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Multifactor models of creativity: structural and dynamic approaches in psychological assessment

V.G. Gryazeva-Dobshinskaya[1], E.I. Koltunov[2], S.Yu. Korobova[3], V.A. Glukhova[4]
South Ural State University, Chelyabinsk, Russian Federation.
E-mail: [1]koltunovei@susu.ru; [2]griazevadobshinskaiavg@susu.ru; [3]k.svetlana-1991@mail.ru; [4]glukhovava@susu.ru

E.S. Naboichenko
Ural State Medical University, Ekaterinburg, Russian Federation.
E-mail: dhona@mail.ru

✉ *dhona@mail.ru*

Abstract. *Introduction*. The article addresses the problem of diagnosing creativity as a complex and multifactor construct. *Aim.* The present article *aimed* to examine multifactor models of creativity and to reveal the structural and dynamic aspects of psychological assessment in order to identify relevant, less developed aspects of the psychological assessment of creativity. *Methodology and research methods*. Multifactor models of creativity were reviewed. A matrix of creativity research in different branches of psychology was modified and a matrix of methods for assessing different aspects of creativity was developed. *Results and scientific novelty.* The analysis of multifactor models of creativity (4P, 4C, 5A, 7C) identified five general structural factors of creativity (5T): *creative person, creative process, creative product, creative environment,* and *co-creation*. The 5T×4C matrix for creativity diagnostic methods, which includes structural (5T) and dynamic parameters (4C), was formed. Research areas with less developed tools of psychological assessment were identified: the creative process at the pro-C and big-C level; the creative environment at the mini-C level; and co-creation at all levels of creativity. *Practical significance.* The proposed 5T×4C matrix serves as the foundation for analysing the current aspects of creativity diagnostics development. The analysis of multifactor models and psychological assessment methods for creativity can be utilised in developing new approaches to studying the phenomenon of creativity.

Keywords: creativity, multifactor models of creativity, creativity assessment, creativity research methods, creativity matrix, matrix for creativity assessment methods

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Многофакторные модели креативности субъектов: структурный и динамический подходы в психологической диагностике

В.Г. Грязева-Добшинская[1], Е.И. Колтунов[2], С.Ю. Коробова[3], В.А. Глухова[4]
Южно-Уральский государственный университет (НИУ), Челябинск, Российская Федерация.
E-mail: [1]koltunovei@susu.ru; [2]griazevadobshinskaiavg@susu.ru; [3]k.svetlana-1991@mail.ru; [4]glukhovava@susu.ru

Е.С. Набойченко
Уральский государственный медицинский университет, Екатеринбург, Российская Федерация.
E-mail: dhona@mail.ru

✉ *dhona@mail.ru*

Аннотация. *Введение*. Статья посвящена проблеме диагностики креативности как комплексного и многофакторного конструкта. *Цель* статьи – анализ многофакторных моделей креативности и выявление структурных и динамических аспектов психологической диагностики для определения актуальных аспектов развития психологической диагностики креативности. *Методология, методы и методики.* В работе проведен анализ многофакторных моделей креативности; осуществлена модификация матрицы исследований креативности в различных отраслях психологии и разработана матрица методов диагностики разных аспектов креативности субъектов. *Результаты и научная новизна.* В результате анализа различных многофакторных моделей креативности (4P, 4C, 5A, 7C) были выделены пять общих структурных факторов креативности (5T): творческая личность, творческий процесс, творческий продукт, творческая среда и совместное творчество и создана матрица методов диагностики креативности 5T × 4C, включающая структурные (5T) и динамические параметры (4C). Выявлены области исследования с менее разработанным психодиагностическим инструментарием: творческий процесс на уровне профессиональной и выдающейся креативности; творческая среда на уровне малой и повседневной креативности; совместное творчество на разных уровнях креативности. *Практическая значимость.* Предлагаемая матрица 5T × 4C является основанием для анализа актуальных аспектов развития диагностики креативности. Проведенный анализ многофакторных моделей и методов психологической диагностики креативности может быть использован при разработке новых психодиагностических методик исследования феномена креативности.

Ключевые слова: креативность, многофакторные модели креативности, диагностика креативности, методики исследования креативности, матрица креативности, матрица методов диагностики креативности

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Modelos multifactoriales de creatividad: enfoques estructurales y dinámicos en el diagnóstico psicológico

V.G. Gryázeva-Dobshínskaya[1], E.I. Koltunov[2], S.Yu. Kórobova[3], V.A. Glújova[4]
Universidad de Los Urales del Sur, Cheliábinsk, Federación de Rusia.
E-mail: [1]koltunovei@susu.ru; [2]griazevadobshinskaiavg@susu.ru; [3]k.svetlana-1991@mail.ru; [4]glukhovava@susu.ru

E.S. Nabóychenko
Universidad Estatal de Medicina de Los Urales, Ekaterimburgo, Federación de Rusia.
E-mail: dhona@mail.ru

✉ *dhona@mail.ru*

Abstracto. *Introducción*. El artículo está dedicado al problema del diagnóstico de la creatividad como un constructo complejo y multifactorial. *Objetivo.* El propósito del artículo es el análisis de modelos multifactoriales de creatividad e identificar aspectos estructurales y dinámicos del diagnóstico psicológico para determinar aspectos relevantes del desarrollo del diagnóstico psicológico de la creatividad. *Metodología, métodos y procesos de investigación.* El artículo analiza modelos multifactoriales de creatividad; se llevó a cabo una modificación de la matriz de investigación de la creatividad en diversas ramas de la psicología y se desarrolló una matriz de métodos para diagnosticar diversos aspectos de la creatividad de los sujetos. *Resultados y novedad científica.* Como resultado del análisis de varios modelos multifactoriales de creatividad (4P, 4C, 5A, 7C), se identificaron cinco factores estructurales generales de la creatividad (5T): *personalidad creativa, proceso creativo, producto creativo, entorno creativo y creatividad conjunta*. Se creó una matriz de métodos para diagnosticar la creatividad 5T × 4C, incluidos parámetros estructurales (5T) y dinámicos (4C). Se han identificado áreas de investigación con herramientas de psicodiagnóstico menos desarrolladas: el proceso creativo a nivel de creatividad profesional y destacada; entorno creativo al nivel de la creatividad pequeña y cotidiana; co-creación en diferentes niveles de creatividad. *Significado práctico.* La matriz 5T × 4C propuesta es la base para analizar los aspectos actuales del desarrollo del diagnóstico de la creatividad. El análisis de modelos multifactoriales y métodos de diagnóstico psicológico de la creatividad puede ser utilizado en el desarrollo de nuevos métodos de psicodiagnóstico con el propósito de estudiar el fenómeno de la creatividad.

Palabras claves: creatividad, modelos multifactoriales de creatividad, diagnóstico de creatividad, métodos para estudiar la creatividad, matriz de creatividad, matriz de métodos para diagnosticar la creatividad

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Introduction

Modern psychology is particularly interested in the phenomenon of creativity. Human creative resources from a wide range of ages, professions, and subcultures are studied as factors ensuring personal and corporate competitive advantages: during childhood and schooling, professional education at universities, training in

various professional fields, and in project implementation. Studies trace both the search for universal creativity factors in various samples of subjects in education and business and the desire to identify specific culturally conditioned factors and resources of creativity. Creative resources are identified using methods based on different theoretical frameworks and provide researchers with a wide choice of assessment tools [1, 2, 3, 4]. The variety of modern assessment methods allows the analysis of the theoretical frameworks and the empirical studies in order to identify their capabilities and constraints.

This work analyses the multifactor models of creativity and identifies the structural and dynamic aspects of psychological assessment to reveal the relevant aspects in the development of psychological creativity assessment. The paper presents the results of a step-by-step review of the multifactor models of creativity aimed at identifying the structural and dynamic aspects of psychological assessment. It proposes a 5T×4C matrix for creativity assessment methods, including the general structural factors of creativity and the dynamic parameters of the development of a creative person.

Research Limitations

The paper analyses multifactor models of creativity and psychometric methods for assessing creativity from the perspective of the 5T×4C matrix. The format is not focused on a complete, detailed description of the psychometric data of each of the methods; the main goal is to classify them within the matrix in order to find the relevant (and missing) aspects of creativity assessment.

Literature Review

Multidimensional models of creativity differ in the structural components and dynamic aspects of creativity.

The 4P model was one of the first and includes the following elements that influence the manifestation of and represent the basis for creativity: Person (personal traits), Process (creative processes), Environment (the impact of external environmental forces), and Product (creative products) [5]. The 4P model of creativity is a popular theoretical approach to understanding creativity, including its structural and dynamic elements, and is widely used for psychometric studies of creativity in education based on various empirical methods [6, 7, 8].

J. P. Guilford's model of creativity considers creativity as a form of problem solving, suggesting the following types of abilities: sensitivity to problems (the ability to recognise problems), fluency (of ideas, associations, and expressions), and flexibility (spontaneous and adaptive). This model served as the basis for identifying convergent and divergent thinking; J. P. Guilford considers divergent thinking to be the most important aspect of creativity [9].

The 4C model of creativity presents creativity as a concept of the life path of a creative person, identifying four qualitatively different levels of creativity: the level of everyday creativity (mini-C), creativity as a learning transformation (little-C), expert, professional-level creativity (pro-C), and eminent creativity (big-C). The 4C model

of creativity considers the development of a creative person from a simpler everyday level of creativity (mini-C and little-C) to more complex levels of professional and eminent creativity (pro-C and big-C) [10]. S. B. Kaufman notes that empirical studies based on the 4C model focus on the self-assessment and self-identification of the levels of creativity and include survey and self-evaluation methods [11].

V. P. Glăveanu's 5A model of creativity considers creativity from the perspective of five factors: Actor, Action, Artifact, Audience, and Affordances. The 5A model of creativity is a logical development of the 4P model, where "Actor" corresponds to "Person", "Action" to "Process", and "Artifact" to "Product". The impact of external environmental forces is enriched with two components: social ("Audience") and material ("Affordances"). The structure of the 5A model is based on the principle that the roots of creativity can be found simultaneously in the natural and social world in which creators live, work, and innovate. The structural and dynamic model presents the personality of the creator as an Actor inseparable from social processes and contexts, while the product of creativity is considered as an Artifact, which is included in the cultural context and focused on its assessment as a product of creativity [12].

Modern cross-cultural studies of creativity develop approaches, which include factors for assessing creativity elements traditional for different cultures. A. V. Kharkhurin's Four-Criterion Construct of Creativity (FCCoC) includes the elements of *novelty and utility,* more traditional for Western culture, and the elements of *aesthetics and authenticity,* reflecting Eastern cultures. This takes into account the specific cultural differences in the understanding of creativity in the West and the East [13].

T. Lubart & B. Thornhill-Miller presented a multifactor analysis of creativity – the 7C model – which includes seven main factors necessary for a holistic understanding of creativity: Creators (person-centred characteristics of those who create), Creating (the creative process), Collaborations (co-creation), Contexts (the environmental conditions), Creations (the creative product, the nature and result of creative work), Consumption (the adoption/implementation of creative products), Curricula (developing and enhancing creativity). The analysis of 7C allows the further development and deployment of the ideas presented in the earlier models (4P and 5A). A comparison of the elements of the three approaches to creativity demonstrates the correspondence and enrichment of the ideas: "Creators" correspond to "Person"/"Actor", "Creative process" to "Process"/"Action", "Creative product" to "Product"/"Artifact". "Conditions and environmental context" corresponds to "Impact of external environmental forces" of the 4P model and "Audience" and "Affordances" of the 5A model. The model identifies new elements ("co-creation", "adoption of a creative product", and "developing creativity"), which complement the study of creativity in psychological research. The 7C model takes into account the cultural context when considering most of the factors, noting that the socio-cultural context can enhance or suppress creativity [14].

A new stage in studying multifactor models of creativity, significant for their further development, is the *creativity matrix* proposed by J. C. Kaufman and

V. P. Glăveanu. The matrix is based on a combination of dynamic and structural approaches to multifactor models of creativity. In the matrix, the authors grouped studies of creativity in various fields of science: clinical psychology, cognitive psychology, social psychology, neuroscience, business, etc. The creativity matrix is presented in the form of a table, which specifies the structural factors of creativity, as per the 5A model (table columns: "Actor", "Action", "Artifact", "Audience", "Affordances"), and the dynamic parameters of developing a creative person as per the 4C model of creativity (table rows: mini-C, little-C, pro-C, big-C). Thus, the model can identify the phenomenal aspects more often presented in theory and research, and the areas that have been less studied and deserve further investigation [15].

These models of creativity include models focused on the structure of the creative process (4P, 5A, 7C), and models studying the dynamics of personal development (4C). The environment is presented in all the models, though the 5A and 7C models offer a more detailed structure for studying the environment as a factor in creativity. The models 5A, FCCoC, and 7C focus on the cultural aspect ("Product" and "Person" are replaced by the more culturally conditioned "Artifact" and "Actor"). This indicates the development of the concepts of creativity towards integrative models based on the cultural conditionality of creativity.

Methodology and Methods

Empirical studies use questionnaires, expert assessments, and tests to identify and analyse creative resources. Our analysis is based on J. C. Kaufman and V. P. Glăveanu's *creativity matrix* to correlate creativity methods with the area of their scientific and practical application. The methods are grouped in a table, according to the structural and dynamic creativity factors they identify. This allows us to analyse the existing approaches to creativity assessment.

The comparison of the components of the 4P, 5A, and 7C models identified the following as structural creativity factors (table columns):

1. creative person ("Creators" – "Person" – "Actor")
2. creative process ("Creating" – "Process" – "Action")
3. creative product ("Creations" – "Product" – "Artifact")
4. creative environment ("Context" – "Press" – "Audience"/"Affordances")
5. co-creation ("Collaborations").

This group of factors is called 5T. We selected elements of the 4C model (mini-C, little-C, pro-C, big-C) as the dynamic parameters of the creative person development (table rows). Table 1 presents the resulting *matrix for creativity assessment methods*.

The creativity assessment methods are considered in detail below according to the five selected factors.

Creative person ("Creators"–"Person"–"Actor")

Assessment methods related to this category measure the personal qualities of the creative person and their life experience and are mainly represented by questionnaires.

A widespread method for measuring individual creativity is memory-based biographical questionnaires. They are based on assumptions about common life experiences that unite creative people; they seek to identify such life experience markers to predict the creative potential of an adult. This type of assessment is represented by the Creative Behaviour Inventory (CBI), B. Batey's Biographical Inventory of Creative Behaviours (BICB), and R. C. Elisondo's Creative Actions Scale (CAS) tests, which assess participation in everyday creative actions [16, 17, 18].

In biographical questionnaires, assessment varies due to the analysed time range: from the beginning of life in CBI, over the past ten years in CAS, and over the past year in BICB. The range of creativity research of these methods is mini-C and little-C.

J. C. Kaufman's "Domains of Creativity Scale" (K-DOCS) also focuses on little-C. This method measures individual creativity in several areas (everyday, performance, scientific, and artistic) using self-assessment [19].

Table 1

Matrix of assessment methods for studying creativity

Creativity factors					
5T	Creative person	Creative process	Creative product	Creative environment	Co-creation
mini-C	CBI, BICB, CAS	RAT, Guilford tests, TTCT, TCT-DP, EPoC, VCAI, CTC	RIBS		
little-C	CBI, BICB, CAS, K-DOCS, KTCPI, SRBCSS, CPPC, RDCA BIG Five SCSS PSS	RAT, Guilford tests, TTCT, TCT-DP, EPoC, VCAI, CTC	CAT, CPSS		PSS
pro-C	BIG Five, CAQ, KAI, SSCS PSS		CAT, CPSS, CSDS	KEYS, 24 Item Preference Scale	PSS
big-C	CAQ		CAT		

Note: CBI – Creative Behaviour Inventory, BICB – Batey's Biographical Inventory of Creative Behaviours, CAS – Elisondo's Creative Actions Scale, K-DOCS – Kaufman's Domains of Creativity Scale, KTCPI – Khatena-Torrance Creative Perception Inventory, SRBCSS – Renzulli's Scales for Rating Behavioural Characteristics of Superior Students, CPPC – The Creative Personality-Potential Composite, RDCA– The Reisman Diagnostic Creativity Assessment, SSCS – Short Scale of Creative Self, CAQ – Creative Achievement Questionnaire, KAI – Kirton Adaptation Innovation Inventory, RAT – The Remote Associates Test, TTCT – Torrance Tests of Creative Thinking, TCT-DP – The Test for Creative Thinking – Drawing Production, EPoC – Evaluation of Potential Creativity, VCAI – Vast Creative Abilities Indicator, CTC – Cebeci Test of Creativity, RIBS – Runco Ideational Behaviour Scale, CAT – Consensual Assessment Technique, CPSS – Creative Product Semantic Scale, CSDS – Creative Solution Diagnosis Scale, KEYS – Assessing the Climate for Creativity, PSS – Periodic Stimuli Space.

S. H. Carson, J. B. Peterson and D. M. Higgins note that the Creative Achievement Questionnaire (CAQ) is more focused on identifying pro-C and big-C creativity and seeks to analyse major achievements in such areas as architectural design, music, or invention [20].

The Kirton Adaptation Innovation Inventory (KAI) questionnaire is also used mainly for assessing pro-C, assessing subjects according to the parameters of efficiency, desire to spread originality, or group conformity [21]. The KAI questionnaire assesses the preferred cognitive style for problem solving within a spectrum ranging from highly adaptive to highly innovative.

The Khatena-Torrance Creative Perception Inventory (KTCPI) includes two questionnaires: Something About Myself (SAM) and What Kind of Person Are You? (WKOPAY). SAM measures such factors as artistic bent, intelligence, individuality, sensitivity, initiative, and mental strength, while WKOPAY evaluates imagination, attractiveness of authority, self-confidence, curiosity, and understanding of other people. KTCPI is used to assess and predict the human ability to be creative and is more focused on little-C [22].

These questionnaires provide for a faster and more convenient collection of a large array of data for analysis. However, their weakness is that they depend on self-assessment [23]. An alternative is the approach presented in Renzulli's Scales for Rating Behavioural Characteristics of Superior Students (SRBCSS). It is designed to assess children and works primarily at the level of little-C. Unlike other questionnaires, the method is filled out not by the child, but by the evaluating adult [24].

The Big Five questionnaire is used to study a creative person as part of the trait paradigm. Its results are used to compare people with different levels of creativity, which can identify general and specific relationships between personal traits and creativity in various scientific and artistic activities, which relates to levels from little-C to pro-C [1].

A special area in creativity research is personal identity assessment implementing the following research design: questionnaires of individual identity are used together with creativity methods, such as CBI, the Creative Personality Scale, Guilford's creativity tests, and TTCT. These identify the relationships between the self-image and the creative abilities of the individual in the socio-cultural context [25, 26, 27, 28, 29; 30, 31].

Specialised methods for creative identity assessment are represented by Karwowski's Short Scale of Creative Self (SSCS) questionnaire. The questionnaire includes two scales: *creative personal identity* – the personal significance of one's own creative potential and *creative self-efficacy* – confidence in one's own creative abilities. This method considers a creative personal identity as an indicator of how important creativity in personal identity [32]. SSCS assesses potential creative qualities inherent in everyone and is significant for any level of creativity [33].

Availability and simplicity of questionnaires mean they are used to study creativity in online resources. This assessment version is represented by the Creative Personality-Potential Composite (CPPC) and the Reisman Diagnostic Creativity

Assessment (RDCA) questionnaires. In particular, RDCA is distributed and used through an online application, which ensured test accessibility. These methods assess general creativity to work primarily at the little-C level.

Periodic Stimuli Space (PSS) method by V. G. Gryazeva-Dobshinskaya is based on personalisation and individual preferences when creating images and is aimed at identifying individual and co-created creativity. It determines the specific forms of individual activity from the standpoint of two styles: attitude (aimed at choosing popular images, specific, complex or simple) and supra-situational (aimed at preferring original images, uncertain and complex stimuli). The method assesses creativity at the little-C and pro-C levels [34].

Creative process ("Creating"–"Process"–"Action")

The investigation of the creative process is primarily represented by methods for studying creativity from the standpoint of convergent and divergent thinking, working mainly in the range from mini-C to little-C. Methods for studying convergent thinking include Mednick's Remote Associates Test (RAT), which requires subjects to find one correct word combining three provided stimulus terms [7, 35].

Methods for studying divergent thinking include J. P. Guilford's test, the Torrance Tests of Creative Thinking (TTCT), and The Test for Creative Thinking – Drawing Production (TCT-DP).

J. P. Guilford's tests require people to give many different answers involving divergent thinking. The test results measure such aspects as the number of ideas (Fluency), their diversity (Flexibility), rarity (Creativity), and expression completeness (Elaboration) [6].

TTCT is widely used for studying creative thinking as it provides for studies in a range from students in primary schools up to university to corporate training for adult professionals [29, 30]. It consists of two forms, verbal and pictorial, assesses the results of the creative process and uses the same four factors as J. P. Guilford's test: Fluency, Flexibility, Originality, and Elaboration [36, 37, 38].

TCT-DP consists of one page depicting several fragments of figures. The subject is asked to complete the drawing, which is then assessed according to several parameters. The method is based on holistic creativity and, in addition to divergent thinking, can analyse other parameters, such as mental risk, border violation, non-standard thinking, and humor. The method is used in complex assessment, including the identification of potential and real achievements of creativity [6, 8].

Evaluation of Potential Creativity (EPoC) method measures divergent-exploratory and convergent-integrative thinking in verbal and graphic formats. It includes tasks aimed at finding original answers and combining several symbols. The method consists of eight subtests and the subject's individual profile, which significantly contributes to the creation of personal development programs [6].

Despite the higher complexity compared to questionnaire tests, attempts are being made to more actively use online resources for creative thinking assessment. The VCAI (Vast Creative Abilities Indicator) digital creativity analysis is based on

TTCT research. It uses cloud technologies and analyses the subject's creative potential [24].

The Cebeci Test of Creativity (CTC) also studies the creative process using network technologies. It provides for the electronic evaluation of creativity according to the four creative factors of Fluency, Flexibility, Originality, and Elaboration. The CTC test overcomes the difficulties and costs associated with the loss of time and resources when similar methods are used for on-site evaluation of creativity in paper form [24].

Creative product ("Creations"–"Product"–"Artifact")

Semantic scales are widely used to analyse creative products. The Creative Product Semantic Scale (CPSS) developed by K. O'Quin's & S. Besemer evaluates the product on a seven-point scale using 55 pairs of adjectives in three dimensions: novelty, utility, and organicity [39]. The method is widespread, available online, and used to study creativity in the range from little-C to pro-C.

The Runco Ideational Behaviour Scale (RIBS) analyses the frequency with which subjects generate new, though not necessarily effective, ideas in everyday life. This method mainly focuses on the level of mini-C [23, 38].

Consensual Assessment Technique (CAT) is a popular creativity measurement method based on the evaluation of a creative product using expert assessments [40, 41]. This approach involves the creation of a real product and its assessment by a group of experts. The complexity and expert work allows CAT to study creative products in the range from little-C to big-C. The difficulty of this technique lies in the time needed for the assessment (which requires the presence of a real creative product) and the need for a number of qualified experts for successful assessment.

D. H. Cropley & J. C. Kaufman developed Creative Solution Diagnosis Scale (CSDS) to overcome the need for experts. The scale includes an assessment of products in several categories and enables an assessment without the participation of experts. The method is focused on the analysis of the functional creativity of new products (both physical objects and ideas) and is therefore better suited for the analysis at the pro-C level and may not be effective in assessing creativity in other areas, such as art [24, 42].

Creative environment ("Context"–"Press"–"Audience"/"Affordances")

Methods for studying the creative environment are mainly represented by questionnaires focused on the organisational climate.

T. M. Amabile, R. Conti, H. Coon et al. developed KEYS to assess the organisational climate for creativity [43]. KEYS analyses environmental factors which facilitate or impede the creative process, assessing the organisational climate according to five parameters: the encouragement of creativity, autonomy, resources, pressure, and organisational obstacles to creativity. KEYS consists of simple descriptive statements that are rated by respondents in terms of the relevance of these items to their workplace. The methodology is designed for work and business and primarily examines creativity in the range of pro-C.

The 24 Item Preference Scale is also designed to assess organisational creativity [44]. It assesses attitudes in the organisation towards creativity and creative problem-solving, highlighting four factors: valuing new ideas, creative individual stereotypes, relevance of new ideas for business and too busy for new ideas as an obstacle to creativity. As in KEYS, this questionnaire works with pro-C creativity level.

Co-creation ("Collaborations")

Co-creation is a complex phenomenon in terms of assessment. Assessment of this phenomenon is presented in V. G. Gryazeva-Dobshinskaya's Periodic Stimuli Space (PSS) which studies the influence of individuals in co-creative activity and outside the current interaction [45].

It includes 50 less structured stimuli (multicolored pictures) and assesses creative activity in three dimensions: intra-, inter-, and meta-individual. At the individual level, the method determines the specifics of the personal activity style (attitude or supra-situational). At the inter-individual level, the method identifies two variants of the subjects' co-activity that contribute to or impede the creation of a higher-quality creative product: reciprocal productive activity united by a general idea which increases creativity ("the effect of ascending to the general"); and autonomous productive activity with subsequent evaluation process to choose the "best" creative product reduces creativity ("the effect of coordinated choice of the general"). At the meta-individual level, actual interaction as a consequence of co-creation can identify the influence of leaders on individual creativity: strengthening ("resonance effects") or reducing ("repression effects") creative activity.

Results

The analysis of the methods for assessing creativity using the matrix for assessing creativity based on its structural and dynamic parameters, allowed us to identify the capabilities and limitations of the existing psychometric tools.

The widest range of methods is presented in aspects of the creative person, creative process, and creative product. Methods for studying the creative environment and co-creation are presented to a much lesser extent.

The properties and qualities of a creative person are studied by a wide range of methods: from specialised tests for everyday creativity (CBI, BICB, KTCPI), to studying personal characteristics of professional creativity (KAI, PSP) and eminent creators (CAQ). Since most of the methods used are represented by questionnaires, their simple procedure facilitates the transfer and adaptation of the development of methods to the online environment (CPPC, RDCA).

The investigation of the creative process is represented by methods for studying creativity in convergent and divergent thinking. The prevailing methods in this area are those studying creative thinking during verbal and non-verbal creative activities (TTCT, TCT-DP, EpoC). Creative thinking tests are focused mainly on everyday creativity. The sophistication of the methods and their implementation complicate the digitalisation of these methods. However, there are successful attempts of electronic

adaptation based on the partial transfer of resources to electronic form and using cloud technologies (VCAI, CTC).

The analysis of creative products is represented by two main methods: the use of pre-prepared categorical assessment scales/indicators (CPSS, CSDS) and the expert assessment technique (CAT). The first approach correlates a new product with several designated parameters, which is not always optimal for identifying a qualitatively new creative result. The widespread use of the second method is limited by the need to select and train experts. Depending on the approach used and the product being assessed, this area offers assessment methods for working with any level of creative personality development.

Studies into the creative environment are primarily represented by questionnaires focusing on the influence of the organisational climate of companies on the creative process. These methods analyse professional creativity, while the study of the influence of the environment on everyday creativity is not represented by available psychometric tools.

Despite the relevance of studies into co-creation, this phenomenon is poorly represented by specialised creativity assessment methods. PSS, aimed at assessing the effectiveness of personal influences during co-creation, shows the prospects of developing assessment tools to analyse creative collaborations.

Creativity assessment methods are widely used in education, wherein the priority development area is the development of an integrated assessment approach that takes into account psychometric testing data and the analysis of students' practical achievements.

Researchers mostly focus on one or several creativity phenomena: a creative person, a creative process, a product, or a creative environment. The popular creativity methods include those that rely primarily on a structural approach to studying a creative person and product and those that analyse the dynamics of creativity in terms of creative thinking and the development of a creative person: from the level of little and everyday creativity (mini-C and little-C) to the level of professional and eminent creativity (pro-C and big-C).

The analysis of psychological creativity assessment methods based on *the matrix for creativity assessment methods*, including multifactor models of creativity, demonstrates the predominance of a structural approach in assessment. It revealed areas with the least developed creativity assessment technologies, which imply a dynamic research paradigm: co-creation and the creative environment (beyond the professional level of creativity). The dynamic approach revealed the relevance of elaborating psychometric tools to determine the development of subjects' professional creative identity.

Discussion

Two leading trends in creativity research – the search for universal and culturally specific factors of creativity – have prompted discussion of effective methods for assessing various aspects of creativity.

The discussion of creativity measurement includes the cultural specificity of assessment tools and creativity parameters. A. V. Kharkhurin pointed out the difference in the analysis of creativity between Western culture, which focuses on novelty and utility, and Eastern culture, which highlights aesthetics and authenticity [13]. M. Karwowski noted that many methods used to analyse creativity emphasise the importance of originality while paying less attention to utility. He also analysed the creative potential in culturally specific categories relevant here and now, as opposed to using such general criteria as fluency, flexibility, or originality. This could allow for a better understanding of how culture influences such processes as imagination [13, 46].

Researchers have discussed the validity of creativity tests. In their review of methods for studying divergent thinking, P. J. Silvia, B. P. Winterstein, J. T. Willse et al. characterised divergent thinking as "one of the most promising candidates" for the foundation of creative ability [48]. This is a reason for the popularity of this type of method, most widely represented in psychometrics by the TTCT.

Popular creativity tests, such as Mednick's RAT and TTCT, are criticised for the unsuitability of the approaches for the phenomena being measured. D. Piffer pointed out that creativity can be measured within three dimensions (novelty, appropriateness, and impact) and identifies the creativity of the creator and the product as two different categories to be measured separately. Based on this, the author noted that modern divergent and convergent thinking tests and creativity tests can measure only individual components of creativity, but not the phenomenon as a whole. He concluded that creativity is a biographical phenomenon and cannot be measured by psychometric tools alone [49].

K. H. Kim noted the high validity and reliability of TTCT as a result of a systematic analysis of assessment using this test. The author noted that the main weaknesses of the test are the need to constantly monitor possible changes in the norms of Originality indicators in different samples under the influence of time and the influence of culture as a factor in creativity on the results. K. H. Kim discussed the possibility of creating individual criteria for assessing different groups [36, 50].

The effectiveness of creativity questionnaires has also been discussed, including biases in self-assessments. In an experimental study of bias in self-assessment, Y. Sidi, I. Torgovitsky, D. Soibelman et al. analysed the uniqueness of the proposed ideas in a specific context [51]. The authors noted that the creative factor of originality is especially susceptible to underestimation in self-assessment because of people's tendency to underestimate their own ideas.

The analysis of questionnaires conducted by P. J. Silvia, B. Wigert, R. Reiter-Palmon et al. revealed several methodological problems typical of this type of methodology, including the prominent positive deviation of results due to the use of categorical or counting assessment methods and the prevalence of a simplified ("average") approach to assessing creativity, which does not always take into account the complexity of the phenomenon. However, the authors noted that creativity questionnaires remain a reliable choice for assessing the phenomenon when researchers

are interested in simple self-assessments of creative behaviour, achievements, or self-esteem [52].

The discussion of creativity assessment in educational practice led to the need to develop a comprehensive approach to assessment, including identifying real achievements and testing creative potentials [14]. Researchers consider prospects for the comprehensive use of batteries of the existing standardised tests of cognitive abilities to analyse creative potential. Thus, J. C. Kaufman, S. B. Kaufman and E. O. Lichtenberger emphasised the rich resources of intelligence tests, such as the Kaufman Adolescent and Adult Intelligence Scale (KAIT) and the Wechsler Abbreviated Scale of Intelligence (WASI) in the context of creativity research and proposed using them based on the philosophy of "intellectual testing". Intellectual testing can help identifying creative potential if tests are interpreted taking into account the specifics of a particular subject in a given situation, contributing to the formation of a complete picture of the subject being assessed [47, 53].

Conclusion

The analysis of methods for psychological creativity assessment revealed the predominant (creative person, creative process, and creative product) and less represented (study of the creative environment, co-creation phenomenon) areas of studies into creativity.

We identified areas with identified areas with less developed psychometric tools: creativity at the level of pro-C and big-C; the creative environment at the level of mini-C and little-C; and co-creation at different levels of creativity.

The predominance of the structural paradigm in modern assessment methods in combination with criticism of existing methods and the gradual development of new multifactor models of creativity indicates the need for new projective creativity research methods to provide for a more profound and comprehensive study of the phenomenon and the need to integrate the structural and dynamic approach to the psychological assessment of creativity.

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Information about the authors:
Vera G. Gryazeva-Dobshinskaya – Dr. Sci. (Psychology), Professor, Head of the Laboratory of Psychology and Psychophysiology of Stress Resistance and Creativity, Department of Psychology of Management

and Service Activity, South Ural State University, Chelyabinsk, Russian Federation; ORCID 0000-0002-9986-4073, AuthorID 304-899, SPIN-code 3365-4221. E-mail: griazevadobshinskaiavg@susu.ru
Evgenii I. Koltunov – Researcher, Laboratory of Psychology and Psychophysiology of Stress Resistance and Creativity; Senior Lecturer, Department of Psychology of Management and Service Activity, South Ural State University, Chelyabinsk, Russian Federation; ORCID 0000-0003-4836-7859, AuthorID 903-340, SPIN-code 7528-1460. E-mail: koltunovei@susu.ru
Svetlana Yu. Korobova – Cand. Sci. (Psychology), Researcher, Laboratory of Psychology and Psychophysiology of Stress Resistance and Creativity, South Ural State University, Chelyabinsk, Russian Federation; ORCID 0000-0002-8633-7231. E-mail: k.svetlana-1991@mail.ru
Vera A. Glukhova – Cand. Sci. (Psychology), Senior Researcher, Laboratory of Psychology and Psychophysiology of Stress Resistance and Creativity, South Ural State University, Chelyabinsk, Russian Federation; ORCID 0000-0002-8322-0302. E-mail: glukhovava@susu.ru
Evgenia S. Naboichenko – Dr. Sci. (Psychology), Professor, Head of the Department of Clinical Psychology, Dean of the Faculty of Psycho-Social Work and Higher Nursing Education, Ural State Medical University, Ekaterinburg, Russian Federation; ORCID 0000-0001-7315-6741, AuthorID 391-572, SPIN-code 2201-3224. E-mail: dhona@mail.ru

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The authors have read and approved the final manuscript.

Информация об авторах:

Грязева-Добшинская Вера Геннадьевна – доктор психологических наук, профессор, заведующая лабораторией «Психология и психофизиология стрессоустойчивости и креативности», профессор кафедры «Психология управления и служебной деятельности» Южно-Уральского государственного университета (Национального исследовательского университета), Челябинск, Российская Федерация; ORCID 0000-0002-9986-4073, AuthorID 304-899, SPIN-код 3365-4221. E-mail: griazevadobshinskaiavg@susu.ru
Колтунов Евгений Иванович – научный сотрудник лаборатории «Психология и психофизиология стрессоустойчивости и креативности», старший преподаватель кафедры «Психология управления и служебной деятельности» Южно-Уральского государственного университета (Национального исследовательского университета), Челябинск, Российская Федерация; ORCID 0000-0003-4836-7859, AuthorID 903-340, SPIN-код 7528-1460. E-mail: koltunovei@susu.ru
Коробова Светлана Юрьевна – кандидат психологических наук, научный сотрудник лаборатории «Психология и психофизиология стрессоустойчивости и креативности» Южно-Уральского государственного университета (Национального исследовательского университета), Челябинск, Российская Федерация; ORCID 0000-0002-8633-7231. E-mail: k.svetlana-1991@mail.ru
Глухова Вера Александровна – кандидат психологических наук, старший научный сотрудник лаборатории «Психология и психофизиология стрессоустойчивости и креативности» Южно-Уральского государственного университета (Национального исследовательского университета), Челябинск, Российская Федерация; ORCID 0000-0002-8322-0302. E-mail: glukhovava@susu.ru
Набойченко Евгения Сергеевна – доктор психологических наук, профессор, заведующая кафедрой клинической психологии, декан факультета психолого-социальной работы и высшего сестринского образования Уральского государственного медицинского университета, Екатеринбург, Российская Федерация; ORCID 0000-0001-7315-6741, AuthorID 391-572, SPIN-код 2201-3224. E-mail: dhona@mail.ru

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Información sobre los autores:
Vera Guennádevna Gryázeva-Dobshínskaya: Doctora en Ciencias de la Psicología, Profesora, Jefe del Laboratorio Psicología y Psicofisiología de la Resistencia al Estrés y la Creatividad, Profesora del Departamento de Psicología de la Gestión y el Desempeño, Universidad Estatal de Los Urales del Sur, Cheliábinsk, Federación de Rusia; ORCID 0000-0002-9986-4073, AuthorID 304-899, SPIN-code 3365-4221. Correo electrónico: griazevadobshinskaiavg@susu.ru
Evguény Ivánovich Koltunov: Investigador del Laboratorio de Psicología y Psicofisiología de la Resistencia al Estrés y la Creatividad, Profesor Titular del Departamento de Psicología de la Gestión y el Desempeño, Universidad Estatal de Los Urales del Sur, Cheliábinsk, Federación de Rusia; ORCID 0000-0003-4836-7859, AuthorID 903-340, SPIN-code 7528-1460. Correo electrónico: koltunovei@susu.ru
Svetlana Yúrevna Kórobova: Candidata a Ciencias de la Psicología, Investigadora del Laboratorio de Psicología y Psicofisiología de la Resistencia al Estrés y la Creatividad, Universidad Estatal de Los Urales del Sur, Cheliábinsk, Federación de Rusia; ORCID 0000-0002-8633-7231. Correo electrónico: k.svetlana-1991@mail.ru
Vera Alexándrovna Glújova: Candidata a Ciencias de la Psicología, Investigadora Principal del Laboratorio de Psicología y Psicofisiología de la Resistencia al Estrés y la Creatividad, Universidad Estatal de Los Urales del Sur, Cheliábinsk, Federación de Rusia; ORCID 0000-0002-8322-0302. Correo electrónico: glukhovava@susu.ru
Evguenia Serguéevna Nabóychenko: Doctora en Ciencias de la Psicología, Profesora, Jefe del Departamento de Psicología Clínica, Decana de la Facultad de Trabajo Psicológico y Social y Educación en Enfermería Superior, Universidad Estatal de Medicina de Los Urales, Ekaterimburgo, Federación de Rusia; ORCID 0000-0001-7315-6741, AuthorID 391-572, SPIN-code 2201-3224. Correo electrónico: dhona@mail.ru

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