

## APPROACHES TO IDENTIFYING THE PSYCHOLOGICAL MOTIVATIONAL STATES OF NAVIGATORS IN ERGATIC SYSTEMS

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**Introduction.** The human factor is recognized as the primary cause of catastrophic situations in maritime transport. Researchers worldwide are analyzing the potential causes of marine disasters to ensure safety. However, identifying the reasons for the shift in customary behavior patterns of mariners during ship navigation poses a challenge [1–3]. The situation is further complicated by the absence of a permanent psychologist on board and the limited use of psychological assessments. Nevertheless, some studies highlight the influence of an individual's mental motivational state on task execution, especially in critical situations [4, 5]. During the research, dependencies between the motivational states of captains and their actions during maritime maneuvers were identified.

This material also examines four behavior models and correspondingly four predominant motivational states. The scientific analysis focuses on studying the navigators' mental motivational states, attempting to accurately pinpoint the primary causes of their emergence. An important aspect is also the time factor for the operationalization of tasks during a navigational watch under risk conditions [6, 7].

**The main material of the study.** During canal passage, navigators adhere to a specific strategy, shaped as a result of certain psychological motivational states (PMS). However, the chosen strategy is not always effective throughout an extended transition. This may necessitate navigators to adjust their expectations and modify the PMS. These changes can lead to accidents due to unstable ship movement trajectories.

Graphs depict changes in the ship's course during hazardous psychological states. The primary challenge lies not in determining the causes of these states but in forecasting future states based on current ones. It is crucial to expand the research on navigators' PMS and develop automated systems for their detection. Numerous scientific sources describe the PMS of an individual, but the mechanisms for shaping such space for a specific mariner remain inadequately described.

The proposed principles for forming the space of a mariner's PMS include:

1. Hierarchical nature of the space.
2. Clear expression of PMS without overlaps.
3. Establishing a structure based on key features.
4. Representation of the motivational space.

The  $p$ -adic number systems are considered closest for a formal description of the motivational space, as their axioms do not contradict the aforementioned principles [8].

Therefore, the arrangement of constructing the PMS navigator's space mainly counts on his experience connections and having been formed models of behavior patterns along with having the initial condition  $x_0$  being  $f_s(x)$ .

Wherefore, transition to a new PMS is viable only from the previous one by means of its transformation while the new signals  $\alpha_j$  appear to occur in the form:

$$f : Z_p \rightarrow Z'_p, x \rightarrow f(x),$$

where  $Z_p$  is said to be space of the states at the moment  $t$ , as well as  $Z'$  is at the moment  $t+1$ .

Thus, the effect of “attracting” a new MMS is being described concerning the condition  $x_0$ . This very effect is able to be depicted in the form of an attractive force:

$A(x_0) = \{x \in Z_p : |x|_p = 1\}$ . Taking into account the stated above formal approaches, the construction of a map for the main four MMS in the framework of p-adic systems is possible to be surfaced. Thus, the space representation of navigators' MMS is likely to be achievable as a result of obtaining a set of p-adic numbers.

For  $p = 4$  and dimension 4, numbers from 1 to 64 and further in p-adic system will be written in the form of infinite sequence of digits from 0 to p-1:

$$\alpha_0 + \alpha_1 p + \alpha_2 p^2 + \dots + \alpha_k p^k \dots, \quad \alpha_0, \alpha_1, \alpha_2, \dots, \alpha_k \in \{0, 1, \dots, p-1\}.$$

Encoding was performed in the last three digits of classification numbers on graphical branches for a specific navigator. Over four months, the network was tested based on the analysis of the maritime navigator's motivational map.

Research results:

State #1 (Uncertainty): a00002, a00102.

State #2 (Confusion): a01001, a01010.

State #3 (Self-doubt): a02000, a02101.

State #4 (Loss of Concentration): a03001, a03010.

State #5 (Despair): a10000.

State #6 (Tension): a11200, a11000.

State #7 (Conservatism): a12010.

State #8 (Unawareness): a13300, a13010.

State #9 (Isolation): a20200, a20001.

State #10 (Aggression): a30100.

State #11 (Stress): a32020.

State #12 (Violation): a33020, a33300.

These states reflect the navigator's motivational and psychological manifestations in various situations, which include the perception of responsibility, readiness for self-education, ensuring safety, awareness of role, and other key aspects of professional activity.

**Conclusion.** The intrinsic dynamics of human behavior, particularly in high-stress environments such as maritime navigation, are complex and multifaceted. This research underscores the criticality of the human factor, frequently pinpointed as the leading contributor to maritime catastrophes [9]. Notably, the study establishes a direct correlation between navigators' psychological motivational states (PMS) and their behavioral responses during maritime maneuvers. Such responses, shaped by the navigators' PMS, can either fortify or compromise the safety of ship navigation, especially during extended transitions.

The research offers a groundbreaking insight into predicting hazardous navigational situations by emphasizing the challenge of forecasting future psychological states from the current ones. This predictive approach is paramount for proactive accident prevention [10–12]. The introduction of p-adic number systems provides an innovative methodology for formally describing the navigational PMS space, further enriching the understanding of the PMS dynamics.

As maritime transport continues to be an indispensable backbone of global commerce, enhancing the understanding of the navigators' mental states becomes imperative. The presented research paves the way for developing advanced automated systems capable of detecting shifts in navigators' PMS, ultimately contributing to safer seas [13, 14]. Furthermore, the research beckons the maritime industry to consider the integration of regular psychological assessments and continuous monitoring, ensuring that the human factor remains an asset, not a liability. Future endeavors should focus on operationalizing the findings, crafting real-time monitoring systems, and scaling the research to encompass a broader spectrum of maritime professionals.

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