

# Psychological representation of an emergency situation in the professional activity of railway employees

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**Abstract.** The article discusses the phenomenon of "psychological space", a brief theoretical analysis of the psychological space is conducted one of the methodological procedures for studying the features of the psychological space of emergency situations is tested. The empirical material was compiled on the basis of the structural unit of Russian Railways. The respondents were employees of the railway – station operators. The professional activity of the station operator is connected with a high responsibility for the safety of train traffic, for the safety of people using railways and employees subordinate to the station operator. The features of the psychological representation of an emergency situation are studied. The article presents the results of the research of psychological space. The data indicate that there are significant differences in the representation of a contingency situation by railway employees who have different "experience" of interacting with it.

**Keywords:** *psychological space, the size of the psychological space, "simplicity-complexity", the structure of "one-dimensionality-multidimensionality", the importance of the elements, the typology of space, an emergency situation.*

## I. INTRODUCTION

The phenomenon of psychological representation is among the little-studied topics of an emergency situation. In modern psychology, it is customary to analyze the features of mental representation from the point of view of the effectiveness / inefficiency of cognitive activity self-regulation. Verbal and graphical representation indicators pointing out the subject's adaptation to certain aspects of professional activity are theoretically substantiated and empirically validated.

Adaptation strategy, as noted by S.L. Belykh, is a combination of the overall productivity of activity, psychological and physiological health, the dynamics of the functional state, working capacity, fatigue, efficiency. According to S.L. Belykh, the mental model consists of images of the object, subject and working conditions. Individually, they differ in varying degrees of concretization and placement of accents. [2]

Different authors most often include the concept, the mental picture, the scheme, the frame, scenario, the strategy in the structure of the mental model. Various theories of mental models are created to predict the actions of a person in an actual situation (both real and mental) and to control the process of the formation of desirable mental models, the most important place belongs to different versions of visualization. For example, Z. Lindenberg pays special attention to mental models of pro-social interaction, which include not only an understanding of the situation, but also a set of rules, the expectations of the parties and the harmonization of these expectations. [2]

Researchers who consider mental representation as a result of a display distinguish several forms of it: figurative, conceptual,

functional representations (representations associated with action) and social representations (Rebeka T.A). The key in this case are the figurative and conceptual mental representations. [9] Work N.R. Afanasieva is devoted to the basics of a comprehensive study of imaginative representations of the inner world of a man. [1] In his article A.E. Tsymbalyuk considers the notion of mental representation, which is literally translated from English as "mental": intellectual, psychical, mental, cognitive. [12] In their paper s, the authors came to the conclusion that the representation of time is connected with human life, and the representation of space - with the existence of a person in the surrounding objective world [according to M.N. Semenova] [11]. From the point of view of D.N. Sazonov it is the correlation between the representation of the urban spatial-objective environment with the socio-business status (place of residence, professional activity, interests, etc.) and the socio-psychological characteristics of consciousness stipulated by it [10]. In modern psychology, representation is considered by categories: according to Yu.G. Panyukova there are sensuous and rational levels [8]; from the point of view of S.Yu. Pankov there are such categories as "space" and "time" [7]. N.A. Kondratova explores the "living space of the personality", for the analysis of which the semantic construct "your-alien" and its components – objects, places, activities, and people with a certain degree of subjective significance – are used. [5]

In modern psychology, the phenomenon of "psychological space" is explained as a kind of mental map of reality, i.e. a system of subjective landmarks, with the help of which a person determines his place and value among other phenomena of existence. Characteristics of the psychological space differ significantly from the physical properties.

Psychological space is a system of relations like "center - periphery" (figure - background), i.e. has the quality of centrality. According to this quality, each event has its own dominant center; it can be some special thing, authority, a person himself or his soulmates.

Describing the subjective being of man, modern psychologists use concepts traditionally used to describe objective being. So, they talk about the inner world of a person [4], about the life world [3], about the factor of place and the isolation of a person, as well as about categories related to the objective existence of a person - psychological: time and space. Moreover, concepts that initially have a purely topological content, such as "space" (internal, psychosemantic, social), "distance", "higher - lower", "closer - further", "borders", "barriers", are also often used in practical psychology. [3,4]

The space is mobile and depends on the intensity and meaningfulness of human life. So it can be "tightened" in case of a supervaluable idea, or, and it happens more often, in a state of love and can expand in the presence of "loose" and uncertain life prospects. However, we tend to view the living space as a stable characteristic of the personality, rather than as its state. In space,

you can select its volume, number of measurements, safety (stability - the mobility of boundaries). It develops in ontogenesis, and is combined with other personality traits. But the most important, in our opinion, is the strength of its borders, giving a person the experience of the sovereignty of his own I, a sense of confidence, security, trust to the world. [6]

According to the regulatory documents of the Ministry of Emergency Situations of Russia and the Regulations on the Information Response System of the "Russian Railways" Open Joint-Stock Company on abnormal situations, an abnormal situation is defined as:

– a combination of conditions and circumstances during the operation of technical systems that differ from those provided by the projects, norms and regulations leading to the occurrence of hazardous conditions in technical systems. Emergency situations include situations with deviations from normal (standard) operating conditions, design and beyond design basis emergencies. The abnormal situation is analyzed when building scenarios for the occurrence and development of man-made disasters, when analyzing risks; [7]

– a situation (force majeure), the circumstances of which are able to bring an individual out of psychological balance; as a result of this situation the individual, driven by fear and doubt, faces certain difficulties; depending on the situation, will and special (physical / psychological) training is required to overcome it [8].

On the railway, emergency situations include: the threat or the beginning of a natural or man-made emergency; terrorist threat or act of terrorism; unlawful acts committed against the management or employees of the "Russian Railways" Open Joint-Stock Company, passengers or other users of railway transport services, etc. [15]

Psychophysiological methods are commonly used to assess the influence of environmental factors and the degree of extremeness of the conditions of professional activity. We attempted to go beyond the psychophysiological correlates of readiness to act in an emergency situation and address the space of the subject's personal resource.

The purpose of the research is to study the characteristics of the psychological representation of an emergency situation. As a general hypothesis, a statement was formulated about the existence of differences in the psychological representation of an emergency situation by employees with different "experience" of interaction with an emergency situation. Particular hypotheses are devoted to checking the provisions on the existence of differences in the formal (sensuous level) and substantive (rational level) features of the representation of an emergency situation.

**II. RESEARCH ORGANIZATION**

The research involved 250 persons, the sample was divided into three groups (Table 1): respondents (N = 200) aged 20 to 45 years (average age is 33 years) who were not involved in an emergency situation, and are familiar with it only theoretically (group 1); respondents (N = 35) aged from 20 to 35 (average age is 21) who were involved in abnormal situations and successfully coped with the difficulties that had arisen (group 2); respondents (N = 15) aged from 20 to 45 years (average age is 30) who were involved in an emergency situation but could not successfully cope with an emergency situation (group 3).

**Table 1.  
Sample distribution of research**

	Quantity in the sample	The average age in the sample	Share in the sample, %
Group 1	200	33	80%
Group 2	35	21	14%
Group 3	15	30	6%

The research was conducted in two stages: the first stage is the assessment of the psychological space, the second stage is the statistical analysis of the obtained data.

The first stage of the research was related to the study of the peculiarities of the psychological space of the respondents. To assess the peculiarities of the psychological space, the "Vitagram" technique, adapted by G.V. Shukova, was used.

The graphic methodology was originally known as the "Family Sociogram" by E. Eidemiller and V. Justitskis (2008), and then adapted by G.V. Shukova as "Vitagram" (2014) in order to analyze the characteristics of the socio-psychological space of practical psychologists. Validity, informativeness and compactness of this method were the basis for its use in our research.

The essence of the technique is that on a sheet of paper in a circle (d = 110 mm) the subject places small circles, symbolizing elements of an "emergency professional situation" (it could be people, relationships, processes, phenomena, etc.). Circles were numbered by respondents "in the order of arrival" and named. The quantitative processing of the results included determining the frequency of occurrence of categories chosen by respondents, while the qualitative analysis was carried out in accordance with the interpretational principles of the 'Family Sociogram method' (order of circles, their size and number, location, presence / absence, distance between them, etc.). [12]

To analyze the reliability of the data, non-parametric methods of comparing samples were used, in particular, the U-Mann-Whitney test.

**III. DISCUSSION OF THE RESEARCH RESULTS**

First of all, it should be noted the methodological correctness of this research method, since there were no difficulties in understanding the proposal "emergency situation in professional activity" among respondents. In general, the sample used three main categories of psychological representation of an emergency situation (Table 2).

**Table 2.  
Frequency of elements of psychological representation of an emergency situation by respondents**

Rank	Category	Number of references
1	The state of the subject in professional activities	185 (74%)
2	Relationships with other people	35 (14%)
3	Device operation	30 (12%)

The analysis was carried out according to the following characteristics:

- by size (simplicity - complexity, number of the depicted elements);
- by structure (one-dimensionality - multidimensionality);
- by importance (central - peripheral level);
- by typology (linear, chaotic, the imposition of elements on each other).

Estimating the results **by size**, the importance of quantitative evaluation of graphically executed elements is noted. It was found that group 1 (80% of the entire sample) is characterized by a significantly larger number of "elements" (5-6 elements each) in the representation of the emergency situation in comparison with groups 2 and 3 (20 % from the entire sample have 2-3 elements each). Significantly fewer "elements" in the representation of an emergency situation were found in group 3 (6% from the sample have 1-2 elements in).

Next, we pay attention to the **structural component** of the graphical representation. The peculiarities of the content aspect of representation are related to the presence of significant differences in the groups of respondents in terms of "one-dimensionality-

multidimensionality”: from the dominance of “multidimensionality” in group 1 – to “one-dimensionality” in group 3. In groups 1 and 2, descriptors were combined into semantic constructs “technical means”, “experiences” and “interaction with other people”. In group 3, descriptors which were included in the meaningful construct “technical means” dominated.

We pay attention to the analysis of **the results** in accordance with the importance of the elements. Inside the main circle, circles of larger and smaller diameter at a certain distance from each other are graphically executed. No central element was found. We note that the circles in the category “the state of the subject in professional activity” are larger than the circles from other categories (64% of the number of subjects), which indicates the importance of the elements of the subject. Smaller circles (10% of the number of subjects) correspond to low significance for the subject. In the categories of “relationships with other people” (14% of the number of subjects) and “operation of devices” (12% of the number of subjects) all the circles are almost of the same size; no obvious differences were found. The arrangement of the circles over the entire area (80% of the number of subjects), keeping a short distance between them and the arrangement of the circles – layering on each other (20% of the number of subjects).

**By typology**, we note that the image of smaller circles are depicted in a chaotic order (Fig. 1), not having a clear structure, and are depicted in one line (Fig. 2), the elements are also superimposed on each other (Fig. 3).

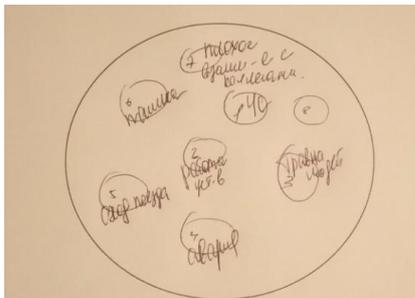


Fig. 1. The vitagram of the emergency situation of respondent K.

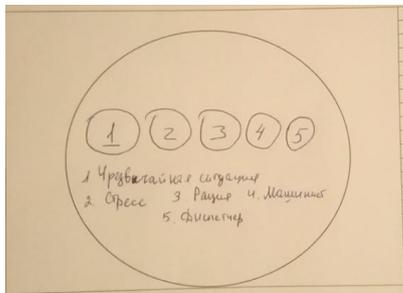


Fig 2. The vitagram of the emergency situation of respondent T.

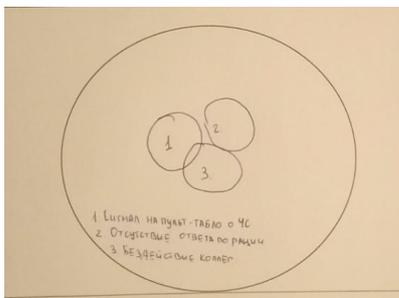


Fig 3. The vitagram of the emergency situation of respondent D.

The farness of one circle (chaotic execution) from others may indicate less significance, emotional rejection of the subject.

The peculiar “sticking”, when the mugs are layered one on another, touch or are in each other, points at lack of differentiation. The image of elements in one “line” is interpreted as an insufficiently differentiated relation to other elements and indirect relation to the driver or colleague (through a less significant element, for example, “portable radio”).

Conventionally, all images are divided into three levels (high, medium, low).

In group 1 (80% of the sample), on the average level (almost in the center of the figure) the states of the subject are depicted, since this is the decisive role in an emergency situation. It is the state of anxiety and high level of stress that violates the positive trajectory of action in solving the difficulties. The top level shows interactions with other people (train workers, train drivers, train dispatchers), devices that, according to respondents, played a great role in current situations (the computer broke down, the alarm did not work, the telephone connection was broken, the control panel was lost and etc) are depicted at a low level.

In group 2 (14% of the sample), the state and operation of the devices is in the middle level; relationships with other people are at the upper and lower levels.

In group 3 (6% of the sample), the work of the devices, the relationship, and the state of the subject are depicted on the middle level. This is explained by the fact that respondents who did not get a positive result, try to forget what happened and project their guilt onto the surrounding space (not the correct operation of the devices).

Further, a statistical analysis of the data was carried out (Table 3).

**Table 3.**  
Statistical analysis of the differences in the psychological representation of an emergency situation.

	Simplicity-Complexity			One dimensionality - multidimensionality		
	UEmp	Critical values		UEmp	Critical values	
		p≤0.01	p≤0.05		p≤0.01	p≤0.05
Group 1 – Group 2	339	413	471	270	413	471
Group 1 – Group 3	55,5	56	72	61,5	56	72

The hypothesis of research was a statement about the existence of differences in the psychological representation of an abnormal situation by employees with different “experiences” of interaction with an abnormal situation. After analyzing the data, we can say that the structural component (content and graphic) is more complex in group 1, which was not involved in an emergency situation, but is able to describe all possible elements than in group 2, which included participants but could not portray the full "picture" contingency. This is explained by the fact that the psychophysiological state of the second group of respondents had a greater impact on employees, and this violated the chronology of the event, and led to the loss of no less important elements. In group 3, the structure is fairly simple, with a minimum set of elements, with names consisting of 1-2 words (in groups 1 and 2, the name of almost every element consisted of more than 2 words). It is worth noting that in this group the cause of the negative outcome of events was the actions of employees and devices, rather than the actions and fortunes of respondents who did not successfully cope with the exit from an abnormal situation.

It is shown that the methodical technique “Vitagram” allows not only to visualize the structure of the psychological space, but also to objectify its essential components and main elements in their dynamic and hierarchical relationship.

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