MODELING OF ORGANIZATIONAL AND ORGANIZATIONAL AND CULTURAL INTERACTION: AN INTERDISCIPLINARY STUDY

Liudmila N. Aksenovskaya
Saratov State University,
Saratov, Russia
liudmila_aksenovskaya@mail.ru

Olga E. Glukhova
Saratov State University,
Saratov, Russia
glukhovaoe@info.sgu.ru

Abstract

The article presents the result of interdisciplinary research of organizational and organizational cultural interaction, aimed at developing a new method of modeling (atomistic modeling) of organizational and organizational cultural interaction. This research was conducted at the intersection of the sociopsychological (order) approach to the study of organizational culture and the physical and mathematical (atomistic) approach to the study of intra-organizational interaction. This article provides a detailed overview of a new method of predictive atomistic modeling of intra-organizational interaction (DEF), demonstrates possibilities of applying a "surface" interaction modeling method, and presents a method of 3D modeling of organizational culture space. Additionally, this research performs mutual verification of qualitative (order) and quantitative (atomistic) methods of diagnostics and prediction of organizational cultural interaction.

Keywords: organizational interaction, organizational cultural interaction, atomistic and molecular modeling, vector space of culture, organizational culture, order model, suborder.

Introduction

There exist certain features that characterize professional activities in the modern world. Firstly, it is growing more specialized and complex; secondly, it is carried out in resource-constrained conditions (time, money, human resources); thirdly, it is often carried out in conditions of high risk to employees' life and health (extreme natural, technogenic, and terrorist situations, outer space, military operations, deep-sea expeditions, etc.). Nowadays working groups or functional and cross-functional teams are used to tackle complex problems in resource-constrained conditions. As a rule, their work is performed in unique conditions and is unique itself because it does not rely on simple compliance with a procedure, but on a catalogue of precedents (if there are any) or it creates such precedents for the first time. Hence, preliminary assessment of a team's (a working group's) ability or inability to tackle problems effectively requires close attention. It is known that this ability is connected not only with the team member's professional qualifications, but also with their personality traits that affect features of interaction in the group. A team of highly qualified specialists may fail to solve a problem only because of some co-workers' unreliability in terms of social and psychological interaction skills, whose presence also implies relevant competences and a highly developed communicative culture. What plays a major role in ensuring the efficiency of jointly done work is organizational culture established in the team, which is responsible for ethical and meaningful regulation of interaction and related rules and standards of interaction. Initially, order diagnostics of organizational culture takes into account the team members' subjective assessment of both the current state of organizational culture and its desired state. A comparison of these assessments helps to form a picture of the current state and at the same time to identify the participants' existing intentions related to the direction of changes in the state of organizational culture.

Therefore, the *problem of this research* lies in the existence of a gap between the need for reliable prognostic tools of performance assessment of the work group and the lack of such highly reliable predictive methods.

The research objective is to develop a new method of organizational and organizational cultural interaction modeling based on a synthesis of qualitative methods of the atomistic approach (physics and mathematics) and qualitative methods of the order approach to the study of management interaction and organizational culture (social psychology).

The theoretical object of this research is organizational interaction and organizational cultural interaction between co-workers.

The empirical object of this research is a real research team at the Institute of Nanostructures and Biosystems (10 people).

The subject of this research is atomistic modeling of organizational interaction, which takes into account social and psychological aspects of organizational culture of the modeling object.

The research hypothesis: there is a correlation between the data obtained using the quantitative method of studying organizational and management interaction *(atomistic approach),* and the data obtained using the qualitative method of diagnostics of organizational and management interaction that generates organizational culture *(order approach).* This correlation serves as a basis for developing a method of prognostic modeling of interaction between co-workers.

The research methods:

1) molecular and atomistic modeling (based on mathematical modeling using the Lennard–Jones formula: calculation of energy/potential of interaction of neutral atoms and molecules);

2) DEF (Distance/Energy/Frequency) technique of assessing organizational interaction efficiency (O. E. Glukhova);

3) technique of order diagnostics of the degree of manifestation of organizational culture suborders (L. N. Aksenovskaya);

4) observation;

5) overt observation;

6) conversation;

7) scientific assessment;

8) software:

- Surfer software for visual representation of a mathematical model (construction of a surface of interaction efficiency distribution — multiwell interaction potential — in order to predict the risk of the group breaking up);

- Grapher software for building 2D diagrams and graphs (computer modeling of the results of order diagnostics of organizational culture of a research team (RT) with the “family”, “army”, and “church” parameters);
- Ring software for 3D modeling of molecular systems (computer 3D modeling of spaces of suborders of organizational culture).

Phases of research

This research was conducted in 4 phases:

Phase 1: DEF — diagnostic of interaction efficiency between the RT members.

1.1. Conducting a survey using the DEF technique to objectively assess the efficiency of the RT’s work and interaction risks.

1.2. Mathematical modeling using the Lennard-Jones formula to describe interactions.

1.3. Building a visual representation of the mathematical model in the form of a surface of interaction efficiency distribution (multiwell interaction potential) for the risk of the team’s break-up.

1.4. Mapping isolines of the RT members’ interaction efficiency (building a computer model).

1.5. Mapping isoareas of the RT members’ interaction efficiency (a computer model).

Phase 2: Order diagnostics of the RT’s organizational culture.

Phase 3: Computer modeling of the order diagnostics results.

3.1. Computer modeling of the results of the order diagnostics of the RT’s organizational culture based on the following parameters: “family”, “army”, “church” (using Grapher software for building 2D charts and graphs).

3.2. Computer 3D modeling of the suborder space of the RT’s organizational culture (using Ring software for building 3D models of molecular systems).

Phase 4: Comparative analysis of quantitative and qualitative research results from earlier stages.

DEF technique: ideas and parameters. Results of modeling of surfaces of interaction between research team members

A theoretical basis of the atomistic approach to modeling of organizational and organizational cultural interaction is a method of molecular modeling called the method of "atom-atom potential", adopted by O. E. Glukhova for describing social and psychological processes and phenomena. According to this approach, an individual is viewed as an atom (or a quant of the system under study), while a social group is viewed as an atomic system. The behavior of atomic systems is described by means of the energy of interatomic interaction, which is determined by attractive and repulsive forces. The balance of these two forces maintains the system's integrity. The total energy is calculated using the Lennard-Jones potential or the Morse potential. Both potentials determine van der Waals (vdW) interaction of neutral particles. Using the van der Waals model, one can predict the system's behavior under different external factors. The energy profile of vdW interaction is shown below (Fig. 1).

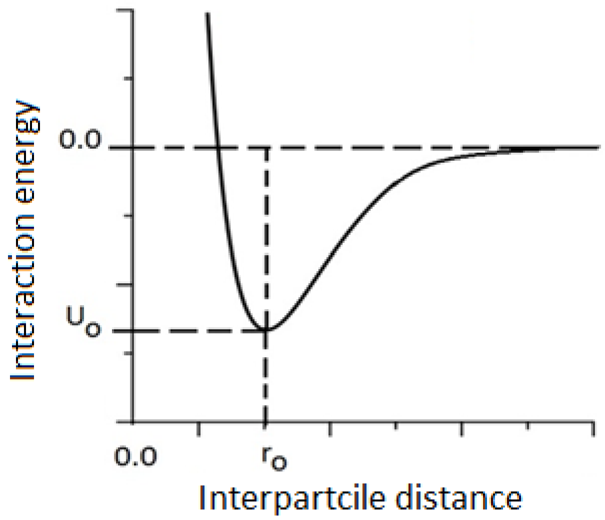


Figure 1. Energy profile of interparticle van der Waals interaction.

The scale of interparticle distances (x-axis) can be divided into two ranges: (0; r_0) and (r_0; ∞). The first range corresponds to repulsion between particles within the distance lower than r_0. The second range corresponds to attraction that equals zero at bigger distances but becomes noticeable at distances close to r_0 (approaching the value r_0 is from the right). Analytically, the energy profile of van der Waals interaction between neutral particles is expressed, to give one example, by the following formula:

$$- \qquad - \qquad . \tag{1}$$

As it was mentioned above, an energy profile is determined by two parameters: the effective distance of interaction r_0 and the so-called "depth of interaction", i.e. the value of interaction energy that corresponds to distance r_0 and, consequently, is the most preferable. Therefore, the lower the energy of interaction, the closer the system is to the ground state condition. The minimum energy Uo defines the system's equilibrium. If the energy increases, the system enters the so-called excited state, an uncharacteristic state from which it seeks to revert to equilibrium. Each system is described by distance r_0 and total energy U_0. Additionally, it should be noted that the curve is asymmetrical, i.e. repulsion between objects occurs within a slightest decrease (of several percent) of distance in comparison to r_0, and attraction is observed at distances exceeding r_0 by tens of percent. Therefore, it is the balance between attraction and repulsion that keeps the system in a stable state of equilibrium.

Based on this theoretical approach, a three-parametric model of organizational interaction (3P-model and the DEF technique) was designed and tested.

The DEF technique (D — distance, E — efficiency, F — frequency of interaction) includes a questionnaire with five questions-tasks aimed at estimating parameters of interaction in a group. The following parameters are estimated: 1) number of interactions (current); 2) number of efficient interactions; 3) distance between group members; 4) optimal distance between group members; 5) efficiency of collaboration between group members; 6) distance at which group members feel discomfort (not optimal). Numerical data obtained from all members of a group are recorded into a summary table.

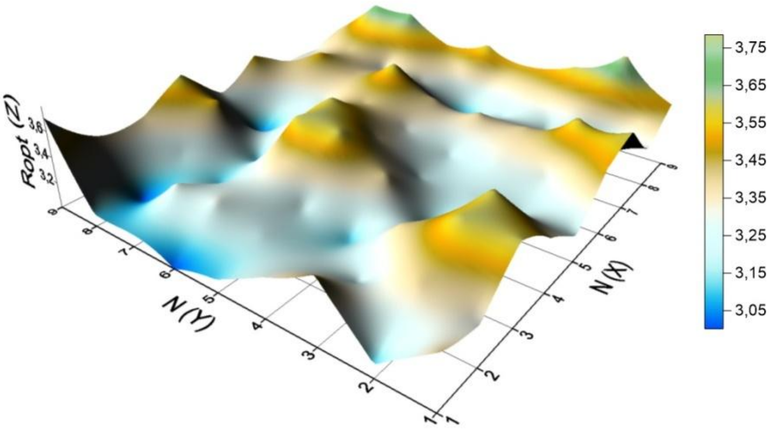
Data processing includes: 1) estimating distances between working contacts; 2) identifying "critical distances" between the group members; 3) building a mathematical model of interaction between the group members and a 2D profile of interaction efficiency; 4) building a working group efficiency profile using computer modeling of the surface of interaction efficiency (multiwell potential); 5) building of a group's work efficiency profile by drawing a map of efficiency isolines; 6) building a group's work efficiency profile in the case of reaching a critical point of the phase transition type; 7) building a 3D diagram aimed at estimating how much the group's work deviates from the most effective state; 8) building a model aimed at estimating interaction efficiency in terms of inter-group interaction frequency at the current moment, interaction frequency necessary for achieving maximum performance results, and interaction frequency in the critical case when the group cannot achieve its goal because of internal conflicts.

Below we will illustrate each step of data processing using relevant formulas and computer models:

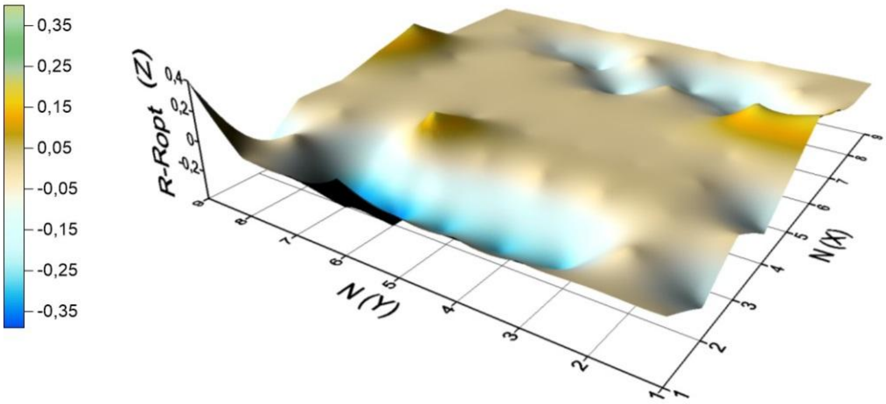
1. Estimating distances between working contacts

What is estimated first is the distribution of optimal distances between the group members. Figure 2a shows a 2D profile of distribution of optimal distances between the group members (the group members are randomly numbered). The group members' numbers are plotted on the x-axis and the y-axis, distance is plotted on the z-axis. All distances are shown in units of interatomic distance measurement, i.e. in angstroms (1 Å = 10^{-10} m). The color scale shows the spread of distances from 3 to 3.8 Å. The optimal distance is defined as the distance specific to, to give one example, a thermodynamically stable atomic structure of graphite r_0 = 3.4 Å. In order to analyze dispersion in relation to the chosen value of r_0 = 3.4 Å, we built a profile of dispersion of optimal distances (Fig. 2b). As this figure shows, the chosen value r_0

corresponds to most values, identified by the group members. Most of the surface corresponds to “0”, i.e. matches r_0, while at the intersections of the lines with the same numbers the optimal distance was set to equal our chosen value of 3.4 Å.



a



b

Figure 2. Profiles of dispersion of optimal interaction distances between the group members: a) optimal distances given by the group members (in angstroms); b) deviation of optimal distances from this value

2. Identifying “critical distances” between the group members

At the next stage, we determine the so-called “critical distances” in inter-group communication, which are extremely undesirable during problem solving. These values correspond to ‘repulsion of atoms that come close within the distance lower than r_0 (Fig. 1). Figure 3 shows a plotted profile of the surface of dispersion of critical values in relation to optimal distances. Based on an analysis of the plotted surface, the difference between critical and optimal distance values is quite significant, even though this information is specific to this particular group and by being its distinctive feature, only specifies the group itself. This step of our research allows us to obtain the first information about both desirable and undesirable contacts in the group.

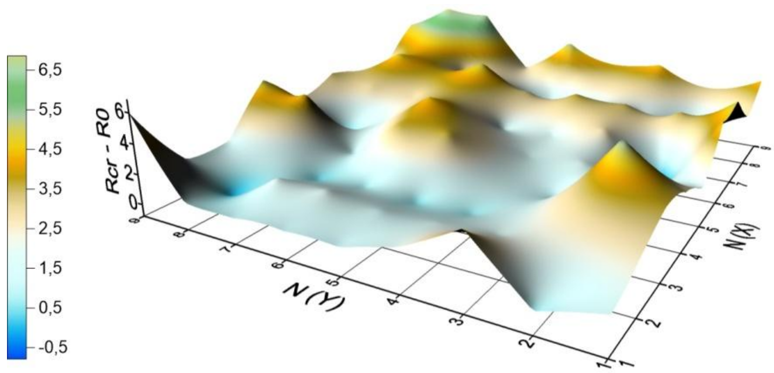


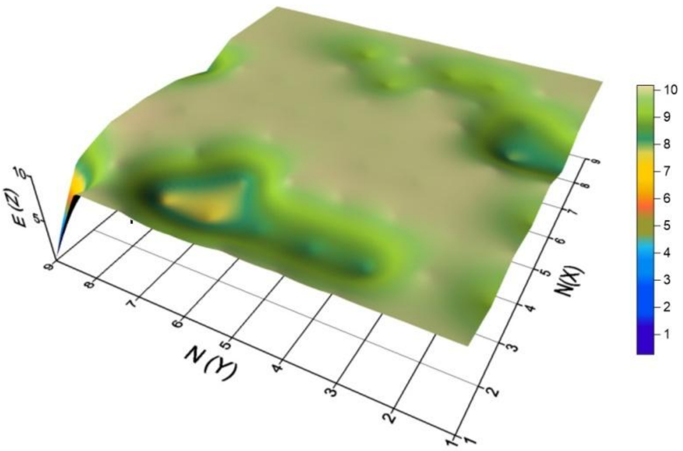
Figure 3. The dispersion surface of critical distances of interaction between the group members, in relation to the optimal distances

3. Building a mathematical model of interaction between the group members and a 2D profile of interaction efficiency

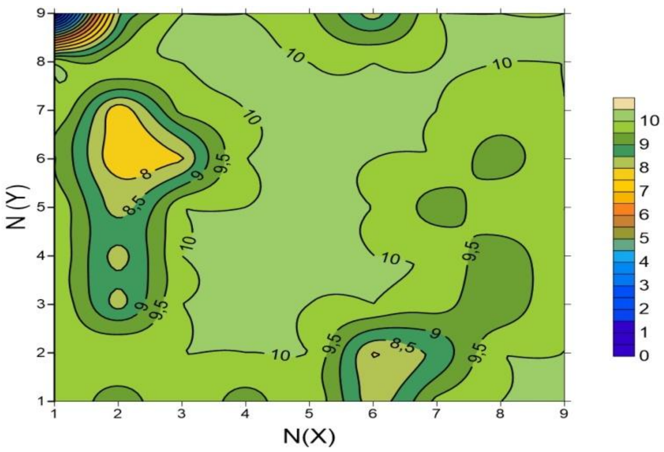
Based on the obtained data about efficient and "critical" interaction distances between the group members, we build a new mathematical model of interaction between the members of the team in question, in order to predict the prospects of its work and possible risks. Applying the Lennard-Jones potential, we devise the following formula:

$$- \qquad - \qquad . \qquad (2)$$

Its product will be a surface (multiwell potential) of interaction efficiency E of each member with all other members. Based on the adopted scale, the maximal value is E_0=10. Value R_0 is the individual value of efficient interaction (as was noted above); value R is the individual distance value. The calculated 2D profile of interaction efficiency in the group is question is displayed in Figure 4. Figure 4a shows a 3D graph that describes the group’s work, while Figure 4b shows the same data in the form of a 2D map of isolines and isostripes.



a



b

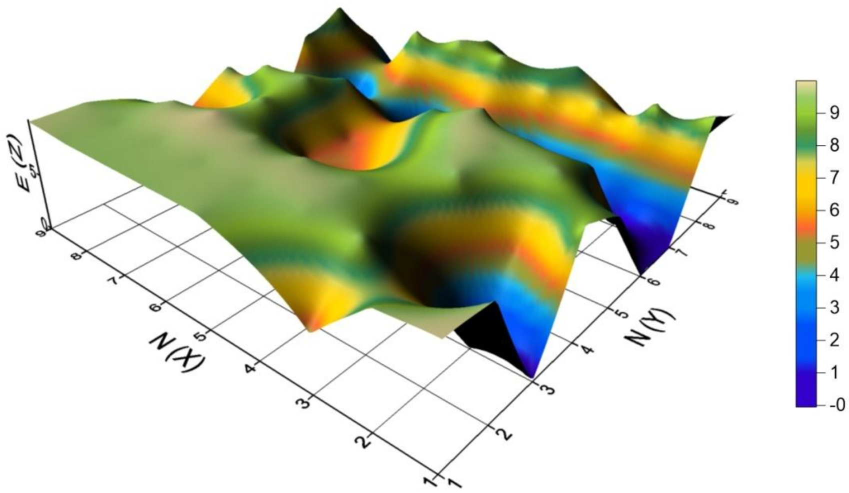
Figure 4. The surface of work efficiency when distributed between the group members: a) a 2D profile with a color scale that shows current work efficiency; b) a map of isolines of the group’s work efficiency

4. Building a working group efficiency profile using computer modeling of the interaction efficiency surface (multiwell potential)

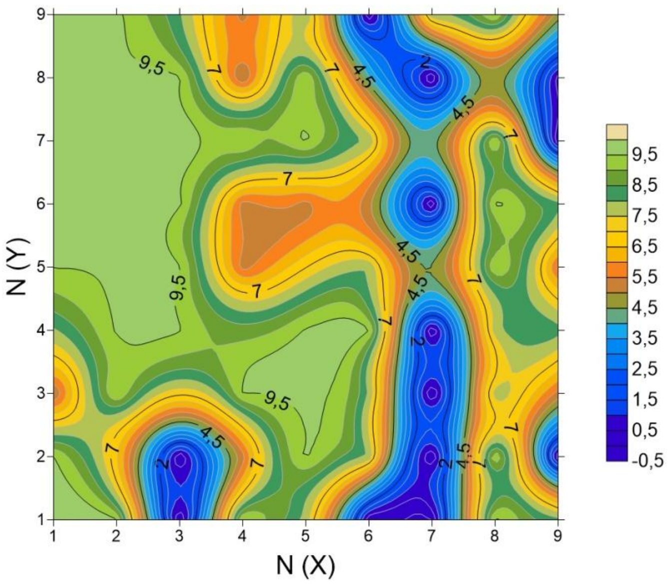
Further, we investigate predictive possibilities of the designed model. In order to build this profile, we “apply” critical distance of interaction (shown in Fig. 2) between each group member and the others and the Lennard-Jones potential (1), where critical values R_{cr} are used as the value of distance:

— — . (3)

Figure 5 shows a 2D profile of the group's work efficiency in achieving critical moments in interaction between the group members. The calculated surface corresponds to unproductive activities and demonstrates the very situation that this particular team should avoid.



a

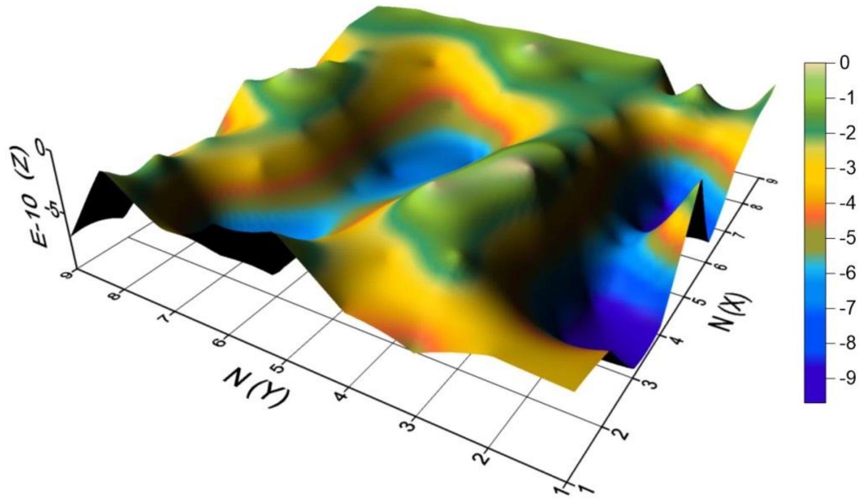


b

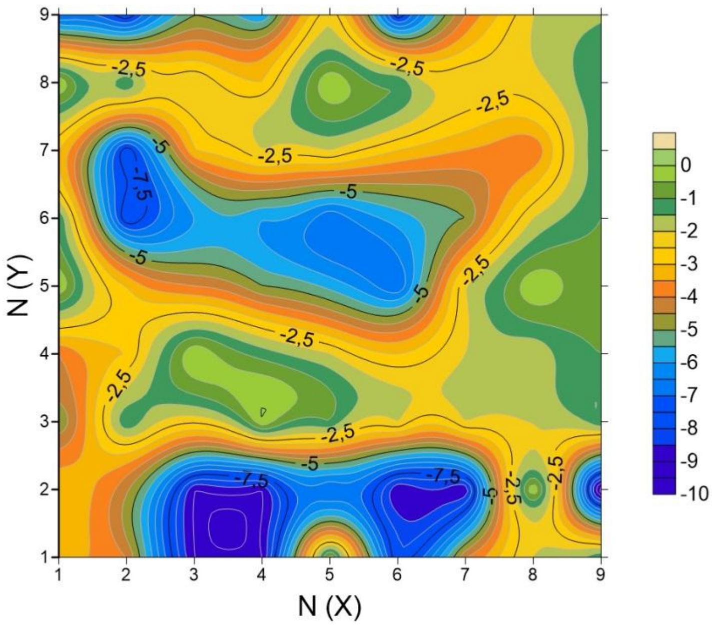
Figure 5. The surface of work efficiency of the members of the group in question when it reaches critical distances: a) a 2D profile with a color scale that shows current work efficiency; b) a map of isolines of the group's work efficiency.

5. Analyzing deviations of the group's actual work efficiency from its "ideal" efficiency

At the next stage, we perform diagnostics of the group's work deviation from its most efficient state. In order to do that, we build a 3D graph, where the group members are plotted on the x- and y-axes, while the difference between current efficiency (Fig. 6a) and "ideal" efficiency (where 100% performance equals 10 points). It should be noted that the best result is "0" because it corresponds to 10 points. This graph conclusively shows this group a purpose in improving its work, and does so for every group member in contact with the other members.



a



b

Figure 6. A 3D graph of the group's actual work efficiency deviations from "ideal efficiency: a) deviations profile; b) map of isolines and isoareas.

6. Building a graph comparing interaction frequency and interaction distance

As an additional step of data processing, figure 7 shows plotted comparative diagrams of interaction frequency and distance. This surface is the surface of distribution of value $10/N_0$ deviation (where N_0 is the optimal interaction frequency) from the optimal interaction distance R_0. Analyzing it, we establish that "interaction frequency" is an independent parameter and represents (apart from efficiency and distance) another parameter for building a predictive model, in particular, its second face — from the perspective of directly productive interaction.

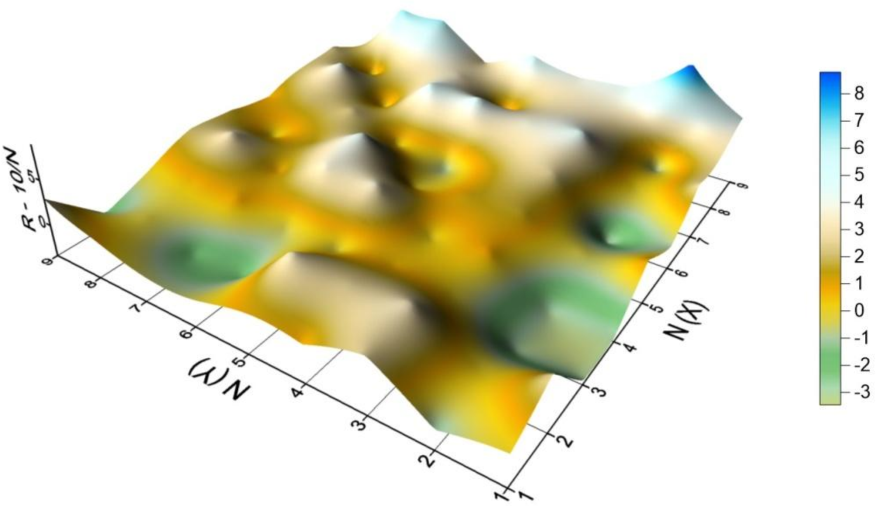


Figure 7. The surface of comparison between interaction frequency and interaction distance

7. Building models in order to estimate interaction intensity depending on distance

This modeling does not predict the behavior of individual group members, but summatively estimates work of the whole team. To do that, we calculate the total number of interactions within the group by summing up the actual (current) number of interactions for all group members. The obtained distance-based correlation is shown in Figure 8. The figure shows effective distance R_{ij}^{opt} of contact between the group members with numbers i and j, R_{ij} — current distance, N_{ij}^{opt} — optimal (the most efficient) value of interaction frequency. Taking into account all collected empirical data, we can note on the curve the point that corresponds to the current condition of the group's work efficiency (purple circles).

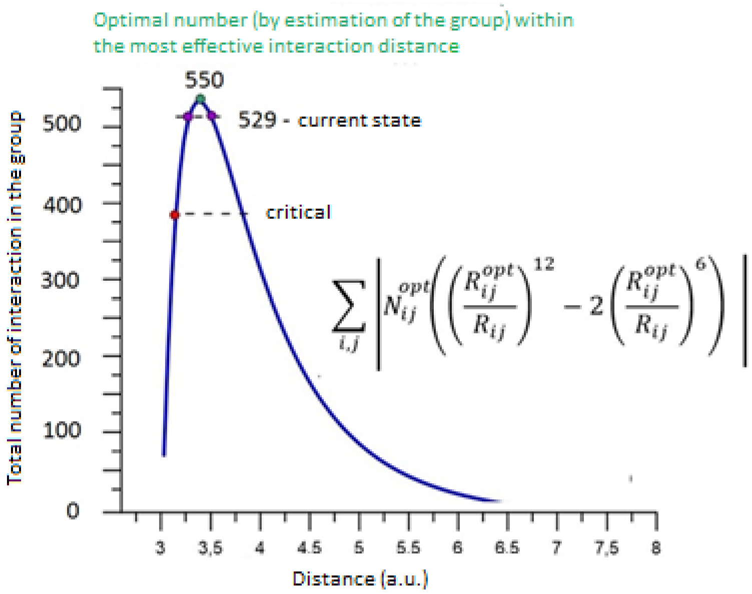


Figure 8. The graph of interaction intensity depending on distance

The sequence of steps outlined above demonstrates the possibilities of numerical modeling of a group's work efficiency using the parameters of current and desirable interaction "distances" of group members and "frequency" of their interaction in the framework of the atomistic approach to modeling of organizational interaction, as well as the promising potential of the DEF technique.

Results of order diagnostics of the research team's organizational culture

Order diagnostics of the RT's organizational culture was performed using L. N. Aksenovskaya's technique of evaluating the degree of manifestation of organizational culture suborders. This technique assesses how three suborders — "family" (emotional and axiological unity of the members of an organization), "army" (unity of purpose of the members of an organization), and "church" (unity of meaning of the members of an organization) — are manifested in the structure of organizational culture. Diagnostics are performed based on six questionnaires completed by the members of the group in question in the course of a conversation with a psychologist. Ten members of the RT participated in this survey (total number).

Table 1 presents the results of order diagnostics.

Table 1.

Overall results of order diagnostics of the manifestation of suborders of the research team's organizational culture (level of the individual)

Suborder	"Family"		"Army"		"Church"	
	CS	DS	CS	DS	CS	DS
Participant no.						
0	65 28.2%	69 27.4%	93 40%	98 39%	74 31.8%	84 33.4%
1	76 31%	84 30%	94 38%	110 40%	76 31%	83 30%
2	80 31%	81 29.5%	106 39%	108 39.4%	74 28%	85 31.1%
3	73 32.3%	77 32.6%	83 36.7%	86 36.4%	70 30.9%	73 30.9%
4	75 32%	80 33.89%	79 34%	74 31.3%	80 36%	82 34.7%
5	112 36.7%	105 34.3%	109 35.7%	115 37.6%	84 27.5%	86 28.1%
6	79 32.9%	87 33.6%	84 35%	83 32%	77 32.1%	89 33.4%
7	96 31.78%	104 32.3%	106 35.1%	111 34.47%	100 33.11%	107 33.23%
8	84 35%	104 38.4%	77 32.1%	81 29.9%	79 32.9%	86 31.7%
9	55 32%	71 35%	53 31%	56 28%	65 37%	75 37%

These results were presented in four pie charts: 1) the results of subgroup 1, 2) the results of subgroup 2, 3) the results of subgroup 3, and 4) the results of the RT's leader. It should be noted that order assessment of the status of organizational culture is carried out based on a comparison between the results of the team members and the team leader.

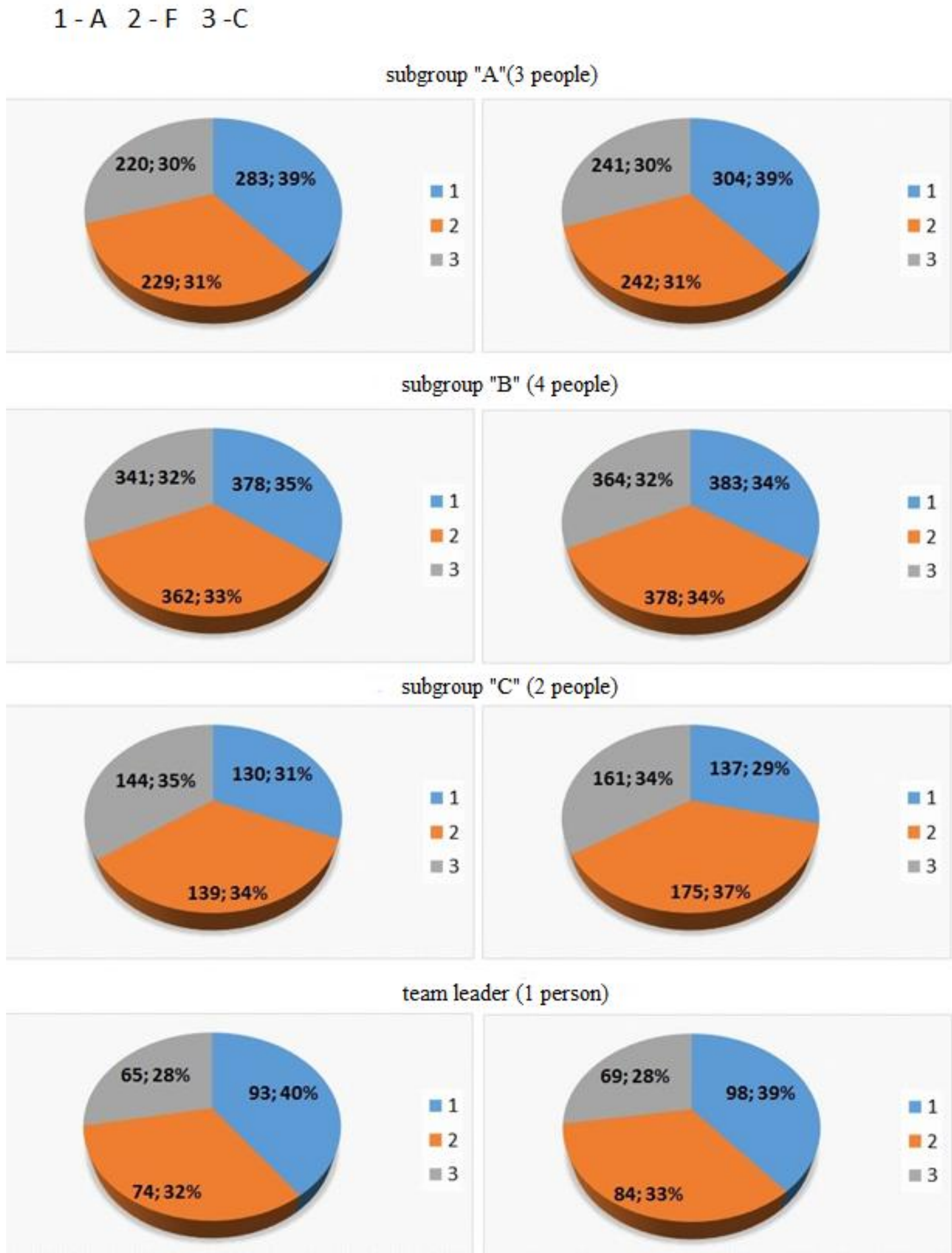


Figure 9. Manifestation of the suborders: results of the subgroups and the leader. (1 — "army", 2 — "family", 3 — "church").

These findings of order diagnostics of the RT's organizational culture indicate that overall the RT showed significant agreement in how they viewed the manifestation of the suborders of organizational culture: 6 out of 9 people named "army" as the most pronounced suborder, two people identified the "church" and "family" suborders as equally pronounced, and one person picked the suborder "church" as such. The third subgroup ranked the "church" suborder first. At the same time, all members of the RT tend to choose the suborder mix of "believer fighters" as the one that characterizes the RT's organizational culture most fully.

These order diagnostics results of the team's organizational culture were processed in Grapher (Fig. 10 and Fig.11):

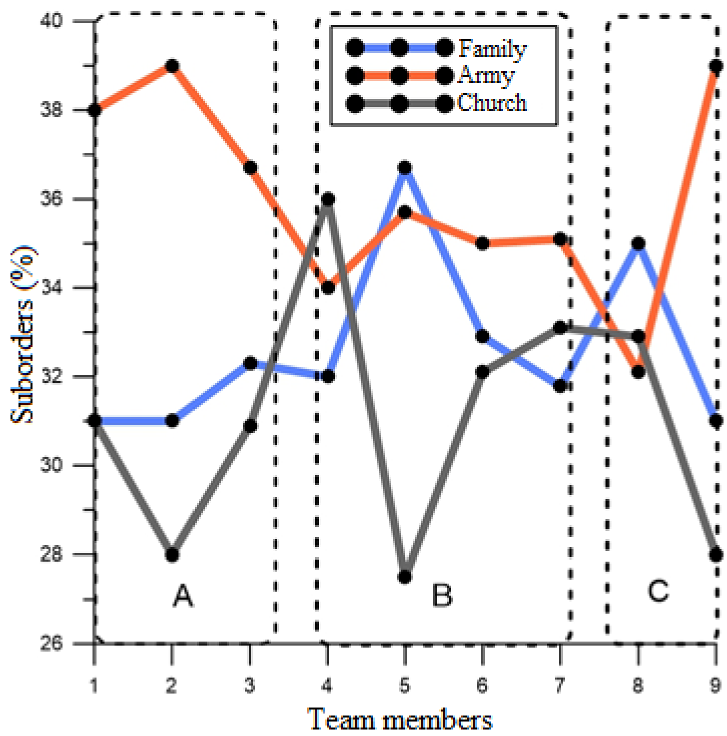


Figure 10. Cross-plot of the results of order diagnostics of organizational culture in the subgroups (CS — current state)

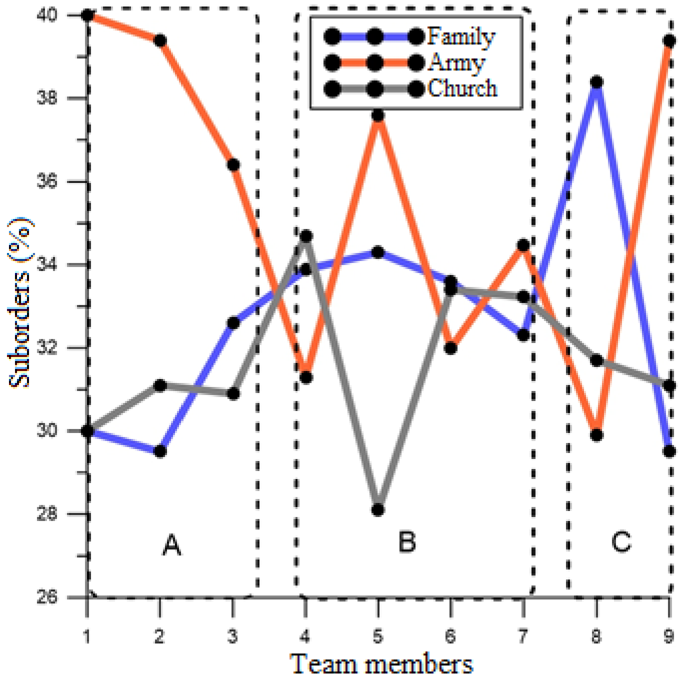


Figure 11. Cross-plot of the results of order diagnostics of organizational culture in the subgroups (DS — desirable state)

These cross-plots display the data of the survey findings and substantiate the results acquired in the course of the survey.

The overall results of the RT's assessment of how pronounced the three suborders are in organizational culture, are displayed below in pie-charts of the current state and the desirable state (CS and DS).

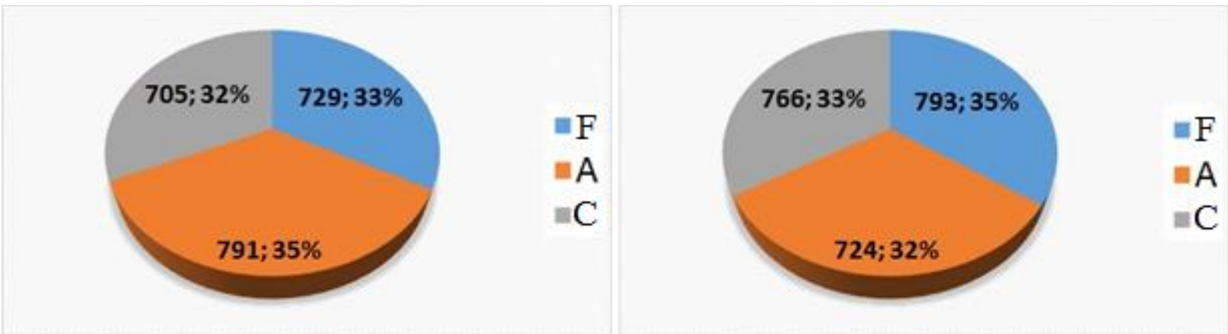


Figure 12. Manifestation of the suborders: RT's overall result

The RT demonstrates the following overall result of assessing manifestation of the suborders in the CS: **A – F – C.** This result differs from that of the leader (**A – C – F**). Moreover, in the DS, the RT would like to change the suborders' manifestation in favor of “family”: **F – C – A**. That is to say, the way the members of subgroup 3 view culture’s future. In other words, this is a vision that is opposite to that of the leader. In this context, the leader’s words about the “mentor — students” role distribution within the RT have considerable importance. The team members are aspiring researchers. Entering the world of serious “grown-up” work, they face difficulties of growing up and becoming mature, which accounts for their need for a “family” and for greater care and protection from the leaders (someone should support, protect, and reassure them until they master the skills of independent work). In other words, it may be a growing-up issue.

It is clear that the team members derive strength from the RT’s ideology developed by the leader. This is evident from the intermediate position of the “church” suborder in the CS and DS between the desirable “family” and the firm pressure of “army” that they would like to escape.

The team members’ almost unanimous choice of the suborder mix “faithful fighters/army of believers” may reflect a collective rational ideal of an effective RT, which is aptly represented by the RT’s leader as this ideal’s reference model. At the same time, in their individual preferences, the team members demonstrate a greater need for family-like care and support. However, becoming a true professional involves adjusting to some “difficult” aspects of work, and young researchers develop professionally by overcoming these difficulties.

The data displayed in the table, charts and graphs suggest that:

1) None of the three subgroups demonstrates the same ranking of the suborders as that of the leader in the CS and DS. The leader’s ranking is A – C – F. Additionally, the leader consistently tries to increase manifestation of each suborder. Subgroup 1 and subgroup 2 demonstrate a different ordering: A – F – C. This means that both subgroups rank the “family” suborder (emotional and axiological unity of the RT) second and not the “church” suborder (unity of meaning of the RT members), as the leader does.

2) The ranking of the suborders (based on how marked they are) by subgroup 3 is different from that of the leader and that of subgroup 1 and subgroup 2: C – F – A. It means that this order looks like a mirror image of the ordering of the suborders by the other two subgroups. The "army" suborder (unity of purpose), which is important for the leader and the other subgroups, ranks last for subgroup 3 both in the CS and the DS. At the same time, the suborder that ranks first in the CS is the "church" suborder, the suborder that ranks as important for the leader and as unimportant for the other two subgroups. The desirable state of culture not only implies a further development of all aspects of culture, but also demonstrates a shift in priorities: in the desirable state, the "family" suborder (emotional and axiological unity of the RT) should replace the most pronounced suborder — "church".

3) What stands out is a discrepancy between percentage figures, which remain the same in the CS and in the DS, and point scores, which show changes in the CS and the DS. This is readily evident when we analyze the diagrams. The point scores appear to be more informative for evaluating changes, especially small, in one or two points, while percentage figures appear to be informative in displaying the proportions of the suborders relative to each other both in the CS and in the DS.

4) The subgroups' comparative data, displayed in the graphs, enable us to estimate the spread of the suborders' values between the subgroup members, as well as between the subgroups. According to the graphs, there is a greater spread of values in the DS (confirmed in 3D modeling). When the spread of values is, conversely, lower, we can observe that the values of order parameters of the RT's organizational culture shift closer to "ideal" values (evenly pronounced, proportional).

Based on the fact that the RT's work is already highly efficient, we put forward the following two hypotheses:

a) adhering to the leader's priorities and adopting his vision is not a prerequisite for achieving good results and, conversely, differences may contribute to better performance due to mutual complementarity and mutual compensation;

b) a discrepancy between the leader's cultural parameters and those of the RT's subgroups provides an additional yet untapped resource of efficiency; and when the subgroup members' cultural characteristics approach those of the RT's leader, the RT's overall potential significantly increases (it is supported by the fact that the leader would like the RT members to be more autonomous), which apparently suggests possible great achievements of the team.

The second hypothesis received considerable support from the leader and experts.

Atomistic modeling of the results order diagnostics of organizational culture

The basis for correct application of the atomistic approach to modeling the results of organizational culture order diagnostics is a selection of a single model-building parameter both in the order approach and the atomistic approach. This single model-building parameter is *interaction*.

The first built model was a model of a surface of the RT members' work efficiency

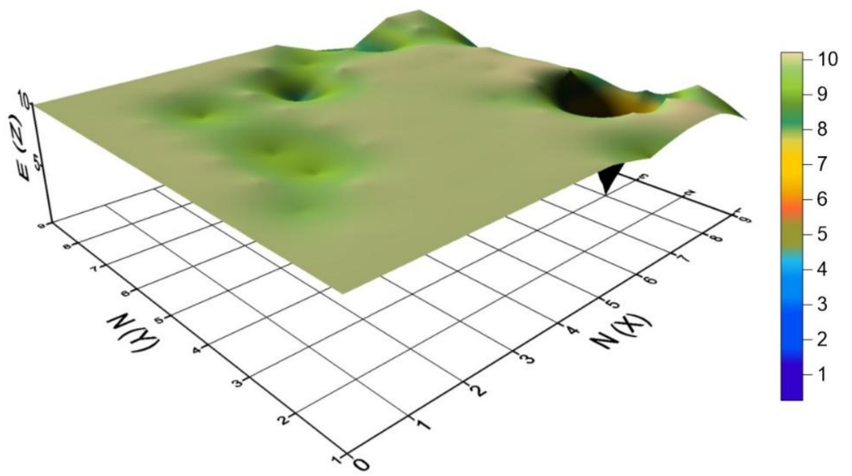


Figure 13. The surface of the RT's work efficiency in subgroups (A, B, C).

The image of the surface of the RT's performance efficiency was obtained by mathematical modeling. The contour of the surface is not smooth. We can observe flat areas (“plateau” — a uniformity of efficiency), elevations and peaks (local maximum of efficiency), and saddle points (inflection points).

The surface of efficiency is represented in the coordinate system where the numbers of the RT members are plotted on the x- and y-axes, while efficiency that we calculated is plotted on the z-axis. This plotting made it possible to identify efficiency levels within each subgroup. The results reveal that efficiency within each subgroup is sufficiently high (9-10) and is evenly distributed (like a plateau). It means that the employees work with the same efficiency.

The second model that we built was two isoarea maps of the RT’s efficiency for the subgroups. The first map includes the leader’s position (Fig. 14), while the second map does not (Fig. 15).

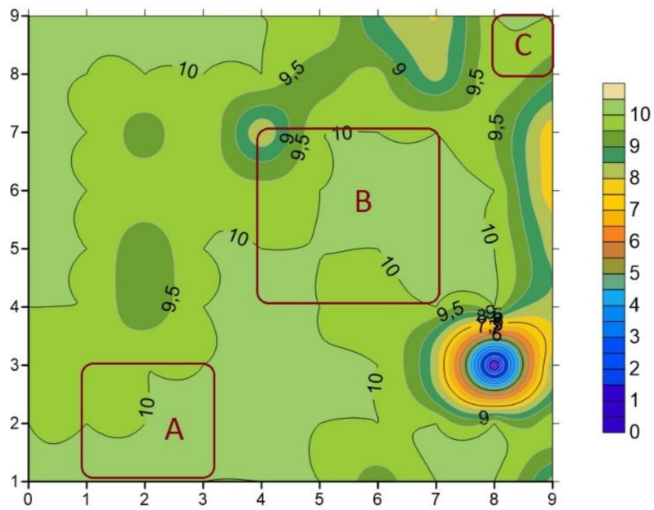


Figure 14. The isoarea map of the RT’s efficiency (with the leader’s position)

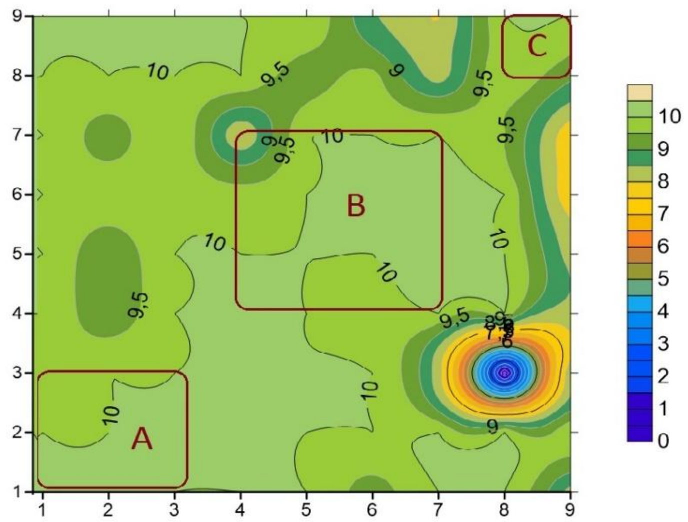


Figure15. The isoarea map of the RT's efficiency (without the leader's position)

The leader is located at the zero point on the x-axis. The leader differs from the other RT members in that when he interacts with the team members, he demonstrates maximum efficiency (10). It is explained by the fact that the leader's interaction distance equals the optimal distance (as expected), hence the highest efficiency. Only one member of the team demonstrates the same result (No. 1), as shown in the figure of the efficiency surface. In this case, we observe a match with the results shown on the vector field map (Fig. 16): No.1's position is closest to the leader, and his/her course is parallel to that of the leader. It demonstrates the similarity of the results obtained using the DEF technique and the technique of organizational culture order diagnostics.

The third model is of particular interest. It displays the results of organizational culture order diagnostics of the RT. O. E. Glukhova suggests a method for building a 3D vector field model of the team's cultural dynamics in the dimension of the three suborders of organizational culture.

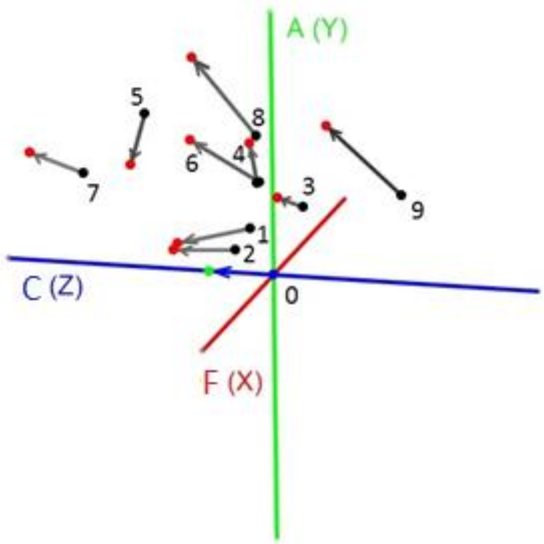


Figure 16. Vector field of the RT cultural dynamics in the dimension of the suborders (3D modeling)

Organizational culture is represented dimensionally by three axes: the x-axis (the “church” suborder), the y-axis (the “army” suborder), and the z-axis (the “family” suborder). Two points represent each team member’s assessment of organizational culture in this coordinate space (CS and DS). The 3D model demonstrates a relative position of the team members’ visions and aspirations in relation to the leader and each other. The vector field data indicate the leading role of the RT’s leader and confirm a dimensional proximity to the leader of those team members who have shown similar results to those of the leader in the course of organizational culture order diagnostics.

Combining the two approaches: methods and results

At the first stage of the study, we performed an assessment of interaction efficiency within the RT using the DEF technique (distance, efficiency and frequency of interaction), and provided a visual representation of the results in the form of a surface of efficiency (Fig. 14). This model enabled us to identify the following:

1) the six people in the RT who are its most efficiently performing nucleus (plateau);

2) the team members who are positioned closest to the leader on the efficiency surface that was built based on the DEF criteria (No. 1, No. 2).

At the second stage, we performed organizational culture order diagnostics of the RT (Fig. 9). Based on these data, we built a portrait of the RT (Fig. 16) in a coordinate system of the order model of organizational culture (3 coordinates plotted on three axes: the x-axis — the "family" suborder, the y-axis — the "army" suborder, the z-axis — the "church" suborder (using Ring software, developed by the authors, for atomic-molecular complex modeling), as well as in two modalities — in the CS (black dots) and the DS (red dots) This model enabled us to identify the following:

1) *the leader's position in relation to the team members*. This position is characterized by the distance between the leader and the team members. Since the leader gravitates toward the suborder "church" and decreases the proportion of the "family" and "army" suborders (redistribution of points occurs at their expense), the z-axis ("church") in the coordinate system of the order model of organizational culture was combined with the line passing through the leader's CS and DS. As a result, the RT members' positions were redistributed in the new coordinate system of the order model of organizational culture, which was obtained after rotating and shifting of the origin in order to match the coordinate origin with the leader's CS;

2) *the team members' aspirations compared to those of the leader.* In order to identify them, we built translation vectors of the RT members in a new (order) coordinate system (with the CS of organizational culture being the vector origin for each team member, and the DS of organizational culture — the vector end). The obtained image of a vector field made it possible to identify cultural aspirations of the team members compared to those of the leader. It was established that the team members shift (gravitate) in the same direction as the leader. In addition, the team members' personal vectors are scattered in relation to the leader's vector: No. 1 and

No. 2 are positioned closest to the leader; No. 8 and No. 9 — farthest from the leader. All of the team members gravitate toward the same cultural direction as the leader.

Therefore, what should be noted first is that a comparison of the results of the DEF technique of assessing interaction efficiency in achieving the team's work goals and the results of organizational culture order diagnostics became possible due to the use of molecular atomic modeling as a single instrument of data processing that made it possible to unify the obtained data. The surface "maps" of efficiency and the vector fields enabled us to compare the data obtained by different methods.

The comparison of the data obtained using the DEF technique and the technique of organizational culture order diagnostics demonstrated that these data *confirm* one another. These mutually confirmed data are:

a) the existence of a distance between the leader and the RT members due to two factors: maximum working efficiency (10 according to the DEF) and suborder priorities of organizational culture (A – C – F) with the maximum number of points (data of order diagnostics);

b) the existence of three subgroups in the RT with exact indication of the subgroup members;

c) the existence of a "nucleus" of the RT with exact indication of the RT members it includes.

The comparison of the data also demonstrated that it is possible to mutually supplement the data obtained by two different methods. In this respect, it was established that:

a) the DEF technique provides data on interaction efficiency between the RT members; data on the personal level of performance efficiency (a team member's "contribution"); data on the critical points during interaction indicating that it is ineffective and that there is a risk that a member may leave the team;

b) the order diagnostics technique (degree of manifestation of suborders) indicates the dominant suborder of organizational culture in the current state and the direction of cultural development in the desirable state. Additionally, it provides data on the extent of desirability or undesirability of certain aspects of organizational culture, related to the emotional and axiological unity of the team, its purpose-related and meaning -related unity for the team members. It also determines mismatching in the team members' preferences, as well as similarities and differences in the meaning-related attitudes between the team members and the leader. Finally, it identifies the team members' individual characteristics that are important for designing a strategy of employees' professional development.

The combination of two approaches in the form of the vector field of the RT's cultural dynamics made it possible to obtain completely *new insight* into the *dimensional state* of organizational culture in its current state and its *dynamic processes* in the form of directions of organizational and cultural development at the level of each team member in comparison with the leader.

Conclusion

1) The DEF technique, as opposed to organizational culture order diagnostics, demonstrates a degree of each team member's contribution (weighting factor) to the team's performance efficiency.

2) The DEF technique demonstrates how critical the distance of interaction between the team members is.

3) The DEF technique demonstrates contact frequency (a desire to participate in team work more or less intensively).

4) The vector field of the RT's organizational and cultural dynamics helps to establish its vector of development and to compare it with the vector set by the leader.

5) The analysis of the RT's vector dispersion (by calculating the angle of deviation, which show dispersion and criticality) enables us to evaluate the degree of criticality of the RT's state and to predict risks that efficiency is likely to decrease and the team is likely to break up.

6) The measurement of vector lengths demonstrates the degree of the team members' aspirations in comparison with that of the leader. In our future research, it

will be possible to construct a dynamic model that will account for changes in vector lengths and predict changes in the team, both in terms of its individual members and the whole team.

7) This approach makes it possible to coordinate findings of quantitative and qualitative research of organizational culture and processes of interaction that generate it.

Afterword

The histories of both psychology and physics exhibit many examples of fruitful interdisciplinary cooperation, which primarily enriched scientific psychology with new insight and research methods. Currently both psychology and physics have a great wealth of new knowledge and new technological capacities that allow for cooperation between the two sciences to jointly address pressing social issues. These issues include a need for improved accuracy of predicting performance efficiency of co-workers (working teams) who tackle complex problems in potentially dangerous and resource-constrained conditions. The results of an interdisciplinary study presented in this article emphasize promising prospects of solving this problem.

References

[1] Aksenovskaya L. N. Ordernaya model organizatsionnoi kultury [Order model of organizational culture]. Moscow, 2007.

[2] Glukhova O. E., Kolesnikova A. S., Savostyanov G. V., Slepchenkov M. M. PO “KVAZAR” – platforma dlya prognosticheskogo modelirovaniya v oblasti nano- I biomeditsinskikh tekhnologii [Software package «KVAZAR» as a platform for predictive modeling in the field of nano- and biomedical technologies]. Saratov, 2015.

[3] Software product “Program for simulation of nanostructures (Ring)”. Certificate of state registration of the computer program №2010612881. Registered in the registry of computer programs on 28.04.2010. Authors: O. E. Glukhova, O. A. Terentiev.

[4] Aksenovskaya L.N.**,** Glukhova O.E**.** Predicting Modeling of Management Interaction: Atomistic Approach // International Annual Edition of Applied Psychology: Theory, Research, and Practice. 2015 V.2.P.2-14//http:

//interpsy.sgu.ru/sites/default/files/predicting_modeling_of_management_interaction_atomistic_approach.pdf.

[5] Glukhova O. E., Aksenovskaya L. N. Modelirovanie organizatsionnogo I organizatsionno-kulturnogo vzaimodeystviya: atomisticheskiy podkhod [Modeling of organizational and organizational and cultural interaction: atomistic approach]. - Saratov: Publishing House “Saratovskiy istochnik”, 2016. 99 p.