientific discourse there can be a distinction between them according to the following parameters: a) "external/internal": an event occurs in response to a situation in the inner world of an individual, the situation is part of the objective reality (Loginova, 1978; Klementyeva, 2014); b) "changes/no changes": here, an event is considered a special kind of perception of a situation that leads to personal changes, while a situation is often a context for the emergence of an event (Kartseva, 1988; Sapogova, 2005); c) depth of experience: events, compared to a situation, are experienced at a deeper level (Antsiferova, 2006; Popova, 2011); d) value-meaning associations: events always occur in the inner world of an individual due to the relationship between the system of values and meanings and the experience and interpretation of the situation (Buhler, 1971; Petrovsky, 1993; Leontiev, 2022).

The emergence of an event can result from the response of an individual's existing value system to a situation; that is, the value system, which is essentially the core of life experience, can induce the process of unfolding in the inner world. An event may also arise as a result of a clash, a challenge to the system of values and meanings, leading to the need for its revision and possible transformation.

Nevertheless, the interchangeability of the two concepts remains quite consistent. Scientific views on the concept of *situation* have undergone significant changes,

transferring it exclusively from the external field to the internal one, considering it as a unit of the individual's inner world (Korzhova, 2012; Solntseva, 2021), making this distinction even more complex.

We believe that a solution to this problem could be to consider these two concepts as interconnected, where one, under certain conditions, can become the other, using the parameter of "trace" in the individual's life experience as a conditional boundary point.

The Event-Related Status of Situations

When we talk about a situation, we essentially describe not the situation itself, but its image. And any image can be created and experienced at different levels: directly at the situation-related level—more superficial—as the processing of information (the results of which can constitute the individual's cognitive experience and be based on it), and at another level, where it acquires a new, different character, leaving a "special traces", becomes a point of bifurcation for the emergence of something qualitatively new — "special knowledge", "special skill", "special meaning", etc. —that is, moving to an event-related level that is consistent with individuals' life experiences, grounding it and enriching it with new elements at the same time.

When situations are transferred to the event-related level, i.e. when they become events, they acquire characteristics of a value-related emotional relationship and become imbued with special meaning. Consequently, they can be considered moments of deterministic rupture, when the usual rhythm of everyday life and the usual way of life are disrupted, when old experiences lose their relevance and new experiences have not yet taken shape, when they disrupt daily routine and are perceived as personally significant and memorable by those who have experienced them (Luhmann, 2021).

In this case, situations evoke profound responses and influence meanings, life values, and the path of life (Bergis, 2014). At such moments, the individual's inner balance shifts; the feeling of inner balance gives way to confusion, worry, anxiety, and bewilderment, leading to an increase in entropy. Thus, a situation at the event level not only acts as a source of change but also leads to structural changes: the emergence of new connections and qualities within experience (Zinovyeva & Kostromina, 2022).

The scientific literature contains attempts to describe the event-related status of situations within the structure of life experience. For example, models are described for reorganizing or changing life experiences due to the resulting formative, life changing choices or the experience of critical life events (the Transformative Life Experience (TLE) model, Russo-Netzer & Davidov, 2020). Such experiences can lead to radical changes where an individual faces the need to reconsider his or her values, identity and life strategies.

Other models describe the mechanisms through which events are integrated into experience and realized in order to predict the future (Barsalou, 2015; Rubin & Umanath, 2015). Events in this context are not considered isolated facts, but dynamic scenarios that connect the past, present and future within lived experience.

However, these models ignore the process of transitioning a situation into an event without revealing the dynamics of the "situation–event" system within the structure of lived experience.

Experience as a Mechanism to Transform Situations into Events

It is important to note that events, with their transformational properties, connect various temporal aspects of the individual's life. Thus, an event that occurred much before other events can be relevant in the present and influence the future (Grishina & Kostromina, 2021).

Experience can act as a mechanism to move from the situation-related level to the event level, leading to changes in the individual's lived experience (Zinovyeva & Kostromina, 2022).

Experiences, although part of daily life, highlight extraordinary moments in the normal flow of events. Experiences are surprising and astonishing in the sense that they have the ability to diverge from expectations, thus creating a changed consciousness and a new understanding of the situation. Awareness of participation in perception and feeling is a necessary condition for gaining experience (Ulanovsky, 2009; Jantzen, 2013).

It is known that not all people react in the same way to different situations, even to extreme ones (Luhmann et al., 2021, Yap et al., 2014). This depends on many factors, including previous experience, personality traits, cognitive characteristics, etc. (Luo et al., 2023; Kobasa, 1979). However, it is the experience itself that determines the level of processing – situation-related, characterized by more superficial experiences and low personal significance (Antsiferova, 2006), or event-related.

In psychology, the impact of a personally significant event on the individual is more commonly studied in the context of the individual's encounter with difficult (traumatic) life situations and the consequences associated with them (Pergamenshchik, 2004).

Events that are not objectively "difficult" are studied significantly less frequently, as are those initiated by individuals due to the need to resolve internal tensions caused by conflict between what is desired and what really happens (e.g., leaving one's job, moving, divorce, revealing hidden information about oneself to another, etc.).

The traditional situation-event approach views individuals as passive reactants to external circumstances and ignores how they experience these circumstances, how past experiences contribute to these experiences, and what traces remain in their lived experiences that influence their future.

The most common methodological approach in these studies is to compare differences in personality change between those who have experienced such a situation and those who have not (Hudson & Roberts, 2016), or to examine changes in average pre- and post-exposure scores. In many cases, major life events are assessed using lists that already include many categories of events, asking participants to indicate whether they have experienced them or not (Dohrenwend, 2006).

Such methodological approaches are based on the hypothesis that situations tend to influence different people in similar ways, resulting in changes in all individuals experiencing them. However, studies using these approaches produce mixed and often contradictory evidence (Schwaba, 2023). In fact, these results indicate the heterogeneity of experiences in encounters with situations and the diversity of these experiences between individuals. Another approach is to allow participants to self-evaluate their perceptions of major life events. We believe that measuring individuals' retrospective perceptions of life events, including how they experience and evaluate them, including important characteristics of the situation that they believe they have caused them to change, and how this affects their experience, can be a way of understanding this heterogeneity. Current narrative research in this field shows that people are attentive to the role that situations and events play in their own lives (Pasupathi et al., 2007; Singer et al., 2013). They are able to accurately identify the specific events that affected them and assess to what extent these events have precipitated changes.

In an attempt to explore empirically how a situation moves to the event-related level, we studied "self-disclosure" situations, i.e. situations in which individuals were obliged to communicate "hidden" information about themselves to another person, in order to confess something important about themselves (Altman & Taylor, 1973).

We hypothesized that although this situation is initiated by individuals themselves with the aim of change, it will not be an event for everyone; for some, it will remain at the situation-related level.

Those who have classified it as a personally significant event in their lives may show specific ways of interaction within it, including those related to the depth of emotions, the construction of meanings that lead to changes in life experiences, through the experience of it as a break point between "before" and "after" and the emergence of something "new" (this could be a new meaning, "knowledge", skill, etc.).

Methods

In our study, we asked participants to write about how they experienced a situation in which they voluntarily confessed to others something intimate and important and how it affected them and their lives. They answered the question, "*Was this situation a personally significant event in your life*?" The following attributes of the event were included in their descriptions: the presence of more intense emotions, indications of intra-personal changes following the event, and the perception of the event as a point of change – "before" and "after". Due to the confidentiality of the information obtained, the content of the self-disclosure situations described and their classification were omitted. We will only focus on simply highlighting the deep personal context of the situations cited by the respondents in their interviews.

The study involved 50 individual participants aged 18 to 42 years, including 33 (66%) women and 17 (34%) men (N = 46, M = 21.6 $\pm$ 7 years). Respondents were from

various cities across Russia and Belarus. The majority of respondents were residents of St. Petersburg, Moscow, and the city of Oryol, of whom 38% had a higher education, 35% had a secondary vocational education, and 12% had a general secondary education. The criteria for inclusion were as follows: 18 years and older, and a single or multiple experience of self-disclosure. We deliberately did not limit the age of the respondents, allowing us to analyze the diversity of life experiences and avoid data bias due to excessive homogeneity in the sample.

Our analysis units were segments that reflect experiences (feelings, sensations, associations), assessments and meanings of events, as well as indications of changes in the individual's internal and external reality after self-disclosure.

Content analysis, frequency analysis, descriptive statistics, testing differences between two independent samples (the Mann-Whitney U test), and cluster analysis were used to process the study results. Quantitative data were processed using IBM SPSS Statistics 22.

Results

The main categories of content analysis we examined were as follows: (a) experiences (feelings, sensations, associations), (b) self-image, (c) life experiences (meanings, senses), and (d) factors and characteristics of the situation accompanying self-disclosure.

The study identified three key aspects of the experience of the self-disclosure situation – emotional, cognitive and behavioral.

The dominant experience during self-disclosure was fear (40% of participants). One third of respondents (36%) reported anxiety accompanied by somatic reactions (hand tremor, voice trembling, lump in throat). The majority of respondents (68%) felt relief, freedom, ease, and relaxation after self-disclosure, while also experiencing a positive attitude towards themselves (24%) and others (18%).

During self-disclosure, 20% of participants experienced thoughts of possible rejection and non-acceptance by the other person (18% feared a negative reaction, and 16% worried about potential changes in their relationship). For 12% of respondents, self-disclosure increased negative self-perceptions (“I’m difficult”, “I’m stupid”, “I’m bad”).

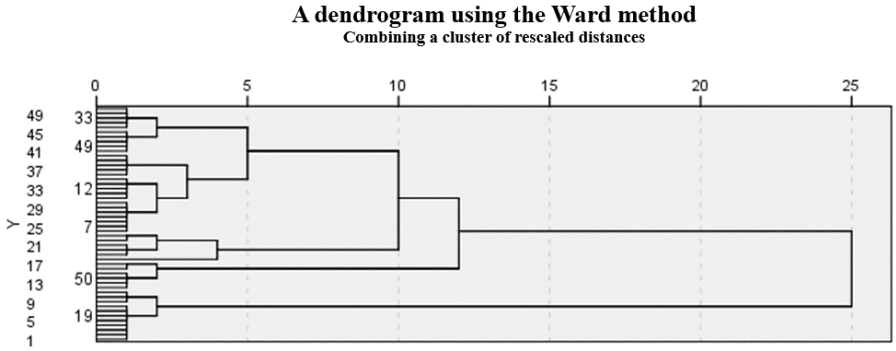
In most cases, the behavioral component (74%) consisted of avoidance and escapism (“I left immediately”, “I turned away”) and freezing (“I couldn’t move”).

The overwhelming majority of participants (96%) reported finding new meanings and values (self-acceptance, authenticity) after self-disclosure, while 62% reported strengthening positive self-perceptions (“strong”, “confident”). In 80% of cases, transformations occurred in key areas? Including professional self-determination, rethinking social roles, changing the image of the future, and improving interpersonal relationships (82%).

Furthermore, we identified two clusters of respondents based on the study results. To divide the sample into subgroups, Ward's method of hierarchical clustering was used, using the interval measurement of the squared Euclidean distance. Content analysis categories were used as clustering variables (Figure 1).

Figure 1

Cluster analysis of variables related to the content of respondents' experiences in their self-disclosure descriptions



The first cluster included all respondents (39 individuals) who rated the situation of "self-disclosure" to others as a personally significant event that resulted in the emergence of new meanings, more intense feelings, changes in major areas of life, and a vision of the future. The second cluster consisted of 11 individuals—those for whom this situation was irrelevant, not leading, in the respondents' opinion, to any changes. As a result, respondents in the first cluster were referred to as "experiencing the event", while those in the second cluster were referred to as "experiencing the situation".

Differences between the experiences of self-disclosure as a "situation" and as an "event" were observed in the content of the descriptions themselves (Table 1).

The texts of the respondents for whom self-disclosure was a personally significant event contained a larger number of words and narrative details (descriptions of time and place, experiences, use of adjectives, participial and adverbial phrases, etc.). They predominantly used perfective verbs (told, did, said, did, etc.), whereas in texts where self-disclosure was not a personally significant event, the activity was largely attributed to others (he asked, found out, guessed, etc.) or to other "forces" or circumstances (it just happened, I had to, etc.). There was no evidence of new knowledge or meanings emerging.

Table 1
Differences between experiences of self-disclosure as a "situation" and as an "event"

Event	Situation
Longer narrative with details	Short narrative without details
Descriptions of changes in self-image, vision of the future, and impact on personally significant areas of life are included.	Changes in self-image and the impact of the situation on areas of life are denied.
Feelings are more intense, predominantly negatively charged ("fear", "anxiety", "jitters", etc.)	Feelings are characterized by less intensity ("calm", "acceptance", "excitement", etc.)
There is an indication of a sense of dividing life into "before" and "after".	No indication of a "break" ("there was no before and after", "nothing has changed")
The narrative usually reveals the authorship of the person in the situation ("decided", "understood", "told", "planned", "wanted", etc.).	In the narrative, the authorship of the person in the situation is clearly the least ("it just happened", "it happened by itself", "spontaneously", etc.

A comparative analysis revealed statistically significant differences between the two groups in the following thematic categories identified during content analysis: "Liberation", "Changes", "Feelings", and "Meanings".

The respondents in the first group usually included sections in their texts mentioning the emergence of a sense of inner freedom after self-disclosure *("I can just be myself", "I finally became free"*) (U=115, p<0.001), as well as more intense feelings (U=169, p=0.033) (both negative: *"I was very afraid"* and positive: *"I felt joy and pride"*). There was also a

greater number of segments in which respondents reported changes (U=51, p<0.001) affecting their image of the future (*"I finally understood what I wanted to do"*), self-image (*"I became braver and more confident"*), and the emergence of new meanings (U=71.5, p<0.001) (*"being myself and accepting myself", "being open to people has become very important to me"*).

The analysis of the descriptions showed that respondents who experienced a self-disclosure situation as an event were characterized by certain conditional stages of transition from a situation to an event. Of course, these stages cannot be regarded as universal; rather, they are a kind of exploratory result requiring a separate examination.

As an example, we will provide an expanded example of a description where one can see how a situation becomes an event during its experience.

We identified the emergence of emotional reactions as the initial stage, "I told my best friend about it. I think I was about 20 years old. I was really afraid to tell her, in case it affected our relationship". Here we see the emergence of emotions even before self-disclosure. Then, emotional reactions emerge at the moment of self-disclosure, "I remember I started talking about it and I burst into tears". Here we also see the emergence of life experience (I was afraid to speak up, perhaps there had already been situations where the other person's reaction was negative).

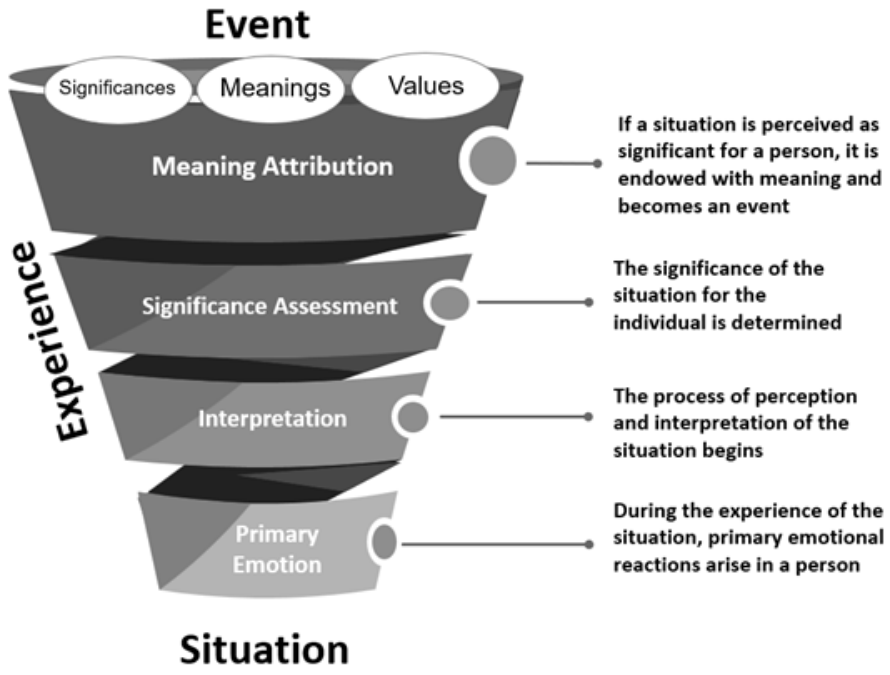
The second stage begins the process of interpreting the situation. At this stage, individuals evaluate the situation, explain it for themselves, and also construct hypotheses regarding the cause-and-effect relationships of what happened based on their lived experience and knowledge: "I don't remember what prompted me to talk about it at that particular moment; perhaps there were some difficulties in the relationship that I had no one to share with".

Then the meaning of the situation is determined, "At that time it was very important for me because I spoke to the person closest to me whose support was extremely important for me". The presence in the descriptions of its assessment as personally significant may mark the beginning of its transition to the event-related level.

Then the situation begins to make sense, reflecting a new experience, "For me, this situation showed that we need to open up to people with whom we feel like ourselves, that we don't need to be shy or afraid of anything or anyone; everything is in our hands". At this stage, the event is again linked to lived experience, through a comparison of the existing and the "new".

Generally, the transition from a situation to an event can be represented as follows (Figure 2).

Figure 2
Model of Transition from Situations to Events



These results lead us to the following interim conclusion: When faced with a personally significant situation, individuals start to respond to it and experience it based on their lived experience. In the process of experiencing the situation, individuals experience initial emotional reactions, and the processes of perception, interpretation, and assessment begin, resulting in the determination of the meaning of the situation.

If a situation is personally significant for an individual and requires a reconsideration of existing tasks and goals, leading to a deepening of emotional experiences, then such a situation is imbued with special meaning and becomes an event. In turn, an event, which includes emotional, cognitive, and behavioral components, again undergoes a cycle of experience, but at a level that meets the criterion of a "pivotal moment" in life, altering its trajectory, transforming individuals themselves, and opening up new possibilities. Thus, a situation, transformed into an event, not only integrates into individuals' lived experience but also influences their values, meanings, and relationships.

At the event-related level, change is not only quantitative (for example, changes in the level of emotional arousal); it is primarily qualitative. When experiences become complex, it occurs due to the awareness generated by these qualitative changes. They draw an

individual's attention to what is happening. Complex experiences are characterized by the emergence of this focus.

The proposed model focuses on the view of a situation and an event as a single dynamic system and describes it as a process based on lived experience, enriching it with new meanings as a result of the transition from the situation-related level to the event-related one.

Discussion

The results obtained during the study suggest the presence of a common "situation-event" dynamic system in experience, based on lived experience. Within this system, an event appears as a qualitatively different level of experiencing fragments of reality (a combination of situations), being a kind of "pivotal moment" in the individual's life. It is through events that an individual's lived experience is transformed and enriched with new meanings and senses.

The transition of a situation (situation-related level) to an event (event-related level) is ensured by an experiential mechanism that includes (a) the emergence of primary emotional reactions, (b) the process of interpreting the situation, (c) determining the personal significance of the situation, and d) imbuing meaning that reflects the new experience.

A situation that has reached the event-related level, that is, has become an event for an individual, acquires special characteristics associated with the depth of feelings and the construction of meanings and values, leading to changes in life experience. An event, unlike a situation, is characterized by the ability to generate *new meanings*, integrating into the system of values and meanings of the individual.

The proposed model was empirically validated using a self-disclosure situation as an example, which made it possible to clearly demonstrate the differences in the experience of the same episode at the situation-related and event-related levels. We found that respondents for whom the self-disclosure situation became a personally significant event were characterized by deeper and more intense experiences, changes in their self-image and future vision, and the emergence of new meanings. A comparative analysis revealed statistically significant differences between respondents for whom the self-disclosure situation had reached the event-related level and those for whom it remained at the situation-related level.

These results are consistent with previous studies. Situations perceived as personally significant and reaching the event-related level were reported to promote profound changes in self-perception, the formation of new meanings and the re-evaluation of personal values (Singer et al., 2013; Schwaba et al., 2023). It has also been confirmed that events are key structural units integrated into an individual's life experience, ensuring its transformation and further enrichment (Pasupathi et al., 2007).

Furthermore, an analysis of scientific literature shows that the problem of the event-related level of a situation in the structure of life experience was previously mainly considered in the context of (a) the reorganization or modification of lived experience through experiencing critical life events (Transformative Life Experience, TLE model, Russo-Netzer & Davidov, 2020) and (b) the mechanisms for integrating personally significant episodes into autobiographical memory (Barsalou, 2015; Rubin & Umanath, 2015).

Until now, however, the process of transition from situations to events has not yet been explored. The proposed model aims to fill this gap in psychological science.

Conclusion

This study enabled us to expand our understanding of concepts such as situation, event, and lived experience. The scientific novelty of the study is in describing the process of transition from situations to events, based on lived experience and enriching it through the emergence of new meanings as a result of the transition from the situation-related level to the event-related one through the mechanism of experience.

The practical significance of this study lies in the fact that the proposed model enables a better understanding of the processes of formation and transformation of an individual's lived experience as a result of experiencing various events.

Of course, the proposed model of a transition from a situation to an event is not universal or comprehensive, but requires further verification and could be used as a perspective for future research in this field.

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Author Contribution

Yana S. Platonova conducted the study, collected the data, performed processing and analysis of the results, wrote the text of the manuscript, worked with sources.

Elena V. Zinovyeva contributed to the research concept and theoretical grounding, wrote the overview section, approved the final version of the manuscript.

Svetlana N. Kostromina edited the text of the sections Introduction, Results and Discussion, performed the critical review of the manuscript.

Author Details

Yana S. Platonova – postgraduate student, Assistant, Department of Personality Psychology, St. Petersburg State University, Saint Petersburg, Russian Federation; Web of Science ResearcherID: JCN-9818-2023, SPIN: 3090-1354, AuthorID: 1151302, ORCID ID: https://orcid.org/0000-0002-4641-7667; e-mail: y.platonova@spbu.ru

Elena V. Zinovyeva – Cand. Sci. (Psychology), Associate Professor, Department of Personality Psychology, St. Petersburg State University, Saint Petersburg, Russian Federation; Researcher ID: P-4011-2015, Scopus ID: 58022792500, Author ID: 3541-1056, ORCID ID: https://orcid.org/0000-0003-1052-103X; e-mail: lena_zi@mail.ru

Svetlana N. Kostromina – Dr. Sci. (Psychology), Professor, Department of Personality Psychology, St. Petersburg State University, Saint Petersburg, Russian Federation; Researcher ID: N-4254-2013, Scopus ID: 56568149000, Author ID: 353554, ORCID ID: https://orcid.org/0000-0001-9508-2587; e-mail: s.kostromina@spbu.ru

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Impact of Initial Task Conditions on Reflexive Loop Formation in Network Thinking

Denis F. Dautov[1*], Yulia A. Tushnova[1], Evgeny A. Pronenko[2]

[1]Don State Technical University, Rostov-on-Don, Russian Federation

[2]Southern Federal University, Rostov-on-Don, Russian Federation

[*]Corresponding author: dautov-80@ mail. ru

Abstract

Introduction. The accelerating proliferation of network technologies into all spheres of human life is driving the adoption of principles from network structures to inform new approaches across many domains of individual and, particularly, collaborative activity. This is especially important for mental processes, which are forced to adapt to new emerging conditions. To study the phenomenon of networks in relation to collaborative thinking, a study was conducted to examine reflective feedback loops in networked thinking. **Methods.** Semantic content analysis was used as a data collection. Mathematical processing of the results was performed using multivariate analysis of variance. **Results.** The study identified the most significant initial conditions that influence the formation of reflective loops in network thinking. The decisive role of purposefulness of thinking in the implementation of reflective loops was noted. The effect of positive and negative feedback loops in the process of solving problems with different initial conditions was discovered. Based on the results of the study, conclusions were drawn about the ability of initial conditions to have a significant impact on reflective loops in network thinking, jointly and separately from each other. It was established that the presence of a known solution reduces the number of questions, while the absence of such a solution leads to a stable predominance of questions over answers at all stages. **Discussion.** The data obtained allowed us to form an idea of the significance of reflective loops for network thinking processes, showing their role in achieving a dynamic equilibrium of the thinking system through the interaction of positive and negative feedback. This makes it possible to use the results in network learning to activate students' thinking activity by controlling the initial conditions of tasks.

Keywords

network, network thinking, reflective cycles, positive and negative feedback

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Introduction

The concept of a *network* is often metaphorical in nature, allowing it to encompass a very wide range of phenomena (Donald, 2012). In general terms, the concept of a network is explored in the works of Gao, Barzel & Barabási (2016), Castells (2011), and Latour (2007).

In psychology and pedagogy, a network is typically understood as a form of human interaction, primarily using digital tools (Ioannou, Brown, & Artino, 2015; Pavlova et al., 2019). At the same time, considerable attention is paid to such network phenomena as network communication and network thinking (Ermakov, & Belousova, 2021; Sutcliffe, Binder & Dunbar, 2018).

Several researchers believe that network activity can influence the behavior of its participants regardless of their individual goals (Donald, 2012; Pishchik et al., 2019). In other words, the network as an independent phenomenon can direct the activities of its components.

Among the theories that examine network structures, we can highlight A.-L. Barabási's network theory and M. Castells' concept of network society, W. Varela and F. Maturana's autopoiesis theory, and E. Morin's complex thinking theory (Gao, Barzel & Barabási, 2016; Castells, 2013; Maturana & Varela, 2012; Morin, 2014).

According to a number of leading experts in network theory, network structures have complementary characteristics in relation to self-organization (Castells, 2013; Lynn, Holmes & Palmer, 2024). A.-L. Barabási, together with other researchers, was able to establish that in network structures, regardless of their specific purpose, the characteristics of an individual network node can be unique, not repeating themselves throughout the entire network (Gao, Barzel & Barabási, 2016). As M. Castells notes, the processes occurring in a network are similar to natural selection in biological environments, where the participants in such selection, adapting to the environment, ultimately shape that environment themselves (Castells, 2020). By demonstrating its adaptive capabilities, the network shows its ability to actively adapt to changing conditions (Treur, 2020; Mukeriia, Treur & Hendrikse, 2024; Zinchenko et al, 2020). It not only adapts to various unpredictable conditions, but also shapes the environment through its inherent internal processes. It can be said that the network is an environment for itself.

The creators of the theory of autopoiesis, W. Maturana and F. Varela, believed that such a complex adaptive structure as a network structure simultaneously strives for independence from the external environment and forms numerous connections with it (Maturana & Varela, 2012). N. Luhmann agreed with this, believing that complex self-organizing systems build complex relationships between their structure and the external environment, constantly checking themselves and the environment for compatibility with each other (Luhmann, Baecker & Gilgen, 2013).

In this sense, the self-organization of network thinking is expressed in the spontaneous formation of a certain form of interaction between the nodes of the network, inherent in it under the existing conditions (Haken, 2012). In his actor-network theory, B. Latour particularly notes that not only people, but also various information objects, can act as such nodes (Latour, 2007; Schwarz et al., 2024).

The presence of unstable forms of interaction inherent in network thinking due to the specific conditions of the digital environment may, in fact, be its notable advantage over traditional forms of thinking. Despite the significant negative factors accompanying online interaction, especially for young people, the advantages are also significant (Davydova, Suroedova, Grishina, 2023). In studies devoted to various forms of interaction, a special place is occupied by the so-called 'weak ties' discovered by M. Granovetter. Weak ties, realized, for example, in social networks, facilitate the rapid exchange of information with minimal resource costs, facilitating the establishment of new connections between network nodes, thereby ensuring a diversity of opinions, ways of thinking, and forms of interaction (Granovetter, 2018). However, at the same time, weak ties and the specific nature of the implementation of network thinking self-organization processes as a whole make it unstable and less sustainable compared to traditional thinking (Brennecke, Ertug & Elfring, 2024; Wiener, 2019; Sundararajan, 2020).

Therefore, processes that ensure a certain level of stability are particularly important for network thinking, while at the same time preventing it from entering a state of stagnation that hinders self-organization and has a destructive effect on such structures.

One such process, recognized as the most important for the existence of a network, is the generation of feedback loops that ensure self-regulation and self-control in complex self-organizing systems (Luhmann, Baecker & Gilgen, 2013).

In general terms, feedback loops are a cyclical process of cause-and-effect relationships in which each element influences the next until the last element affected begins to influence the first element in the chain (Wiener, 2019). An important feature of feedback is its ability to amplify or suppress emerging trends in the system. Positive feedback supports and amplifies changes that have occurred in the system, contributing to its development, while negative feedback suppresses them, thereby returning the system to a stable state (Krancher, Luther & Jost, 2018; Skene, 2024).

In his study of self-reinforcing deviations from a cybernetic perspective, M. Magoroh established the importance of positive feedback between elements within a complex system for its development (Magoroh, 2017).

Subsequently, researchers have established that self-organization in a system is only possible if positive feedback prevails over negative feedback. Otherwise, negative feedback quickly stabilizes the system, preventing any possible changes (Haken, 2012; Wiener, 2019). However, the obvious predominance of positive feedback in the system quickly destabilizes it, destroying the boundary between the internal and external environments (Latour, 2007). Therefore, network structures need an alternation of positive and negative loops for their existence (Zhang & Wang, 2024).

Feedback loops in network thinking are implemented through the processes of self-reference described by N. Luhmann using the example of interaction between people (Luhmann, Baecker, & Gilgen, 2013). Such loops are based on the reflection of thinking, when people, communicating with each other, evaluate the incoming information, ask questions to clarify their understanding, and build mental operations (Korbak, 2023).

Thus, the reflective loop manifests itself in the form of positive feedback for network thinking, causing targeted changes in thinking under the influence of this activity itself (Roedema et al., 2022).

In the process of interaction, participants in network thinking are able to build chains of unique conclusions based on questions and answers, closing the information received in reflective loops necessary to clarify the incoming information (Zienkowski, 2017). The main function of reflective loops from the point of view of self-organization is to strengthen feedback in understanding of synergistic and cybernetic theory (Haken, 2012; Wiener, 2019). Reflective loops, through the manifestation of positive feedback in mental activity, cause changes in thought processes by strengthening the selection of incoming information, which, through the implementation of recursion, leads to the subsequent strengthening of the selection of similar information (Jeon, 2022). In the course of cognitive activity, thinking itself influences its implementation through recursive reasoning initiated by reflective cycles (Igamberdiev, 2017).

Thus, the study of reflective loops can advance our understanding of the internal mechanisms of network thinking. At the same time, the psychological aspect of this area has hardly been studied. The manifestations of reflective loops in network thinking are unexplored, and the factors that influence the ratio of positive and negative feedback loops implemented in the process of network thinking have not been considered. To provide a preliminary description of the issues raised, a study was conducted to analyze the influence of initial conditions on reflective loops implemented in network thinking.

Methods

Websites dedicated to solving intellectual problems were used as data sources. Preference was given to those that contained a large number of diverse tasks, which expanded the range of choices, allowing tasks to be selected according to the study design. In addition, preference was given to those web sources that displayed not only the conditions of

the task itself but also comments on their solution. As a result, two sites were selected as such sources: Smekalka (http://www.smekalka.pp.ru) and Braingames (https://www.braingames.ru). An important feature of the research websites is the opposite approach to describing tasks. The first website does not typically present the solution itself directly in the descriptions of the conditions or comments of the participants. Messages with the correct solution are deleted by the moderator. Completed tasks must be sent for verification on an individual basis. Thus, to solve a problem, it is necessary, first of all, to use direct reasoning, moving from beginning to end in the thought process. The second site, in contrast, publishes the solution to the problem immediately after describing its conditions. Thanks to this approach, participants should not so much offer their solution, as to recreate the chain of reasoning, moving in reverse order from the end to the beginning.

Tasks for further analysis were selected based on two parameters. The first parameter was the number of ways to solve the task, its variability. Based on this parameter, the tasks on the websites were divided into two groups: those with several possible solutions and those with one acceptable option. This division of tasks made it possible to assess the influence of constraints on the characteristics of collaborative thinking, which, according to the autopoietic approach, as a complex self-organizing system is capable of forming parameters of order depending on the degree of such limiting conditions (Maturana & Varela, 2012). The second parameter is the presence of a ready-made solution to the task, known to the participants in the discussion. As in the first case, the tasks were divided into two groups:

- Tasks with a known solution, which makes network thinking more spontaneous, since participants cannot join forces to achieve a goal that is clear to everyone, namely finding a solution;
- Tasks with an unknown solution, which set the traditional direction for collaborative thinking. Due to this, the parameter contributes to or hinders the spontaneity of network thinking to a greater or lesser extent.

The two parameters of the tasks presented determine, as initial conditions, the degree of limitation and spontaneity of network thinking, which are important for self-organization processes (Haken, 2012).

Based on these parameters, four types of tasks were identified:

- Tasks that have one correct solution, initially unknown to the participants in the discussion;
- Tasks with one correct solution that is known in advance;
- Tasks with several possible solutions, none of which are known in advance;
- Tasks with several possible solutions, where at least one of them is known in advance.

Thus, two main parameters, the limited nature and spontaneity of network thinking, can be considered as initial conditions that influence self-organization processes.

A total of 16 tasks were identified in accordance with the parameters presented. Thus, four tasks corresponding to each combination of parameters were found. Because of the equal number of tasks for each type of task, it was possible to obtain observations for the sample as a whole, which made it possible to avoid the difficulties that arise when calculating heterogeneous complexes.

Semantic content analysis based on expert comments evaluations aimed at solving the tasks listed on the websites was used as the main method to analyze the statements of participants in solving intellectual tasks. This type of content analysis was chosen because of its ability to identify the content component of selected text components.

The content analysis was carried out in four stages.

The first stage involved coding related to signs of reflective loops in network thinking. In this case, sequences of statements in which participants asked questions about the conditions of the task and received responses from other participants in the discussion were selected as units of analysis to identify reflective loops, thereby supporting a specific topic in network thinking and demonstrating positive feedback. The more questions the discussion participants asked, the more intense the discussion of the task conditions became, the more questions were asked, which in turn led to a change in the direction of network thinking and, as a result, a new series of questions. Coding was carried out using latent coding, which allowed for the analysis of implicit meanings based on a specific context.

The second stage was devoted to assessing the reliability of the coding. For this purpose, two pairs of independent-working evaluators were selected, whose task was to analyze the data obtained. The results obtained by these evaluators were then compared to verify the consistency of the data. As a result of such comparisons, the level of inconsistency was estimated at 16% of the analyzed cases, which indicates a high degree of reliability of the analyzed information (Cohen's kappa 0.83).

The third stage involved conducting a frequency analysis, which was carried out in accordance with the characteristics of reflective loops described previously.

In the fourth stage, the quantitative data obtained as a result of the analysis were entered into a table for statistical analysis.

Data analysis

Statistical analysis was performed using SPSS Statistics for Windows (17.0; IBM Corp.). To analyze the data obtained through content analysis, multivariate analysis of variance was used after testing the assumptions of normality and homoscedasticity. The statistical analysis method was used to assess the impact of task parameters on changes in the number of questions and answers during the problem solving process. Dependent variables were the number of questions and answers at the initial, intermediate, and final stages of task discussion. The independent variables remained unchanged: the familiarity and variability of task solutions. The critical level of significance was established at $\alpha = 0.05$.

Results

After the data necessary for further research were obtained by content analysis, it was converted into conditional indicators. This was done by dividing one indicator by another. In this way, the problem of the unequal number of questions and answers characteristic of different tasks was solved. Using this procedure, three conditional indicators of reflective loops were obtained.

The indicators 'Question on solving the task' (QST) and 'Answer to question' (AQ) were obtained by dividing the questions and answers by the total number of relevant comments on this task. The Question-to-Answer (QAR) indicator was obtained by dividing the Question-on-Task Solution indicators by the 'Answer to question' indicators.

The 'Question on solving the task' indicator allows us to assess which part of the total number of comments relates to those that initiate reflective loops. The 'Answer to Question' indicator allows us to determine the degree of representation of reflective loops in network thinking. As for the 'Ratio of questions to answers' indicator, it demonstrates the predominance of positive or negative feedback loops in network thinking. If the number of questions exceeds the number of answers, this may indicate a predominance of positive feedback in reflective loops, as each question stimulates new answers, which in turn raise even more questions, thereby reinforcing reflective tendencies in network thinking. If the number of answers prevails over the questions, this may indicate a predominance of negative feedback in reflective loops, where the answers suppressed new questions, thereby reducing the reflection of network thinking as a whole.

To study the influence of task parameters on changes in reflective loop indicators in the initial, middle, and final stages of network thinking, multivariate analysis of variance (MANOVA) was used. The final results are presented in Table 1, Table 2, and Table 3.

Table 1

Results of MANOVA analysis to assess the influence of task parameters on the 'Question on solving the task' indicator as a component of reflective loops of network thinking at the initial, middle and final stages

Task parameters Task	Test Statistic	Value	F	Hypothesis df	Error df	Sig.(p)	Partial η 2
Question on solving the task							
Fame	Wilks'λ	0.107	27.781	3.000	10.000	<0.001	.893

Task parameters Task	Test Statistic	Value	F	Hypothesis df	Error df	Sig.(p)	Partial η 2
Variability	Wilks'λ	0.863	0.530	3.000	10.000	0.672	.137
Variability and popularity	Wilks'λ	0.630	1.962	3.000	10.000	0.184	.370

The results presented in Table 1 allow us to determine the influence of such a parameter as 'Fame' on the indicator of change in the 'Question on solving the task' at different stages of network thinking (Wilks'λ = 0.107, F (3.10) = 27.781, p < 0.000, η = 0.893). A univariate analysis made it possible to clarify specific changes in indicators at the beginning, middle and end of the network thinking process. The 'Fame' parameter had an impact on the indicator change in the 'Question on solving the task' in the initial (F (3.10) = 76.438, p < 0.001, η = 0.864), middle (F (3.10) = 69.522, p < 0.001, η = 0.853) and final (F (3.10) = 96.026, p < 0.001, η = 0.889) stages of network thinking aimed at problem solving. Marginal means indicate an increase in the number of questions in the case of an unknown solution in the initial (M = 0.301), middle (M = 0.284) and final (M = 0.310) stages, compared to tasks with a known solution (M = 0.037) (M = 0.031) and (M = 0.024), respectively.

Table 2

Results of MANOVA analysis to assess the influence of task parameters on the 'Answer to question' indicator as a component of reflective loops of network thinking at the initial, middle, and final stages

Task parameters Task	Test Statistic	Value	F	Hypothesis df	Error df	Sig.(p)	Partial η 2
Answer to question							
Fame	Wilks'λ	0.684	1.537	3.000	10.000	0.265	0.316

Task parameters Task	Test Statistic	Value	F	Hypothesis df	Error df	Sig.(p)	Partial η 2
Variability	Wilks'λ	0.908	0.337	3.000	10.000	0.799	0.092
Variability and familiarity	Wilks'λ	0.904	0.354	3.000	10.000	0.787	0.096

The results presented in Table 2 demonstrate that task parameters have no effect on the 'Answer to question' indicator at all stages of network thinking. A univariate analysis also revealed that the task parameters at the beginning, middle, and end of the network thinking process did not have an effect on this indicator.

Table 3

Results of the MANOVA analysis to assess the influence of task parameters on the 'Question-Answer Ratio' indicator as a component of reflective loops of network thinking at the initial, middle, and final stages

Task parameters Task	Test Statistic	Value	F	Hypothesis df	Error df	Sig.(p)	Partial η 2
Question-Answer Ratio							
Fame	Wilks'λ	0.142	20.184	3.000	10.000	<0.001	.858
Variability	Wilks'λ	0.646	1.825	3.000	10.000	0.206	.354
Variability and popularity	Wilks'λ	0.653	1.775	3.000	10.000	0.215	.347

The results presented in Table 3 allow us to determine the influence of a parameter as 'Fame' on the indicator of change in the 'Question-Answer Ratio' (Wilks'λ = 0.142, F (3.10) = 20.184, p < 0.000, η = 0.858). A univariate analysis allowed for the clarification of specific changes in indicators at the beginning, middle, and end of the network thinking process. This parameter had an impact on the indicator of the 'question-to-answer ratio' at the initial stage (F (3.10) = 42.155, p < 0.001, η = 0.778), middle (F (3.10) = 29.923, p < 0.001, η = 0.714), and final (F (3,10) = 34.908, p < 0.001, η = 0.744). At the same time, tasks with unknown solutions increased the number of questions and answers in all stages of network thinking, compared to tasks with known solutions, which amounts to (M = 1.593), (M = 1.555) and (M = 1.321), versus (M = 0.272), (M = 0.236) and (M = 0.229).

Discussion

The aim of this study was to investigate the influence of initial conditions on solving problems on reflective loops implemented in the network thinking.

The analysis of changes in reflective loop indicators at the initial, middle, and final stages of network thinking allowed us to establish the decisive influence of the known solution to the problem on the number of questions and the ratio of questions to answers. A decrease in the number of questions relative to answers when solving intellectual problems with a known solution compared to solving problems without a known solution indicates a weakening of the self-regulation processes of network thinking. When the answer is known in advance and the discussion focuses on identifying intermediate steps, this reduces the significance of the questions. They are less useful for solving the problem. As a result, the number of answers begins to increase, suppressing the emergence of new questions, which reduces the overall intensity of network thinking.

The absence of a known answer in advance led to an increase in the number of questions and the general predominance of questions over answers in the initial, middle and final stages of network thinking (Belousova, Kozhukhar, & Pishchik, 2019; Dautov, 2021). Thus, the presence of a clear goal in solving intellectual tasks had a constant influence at each stage of network thinking (Hesse, Care, Buder, Sassenberg, & Griffin, 2015). At the same time, the number of questions in the final stage was greater than at the initial stage, and the ratio of questions to answers gradually decreased in favor of answers, while the questions remained predominant at all stages. This indicates that reflective loops gradually stabilize positive feedback by increasing the number of answers and, as a result, increasing negative feedback loops in the process of collaborative thinking.

As B. Latour's research shows, unrestrained positive loops can destroy the system (Latour, 2007). Therefore, in order to maintain its integrity, network thinking, in accordance with the principles of self-organization, generates negative feedback. As a result, as positive connections increase, reflective loops provoke the growth of negative connections, bringing the network thinking system into a state of dynamic equilibrium.

Conclusion

The results of the study demonstrated that reflective loops in network thinking are influenced by a number of initial conditions related to task parameters. These conditions have an independent influence on network thinking. The most significant influence is the presence of a goal shared by the participants, in this case expressed in the desire to solve the task. It was the participants' goal-orientedness that contributed to the initiation of reflective loops and maintained their activity throughout all stages of network thinking.

Although the number of responses depends only slightly on the task parameters, the ratio of questions to answers is an important indicator to assess the ratio of positive and negative feedback in reflective loops. This ratio in network thinking allows us to judge the intensity of reflective loops and the degree of stability of network thinking as a whole.

The study provides a more complete picture of the processes that occur in network thinking and a better understanding of its internal mechanisms that ensure self-organization processes. The data obtained can be used in collaborative network learning to initiate students' mental activity by activating reflective loops through the selection of specific initial conditions for mental activity.

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Author Contribution

Denis Fatyhovich Dautov – providing the sections "Materials and Methods," "Results," "Discussion," and "Conclusions."

Yulia Andreevna Tushnova – providing the sections "Introduction," "Data Analysis," "Conclusions" and working with scientific sources.

Evgeniy Aleksandrovich Pronenko – work with scientific sources, article text formatting.

Author Details

Denis Fatyhovich Dautov – Cand. Sci. (Psychology), Associate Professor of the Department of Psychology, Don State Technical University, Rostov-on-Don, Russia; ORCID ID: https://orcid.org/0000-0001-8147-5603; e-mail: dautov-80@mail.ru

Yulia Andreevna Tushnova – Cand. Sci. (Psychology), Associate Professor, Department of Psychology, Don State Technical University, Rostov-on-Don, Russia; ORCID ID: https://orcid.org/0000-0001-8579-2630; e-mail: trubulya@yandex.ru

Evgeny Aleksandrovich Pronenko – Cand.Sci (Psychology), Associate Professor of the Department of General and Educational Psychology, Southern Federal University, Rostov-on-Don, Russian Federation; Scopus Author ID: 57351954200, SPIN-code RSCI: 9896-5451, ORCID ID: https://orcid.org/0000-0002-6032-6059; e-mail: pronenko@sfedu.ru

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Personal Integrity: A Conceptual Model

Natalia V. Grishina

St. Petersburg State University, St. Petersburg, Russian Federation
n.v.grishina@spbu.ru

Abstract

Introduction. Changes in modern reality are described in terms of its uncertainty, variability, and complexity. The complex and differentiated nature of the surrounding reality is the main challenge in maintaining personal integrity. This paper aims to describe and substantiate a conceptual model of personal integrity. **Personal integrity as a systemic property: Description possibilities.** Integrity is the most integral characteristic of personality, relating to its fundamental properties that stem from the systemic nature of personality. The possibility of identifying independent partial integrity types is justified, provided that the relevant units that preserve integrity properties are selected. **The contextual nature of integrity.** Personal integrity is most clearly manifested in human activity in various forms of life and can be described through its manifestations in situational and life-related contexts. The integrity of an individual as a subject of activity and a subject of life is ensured by the processes of self-regulation and self-determination. Consistency of activity in situational and life-related contexts ensures higher-level consistency. The highest level of human behavior control, which determines human activity at different levels of life, is the value-meaning system. **Identity and authenticity as forms of manifestation of personal integrity.** Integrity, as a property of the systemic nature of personality, has no inherent psychological content. Personal identity and authenticity are considered psychological forms of manifestation of integrity as forms of personality "consolidation". **Meaning-related associations as the basis for the formation of identity and authenticity.** The formation and maintenance of personal identity and authenticity are based on meaning-related associations between individual psychological structures of personality, types of human activity, and life space spheres. **Discussion.** A theoretical analysis of the issue of personal integrity enabled us to propose

a conceptual model that connects the integralities that ensure the coherence of individual forms of life activity in situational and life-related contexts, and their integration through meaning-based regulation, which underlies identity and authenticity as psychological manifestations of personal integrity.

Keywords

integrity, differentiation, context, identity, authenticity, meaning-related associations, conceptual model

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Introduction

Over the past few decades, the most important issue of social science and humanities has been the change in the modern world. This discussion has led to the identification of many characteristics of a changing reality, including the most frequently mentioned uncertainty, variability, and complexity.

Psychology, with its emphasis on the study of the "changing individual in a changing world", has encountered the need to describe the psychology of modern people in these new realities. Changes in modern reality are fundamentally altering the context of human life and challenging the most fundamental characteristics of personality—the ability to change, maintain stability, and maintain integrity.

Psychologists have increasingly focused on the uncertainty of the modern world, identified by D. A. Leontiev as the central problem of personality psychology (Leontiev, 2018), and personality variability (Grishina et al., 2021). Methods for identifying the potential of personality variability and its ability to cope with uncertainty have been developed and are actively used in modern psychology.

The complexity of modern reality, as experienced by modern people, has received little attention in the psychological sciences dealing with the problem of human existence in the modern world. It is no coincidence that in the fundamental monograph Mobilis in Mobile: Personality in an Era of Change, published by a team of authors led by A.G.

Asmolov (2018), complexity challenges are the least studied. At the same time, the need to face the complexities of this world is a task of no less importance for modern humans, and complexity challenges address the most fundamental foundations of personality.

The complexity of systems or objects is traditionally defined by the complexity of their structure, which causes difficulties in understanding and interaction with complex objects. The complexity of modern reality is linked to its diversity and differentiation, to the variety of the worlds of human existence.

It is well known that the evolutionary processes occur within the coordinates of development and increasing differentiation. Human development, as a process of personality transformation, becomes a challenge to the individual's ability to change and maintain sustainability, while the growing complexity of the world and its differentiation becomes a challenge to the individual's integrity. If we accept the current view that modern human evolution is no longer determined by biological processes, but by sociocultural processes, then the rapid pace of change in reality may lead to the acceleration of evolutionary trends, leading to even greater challenges for the ability of the individual to cope with them.

Personal integrity as a systemic property: Description possibilities

The concept of integrity is a general scientific category, and its description dates back to Aristotelian science. According to Aristotle, integrity unifies the structure and function of an organism into a single whole, which means the unity and harmony of the elements of the organism (personality). This understanding of integrity reflects its nature and, in this sense, it is present in the scientific discourse in various areas of knowledge.

Despite the long tradition of the concept of integrity, modern science is still interested in its development. Modern approaches to describing integrity are characterized by transdisciplinarity, complementing the philosophical understanding of integrity with its exploration in various fields of scientific knowledge and art. The development of the concept of integrity is linked to a broader understanding of the complexity of human beings and their relationships with the world around them, contributing to the emergence of new perspectives on integrity (see, for example, Kiyashchenko, Sidorova, 2022).

We can also observe the increasing interest in the integrity problem in modern science, associated with the characteristics of changing reality, its growing complexity, and its differentiation, which poses a challenge to human ability to maintain and preserve integrity.

Increased differentiation is one of the vectors of human ontogenetic development. This process is described in detail by L. I. Antsyferova. The initial "diffuse single-level integrity of the psyche" inherent in infancy undergoes "stratification and differentiation"

into increasingly clearly distinct "levels, structures, and mechanisms"; and this "constant mechanism for the segregation of new parts of the integral psychological system requires the formation of mechanisms for the integration of the personality system, which strengthening is one of the central tendencies of personality development" (Antsyferova, 2006, pp. 23-24). K. Lewin also writes about increased differentiation in the process of individual development, "Increasing differentiation means that the number of parts of an individual that can function relatively independently increases, i.e., the degree of their independence increases" (Lewin 2001, pp. 284-285). Increasing differentiation requires greater integration of the "parts" of a person, the development of "inner order" (Allport, 2002).

However, individuals do not exist outside their existence in the world, and the structure of human existence is described by the diversity of their connections and relationships to the world. Consequently, the space of a person's life, connecting its inner world to reality, is influenced by modern reality and its increasing differentiation. As a result, the increasing complexity of the environment becomes a challenge for the integrity of personality and its integrating mechanisms.

According to Antsyferova's dynamic understanding of integrity, it means more than simply maintaining the stability and "coherence" of the individual. Integrity develops, "builds" itself up to a new level; it is the subject's constant "cultivation" of their personality (Antsyferova, 2006, p. 162). The result of this process is the development of increasingly comprehensive and more integrated forms of integrity that correspond to the development of the individual and the expansion of their living space. At the same time, the integrity of personality as a means of connecting its components, coping with the complexity of the inner world and the world of life, can also be achieved by reducing this complexity.

The mechanisms of personality functioning contain the potential for reducing differentiation. M.A. Kholodnaya, in her analysis of patterns of change in cognitive function in the late stages of ontogenesis, therefore points to the emergence of a phase of dedifferentiation on the path to centralization as the mobilization of available resources. In fact, the same thing happens with the human space—a decrease in activity in the elderly, a contraction of the spheres of active activity and a reduction in connections to the outside world—which essentially means the same process of dedifferentiation. These are examples of natural process of reducing complexity related to human capabilities limitations.

However, people can consciously or unconsciously reduce the complexity of the world they life in. Lyotard's well-known hypothesis about the relationship between man and the world around him speaks of a tendency to simplify the worldview in the face of growing complexity, i.e. of the same process of dedifferentiation. "In response to growing uncertainty, complexity, and diversity, humanity increasingly differentiates itself into those willing to perceive complexity and those inclined to simplify reality" (Asmolov,

2018, p. 19). Rollo May, describing neurotic symptoms, writes of a narrowing of the human world "to a size that one can manage" (May, 2013, p. 29). This refers to the conscious or unconscious choice of strategies for reducing complexity, strategies aimed at avoiding difficult situations.

This choice, however, has serious psychological consequences for the individual. The existential philosopher Kierkegaard once wrote of a fundamental choice that involves the entire personality. The result of this choice goes beyond a specific situation and has a profound impact on personality as a whole. "By making a choice, one is completely filled with what has been chosen" (Kierkegaard, 1994, p. 234).

Today, the consequences of choosing certain strategies to manage life for the individual have empirical basis. L.I. Antsyferova noted, "Individuals... who avoid difficult situations, resort to psychological defense mechanisms, and are prone to downward social comparison, perceive the world as a source of danger, have low self-esteem, and their worldview is colored by pessimism" (Antsyferova, 2006, p. 345).

Therefore, strategies aimed at reducing the complexity of the environment are perceived in psychology as destructive by nature and have devastating consequences for the individual.

Understanding the constructive possibilities for ensuring personal integrity requires clarifying its nature.

In psychology, personal integrity is associated with the harmony of various spheres of personality, their coherence, ensuring internal balance, and the correspondence of a person's behavior to his/her inner world.

The ideas of a holistic approach—as opposed to simpler elemental descriptions of personality—were developed by W. Stern (1911), K. Lewin (1935), G. Murray (1938), and others in the early stages of personality psychology (see Magnusson & Torestad, 1993).

Within the disposition paradigm, personality integrity began to be considered from the perspective of the interconnectedness of its components; the advantage of this approach is the ability to create methods to measure personality integrity.

Research describing integrity through the connectivity of personality components predominates in psychology in worldwide perspective (Fournier, 2021, Beck et al., 2022; Rasool et al., 2022; etc.); this reflects in particular the widespread use of the concept of coherence, which denotes the degree to which a person's psychological characteristics are coordinated and integrated (Fournier et al., 2022). In 2022, a special issue of the European Journal of Personality, titled "Towards Conceptualizing and Assessing Personality Coherence and Incoherence", was published. It explored the development of approaches to describing and measuring personality coherence. For example, it proposed to study personality coherence based on an analysis of the "personality architecture", i.e. the overall structure and dynamics of intra-personal personality systems, including (a) belief-based coherence, (b) goal-based coherence, (c) evaluative standards-based

coherence, (d) intrapsychic coherence (i.e., coherent functional interrelations among personality systems), and (e) phenomenological coherence (Cervone, 2022).

Increasing attention to dynamic approaches to personality description also requires new approaches to personality integrity description. An example of such a solution is the Dynamic Model of Personality, which includes (a) the foundation or stable part of personality; (b) personality variability; (c) the force of attraction in the personality system—the speed with which deviations in the system are replaced by a return to its center, reflecting the individual's ability to maintain balance in the system (Sosnowska et al., 2020). The advantage of this model is its description of the integrity of personality as a result of the interaction of stability and variability processes.

Overall, descriptions of the concept of integrity in foreign psychology show a variety of interpretations, expressed in terminological inconsistencies and in the existence of different methodological approaches. The concept of coherence is most frequently used to operationalize the concept of integrity. An analysis of the use of the concept of integrity in scientific discourse reveals some trends and perspectives on its development—the advantage of describing integrity at different levels of personality organization, the need to address the context of the manifestation of integrity, and the integration of these descriptions with a phenomenological approach to understanding integrity (Moskvicheva, Mamaeva-Niles, 2025).

In Russian literature, the concept of personality integrity cannot also be considered as a specific terminological definition. Integrity is generally described through its psychological manifestations. Moreover, the coherence of various components is typically considered as the mechanism for maintaining integrity. Thus, A. L. Zhuravlev, D. V. Ushakov, and A. V. Yurevich note that "for a psychosocial individual, the principle of integrity signifies the presence of correlations between their attitudes, relationships, and action patterns" (Zhuravlev et al., 2013, p. 73). This approach—through assessing the degree of correlation between various components—is used in a number of studies (see Kaptsov, 2018). Work on individual forms of integrity, particularly the holistic nature of cognitive systems, can also be mentioned (Apanovich, Znakov, Aleksandrov, 2017).

The concept of integrity refers to the integral characteristics of personality, and, accordingly, the development of this concept faces difficulties typical of attempts to describe integral concepts. In the context of traditional structural and functional approaches, integral concepts are often defined by their constituent components.

The integrity of personality refers to its fundamental properties, arising from the systemic nature of personality. The existence of personality as a system is associated with processes of variability and stabilization, the combined effect of which ensures the integrity of personality, which was the focus of our previous studies (Grishina, Kostromina, 2021; Kostromina, Grishina, 2024; Grishina, Kostromina, 2024). These processes, like the principle of integrity, are inherent in all systems. Integrity is a condition for the existence of the system.

Accordingly, integrity (like variability and stability) is not a purely psychological property of personality, but a property of its systemic nature. This applies equally to the functioning of the integrating mechanisms that ensure the coherence of the components of the system and, ultimately, its integrity. If we do not consider systems in general, but individuals, then the principle of integrity also applies to all their subsystems, organismic and individual characteristics.

Integrity is the ultimate integrative characteristic of personality, which is described by integrative concepts and manifests itself in integrative phenomena. Traditional approaches to classical personality psychology face a key methodological problem—the description of personality as "splintered", which makes such explanations wrong and largely dead-end. This is especially evident when we describe the problems of life. An individual interacts with reality and life not through individual mental processes and states, but through their integral properties.

The study of personality integrity as a fundamental feature involves finding description units.

The possibility of a partial study of integrity is observed in the discussion of the integrity problem by L.I. Antsyferova and K. Lewin, who not only acknowledges this possibility, but even warns against the "inclination to make these integrities as encompassing as possible", noting that "some integrities exist at all levels of dynamic unification" (Lewin, 2001, p. 114).

A. R. Luria, analyzing L. S. Vygotsky, pointed out that any science is forced to decompose a complex phenomenon into its component parts, and that it was Vygotsky who succeeded in finding the answer to the question of "into what parts can a complex mental integrity be decomposed without losing the characteristics of the integrity". The correct answer, referred to by Luria as Vygotsky's greatest achievement and his contribution to psychological science, is that complex phenomena must not be decomposed into elements, but into units (Luria, 2002, p. 280). Moreover, the "unit" of a complex phenomenon (unlike its component parts) must retain all the properties of the whole (a well-known illustration of this is the example of a drop of water, which retains all its properties, unlike the "parts" of the molecular formula of water H_2O).

The interpretation of this principle regarding the description of integrity means that it should not be divided into its components, but can be studied in different "orders" of its manifestation, while maintaining the general properties and nature of integrity.

The Contextual Nature of Integrity

In our approaches to personality research, the principle of the contextual nature of personality phenomena is an obvious criterion for identifying individual manifestations of integrity.

The principle of contextuality in the study of psychological phenomena can be traced back to K. Lewin's well-known methodological work, "The Transition from the Aristotelian

to Galileian Mode of Thought in Biology and Psychology". The fundamental differences in these approaches stem precisely from their treatment of situational conditions as factors potentially influencing objects. According to the concepts of traditional Aristotelian science, with its focus on describing an object through its inherent properties, "...in order to understand the essence of an object and its inherent purposefulness, it is necessary to exclude as much as possible the influence of the situation and abstract from it". Thus, the "purity" of studying an event (object) requires eliminating the influence of the situation in which it occurs. In contrast, Lewin asserts the principle of contextuality, which presupposes "a profound study of situational factors", since "*only a concrete holistic situation, including an object and its environment, determines the vectors that determine the dynamics of a particular event*" (Lewin, 2001, pp. 75–76).

In personality psychology, the logic of the Aristotelian approach underlies theoretical descriptions of personality through the combination of its inherent traits and characteristics. The limitations of this approach manifested themselves in the impossibility of predicting a person's behavior in specific life situations based on knowledge of their personality traits. In the 1970s and 1980s, a number of works were published arguing this position, the most prominent of which was the well-known and resonant work by W. Mischel. An equally important work of this decade was the book by L. Ross and R. Nisbett, dedicated to the development of K. Lewin's ideas (Ross, Nisbett, 1999). In the early 1980s, fundamental works on the psychology of situations began to appear (Argyle et al., 1981; Magnusson, 1981; and others).

In contemporary psychology, the principle of contextuality in the study of personal phenomenology has acquired a new meaning. Modern humans engage in more active and extensive interactions with the world, with information space and virtual reality, which has led, among other things, to the replacement of the concept of the situation as the primary unit for describing the world around us with the concept of context as one that reflects contemporary realities. Furthermore, there is a growing awareness of the limitations of the decontextualized nature of psychological research, in which psychological phenomenology is studied "outside of time and space", outside the context of human existence (Rauthmann et al., 2015; Geukes et al., 2017). In contemporary literature, it is precisely this methodological limitation that is regarded as the main problem behind the inconsistency of empirical data obtained in studies.

According to our process-based approach to personality description and the idea of a leveled structure in personality phenomenology (Grishina et al., 2018), personal integrity can be described through its contextual manifestations.

Personal integrity is most clearly manifested in individuals' behaviors and their activity in various forms of life. The primary contexts of an individual's life are the situational context of habitual everyday activity and the life context described by their life situation, life circumstances, life goals, and plans.

Each form of human activity requires the coordination of its actions, ensuring the "unity of action". The usual forms of daily activity are largely based on the usual patterns of behavior, but even in these cases, coordination between the conditions of the task at hand, an individual's competences and his/her motivation is necessary. This coordination is based on self-regulation processes, and its integral result is an individual style of activity.

In the context of life, people face more complex tasks, such as coordinating distant and immediate life goals, life strategies and plans, and opportunities posed by current life situations. In this case, coherence requires the work of higher-order integrative mechanisms—self-determination processes. In the context of life, stable strategies of human behavior form their lifestyles as an integral characteristic of the relationship with life. Thanks to the work of integrative mechanisms—the processes of self-regulation and self-determination—not simply coherence is ensured, but the integrity of an individual as a subject of activity and a subject of life.

Coherence between these levels ensures *coherence at the highest level*, which in turn becomes the coordination center for the functioning of the lower levels. Luria wrote, "The genesis of organized human behavior follows the path of the development and integration of ever more new regulatory systems that overcome the primary forms of behavior and transform them into increasingly new and complete organizational systems" (Luria, 2002, p. 27).

The different contexts of human life are interconnected and united by a common "vertical contour" of regulation, a common center that performs the meaning-based regulation of human activity. It is the value-meaning system that constitutes the "highest" level of human behavioral control, determining human activity at various levels of life. This "highest" level is the one that guarantees personality integrity, integrating all manifestations, personality "consolidation" and "compression" (L. Karsavin 1992).

Identity and Authenticity as Forms of Manifestation of Personal Integrity

The description of personal integrity—not simply the coherence and integration of the activity of an individual as a subject of activity and a subject of life in individual contexts—requires a search for a personal phenomenon which nature corresponds to the holistic nature of the personality, its "consolidation" into a single whole.

In our opinion, such phenomena are the phenomena of identity and authenticity.

The issue of identity remains a constant subject in psychology, mainly because identity is a fundamental characteristic of personality and the nature of these characteristics will always be at the center of research interest.

The study of identity has a long history in psychology. In addition to the classical distinction between individual and social identities, various types of "individual" identities,

the characteristics of identity under modern conditions, and the crisis manifestations of identity are described. The modern understanding of identity is characterized by the influence of a general trend towards a transition from structural descriptions of personal phenomenology to its process-based and dynamic descriptions. The process-based and dynamic approach to identity leads to the rejection of the traditional distinction between personal and social identity. As E. P. Belinskaya notes, "today, the traditional dichotomy of 'personal identity vs. social identity', which emphasized the structural components of the self, is becoming a thing of the past, while modern identity is increasingly understood as a constant process of transformation, where both poles (social and personal identity) are simultaneously completed by an individual in accordance with the 'external-internal dialectic' of identifications" (Belinskaya, 2024, p. 7). In this approach, the identification of individual, specific forms of identity that are oriented towards their traditional structural understanding also seems doubtful.

The identity of modern man is a living, dynamic construct, confirmed and refined through interaction with the surrounding reality. Identity is increasingly understood as a contextual phenomenon. Two recent issues of the Identity journal are devoted to "real-time identity" (*Real-time processes: Theories and methods* (2021). *Real-time processes: Empirical applications.* (2022*). Identity. An International Journal of Theory and Research).*

Identity is considered to be the result of an individual's interaction with the context, the result of his/her interaction with the micro (family, partners, school, workplace) and macro (social, cultural, political and historical) levels of the context. Identity originates from everyday experiences, thoughts, feelings, interactions and behaviors of individuals, and refers to their efforts to build, maintain, and improve their identity. The concept of narrative identity is increasingly popular because it is more sensitive to socio-cultural contexts.

Understanding identity as a holistic, dynamic entity completely aligns with the understanding of integrity in the process-based approach, so that it can be regarded as a form of expression of integrity.

The basis for this understanding of identity is that identity, like integrity, is a response to the complexity and differentiation of an individual's life space and internal world. Identity is a form of self-determination that overcomes the diversity and uncertainty of existence in the multidimensionality of the modern world. Essentially, like integrity, it is a form of "consolidating" or "compressing" personality. G. M. Andreeva (Andreeva, 2011) argues that identity can support integrity in her work on identity crisis. In our interpretation, identity is not considered one of the pillars of integrity, but a form of its manifestation.

In the logic of analysis, authenticity appears as another form of manifestation of personal integrity. Like identity, it relates to the individual's self-identity. Both identity and authenticity belong to the same problematic field of personal "self-consolidation", its "compressing", and thus are the forms of maintaining and protecting personal integrity.

The difference between the concepts of identity and authenticity is that identity is the individual's accordance with the context of life, while authenticity is the individual's consonance with himself.

The issue of authenticity is not less popular than the issue of identity and is also distinguished by various interpretations of the phenomenon of authenticity.

In particular, there is ambiguity in understanding the nature of the phenomenon of authenticity — whether authenticity is a characteristic of personality or a state of experience. S.K. Nartova-Bochaver, the author of a series of studies on authenticity issues, attempted to synthesize various approaches into a general concept, which she designates as subjective. "In the context of the paradigm of subjective approach authenticity is defined as a transcendental and adaptive personality trait that ensures the fidelity of individuals to their nature (individual qualities), the spatio-temporal circumstances of their life (environmental parameters of existence), their vocation and destiny (existential-transcendent challenges)" (Nartova-Bochaver, Korneev, Bochaver, 2024, p. 24). In the main provisions of the subjective concept of authenticity, Nartova-Bochaver points to the dynamic development of authenticity, however, by adopting a dispositional approach to its understanding, which is reflected in her active development of a psychometric instrument for measuring identity.

Studies that interpret authenticity as a state felt (experienced) by an individual present a phenomenological approach to its interpretation, giving priority to the subjective experience of one's own authenticity, the feeling of 'being oneself'. This understanding of authenticity is more consistent with the principles of a dynamic processual approach and is also closer to the modern understanding of identity as a dynamic entity, 'refined' through interaction with the surrounding reality.

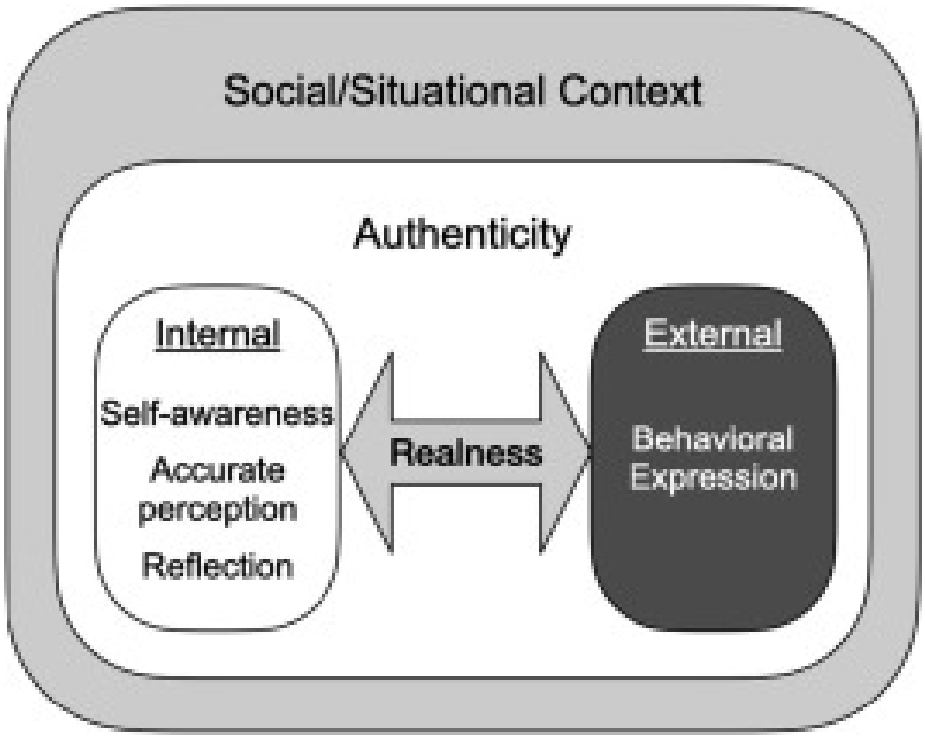
The definitions of authenticity in the literature emphasize a person's ability to "be himself", to "be faithful to himself", to experience harmony, etc., and are clearly vague and ambiguous. Some definitions are based on the concept of authenticity used in existential philosophy and later in humanistic (Carl Rogers, A. Maslow, and others) and existential psychology. According to the existential approach, it is assumed that an individual is endowed with a desire to realize his authenticity, identified with his true nature, and the extent to which an individual succeeds in achieving this authenticity determines his personal maturity.

Despite all the differences in the descriptions of the concept of authenticity and the ambiguity of its existing interpretations, its understanding as an integral characteristic of personality, related to its integrity, remains.

A direct or indirect confirmation of this can be found in several studies. For example, Hopwood et al. (2021) tried to provide a more stringent framework for the dynamic and multifaceted concept of authenticity. To this end, the authors introduce the concept of realness, which can be translated into Russian as "truth" or "being real", into their description of the phenomenology of authenticity.

Authenticity is described as a complex construct comprising two dimensions—internal and external. The internal aspects of authenticity include psychological functions that support authentic behavior, such as self-awareness, accurate social perception, and the ability to reflect. The external dimension of authenticity is described through its behavioral manifestations, which reflect the variability of authenticity in social situations. These two dimensions of authenticity are complemented by the authors' concept of Realness, which serves as a link between its internal and external aspects (Figure 1). Realness is considered by the authors as a key ("core") feature of individual differences in authenticity; it reflects the extent to which people behave in accordance with what they think and feel; in this case, as the authors write, they are "real". Realness is a relatively stable tendency to act and behave in accordance with one's inner feelings, without regard for possible personal and social consequences, and is considered a key ("core") characteristic of individual differences in authenticity. Realness reflects a certain level of psychological maturity of an individual and is associated with indicators such as well-being, mental health and satisfying relationships.

Figure 1
Realness as the core of authenticity (Hopwood et al., 2021, p. 2)



The theoretical description of realness as a central component of authenticity was empirically verified in a series of empirical studies by the authors, confirming a number of their hypothetical propositions. The authors note that they successfully verified the concept of realness in their empirical studies (Hopwood et al., 2021).

The conceptual model of authenticity, with its central, unifying component of realness, in our view, is consistent with our interpretation of authenticity as a form of link between internal psychological structures of personality, the "consolidation" of personality.

The next step in developing an approach to understanding the personal integrity is to find a solution to the question of what mechanisms constitute the "consolidation" of personality into identity and authenticity.

Meaning-Related Associations as the Basis for the Formation of Identity and Authenticity

The results of our empirical studies suggest that meaning-related associations underlie personal integrity and the formation and maintenance of identity and authenticity.

The subject of some of our studies focused on the goal-based and situational determinants of human activity, immediate and distant goals, the meaning of life, the position of life and authenticity. These research findings have led to an understanding of meaning-related associations as the basis of personal integrity.

The origins of this research were associated with the development of problems in the goal-based regulation of behavior, within which activity tasks, life goals, and meanings were correlated with the contexts of human life (Grishina, 2023).

Further research into the goal-based regulation of behavior and the contextual nature of goals (N=350) confirmed the contextual nature of goals and that the presence or absence of important life goals and the degree of goal determination become significant, system-forming factors determining a person's relationships with the outside world (Grishina et al., 2023).

The results of this study determined the focus of further research aimed at identifying the connections between the goal-based regulation of human activity and its meaning-related parameters.

In a study conducted under our supervision, Z. Zhou tested the hypothesis of the relationship between goals and meaning in life. Participants included individuals from Russian and Chinese cultures (143 and 150 subjects, respectively). For Russian participants, meaning in life was associated with the importance of life goals and the ability to achieve them, while for Chinese participants, it was associated with a willingness to make changes to achieve goals, life satisfaction, as well as a focus on family and traditional values and closeness to the parent family. In view of these differences, the main result of the study

was the confirmation of the primary hypothesis on the contextual nature of goals and their relationship to meaning in life (Zhou, 2024).

The next step in our research was to test the hypothesis of meaning-related associations between individuals' immediate and distant goals, their daily activities and life plans, their position in life, and authenticity (realness) (study by M. V. Viklein). A total of 110 subjects participated in the study. The results showed that authenticity is closely related to the meaningfulness of life ($R = 0.432$; $p < 0.01$). Higher authenticity scores were also associated with a more active life position and a sense of harmony in life. The realization of future goals in the daily activities of individuals gives them a sense of meaning in their lives. The higher the level of goal-setting, the greater harmony in life, the higher the meaningfulness of life, and the greater the ability to be oneself as manifestations of authenticity (Viklein, 2024; Viklein, Grishina, 2024). The study of authenticity was continued by E. V. Mokhova (n = 102), whose results showed the close relationship between authenticity and psychological well-being indicators, particularly general psychological well-being (0.461*) and autonomy as a manifestation of independence of thought and behavior (0.485*) (Mokhova, 2025).

The results of these studies allowed us to clarify the concept of authenticity and its relationship with integral parameters of personality description, such as meaningfulness in life, life position, and life goals. While they do not fully support the hypothesis of meaning-related associations as the basis for the formation of identity and authenticity, they do allow us to consider this hypothesis plausible. This suggests that the threat to personal integrity, their identity, and authenticity lies in the destruction of meaning-related associations. Consequently, the protection and strengthening of integrity lies in the strengthening of these meaning-related associations.

Discussion

Integrity is a fundamental characteristic of personality and attracts the attention of new researchers. The principle of integrity, not only in understanding personality but also in its study, is generally recognized in psychological science. Nevertheless, and considering the idea of a holistic approach formulated in psychology a long time ago, the description of the nature of integrity is far from complete.

Initially, within the framework of the dispositional paradigm, which dominated psychology for decades with its emphasis on personality traits, the search for research solutions focused on describing integrity as the coherence of personality characteristics. This approach is a feature of many studies in psychology and interest in this approach has not diminished.

However, in this respect, it is appropriate to recall L.I. Antsyferova's statement on the inadmissibility of solutions based on "mechanism in personality research

through identification of different characteristics and subsequent research into their interrelationships" (Antsyferova, 2006, p. 230). In her work, the scientist contrasts this with the system-based approach developed in Russian psychology.

In modern personality psychology, with its increasing emphasis on a process-dynamic understanding of personality, integrity is regarded as a dynamic entity, the result of the coordination of variability and stabilization processes.

Integrity is a systemic characteristic of personality. However, integrity (like the processes of variability and stabilization) relates to the properties of any system; therefore, integrity itself has no psychological content.

The research task is to find a way to describe personal integrity within the framework of the logic of a system-based approach that reflects its systemic nature.

Works of prominent methodologists in the field of personality psychology such as K. Lewin (2001) and L.I. Antsyferova (2006) allow partial analysis of integrity and require the selection of descriptive units that can be studied but reflect the nature of integrity.

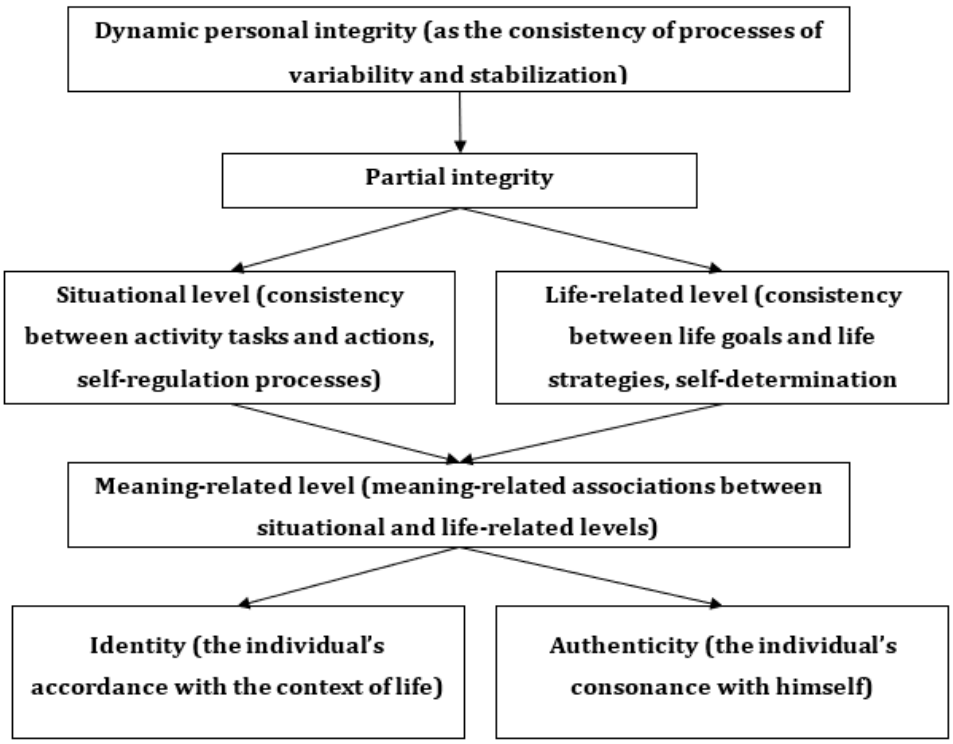
In the framework proposed for describing integrity, these units are described as partial types of integrity in human life. This approach to studying integrity aligns with the principle of the contextual nature of personal phenomenology, recognized in contemporary personality psychology. Personality integrity is most clearly manifested in its activity, behavior, and performance, which require "unity of action" and the coherence of its various components. According to the distinction between situational and life contexts, integrity at the level of habitual activity in the situational context (the unit of description of which is the activity situation) is ensured by self-regulation processes, while at the level of the life context (including life situations, life goals, and plans) it is ensured by self-determination processes. As noted above, these processes ensure the effectiveness of human activity as a subject of activity and a subject of life.

These partial types of integrity, however, do not yet constitute personal integrity. Personal integrity is associated with the coherence of different levels of life activity, situational and life contexts. The highest "coordinating center" is the value-meaning system, which provides the foundation and direction for various types of human activity.

Another key thesis of the approach we present to describing personal integrity is that identity and authenticity are considered psychological phenomena that manifest personal integrity. These phenomena are exactly what defines the holistic nature of personality, its "consolidation".

These ideas form the basis for our conceptual model of personal integrity (Figure 2).

Figure 2
Hypothetical conceptual model of personal integrity



The eventfulness of life, a sense of its meaningful realization, is achieved by an individual in result of the alignment of daily activities with individual life goals and the realization of these life goals and plans in everyday life.

The advantages of the proposed model, in our view, lie in the justification of the study of integrity in accordance with the contexts of human life, in the connection of the phenomenon of integrity with the phenomenology of identity and authenticity, in the possibility to take into account the meaning foundations of human life through the coherence of the activity of situational and life contexts, by "adapting" daily activities to individual life plans and objectives.

This model is a hypothetical model that serves a heuristic function and identifies ways forward for further research, in particular for the search for methodological solutions and the development of methodical tools to study the coherence of human activity in different contexts.

Conclusions

One of the major trends in modern reality changes is the increase in its complexity, associated with the growing diversity and differentiation of reality, with the multiplicity of the worlds of human existence, which poses a challenge to the individual's ability to maintain integrity.

Personal integrity is a systemic property that reflects the individual's ability to ensure coherence of the components, "consolidation" of personality, in the context of the differentiation of individual inner world and living space.

On the basis of the methodological justification of the possibility of identifying partial manifestations of integrity, it is proposed that the principle of context – the description of integrity in different contexts of human life – be considered as a criterion for its distinction.

Personal integrity is ensured by the action of integrative mechanisms—the processes of self-regulation in the situational context of habitual activity and the processes of self-determination in the context of life. Integrity is one of the ultimate integral characteristics of personality; the coherence of various levels of activity is guaranteed by the value-meaning regulation, which is the highest level of regulation.

We propose to consider identity and authenticity, the unifying foundation of which are meanings, as psychological forms of manifestation of personality integrity and its "consolidation".

The proposed conceptual model of integrity based on theoretical and empirical research enables us to define the prospects for the development of methodological tools for the study of human integrity in various contexts of life.

The aim of our ongoing work is to provide a theoretical and empirical basis for the phenomenon of personality integrity and its ability to cope with challenges of the complexity of modern life.

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Author Details

Natalia V. Grishina – Dr. Sci. (Psychology), Professor, Department of Personality Psychology, St. Petersburg State University, St. Petersburg, Russian Federation. Research ID F-8228-2015; SPIN 3225-0645; RSCI Author ID: 304269; ORCID ID: https://orcid.org/0000-0001-6763-7389; e-mail n.v.grishina@spbu.ru

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Leadership Qualities of Females Entering Male-Dominated Occupations in Educational Institutions of the Federal Penitentiary Service of Russia

Tatiana P. Skripkina[1*], Natalia M. Martynova[2]

[1] Research Institute of the Federal Penitentiary Service of Russia, Moscow, Russian Federation
[2] The Academy of the FPS of Russia, Ryazan, Russian Federation

[*]Corresponding author: skripkinaurao@mail.ru

Abstract

Introduction. In the process of training management personnel, the development of leadership qualities and in particular the study of gender differences in leadership styles are particularly relevant. The importance of this issue is reinforced by official statistics, which show that women are increasingly represented in traditionally male-dominated occupations. This category includes women working in law enforcement agencies and the Federal Penitentiary Service. **Methods.** The assessment instruments applied to a comparative study of leadership qualities in young men and women studying at educational institutions of the Federal Penitentiary Service were as follows: (a) the questionnaire developed by us to assess cadets' knowledge of leadership characteristics, (b) the Leadership Skills Inventory, (c) the Leadership Self-Assessment Short-Form Survey, (d) the Communication and Organizational Skills Inventory (COS-2), (e) the Management Orientations Inventory, (f) the Cattell 16 PF Questionnaire (Form A), (g) the California Psychological Inventory, and (h) the Self-Management Ability Inventory. The Mann-Whitney U-test was used in data processing. **Results.** In total, 661 participants (365 males

and 296 females, aged 18 to 23) took part in the study. Differences were found between male and female students in their perception of the importance of each of the personality traits examined, as well as the most important qualities of an ideal leader. Female students rated their leadership qualities lower than male students, which is accompanied by a more critical attitude towards themselves. Female students were also more sensitive, diplomatic, careful, conventional, and prone to suppressing their feelings than male students. **Discussion.** The findings on personality differences between male and female students correlate with previous studies on leadership styles, which suggests that female students are more oriented towards emotional and communicative styles, while male students are more oriented towards transactional and authoritative styles. The findings suggesting a lack of gender specificity in the cadet self-governance system are likely related to the specific nature of education at a departmental university and, according to Russian authors, are due to the age-specific nature of student populations. **Conclusion.** For the first time, data have been obtained that reflect the need to develop leadership skills among FPS cadets. In this process, it is important to consider gender specificities and focus on the development of different qualities among young men and women.

Keywords

leadership, leadership qualities, self-assessment of leadership qualities, ideal leader, gender characteristics of leadership

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Introduction

The development of leadership qualities is becoming increasingly important for students at Russian universities, including cadets at educational institutions of the Federal Penitentiary Service of Russia. For the latter, this task aligns with the requirements of the Concept for the Development of the Penitentiary System until 2030 (RF Government Order No. 1138r of April 29, 2021, On Approving the Concept for the Development of the Penitentiary System of the Russian Federation until 2030), which mandates the implementation of measures to train highly qualified personnel within the penitentiary system. The demands placed on its employees are increasing, aimed at creating a reserve of management personnel with well-developed leadership qualities and experience. Consequently, the purposeful development of leadership qualities in cadets and the development of technologies to

ensure the effectiveness of such work are particularly important during their training at educational institutions of the Federal Penitentiary Service of Russia.

Despite these requirements, however, gender differences in the process of training management personnel in educational institutions of the Federal Penitentiary Service of Russia are completely ignored. We should note that over the past 10 years gender characteristics of leadership have been actively studied in relation to feminist trends in society. Women are increasingly seeking leadership in business, economics, and politics, as well as in many other sectors. Women's representation in traditionally male-dominated occupations, such as pilots, the military, including those serving in war zones and law enforcement agencies, is growing. However, this trend has been slowed by the so-called 'glass ceiling' and 'sticky floor' effects—phenomena that refer to invisible barriers that prevent women from occupying management positions and advancing beyond entry-level positions (Isupova & Utkina, 2018; Shabsough et al., 2025).

For example, a study conducted by Deloitte found that the share of women among the leaders of the largest companies is only 6.5%. Specifically, it is noted that in the business sector, "according to expert estimates, the proportion of women is highest among the leaders of small companies with revenues of less than 800 million rubles, it decreases to 12% in large companies and to 6.5% in the 200 largest companies" (Golubosh, 2021, p. 15). The share of women CEOs varies significantly across different economic segments. It reaches its highest point in education, where women manage almost half of all companies (42%), and its lowest point is in the mining, public, and security sectors (up to 6%) (Gominyuk, 2025). In 2018, V. Utkina, together with sociologist O. Isupova, studied the status and role of women in government. They identified several reasons why women are underrepresented in Russian politics. The first is stereotypes about the division of responsibilities – women care, men manage. The second is the double or even triple workload, which leaves women little time for full participation in politics. The third is a combination of age- and gender-based discrimination—gender ageism. It makes it more difficult for women to find a job and advance in their careers (Isupova & Utkina, 2018).

Official statistics indicate that gender inequality persists in Russia, thus preserving a largely patriarchal society. However, it is worth noting that gender issues related to the study of female leaders are also extremely relevant in psychology worldwide. For example, a study by Pennsylvania authors found that male leaders were perceived to be less competent in solving work problems and working relationships, less suitable for their positions and less effective than female leaders when assessing their perception of mistakes in traditionally male-dominated occupations (Thoroughgood et al., 2013).

Traditionally male-dominated occupations primarily include executive authorities, such as penal institutions (PI) and military units. Psychologists from Serbia, Montenegro, and Bosnia and Herzegovina conducted a cross-cultural study of the gender distribution of police positions in all three countries, finding a similarity in that women are assigned to typically female positions (administrative, as well as positions in the penitentiary

department and the counteraction department) (Tomić & Mićović, 2025). The authors also note the previously mentioned 'sticky floor' phenomenon – the predominant representation of women in lower-level positions is dictated by gender discrimination, working conditions incompatible with family life, harassment, etc. (Tomić & Mićović, 2025). Clearly, service in the PI has its own unique characteristics, associated with considerable psychological and sometimes psychophysiological stress. It also involves meeting difficult demands. For penal system employees to be effective, they should possess certain traits, such as strictness, responsibility, honesty, high stress tolerance, endurance, and deep professional literacy. At the same time, researchers analyzing female labor in penal system organizations point to the need to employ females, but a rigid management style discourages women from working in this system (Magomedova & Ivanov, 2022; Tsvetkova & Kulakova, 2021). Furthermore, foreign researchers note the internal informal division between female and male positions as another obstacle to increasing the number of female managers in penal system organizations (Tomić & Mićović, 2025). Consequently, correctional institutions are currently underusing the strengths of female staff, which has a negative impact on the effectiveness of institutions.

Because the nature of law enforcement requires specific personality traits, only 1% of women who join the force advance and occupy leadership positions (Boldyreva, 2018). However, their work is crucial, as women often possess qualities such as perseverance, tolerance, the ability to build effective relationships, responsiveness, and attentiveness. These personality traits enable successful careers in many departments of the penal system. However, to fully realize the potential in this field, it is not enough to have only these qualities. Service in the system cannot be effective without developing leadership qualities, which are essential in all management and educational activities.

Social and legal psychology attaches great importance to leadership and its development. For example, B. Bass believes that leadership plays an important role, if not the most important, in industrial companies, educational and military institutions and social movements and is therefore an important research subject (Bass, 2009). R. M. Stogdill and C. L. Shartle believe that many people possess leadership potential, but that its development requires specific conditions: exposure to certain cultural values, free access to information, the ability to introspect, and the ability to identify outstanding personal qualities (Stogdill & Shartle, 1955). O. Onasanya defines leadership as "the ability to persuade people to do what is required, and, in organizations, the ability to get people to work voluntarily, without coercion" (Onasanya Opeyemi, 2022, p. 450). Key leadership skills include navigating complex and emergency situations, as well as strategic forecasting. With these skills, a leader can be adaptive and flexible, which, according to researchers, is the most favorable leadership style (Glomseth & Boe, 2025). However, not only managers should develop leadership skills.

Biks (2025) notes the need to develop leadership skills among employees to further delegate management functions and improve organizational performance. The author found that police effectiveness is directly related to the level of leadership skills among

employees. Police effectiveness is also influenced by the promotion of employees who demonstrate ethical leadership qualities (Modise, 2025), which are aimed at maintaining trusting and respectful interactions within the organization. However, the authors do not disaggregate their samples by gender, which is a significant limitation of their research.

We should emphasize that the communication and organizational skills of the FPS cadets are fundamental and universal personality traits that are essential for the development of their leadership potential. Consequently, research aimed at studying leadership qualities in female cadets, the purposeful development of leadership qualities in them, and the development of psychological conditions that ensure the effectiveness of such work are particularly important during their training at educational institutions of the Federal Penitentiary Service of Russia. Therefore, we conducted a study to examine gender differences in various aspects of leadership qualities between female and male cadets who have chosen a traditionally male-dominated occupation (the FPS).

Methods

The study used the following assessment instruments:

- The questionnaire developed by us to assess cadets' knowledge of leadership characteristics;
- The Leadership Skills Inventory by E. S. Zharikov and E. A. Krushelnitsky to assess the general level of development of leadership qualities (Ladanov & Urazaeva, 1987);
- The Leadership Self-Assessment Short-Form Survey to assess subjectively perceived leadership;
- The Communication and Organizational Skills Inventory (COS-2) to identify the two most important components of leadership – communication and organizational ones (Raigorodsky, 2007);
- The Management Orientations Inventory to assess the respondents' orientation towards a task or team (Santalainen et al., 1988);
- The Cattell 16 PF Questionnaire (Form A), (Kapustina, 2004) to examine cadets' personality traits;
- The California Psychological Inventory to assess the socio-psychological characteristics of personality (Petrov & Smetanina, 2010);
- The Self-Management Ability Inventory to assess the ability to maintain self-control in various situations (Peysakhov & Gabdreeva, 1988).

Statistical data processing was performed using the Mann-Whitney U-test to compare two independent samples.

Results

The study was conducted at educational institutions of the Federal Penitentiary Service of Russia (the Federal Penitentiary Service Academy in Ryazan and the Vladimir Law Institute of the Federal Penitentiary Service of Russia). In total, 661 participants (365 males and 296 females, aged 18 to 23) took part in the study.

Initially, we used the questionnaire developed by us, which enabled us to clarify the students' perceptions of leadership, leadership competencies, and their readiness to assume a leadership role. The majority of respondents from both gender groups demonstrated a sufficient level of knowledge about the phenomenon of leadership and its importance for the personal and professional development of employees in penal institutions. Cadets are aware of the specificities of organizational work, have sufficient expertise in interpersonal relations and have a clear understanding of how to act in conflict situations.

Their own readiness to become a leader within the cadet group can be described as 'rather partial' (M_x = 2.45 in the male sample and lower, M_x = 2.24 in the female sample). As can be seen from the average values, male cadets exhibit a greater readiness to assume leadership roles than female cadets. A comparison of gender groups revealed that male cadets rated their interpersonal competence ($p < 0.001$), their knowledge of leadership and its importance for penal system employees ($p < 0.01$), their knowledge of organizational activities and conflict management ($p < 0.05$), and their readiness to assume leadership and unit management roles ($p < 0.001$). Cadets in each group also demonstrated a similarly moderate interest in developing their leadership qualities.

In the first stage of our empirical study, we examined the perceptions of leadership in male and female cadets using a psychosemantic approach. To explore leadership image, participants were asked to first write a list of leadership qualities and then rank them by importance. A total of 36 frequently cited qualities were selected from the list. These qualities were then ranked on a five-point scale. Female cadets demonstrated a more demanding attitude towards the leader: the average ratings of the importance of all the proposed qualities in the female sample were higher than in the male sample (Table 1).

According to the females, the most important qualities of a leader are as follows:

- "lack of aggression" (M_x = 4.64),
- "responsibility" (M_x = 4.51),
- "emotional stability" (M_x = 4.47),
- "psychological stability" (M_x = 4.44),
- "communication and organizational skills" (M_x = 4.43),
- "attentiveness" (M_x = 4.41).

For males, the list of the most important leadership qualities was generally the same, but there were some differences:

- "responsibility" (M_x = 4.31),
- "psychological stability" (M_x = 4.24),
- "emotional stability" (M_x = 4.20),
- "discipline" (M_x = 4.19),
- "reliability" (M_x = 4.19).

As can be seen from the resulting lists, female cadets' perceptions rely more on the fulfillment of leadership tasks (M_x = 3.69 in the female sample and M_x = 3.45 in the male sample) and high self-esteem (M_x = 3.20 in the male sample and M_x = 3.44 in the female sample).

We compared the mean scores for the importance of leadership qualities assessed by young men and women. Table 1 presents our findings.

Table 1

Mean scores for the importance of leadership qualities in the samples of male and female cadets

What qualities do you think a leader should have?	M	F	U	p
Lack of aggression	4.39	4.64	44862.5	0.00000276
Wariness	3.96	3.99	53816	0.92927404
Discipline	4.19	4.35	50564.5	0.09554134
Psychological stability	4.24	4.44	49648	0.02682350
Cheerfulness	3.61	3.77	50611	0.14737352
Sincerity	3.64	3.89	47746	0.00743620
Reliability	4.19	4.35	50529.5	0.09186130
Attentiveness	4.18	4.41	48803.5	0.01174094
Responsibility	4.31	4.51	49558.5	0.01842154
Sensitivity	4.00	4.22	49089	0.02745464
Defending one's opinion	3.89	4.10	49190.5	0.03445016
High level of self-esteem	3.20	3.44	48310.5	0.01644438
Need for achievement	3.58	3.89	46734	0.00191618
High level of aspirations in life	3.45	3.69	48219.5	0.01431170
Emotional stability	4.20	4.47	47704	0.00156725
Prognostic abilities	3.87	4.10	48493.5	0.01581564

What qualities do you think a leader should have?	M	F	U	p
Independent goal setting and planning	3.96	4.25	47381	0.00304622
Communicative competence	4.05	4.33	47110.5	0.00138422
Communication and organizational skills	4.09	4.43	45300.5	0.00003133
Proactive attitude	3.92	4.23	46778	0.00123777
Rationalism	3.77	3.98	49356.5	0.04417686
Determination	4.16	4.30	51050	0.15959219
Self-control	4.14	4.36	48966.5	0.01667183
Independence	4.04	4.28	48922.5	0.01995557
Strong will	4.03	4.26	48677	0.01512995
Hard work	4.02	4.25	48300.5	0.00969502
Self-confidence	4.12	4.28	50156	0.07369249
Courage	4.04	4.19	50886	0.16056986
Honesty	4.01	4.24	48556	0.01383516
Initiative	3.96	4.18	48547	0.01543714
Resourcefulness	4.01	4.25	47883	0.00583411
Bravery	4.08	4.16	53290	0.74035961
Developing a strategy for achieving goals and developing cadet activity	4.06	4.26	49396.5	0.03462762
Unifying students for conscientious academic and daily activities	4.06	4.28	48865.5	0.01819576
Motivating the cadet team to achieve a common goal	4.10	4.27	50668.5	0.11988999
Successful completion of assigned tasks	4.16	4.33	50350	0.08350286

Statistical analysis showed that girls gave higher ratings to those qualities in which differences were found at high ($p < 0.001$), medium ($p < 0.01$), and low ($p < 0.05$) significance levels. The results showed that girls attached higher importance to most of the leadership qualities proposed for assessment. Significant differences were found in the significance of 26 positions out of 36 proposed. At the highest level of significance ($p < 0.001$), differences were found in such leadership characteristics as "lack of aggression" and "communication and organizational skills"; at the medium level of significance ($p < 0.01$) – "sincerity", "need for achievement", "emotional stability", "independent goal setting and planning", "communicative competence", "proactive attitude", "hard work", and "resourcefulness". Additionally, we should note that female cadets rated the qualities that directly describe leadership in a cadet group significantly higher ($p < 0.05$), including "developing a strategy for achieving goals and developing cadet activity" and "unifying students for conscientious academic and daily activities".

In the next stage of the study, respondents were asked to rate the presence/absence of these leadership qualities in themselves. In their self-assessment of leadership qualities, female cadets demonstrated a more critical attitude towards themselves. For most of the proposed attributes (26 out of 36), the average ratings in the female sample were lower than in the male sample. A comparative analysis of the subjective assessments of leadership qualities by male and female cadets was then conducted (Table 2).

Table 2

Female and male cadets' self-assessments of leadership qualities

What personality traits do you think you have?	M	F	U	p
Lack of aggression	0.83	0.93	48642	0.00010524
Wariness	0.68	0.54	46333.5	0.00018643
Discipline	0.82	0.86	52213	0.24432144
Psychological stability	0.81	0.73	49632	0.01302402
Cheerfulness	0.62	0.68	51116	0.15104547
Sincerity	0.63	0.74	48058	0.00246133
Reliability	0.78	0.72	51043	0.10245345
Attentiveness	0.65	0.70	51432	0.19095430
Responsibility	0.82	0.86	51586.5	0.11965137
Sensitivity	0.66	0.74	49868.5	0.03260178

What personality traits do you think you have?	M	F	U	p
Defending one's opinion	0.63	0.59	51952	0.31481396
High level of self-esteem	0.31	0.29	52660.5	0.48354163
Need for achievement	0.52	0.41	48461	0.00843638
High level of aspirations in life	0.32	0.28	52330	0.38375241
Emotional stability	0.72	0.55	45139.5	0.00001193
Prognostic abilities	0.49	0.36	46873	0.00064352
Independent goal setting and planning	0.48	0.47	53635.5	0.85567893
Communicative competence	0.53	0.49	52066.5	0.35553964
Communication and organizational skills	0.45	0.44	53359.5	0.75368865
Proactive attitude	0.48	0.48	53887	0.94999424
Rationalism	0.52	0.46	50685.5	0.11474963
Determination	0.62	0.57	51380	0.20360244
Self-control	0.71	0.64	50180.5	0.05205694
Independence	0.67	0.69	52902	0.57173785
Strong will	0.54	0.41	46912	0.00076578
Hard work	0.62	0.58	51779.5	0.27943799
Self-confidence	0.64	0.54	48257.5	0.00548628
Courage	0.60	0.36	41318	0.00000000
Honesty	0.70	0.73	52488	0.42282015

What personality traits do you think you have?	M	F	U	p
Initiative	0.52	0.42	48643.5	0.01086110
Resourcefulness	0.59	0.48	48001.5	0.00426656
Bravery	0.68	0.28	32281	0.00000000
Developing a strategy for achieving goals and developing cadet activity	0.51	0.32	43795	0.00000098
Unifying students for conscientious academic and daily activities	0.49	0.34	45630	0.00005942
Motivating the cadet team to achieve a common goal	0.52	0.36	45097	0.00002216
Successful completion of assigned tasks	0.68	0.62	50565.5	0.08605100

The following qualities, essential for a leader, were identified by the female cadets as the most developed: "lack of aggression" ($M_x = 0.93$), "responsibility" ($M_x = 0.86$), "discipline" ($M_x = 0.86$), "sincerity" ($M_x = 0.74$), "sensitivity" ($M_x = 0.74$), "psychological stability" ($M_x = 0.73$), "honesty" (Mx = 0.73), and "reliability" ($M_x = 0.72$). The least characteristic for girls, in their opinion, are "bravery" ($M_x = 0.28$), "high level of aspirations in life" ($M_x = 0.28$), "high level of self-esteem" ($M_x = 0.29$), "developing a strategy for achieving goals and developing cadet activity" ($M_x = 0.32$), "unifying students for conscientious academic and daily

activities" (M_x = 0.34). In the group of male cadets, the most pronounced characteristics were "lack of aggression" (M_x = 0.83), "discipline" (M_x = 0.82), "responsibility" (M_x = 0.82), "psychological stability" (M_x = 0.81), "reliability" (M_x = 0.78), "emotional stability" (M_x = 0.72), and "self-control" (M_x = 0.71). The lowest ratings were given to such characteristics as "high level of self-esteem" (Mx = 0.31) and "high level of aspirations in life" (M_x = 0.32). We should note that, although the "lack of aggression" indicator ranks first among both males and females, this indicator is significantly lower among females.

As Table 2 shows, in contrast to their overall assessment of leader image, male cadets demonstrate a more positive and loyal self-image when assessing their own leadership qualities. Thus, according to the results of a significance test, female cadets significantly higher rated themselves as possessing leadership qualities such as "lack of aggressiveness" ($p < 0.001$) and "sincerity" ($p < 0.01$). Males significantly higher evaluated their "wariness" ($p < 0.001$), "need for achievement" ($p < 0.01$), "emotional stability" ($p < 0.001$), "prognostic abilities" ($p < 0.001$), "strong will" ($p < 0.001$), "self-confidence" ($p < 0.01$), "courage" ($p < 0.001$), "resourcefulness" ($p < 0.01$), "bravery" ($p < 0.001$), "developing a strategy for achieving goals and developing cadet activity" ($p < 0.001$), "unifying students for conscientious academic and daily activities" ($p < 0.001$), "motivating the cadet team to achieve a common goal" ($p < 0.001$).

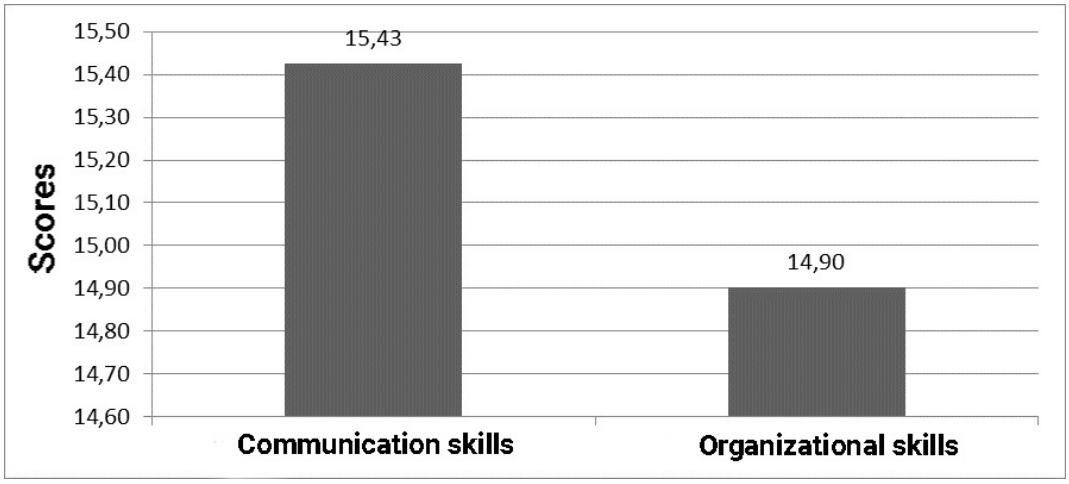
A comparison of the leader's image and the self-image shows that, in general, the various components of these images have a relatively high percentage of congruence among the cadets (M_x = 86.12). Moreover, we should note that the degree of congruence is significantly higher in the male sample (M_x = 89.76 for males and M_x = 81.63 for females; $p < 0.05$). Thus, young men have a higher and more positive self-assessment as a leader, while young women place higher demands on both themselves and their leader.

The assessment of cadets' leadership qualities using the Leadership Skills Inventory, and the Leadership Self-Assessment Short-Form Survey showed that cadets from both groups self-assessed their leadership skills at a high level. However, according to the results of these instruments, it was also higher for male cadets than for female cadets (M_x = 7.80 in the male sample and 7.15 in the female sample). Their assessment of their leadership ability indicated a moderate level of leadership qualities (M_x = 29.70 in the male group and M_x = 27.91 in the female group). Moreover, both indicators were significantly higher in the male sample ($p < 0.001$). Overall, cadets have well-developed leadership qualities and have sufficient potential to improve those qualities and become effective leaders.

The assessment of the communication and organizational skills of male and female cadets revealed a high level of development. The mean score for the communication skills scale in the male sample was 15.78, while in the female sample it was 14.99. The mean score for the organizational skills scale was M_x = 15.07 in the male group and M_x = 14.70 in the female group. A comparative analysis confirmed a significantly higher level of communication skills in males ($p < 0.01$).

Figure 3

Mean scores for communication and organizational skills in cadets of educational institutions of the Federal Penitentiary Service of Russia



Testing of the significance of differences between males and females revealed that males had higher scores for the communication skills scale (U = 47224; p < 0.01). No significant differences were found in organizational skills.

The assessment of the leadership orientations of cadets at the Federal Penitentiary Service of Russia revealed no significant differences between males and females, and demonstrated a dominant task orientation in both groups (M_x = 17.19 for males, M_x = 17.56 for females).

The assessment of personality predictors of leadership development revealed that male cadets are characterized by a more pronounced competitive effort and a tendency to authoritarian behavior. Female cadets are more emotional and sensitive and tend to suppress their feelings (Table 3).

Table 3

Comparison of personality predictors of leadership qualities in male and female cadets

Socio-psychological characteristics of personality	Means		U	p
	M	F		
Dominance (Do)	61,98	59,45	47220,5	0,00519700
Responsibility (Re)	60,59	63,36	46012,5	0,00101200

Socio-psychological characteristics of personality	Means		U	p
	M	F		
Socialization (So)	65,93	68,38	47085	0,00442500
Self-control (Sc)	55,92	58,28	49219,5	0,04885100
Commonness (Cm)	72,63	74,46	49214	0,04850600
Femininity/masculinity (F/m)	41,24	49,15	27278	0,00000000

According to the results presented in Table 3, females scored significantly higher on responsibility ($U = 46{,}012.5$; $p < 0.01$), socialization ($U = 47085$; $p < 0.01$), self-control ($U = 47219.5$; $p < 0.05$), commonness ($U = 49214$; $p < 0.05$), and femininity ($U = 27278$; $p < 0.001$). Males, on the other hand, scored higher on dominance ($U = 47.220.5$; $p < 0.01$). Males showed a more pronounced competitive effort, a more persistent pursuit of power, and were more likely to express and defend their own opinions. Female cadets were characterized by a higher level of self-organization, discipline, a desire to follow rules, and control their emotions and behavior. However, they were also characterized by greater sensitivity to criticism.

The next stage of the empirical study involved a comparative analysis of the development of personality traits between female and male cadets using the Cattell 16 PF Questionnaire (Form A). Table 4 shows the results.

Personality traits	Means		U	p
	M	F		
A (Warmth)	12,01	12,86	45142,5	0,00025900
B (Reasoning)	7,62	8,07	48957	0,03694900

Personality traits	Means		U	p
	M	F		
E (Dominance)	13,61	13,35	48891,5	0,03351100
F (Liveliness)	13,88	13,17	47493,5	0,00714500
I (Sensitivity)	9,37	11,97	28444,5	0,00000000
L (Vigilance)	10,02	9,26	46061,5	0,00104400
N (Privateness)	11,33	12,18	43631,5	0,00001900

The results showed significant differences in personality traits between male and female cadets for the following parameters: Female cadets were characterized by higher scores on Warmth ($U = 45142.5$; $p < 0.001$), Reasoning ($U = 48957$; $p < 0.05$), sensitivity ($U = 28444.5$; $p < 0.001$), and Privateness ($U = 43631.5$; $p < 0.001$). Males, in turn, demonstrated greater dominance ($U = 48891.5$; $p < 0.05$), Liveliness ($U = 47493.5$; $p < 0.01$), and Vigilance ($U = 46061.5$; $p < 0.01$).

In the next stage of the empirical study, we examined self-management ability using The Self-Management Ability Inventory. A comparison of the male and female cadet samples using the Mann-Whitney U test revealed no significant differences in self-management ability. Therefore, the self-management system of the FPS cadets has no pronounced gender specificity and is characterized by a slightly lower overall level of development. Planning and correction are the most difficult stages of self-management for both male and female cadets.

Discussion

According to the results obtained, the cadets in both groups distinguish between the roles of manager and leader and show a greater willingness to serve as unit manager instead of leader during their service. Obviously, the role of the team leader is perceived by cadets as more complex and challenging, as it is not based on formal functions or

authority, but rather a form of social activity within a group and only emerges through the practical application of various aspects of group activity. Using a psychosemantic approach to assess the image of a leader among young men and women, we have shown that women give greater importance to most leadership qualities than men. In self-evaluating their leadership qualities, female cadets demonstrated a more critical attitude towards themselves.

Overall, the data obtained showed that female cadets were more extroverted, sensitive, compassionate, more sophisticated and perceptive in social interactions, and with a higher level of verbal culture. Young men have a greater need for self-affirmation and independence; they are more stubborn and assertive, expressive and impulsive, but also show greater wariness and suspicion of others. This generally corresponds to gender-role stereotypes of leadership: Females are more emotional and communicative, while males value business and organizational skills more (Ayman & Korabik, 2010). This also aligns with Del Giudice's (2015) findings on differences between women and men in traits such as extroversion, conscientiousness, agreeableness, openness, and neuroticism. Goryachkina (2015), on the other hand, believes that the manifestation of leadership qualities is determined, rather than by the gender of a person, but by the level of development of male and female characteristics, which in turn determine the development of different personality traits but do not inhibit the development of leadership qualities. In fact, our data confirm this conclusion.

The study of the communication and organizational skills of male and female cadets revealed a high level of their development. Cadets of both genders feel quite comfortable in new environments, quickly establish contacts and seek to expand their circle of acquaintances, and are willing to help others and take responsibility for decisions in difficult situations. In this case, a high level of these qualities was also observed among male cadets. When assuming management, the cadets concentrate more on the effectiveness of the group's activities, high working speed, and the achievement of the highest possible performance indicators, etc. The issues of team members' freedom of action, their ideas, initiatives and critical comments are of little importance to them and are not the focus of management attention, which is consistent with the specificities of service in the penal system.

The study of personality predictors of leadership qualities revealed that, while cadets of both genders share similar personality traits (sociability, emotional stability, dominance, calmness, and courage), male cadets are characterized by a more pronounced competitive spirit, rationality, expansion, and an authoritarian tendency. Female cadets, on the other hand, are more sensitive, diplomatic, careful, conventional, and prone to suppressing their feelings. This is consistent with the results of the study by Tazhutdinova (2019), which indicates that male and female characteristics as personality traits affect the focus of a leader's activities and the choice of means by which they maintain their leadership position.

We attribute the lack of gender-specific characteristics of the FPS cadet self-government system both to the age-related psychological characteristics of adolescence and to the lack of development of these qualities in cadets who acquire only professional knowledge and lack sufficient experience and professional skills. They have difficulty planning the means to achieve the goals and the sequence of their application, as well as adjusting their actual actions, behaviors and the self-government system itself. We believe that this may also be due to the specific nature of education in a departmental university (a strict schedule, the need to comply with orders, clearly defined requirements for cadets and their behavior, etc.). Similar results have previously been obtained by T. A. Trifonova, who found that the qualitative differences in gender characteristics of the voluntary component of self-concept in young men and women between the ages of 17 and 25 are insignificant, which, according to the researcher, is due specifically to age characteristics (Trifonova, 2004). M. Z. Gadzhidadaev and his co-authors argue that self-management abilities are mainly associated with individual characteristics rather than gender. The authors found that students with pronounced leadership qualities demonstrate a high level of development of this ability (Gadzhidadaev et al., 2021). Data obtained from a sample of cadets at educational institutions of the Ministry of Internal Affairs of Russia also indicate the low significance of gender in the development of personal self-management. M. S. Korotaeva found that the ability to exert volitional control positively correlates with academic and professional motivation. Students who focus on achieving success in their studies and professional tasks demonstrate the highest level of personal self-management (Korotaeva, 2020). V. I. Morosanova and V. N. Krasnikov emphasize the significant role of regulatory personality traits (independence, flexibility, determination) in the development of self-management (Morosanova & Krasnikov, 2012). M. A. Pakhmutova focuses on the relationship between self-organization and self-management with integral personality features (results-oriented, proactive, flexible, etc.) (Pakhmutova, 2018). Cadets' self-organization skills are probably underdeveloped due to the strict schedule imposed by the specific nature of training in the FPS system.

A limitation of the study is its limited scope. Our respondents were cadets of the Federal Penitentiary Service educational institutions, where service training is generally characterized by the cultivation of traditional masculine characteristics in future cadets.

Conclusion

Overall, the study allowed us to draw several conclusions. First, there were significant differences between female and male students in both their perception of the importance of individual leadership qualities and their perception of the essential qualities of an ideal leader. Secondly, female cadets' self-assessment of their leadership qualities was significantly lower than that of male cadets. This may be due to the traditionally masculine nature of their profession, where the image of a leader is portrayed as a hard, principled, and authoritarian individual.

Male cadets rated their interpersonal competence, their knowledge of leadership and its importance for penal enforcement system, their knowledge of organizational activities and conflict management higher; they also demonstrated a higher level of readiness to assume leadership roles and unit management. However, female cadets showed a more demanding attitude to leadership. Female cadets were more oriented towards an emotional and communicative leadership style, while male cadets preferred a more transactional and authoritarian style. Female cadets demonstrated a higher level of self-organization, discipline, and a desire to follow rules and control their emotions and behavior. However, they also demonstrated greater sensitivity to criticism.

The study, which was the first to achieve results, demonstrates the need for development work to enhance leadership qualities among FPS cadets. However, we should emphasize that different qualities should be cultivated in male and female cadets. Key targets for psychological and pedagogical work to develop leadership qualities in female cadets include "emotional stability", "communication and organizational skills", "initiative", "motivating the cadet team to achieve a common goal", "courage", and "bravery". For male cadets, these qualities include "communication and organizational skills" "initiative", "developing a strategy for achieving goals and developing cadet activity", "unifying students for conscientious academic and daily activities", and "motivating the cadet team to achieve a common goal". These qualities are characterized by the greatest degree of discrepancy between the ideal leader and the actual leader. In other words, in the perceptions of the cadets, they are quite important for a leader, but they are characterized by a low level of development.

Consequently, the study revealed differences in various aspects of leadership abilities and qualities between young men and women studying in the Federal Penitentiary Service educational institutions and identified those that need development and correction. The study also demonstrated that the development and correction of leadership qualities in young men and women requires a differentiated approach that takes into account the gender characteristics of their development.

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Author Contribution

Tatiana P. Skripkina developed theoretical foundations and methodical instruments for the study, analyzed and interpreted the data, prepared, revised and edited the manuscript.

Natalia M. Martynova collected the data and prepared statistical data.

Author Details

Tatiana P. Skripkina – Dr. Sci. (Psychology), Professor, Chief Scientist; Research Institute of the Federal Penitentiary Service of Russia, Moscow, Russian Federation; RSCI SPIN: 2566-4808, Scopus ID: 57221202571, Web of Science Researcher ID: AAB-6363-2022, RSCI Author ID: 67186405; E-mail: skripkinaurao@mail.ru

Natalia M. Martynova – Cand. Sci. (Psychology), Senior Lecturer, Department of Psychology of Professional Activity, Faculty of Psychology and Probation; The Academy of the FPS of Russia, Ryazan, Russian Federation; RSCI AuthorID: 1061385; RSCI SPIN: 2493-3490; E-mail: m4rt.natal@yandex.ru

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The Impact of a Child's Sibling Position on Speech Fluency in 5- to 6-Year-Old Children

Ekaterina Oshchepkova*, Arina Shatskaya, Alexander Veraksa, Margarita Aslanova, Elena Chichinina

Lomonosov Moscow State University, Moscow, Russian Federation

*Corresponding author: Oshchepkova_es@iling-ran.ru

Abstract

Introduction. The study examined the relationships between a child's sibling position and language development (based on active vocabulary volume and narratives' production). **Methods.** Six hundred seventy-four preschoolers (M = 70.2 months, SD = 4.01, 50.7% boys) from Moscow, Kazan, and Sochi (Russia) participated in the study. The children's parents filled out a form about the child's age, sex, and sibling position. Children were asked to create a story based on a series of pictures and were tested on their active vocabulary using a verbal fluency test and Raven's matrix test on nonverbal intelligence. We then analyzed how sibling position was interrelated with language development. **Results.** A regression model was built where the dependent variable was the child's speech rate, and the main predictor was the sibling position while controlling for such factors as the level of nonverbal intelligence, sex (gender), and age of the child. The results were interpreted via language input the child receives in the family. The study showed that the highest speech rate was observed in older and only children, and that sibling position significantly contributed to the rate of speech, but less strongly than the gender factor. **Discussion.** In future research we find it important to control sibling similarities within a family when comparing children with different sibling positions from different families.

Keywords

preschool age, sibling position, birth order, speech rate, narratives, gender differences

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Introduction

The cultural-historical approach postulates that the most important factor in a child's cognitive and emotional development is the social environment and the children's interaction with their environment because in the interactive process, interpsychic functions, being internalized, become intrapsychic (Hakkarainen & Bredikyte, 2021; Oshchepkova et al., 2021, Vygotsky, 1991). The child's main social environment is the family. Numerous studies have shown the definite role of family (specifically, parents' input) in cognitive and language development (Anderson et al., 2021; Clark, 2009; Kidd, & Donnelly, 2020).

The family's role in language development was studied thoroughly: the impact of socioeconomic status (Pungello et al., 2009) and mother-child interaction (Stolt et al., 2014). However, the impact of a child's sibling position has received relatively little attention.

The present study aims to determine the impact of sibling position on language development. This impact plays an increasingly important role in children's cognitive development in general because language strongly affects executive functions in preschool children.

Sibling Position

In a family a child has a sibling position. This means that the child is born first and stays the only child or has siblings, is born later and has older or younger siblings, or is a twin. So a child can have one of the following sibling positions: only child, firstborn child (eldest), later-born (middle), or last-born child (youngest) (Tsvetkova et al., 2022). Besides the notion of sibling position, there is a notion of birth order. This term takes into account only the child's birth order, meaning the child can be firstborn (regardless if she is an only child or has younger siblings) or later-born (and has older siblings and also possibly younger siblings or a twin).

The influence of birth-order on children's cognitive and language development was studied in numerous studies, although the results are inconsistent (Berglund et al., 2005;

Ketrez et al., 2017; Nafissi & Vosoughi, 2015; De Haan et al., 2014). Pine (1995) discovered that firstborns learned their first 50 words significantly earlier than secondborns. However, there was no significant difference in the age of acquisition of 100 first words. It was also shown that the influence of the birth-order factor is much less significant than sex (gender) and maternal education (Zambrana et al., 2012).

The Sibling Position effect on cognitive and language development

The main conclusion of the meta-analysis on the birth-order effect on language development made by Nafissi and Vosoughi (2015) is as follows: "The debate continues. Maybe further researches can clarify this interesting line of research with more scrutiny in the near future" (Nafissi & Vosoughi, 2015; 1968). However, several studies have shown that firstborns were better in language tests, and later-borns were better in conversational abilities (Hoff-Ginsberg, 1998; Keller et al., 2015).

Sibling position's influence on cognitive development has been examined in numerous studies and has been proven to be an important factor of developmental particularities (Abdulla Alabbasi et al., 2021; Luo et al., 2022), but the effects in different studies were not identical. For example, Almazova and Mostinets (2023) found that the level and structure of executive functions in the only and youngest children in the family are more similar to each other than in the oldest and only children or in the oldest and youngest children. Contrariwise, no significant difference was found between only children and firstborn children with siblings nor between middle- and later-born children in divergent thinking (Abdulla Alabbasi et al., 2021). Whereas the confluence model, built by Zajonc and Markus (1975) demonstrated positive as well as negative effects of birth order on intellectual development, a necessarily negative effect of family size, and a handicap for the last born and the only child (Zajonc & Markus, 1975).

Language development in children begins from birth. At preschool age, language development is measured in different ways. The aspects most studied are active or passive vocabulary and narrative ability (Gao et al., 2023; Souza & Cáceres-Assenço, 2021). Active and passive vocabulary and narrative ability grow significantly at this age (Oshchepkova & Shatskaya, 2023). So the factors that influence language improvement in preschool children are in demand. Numerous studies showed that the external input is one of the most important factors of language development (Meredith & Catherine, 2020). The family proved to be the most important source of language input (Hoff-Ginsberg, 1998; Holzinger et al., 2020).

As mentioned earlier, sibling position within the family is one of the most critical characteristics of a child. Consequently, the influence of a child's sibling position on their language development is one of the questions that needs to be studied more thoroughly. Yet the mentioned studies (Hoff-Ginsberg, 1998; Keller et al., 2015) do not permit to give definite answer to the research question if sibling position is interrelated to language development.

Speech rate, or narrative fluency, has mostly been studied within the context of L2 and been associated with overall speaking proficiency (Arslan et al., 2023). Narrative fluency in first language acquisition has been rarely studied, and studies about sibling position's impact on speech rate are missing. It was also shown that fluency rates in conversation could depend on age, gender, topic, and other factors (Bortfeld et al., 2001).

The Research Question of the current study is whether there is influence of sibling position on language development, particularly on narrative ability, while controlling for such factors as the level of nonverbal intelligence, sex (gender), and age of the child.

Methods

Participants

Six hundred seventy-four preschoolers (M = 70.2 months, SD = 4.01, 50.7% boys) participated in the study. The children attended senior kindergarten groups in Moscow, Kazan, and Sochi (Russia). Their parents filled out a form about the child's sex (gender), age, diseases, bilingualism, and sibling position. There were four positions: only child, firstborn child (eldest), later-born (middle), and last-born child (youngest). Children with medical diagnoses and bilinguals with Russian 2L were excluded from further research.

Assessments and Measures

Two instruments were used for language development assessment: a verbal fluency test and a narrative production test.

The verbal fluency test consisted of two subtests: general and semantic (action naming). In the first, a child is asked to name all the words they know in one minute. In the second, the child is asked to name as many actions as possible in one minute. One point was given for each correct answer and 0.5 points for each word combination. If a child repeats what they has already said or pronounces nonsense, 0 points were given.

For the narrative production test, children were given a series of pictures from the MAIN method (Multilingual Assessment Instrument for Narratives) (Gagarina et al., 2019) and asked to create a story based on this series of pictures. Each child's story was transcribed and assessed regarding the microstructure of the narrative (its vocabulary and grammar) (1–10 points), the macrostructure of the narrative (its adequacy and completeness) (1–10 points) (Veraksa et al., 2020) and the speech rate (the ratio of words number to story time) (Kartushina et al., 2022).

Children were also tested on nonverbal fluid intelligence levels. The child's nonverbal fluid intelligence was assessed with Raven's Colored Progressive Matrices (Raven & Court, 1998), in which the children were asked to match a missing piece that corresponded with three other pieces. The number of correctly completed tasks was counted, and time was

not considered. Every correct answer received a point; the final score could vary between 0 and 36.

Procedure

The study was conducted individually in a bright, quiet room of the preschool educational institutions attended by children at the time of testing. One meeting lasting 15–25 minutes was organized with each child. Children were free to stop the test at any time. All children received a small gift (sticker) for their participation. All techniques were presented to children in the same established order. Assessment was carried out by specially trained testers (undergraduate and graduate students of the Faculty of Psychology). All parents were informed about the study's aims and gave written consent for their children's involvement in the research. The study was approved by the Ethics Committee of the Faculty of Psychology at Lomonosov Moscow State University (Approval No: 2022/23).

Results

Descriptive statistics

We compared the number of children in each sibling position in the first stage. Only children comprised 26.1% of the children, 19.4% older children, 10.1% middle, and 44.4% youngest (Table 1). As can be seen, the group of younger children was the most numerous. Descriptive statistics for the speech rate in different sibling positions show that the highest rate was characteristic for older and only children (Table 2).

Table 1
Descriptive Statistics for Sibling Positions

	Only	Eldest	Middle	Younger
%	26.1	19.4	10.1	44.4
M (month)	70.1	70.6	70.5	70.1
Sd (month)	3.93	4.32	4.01	3.92

Table 2
Descriptive Statistics for Speech Rate in Different Sibling Positions

Siblings position	Mean	Median	SD
Older	.874	.880	.280
Youngest	.790	.797	.297
Only child	.867	.846	.264
Middle	.743	.765	.270

Language development in different sibling position

The differences in the parameters of language development between sibling position groups were later analyzed (verbal fluency and narrative aspects) using the one-way Kruskal–Wallis analysis since the Shapiro-Wilk normality test and Levene's test for homogeneity showed that the sample did not follow a normal distribution for any of the language (narrative) parameters. The results showed that there were significant differences between sibling position groups only in the speech rate measure ($\chi^2 = 18.397$, $p < 0.001$, $\varepsilon^2 = 0.03$), but no significant differences were found in general verbal fluency test ($\chi^2 = 7.883$, $p = 0.05$, $\varepsilon^2 = 0.01$), semantic verbal fluency (actions naming) ($\chi^2 = 0.933$, $p = 0.817$, $\varepsilon^2 = 0.001$), narrative length ($\chi^2 = 5.350$, $p = 0.148$, $\varepsilon^2 = 0.008$), nor the narrative's duration ($\chi^2 = 7.265$, $p = 0.064$, $\varepsilon^2 = 0.01$), narrative macrostructure ($\chi^2 = 1.825$, $p = 0.609$, $\varepsilon^2 = 0.002$), or narrative microstructure ($\chi^2 = 1.713$, $p = 0.634$, $\varepsilon^2 = 0.002$).

Speech rate in different sibling positions

Next, we analyzed the speech rate assessment since significant differences were found between children with different sibling positions (see section 3.2). We built a regression model to answer the second research question: what impact does this factor have on children with different sibling positions with regard to the child's sex (gender), age, and level of nonverbal intelligence? The dependent variable was the child's speech rate, and the main predictor was the sibling position while controlling for such factors as the level of nonverbal intelligence, sex (gender), and age of the child.

The final regression model was significant ($R = 0.252$, $R2 = 0.064$, $AdR2 = 0.057$, $F = 8.95$, $p < 0.001$). As a result, the most significant factor for speech rate was the sex of a child ($t = 3.84$, $p < 0.001$). Results showed that the speech rate is significantly higher in girls than boys (Figure 1).

It was also shown that the child's age is also a significant factor: the older the child, the higher their rate of speech ($t = 3.146$, $p = 0.002$). The sibling position factor showed its significance in the following cases: a significant difference was found between younger and older children in favor of the older ones ($t = -2.911$, $p = 0.004$), as well as between middle and older children in favor of the older ones ($t = -3.121$, $p = 0.002$). No significant differences were found between only and older ($t = -0.283$, $p = 0.777$). At the same time, the highest rate of speech was observed among older ($M = 0.874$, $SD = 0.280$) and only children ($M = 0.867$, $SD = 0.264$); it was lower among younger children ($M = 0.790$, $SD = 0.297$) and the lowest among middle-aged children ($M = 0.743$, $SD = 0.270$) (Figure 2).

Figure 1
Differences in speech rate between boys and girls

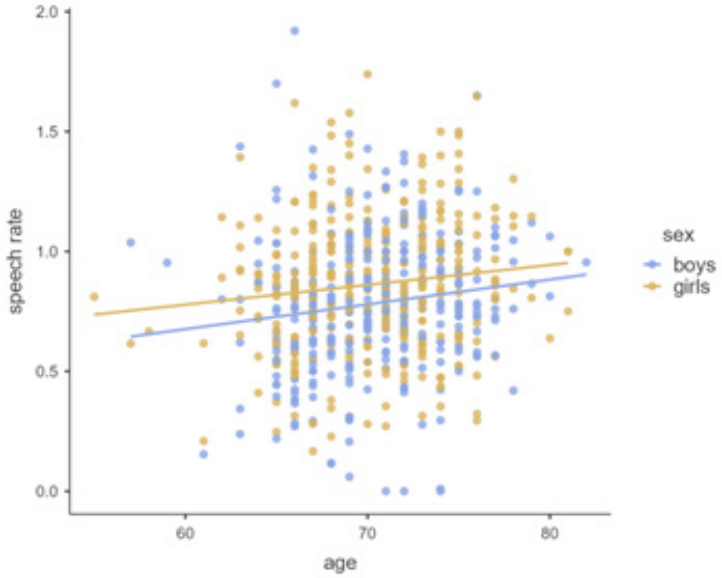
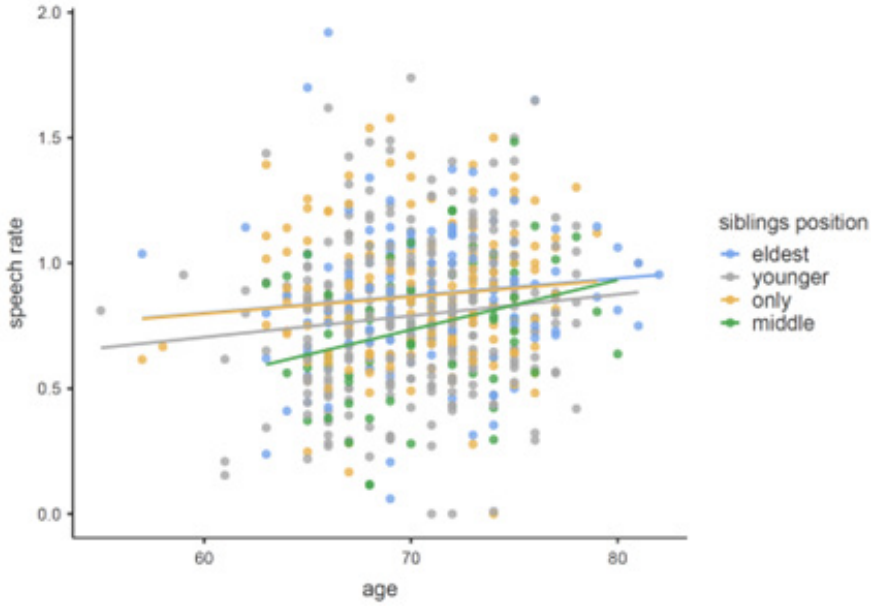


Figure 2
The difference in speech rate between children with different sibling positions



Nonverbal intelligence level was not a significant factor for speech rate (t = 0.540, p = 0.589) in the current linear regression model.

A Kruskal-Wallis analysis also found significant differences in speech rate between different sibling positions ($\chi^2 = 18.4$, $p < 0.001$; $\varepsilon^2 = 0.03$). Thus, according to the results of pairwise comparisons, the DSCF Post-Hoc Test showed that older children had a significantly higher speech rate than younger ($W = -4.247$, $p = 0.014$) and middle children ($W = -4.383$, $p = 0.010$). Only children had significantly higher speech rates than middle-born children ($W = -4.175$, $p = 0.017$) and younger children ($W = -4.132$, $p = 0.018$). At the same time, there are no significant differences in speech rate between only and older children ($W = -0.690$, $p = 0.962$).

Discussion

Contrary to studies (Pine, 1995; Schults et al., 2012), we found no difference in active vocabulary for children with different sibling positions. We suppose this is due to the children's age because differences were noticed in children before 36 months, and we studied children of 70 months. However, it was shown that language differences in first- and later-borns disappeared with age (Hoff-Ginsberg, 1998; Fenson et al., 1994). Moreover, our finding differed from other research on the impact of birth order on language development (Bornstein et al., 2004; Luo et al., 2022; McFayden et al., 2022; Skeat et al., 2010; Tomblin, 1990) in that we did not find sibling position impacted most language measures (active vocabulary, narrative's micro- nor macrostructure). The only measure that showed a significant correlation with sibling position is the speech rate (the ratio of the number of words in the narrative and the narrative's duration). The speech rate is a measure that depends on numerous factors: parental input (Guitar & Marchinkovski, 2001), age (Martins et al., 2007), gender (Van Borsel & De Maesschalck, 2008), language and culture (Narayan & McDermott, 2016).

The children's speech rate in our study proved to be much lower than that of other studies. For example, in (Martins et al., 2007), the speech rate of 5-year-olds was 64.1 words per minute, and for 7-year-olds was 73.2 words per minute. In our study, the average speech rate is 0.82 words per second or 49.11 words per minute. We suppose that this is due to Russian vs. English language particularities. Previous studies have shown that the speech rate in English is higher than in Russian (Ryabov et al., 2016).

Our study showed that the most significant factor for speech rate was the sex of a child (girls significantly outperformed boys). These results agree with other studies, showing that firstborn girls outperformed the other groups of children in speech fluency (Zambrana et al., 2012). Other studies (Eriksson et al., 2012) showed that girls outperformed boys in different language aspects. However, a Turkish study on speaking adults (Emrah Cangi et al., 2020) showed that males outperformed females in speaking and articulating rates.

The second most significant factor influencing our study's speech rate is the child's age (66 to 74 months). Martins et al.'s (2007) study found that the speech rate

of discourse (describing pictures) increased with age (from 5 to 17 years old) and was strongly correlated with semantic verbal fluency (naming of animals and food) and did not correlate with phonemic fluency. More precise research showed that the speech rate grows until adolescence and decreases in older adults (Nip & Green, 2013; Quené, 2007). In the present study, we confirmed the impact of age on speech fluency: in older children, speech fluency is higher.

The significance of the level of nonverbal intelligence was also discovered: in children with a low level of nonverbal intelligence, the speech rate was significantly lower than in children with an average rate. This corresponds with studies showing that language development is associated with executive functions (Kovyazina et al., 2021) and, more precisely, with nonverbal intelligence in preschoolers (Lacalle et al., 2023). However, since no significant difference was found between children with high and average levels of nonverbal intelligence, the relationship between speech rate and nonverbal intelligence needs to be retested in future studies, taking into account additional control variables.

The impact of sibling position on speech rate in our study showed no difference between an only child and older children, but a significant difference between only children on the one side and middle and younger children on the other side so as between older children on the one side and middle and younger children on the other side. This can be understood via the notion of birth order as only older children are firstborns, and middle and younger children are later-borns. Consequently, the explications of the difference between first- and later-borns can be applied to our study. As was shown by Hoff-Ginsberg (1998), mothers spoke more with firstborns and used longer and more complex phrases.

The data obtained are in accordance with the studies that showed better language development in firstborns (Pine, 1995; Schults et al., 2012). There are no published data about the interrelations between sibling position and speech rate in narratives, so we cannot compare our data with others.

Numerous studies (for example, (Ferjan Ramírez, 2024; Valitova, 2022) have discovered that parental input via child-parent interaction is a key predictor of a child's language development from a longitudinal perspective. The higher speech rate of firstborn children compared to that of later-born is in contrast with T. Kokkinaki's (2018) findings that "mothers of second-born infants are more likely to address verbal content to their infants (75.4%) compared to mothers of firstborn infants (65.5%)" (p. 1475). In addition, our result is inconsistent with the results obtained by Brody et al. (2003), who found that the oldest and middle children in the family are better at speech recognition from people of different genders and ages than the youngest and only children. We posit that only children growing up surrounded by adults or the youngest children interacting with older children show better language development. In other words, the only child will continue to speak mostly with adults in the family, and the older children take the role of an adult toward the younger ones, who are favorites and "babies" compared to other family members, but there is no known research known that supports this idea.

One more possible explanation is the fact that properties of the language input reflect properties of caregivers (Huttenlocher et al. 2007). For example, effects of birth order, such as its influence on IQ (e.g., Bellmont & Marola 1973), disappear when siblings are compared with each other (Wichman et al. 2006).

Conclusion

The child's interaction with their environment plays the definite role in cognitive and language development. Although child's interaction with mother is well studied, other family's positions are underestimated. The current study aimed to show the role of sibling position in child's language development.

The study showed that significant differences in language outcomes depending on sibling position were found only for the speech rate measure: the highest speech rate being observed in older and only children. Moreover, children in both these sibling positions have a significantly higher speech rate than that of the middle and younger children. At the same time, based on the results of the constructed regression models, sibling position significantly contributes to the rate of speech, but less strongly than the gender factor - in girls, the rate of speech is higher than in boys. The factor of the child's age also turned out to be significant: the older the child, the higher her speech rate.

Research on the influence of sibling position is still in progress, so the explanation of the effects found is still limited. It is necessary to compare language input via parent-child interaction in large families (including sibling communication) and in only-child families. Furthermore, it is important to control sibling similarities within a family when comparing children with different sibling positions from different families.

The results indicate that speech rate may depend on the time a mother speaks to a child: more frequently mother–child interaction takes place, more fluently the child speaks.

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Ekaterina Oshchepkova — original draft preparation.

Arina Shatskaya — formal analysis, investigation, visualization.

Alexander Veraksa — conceptualization, methodology, supervision.

Margarita Aslanova — data collection and analysis.

Elena Chichinina — writing, review and editing.

Author Details

Ekaterina Oshchepkova — PhD in psycholinguistics, Researcher at the Department of Psychology of Education and Pedagogy, Faculty of Psychology, Lomonosov Moscow State University, Moscow, Russian Federation; ResearcherID: GNW-6424-2022; Scopus Author ID: 57211317843; ORCID: https://orcid.org/0000-0002-6199-4649; e-mail: oshchepkova_es@iling-ran.ru

Arina Shatskaya — Researcher at the Department of Psychology of Education and Pedagogy, Faculty of Psychology, Lomonosov Moscow State University, Moscow, Russian Federation; ResearcherID: ACM-9022-2022; SPIN: 9071-5510; ORCID: https://orcid.org/0000-0001-7283-8011; e-mail: arina.shatskaya@mail.ru

Alexander Veraksa — Doctor of Psychology, Academician of the Russian Academy of Education, Associate Professor, Head of the Department of Educational Psychology and Pedagogy, Faculty of Psychology, Lomonosov Moscow State University, Moscow, Russian Federation; ResearcherID: H-9298-2012; ORCID: https://orcid.org/0000-0002-7187-6080; e-mail: veraksa@yandex.ru

Margarita Aslanova — Researcher at the Department of Psychology of Education and Pedagogy, Faculty of Psychology, Lomonosov Moscow State University, Moscow, Russian Federation; ORCID: https://orcid.org/0000-0002-3150-221X; e-mail: simomargarita@ya.ru

Elena Chichinina — Researcher at the Department of Psychology of Language and Foreign Languages Teaching, Faculty of Psychology, Lomonosov Moscow State University, Moscow, Russian Federation; Scopus Author ID: 57219161203; ResearcherID: AAZ-5968-2021; ORCID: https://orcid.org/0000-0002-7220-9781; e-mail: alchichini@gmail.com

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Study of Cognitive Component of Media Competence of Future Teachers: Theoretical and Practical Aspects

Olga V. Galustyan[1*], Saida S. Gamisonia[2], Irina V. Vlasyuk[3], Galina P. Zhirkova[4], Olga V. Telnova[1]

[1] Southern Federal University, Rostov-on-Don, Russian Federation
[2] Abkhaz State University, Sukhum, Republic of Abkhazia
[3] Volgograd State University, Volgograd, Russian Federation
[4] National Research University ITMO, Saint Petersburg, Russian Federation

[*]Corresponding author: ovgalustyan@sfedu.ru

Abstract

Introduction. Study of the problem of developing media competence of future teachers is relevant. Application of modern media within the educational process enables the preparation of teachers who are capable to use media resources effectively and to educate media-literate generation of students who are prepared for life within the constant information flow. Cognitive component of media competence is important particularly; it includes knowledge and understanding of the functions and capabilities of educational media resources. Novelty of this study lies in its identification of cognitive component of media competence of future teachers, which is revealed in knowledge and understanding of use of educational media in teaching. **Methods.** This study involved 107 students aged 17–19. Test for identifying the level of the information component of media competence (A. V. Fedorov, modified by S. S. Gamisoniya and O. V. Galustyan) and test of assessing teachers' media literacy (I. V. Zhilavskaya) were used. **Results.** Level of cognitive component of media competence of student of the experimental group increased during the formative phase of the experiment and became high predominantly. It is submitted that the majority of the experimental group students obtained knowledge

and understanding of basic and specific functions and capabilities of educational media resources; they acquired structured and systematic understanding of the potential use of educational media information and products in teaching; they acquired ability and skill to analyze and to evaluate feasibility of using basic and specific media resources during the lessons. The majority of the control group students retained middle level and low level of cognitive component of media competence. **Discussion.** Study of cognitive component of media competence includes theoretical foundations and practical approaches of developing teachers' knowledge and skills for effective use of media resources. Its development within blended learning environment fosters the students' critical thinking and ability to use media content for educational purposes. The study concludes that it is necessary to integrate media education into curricula and to use interactive teaching methods.

Keywords

information and communication technologies, media competence, cognitive component, future teachers

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Introduction

Current stage of higher education development is characterized by a competence-based orientation (Galustyan et al., 2019). Currently, trend towards digitalization is observed in all spheres of life of modern society (Garanina et al., 2021; Hsiao, 2021; Azarko, Ermakov, Pronenko, 2024). This trend has not bypassed the educational process within higher education. Rapid development of information and communication technologies, expansion of wide public access to the content of various types (professional, educational, entertaining, etc.) leads to the attraction of many young people to social networks and online media resources (Macedo-Rouet et al., 2009; Spracklen, 2015). Modernization of Russian education highlights digitalization of education as one of its priorities, the main goal of which is to form a holistic information and educational environment (Ermakov et al., 2022; Orlov, Orlova, 2018). Application of the potential of modern media within the educational process enables the preparation of highly qualified teachers who are capable to deal with professional challenges effectively (Galustyan et al., 2018; Hawi &

Samaha, 2019). Therefore, developing the media competence of future teachers within the information society is becoming important increasingly.

Furthermore, studying of future teachers' media competence development within the context of its cognitive component is of a particular interest. It relates to that modern digital era has changed communication methods fundamentally (Martsinkovskaya, 2019; Rodríguez et al., 2018). Language of social media and instant messaging has become a new medium for self-expression of younger generation, when traditional norms of written language interact with innovative forms of communication (Matviyevskaya et al., 2019; Garg et al., 2022). Therefore, future teachers should acquire understanding of functions and capabilities of educational and digital technologies, as well as possess understanding of the characteristics of mass media discourse and digital trends.

Today, due to the constant advancement of technology, social communication between people has undergone significant changes. Internet has played a significant role in this, becoming an integral part of not only modern leisure time but also of educational process at universities during recent years. The authors (Galustyan et al., 2020; Lazem, 2019) note the importance of widespread use of digital educational resources within blended learning environment. The demand for application of blended learning in educational practice became evident during the COVID-19 pandemic (2020–2021) especially, when educational institutions were forced to transition to this format, relying primarily on educational resources and online media technologies (Choudrie et al., 2021; Hollweck & Doucet, 2020; Trombly, 2020; Kosyanenko, Topchiy, Volkova, 2025).

Application of a range of electronic media resources and blended learning tools by teachers are aimed at developing and improving competencies which are essential for professional teaching within the realities of modern era. Today, success of a modern teacher's professional activity depends on their mastery of new information technologies and methods, and their ability to use them in their professional work primarily (Molodozhnikova et al., 2020; Said, Kurniawan & Anton, 2018). Blended learning has enabled a reorientation to new educational conditions as one of the promising teaching tools (Appiah-Kubi & Annan, 2020). The use of media resources by teachers is a prerequisite for achieving high educational results currently, because media and Internet space are becoming platforms for professional communication, which include social networks, websites, chats, forums, and blogs, that make communication easier and more accessible (Johnson et al., 2021; Korhonen, Ruhalahti & Veermans, 2019; Smirnova, 2023). It highlights the demand for developing cognitive component of media competence of future teachers. Cognitive component of media competence is considered as knowledge and understanding of functions and capabilities of educational media resources; it includes understanding of the possibilities of using educational media information and media products in teaching activities; it includes ability and skill to analyze and to evaluate the feasibility of using basic and specific media resources during the lesson.

Methods

The aim of our experimental work was to develop cognitive component of media competence of future teachers. Southern Federal University (Rostov-on-Don, Russia) served as the basis for the empirical study.

Organization and participants of the empirical study

The object of the empirical study was the process of developing media competence of first-year students and second-year students. 107 students of Institute of Philology, Journalism and Intercultural Communication of Southern Federal University, who were trained at the Program 44.03.05 – "Pedagogical Education (with two profiles): Russian language and Foreign Language (English)" were involved in the study. Students were from 17 to 19 years of age. The empirical study was carried out within the framework of teaching disciplines "Introduction to Project-Based Activities" and "Project". Control group and experimental group were formed in order to identify statistical differences within the indicators of the studying phenomenon at the beginning of the ascertaining stage of the experiment. The control group included 53 first-year students, and the experimental group included 54 first-year students. The study was followed by six experts who were faculty members of Southern Federal University. They held PhD in Pedagogy and possessed a high level of media competence.

Instruments

Expert assessment and survey method were used as research instruments. Survey method was presented by the following techniques:

- Test for identifying the level of the information component of media competence (author is A. V. Fedorov, test was modified by S. S. Gamisoniya, O. V. Galustyan),
- Method "Assessment of Teachers' Media Literacy" (I.V. Zhilavskaya).

We used test for identifying the level of the information component of media competence in order to assess knowledge and understanding of functions and capabilities of educational media resources (A. V. Fedorov, modified by S. S. Gamisoniya, O. V. Galustyan). Test consisted of closed test tasks which were aimed at identifying knowledge and ideas of what media competence of a teacher included, what the advantages of a multimedia lesson were, what concepts "media text", "media editing", "media categories", "media library", "teacher's media culture", "media perception", "media language" included. (Fedorov, 2014).

Test "Assessment of Teachers' Media Literacy" by I.V. Zhilavskaya was also used in order to assess the cognitive component of future teachers' media competence comprehensively. This test contained questions and tasks that provided a comprehensive analysis of the respondent's media literacy (Zhilavskaya, 2013). The indicators and levels of cognitive component media competence of future teachers are presented in Appendix.

Experimental work

We implemented our technology for developing media competence of future teachers within blended learning during the pilot project. This technology was implemented within the framework of the disciplines "Introduction to Project-Based Activities" and "Project" for the first-year and second-year students who were trained at the Program 44.03.05 – "Pedagogical Education (with two profiles): Russian language and Foreign Language (English)." Technology's implementation involved several stages.

The first stage

The first stage involved lectures and practical classes which covered theoretical foundations, basic concepts, principles of media pedagogy, media literacy, and media competence. Classes were held face-to-face and online within flipped classroom blended learning model during this stage. It involved independent viewing of instructors' video lectures and study of online information and media resources. Students recorded their classmates' responses on their mobile phones during practical classes. Then students analyzed the responses of their groupmates in order to eliminate deficiencies in their learning. Students completed test for identifying the level of the information component of media competence (A. V. Fedorov, modified by S. S. Gamisoniya, O. V. Galustyan) at the end of this stage.

The second stage

The second stage involved students' completing cases and analyzing them in the group. Blended learning was also implemented during the case studies. Station Rotation Model and Self-Blend Model were used during the second stage. Students were divided into subgroups, then they were rotated. Students moved to another group and completed a new assignment when they completed their case based on the instructor's assignment. Students completed the assignments online under instructor supervision using Miro collaboration platform.

The second stage also included online classes which were conducted using Microsoft Teams Platform. Students developed WebQuests on the topic "Creating School of Future" independently during the second stage.

During this stage students were also given tasks that involved studying media texts from the Internet and analyzing them.

Here are some tasks and recommendations for working with media texts from Internet:

4. The goal is to gain experience in analytical activities within scientific and educational sphere.
5. Tasks:

- Studying the conceptual apparatus of media pedagogy, media literacy, and media competence.
- Studying the experience of successful activities in the field of education.

6. Credit assignments:
   - Preparation of a summary/glossary for the course (at least 25 lexical units). Using such options as Agile/Scrum/Kanban/.
   - Comprehensive examination and comparative assessment of several media texts and presenting educational projects based on the following criteria:
   – relevance (for education system, for educational sciences, personal assessment),
   – goal setting (definiteness, significance and achievability of the goal),
   – content (presence of system of tasks, appropriate methods and resources, logicality and structure of activities),
   – partnership (presence of partners, participants, implementation of their expectations and needs),
   – general assessment of the project (possibility of sharing experience, choosing a preferred project, etc.);
   - comprehensive assessment of the individual teacher's project. https://teacherofrussia.ru/:
   – main stages of biography (career development after participation in the competition),
   – features of methodological system (teaching the subject),
   – features of social and educational system (interaction with children, parents, colleagues),
   – scientific and public activities (blogs, websites, publications),
   – general professional and personal assessment.
7. Advanced training and professional socialization (joining professional focused groups, blogging, participating in conferences and seminars).
8. Design of lesson activity project using media resources.
9. Project design in social and educational sphere using media resources.

Students used electronic information resources of Internet as well as materials posted in open access scientific social networks (*Academia, Mediagram.ru, ResearchGate, Science ID SciPeople, Scientific Social Community, Social Science Research Network, etc.*).

During this stage students also analyzed research articles by famous educators and psychologists who had influenced the educational process. Students prepared multimedia presentations with audio and video effects, using software (iMovie and DaVinci Resolve) and data visualization tools (Storytelling Tools, Data Illustrator, data-illustrator.com, Visual.ly, Canva, Infogram, and others) after analyzing the research papers. The presentations were presented in a virtual classroom using Zoom and Microsoft Teams (Gamisonia & Galustyan, 2024).

Data Analysis

We used methods of descriptive statistics as well as mathematical statistical analysis using the Fisher angular transformation criterion (φ*) to process the research results.

Results

Most of the future teachers of the experimental group demonstrated high level of media knowledge (75.9% of respondents, compared to 9.3% at the ascertaining stage) during the formative stage of the experiment. Middle level of knowledge and understanding of the potential of media resources within the educational activities was demonstrated by 20.4% of students of the experimental group. It is reported that there was a decrease from 38.9% at the initial stage of the experiment. Low level of media knowledge was demonstrated by 3.7% of respondents of the experimental group which is lower significantly than at the initial level (51.8%).

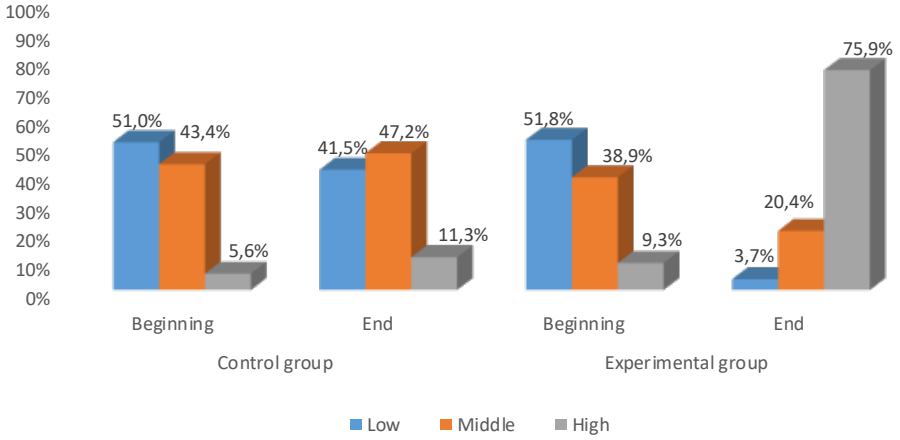
Respondents of the control group demonstrated middle level of knowledge in the media sphere in education which became predominant. It amounted to 47.2% of respondents, there was a slight increase in awareness of the media sphere (the number of respondents with unformed ideas decreased from 51.0% to 41.5%, and the number of respondents with extensive and structured ideas concerning the media sphere in education increased from 5.6% to 11.3% (Table 1, Figure 1).

Table 1
Level of knowledge in educational media sphere at various stages of the experiment

Level	Control group		Experimental group	
	Beginning	End	Beginning	End
Low	51,0%	41,5%	51,8%	3,7%
Middle	43,4%	47,2%	38,9%	20,4%
High	5,6%	11,3%	9,3%	75,9%

Figure 1

Level of knowledge in educational media sphere at various stages of the experiment



We used a statistical comparison of the results between the experimental group and control group at various stages of the experiment in order to confirm the growth of knowledge and understanding of the media sphere in education at the experimental group. We made conclusions which were based on the results of mathematical data analysis by using Fisher angular transformation criterion (φ*). It was investigated that the experimental group had an increased proportion of respondents with comprehensive and structured system of understanding of the media sphere, while the number of respondents with undeveloped or partially developed knowledge base had been decreased compared to the control group. There were not identified any statistically significant changes in the system of understanding of media sphere at the control group (Table 2).

Table 2

Comparative analysis of level of knowledge in the media sphere at control group and experimental group at different stages of the experiment (Fisher angular transformation criterion (φ))*

Level	Control group and experimental group at the ascertaining stage	Control group at various stages of the experiment	Experimental group at various stages of the experiment	Control group and experimental group at the formative stage
Low	0,08; ρ >0,05	0,99; ρ >0,05	6,34; ρ ≤0,01	5,26; ρ ≤0,01
Middle	0,47; ρ >0,05	0,40; ρ >0,05	2,13; ρ ≤0,05	3,00; ρ ≤0,01

Level	Control group and experimental group at the ascertaining stage	Control group at various stages of the experiment	Experimental group at various stages of the experiment	Control group and experimental group at the formative stage
High	0,73; ρ >0,05	1,08; ρ >0,05	7,71; ρ ≤0,01	7,43; ρ ≤0,01

Level of media literacy of the students of the experimental group has also changed. Students of the experimental group demonstrated low level of media literacy at the ascertaining stage of the experiment. No one of the respondents of the experimental group exhibited low levels (0.0% of respondents) during the formative stage of the experiment. The proportion of future teachers with middle level of media literacy also decreased (from 42.6% of respondents to 26.0%). The overwhelming majority of students of the experimental group demonstrated high level of media literacy (74.0% of respondents during the formative stage of the experiment).

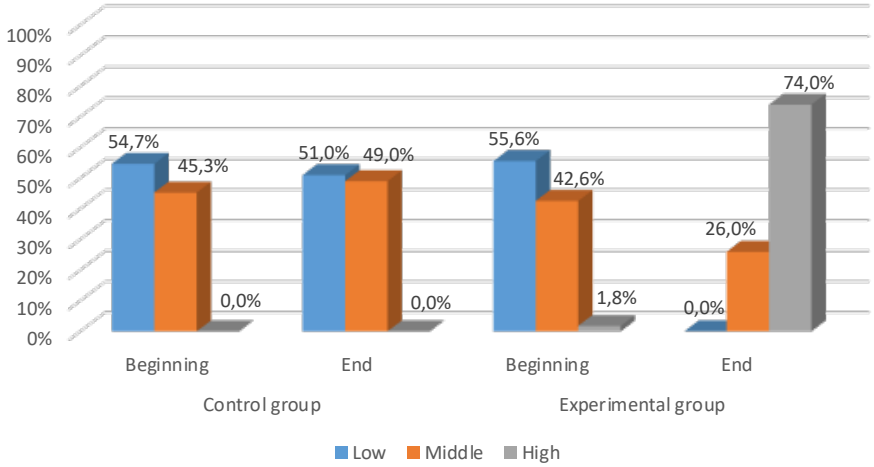
Low level and middle level of media literacy remained predominant (51.0% and 49.0% of respondents respectively) in the control group. None of the respondents of the control group demonstrated high level of media literacy (Table 3, Figure 2).

Table 3
Level of media literacy at control and experimental groups at different stages of the experiment

Level	Control group		Experimental group	
	Beginning	End	Beginning	End
Low	54,7%	51,0%	55,6%	0,0%
Middle	45,3%	49,0%	42,6%	26,0%
High	0,0%	0,0%	1,8%	74,0%

Figure 2

Level of media literacy at control and experimental groups at different stages of the experiment



We compared the results between experimental group and control group at various stages of the experiment in order to confirm the increase of media literacy in the experimental group. So, we can conclude that media literacy improved in the experimental group compared to the control group based on the mathematical analysis of the data. Statistically significant changes in media literacy weren't found in the control group (Table 4).

Table 4

Comparative analysis of levels of media literacy at control group and experimental group at different stages of the experiment (Fisher angular transformation criterion (φ))*

Level	Control group 1 and Experimental group 1	Control group 1 and Control group 2	Experimental group 1 and Experimental group 2	Control group 2 and Experimental group 2
Low	0,14; ρ >0,05	0,38; ρ >0,05	8,75; ρ ≤0,01	8,27; ρ ≤0,01
Middle	0,28; ρ >0,05	0,38; ρ >0,05	1,83; ρ ≤0,05	2,50; ρ ≤0,01
High	1,39; ρ >0,05	0,0; ρ >0,05	9,37; ρ ≤0,01	10,7; ρ ≤0,01

1.8% of students of the experimental group and 45.3% of the control group delivered low level of cognitive component of media competence (Table 5, Figure 3).

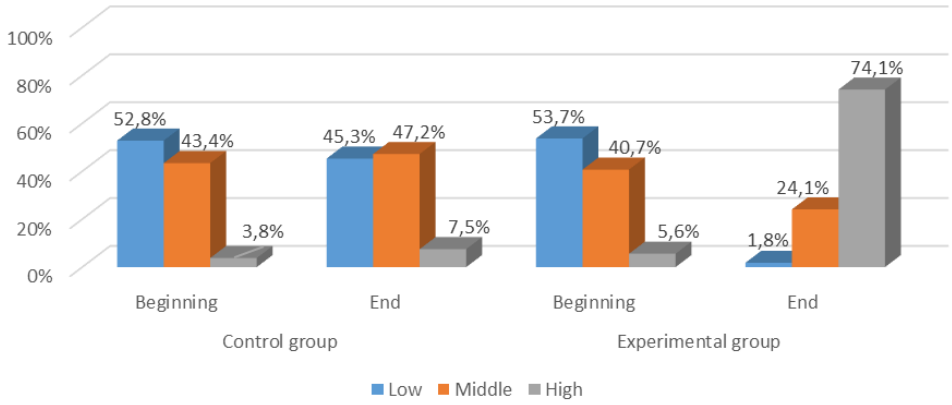
Table 5

Level of cognitive component of media competence of future teachers at different stages of the experiment

Level	Control group		Experimental group	
	Beginning	End	Beginning	End
Low	52,8%	45,3%	53,7%	1,8%
Middle	43,4%	47,2%	40,7%	24,1%
High	3,8%	7,5%	5,6%	74,1%

Figure 3

Level of cognitive component of media competence of future teachers at different stages of the experiment



Data analysis confirmed a significant increase in the proportion of future teachers with high level of cognitive component of media competence in the experimental group, while the proportion of future teachers with middle level and low level had been decreased. Control group and experimental group differed in the development of cognitive component of media competence significantly during the formative stage

of the experiment. It can be concluded that the level of development of the cognitive component of media competence in the experimental group increased comparing to the ascertaining stage and comparing to the control group.

Discussion

Study in the field of media education focuses on developing future teachers' skills in working with various media, developing critical thinking, and creating educational media content, i.e., on the formation of cognitive component of media competence. Researchers (Rensaa, 2014; Said, Kurniawan & Anton, 2018) consider media competence and application of media in education to be one of the most important components of communicative and social development of future specialists. A number of researchers (Liao & Wu, 2020; Rodríguez et al., 2018) believe that media competence is component of teacher's professional competence. It should be noted that researchers (Lund & Engeness, 2020; Shaigerova et al., 2022) addressed the problem of media competence in general, however, scientific understanding of the problem of studying cognitive component of media competence of future teachers had been represented by a very limited number of theoretical and empirical material in modern pedagogy. Researchers (Podolskij, 2020; Rodríguez et al., 2018) focus primarily on the development of media competence in the context of developing teachers' knowledge, skills, and attitudes which are necessary for effective work with media resources and imparting media literacy to students. Key aspects of studies, which are devoted to media competence (Galustyan et al., 2019; Macedo-Rouet et al., 2009), include analysis of media messages, assessing their credibility, understanding the mechanisms of media influence, and developing critical thinking, which contributes to both the professional development of teachers and the enhancement of students' media literacy.

Our study substantiated and tested application of blended learning in developing cognitive component of media competence of future teachers experimentally. We used the two methods used in order to make analysis of levels of component of media competence of future teachers. So, important conclusions have been drawn. Control group and experimental group demonstrated low level of cognitive component of media competence of future teachers at the ascertaining stage of the experiment. Changes occurred during the formative stage of the experiment. Predominant level of cognitive component of media competence of future teachers in the experimental group became high. The proportion of respondents with high level reached 74.1% comparing to 5.6% of respondents at the ascertaining stage of the experiment. This proportion remained unchanged in the control group, which amounted to 7.5% of respondents.

It can be concluded that the majority of respondents of the experimental group obtained extensive structured knowledge and full understanding of functions and capabilities of educational media resources. They also obtained systemic understanding

of the possibilities of educational media information and media products application within the pedagogical activities.

Proportion of respondents of the experimental group with middle level of cognitive component of media competence decreased from 40.7% to 24.1%. The predominant level of cognitive component of media competence of future teachers was middle in the control group. Middle level persisted throughout all stages of the experimental study. These respondents demonstrated general knowledge and understanding of basic functions and capabilities of educational media resources, as well as general understanding of the potential use of educational media information and products in teaching. In summary, the experimental group demonstrated increase in cognitive component of media competence.

The obtained data are consistent with the opinion of researchers (Garanina et al., 2021; Hawi & Samaha, 2019) who consider that development of media competence of future teachers in the context of the information society presupposes the development of their ability of critical evaluation, creation and application of media content for educational purposes. Our findings are consistent with the findings of studies (Gamisonia & Galustyan, 2024; Zhao & Shi, 2022) indicating that the impact of media on students helps future teachers to understand the mechanisms of information influence and to develop an adequate teaching strategy. We also found that the use of blended learning contributes to the development of cognitive component of media competence. This demonstrates the need to emphasize the use of blended learning within the professional training of future teachers.

Conclusion

Cognitive component of media competence of future teachers was assessed using test for identifying the level of the information component of media competence (A. V. Fedorov, modified by S. S. Gamisoniya, O. V. Galustyan) and method "Assessment of Teachers' Media Literacy" (I.V. Zhilavskaya). The formative experiment resulted in changes. Predominant level of cognitive component of media competence of the experimental group became high, while this proportion remained unchanged in the control group. It can be stated that the majority of students of the experimental group acquired knowledge and understanding of basic and specific functions and capabilities of educational media resources, as well as structured and systematic understanding of the possibilities of using educational media information and media products within pedagogical activities.

Thus, the conducted study confirmed the need to develop media competence of future teachers in the context of blended learning, which is associated with the need for professionals with a high level of knowledge of media technologies, who are capable of carrying out professional pedagogical activities within the information society.

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Appendix

Indicators and levels of the cognitive component of media competence of future teachers

Indicator	Level		
	Low	Middle	High
Knowledge and understanding of functions and capabilities of educational media resources; understanding of possibilities of application of educational media information and media products within pedagogical activities	Lack of knowledge and insufficient understanding of functions and capabilities of educational media resources; insufficient understanding of possibilities of application of educational media information and media products within pedagogical activities	General knowledge and understanding of basic functions and capabilities of educational media resources; general understanding of possibilities of application of educational media information and media products within pedagogical activities	Knowledge and understanding of basic and specific functions and capabilities of educational media resources; readiness, structured and systematic understanding of possibilities of application of educational media information and media products within pedagogical activities

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Olga V. Galustyan — scientific supervision of the research, theoretical review of foreign and domestic studies, planning of research stages, critical revision of the article text.

Saida S. Gamisoniya — organization and implementation of the empirical procedure, selection of respondents, statistical processing of data, interpretation of results, preparation and editing of the article text.

Irina V. Vlasyuk — preparation of materials for theoretical review, analysis of the results.

Galina P. Zhirkova — analysis of material for literature review, technical design of the article text.

Olga V. Telnova — analysis and interpretation of obtained empirical data, work with sources.

Author Details

Olga V. Galustyan — Doctor of Pedagogical Sciences, Associate Professor, Acting Head of the Department of Social Pedagogy, Southern Federal University, Rostov-on-Don, Russia; WoS Researcher ID: B-6990-2016; Scopus ID: 57189005227; RSCI Author ID: 536102, SPIN code RSCI: 3222-1686; ORCID ID: https://orcid.org/0000-0003-1062-547X; e-mail: ovgalustyan@sfedu.ru

Saida S. Gamisoniya — Candidate of Pedagogical Sciences, Lecturer, Department of English and German Languages, Abkhaz State University, Sukhum, Abkhazia; Scopus ID: 57213597083; RSCI Author ID: 1215837, SPIN code RSCI: 1428-9865; ORCID ID: https://orcid.org/0009-0005-0710-8828; e-mail: sgamisonija@rambler.ru

Irina V. Vlasyuk — Doctor of Pedagogical Sciences, Professor, Director of the Institute of History, International Relations and Social Technologies, Volgograd State University, Volgograd, Russia; WoS Researcher ID: GRX-1637-2022; Scopus ID: 57194378020; RSCI Author ID: 289395, SPIN code RSCI: 3204-1782; ORCID ID: https://orcid.org/0000-0001-7220-9602; e-mail: ivlasyuk@rambler.ru

Galina P. Zhirkova — Candidate of Pedagogical Sciences, Associate Professor, Director of the Center for Social and Humanitarian Sciences, National Research University ITMO, St. Petersburg, Russia; Scopus ID: 57202216718; RSCI Author ID: 967198, SPIN code RSCI: 7293-8436; ORCID ID: https://orcid.org/0000-0001-8584-500X; e-mail: galina.jirkova@rambler.ru

Olga V. Telnova — Candidate of Psychological Sciences, Associate Professor, Associate Professor of the Department of General and Educational Psychology, Southern Federal

University, Rostov-on-Don, Russia; RSCI Author ID: 699158, SPIN code RSCI: 9792-1894; e-mail: ovtelnova@sfedu.ru

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Adaptation and Validation of the Russian Version of G. Clatterbuck's Attributional Confidence Scale (CL7): Psychometric Properties and Invariance

Arseniy V. Leontyev[1*], Elina S. Tsigeman[2], Larisa V. Mararitsa[2]

[1] Saint Petersburg State University, St. Petersburg, Russian Federation
[2] National Research University "Higher School of Economics" (HSE University), St. Petersburg, Russian Federation

Corresponding author: arsleokan@gmail.com

Abstract

Introduction. There are no Russian-language instruments that assess a person's confidence in predicting another's reactions and in the perceived accuracy of one's representation of that person. Meanwhile, Uncertainty Reduction Theory and Anxiety/Uncertainty Management Theory posit that attributional confidence is an indicator of the quality of interpersonal communication and can predict whether a dialogue will continue or be terminated. Studies measuring attributional confidence most often use G. Clatterbuck's Confidence in Proactive Attribution (CL7) scale, which has demonstrated good validity and reliability. **Methods.** The aim of the study was to adapt and validate the Russian version of Clatterbuck's Confidence in Proactive Attribution (CL7) questionnaire. Exploratory factor analysis and confirmatory factor analysis were conducted on a sample of 166 respondents. Criterion and discriminant validity were examined on two additional samples (N = 82 and N = 81). **Results.** We obtained strong evidence for a unidimensional structure of the questionnaire and for the optimality of this structure. Internal consistency was high. Tests of criterion and discriminant validity produced mixed findings for several subscales. **Discussion.** The scale meets internal consistency requirements, shows high reliability and adequate validity, and has a one-factor structure, indicating compliance with core psychometric standards and potential applicability in research. Gender

invariance and discriminant validity were confirmed. At the same time, results regarding the instrument's construct validity were unstable.

Keywords

social perception; attributional confidence; uncertainty; uncertainty-reduction theory; validation; adaptation; mentalization

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Introduction

Problem Statement

Attributional confidence refers to a subjective evaluation of how adequate one's available information is for assessing and predicting the behavior of others (Clatterbuck, 1979). G. Clatterbuck conceptualized attributional confidence through the lens of uncertainty, which naturally arises during the initial stages of communication with strangers (Berger & Calabrese, 1975; Clatterbuck, 1979; Gudykunst & Nishida, 1986; Samochowiec & Florack, 2010).

According to theoretical premises (Berger & Calabrese, 1975; Gudykunst, 2005; Neuliep, 2012, 2017) and empirical findings (Gudykunst & Nishida, 2001; Nadeem & Koschmann, 2023; Presbitero & Attar, 2018), attributional confidence is associated both with subjective communication effectiveness (r = 0.43 to 0.73) and with behaviors reflecting a desire to continue interaction (Duronto et al., 2005; Samochowiec & Florack, 2010).

This construct has been shown to influence relationship satisfaction (Imai et al., 2021), interpersonal attraction (Baruh & Cemalcılar, 2018), and as a mediator between perceived similarity and relationship satisfaction (Lee & Ng, 2024). Moreover, attributional confidence is often treated as a variable for comparing information-rich versus information-poor communication channels (Wagner, 2018) and for studying how individuals perceive each other in online networks (Antheunis et al., 2010; Orben & Dunbar, 2017).

Attributional confidence thus reflects people's subjective understanding of their knowledge about a communication partner, their ability to predict the partner's reactions and behaviors, and can be regarded as a crucial indicator of communication quality. The most widely used instrument for assessing this construct is the Attributional Confidence Scale (CL7), originally developed and validated by G. Clatterbuck on an American sample (Clatterbuck, 1979).

Currently, no standardized Russian-language instruments exist to measure the subjective degree of uncertainty when predicting another person's actions. Available methods such as T. Leary's Interpersonal Diagnosis of Personality (Sobchik, 2005) or the Interpersonal Trust Questionnaire (Razvalyaeva & Polskaya, 2021) focus on different aspects of interpersonal communication—namely trust and self-perception.

It should be noted that O. Khukhlaev and M. Bratkina (2021) reported on a preliminary adaptation of a modified Russian version of Clatterbuck's CL7 scale. However, the authors introduced major structural changes — for instance, reducing the number of items to four—and did not describe the translation procedure, present the full item wording, or analyze the factor structure or socio-demographic effects. Despite these omissions, they confirmed the criterion validity of their version, reporting positive correlations with positive affect and perceived communication effectiveness.

A subsequent Russian-language version appeared in 2022, differing in both the number of items and response options from both the 2021 and original versions (Khukhlaev et al., 2022). Yet again, the rationale for these modifications and the actual text of the adapted scale were not reported.

Accordingly, the aim of the present study is to provide a detailed theoretical overview of Clatterbuck's CL7 methodology, and conduct a full-scale adaptation and validation of its Russian-language version.

Theories of Uncertainty Reduction in Communication

Attributional confidence, as measured by G. Clatterbuck's Attributional Confidence Scale (CL7), is one of the key concepts within the framework of Uncertainty Reduction Theory (URT). One of the earliest examples of treating uncertainty as a central component of communication was Shannon and Weaver's Mathematical Theory of Communication (1949), in which the process of communication was described through an information-processing metaphor. In this model, communication was understood as the transmission of encoded information from a source to a receiver, who decodes the message and delivers the information to the addressee. Encoded information in this theory is characterized by entropy—a quantitative measure of a message's uncertainty. The higher the entropy, the greater the number of possible interpretations of the message.

Later, the construct of uncertainty was developed by Charles Berger and Richard Calabrese in Uncertainty Reduction Theory (URT) (Berger & Calabrese, 1975; Berger, 2005). According to URT, the level of predictive uncertainty influences the desire to learn more

about another person, determines the format and topics of conversation, and ultimately has a significant impact on the effectiveness of communication: the lower the uncertainty, the more successful the interaction becomes. Therefore, during communication people seek to reduce uncertainty and increase attributional confidence through two parallel processes: reducing uncertainty about the possible behavior of a new interlocutor (predictive uncertainty) and uncertainty about the causes of past behavior (retroactive uncertainty) (Berger & Calabrese, 1975). Retroactive attribution refers to explaining a partner's past actions based on current information, whereas proactive attribution, also based on current information, predicts their possible future actions (Berger & Calabrese, 1975; Clatterbuck, 1979).

This approach represents an alternative to Social Exchange Theory (SET) (Homans, 1958), which views human interaction as an exchange of resources, where each participant evaluates their actions in terms of potential rewards and costs, striving to maximize personal benefit. An important distinction between URT and SET lies in the fact that reducing uncertainty cannot be viewed as a personal gain, since excessive reduction may lead to boredom. Moreover, at the stage of initial acquaintance it is difficult to determine what can be considered a "reward," and therefore explaining communication in cost–benefit terms is not sufficient for predicting behavior during interaction (Berger & Calabrese, 1975). Newcomb's Theory of Communication (Newcomb, 1961), which describes the process of acquaintance through the formation of opinions and feelings toward a common object, also has its limitations in interpreting interpersonal interaction, as it does not focus on the actual process of communication between individuals (Berger & Calabrese, 1975).

Anxiety/Uncertainty Management Theory (AUM) expanded URT (Gudykunst, 1995; Gudykunst, 2005; Neuliep, 2017). In AUM, the main motive during acquaintance remains the reduction of uncertainty, but as communication continues, the focus shifts from constant reduction to managing the level of uncertainty. When uncertainty exceeds the maximum tolerable level, people feel too insecure to initiate or maintain communication (Gudykunst & Nishida, 2001). At the same time, if uncertainty drops below a minimal level, individuals may lose interest and motivation to continue interaction (Gudykunst, 1993; 1995). Another important addition was the inclusion of the construct of anxiety, which is viewed as the emotional equivalent of uncertainty and defined as «a general or nonspecific disturbance of equilibrium» (Stephan & Stephan, 1985; Stephan, 2014). According to numerous studies, attributional confidence negatively correlates with anxiety, while communication effectiveness correlates positively with attributional confidence and negatively with anxiety (Gudykunst & Shapiro, 1996; Gudykunst & Nishida, 2001; Nadeem & Koschmann, 2021).

It is also important to note that strategies for increasing attributional confidence and the factors influencing it depend on the specifics of communication in a given culture (Gudykunst & Nishida, 2001). Therefore, studies confirming the fundamental propositions of the theory on samples from different cultures (Nadeem & Koschmann, 2021), as well as

examinations of the validity and internal structure of the scale during its adaptation into another language, are particularly valuable.

Description of the Original CL7 Questionnaire by G. Clatterbuck

The CL7 questionnaire was developed based on behavioral indicators identified within the framework of Uncertainty Reduction Theory (Clatterbuck, 1979). The finalized items of the scale were presented to respondents with varying response formats—most commonly a 0–100% scale, although 4- and 9-point versions were also tested. According to the data reported in the original study, across 16 samples comprising a total of 1,328 respondents, internal consistency ranged from 0.763 to 0.975 (Cronbach's alpha).

To assess construct validity, correlations were examined with the following psychological constructs: empathy (Mehrabian & Epstein, 1972), extraversion (Maudsley Personality Inventory, short form; Jensen, 1958), dogmatism (Troldahl & Powell, 1965), tolerance of ambiguity (Martin & Westie, 1959), self-esteem (Berger, 1968), neuroticism (Maudsley Personality Inventory, short form; Jensen, 1958), and social desirability (Crowne & Marlowe, 1960). No significant relationships were found with any of these constructs, indicating that the scale meets the requirements for divergent validity.

In nearly all studies, there were no statistically significant differences in attributional confidence between men and women (in 14 out of 16 samples) or across age groups (in 13 out of 20 samples) (Clatterbuck, 1979). Using this scale, numerous studies have confirmed the relationship between attributional confidence and other constructs such as communication effectiveness ($r = 0.42$ to 0.83) and anxiety ($r = -0.26$ to -0.76) (Gudykunst et al., 1986; Gudykunst & Shapiro, 1996; Gudykunst & Nishida, 2001).

The relationship between attributional confidence and accuracy of social perception remains ambiguous: actual knowledge about another person and confidence in that knowledge may differ substantially, especially in the early stages of communication and in the absence of feedback. Within Uncertainty Reduction Theory, it is assumed that a high level of attributional confidence does not necessarily guarantee accuracy in attributional judgments (Berger & Calabrese, 1975; Clatterbuck, 1979).

In addition, a study using a modified version of the Attributional Confidence Scale demonstrated correlations with negative and positive affect (Khukhlaev & Bratkina, 2021). The predictive validity of the scale was also supported: low attributional confidence scores were strong predictors of communication avoidance or a desire to terminate interaction (Duronto et al., 2005).

The Present Study

The aim of the present study is to adapt and validate the Attributional Confidence Scale (CL7) for use in Russian-speaking samples. The study addressed four main objectives: to assess the internal consistency of the CL7 scale; to determine whether the scale maintains

its unidimensional structure as in the original study; to evaluate construct validity by testing four hypotheses; and to verify the gender invariance of the scale.

The hypotheses were as follows:

(1) Attributional confidence is negatively associated with anxiety and negative affect during communication.

(2) Attributional confidence is positively associated with communication satisfaction.

(3) Attributional confidence shows weak associations with extraversion and neuroticism as personality traits.

(4) Attributional confidence shows weak associations with the accuracy of social perception of personality traits following an interaction episode between strangers.

To address these objectives, two studies were conducted. The first, an online survey, examined the reliability and factor structure of the scale. The second, an experimental study in which pairs of same-gender strangers interacted either face-to-face or via videoconference, focused on testing discriminant and criterion-related construct validity, as well as the gender invariance of responses.

Both studies were approved by the Commission for Intra-University Surveys and Ethical Review of Empirical Research Projects of the Higher School of Economics (HSE). All participants provided informed consent for participation and the processing of personal data.

The results of these studies are presented below.

Study 1

Methods

Sample and Procedure

For the first study, conducted to pilot and test the adapted methodology, data were collected via online forms. Participants were recruited through communication channels commonly used in the university environment, including social networks, group chats, and mailing lists. The final sample consisted of 166 university students from Saint Petersburg, Russia (age range: 18–57 years, M(SD) = 20.81 $\pm$ 4.81, median = 20; 80.84% female). Most participants at the time of the study had completed secondary education (74.69%).

In the instructions, respondents were asked to recall a recent conversation lasting at least 15 minutes and to evaluate their communication partner using the questionnaire, regardless of the communication format (online or face-to-face).

Materials

The instruction text, rating scale, and items of the CL7 questionnaire were translated into Russian by three independent experts holding PhDs in social psychology. Each expert completed the translation independently, after which all versions were compared, and discrepancies were discussed until a consensus was reached. Instead of a strict forward–backward translation procedure, the researchers applied a semantic equivalence approach, focused on maintaining conceptual correspondence between the Russian and English versions of each item, taking into account the theoretical meaning of the construct. The full Russian version of the questionnaire and its scoring key are presented in Appendix 1.

The instruction read as follows: "Using a scale from 0% confidence (I can only guess) to 100% confidence (complete certainty), please rate…". Respondents were asked to evaluate seven statements using a 0–100 scale, where only multiples of 10 were available (resulting in 11 possible response options). This format was selected to improve usability for online administration. Participants were instructed to recall the most recent person they had interacted with and to answer each question with that individual in mind.

Results of Study 1

Results: Factor Structure Analysis

To examine the factor structure of the scale, an exploratory factor analysis (EFA) with Varimax rotation was conducted using Python (the factor_analyzer package). The results are presented in Table 1. The analysis confirmed the presence of a single underlying factor, which accounted for 71% of the total variance. All items demonstrated factor loadings above 0.80, except for Item 2 (loading = 0.763).

Table 1
Descriptive statistics and factor loadings for CL7 scale items

Scale items	M (SD)	Factor loading
How confident are you of your general ability to predict how he/she will behave?	6.77 (2.27)	0.822
How certain are you that he/she likes you?	6.91 (2.53)	0.763
How accurate are you at predicting the values he/she holds	6.50 (2.49)	0.865

Scale items	M (SD)	Factor loading
How accurate are you at predicting his/her attitudes?	6.49 (2.25)	0.845
How well can you predict his/her feelings and emotions?	6.71 (2.21)	0.850
How much can you empathize with (share) the way he/she feels about himself/herself	6.79 (2.39)	0.874
How well do you know him/her?	6.71 (2.58)	0.870

Additionally, to further examine the structure of the questionnaire, a confirmatory factor analysis (CFA) was conducted. All regression weights were statistically significant ($p < .001$), and no extreme discrepancies were observed between the empirical and model-implied covariances. The model met the requirements of most conventional goodness-of-fit criteria (RMSEA < .10, CFI > .95, TLI > .95, SRMR < .08) (Kline, 2016), with the exception of RMSEA, which slightly exceeded the recommended threshold. However, as noted by Kline (2016), such a deviation is not considered critical when the SRMR value remains below .08 (see Table 2).

Table 2
Model fit indices for the confirmatory factor analysis

Model	X2 (df, p)	RMSEA (90% CI)	CFI	TLI	SRMR
Study №1	38.220 (14. 0.000)	0.102 (0.064..0.142)	0.975	0.963	0.0266

Results: Reliability Analysis

To assess the reliability of the obtained unidimensional factor structure, Cronbach's alpha was calculated (Cronbach, 1951). The coefficient value of 0.94 indicated a high level of internal consistency (Evers et al., 2013). However, Cronbach's alpha has several well-documented limitations: it is sensitive to scale length (Cortina, 1993), assumes tau-equivalence—that all items have equal true-score variances (Raykov, 1997)—and is affected by non-normal item distributions (Sheng & Sheng, 2012). Therefore, following

current methodological recommendations, we additionally estimated McDonald's omega (Hayes & Coutts, 2020). The obtained omega coefficient was 0.94, which also indicates high reliability. Table 3 presents the values of Cronbach's alpha and McDonald's omega when each item was excluded from the scale.

Table 3
Cronbach's alpha and McDonald's omega coefficients with item exclusion

Scale items	Cronbach's α if item deleted	McDonald's ω if item deleted
CL_1	0.93	0.93
CL_2	0.94	0.94
CL_3	0.93	0.93
CL_4	0.93	0.93
CL_5	0.93	0.93
CL_6	0.93	0.93
CL_7	0.93	0.93

Excluding any item from the scale did not improve its reliability, except for Item 2.

Study 2

Methods

Sample and Procedure

The sample consisted of participants in a study examining perceived communication quality in both real-life and computer-mediated interactions. Participants were paired into same-gender dyads and randomly assigned to one of two experimental conditions: the first group communicated via computer-mediated interaction, while the second engaged in face-to-face communication. After removing incomplete responses, the total sample size was 163 participants.

In Group 1 (N = 83), ages ranged from 18 to 25 (M = 20.9, median = 20, SD = 1.78), with 50.6% identifying as female. In Group 2 (N = 80), ages ranged from 18 to 25 (M = 20.4, median = 21, SD = 2.06), with 51.3% identifying as female.

Before the experimental session, participants completed the Big Five Inventory–2 (BFI-2) in the Russian adaptation by Kalugin et al. (2021). Each dyad then completed a series of task-based and socio-emotional interaction exercises. After completing the tasks, participants filled out the following instruments: the Russian version of the Positive and Negative Affect Schedule (PANAS) adapted by Osin (2012); the BFI-2 (this time rating their partner rather than themselves); the Russian version of the CL7 scale; and five items from the Interpersonal Communication Satisfaction Inventory (ICSI) (Hecht, 1978) assessing communication satisfaction.

Because partners in a dyad could influence each other, the assumption of independent observations was violated. Therefore, for statistical analysis, participants were randomly split into two separate subsamples, ensuring that members of the same dyad were not included in the same dataset. All subsequent analyses were conducted separately for each subsample.

Measures

(1) Attributional Confidence. The same Russian version of the CL7 scale used in Study 1 was employed here, with a modified instruction asking participants to evaluate their communication partner in the experimental setting.

(2) Neuroticism and Extraversion. To assess divergent validity, we used scores on the Neuroticism and Extraversion subscales of the Big Five Inventory–2 (BFI-2), consistent with the procedure used to test divergent validity in the original CL7 validation (Clatterbuck, 1979). The Russian version of the BFI-2 (Kalugin et al., 2021) contains 61 items and has demonstrated high reliability and validity in prior psychometric studies.

(3) Accuracy of Partner Personality Ratings. At the beginning of the experimental session, each participant completed the BFI-2 about themselves. At the end of the interaction, participants again completed the same inventory, but this time as if they were their partner. For each participant, the score on each BFI-2 subscale was compared to the corresponding score given by their partner, who was instructed to answer as they believed the participant would respond after the interaction. For every participant, we thus obtained six discrepancy indices (one per Big Five trait and one total score) representing social perception accuracy.

(4) This approach follows the self–other discrepancy paradigm, which has been used to study perceptual asymmetries in personality disorder assessment (Carlson et al., 2013), links between asymmetry and mindfulness (Birjandi & Siyyari, 2016), and the temporal stability of self–other rating differences (Oltmann et al., 2020).

(5) Post-Interaction Anxiety. To evaluate criterion validity, we examined correlations between attributional confidence and post-interaction anxiety.

Four items were selected from the Russian adaptation of the State–Trait Anxiety Inventory–20 (STAI-20) (Osin, 2012): items 11, 15, 18, and 20 (irritable, nervous, restless, anxious). These items were chosen to correspond to the set of negative emotions used in the intergroup anxiety questionnaire by Gudykunst and Nishida (2001). We also examined correlations with overall negative affect and positive affect, consistent with the approach of Khukhlaev and Bratkina (2021).

(6) Communication Satisfaction. To further assess criterion validity, we analyzed associations between attributional confidence and communication satisfaction and effectiveness. Five items were used from the Interpersonal Communication Satisfaction Inventory (ICSI) (Hecht, 1978). Since no official Russian translation exists, the items were translated and used individually as separate measures:

   a. The interlocutor made me feel that I was being clear and that the conversation was productive.
   b. We didn't reach any conclusions or achieve anything in the conversation.
   c. I was very dissatisfied with this conversation.
   d. I felt that I could talk to this person about anything.
   e. We managed to discuss everything; each of us said what we wanted to say.

Results

Relationship between CL7 and Anxiety/Negative Affect

According to the first hypothesis, we expected that confidence in proactive attribution would be negatively associated with anxiety and negative affect during communication. The analysis revealed significant negative correlations between attributional confidence and the negative affect items irritable, restless, nervous, as well as with the Negative Affect subscale (see Table 4). A positive correlation with the Positive Affect subscale was also observed, though this association became non-significant after applying the Bonferroni correction; the correlation with the Negative Affect scale remained significant. In the second subsample, no significant associations were found. All analyses were conducted using Spearman's rank correlation coefficient.

Table 4

Correlations between the PANAS scale, its items, and CL7

Items scale PANAS-20	Correlation coefficient (r) and significance (p)	CL7	
		Sample №1	Sample №2
Irritable	r	- 0.326	- 0.041
	p	0.003	0.722
Nervous	r	- 0.196	0.092
	p	0.077	0.418
Restless	r	- 0.223	- 0.128
	p	0.044	0.259
Anxious	r	- 0.271	- 0.028
	p	0.014	0.806
Negative Affect	r	- 0.320	- 0.056
	p	0.003	0.625
Positive Affect	r	0.248	0.161
	p	0.025*	0.157

Relationship between CL7 and Communication Satisfaction

The second hypothesis proposed a positive association between confidence in proactive attribution and communication satisfaction. After applying the Bonferroni correction, no significant correlations were found between CL7 scores and any of the satisfaction items in either Subsample 1 or Subsample 2 (see Table 5).

Without applying the Bonferroni correction, significant correlations were observed between CL7 and two out of five satisfaction items in Subsample 1; however, no significant correlation with the total communication satisfaction score was found in either subsample. All analyses were conducted using Spearman's rank correlation coefficient.

Table 5
Attributional confidence and communication satisfaction

Item	Correlation coefficient (r) and significance (p)	*CL7*	
		Sample 1	Sample 2
The interlocutor made me feel that I was being clear and that the conversation was productive.	*r*	0.271	0.148
	p	0.013*	0.189
We didn't reach any conclusions or achieve anything in the conversation. **	*r*	–0.046	–0.102
	p	0.677	0.370
I was very dissatisfied with this conversation. **	*r*	0.032	0.022
	p	0.773	0.849
I felt that I could talk to this person about anything.	*r*	0.226	0.047
	p	0.039*	0.681
We managed to discuss everything; each of us said what we wanted to say.	*r*	0.040	–0.093
	p	0.717	0.412
Total score across all five items (Cronbach's α = 0.701, McDonald's ω = 0.721)	*r*	0.175	–0.004
	p	0.114	0.970

Note: *After applying the Bonferroni correction for multiple hypothesis testing, the statistical significance of the results disappears. **Reverse-scored items; values were recoded so that higher scores indicate greater communication satisfaction.

Reliability and Relationships with Personality Traits

As in the first study, the reliability of the scale was evaluated using Cronbach's alpha (0.88 for both Subsample 1 and Subsample 2) and McDonald's omega (0.88 for both subsamples). Both coefficients indicate high internal consistency of the scale, consistent with the findings of Study 1.

The third hypothesis proposed that confidence in proactive attribution would be weakly associated with Extraversion and Neuroticism as personality traits. In line with the results of the original study, no significant correlations were found between CL7 scores and the Neuroticism subscale in either subsample. However, in Subsample 1, a weak but significant correlation was observed between CL7 and Extraversion, which became non-significant after applying the Bonferroni correction (see Table 6). In Subsample 2, a positive association was found with the Openness to Experience subscale.

All analyses were conducted using Spearman's rank correlation coefficient.

Additionally, a gender differences analysis was performed using Student's t-test, which revealed no statistically significant differences between men and women in either subsample.

Table 6

Correlations between CL7 and BFI-2 subscales

BFI-2 subscales	Correlation coefficient (r) and significance (p)	CL7	
		Sample 1 (n = 83)	Sample 2 (n = 80)
Extraversion	r	0.268	0.218
	p	0.014*	0.052
Neuroticism	r	−0.076	−0.125
	p	0.492	0.270
Openness to Experience	r	0.202	0.242
	p	0.068	0.030*
Agreeableness	r	0.165	0.026
	p	0.136	0.821
Conscientiousness	r	0.105	0.002
	p	0.347	0.983

Note: *after applying the Bonferroni correction for multiple hypothesis testing, the statistical significance of the results disappears.

Relationship between CL7 and Social Perception Accuracy

The fourth hypothesis proposed that confidence in proactive attribution would be weakly associated with the accuracy of social perception of personality traits following an interaction between strangers. The analysis revealed no significant correlations—neither with the total absolute discrepancy score across all BFI-2 subscales nor with any individual subscales (see Table 7). All analyses were conducted using Spearman's rank correlation coefficient.

Table 7

Correlations between CL7 scores and the accuracy of social perception of personality traits.

Absolute discrepancy for BFI-2 subscales	Correlation coefficient (r) and significance (p)	CL7	
		Sample 1	Sample 2
Extraversion	*r*	–0.122	–0.084
	p	0.280	0.460
Conscientiousness	*r*	0.036	0.048
	p	0.748	0.675
Neuroticism	*r*	–0.008	–0.036
	p	0.947	0.750
Openness to Experience	*r*	0.199	0.029
	p	0.076	0.797
Agreeableness	*r*	0.072	–0.021
	p	0.524	0.853
Total discrepancy (across all subscales)	*r*	0.004	0.019
	p	0.975	0.866

Discussion

The exploratory factor analysis (EFA) conducted in Study 1 confirmed the unidimensional structure of the Russian-language version of the Attributional Confidence Scale. The confirmatory factor analysis (CFA) results, based on model–data fit indices, also supported the single-factor structure of the scale, consistent with the findings obtained for the original CL7 version (Clatterbuck, 1979). Reliability was examined using both Cronbach's alpha and McDonald's omega, allowing us to compensate for the limitations of each method and to provide a more comprehensive assessment of internal consistency. The reliability coefficients were high and comparable to the best results reported for the original English-language version (Clatterbuck, 1979). A repeated reliability analysis in Study 2 further confirmed these findings, demonstrating strong internal consistency across samples.

To test criterion validity (Hypothesis 1: confidence in proactive attribution is negatively related to anxiety during communication), selected items from the State–Trait Anxiety Inventory–20 (STAI-20) related to anxiety experiences were used. In the first subsample, a significant negative correlation was observed between attributional confidence and the items *irritable*, *restless*, *nervous*, as well as with the Negative Affect subscale, and a positive correlation with Positive Affect. This pattern is consistent with the findings of Khukhlaev and Bratkina (2021) obtained using a modified version of the Attributional Confidence Scale. Within the framework of Anxiety/Uncertainty Management Theory (AUM), a relationship between anxiety and attributional confidence is theoretically expected (Gudykunst, 1993, 1995) and has been empirically confirmed in several studies (Gudykunst & Shapiro, 1996; Gudykunst & Nishida, 2001; Khukhlaev & Bratkina, 2021). However, this association did not replicate in the second subsample, indicating that the relationship is weak and possibly unstable—at least in experimental settings involving dyadic interactions between previously unacquainted same-gender students.

To further assess criterion validity, we analyzed the relationship between attributional confidence and items reflecting communication satisfaction, conceptualized as a component of perceived communication effectiveness (Hypothesis 2: confidence in proactive attribution is positively related to communication satisfaction). In the first subsample, a positive association was found with two of the five items—"The interlocutor made me feel that I was being clear and that the conversation was productive" and "I felt that I could talk to this person about anything." These findings align with theoretical assumptions (Gudykunst, 1993, 1995) and prior empirical research (Gudykunst et al., 1986; Gudykunst & Shapiro, 1996; Gudykunst & Nishida, 2001; Presbitero & Attar, 2018; Nadeem & Koschmann, 2021). However, no significant associations were observed in the second subsample. It should also be noted that communication satisfaction was used here as a proxy for communication effectiveness, since the latter could not be measured directly. Thus, the observed associations can be regarded as partial and limited confirmations of criterion validity. Future studies using more ecologically valid interaction settings are required to draw firmer conclusions.

To evaluate divergent validity (Hypothesis 3: confidence in proactive attribution is weakly related to Extraversion and Neuroticism as personality traits), we used the Neuroticism and Extraversion subscales of the Big Five Inventory–2 (BFI-2). Consistent with the original study (Clatterbuck, 1979), no significant correlation was found with Neuroticism in either subsample. A weak significant association with Extraversion emerged in one subsample only. Overall, the results suggest that confidence in proactive attribution is not strongly related to personality traits, supporting our divergent validity hypothesis.

We also found no significant correlations between attributional confidence and social perception accuracy (Hypothesis 4: confidence in proactive attribution is weakly related to the accuracy of personality perception following interaction between strangers). This finding is theoretically consistent: the accuracy of judgments about another person

and confidence in those judgments can differ substantially (Clatterbuck, 1979; Berger & Calabrese, 1975) and may converge only when feedback is available (Samochowiec & Florack, 2010). Additionally, no significant gender differences were observed, consistent with both theoretical expectations and the validation results of the original CL7 scale (Clatterbuck, 1979). Collectively, these results provide support for the divergent construct validity of the Russian version of the scale.

It was not possible to test the convergent validity of the Proactive Attributional Confidence Scale due to the absence of comparable instruments in Russian that measure related constructs.

The study has several limitations. All data were obtained from student samples, and the first study—examining the factor structure—was conducted on a gender-imbalanced sample. Evidence for criterion and divergent construct validity was gathered under laboratory conditions, which may differ from natural communication settings, and the results are limited to initial same-gender interactions between previously unacquainted individuals. Under different communicative contexts, the relationships between attributional confidence, anxiety, social perception accuracy, and communication satisfaction may vary.

Conclusion

The present research confirmed the unidimensional structure of the Russian version of the Proactive Attributional Confidence Scale, consistent with the original English version. The scale demonstrated high reliability, as indicated by Cronbach's alpha and McDonald's omega, reflecting good internal consistency and measurement stability.

Divergent validity received strong support: confidence in proactive attribution was weakly or non-significantly associated with Extraversion, Neuroticism, and social perception accuracy of one's partner. Criterion validity received partial confirmation, with weak and inconsistent negative correlations observed with negative affect and post-interaction anxiety, as well as limited associations with communication satisfaction. Moreover, evidence was obtained for the gender invariance of the scale.

Overall, the adapted Russian version of the CL7 scale exhibits the theoretically expected one-factor structure, high reliability, and adequate validity, meeting the core psychometric standards and demonstrating potential applicability in psychological and communication research. Nevertheless, further refinement is warranted—particularly through testing associations with additional constructs, improving response scaling, and expanding item content based on contemporary theoretical developments.

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Author Contributions

Arseniy V. Leontyev — selection of statistical methods and statistical data analysis, interpretation of statistical findings, writing the initial draft of the manuscript.

Elina S. Tsigeman — data collection, manuscript editing.

Larisa V. Mararitsa — study supervision, research design development, writing the final version of the manuscript.

Author Details

Arseniy V. Leontyev — Student, Saint Petersburg State University, St. Petersburg, Russian Federation; ORCID ID: https://orcid.org/0009-0000-5984-2403; e-mail: arsleokan@gmail.com

Elina S. Tsigeman — Junior Research Fellow, Saint Petersburg Branch, National Research University "Higher School of Economics" (HSE University), St. Petersburg, Russian Federation; ORCID ID: https://orcid.org/0000-0002-7966-5982

Larisa V. Mararitsa — Cand.Sci. (Psychology), Head of the Laboratory of Evidence-Based Psychology of Health and Well-being, Saint Petersburg, Russian Federation; ORCID ID: https://orcid.org/0000-0003-3858-5369

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Validation of the Scale of Satisfaction of Basic Psychological Needs—Autonomy, Competence, Relatedness—in the Context of Treatment in Cancer Patients Receiving Chemotherapy and Radiation Therapy

Marina K. Karakurkchi[1], Aleksander Sh. Tkhostov[2], Elena I. Rasskazova[2], Sofia A. Kirsanova[2]

[1] S.S. Yudin City Clinical Hospital, Moscow, Russian Federation
[2] Lomonosov Moscow State University, Moscow, Russian Federation

Corresponding author: karakyrkchi_m@mail.ru

Abstract

Introduction. According to Self-Determination Theory (SDT), the satisfaction of basic psychological needs for autonomy, competence, and relatedness is associated with subjective well-being, treatment motivation, and adherence—particularly in cancer patients. The aim of this study was to validate the Scale of Satisfaction of Basic Psychological Needs in the Context of Treatment in cancer patients receiving chemotherapy and radiation therapy. **Methods.** The study included 203 cancer patients undergoing systemic anticancer treatment. The assessment instruments were: the Scale of Satisfaction of Basic Psychological Needs in the Context of Treatment (Kovyazina et al., 2019), the Illness Perception Questionnaire–Revised (Moss-Morris et al., 2002; Rasskazova, 2016), and the Illness and Treatment Self-Regulation Questionnaire (Kovyazina et al., 2019). **Results.** The scale demonstrated adequate internal consistency (with the exception of the Autonomy subscale, which requires further investigation) and acceptable factor validity. Higher satisfaction of basic psychological needs was associated with greater treatment self-efficacy and lower levels of health anxiety and helplessness. Patients receiving radiation

therapy reported higher satisfaction of basic psychological needs compared to those undergoing chemotherapy. **Discussion.** The findings support the use of this scale for assessing basic psychological needs satisfaction in cancer patients undergoing treatment. Such assessment may facilitate the development and implementation of psychological interventions aimed at enhancing treatment motivation and improving engagement in rehabilitation.

Keywords

psychodiagnostics, self-determination theory, satisfaction of basic psychological needs, oncological diseases, chemotherapy and radiation therapy

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Introduction

Psychological adaptation to oncological diseases and their treatment is a long, complex, and dynamic process that requires patients' active and purposeful involvement. It begins at the stage of diagnosis (Secinti et al., 2019) and continues through antineoplastic drug therapy and surgical interventions. The post-treatment period is characterized by long-term medical monitoring, fear of recurrence (Tauber, 2019), and challenges in social reintegration (Andrykowski, Lykins, & Floyd, 2008). The quality of life of cancer patients declines at every stage of treatment, starting from diagnosis (Lewandowska, 2022; Mehnert et al., 2018).

Patients' behavior during treatment is closely related to their subjective well-being (Shagarova, 2019). Encouraging cancer patients to engage actively in treatment is an essential component of psychological support.

According to self-determination theory (Ryan & Deci, 2000), health, well-being, and motivation to seek treatment among patients with mental and somatic conditions are determined by the extent to which their basic psychological needs are satisfied (Sheldon et al., 2003). Autonomy refers to the need to experience a sense of volition and self-direction in one's life and actions. It is associated with the development of intrinsic motivation, which in turn fosters greater personal engagement in activities. Competence is the need to feel effective and capable of mastering tasks and challenges. Relatedness reflects the need to establish and maintain meaningful connections with others. The satisfaction of these basic psychological needs is linked to both the quality of life and treatment adherence of patients with somatic conditions (Xia et al., 2023).

The extent to which patients receive tangible social support from family and loved ones, as well as from the interdisciplinary oncology team, along with autonomy support within the medical process, determines not only their quality of life but also their engagement in and satisfaction with treatment (Kroemeke, 2022; Bonetti et al., 2022).

Psychological support at different stages of treatment, tailored to the individual's personal values and meaning orientations, can facilitate adaptation; however, it is not always accompanied by a positive emotional state (Hulbert-Williams et al., 2018).

Lynch and Lee (2021) investigated the roles of social support and psychological needs in predicting social well-being among older adult cancer survivors. They found that social support is positively associated with social well-being, with support from family and friends emerging as a significant predictor even after controlling for key demographic variables. Similarly, Rivera-Rivera (2021) reported that social support from family members and friends significantly predicts social well-being. Moreover, the satisfaction of basic psychological needs—autonomy, competence, and relatedness—was identified as an important predictor of social well-being.

Kroemeke and Sobczyk-Kruszelnicka (2022) explored how healthcare professionals provide autonomy support within patient–caregiver dyads and how this support influences patients' well-being following hematopoietic cell transplantation. Their data indicated that patients' perceptions of the autonomy support they received were associated with positive emotions and satisfaction with their relationships. In a study on maintaining autonomy in individuals with intellectual disabilities, Stefánsdóttir et al. (2018) concluded that, even among those with severe intellectual disabilities, individuals can achieve greater autonomy through specific interactions and support from family members and loved ones.

A meta-analysis of experimental studies based on self-determination theory (SDT) in healthcare (Ntoumanis et al., 2021) demonstrated the effectiveness of SDT interventions, with the strongest effects arising from autonomy support and competence development, the creation of environments that satisfy basic psychological needs, and the promotion of autonomous motivation.

In this context, it is crucial to develop and validate methodologies across various clinical populations that assess the satisfaction of autonomy, competence, and relatedness needs in relation to treatment and rehabilitation. A corresponding scale was subsequently developed and underwent initial testing in a sample of patients who had experienced a stroke (Kovyazina et al., 2016, 2017, 2019). However, no studies have examined the relationship between the satisfaction of basic psychological needs and subjective well-being or quality of life in patients with other medical conditions, nor has the questionnaire been tested in cancer patients.

The aim of the research is to validate a scale assessing the satisfaction of autonomy, competence, and relatedness needs in relation to treatment among cancer patients undergoing chemotherapy and radiotherapy.

Research objectives:

1. To assess the reliability, internal consistency, and factorial validity of the scale in cancer patients.
2. To identify the relationships of gender and age with the satisfaction of basic needs related to treatment in cancer patients.
3. To compare satisfaction with basic needs related to treatment across patients undergoing chemotherapy versus radiotherapy.
4. To examine the associations between autonomy, competence, and relatedness in relation to treatment and patients' perceptions of their illness and treatment.

Methods

The study was conducted at S.S. Yudin City Clinical Hospital, Moscow, Russian Federation; N.N. Blokhin National Medical Research Center of Oncology, Moscow, Russian Federation; and MEDSI International Oncology Center, Moscow, Russian Federation.

The study included 203 cancer patients receiving systemic antineoplastic therapy, comprising 149 women and 54 men (mean age = 49.94 $\pm$ 12.20 and 46.50 $\pm$ 12.68 years, respectively). The distribution of patients by diagnostic category was as follows: 37% had breast cancer, 20% had malignant neoplasms of the intestine, and the remaining patients were diagnosed with oncological diseases of other localizations.

A total of 149 participants (103 women and 46 men) were receiving chemotherapy (CT), and 54 participants (46 women and 8 men) were receiving radiation therapy (RT). At the time of assessment, all participants were undergoing active treatment — either chemotherapy (CT) or radiotherapy (RT). Some patients were receiving neoadjuvant chemotherapy, while those undergoing RT had previously undergone surgical intervention and chemotherapy.

Eighty-nine participants reported having an additional chronic condition, 99 reported no comorbidities, and for 15 participants this information was not available. This variable

was considered relevant due to the potential influence of comorbid medical burden and prior experience with chronic illness on the satisfaction of psychological needs.

Respondents completed the following questionnaires:

1. Scale of Satisfaction of Basic Psychological Needs in the Context of Treatment (M.S. Kovyazina et al.; see Appendix 1), which is a modification of T.O. Gordeeva's (2015) Basic Psychological Needs Questionnaire.
2. Illness Perception Questionnaire–Revised (IPQ-R; Moss-Morris et al., 2002) in the Russian adaptation by Rasskazova (2016), designed to assess the cognitive component of illness representation. The questionnaire consists of three sections: *Identity*, *Illness Representations*, and *Causes of Illness*. In the present study, only the *Illness Representations* section was used, with questions referring specifically to the respondents' current oncological disease. This section includes 38 statements rated on a 5-point Likert scale (from 1 = "strongly disagree" to 5 = "strongly agree") and comprises the and comprises the following subscales: 1) *Timeline* (acute/chronic), which reflects perceptions of how long the illness will last; 2) *Consequences*, which represents the perceived negative impact of the illness on life; 3) *Personal control*, which indicates the perceived ability to control the illness; 4) *Treatment control*, which reflects confidence in the effectiveness and importance of treatment; 5) *Illness coherence*, which reflects the perceived understanding (or lack of understanding) of the illness (reverse item); 6) *Timeline* (cyclical), which represents perceptions of the cyclical nature of the illness; and 7) *Emotional representations*, which describe emotional responses related to the illness.
3. Illness and Treatment Self-Regulation Questionnaire (Kovyazina et al., 2019), which assesses patients' current attitudes and decisions regarding their health and treatment. It includes the following subscales: Health Anxiety, Helplessness in the Rehabilitation Process, and Self-Efficacy in the Rehabilitation Process.

Statistical analysis was performed in RStudio (version 2024.09.0) using functions from the *psych* (version 2.4.6.26), *tidyverse* (2.0.0), and *lavaan* (0.6.19) packages, as well as functions from the base R library (version 4.3.3).

The reliability of the scales was assessed using Cronbach's alpha (α). Structural (factorial) validity of the instrument was evaluated by means of confirmatory factor analysis (CFA). Since the individual items used ordinal (Likert-type) scales, a CFA method designed for ordinal data and robust to non-normality was applied—specifically, the diagonally weighted least squares (DWLS) estimation method.

The following indices were used to evaluate model fit: root mean square error of approximation (RMSEA; the model is considered a good fit for RMSEA < 0.08), comparative fit index (CFI), and Tucker–Lewis index (TLI). Values of CFI and TLI of ≥ 0.90 are regarded as acceptable, and ≥ 0.95 as good (Hu & Bentler, 1999).

Intercorrelations among the scales and analyses of external validity (correlations with scores from other instruments) were assessed using correlation coefficients; given

the non-normal distribution of the scales, the Spearman correlation coefficient was calculated.

Differences between male and female participants were compared using Welch's t-test (an adaptation of Student's t-test for unequal variances).

Results

Reliability, internal consistency, and factorial structure of the scale

Structural validity of the three-factor model was assessed to examine the factor structure. Confirmatory factor analysis (CFA) was conducted using maximum likelihood estimation. Model fit indices fell below commonly accepted thresholds, although they approached acceptable levels: $\chi2(123) = 416.404$, $p < 0.001$, RMSEA = 0.106, CFI = 0.839, TLI = 0.813.

In this model, factor loadings were statistically significant at $p < 0.001$ for all items except Item 13. Item 13, formulated as "I feel that I choose my treatment approaches as I see fit" [Я чувствую, что сам выбираю свои способы лечения так, как я сам считаю нужным], belongs to the Autonomy scale. The wording of the question likely sounds contradictory for oncological patients due to the specific nature of cancer disease and treatment and, in essence, the lack of alternatives in prescribed treatment regimens, which are often complex and accompanied by pronounced adverse effects causing patient suffering. Following removal of this item from the model, fit indices increased somewhat but remained below commonly accepted criterion values: $\chi2(116) = 340.728$, $p < 0.001$, RMSEA = 0.100, CFI = 0.870, TLI = 0.848.

Based on technical assessment using modification indices and given the substantive content links identified, correlations were added in the formulations of the following item pairs: 3–5, 6–14, 8–10. Items 3 and 5 address the theme of emotional support from healthcare providers; items 6 and 14 address the theme of pressure and conflict related to treatment process participants; items 8 and 10 address the theme of rehabilitation task completion effectiveness. The final model demonstrated acceptable fit indices: $\chi2(113) = 270.970$, $p < 0.001$, RMSEA = 0.085, CFI = 0.909, TLI = 0.890. All factor loadings differed significantly from zero at $p < 0.001$. Standardized factor loadings are presented in Table 1.

In the one-factor model, analysis yielded less acceptable fit indices: $\chi2(104) = 432.187$, $p < 0.001$, RMSEA = 0.128, CFI = 0.811, TLI = 0.789. Following the addition of correlations, fit indices became more acceptable: $\chi2(99) = 273.420$, $p < 0.001$, RMSEA = 0.095, CFI = 0.900, TLI = 0.878. All factor loadings differed significantly from zero at $p < 0.001$.

Table 1
Standardized Factor Loadings in the Three-Factor Model

Factor	Item Number	Loading	Standard Error
Relatedness	SDT1	0.859	0.041
	SDT3	0.584	0.056
	SDT5	0.572	0.058
	SDT2	-0.577	0.058
	SDT4	-0.706	0.057
	SDT6	-0.574	0.070
Competence	SDT7	0.761	0.036
	SDT9	0.750	0.037
	SDT11	0.771	0.037
	SDT8	-0.549	0.048
	SDT10	-0.371	0.063
	SDT12	-0.587	0.050
Autonomy	SDT15	0.307	0.068
	SDT17	0.713	0.065
	SDT14	-0.456	0.076
	SDT16	-0.255	0.070
	SDT18	-0.395	0.066

Note. ** all factor loadings differed significantly from zero at p <0.001.*

This model showed strong correlations between the factors Relatedness and Competence ($r = 0.639$, $p < .001$) and between Relatedness and Autonomy ($r = 0.642$, $p < .001$). The very high correlation between the Relatedness and Autonomy subscales ($r = 0.922$, $p < .001$) suggests substantial overlap between these dimensions.

Reliability analysis indicated that the Relatedness and Competence scales demonstrated relatively high internal consistency (Cronbach's $\alpha = 0.741$ and 0.734, respectively), whereas the Autonomy scale showed low reliability (Cronbach's $\alpha = 0.438$), reflecting heterogeneity within this subscale. Overall, the questionnaire exhibited satisfactory reliability (Cronbach's $\alpha = 0.807$).

Descriptive statistics for the three subscales and the overall scale are presented in Table 2.

Table 2

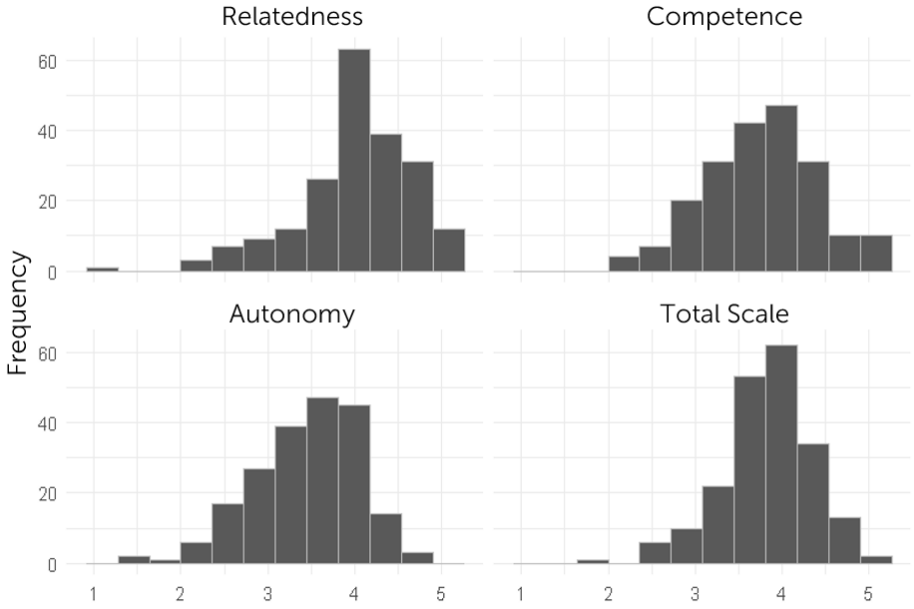
Descriptive Statistics for the Basic Needs Satisfaction Questionnaire Scales

Scale	Mean (SD)	Skewness	Normality Test Result*
Relatedness	4.026 (0.668)	-0.962	< 0.001
Competence	3.76 (0.643)	-0.044	0.017
Autonomy	3.441 (0.595)	-0.370	0.012
Total Scale	3.833 (0.52)	-0.460	0.019

Note. **Shapiro-Wilk test of normality.*

The distributions of all scales in the questionnaire deviated significantly from normality. Examination of the scale distributions (see Fig. 1) revealed some skewness, with scores shifted toward lower values; however, no ceiling or floor effects were observed. The distributions of scores are presented in Figure 1.

Figure 1
Distribution of Basic Needs Satisfaction Scales



The distribution of scores across questionnaire scales was analyzed to examine empirical relationships between scales using Spearman's rank correlation. Results revealed significant correlations between Relatedness and Competence: $r = 0.429$, $p < 0.001$; between Relatedness and Autonomy: $r = 0.322$, $p < 0.001$; and between Competence and Autonomy: $r = 0.487$, $p < 0.001$.

Comparison of scale scores between men and women revealed no significant differences across all scales.

No significant correlations were found between basic needs satisfaction scales, age, disease duration, and functional status.

Comparison of groups with and without comorbid chronic conditions revealed no significant differences.

Comparison of Two Types of Treatment

Comparison of results between the two treatment groups showed that patients receiving radiotherapy demonstrated significant differences on the overall scale of satisfaction of basic psychological needs, as well as a marginally significant difference on the Competence subscale. In both cases, the mean scores were higher in the radiotherapy group (see Table 3).

Table 3

Comparison of Two Types of Treatment

Scale	Treatment Type		t-Test Result	Effect Size (Cohen's d)
	CT	RT		
Relatedness	3.984 (0.693)	4.142 (0.583)	t(110.7) = -1.616, p= 0.109	-0.246
Competence	3.707 (0.634)	3.908 (0.651)	t(92.1) = -1.961, p= 0.053	-0.314
Autonomy	3.638 (0.665)	3.781 (0.608)	t(102.6) = -1.446, p= 0.151	-0.225
Total Scale	3.79 (0.535)	3.953 (0.461)	t(108.3) = -2.138, p= 0.035	-0.328

Relationship between the Scale of Satisfaction of Basic Psychological Needs—Autonomy, Competence, Relatedness—in the Context of Treatment and the Illness Perception Questionnaire–Revised, attitudes toward treatment, and self-regulation in the rehabilitation process

During the analysis of the relationships between the Scale of Satisfaction of Basic Psychological Needs—Autonomy, Competence, Relatedness—in the Context of Treatment and the Illness Perception Questionnaire–Revised, negative correlations were found between Emotional representations and the Total Scale, between Consequences and the Total Scale, and between Consequences and Competence. In other words, the higher the subjective perception of the satisfaction of psychological needs in treatment, the less likely patients are to develop emotional representations of the illness and its consequences. The higher the subjective perception of the satisfaction of the need for competence, the less negative the representations of the illness consequences. Significant positive correlations were identified between Treatment control and the Total Scale, between Illness coherence and Competence, and between Treatment control and Relatedness.

Parameter *Autonomy* shows the weakest correlations compared to the other scales, while the strongest correlations are observed with *Total Scale* and *Competence*. Complete data on correlations between the scales of the two questionnaires are presented in Table 4.

Table 4

Relationship Between Satisfaction of Basic Psychological Needs and Illness Representation: Pearson Correlation Analysis

Illness Representations	Relatedness	Competence	Autonomy	Total Scale
Timeline (acute/ chronic)	r = -0.14, p = 0.041	r = -0.1, p = 0.137	r = -0.069, p = 0.329	r = -0.15, p = 0.036
Timeline (cyclical)	r = -0.13, p = 0.07	r = -0.27, p < 0.001	r = 0.001, p = 0.991	r = -0.19, p = 0.008
Consequences	r = -0.22, p = 0.002	r = -0.34, p < 0.001	r = -0.24, p < 0.001	r = -0.36, p < 0.001
Personal control	r = 0.12, p = 0.076	r = 0.23, p < 0.001	r = 0.12, p = 0.084	r = 0.19, p = 0.006
Treatment control	r = 0.36, p < 0.001	r = 0.32, p < 0.001	r = 0.2, p = 0.004	r = 0.39, p < 0.001
Illness coherence	r = 0.23, p = 0.001	r = 0.38, p < 0.001	r = 0.26, p < 0.001	r = 0.36, p < 0.001
Emotional representations	r = -0.35, p < 0.001	r = -0.38, p < 0.001	r = -0.26, p < 0.001	r = -0.41, p < 0.001

The obtained results confirm significant relationships with all three scales of the tested questionnaire. *Autonomy* shows the weakest but significant negative correlations with the scales *Health Anxiety* and *Helplessness in the Rehabilitation Process*. In other words, the higher the subjective evaluation of satisfaction of the need for autonomy, the lower the perceived health anxiety and the sense of helplessness in the rehabilitation process. A strong negative correlation is shown between the scale *Health Anxiety* and the scale *Competence*, i.e., the higher the subjective evaluation of satisfaction of the need for competence, the less patients tend to report health anxiety. Significant negative correlations with the overall needs satisfaction scale were found for *Helplessness in the Rehabilitation Process* and *Health Anxiety*, and a positive one with the scale *Self-Efficacy in the Rehabilitation Process*. In other words, the data indicate that the higher the patients' subjective perception of satisfaction of needs in treatment, the less they tend to report health anxiety and helplessness during rehabilitation and the more they report self-efficacy in the rehabilitation process.

Significant negative correlations were found between the scale *Relatedness* and the scales *Helplessness in the Rehabilitation Process* and *Health Anxiety*, and a positive correlation with the scale *Self-Efficacy in the Rehabilitation Process*. In other words, the

stronger the subjective sense of satisfaction of the need for relatedness, the less patients tend to exhibit health anxiety and report helplessness during rehabilitation, and the more they tend to feel self-efficacy in the rehabilitation process.

All correlations, except for the pair *Self-Efficacy in the Rehabilitation Process–Autonomy*, are statistically significant. Complete data on correlations between the scales of the two questionnaires are presented in Table 5.

Table 5

Correlation Analysis Between the Scale of Satisfaction of Basic Psychological Needs—Autonomy, Competence, Relatedness—in the Context of Treatment and the Illness and Treatment Self-Regulation Questionnaire

Illness and Treatment Self-Regulation Questionnaire	Relatedness	Competence	Autonomy	Total Scale
Health Anxiety	r = -0.28, p < 0.001	r = -0.39, p < 0.001	r = -0.21, p = 0.002	r = -0.36, p < 0.001
Helplessness in the Rehabilitation Process	r = -0.28, p < 0.001	r = -0.35, p < 0.001	r = -0.17, p = 0.018	r = -0.38, p < 0.001
Self-Efficacy in the Rehabilitation Process	r = 0.25, p < 0.001	r = 0.36, p < 0.001	r = 0.14, p = 0.055	r = 0.35, p < 0.001

Discussion

Reliability, internal consistency, and factorial structure of the scale

The analysis of the obtained results indicates that the questionnaire demonstrates adequate internal reliability. Acceptable model fit indices were also observed, although they were less robust in the one-factor model. The high correlations among all factors and the low discriminant validity of the scales are likely attributable to the substantial interconnectedness and interdependence of the basic psychological needs themselves. This interdependence may also be reflected in the way patients interpret the questionnaire items, as well as in the screening nature of the instrument, where the limited number of items per scale may be insufficient for a more differentiated assessment. A larger sample size would allow for a more comprehensive evaluation of this convergence. This explanation remains hypothetical and requires further verification; however, the current findings suggest that the internal consistency of the Autonomy scale, considered as a homogeneous construct, is limited. Overall, both the one-factor and three-factor models demonstrate generally acceptable fit. Nevertheless, the three-factor model shows superior fit indices, and all factor loadings are substantial and statistically significant in both models.

Thus, the instrument can be considered to demonstrate adequate structural validity.

Associations Between Gender, Age, Disease Duration, Treatment Type, and Satisfaction of Basic Psychological Needs During Treatment

No significant correlations were identified between the *Scale of Satisfaction of Basic Psychological Needs—Autonomy, Competence, Relatedness—in the Context of Treatment* and age, disease duration, the presence or absence of comorbidity, or functional status. These results suggest a relative independence of basic psychological needs satisfaction in treatment from sociodemographic and clinical factors. However, given that the sample did not include patients receiving palliative care or those in terminal stages of illness, these findings should be interpreted in light of these limitations.

Significant differences were observed on the *Total Scale* of needs satisfaction, as well as a marginally significant difference on the *Competence* scale. In both cases, mean values were higher in the radiation therapy group. This may be explained by the fact that patients receiving radiation therapy had previously undergone chemotherapy and surgical treatment, whereas patients receiving chemotherapy had not received other modalities of systemic anticancer treatment. According to the clinical practice guidelines for breast cancer pharmacotherapy (Tyulyandin et al., 2022), the recommended first-line treatment for primary breast cancer is neoadjuvant chemotherapy, while radiation therapy represents the final treatment phase prior to follow-up surveillance, administered after breast-conserving surgery or mastectomy and preceded by one or more courses of chemotherapy or hormone therapy.

Patients receiving neoadjuvant chemotherapy for breast cancer—often asymptomatic at presentation—experience treatment-related adverse effects and uncertainty regarding surgical options (breast-conserving surgery versus mastectomy). Similarly, patients undergoing post-neoadjuvant or adjuvant chemotherapy following surgical treatment (37% of the sample) may demonstrate different patterns of needs satisfaction compared to patients receiving radiation therapy as a sequential or final treatment course. This difference may be attributable not only to the type of treatment modality but also to additional factors, including surgical recovery and adaptation, experience with more complex treatment schedules, optimism regarding treatment completion, and associated psychosocial variables.

The difference observed on the *Competence* scale may be related to patients' cumulative treatment experience and to their differential perception of various systemic anticancer modalities. Chemotherapy, as a systemic therapeutic intervention affecting the entire body, is often associated with significant apprehension about treatment-related adverse events and uncertainty regarding the unpredictable nature, frequency, and intensity of these adverse effects. Chemotherapy-induced adverse effects constitute distinct medical conditions that often require additional supportive management. The difficulty of predicting the type and severity of adverse effects may contribute to substantial concerns regarding treatment necessity and efficacy.

Although the chemotherapy administration process itself is more familiar to patients (Tkhostov, 2002) compared to radiation therapy procedures, concerns regarding the necessity of chemotherapy tend to be more pronounced. Radiation therapy prescription is generally associated with fewer doubts; however, the organization of radiation therapy—involving invisible radiation and the unclear, seemingly "magical" manner of its delivery through specialized apparatus under specific conditions—is likely associated with increased susceptibility to magical thinking and may elicit both placebo and nocebo effects (Tkhostov, 2002). Patients typically have limited knowledge about radiation therapy (Zinchenko et al., 2020), and its adverse effects are perceived as less predictable, which depending on the clinical context may provoke either reassurance or increased anxiety. Confidence in the necessity of radiation therapy is not necessarily associated with the absence of doubts or overall patient well-being (Zinchenko et al., 2020); however, the decision to receive radiation therapy may be perceived as more autonomous, potentially leading to a subjective sense of greater satisfaction of basic psychological needs. To our knowledge, no studies directly compare attitudes toward radiation therapy as a primary systemic anticancer treatment with attitudes among patients who previously received chemotherapy prior to radiation therapy. Treatment modality appears to be an important but not the sole factor influencing patient well-being and satisfaction of psychological needs.

External Validity of the Questionnaire: Relationships with the Illness Perception Questionnaire–Revised and the Illness and Treatment Self-Regulation Questionnaire

The obtained data indicate that higher satisfaction of basic psychological needs is associated with a greater sense of treatment control and illness coherence, and, conversely, with reduced tendencies toward emotional representations of the illness and negative perceptions of its consequences. The Autonomy parameter shows the weakest correlations compared with the other scales, whereas the strongest correlations are observed with the Total Scale and the Competence scale.

Similar results were found in the context of pain management: higher satisfaction of psychological needs was associated with greater engagement in active pain management strategies and reduced reliance on avoidance behaviors. It is likely that the satisfaction of basic psychological needs contributes to enhanced psychological resilience and a greater capacity to maintain realistic appraisals of illness-related threat (Ionescu et al., 2023). In other words, higher subjective satisfaction of basic psychological needs in the treatment context is associated with reduced formation of emotional representations of the disease and its consequences. These results correspond with findings from research on motivation for physical activity (Ntoumanis et al., 2021), where the quality of motivation—autonomous versus controlled—rather than the presence or absence of illness, served as the primary predictor of physical activity engagement. This suggests that the relationship between Self-Determination Theory (SDT) constructs and illness perception may be bidirectional and mutually reinforcing.

Our findings also align with existing literature showing that individuals' appraisal of basic psychological needs satisfaction is associated with their selection of health behaviors, which in turn influences subjective well-being (Kim et al., 2023). The Common Sense Model of illness adaptation (Leventhal et al., 2016) posits that cognitive appraisal of illness plays a central role in shaping adaptive coping strategies (Moss-Morris et al., 2002). Within this framework, patient competence serves a dual function: it is both an ethical imperative in medical practice—supporting informed participation and autonomy—and a fundamental psychological need which, when fulfilled, enhances treatment outcomes. Addressing this dual role requires collaborative work between healthcare providers and patients to create conditions supportive of competence and other basic psychological needs. Such collaboration is most effectively achieved through clinical interventions and medical-psychological support specifically designed to promote the satisfaction of these needs.

Higher satisfaction of basic psychological needs is also associated with lower levels of helplessness and health anxiety, as well as higher self-efficacy during rehabilitation. These findings, particularly the association between satisfaction of the need for relatedness, increased rehabilitation-related self-efficacy, and reduced helplessness, are consistent with existing research. A longitudinal study by Schroevers et al. (2010) showed that emotional support received within the first three months after diagnosis predicted more positive perceptions of illness consequences eight years later. In other words, posttraumatic growth was significantly associated with early social support in the initial post-diagnosis period.

These results are theoretically expected and can be explained through bidirectional mechanisms. They are consistent with empirical literature demonstrating the influence of perceived social support on subjective well-being. The association between SDT constructs and reduced health anxiety aligns with findings from other studies showing that satisfaction of basic psychological needs is linked to better self-rated physical and mental health status (Leow, Lynch, & Lee, 2021).

Conclusion

The findings of this study support several key conclusions:

1. The Scale of Satisfaction of Basic Psychological Needs—Autonomy, Competence, Relatedness—in the Context of Treatment demonstrates adequate internal consistency and factor validity, with the exception of the Autonomy subscale, which requires further refinement. These psychometric properties support the use of the Competence and Relatedness subscales, as well as the Total Scale score, for assessing satisfaction of basic psychological needs in future research.

2. The *Autonomy* subscale exhibited lower internal consistency relative to the other scales, which may reflect the specific characteristics of autonomy perception among cancer patients undergoing active treatment.

3. Higher satisfaction of basic psychological needs was associated with greater treatment-

related self-efficacy and lower levels of health anxiety and helplessness, indicating a meaningful relationship between satisfaction of basic psychological needs and adaptive coping within the treatment process.

4. No significant differences in basic psychological needs satisfaction were found across gender, age, disease duration, or comorbidity status, suggesting that these sociodemographic and clinical variables do not substantially influence the assessed constructs within this sample.

5. Patients receiving radiation therapy reported higher satisfaction of basic psychological needs compared to those receiving chemotherapy. This difference may reflect variations in treatment trajectory, perceived treatment burden, and subjective appraisal of treatment phases.

Overall, these results demonstrate the utility of the *Scale of Satisfaction of Basic Psychological Needs—Autonomy, Competence, Relatedness—in the Context of Treatment* for evaluating basic psychological needs satisfaction among cancer patients undergoing treatment. Such assessment may support the development of targeted psychological interventions aimed at strengthening treatment motivation and rehabilitation engagement. Future research should prioritize improving the internal consistency of the Autonomy subscale and further examining the associations between basic psychological needs satisfaction, subjective well-being, and health outcomes in oncology populations.

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Appendix 1

Scale of Satisfaction of Basic Psychological Needs—Autonomy, Competence, Relatedness—in the Context of Treatment

№	За время лечения я … [During treatment, I…]	Абсолютно не согласен [Strongly disagree]		В чем-то согласен, в чем-то нет [Partially agree]		Абсолютно согласен [Strongly agree]
1	Я чувствую, что у меня установились хорошие отношения, связь с медицинскими работниками [I feel that I have established good relationships and connection with healthcare providers]	1	2	3	4	5
2	Я часто чувствую себя одиноким [I often feel lonely]	1	2	3	4	5
3	Я чувствую эмоциональную связь и поддержку со стороны медицинских работников, которые со мной работают [I feel emotional connection and support from the medical professionals working with me]	1	2	3	4	5

№	За время лечения я … [During treatment, I…]	Абсолютно не согласен [Strongly disagree]		В чем-то согласен, в чем-то нет [Partially agree]		Абсолютно согласен [Strongly agree]
4	Я чувствую, что врачи или другие медицинские работники меня недооценивают или не понимают [I feel misunderstood or undervalued by doctors or other medical professionals]	1	2	3	4	5
5	Я чувствовал душевную близость с врачом или другими медицинскими работниками, которые со мной работают [I felt emotional closeness with the doctor or other medical professionals working with me]	1	2	3	4	5
6	У меня возникали разногласия или конфликты с людьми, которые участвуют в моем лечении или реабилитации [I have had disagreements or conflicts with people involved in my treatment or rehabilitation]	1	2	3	4	5
7	Я успешно выполняю трудные задачи, связанные с лечением и реабилитацией [I successfully complete difficult tasks related to my treatment and rehabilitation]	1	2	3	4	5
8	Я испытывал неудачи в лечении и реабилитации, НЕ мог успешно справиться с некоторыми моими делами [I experienced failures in treatment and rehabilitation and could not successfully manage some of my tasks]	1	2	3	4	5

№	За время лечения я … [During treatment, I…]	Абсолютно не согласен [Strongly disagree]		В чем-то согласен, в чем-то нет [Partially agree]		Абсолютно согласен [Strongly agree]
9	Я берусь за трудные задачи в реабилитации и справляюсь с ними [I take on difficult rehabilitation tasks and manage them successfully]	1	2	3	4	5
10	Стараясь восстановиться, я иногда чувствую себя некомпетентным, как будто у меня ничего не получается, как нужно [While trying to recover, I sometimes feel incompetent, as if nothing I do succeeds]	1	2	3	4	5
11	Я хорошо справляюсь даже с трудными задачами, связанными с лечением или реабилитацией [I handle even difficult tasks related to my treatment or rehabilitation]	1	2	3	4	5
12	Я испытываю трудности даже в тех задачах в лечении и реабилитации, с которыми вполне мог бы справиться [I experience difficulties even with tasks in treatment and rehabilitation that I could reasonably manage]	1	2	3	4	5
13	Я чувствую, что сам выбираю свои способы лечения, так, как я сам считаю нужным [I feel that I choose my treatment approaches as I see fit]	1	2	3	4	5

№	За время лечения я … [During treatment, I…]	Абсолютно не согласен [Strongly disagree]		В чем-то согласен, в чем-то нет [Partially agree]		Абсолютно согласен [Strongly agree]
14	Я испытываю много излишнего внешнего давления со стороны медицинских работников [I experience considerable external pressure from medical professionals]	1	2	3	4	5
15	Решения, которые я принимаю в отношении своего лечения, взвешенные и действительно МОИ собственные [The decisions I make regarding my treatment are well-considered and truly my own]	1	2	3	4	5
16	Люди вокруг меня все время говорят, что я должен делать для своего лечения [People around me constantly tell me what I should do for my treatment]	1	2	3	4	5
17	Я чувствую себя вовлеченным в процесс лечения, я активно участвую в нем, а не просто соглашаюсь на предложения врачей [I feel involved in the treatment process; I actively participate in it rather than simply accepting the doctors' suggestions]	1	2	3	4	5
18	Во время лечения я вынужден делать многие вещи против своего желания [During treatment, I am forced to do many things against my will]	1	2	3	4	5

Шкалы: «Автономия» (13–18), «Компетентность» (7–12), «Связанность» (1–6).
[Scales: Autonomy (Items 13–18), Competence (Items 7–12), Relatedness (Items 1–6)].

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All listed authors (Marina K. Karakurkchi, Aleksander Sh. Tkhostov, Elena I. Rasskazova, Sofia A. Kirsanova) contributed equally and comparably at all stages of the work—from formulating the research objectives and collecting the data to analyzing the results and writing the manuscript.

Author Details

Marina K. Karakurkchi, Medical Psychologist at Oncology Center No. 1, S.S. Yudin City Clinical Hospital; Postgraduate Student at the Department of Neuro- and Pathopsychology, Faculty of Psychology, Lomonosov Moscow State University, Moscow, Russian Federation; ORCID ID: https://orcid.org/0009-0007-6105-7798; e-mail: karakyrkchi_m@mail.ru

Aleksander Sh. Tkhostov, Dr. Sci. (Psychology), Professor at the Department of Neuro- and Pathopsychology, Faculty of Psychology, Lomonosov Moscow State University, Moscow, Russian Federation; Researcher ID: I-4782-2012; Scopus Author ID: 6603614962; ORCID ID: https://orcid.org/0000-0001-9676-4096; e-mail: tkhostov@gmail.com

Elena I. Rasskazova, Cand. Sci. (Psychology), Associate Professor at the Department of Neuro- and Pathopsychology, Faculty of Psychology, Lomonosov Moscow State University; Senior Researcher at the Mental Health Research Center, Moscow, Russian Federation; Researcher ID: I-6603-2012; Scopus Author ID: 8379943500; ORCID ID: https://orcid.org/0000-0002-9648-5238; e-mail: e.i.rasskazova@gmail.com

Sofia A. Kirsanova, Postgraduate Program Graduate, Faculty of Psychology, Lomonosov Moscow State University, Moscow, Russian Federation; ORCID ID: https://orcid.org/0009-0002-6993-4306; e-mail: sonyakirsanova@mail.ru

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Indicators of Character Strengths in Individuals with Different Heart Rate Variability

Anna V. Varfolomeeva[1,2*], Anton G. Tishchenko[1,2], Artur A. Rean[2], Andrey O. Shevchenko[2], Alexey A. Stavcev[2], Yuri I. Alexandrov[1,2]

[1] Russian Academy of Science, Moscow, Russian Federation
[2] Moscow Pedagogical State University, Moscow, Russian Federation

[*]Corresponding author: varflany@gmail.com

Abstract

Introduction. The problem of inter-coordination of systemogenesis processes in achieving a purposeful result is part of the problem of inter-coordination of individuals in achieving a collective result. The aim of the study was to assess the expression of indicators of 24 character strengths in individuals with different heart rate variability indicators. Since we previously showed that Heart Rate Variability (HRV) characteristics are related to the features of the structure and dynamics of actualized individual experience in achieving results, and also that the difference in ways individuals solve complex cognitive tasks and their character strength patterns correlate, we tested the hypotheses about different heart rhythm organization in participants with different patterns of 24 character strengths. **Methods.** Study participants (N=145; Med = 19 years old) completed the "Scale of Analyticity-Holism" and "24 Character Strengths" (VIA-24) methods, after which a cardiorhythmogram was recorded while they solved complex cognitive tasks. **Results.** A cluster analysis was performed on the heart rate variability indicators "Mean Heart Rate" and "Standard Deviation of Normalized RR-intervals", resulting in two clusters being identified. It was determined that these clusters differ in the dynamics of the indicators "Standard Deviation of Normalized RR-intervals" and "Sample Entropy": a cluster with high heart rate variability and its increasing complexity, and a cluster with low variability and its decreasing complexity. These same clusters differ in the pattern of character strengths. **Discussion.** Since the possibility of identifying groups of study participants with

differing ratios of heart rate variability indicators and character strength patterns has been established, it is concluded that substantive differences in the organization of the structure of individual experience, recorded by psychometric methods, are associated with the dynamic characteristics of the actualization of experience in behavior.

Keywords

structure of individual experience, systemogenesis, well-being, ways to achieve well-being, character strengths, heart rate variability, heart rate entropy

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Introduction

The present study addresses the problem of inter-coordination of systemogenesis processes in achieving a purposeful result and is part of the problem of inter-coordination of individuals in achieving a collective result. In relevant literature, problems similar to this are solved within the framework of interdisciplinary studies and are aimed at applying multivariate analysis to establish relationships between various properties of individuals, i.e., it allows for the identification of intersecting classes of equivalence and is achievable in quasi-experimental studies (in accordance with the modified typology of D. Campbell (Alexandrov, Maksimova, 2018; 2023), built on differing research objectives), which are distinguished by establishing contiguity relationships—syndromes are identified. This will allow linking the features of experience formation with their manifestations in the characteristics of both inter-individual interactions and general bodily systemic processes (including the organization of cardiac activity in ensuring the achievement of performance results) and will make it possible to formulate a more complete solution to the problem of individual variations in the learning process.

A special issue of the journal "Frontiers in Public Health", published in 2019, was titled "Heart Rate Variability, Health, and Well-being: A Systems Perspective" (Drury et al., 2019)

and was dedicated to the problem of assessing subjective well-being based on Heart Rate Variability (HRV). A variety of methods applied based on HRV were described, including the consideration of changes in variability during diseases, under conditions of acute stress and adaptive behavior in military personnel; HRV-based interventions such as resonant breathing, changing state through biofeedback methods, and improving quality of life after traumatic brain injury through acoustic stimulation and control of HRV change were also described.

In the article (Varfolomeeva et al., 2025), the significance, from the perspective of the systemic-evolutionary approach, of applying cardiorhythmogram analysis is considered, which allows for the reconstruction of "...the results of the processes of coordination of activity of various elements of the organism, which depends on the basic characteristics of the systemic organization of the behavior being implemented, including the degree of differentiatedness of the actualized set of systems..." (Bakhchina, Alexandrov, 2017, p. 117). At the same time, the dynamics of Sample Entropy (SampEn) of the heart rhythm during acute alcohol intoxication, as well as during changes in the complexity of cognitive tasks, emotionality, and stress level, are described. This indicator is standard in HRV studies, its magnitude describes the complexity of the heart rhythm, and its dynamics are related to the dynamics of the differentiatedness of actualized systems—elements of experience such that entropy increases with increasing differentiatedness (Alexandrov et al., 2017; Bakhchina, Alexandrov, 2017; Bakhchina et al., 2018; Bakhchina et al., 2021).

In S. B. Parin's studies, it is noted that individuals with a high expression of the characteristic "Self-Blame" show more pronounced stress activation when recalling a story publicly, and individuals with a high expression of the characteristic "Reflected Self-Attitude" show activation of the sympathetic division of the autonomic nervous system (Parin, Chugrova, 2017). Studies are conducted to assess the relationship between HRV and subjective well-being/quality of life. Some authors do not find such a relationship (Geisler et al., 2010). However, the work (Boman, 2018) established a relationship between a pronounced high-frequency spectrum of HRV and subjective well-being, and the work (Sommerfeldt et al., 2019) showed a connection between indicators of stress and anxiety, as well as HR.

The most important factor is not the actual "subjective assessment" of well-being, since this is a dynamic indicator and in clinical protocols such an assessment is limited to two-week intervals, but rather the way of achieving well-being (according to VIA), because it is a relatively stable indicator that relates to self-regulation. In previous studies aimed at operationalizing the construct "Ways of Solving" (WoS, see Tishchenko et al., 2021), a protocol was developed that allows for the identification of groups of study participants with differing WoS by grouping characteristics of problem-solving and establishing their correspondence to psychological characteristics. The assessment of the connectivity of the subjective report on the ways of achieving a result with the actual ways of achieving a result, as well as with the description from a third-party perspective (for example, by the researcher), is of fundamental importance.

Aim of the research: Assessment of differences in the ways of achieving psychological well-being in individuals differing in HRV indicators.

Research Hypotheses:

1. HRV indicators differ across the sample in such a way that it is possible to identify clusters representing groups of study participants with differing heart rhythm organization.
2. Study participants differing in heart rhythm organization possess differing expressions of the character strength pattern.

Methods

Sample

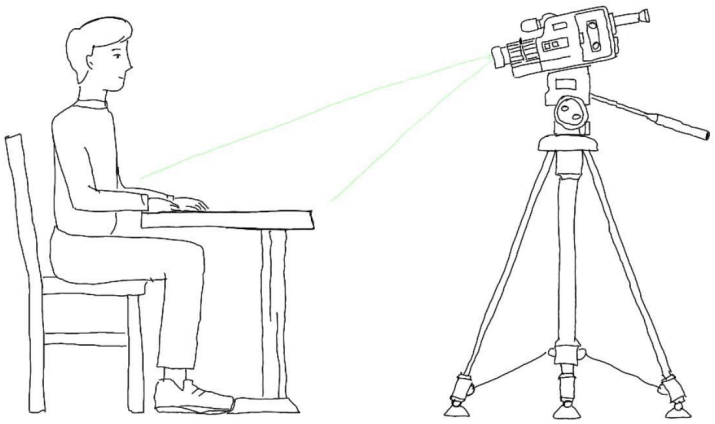
The study sample consisted of representatives of the student youth from Moscow (N=145) aged 18 to 35 years (Med=19 years).

Procedure

Before the main part of the study, participants completed the questionnaires: "24 Character Strengths" and "Scale of Analyticity-Holism". Also, before the main part, electrodes were placed on the study participants for ECG registration. The main part of the study consisted of a set of text tasks (N=30): "Knights and Knaves" (N=15) and "Moral Judgements" (N=15), which were presented in a quasi-random order and the time for solving them was not limited.

Figure 1

Schematic image of a study participant at a table while solving complex cognitive tasks and a video camera oriented towards the table surface and the participant's hands



Tests

1. The "Scale of Analyticity–Holism" questionnaire was constructed in 2007 in Korea (Choi et al., 2007) and validated in Russian (Apanovich et al., 2017). The scale includes 24 questions, 18 direct and 6 reversed. All questions are grouped into four subscales (focus of attention, causal attribution, tolerance for contradiction, perception of change), which reflect one of the indicators of analyticity/holism.
2. The "24 Character Strengths" (VIA-24) questionnaire is based on the model by C. Peterson – M. Seligman (Peterson, Seligman, 2004; Stavtsev et al., 2021), which describes 24 personality characteristics that can also be viewed as ways of achieving psychological well-being (Rean, Stavtsev, Kuzmin, 2024). Character strengths include: creativity (originality, ingenuity); love of learning; curiosity; broad-mindedness (wisdom); critical thinking; bravery (courage); perseverance (industry, diligence, grit); honesty (authenticity, integrity); zest (vitality, enthusiasm); love; kindness (generosity, nurturing, compassion); social (emotional) intelligence; prosocial activity; fairness; leadership; forgiveness (mercy); humility; prudence (caution); self-control (self-regulation); appreciation of beauty and excellence; gratitude; optimism (hope, future-mindedness); humour (playfulness); spirituality (faith, sense of purpose) (Stavtsev, Rean, Kuzmin, 2021).
3. Rosenberg Self-esteem Scale (Rosenberg Self-esteem Scale), in the adaptation by A. A. Bodalev, V. V. Stolin (Zolotareva, 2020).
4. General Self-Efficacy Scale by R. Schwarzer, M. Jerusalem in the adaptation by V. G. Romek (Schwarzer, Jerusalem, Romek, 1996).

Apparatus and Indicators

Electrocardiogram registration was performed using an autonomous telemetric electrocardiograph (MODEL ATÉK-1). The recorded cardiorhythmogram provided the values of RR-intervals, which are primary in heart rate variability analysis. The basis of HRV analysis is the isolation of the QRS complex of the electrocardiogram wave, where R—the point corresponding to the peak of this complex—acts as the beginning and end of the RR-intervals, the dynamics of which possess the properties of nonlinearity, fractality, and non-stationarity, which, in turn, allows calculating the values of entropy, i.e., the measure of scatter (distribution) of the heart rhythm. The duration of RR-intervals was measured programmatically, using the Pan-Tompkins algorithm, after which a recording of the sequence of RR-intervals was formed. These intervals are particularly significant in the analysis, since the beginning of the R wave is precisely the beginning of a new cardiac cycle, associated with the excitation of the sinus node, which allows studying the involvement of the heart cell population in ensuring purposeful behavior. The obtained sequence of RR-intervals was additionally cleaned manually for intervals invalid for analysis, outside the normative range of 550-1200 ms (see, for example, Galstyan, 2015). Then a matrix was compiled with the following variables: "Participant Number", "Interval Duration", "Task Number". The final matrix comprised 220 thousand rows. The prepared

matrix was loaded into the Python environment for calculating the main heart rate variability values (see Table 1).

Table 1
Heart rate variability indicators and their description

Indicator	Description
Mean-HR	Mean Heart Rate
SDNN	Standard Deviation (Root Mean Square) of Normalized RR-intervals
rMSSD	Root Mean Square of the Difference of Successive RR-intervals
LF	Absolute power of the Low-Frequency range (0.04-0.15 Hz)
HF	Absolute power of the High-Frequency range (0.15-0.4 Hz)
LF/HF	Ratio of Low-Frequency power to High-Frequency power
SampEN	Sample Entropy, describing the regularity and complexity of the time series

Data analysis

Only the values of HRV indicators and questionnaire scales were selected for analysis; task-solving characteristics were not included in the analysis described here. The analysis was conducted in SPSS 22.0 (IBM Statistics) software. The following statistical procedures were applied:

Two-step cluster analysis for identifying groups of study participants differing in HRV indicators (log-likelihood metric, Akaike criterion).

Mann-Whitney U-test and Kruskal-Wallis H-test for assessing the distribution of variables in the identified clusters.

The null hypothesis H_0 was rejected at $p<0.05$; tendencies were determined at $0.05 \leq p \leq 0.09$.

Results

The variables "Mean Heart Rate" and "Standard Deviation of Normalized RR-intervals" (hereinafter referred to as Mean-HR and SDNN, respectively; explanations in Table 1) were selected for clustering, as they were the most variable. Based on the results of the two-step clustering, two clusters were identified (Cluster 1 =20 individuals; Cluster 2 =20 individuals). This reduction in the number of study participants is due to the fact that only 40 participants solved all 30 tasks. Participants from Cluster 1 are characterized by higher values of Mean-HR and SDNN compared to participants from Cluster 2, as well as different expression of the pattern of 24 character strengths (see Table 2 for Mann-Whitney U-test results).

Table 2
Results of Assessing the Distribution of VIA-24 and AHS Variables in Two Clusters using the Mann-Whitney U-test

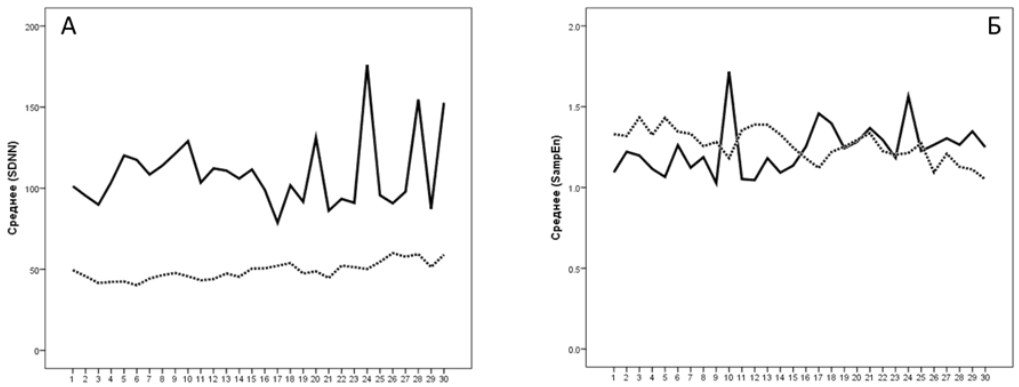
	Mean Rank		U	p-level
	Cluster 1	Cluster 2		
Critical Thinking	21,34	14,08	82,5	.032
Perseverance	22,34	13,19	66,5	.007
Fairness	20,81	14,56	91	.065
Gratitude	21,75	13,72	76	.018
Optimism	21,94	13,56	73	.014
Spirituality	20,91	14,47	89,5	.059
Causal Attribution	22,22	13,31	68,5	.009

Study participants from each cluster are characterized by different dynamics of the SDNN indicator from the 1st to the 30th task (see Fig. 2A). For participants from Cluster 1, no significant shift was found ($\chi 2$ = 23.653; p=0.746), whereas for participants from Cluster 2, an increase in SDNN magnitude is noted ($\chi 2$ =45.262; p=0.028). Study participants from each cluster are characterized by different dynamics of the Sample Entropy (SampEn) indicator from the 1st to the 30th task (see Fig. 2B). For participants from Cluster 1, a significant shift was found—entropy increases ($\chi 2$ =43.793; p=0.038), whereas for participants from Cluster 2, no significant changes in the magnitude of SampEn—entropy—are noted ($\chi 2$ =37.725; p=0.125).

Thus, the identified clusters can be characterized as follows: participants from Cluster 1 have high heart rate variability and its increasing complexity, while participants from Cluster 2 have low variability and its decreasing complexity.

Figure 2

Dynamics of the indicator (magnitudes are shown on the ordinate) SDNN (A) and SampEn (B) in two clusters from the 1st to the 30th task (on the abscissa). Solid line – Cluster 1, dashed line – Cluster 2.



A further clustering was conducted taking into account 15 solved tasks to check the partition on a larger part of the sample. Four clusters of study participants were identified: Cluster 1 (N=26), Cluster 2 (N=7), Cluster 3 (N=27) and Cluster 4 (N=27).

When assessing the dynamics of the SDNN and SampEn indicators, as was done in the first clustering, it was established that in participants from Cluster 2 there is a significant decrease in the SDNN indicator (Fig. 3A; χ^2 =73.758; p=0.000015) and a significant increase in the SampEn indicator (Fig. 3B; χ^2 =52.609; p=0.007). In participants from Cluster 4, there is a significant increase in the SDNN indicator (Fig. 3A; χ^2 =86.665; p=2.0845×10^{-7}).

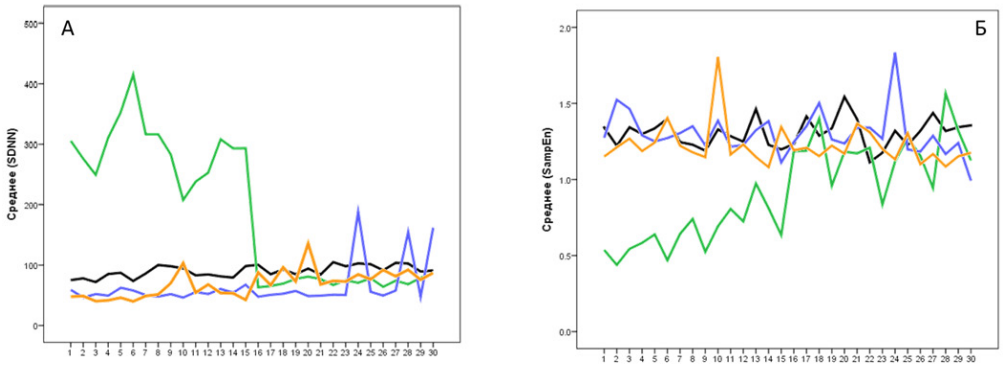
Table 3

Results of Assessing the Distribution of Variables in four Clusters using the Kruskal-Wallis H-test

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	H	p-level
Curiosity	43,91	53,79	37,7	29,58	8,738	.033
Optimism	45	51,14	32,27	32,29	6,990	.072
Self-assessment	38,15	59,5	39,84	31,48	8,871	.031
Self-Efficacy	042,09	57,71	31,09	36,25	8,660	.034
Causal Attribution	43,07	51	29,61	38,63	6,818	.078

Figure 3

Dynamics of the indicator (magnitudes are shown on the ordinate) SDNN (A) and SampEn (B) in four clusters from the 1st to the 30th task (on the abscissa). Black – Cluster 1, Green – Cluster 2, Blue – Cluster 3, Orange – Cluster 4.



It should be noted that when clustering study participants based on HRV indicators for 15 tasks, the result is less pronounced and less stable. However, the four identified clusters can presumably be an intermediate result, i.e., with an increase in sample size, the final partition will be represented by two clusters. Therefore, considering the dynamic nature of the measured values and the nature of the tasks performed, both cluster solutions with the results of the distribution of psychometric variables in the identified clusters should be considered.

Discussion

The results obtained allow us to state that it is possible to identify clusters, representing groups of study participants with differing heart rhythm organization, based on HRV

indicators. The assessment of HRV indicators indicates their homogeneous nature across the sample for all tasks, which, considering the specificity of the two-step clustering procedure, does not allow for the isolation of brightly expressed clusters. This pattern was obtained, for example, for the indicators LF, HF, and LF/HF (which denote the power of the low- and high-frequency spectrum, as well as their ratio to each other). Since these indicators are mainly used in assessing the emotional state during task performance (Zaripov, Barinova, 2008), it can be concluded that the tasks used in the study were emotionally neutral.

The most variable indicators (within individual tasks and from the 1st to the 30th task) are Mean-HR and SDNN, which indicates a specific organization of the processes of coordination of activity of cells of different morphology, as well as its individual variability, which is manifested in the dynamics of the HRV entropy indicator (Varfolomeeva et al., 2025). An increase in the magnitude of entropy indicates an increase in uncertainty (unpredictability) of values in a numerical sequence or time series, while a decrease indicates an increase in certainty (predictability). From the perspective of the systemic-evolutionary approach, this points to differences in the degree of involvement of experience systems of different differentiatedness.

Character strengths make a significant contribution to the partitioning of study participant groups, who are characterized by different indicators of cardiac activity, which indicate a different structure and/or dynamics of their experience actualization during problem-solving. These groups differ in the indicators of the scales "Critical Thinking", "Perseverance", "Gratitude", "Optimism", "Spirituality", and "Causal Attribution"; the indicators of these scales are higher in the first cluster than in the second.

Moreover, such character qualities as "Critical Thinking", "Perseverance", and "Spirituality" can be viewed as ways of overcoming uncertainty, forming different solution strategies. "Critical Thinking" is considered as the ability and inclination for multilateral analysis, the ability to weigh arguments and change opinions based on evidence, making more effective decisions. "Spirituality" is characterized as having structured beliefs about a higher purpose. "Perseverance" is defined as the ability to voluntarily continue active work despite emerging obstacles and difficulties (Peterson & Seligman, 2004; Rean, Stavtsev, Kuzmin, 2024).

Such character qualities as "Gratitude" and "Optimism" are related to a positive perception of reality—in the first case, current and past, and in the second, related to the future. "Gratitude" as a character strength is defined as the ability to realize and be thankful for all the good that happens in life. "Optimism" is the expectation of the best from the future and the readiness to work towards achieving a high goal. These two character qualities frequently show the strongest connection with high indicators of life satisfaction, subjective resilience, and other indicators of high psychological well-being in both Russian and foreign studies. Furthermore, in the authors' empirical studies, "Gratitude" and "Optimism" are part of the "quartet of psychological resilience", along with "curiosity" and "zest" (Brdar, Kashdan, 2010; Gander et al., 2020; Rean, Stavtsev, Kuzmin 2022).

From the perspective of the "neurovisceral integration theory" (Thayer, Lane, 2000; 2009), which is leading in the study of the relationship between HRV and psychological well-being, it is substantiated that HRV acts as an "index of self-regulation strength" and is an indicator of the integration of the central nervous and autonomic nervous systems. Here, "self-regulation strength" is defined as "...the ability to exercise self-control, to cancel or change one's dominant response tendencies..." (Baumeister, Heatherton, 1996), and is a primary condition for adaptive behavior, such as regulating emotions, persistence in the face of failure, or positive health behavior (Schmeichel, Baumeister, 2004; Tangney et al, 2005).

Similar studies implement the logic of comparative (traditional or correlational) psychophysiology and directly relate "physiological" and "psychological" processes, arguing, in terms of influence, the connection between "nervous", "visceral", and "psychological" phenomena, focusing attention on the role of the autonomic nervous system and the vagus nerve.

The application of cluster analysis to HRV indicators allows assessing the joint dynamics of these indicators and, based on this assessment, comparing the expression of individuals' psychological properties. This approach to data analysis resolves the noted ambiguity in the results of studies examining the relationship between HRV and psychological well-being (or quality of life). The results of the present study indicate the relationship of HRV indicators during problem-solving, which in turn suggests a differing organization of the actualized systems of experience, manifested in HRV, in individuals implementing differing ways of problem-solving (Varfolomeeva et al., 2023).

Conclusion

1. It is established that, based on HRV indicators, it is possible to identify groups of study participants for whom the ratio of these indicators differs. Two stable groups are identified: a group with high heart rate variability and its increasing complexity and a group with low variability and its decreasing complexity.
2. Differences in the ratio of HRV indicators are associated with a differing expression of the character strength pattern: "Critical Thinking", "Spirituality", "Perseverance", "Optimism", and "Gratitude". These strengths are, on one hand, related to ways of overcoming difficulties ("Critical Thinking", "Spirituality", "Perseverance") and, on the other, provide psychological resilience and a positive attitude towards the world ("Optimism" and "Gratitude").

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Author Contributions

Anna V. Varfolomeeva: Literature analysis on electrocardiographic studies, analysis of heart rate variability, writing and preparation of the preliminary version of the manuscript.

Anton G. Tishchenko: Literature analysis on electrocardiographic studies, statistical analysis of heart rate variability indices and their associations with the psychological components of the VIA model.

Artur A. Rean: Scientific supervision; literature search, selection, and analysis; formulation of conclusions; preparation of the final version of the manuscript.

Andrey O. Shevchenko: Literature search, selection, and analysis; description of the socio-psychological components of the VIA model; formulation of conclusions.

Alexey A. Stavcev: Literature search, selection, and analysis; description of the socio-psychological components of the VIA model; formulation of conclusions.

Yuri I. Alexandrov: Scientific supervision; literature search, selection, and analysis; formulation of conclusions; preparation of the final version of the manuscript.

Author Details

Anna V. Varfolomeeva, Junior Researcher, V.B. Shvyrkov Laboratory of Psychophysiology, Institute of Psychology of the Russian Academy of Sciences, Moscow, Russian Federation; Author ID: 1074220, ORCID ID: https://orcid.org/0009-0006-7103-7240; e-mail: varflany@gmail.com

Anton G. Tishchenko, Junior Researcher, V.B. Shvyrkov Laboratory of Psychophysiology, Institute of Psychology of the Russian Academy of Sciences, Moscow, Russian Federation; Researcher ID: AAX-9769-2021, Scopus ID: 57221597354, Author ID: 1010811, ORCID ID: https://orcid.org/0000-0002-6289-8202; e-mail: antongtishenko@gmail.com

Artur A. Rean, Academician of the Russian Academy of Education, Dr. Sci. (Psychology), Professor, Director of the Center for Socialization, Family and Prevention of Asocial Behavior, Moscow Pedagogical State University, Moscow, Russian Federation; Researcher ID: KHX-7756-2024, Scopus ID: 6507072773, Author ID: 1475, ORCID ID: https://orcid.org/0000-0002-1107-9530; e-mail: aa.rean@mpgu.su

Andrey O. Shevchenko, Cand. Sci. (Psychology), Analyst, Center for Socialization, Family and Prevention of Asocial Behavior, Moscow Pedagogical State University, Moscow, Russian Federation; Researcher ID: GLQ-7645-2022, Scopus ID: 57221080641, Author ID: 976827, ORCID ID: https://orcid.org/0000-0002-9118-2617; e-mail: andreyshevchenkomsu@gmail.com

Alexey A. Stavcev, Cand. Sci. (Psychology), Analyst, Center for Socialization, Family and Prevention of Asocial Behavior, Moscow Pedagogical State University, Moscow, Russian Federation; Researcher ID: AAC-9556-2021, Scopus ID: 57219288519, Author ID: 1084194, ORCID ID: https://orcid.org/0000-0001-7299-5017; e-mail: stavtsev.alex@yandex.ru

Yuri I. Alexandrov, Academician of the Russian Academy of Education, Dr. Sci. (Psychology), Professor, Head of the V.B. Shvyrkov Laboratory of Psychophysiology, Institute of Psychology of the Russian Academy of Sciences, Moscow, Russian Federation; Researcher ID: O-6826-2015, Scopus ID: 7005342266, Author ID: 74403, ORCID ID: https://orcid.org/0000-0002-2644-3016; e-mail: yurialexandrov@yandex.ru

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Visual Saliency: From Theoretical Assumptions to Modern High-Performance Models

Denis V. Yavna

Southern Federal University, Rostov-on-Don, Russian Federation

Corresponding author: yavna@fortran.su

Abstract

Introduction. Visual saliency refers to the perceptual quality of location in a visual scene, which manifests itself subjectively in its attractiveness to the observer and objectively in the probability of shifting attention or fixating eye movements on it. This quality arises from the integration of visual feature maps and is modulated by several central mechanisms. It is important to distinguish between the terms saliency and conspicuity; in a theoretical context, these are not the same. This review, for the first time, combines the results of computer modeling of visual saliency with a detailed discussion of the theoretical background for creating such models. The theory of feature integration proposed by A. M. Treisman is examined, along with its advantages and limitations, which provided the way for the three-level model of visual attention developed by C. Koch and S. Ullman. According to this theory, focal attention is governed by a "winner-takes-all" mechanism, which relies on a saliency map encoding the attractiveness of each fragment of the visual scene. The original theory did not describe how the saliency map is formed, and this question remains the focus of research using computer modeling. **Results and Discussion.** The results of studies on modeling visual saliency are reviewed. In particular, the early computational model by L. Itti, C. Koch, and E. Niebur, which laid the foundation for many subsequent developments, is described in detail. Approaches to modeling that preceded the advent of modern high-performance neural networks are examined, and a range of contemporary models based on deep learning technologies is presented, together with their characteristic properties. This is the first comprehensive review of saliency models published in Russian. Researchers have developed several models of practical utility, and the paper discusses their potential for real-world application.

Keywords

visual system, attention, eye movements, visual search, saliency, eye tracking, computer vision, modeling

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Introduction

Why do we perceive the visible world around us in such a way that we often notice small details of our surroundings, but sometimes fail to see something we have been searching for unsuccessfully for a long time? And why can we periodically pay attention–or not pay attention–to the same object at different times and under different circumstances? A formal answer is that we usually pay attention to objects that have the quality of saliency. One could also answer that we notice objects that are conspicuous. Such answers may seem a little strange and could be perceived as pre-logical; however, it should be noted that conspicuousness and saliency are fairly well-formalized constructs, filled with specific content and used in a number of research areas on visual perception. Moreover, these constructs are not speculative and owe their emergence and content primarily to the experimental work of cognitive psychologists in the late 1970s and early 1980s. It is also important to note that outside of a scientific context (and in philological sciences), the word "saliency" is practically not used in the Russian language. Usually, words of the same root in Western languages, derived from the Latin salio ("jump, leap"), are translated as noticeability, significance, expressiveness, etc.; however, as special terms, these words have different meanings.

The term "visual saliency" has relatively recently entered the Russian language (Kochurko, Madani, Saburan, Golovko & Kochurko, 2015; Martynova & Balaev, 2015), is used by a fairly narrow circle of researchers, and therefore requires clarification. Visual saliency is generally understood as a property of a certain area of an image that characterizes its ability to attract the observer's attention. However, this understanding does not imply that saliency is a property inherent exclusively to the object of observation; saliency also has a subjective component.

There are two types of saliency: bottom-up and top-down. Bottom-up saliency is determined primarily by the physical properties of a fragment of the visual scene and is processed by stimulus-driven mechanisms of involuntary attention. For example, a red vertical line among many blue lines will have a high degree of bottom-up saliency (Fig. 1a) (*Strictly speaking, this example represents an extreme case where detection can theoretically be explained in terms of feature maps and saliency, without using the conceptual apparatus of saliency models; however, it illustrates well the phenomenal side of the issue under discussion)*. The perception of such stimuli is often accompanied by a pop-out effect, objectively expressed in the absence of time-consuming search costs, and subjectively in the ease and involuntariness of detection. It is important to note that early studies focused primarily on bottom-up saliency, and the term "top-down saliency" may have sounded strange in the past.

Top-down saliency is determined primarily by the perceptual task facing the observer. Such saliency is assigned to certain objects, features, or combinations thereof by the subject and is primarily addressed to the mechanisms of voluntary, goal-directed attention. For instance, a red vertical line among red horizontal and blue vertical lines (Fig. 1b) will have rather low bottom-up saliency, but if it is designated as a target in an experiment, its top-down saliency becomes significant. Saliency will increase, and in the course of sequential visual search, this line will sooner or later become the object of attention. In classical experiments with eye movement recording, the influence of the task on attention control was demonstrated by A. L. Yarbus (Yarbus, 1965). Yarbus analyzed the tracks of image viewing. Images were recorded during free viewing and specified by the instructions. His conclusion states: "The distribution of fixation points on an object, the sequence of their changes, their duration, and cyclicality are determined by the content of the object and the tasks of the observer" (Yarbus, 1965, p. 148).

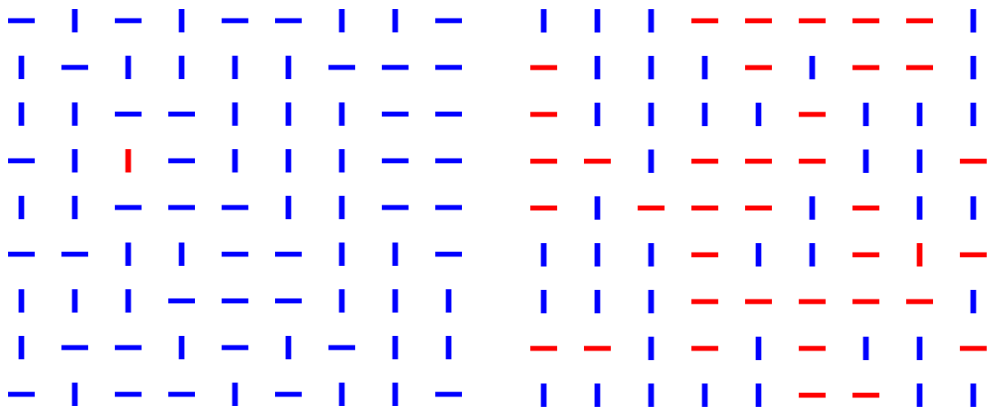
The professional experience and cultural level of the observer also have an influence. Yarbus repeatedly notes another idea-eye movements reflect the thought process. At the same time, Yarbus distinguishes between shifts in attention and eye movements. Both can be voluntary and involuntary.

Changes in the focus of attention remain in our memory, but the points of fixation are not retained.

Thus, the saliency of a particular part of an image may vary depending on the perceptual task facing the subject. Of course, the characteristics of the subject's attention also play a role in the formation of saliency, introducing additional "noise" when training computer models.

Figure 1

An example of arrays of lines in which the red vertical line is searched for in parallel (a) or sequentially (b).



1а 1б

Modeling visual saliency, being directly related to fundamental psychological problems such as the relationship between the focus of attention and eye movements, has a long history. While I. M. Sechenov directly identified visual attention with "the convergence of the visual axes of the eyes on the object being viewed" (Sechenov, 1942, p. 80, reprinted from the 1866 text), G. von Helmholtz (Helmholtz, 1896) demonstrated the existence of a mechanism for spatial attention shifts that does not depend on eye movements (cited in Rozhkova, Belokopytov & Iomdina, 2019). Currently, attention associated with gaze movement is commonly referred to as overt, as opposed to covert, as discovered by Helmholtz (Podladchikova et al., 2017; Rozhkova et al., 2019). Ideas about these types of attention in cognitive psychology were significantly developed by M. Posner (e.g., Posner, 1980), who later proposed a three-component model of attention (Posner & Petersen, 1990). This model is largely based on neurophysiological data and describes three subsystems of attention: alerting sistem, orienting, and executive control. The brain mechanisms and connections between implicit and explicit attention orientation are not fully understood and are a current topic of neurophysiological research (Petersen & Posner, 2012). The difficulties of objectively recording covert attention movements, combined with significant progress in eye-tracking methods, have led to the current focus on overt attention when testing models of visual saliency. Eye movements serve as

an objective marker of these acts; it is believed that during fixations, the brain reads most of the information necessary for solving perceptual tasks (Rayner, 2009). Nevertheless, early work on saliency modeling focused primarily on covert attention. This apparent contradiction can be explained by the fact that both covert and overt attention operate within the same saliency map, i.e., they visit approximately the same locations, although the duration of focus and sequence of shifts may differ. Thus, "spatial attention shifts are usually (but not necessarily) accompanied by eye movements" (Theeuwes, 2013, p. 1), and eye movements "are often considered a proxy for attention shifts" (Borji & Itti, 2013, p. 186).

Theoretical Background

The theory of feature integration by A. Treisman and G. Gelade had a decisive influence on the understanding of visual saliency mechanisms. Based on early studies, the authors put forward propositions representing their theory in its "extreme form" (Treisman & Gelade, 1980, p. 99). While acknowledging that Gestalt concepts correspond to normal subjective perceptual experience, they argued that these concepts are less useful for studying early stages of information processing, where features come first. The visual scene is initially encoded according to separate features such as color, orientation, spatial frequency, brightness, and direction of movement. To synthesize these correctly for each object in a complex image, focal attention sequentially processes the corresponding locations, acting as a "glue" (Treisman & Gelade, 1980, p. 98) that connects initially separate features into a single object. Once a composite object is perceived, it is stored in memory for future recognition. Under certain circumstances (e.g., memory impairment), features may "float free" or recombine into "illusory conjunctions" (Treisman & Gelade, 1980, p. 98). Features outside the focus of attention influence task performance only at the level of individual features, not at the level of their combinations. Experiments confirmed predictions about parallel detection of basic features and the necessity of sequential scanning for conjunctions of features. Further predictions concerned figure-ground separation, illusory feature combinations, and the relationship between feature identification and localization.

The predictions made by the authors regarding various characteristics of the perception process, based on the proposed concepts, were tested in nine experiments; their results and corresponding theoretical generalizations were published in 1980 (Treisman & Gelade, 1980). Although the theory has since undergone significant development, it was this work that had the most important influence on the advancement of saliency models.

The first set of predictions stated that if basic features can be detected in parallel, without restrictions on attention, then variations in the number of simultaneously presented distractors should have little effect on the search for targets defined by such features (e.g., color red or vertical orientation). Conversely, if focal attention is required

to detect targets defined by a combination of features (e.g., a red vertical line among red horizontal and blue vertical lines, Fig. 1b), such targets can only be detected after sequential scanning of the array of presented elements.

The second group of predictions dealt with the separation of textures and figure-ground grouping: if these are parallel preattentive processes, they should depend only on spatial gaps between groups of stimuli that differ in individual features, rather than in their combinations.

The third group of predictions relates to the possibility of illusory combinations of features that "float freely" outside the focus of attention.

The fourth group of predictions concerns the relationship between the identification and localization of features and their combinations. If features outside the focus of attention can float freely, and the presence of these features can be established without determining their exact location, then identification and localization are independent processes. In the case of searching for a single feature, identification may precede localization; in the case of searching for combinations, localization precedes identification, as attention is drawn to a specific location.

The fifth group of predictions pertains to the potential influence of objects outside the focus of attention on the effectiveness of the search: only features, but not their combinations, should either facilitate or hinder it.

The verification of these predictions, primarily through visual search experiments, largely confirmed their validity. B. M. Velichkovsky notes that the theory of feature integration "has withstood 20 years of experimental testing remarkably well" (Velichkovsky, 2006, p. 295), although it faced challenges in explaining the relatively flat (10–20 ms per distractor) functions relating to the dependence of search time on the number of elements. Recall that in sequential search, the slope is approximately 60 ms per element when a target is absent; if the target is present, the slope decreases by about half, indicating a potential strategy of exhaustive search: the average number of elements examined by attention before the target is found is exactly half the number of elements when the target is located in a random position. However, Velichkovsky accurately pointed out that a minimal slope in these functions would suggest viewing up to 100 elements per second, which does not align with experimental data on covert attention shifts (e.g., Saarinen & Julesz, 1991). An explanation can be offered within the framework of the theory of guided (the more common translation of the original term) or driven (according to Velichkovsky) visual search, developed by J. Wolfe et al. (Wolfe, Cave, & Franzel, 1989) /Вставить примечание: Editor's note: These are back-translations of Russian versions of the original term./. The current version of this theory (in its sixth iteration) at the time of writing this review is presented in (Wolfe, 2021).

A detailed examination of the theory of guided search is beyond the scope of this review, especially since it is well known in our country and often serves as the theoretical basis for research conducted by a number of domestic authors (e.g., Gorbunova, 2023;

Kruskop, Lunyakova, Dubrovsky & Garusev, 2023; Sapronov & Gorbunova, 2025; Falikman, 2015; Falikman, Utochkin, Markov & Tyurina, 2019)). However, it seems appropriate to give a brief summary of it in order to show the commonality of the tasks solved within the framework of the theories of guided search and saliency, as well as the similarity of their conceptual apparatus.

When we look at a scene, we can see anything in any location, but we cannot recognize more than a few elements at a time; this is a kind of bottleneck. As with Traiman, locations are selected by attention so that the features they contain can be glued together into recognizable objects. But in order for the selection order to be rational (intelligent), the attention that provides access to the "bottleneck" is guided based on five different sources of preattentive information, namely:

1. Top-down guidance
2. Bottom-up, feature-based guidance
3. Preceding history (e.g. priming)
4. Reward
5. Syntax and semantics of the scene

These sources form a spatial priority map (Serences & Yantis, 2006), a dynamic landscape of attention, with selective attention directed approximately 20 times per second (every 50 ms) to the most active location. The nature of foveal bias toward locations near the fixation point is described by three types of functional visual fields (FVF): resolution FVF, exploratory eye movement control, and covert attention control. Looking ahead a little, we note that in describing how attention is shifted, the theory of guided search explicitly (Wolfe, 2021, p. 1068) on the ideas of Koch and Ullmann (1985) about the WTA mechanism, which will be discussed in detail below.

The element selected by attention is placed in working memory, which also contains a guiding template and can determine the subsequent direction of attention. For example, when searching for a banana, attention is directed to target attributes using the templates "yellow" and "curved" (Wolfe, 2021, p. 1064).

To be identified as targets or rejected as distractors, objects selected by attention must be compared with target templates stored in the activated long-term memory (ALTM) fragment activated by the current task. The comparison helps to establish that the object is not just yellow and curved, but actually the banana that needs to be found. If there are only a few guiding templates in working memory, there can be many target templates; as an example, Wolfe cites the so-called hybrid search (Wolfe, 2012), see also (Angelhardt, Makarov & Gorbunova, 2021; Sapronov, Makarov & Gorbunova, 2023; Rubtsova & Gorbunova, 2022). These templates can be either specific (a ripe banana) or much more general (a fruit).

The binding and recognition of the object of attention is modeled as a diffusion process (Voronin, Zakharov, Tabueva & Merzon, 2020; Ratcliff, 1978), carried out at a speed of > 150 ms/element. Selection can occur more frequently if several elements are

recognized simultaneously, albeit asynchronously; this makes controlled search a hybrid of sequential and parallel processes. For each target pattern stored in the ALTM, there is one diffuser (diffusion channel) that accumulates data (including noise) approaching the output threshold. When the data reaches the threshold, the search stops and either a true or false positive response is given. The search may also stop when the output signal accumulation threshold is reached, resulting in either a true or false positive response.

The accumulation threshold is adaptive, allowing feedback from previous presentations to program subsequent searches. Simulation shows that combining asynchronous diffusion with an output signal can reproduce the basic patterns of response times and errors obtained in a series of visual search experiments.

Thus, the theory of guided search explicitly describes the algorithm of attentive selection, closely resembling the theory of saliency. Thanks to this, it successfully overcomes the limitations of the theory of feature integration. In addition, it significantly expands the latter in terms of describing the algorithms of decision-making by the observer. The theory of guided search is developed mainly within the framework of the theoretical- informational approach and the traditional experimental-psychological paradigm of cognitive research. Saliency theory is at the intersection of cognitive and technical sciences and mainly describes the early stages of visual processing associated with the deployment of attention; modeling is an important part of it.

The theoretical foundations of mathematical and computer modeling of saliency were laid more than 40 years ago by the work of K. Koch and S. Ullman, which examines spatial shifts in attention and their possible neural mechanisms (Koch & Ullman, 1985). It should be noted that the term "saliency" had been used in psychology before, but as a more general concept that did not reflect the specifics of the work of a particular sensory system. Thus, as early as 1977, A. Tversky published a significant theoretical work formalizing the concept of "similarity" (Tversky, 1977) in set-theoretic terms. To summarize its content briefly, we can say that each object is characterized by a set of features, some of which are common to other objects, and some of which are distinctive and unique. Saliency (rather in the sense of "noticeability, significance") in Tversky is a property of a feature; it depends both on its physical characteristics stick (brightness, etc.), as well as from so-called diagnostic factors–contextual relevance and the importance of this feature for solving a specific task. Saliency occupies an important place in Tversky's theoretical constructs: thus, a more salient object is more likely to become a reference point in human judgments about similarity. The degree of similarity between objects **a** and **b** can be assessed on a scale **S** as:

$$S(a,b) = \phi f(A \cap B) - \alpha f(A - B) - \beta f(B - A),$$

$$\phi, \alpha, \beta \geq 0,$$

where **A** and **B** are the sets of properties of **a** and **b**, respectively, and **f** is the saliency

measure, which, like the parameters ϕ, α, and β, depends on the context and the task at hand. Thus, the saliency of an object can be determined within the framework of assessing the similarity of objects. A fairly simple interpretation of Tversky's ideas is given by B. Jules in his work (Julesz, 1986): saliency can be defined as a function (e.g., a ratio) of the number of unique and common features, or as a function of the number of unique features relative to their total number.

The concept of visual saliency itself was introduced by Koch and Ullman (Koch & Ullman, 1985) as a designation for the fundamental link in the organization of visual attention, combining information from individual feature maps into a general map containing measures of "conspicuity." The work was theoretical in nature and was largely based on the ideas expressed by Treisman and Gelade (1980), expanding on them in terms of explaining the algorithm for switching focal attention. Let us consider this article in more detail, as it has had a decisive influence on the entire field of attention research, while remaining virtually unknown in Russia.

The authors begin their article with arguments in favor of a two-level theory of human visual perception, which assumes the existence of a preattentive level, at which simple features are processed quickly and in parallel across the entire field of vision, and an attentional level. At the second level, the specialized focus of processing, i.e., the focus of attention, is directed at a specific location in the field of view, with the analysis of complex shapes and object recognition are associated with this level. If specific algorithms that solve problems such as shape analysis or object recognition in a specific location were performed in parallel, this would lead to a combinatorial explosion in the volume of required computations and a shortage of the necessary resources. The authors refer in particular to the criticism of the capabilities of perceptrons presented by M. Minsky and S. Papert in their well-known book (Minsky & Papert, 1971), which is of particular historical interest. Indeed, parallel processing in modern convolutional networks could hardly serve as a metaphor for the limited capabilities of the parallel stage of information processing in humans; however, the shallow fully connected perceptrons of those years were quite suitable for this role. In the end, the authors conclude that after a certain (parallel) preprocessing stage, the analysis of visual information continues in a sequence of operations, each of which is applied to a selected location or locations.

In presenting experimental evidence of selective attention, Koch and Ullman rely on both "psychophysical" (sic!) and physiological data. The existence of a moving specialized processing focus associated with foveal projections, but not identical to them, is confirmed by two classes of psychophysical experiments. First, there are the studies by Traiman and colleagues, in which "the search for a target specified by a single feature . . . , turns out to be parallel . . . , while the search for a conjunctive target defined in terms of several features . . . requires sequential, arbitrarily interrupted scanning among the presented distractors" (Koch & Ullman, 1985, p. 219). A number of studies devoted to the identification of visually detectable features also belong to this class of evidence. Thus, in their studies of texture discrimination, Julesz et al. showed that only a limited

set of texton features can be detected in parallel (Bergen & Julesz, 1983–0029; Julesz, 1984). Secondly, there are a number of early studies using the spatial cueing paradigm (Bashinski & Bacharach, 1980; Eriksen & Hoffman, 1972; Posner, 1980; Remington & Pierce, 1984). Currently, there are several established names for tasks of this type: Posner cueing task, spatial cueing, Posner paradigm, cueing method, etc. (Gusev & Utochkin, 2012; Shevel & Falikman, 2022). Physiological data also support selective processing of visual information. Presenting a series of studies recording cellular activity, the authors conclude that "individual cells in certain parts of the visual system respond differently to identical physical stimuli, increasing their response as a function of the visual task being solved" (Koch & Ullman, 1985, p. 220).

As a result of their analysis, the authors formulate a number of fundamental questions about the mechanisms of selective processing. They are interested in what operations can be applied to selected locations, how this selection is carried out, and, in particular, how the change of locations is carried out.

Moving on to theoretical constructs, the authors first introduce the concept of early representation–a set of topographic cortical maps that encode visual information at the level of various elementary features, such as boundary orientation, color, disparity, and direction of motion. Each location in such maps has multiple feature dimensions. Probably, in accordance with evidence of the existence of spatial-frequency channels in the visual system (e.g., Campbell & Robson, 1968; Wilson & Bergen, 1979), there may be sets of maps with different resolutions for each individual feature. The maps contain neighborhood relations and local inhibitory connections (lateral inhibition), thanks to which locations that differ significantly from their surroundings can be detected at this early stage of analysis. Thus, the maps "signal" the conspicuity of a section of the visual scene.

We are talking specifically about conspicuity, not saliency. Saliency arises at the next stage of processing as a separate perceptual mechanism. This explains the need to directly transfer the term "saliency" into Russian; attempting to translate it could lead to confusion when naming the levels of processing.

When attention is focused on a particular location, the features present in it must be transferred to a higher, more abstract and non-topographic level of representation. The authors note that this formulation of the question does not contradict the idea of hierarchical information processing in the cortex; we also note that it is consistent with the basic tenets of feature integration theory. How is the location for attention selected? How is high-dimensional feature information represented in early representation processed?

The authors suggest that the saliency of a location in the visual scene determines the level of activity of the corresponding elements in various feature maps, with different maps encoding saliency within a specific feature dimension. All this diverse information is combined thanks to a saliency map, which is a single global measure of saliency that, like feature maps, has a topographical structure. The authors do not describe the exact

nature of the process of combining feature maps, assuming that it, still being part of the early visual system, "encodes the saliency of objects in terms of simple properties such as color, direction of motion, depth, and orientation" (Koch & Ullman, 1985, p. 221). It was this uncertainty that served as a starting point for a whole new direction of research in the future. Note that the authors also allowed for the possibility of modulating influences on the saliency map from higher cortical centers; in the future, such influences would begin to be implemented in models of top-down saliency.

The central place in Koch and Ullmann's theoretical constructs is occupied by the main link of attentional selection, which was explicitly absent in the theory of feature integration–the WTA ("winner takes all") network (Feldman, 1982), which is responsible for selecting the location for focal attention, the properties of which are then transferred to the "central representation"; it works with a saliency map.

The WTA mechanism can be viewed as equivalent to a maximum search operator operating on the elements of the saliency map xi ; in a neural network, xi can be interpreted as the electrical activity of an element at location i. WTA maps a set of input elements to an equivalent set of outputs yi according to the following rule:

$$y_i = 0 \; if x_i < \max_j x_i$$
$$y_i = f(x_i) \; if x_i = \max_j x_j,$$

where f is any increasing function of x_i or a constant. Thus, all output elements except one, corresponding to the most active input element, are set to 0.

If we disregard the "hardware" features of the brain substrate of computations, building a WTA network seems to be a fairly simple task. The authors consider a number of possible implementations of the network, both fully sequential, which is unacceptable due to its extremely slow operation, and highly parallel, characterized by too many connections between processing elements and the inability to process an arbitrary number of inputs. Based on this, the authors formulate two biologically plausible assumptions, building on them possible implementations of WTA:

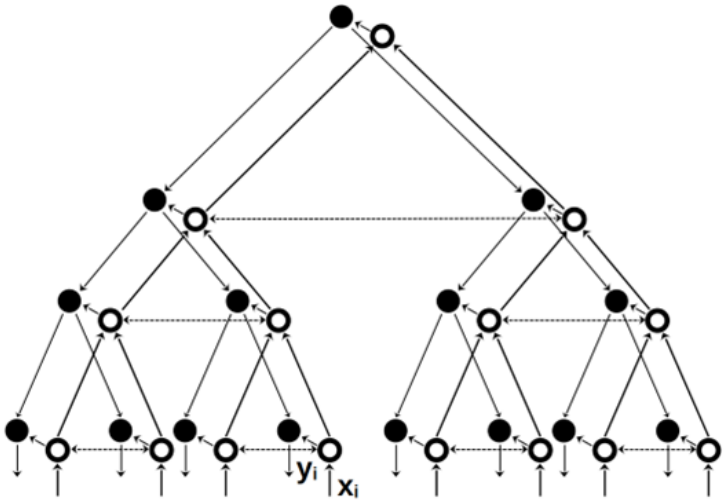
1. "With the exception of some distant excitatory connections, most of them, both excitatory and inhibitory, are local" (Koch & Ullman, 1985, p. 222).
2. "Each elementary processing element performs only simple, well-defined operations, such as addition or multiplication. In particular, basic processing elements are incapable of processing any symbolic information, such as addresses".

There are two such implementations in total, and the authors clearly prefer the second one. This WTA implementation has a hierarchical pyramidal structure and operates in a highly parallel mode. First, the maxima among m elements from the input set of size n are calculated. At the next level of the hierarchy, the process is repeated for n/m input

elements; This continues until the pyramid of comparisons closes on the last element, which displays the global maximum. However, both the absolute value of the maximum and its location are important for the selection process. It is determined using a second pyramid of additional elements, in which information is distributed in reverse order. Each additional element is associated with an element of the main pyramid and is activated only when it receives simultaneous excitation from its main element and from an additional element located at a higher level. "Since at each level the most activated element of the main pyramid in suppresses the activity of the other $m-1$ main elements in a local comparison, associated additional elements, as well as all additional elements in the lower branches, will never be activated" (Koch & Ullman, 1985, p. 223). Fig. 2 shows a possible example of a WTA network implementation with $n=8$inputs and $m=2$ comparator elements. The number of ascending and descending time´ x computational steps for such a network should not exceed $2\log_m n$, the network contains no more than $2nm/(m-1)$ elements. It is assumed assumes that the input values do not have to be exactly the same.

Figure 2

Second implementation of the WTA network with $n=8$ input elements. Local comparison is performed between m= 2 elements. The main elements are shown in light color, the additional ones in black; x(i)corresponds to the maximum at the network input, y(i)corresponds to the network response to the detected maximum. According to (Koch & Ullman, 1985).



Local comparison is performed between$m=2$ elements. Primary elements are shown in light, secondary elements in black; $x_i$corresponds to the maximum at the network input, ,y_i the network response to the detected maximum. According to (Koch & Ullman, 1985).

The authors provide estimates according to which only a small portion of the available visual neurons is sufficient for the implementation of the WTA network in a living system (primates, cats). Presumably, large-cell systems, such as the Y-path in cats, are well suited for the role of the WTA substrate.

How does the change in locations captured by attention occur across the visual field? Two mechanisms are possible here, local and central, acting through modification of the saliency map. The local mechanism can be implemented through adaptation and weakening of the active location in the saliency map over time; the most active element is locally inhibited, for example, after a certain time interval. The central mechanism activates an inhibitory signal from the central representation, where the information was previously received. There is no contradiction between the existence of these mechanisms, and they can operate simultaneously; it is likely that the local mechanism is constantly engaged, while the central mechanism is activated when there is an impulse to shift attention arbitrarily (Posner, 1980). ´Both of these mechanisms implement long-term inhibition of the selected element of the saliency map, preventing a repeat visit to the corresponding location for a certain period of time–the so-called inhibition of attentional return return (Utochkin & Falikman, 2006; Posner, Cohen, & Rafal, 1982).

The attentional selection mechanisms proposed by Koch and Ullmann, based on saliency maps and WTA, enable them to offer their interpretation of the effects of parallel and sequential search, as well as the camouflage of a specific object by others (Treisman, 1982). If the target has a salient feature that distinguishes it from its neighbors, WTA will immediately determine its location, and the target will be detected in a time that does not depend on the number of distractors. If the target is determined by a combination of features, the saliency map will have many local peaks, "in the worst case, as many as there are objects presented" (Koch & Ullman, 1985, p . 224). If no additional optimization strategy is applied, WTA will go through them; thus, to successfully complete the search, it will be necessary to view an average of $n/2$ of the presented objects. Thus, an object "pops out" because, due to its saliency, it is the first one to be visited, and parallel and sequential searches are not fundamentally different processes. As for masking, there are two different strategies: you can reduce the visibility of an object by blending it with its surroundings (this is roughly how military camouflage works), or you can place it among very visible objects. In both cases, the activity of the saliency map at the point corresponding to the target object will decrease relative to its surroundings.

What is the additional optimization strategy that allows, in a significant number of cases, to avoid the need for a complete search of objects in the visual scene? The authors believe that such a strategy can be based on the rules of proximity and similarity priorities, roughly corresponding to the phenomena of perceptual grouping and the Gestalt principles of the same name. Thus, searching for a target around a selected location will be more successful if the selection mechanism's preferences are shifted toward neighboring locations. As experimental confirmation of the priority of proximity, the authors cite studies demonstrating the dependence of the probability of target detection

on proximity to the location on which attention is focused (F. L. Engel, 1971, 1974). The search for objects with a common distinguishing feature will improve if locations with properties similar to those represented in the current location become preferred. This is partially confirmed by the results that were in press at the time of writing (Geiger & Lettvin, 1986): the demonstration of a figure at the fixation point makes the same figure appearing elsewhere in the field of view in the same presentation salient.

The simplest way to implement proximity priority within the WTA mechanism is to enhance all elements in the saliency map that are adjacent to the currently selected one. "The output of the WTA mechanism associated with the selected location increases the saliency of nearby elements in the saliency map by an amount depending on the distance between that location and its surroundings, thereby facilitating a shift in the focus of processing to nearby locations," which "is equivalent to the assertion that there is attractive potential around each selected location" (Koch & Ullman, 1985, p. 224).

The priority of similarity can be implemented as follows. When triggered, the WTA mechanism initiates interactions within individual maps of signs at the level of early representation, thanks to which maps containing currently selected features become more visible in the vicinity of the selected location. This process does not involve interaction between feature maps or their precise topographical reference to each other. If an object with a red horizontal line is selected, the neighboring locations in the "red" and "horizontal" feature maps will be enhanced; the focus of attention is more likely to shift to them.´ The process that ensures the priority of similarity acts in opposition to the initial priority of salient locations, which arises due to lateral inhibition within feature maps; various options for the interaction of these processes are possible.

These are, in general terms, the main theoretical positions put forward by Koch and Ullmann in 1985. The first computational models of saliency appeared much later, in the mid-1990s (Baluja & Pomerleau, 1994; Itti, Koch, & Niebur, 1998; Milanese, 1993; Tsotsos et al., 1995); as they improved, they began to gain practical significance. Let us now consider the main results obtained within the framework of various approaches to modeling.

Discussion

Computational saliency Models

Approaches to saliency modeling can be broadly divided into traditional and neural network approaches. Thanks to the use of modern neural network architectures, primarily convolutional ones, all records for model training quality have been broken in recent years (Borji, 2019). The success of neural network models is facilitated not least by the increase in the volume of publicly available data from eye-tracking studies and the emergence of standardized and relatively easy-to-use neural network modeling tools. Let us consider these approaches in more detail, starting with the traditional ones that have had the greatest impact on the subsequent development of the field.

The model developed by Laurent Itti, Christoph Koch, and Ernst Niebur served as the basis for many subsequent models; it also serves as a benchmark for comparing them (Borji & Itti, 2013). The model analyzes intensity, color, and orientation. In the first stage, the input color (r, g, b) image 640x480 in each of the corresponding channels is represented as a Gaussian pyramid (9 scales from 1 :1 to 1 :256 with an octave step). The intensity representation of the image $I = (r + g + b)/3$ is used to create the pyramid $I(\sigma)$, where $\sigma \in [0..8]$ is the scale. It is also used to normalize the primary color channels r, g, and b, which is used to separate color hue from intensity. Since hue changes are not perceived at low brightness, normalization is applied only where I is greater than $1/10$ of its maximum across the entire image; in other locations, pixel values are set to zero.

Local feature maps are calculated using a set of linear central-peripheral operators, which are implemented in the model as a point-by-point difference between fine high-frequency and coarse low-frequency scale representations (denoted by $\ominus$): the center is represented by pixels at scale $c \in \{2,3,4\}$, and the neighborhood is the corresponding pixels at scale $s = c + d$ where $d \in \{3,4\}$. Six intensity maps are calculated as

$$\mathcal{I}(c, s) = |I(c) \ominus I(s)|.$$

Based on the primary normalized color channels, four new broadband channels are created:

- red: $R = r - (g + b)/2$
- green: $G = g - (r + b)/2$
- blue: $B = b - (r + g)/2$
- yellow: $Y = (r + g)/2 - |r - g|/2 - b$.

Negative values are set to zero. Pyramids are created from these channels $R(\sigma)$, $G(\sigma)$, $B(\sigma)$ and $Y(\sigma)$.

Sets of maps for color channels are created similarly to intensity maps, while channels with double color opposition are modeled (Hohlova, 2012; S. Engel et al., 1997): the centers of the receptive fields of neurons are excited by one color (e.g., red) and inhibited by another, while the opposite occurs at the periphery. Maps modeling dual color opposition in the primary visual cortex of humans (green/red ($\mathcal{RG}$) and blue/yellow ($\mathcal{BY}$)), are calculated using the formulas

$$\mathcal{RG}(c, s) = |(R(c) - G(c)) \ominus (G(s) - R(s))|,$$

$$\mathcal{BY}(c,s) = |(B(c) - Y(c)) \ominus (Y(s) - B(s))|.$$

Local orientation information is extracted from I using an oriented Gabor pyramid $O(\sigma,\theta)$, where $\theta \in \{0°,45°,90°,135°\}$. Orientation feature maps $\mathcal{O}(c,s,\theta)$ encode local differences in orientation between the center and the periphery, represented by different scales:

$$\mathcal{O}(c,s,\theta) = |O(c,\theta) \ominus O(s,\theta)|.$$

Thus, a total of 42 feature maps are created: 6 for intensity, 12 for color, and 24 for orientation.

Combining feature maps into conspicuity and saliency maps is problematic: different modalities have different dynamic ranges and use different feature extraction mechanisms, making them difficult to compare. In addition, salient objects represented on only a few feature maps may be masked by noise or less salient objects represented on a larger number of maps. In the absence of a mechanism in the model that provides top-down control, the authors propose using the map normalization operator $\mathcal{N}(.)$, which would increase the global role of those that contain a small number of strong activity peaks and would lower it for those that contain a large number of peaks of comparable strength. The application of $\mathcal{N}(.)$, involves:

1. bringing map values to a single fixed range $[0..M]$, to eliminate modality-specific amplitude differences;
2. searching for the global maximum of the map M and calculating the average $\overline{m}$ of all its local maxima;
3. global multiplication of the map by $(M-\overline{m})^2$.

The authors use the model of cortical mechanisms of lateral inhibition to explain how the operator works (Cannon & Fullenkamp, 1996): when $M - \overline{m}$ is sufficient, the most active location stands out sharply, and the map becomes more important; if the difference is small, the map contains nothing unique and turns out to be insignificant. Feature maps are combined into three saliency maps $\overline{I}$, $\overline{C}$ and $\overline{O}$, for intensity, color, and orientation, respectively. Saliency maps are created by summing all the maps of the Gaussian pyramid after bringing them to a single scale with $\sigma = 4$; this operation is referred to by the authors as $\bigoplus$:

$$\overline{I} = \bigoplus_{c=2}^{4} \bigoplus_{s=c+3}^{c=4} \mathcal{N}(\mathcal{I}(c,s)),$$

$$\overline{C} = \bigoplus_{c=2s=c+3}^{4} \bigoplus^{c=4} [\mathcal{N}(\mathcal{RG}(c,s)) + \mathcal{N}(\mathcal{BY}(c,s))],$$

$$\overline{O} = \sum_{\theta\in\{0°,45°,90°,135°\}} \mathcal{N}\Big(\bigoplus_{c=2s=c+3}^{4} \bigoplus^{c=4} \mathcal{N}(\mathcal{O}(c,s,\theta))\Big).$$

The process of calculating $\overline{O}$ involves creating four intermediate maps by combining six feature maps for each θ, and then combining them into a single saliency map.

The authors explain the creation of three independent channels $\overline{I}$, $\overline{C}$ and $\overline{O}$, and their separate normalization by the hypothesis that similar features compete strongly for saliency, while different modalities contribute independently to the saliency map. The three saliency maps are normalized and summed into the final input $\mathcal{S}$ of the SM saliency map:

$$\mathcal{S} = \frac{1}{3}(\mathcal{N}(\overline{I}) + \mathcal{N}(\overline{C}) + \mathcal{N}(\overline{O})).$$

At each moment in time, the maximum activation of the SM map determines the most salient location in the image on which attention should be focused. To determine the point to which the model should switch next, one could simply select the most active location on the map. However, based on considerations of biological plausibility, the authors model the saliency map as a two-dimensional layer of leaky integrate-and-fire neurons on the $\sigma = 4$. The model of such neurons includes a single "capacitor" that accumulates charge from the synaptic input, leakage conductance, and threshold voltage. When the threshold is reached, an "action potential" (prototypical spike) is generated, and the charge of the "capacitor" is reset to zero. The maximum activation of the map enters a biologically plausible two-dimensional WTA neural network, in which synaptic interactions between elements ensure that only the most active location remains, while all others are suppressed (here the authors refer us, among other things, to the previously discussed work (Koch & Ullman, 1985).

Neurons in the SM receive excitatory input from $\mathcal{S}$ and are independent of each other; therefore, their potential in more salient locations increases faster (these neurons are used as pure integrators and do not fire continuously). Each SM neuron excites its

corresponding WTA neuron. All WTA neurons also change their state independently of each other until one ("winner") is the first to reach the threshold and fire. This triggers three simultaneous mechanisms:

1. the focus of attention shifts to the location of the winning neuron;
2. global inhibition is triggered and completely suppresses (resets) all WTA neurons;
3. In SM, in the area corresponding to the position and size of the new focus of attention, local inhibition is temporarily activated; this not only leads to dynamic shifts in focus, allowing the next most salient location to subsequently become the winner, but also prevents the focus of attention from immediately returning to the previously visited location.

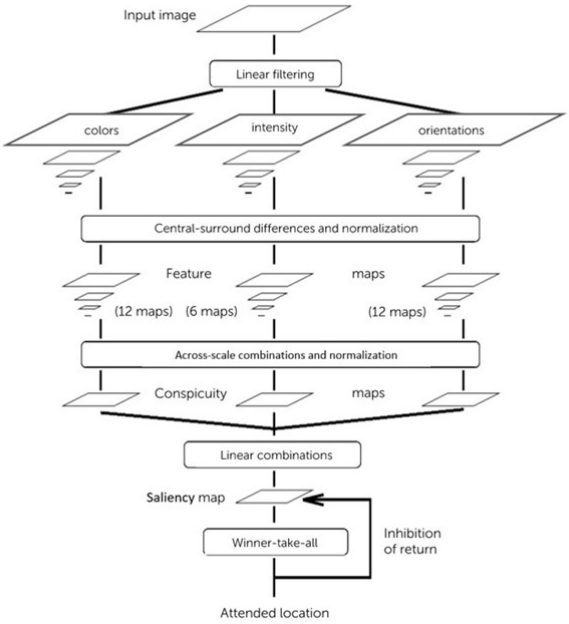
Such "inhibition of attention return" has been described in studies of human vision (see, e.g., (Utochkin & Falikman, 2006)). In addition, Koch and Ullman's "proximity preference" rule is modeled (Koch & Ullman, 1985): to slightly reorient the model toward finding the next salient location close to the previously visited one, in the SM, in the area corresponding to the position and size of the new focus of attention, local inhibition is temporarily activated; this not only leads to dynamic shifts in focus, allowing the next most salient location to subsequently become the winner, but also prevents the focus of attention from immediately returning to the previously visited location: in order to slightly reorient the model to search for the next salient location close to the previously visited one, in SM, in the immediate vicinity of the current focus of attention, a small excitation is temporarily activated.

Since this saliency model does not take into account top-down "top-down" controle, the focus of attention is a simple disk, the radius which is constant and equal to $\frac{1}{6}\min(h,w)$, where h, w are the height and width of the input image, respectively.

´The time constants, conductivity values, and thresholds of the simulated neurons were chosen so that the focus shifted from one salient location to another in approximately 30–70 ms, and the previously visited location was suppressed for approximately 500–900 ms, which corresponds to psychophysical data (Posner & Cohen, 1984). The difference in the relative magnitude of these delays was sufficient to ensure complete scanning of the image and prevent looping on a limited number of locations. ´All tuning parameters are fixed in the author's implementation of the model in C++, and with them, the system demonstrates temporal stability on all test images. A generalized diagram of the model is shown in Fig. 3.

Figure 3

General diagram of the saliency model by L. Itti, K. Koch, and E. Niebur. Adapted from (Itti et al., 1998).



The review by Ali Borji and Laurent Itti (Borji & Itti, 2013), which essentially summarizes the development of saliency modeling up to the moment of widespread interest in deep learning technologies, covers more than fifty models published between 1998 and early 2012. The authors analyze 52 saliency models that primarily consider ascending attention, although this analysis does not include developments known to them (Baluja & Pomerleau, 1994; Milanese, 1993; Tsotsos et al., 1995) presented before 1998, i.e., before the publication of "the first complete implementation and verification of the Koch and Ullmann model proposed by Itti et al." (Borji & Itti, 2013, p. 186). The review also analyzes works presenting more generalized models of attention with top-down control–there are 11 of them, two of which were proposed before 1998 (McCallum, 1996; Rao, Zelinsky, Hayhoe, & Ballard, 2002). It probably makes no sense to list all the models considered here; however, the theoretical generalizations made by the authors in the course of their analysis, a summary of which is presented below, are particularly interesting. The authors highlight the following properties of the models that are important for categorizing and understanding their features:

1. bottom-up and top-down control. Models can represent predominantly ascending attention control factors based on certain characteristics of the visual scene, or

descending factors (knowledge, expectations, reinforcement, current goals, etc.), or take both into account. At the same time, they differ in:

– the features used. Both individual low-level features (color, orientation, etc.) and fairly complex object properties can be taken into account. In cases where the model includes top-down control, a mechanism for adjusting feature detectors can be used. Models that process features are closely related to purely computational methods of object detection; cognitive modeling and computer vision enrich each other;

– the degree of scene context consideration. It is known that with very short exposures (80 ms or less), the observer is able to grasp the main content ("gist") of the scene. Its representation does not contain a large number of details of the objects presented in it, but it can provide sufficient information for coarse discrimination (e.g., inside or outside a room). The influence of context is also evident in the speed of object detection and in the characteristics of eye movements. Traditional computational models that take into account the main content of a scene typically use filtering (including biologically based methods such as central-peripheral filtering and Gabor filters) or spectral methods to extract features, the dimensionality of which is then reduced using principal component analysis (PCA) independent component analysis (ICA), or cluster analysis. The result is a vector of values ("gist vector") that characterizes the scene. The authors of the review note that at the time of writing, the popularity of this approach in computer vision was growing.

– taking into account the requirements of the task. The task greatly influences the distribution of attention, and scenes can be interpreted based on the needs that arise to meet the task requirements. When solving complex tasks, there is a strong connection between visual cognition and eye movements. Thus, during visual control, most fixations are directed at areas relevant to the task. Eye movements often reveal the solution algorithm used by the subject. In particular, in the block copying task (Ballard's paradigm, for more details, see (Ballard, Hayhoe, & Pelz, 1995; Ballard, Hayhoe, Pook, & Rao, 1997; Hayhoe & Ballard, 2005)), which involves the test subject reproducing a structure from elementary "building" blocks of different colors, the test subjects first selected the target block in the original structure, confirming its position, and then fixed their gaze on the workspace to place the corresponding block in the correct place. The authors also provide a list of studies in which activities in natural conditions were investigated in a similar manner.

The authors of the review note that ascending and descending attention combine to control our attention, providing several options for implementing the rules for integrating these processes.

2. only space or space and time. Models can take into account the movement of objects and predict attention shifts between objects in a static or dynamic scene;

3. overt and covert attention. Models can describe both overt and covert attention, but the degree to which they account for covert attention is difficult to assess due to the complexity of measuring it;
4. objects or spatial locations. Given that there are grounds for distinguishing between feature-based attention and object-based attention, models may give preference to one of these types;
5. features used in the model. Many models use traditional features used in integration theory; however, there are many others, such as mathematically constructed (wavelets, PCA, ICA), geometric, etc.;
6. stimuli and task type. Since real empirical data is needed to test the model, the authors identify two grounds for distinguishing models based on the stimuli used in data collection: static/dynamic and artificial/natural. The type of task solved by the observer is also important. It can be free viewing, visual search, or an interactive task;
7. metrics used for evaluation. When evaluating a model, its prediction is usually compared with an empirically obtained result (ground truth); often, various versions of gaze fixation maps are used as such a result. Depending on the map and the type of result produced by the model (fixation points, two-dimensional probability distribution, etc.), several modifications of the area under the curve, normalized saliency of the gaze path, Kulback-Leibler metric, Pearson's correlation coefficient, etc. can be used. A detailed discussion of various metrics can be found in a more recent work (Bylinskii, Judd, Oliva, Torralba, & Durand, 2017);
8. eye movement datasets used. At the time of the publication of the review by Itti and Borji, eye movement data recorded while viewing static images (Bruce & Tsotsos, 2005; Judd, Ehinger, Durand, & Torralba, 2009) and videos (Marat et al., 2009) were freely available. Many authors used their own data to train and test models, which eventually became available to other researchers;
9. Models can be classified based on how saliency is calculated. For example, a model can be based on neuron-like calculations, or it can use formal high-level approaches. The authors note that some models fall into several categories at once, but nevertheless use a simple single-level classification in the future:

– cognitive models. Almost all models of attention were created under the influence of cognitive concepts. However, the authors include in this class those models that are more closely related to psychology or neurophysiology; the author of this review believes that this may be a matter of substantive connection, since the algorithms used in these models intersect in one way or another with psychological and/or neurophysiological concepts;

– Bayesian models. "In these models, prior knowledge (e.g., the context of the scene or its gist) and sensory information (e.g., target features) are probabilistically combined

according to Bayes' rule (e.g., to detect an object of interest)" (Borji & Itti, 2013, p. 194). These models are capable of learning from data and generalizing various factors;

– models based on decision-making theory. These models are based on the idea that visual attention should be managed in an optimal way in the context of the current task; they can be based on very different algorithms (both biologically based and purely computational);

– models based on information theory. These models are based on the assumption that salient areas are the most informative in terms of the amount of information they contain. Computationally, these models are based on comparing various statistical estimates of image regions (entropy, distribution parameters, etc.);

– Graphical probability models. "Graphical models can be viewed as a generalized version of Bayesian models" (Borji & Itti, 2013, p. 197). Such models use graphs that represent the structure of conditional independence of random variables; eye movements are viewed as a time series. Due to the existence of hidden variables that influence the formation of eye movements, solutions such as hidden Markov models (HMM), dynamic Bayesian networks (DBN), and conditional random fields (CRF);

– models based on spectral analysis. This group of models is based on the analysis of image properties, often with scaling, represented in the frequency domain (amplitude and phase spectrum);

– models based on pattern classification. These models use machine learning methods such as support vector machines (SVM), regression, etc. Training is carried out on specially labeled data (for example, divided into areas, each of which is marked as salient or non-salient);

– Other models. A fairly extensive and highly blurred "class" of models characterized by originality and based on a wide variety of computational solutions.

Based on these properties, the authors of the review have compiled an extremely useful summary table of the models they have considered (Borji & Itti, 2013, p. 201), allowing the reader to quickly navigate the vast array of rather complex developments and find the necessary bibliographic information. Each of the listed properties is represented by a column in the table, with the models known to the authors listed in rows; the cells contain symbols that indicate whether a model has a particular property. Thus, using the table, one can quickly determine that the classical model of Itti, Koch, and Niebur (Itti et al., 1998) discussed earlier is ascending, spatial, rather than spatiotemporal, static; dealing with natural stimuli and the task of free viewing, based on spatial locations rather than objects, taking into account only simple features (color, brightness, orientation), cognitive; data for training the model were not used.

Neural network models of saliency

Moving on to the description of saliency models based on deep learning methods, we cannot fail to mention the existence of a remarkable review published by A. Borji in 2021 (Borji, 2021), but available as a preprint since 2019 (Borji, 2019). I would like to recommend this document to interested readers as a valuable source of reference information on neural network models and datasets created over the past decade, on the metrics used, and on methods for evaluating model performance. Given the existence of this high-quality review, the author of this text (D. Ya.) sets himself two fairly modest tasks: to acquaint the reader with the history and logic of the development of the field using the example of the work of one of the most successful research groups working in the field of saliency modeling; to examine the models created after the publication of Borji's review and attempt to identify and summarize their characteristic features.

The work of A. Krizhevsky, I. Sutskever, and J. E. Hinton (Krizhevsky, Sutskever, & Hinton, 2012) sparked another revolution in artificial intelligence research, reviving widespread interest in deep learning neural networks, which had faded somewhat due to the rapid development of machine learning approaches such as kernel methods and decision trees at the turn of the century (see, e.g., (Chollet, 2023)). The model, later named AlexNET, won a decisive victory at the annual ImageNet competition in 2012, achieving a record performance of 83% in the classification of 1,000 object categories. The use of the then-novel multilayer convolutional architecture and graphics processing units allowed researchers to achieve impressive results in the following years, including in the modeling of visual saliency.

As early as 2014, a group of researchers from the University of Tübingen (Bethge Lab) developed the DeepGaze I model (Matthias Kümmerer, Theis, & Bethge, 2015), which used weights from the neural network of A. Krizhevsky et al. 2015). The use of transfer learning technology allowed the authors to achieve a significant increase in performance compared to previously created models. Thus, the correlation between predictions and tracking data on the MIT300 dataset is 0.6144. The model used the outputs of the convolutional layers of AlexNET, which were linearly combined with different weights. The resulting layer was filtered (convolution with a Gaussian kernel), then a weight matrix implementing a center bias correction was added to it elementwise. In this form, the result was fed to the softmax layer, at the output of which the distribution of fixation probabilities was formed. To stimulate sparsity, l1 regularization of weights was applied in the model.

In 2017, a new version of the model appeared, DeepGaze II (M. Kümmerer, Wallis, Gatys, & Bethge, 2017). It used the convolutional part of VGG-19 (Simonyan & Zisserman, 2015) as its base; information was extracted from the conv5_1, relu5_1, relu5_2, conv5_3,

and relu5_4 layers. The trainable part was made more complex (4 convolutional layers 1x1), but otherwise the model was similar to the previous one. The model demonstrated very high performance at the time: the correlation between the empirical MIT300 data and the forecast was 0.7703.

In parallel with it, the DeepGaze ICF model was created, in which, instead of the basic part in the form of network layers that were pre-trained to recognize objects, operations for extracting exclusively low-level features were used. Calculations were performed for brightness and two color difference components in five scales (Gaussian pyramid) for brightness and contrast, respectively; thus, 30 low-level feature maps were generated at the output. This model achieved better performance (correlation of 0.5876 on MIT300) than all models that did not use features from neural networks pre-trained to recognize objects, which, according to the authors, makes it a reliable basis for assessing the usefulness of high-level features. Thanks to this model, the authors found that some fixations are much better predicted by low-level features.

The DeepGaze IIE model (Linardos, Kümmerer, Press, & Bethge, 2021), introduced in 2021, is an improved version of DeepGaze II. The trainable part of the network has been made deeper, and ReLU activations have been replaced with norm and softplus. Training was performed on the Salicon and then MIT1003 datasets. The main change concerned the base network: the original VGG-19 could be replaced with other deep networks trained on the ImageNet dataset (ResNet50 (He, Zhang, Ren, & Sun, 2015), EfficientNet85 (Tan & Le, 2020), etc.). According to MIT/Tübingen Saliency Benchmark), the highest correlation between the prediction and empirical fixation maps was 0.8242; in fact, this is the best model tested to date and presented on the website. However, the authors continue to create new versions of the model.

In 2022, DeepGaze III was introduced (Matthias Kümmerer, Bethge, & Wallis, 2022; Matthias Kümmerer, Wallis, & Bethge, 2022), which includes a spatial prediction module that takes into account the influence of scene content on fixation location, and a scan history module that identifies the influence of earlier fixations and, consequently, the dynamics of gaze trajectory. The first module broadly replicates previously developed spatial models; the second uses information about four or fewer previous fixations to predict the current fixation, which is represented as maps of three features: distance to the current fixation, as well as x and y displacements. Information about previous fixations made by the subject is processed in this module and then combined with the spatial map in the fixation selection network. The final prediction is blurred, combined with the central offset correction weights, and converted into a probability distribution using softmax. Judging by the AUC= 0.906 and NSS= 2.957 values reported by the authors, obtained on MIT300 (the correlation value is not given), the model demonstrates the highest performance of those previously presented, but data on it on the MIT/Tübingen

Saliency Benchmark is not yet available. The approach used by the authors allows us to investigate the influence on perceptual saliency not only of the physical properties of the image and the task, but also of previously produced fixations.

The idea of processing features extracted from layers of a convolutional neural network trained to recognize objects is also used by the authors of the TranSalNet model (Lou, Lin, Marshall, Saupe, & Liu, 2022). When developing the model, they set themselves not only the task of obtaining maximum results, but also sought to bring the architecture of the artificial network closer to the human perceptual system. First, the image is fed into a convolutional encoder. To obtain multi-scale representations, three sets of feature maps with different spatial dimensions are extracted from the encoder. Due to the inductive biases inherent in convolutional architectures, the extracted image representations do not contain contextual information at a large scale, which potentially makes the saliency model less human-like. The authors draw the reader's attention to the fact that the human visual system is capable of capturing both local and global information. The authors stress that the saliency model is not as human-like as it could be; they emphasize that the human visual system is capable of capturing both local and global information. Therefore, to obtain a prediction that is more relevant from the point of view of perception, these feature maps are passed through three encoder transformers (Vaswani et al., 2023), which allows us to obtain global feature maps with improved context information transfer. The encoder transformers contain a multi-head self-attention layer and a multilayer perceptron. Then, a convolutional decoder combines the feature maps to construct a saliency prediction. The model demonstrates performance comparable to DeepGaze: when using DenseNet-161 (Huang, Liu, Maaten, & Weinberger, 2018) as the base network, the correlation between the prediction and the MIT300 data is 0.8070; with ResNet-50, the correlation decreases slightly (0.7991).

Despite their significant capabilities for forming representations of image elements, feedforward convolutional neural networks can ignore their internal connections and lack the potential advantages provided by the use of feedback in visual tasks. This also applies to saliency modeling. Given this circumstance, the authors of the SalFBNet model (Ding, İmamoğlu, Caglayan, Murakawa, & Nakamura, 2022) propose a convolutional architecture with feedback and recursion. The proposed model can form multiple contextual representations using a recursive path from higher-level feature blocks to lower-level layers. To address the problem of training data scarcity, the authors use a special approach to knowledge transfer, creating a large-scale training set using pre-trained saliency models listed on the MIT/Tübingen Saliency Benchmark website. First, they train the proposed model on the artificial data obtained in this way, then retrain it on real gaze fixations. In addition, to facilitate training their feedback model, the authors propose a new loss function, which they call sFNE (selective fixation and non-

fixation error). Numerous experimental results show that SalFBNet with fewer parameters achieves competitive results in publicly available saliency model tests, which indicates the effectiveness of both the feedback model itself and the use of artificial data for pre-training. SalFBNet ranks second in performance after DeepGaze IIE (correlation with MIT300 data 0.8141).

The Saliency TRansformer (SalTR) model (Dahou Djilali, McGuinness, & O'Connor, 2024) is based on a new approach to predicting saliency in images, using parallel decoding in transformer networks to train the network exclusively on fixation maps. To overcome the optimization challenges for discrete maps, models are typically trained on continuous maps. The developers of SalTR attempt to build an experimental computing system that generates saliency datasets. The authors' approach treats saliency estimation as a direct prediction problem using a global loss function that predicts individual fixations through bilateral matching and a transformer-encoder-decoder architecture, with a ResNet50 base network at the input. Using a fixed set of learned fixation queries, cross-attention processes image feature information to directly infer fixation points, which distinguishes this development from other modern models. The authors note that their approach achieves estimates comparable to other modern approaches in the Salicon and MIT300 tests. Thus, the implementation of SalTR-Small provides correlations between predictions and original samples at the level of 0 .84 and 0 .7 for Salicon and MIT300, respectively, while SalTR- Base provides correlations of 0 .87 and 0.75. The use of deformable convolutions in the models increases the similarity to 0.86 and 0.76 (small) and 0.89 and 0.8 (base), respectively. Thus, SalTR is indeed one of the best modern models of visual saliency.

Modeling of visual saliency is also developing in the direction on video stream processing. In their work (Droste, Jiao, & Noble, 2020), the authors point out that saliency modeling for images and videos is considered in the current literature on computer vision as two independent tasks. And while modeling for images is a well-developed problem, and progress in this area is slowing down, as seen in the SALICON and MIT300 benchmarks, saliency models for video have recently shown rapid growth in the DHF1K benchmark (Wang et al., 2021). The authors ask whether it is possible to approach saliency modeling for images and videos using a single model with mutual benefits. In their opinion, the key prospects for joint modeling are provided by the application of domain shift (adaptation of an AI system to use in a new area and/or applying to new data) both between saliency data for images and for videos, and between different sets of video data. In addition to an improved algorithm for creating trained Gaussian priors (correction for gaze shift to the center), four new domain adaptation methods are proposed to solve this problem: domain-adaptive prior values, domain-adaptive fusion, domain-adaptive smoothing, and recurrent network bypass. These methods are integrated into a "simple and lightweight"

(Droste et al., 2020, p. 1) UNISAL network with an "encoder-recurrent block-decoder" architecture, trained on saliency data for both images and videos. The training results are evaluated on the DHF1K, Hollywood-2, and UCF-Sports video datasets, as well as on the SALICON and MIT300 static datasets. With the same set of parameters, UNISAL achieves the highest performance at the time of publication on all saliency datasets for video and is on par with the best models in tests on image data (correlation with MIT300 data is 0.7851); Compared to all competing models using deep learning, the execution time is reduced by 5–20 times, and the model itself is smaller. The authors also conduct retrospective analysis and ablation studies (studies of the role of an AI system component by disabling it), which confirm the importance of domain shift in modeling.

Characteristics of Modern Deep Learning Saliency Models

1. Modular neural network architectures with replaceable modules.
2. Knowledge transfer: leveraging pre-trained networks and artificial datasets for pre-training.
3. Domain adaptation: extending models across domains, e.g., images and videos.
4. Beyond classical convolution: use of recurrent paths, self-attention, feedback loops, and transformers.
5. Modular manipulation for ablation studies, enabling analysis of each component's contribution.

Conclusion

A considerable amount of time passed between the publication of Koch and Ullmann's seminal article (1985) and the practical testing and implementation of their ideas. Early research focused primarily on the algorithm for forming the initial saliency map, while many details of its construction were only briefly mentioned in the original work. The first, traditional stage of saliency model development was characterized by a wide variety of computational methods and approaches. Some of these solutions were well-aligned with psychological and neurophysiological data. At this stage, visual saliency models were largely "transparent" in terms of internal structure, making them especially valuable for comparison with theoretical models from cognitive science. With the rise of machine learning methods–such as Bayesian classifiers and support vector machines–particularly in the first decade of the 21st century, some conventional models began to resemble "black boxes." This trend intensified dramatically after the 2012 revolution in neural network technology, though it also brought impressive gains in performance. There is hope that, as tools for analyzing the specific algorithms learned by neural networks improve, the contents of these "black boxes" will become more interpretable. Optimism is also supported by the growing volume of publicly available data for training saliency models, as well as a clear understanding in the research community of the importance of task type

(e.g., free viewing, visual search) and task characteristics when collecting such data.

As effective computational approaches have matured, the literature has increasingly explored practical applications of saliency models, including computer vision (Medioni & Mordohai, 2005), engineering psychology and usability studies (Sun et al., 2019), medical image analysis (Arun et al., 2020; Jampani et al., 2012), and video compression (Gitman et al., 2014; Lyudvichenko et al., 2017). The first commercial solutions are also emerging. Thus, the modeling of visual saliency has now acquired significant practical relevance, enabling both the simulation of attention for technical purposes and the prediction of attentional shifts in humans.

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Author Details

Denis V. Yavna — Cand.Sci (Psychology), Associate Professor, Southern Federal University, Rostov-on-Don, Russian Federation; Scopus Author ID: 56034231500; WoS Researcher ID: B-1314-2013; ORCID ID: https://orcid.org/0000-0003-2895-5119; e-mail: dvyavna@sfedu.ru

Conflict of Interest Information

The authors have no conflicts of interest to declare.