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Vehicle drivers' psychological and operational activity readiness peculiarities

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Summary: In this paper the problem of operational readiness formation and evaluation for the driver's vehicle is considered. The results of the study of the dynamics of visual-motor reaction time and change the information basis of activity in the process of mastering the driver's activities are presented. These indicators usage in assessing the operational readiness of the driver to control the vehicle is recommended.

Keywords: activity, operational readiness, drivers of vehicles, information activity basis, visual-motor reactions, expert evaluation

Introduction: The level of road accidents in Ukraine is much higher than in the rest of Europe. According to the UN data, so called "human factor" is responsible for over 70% of all accidents, more than 40% of accidents are caused by the mismatch of psychological characteristics of drivers profession requirements. Well-judged and correct actions of the driver, his ability at the right moment to implement his functions correctly, influence largely on the occurrence and outcome of emergency situations on the road. In this regard, one of the most effective ways to improve road safety is to assess the operational readiness of the drivers to control a vehicle.

Review of publications on the topic. Analysis of the scientific literature on activities preparedness demonstrates that this concept is widely interpreted by researchers: as a manifestation of formation or as a required level of certain mental qualities and properties [4]; as a mental state is characterized by a constant strain of consciousness and the presence of the image of the structure of action [8]; as motivational education, characterized by the concept of setting [9]; as a mental state, form a common functional level needed to ensure the effectiveness of activities [5]; as a state of concentration of human capabilities, manifested before, during and after the implementation of activities [7]. Willingness is closely connected with the system activity, its psychological structure similar to the structure and composition of the component activities [1]. Its expression is an indicator of human systems and functions that make up the structure of activity [2]. Objective measures of operational readiness are indicators of successful error-free operations.

From the point of view of the requirements for the driver's psychological component implementation activities in the management of the vehicle, drivers should: perceive and evaluate changes in the driving situation in time; form and accurately perform a sequence of operations and activities in the regulatory environment and under the influence of extreme factors (lack of time, high density and / or speed and so on); switch attention timely; make appropriate decisions quickly and act with confidence. From the above it follows the basic understanding of the functions and, above all, visual-motor reactions as a basis to ensure the operational readiness for operation of the vehicle.

When unexpected changes in the traffic situation happen, any driver must be able to change his perception of the situation timely. A driver should change the information base activity (perception change), with a view to the appropriate adjustment. In this regard, the time to change own perception, rebuild one information model of reality to another, change the psychological attitude is extremely im-

portant and has a significant impact on the efficiency and infallibility of the activity itself. Researchers have proposed ways to fix the perception time change by presenting the test tasks "double selection", where the perception change consider two sets of signals from one and three components. Time modification is determined by comparing the perception change response time signal of the plurality of stimulation with one embodiment in the problem of "double selection" eventually simple visual-motor responses [6].

Based on the definition of readiness as a situational phenomenon, it is a reflection of the level of functioning of the human body and psyche needed for reliable performance of activities in a certain period of time. In this connection, the operational readiness assessment should be based on the diagnosis of the basic components of the driver's activities, which are realized through the implementation of basic functions: switching information activity base, goal-setting, implementation of a sequence of operations, assess the situation and make a decision.

The goal: is to analyze the psychological peculiarities of operational readiness of the vehicle drivers.

Materials and methods. The study was conducted on the basis of Konstantinovka urban automotive school (Donetsk region). The sample included 70 driver candidates for motor vehicles driving (35 men and 35 women) who were trained in a driving school for driving category B and BC. Average age of testees was 28.3 ± 0.8 years. The youngest testee was 17 years old; the oldest one was 55 years old.

Operational readiness activity was assessed immediately before running the vehicle as part of the school leaving. The benchmark was performed at the beginning of training in a driving school (2-3 lesson) and its end (17-18 lesson). A total test number was 140.

Diagnosis included three consecutive blocks: 1) an objective diagnosis of the functional state by measuring the blood pressure (BP) and heart rate (HR) using a digital meter UA-787 AND, Japan; 2) a subjective assessment of the current functional and mental status using the developed 5-point scale, which included: health, activity, mood, performance, motivation, emotional stress, anxiety, discomfort (emotional or physical), physical fatigue, mental fatigue; 3) diagnosis time changes vehicle, a simple visual-motor reaction (SVMR) and complex visual-motor choice reaction of the three alternatives (CRTA).

The problem of determining the time change information activity base was implemented as a computer program, and included the two experimental series. In the first series was carried out on a sample SVMR: in the center of the solid square, the appearance of which the – screen with

an incentive subject was asked as soon as possible to press the keyboard key "↓". In the second series was carried out with a sample exposure alternatives elections, i.e., "double selection" – squares appear in one of three places: in the center of the screen, to the right of the center of the screen and the left of the center of the screen. In this problem as OAI considered two sets of signals from one and three components. For some time before the appearance of the square on the screen at places of its possible occurrence indicated significant set of relevant options for possible incentives by displaying small shaded circles. The subject was, focusing on the marked circle space of possible occurrence of the stimulus, after the appearance of the square to press the key "←"; appropriate key on the keyboard: the left square key "↓"; for the central square key "→" – for the right square. The experiment was performed under investigation training and record-attempt: in the first part of experiment – 5 training and 15 credits attempts; 10 training and 40 credits attempts during the second part. Array data including the results of each attempt, the software was processed and recorded in the file of the test results. Premature reaction (%); – SVMR time (s), the fallacy – Test results contained the following figures: in the first series exposure time alternatives election (s), the – in the second series errors and premature reaction (%), as well as time and SVMR–fallacy CRTA in the sample with an exposition of alternatives to the election (s).

Presented the structure of the experiment will simulate the realization of switching functions vehicle, goal-setting, perform the necessary sequence of operations to assess the situation and decide which reflect the basic components of the driver's activity, and to assess the state of these functions before departure.

The success of departure estimated by experts, which acted as a driving 20.0 ± 5.3 – school instructors 5 (average length of vehicle management 5.1 ± 1.3 years), direct–average length of service as an instructor control over the actions of the subjects while driving car. Based on driver's activity analysis, the following objective external criteria of operational readiness have been identified: the correctness of vehicle management, proper placement of information activity base on the roadway, care, and confidence. Experts were asked on a scale to assess the skills of the driving test, fix the amount of coarse, medium and small mistakes that they made in the management.

Statistical data is processed in the program SPSS Statistics 19, using the methods of descriptive statistics and Wilcoxon test for two related samples.

Results and discussion. A comparative analysis of the data obtained from the results of the diagnostics at the beginning and end of the course in a driving school. In terms of the functional state of reliably established significant differences in terms of diastolic blood pressure ($p = 0.017$), which, however, in the first and in the second case is within the normative values. This self-assessment of functional and mental status indicates that the average scores for these indicators were placed in the same group and did not differ significantly ($p > 0.05$). It should, however, highlight the emotional tension and anxiety, which is celebrated on the reduction of 0.4 ± 0.03 points ($p = 0.054$) and 0.3 ± 0.04 points ($p = 0.083$), respectively. These data suggest firstly, that in the process of forming the driver activity severity

indicators submitted functional and mental state does not change and secondly that the measurements the exposure time and visual-motor reactions conducted under equal conditions, which eliminates the possibility of influencing the subjective factor a change in these indicators.

Evaluated activity change dynamics, time and productivity of SVMR, as well as time of SVMR, CRTA and productivity in the sample with an exposition of alternatives elections. Significant differences between the mean values are set in terms of SVMR, time shift information activity base; time CRTA in the sample with an exposition of alternatives elections, as well as premature reactions (Fig. 1).

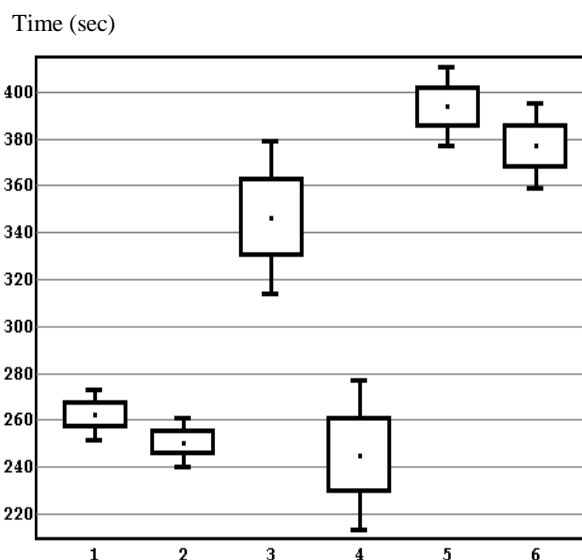


Fig. 1. Changing the exposure time and visual-motor reactions as a result of driving instruction, x mean. \pm m (safe range – 95%):

- 1 – SVMR time at the beginning of training;
- 2 – SVMR time at the end of training;
- 3 – Exposure time at the beginning of training;
- 4 – Exposure time at the end of training;
- 5 – Time CRTA in the sample with an exposition of alternatives elections in early learning;
- 6 – CRTA time in the sample with the exposition of alternatives elections at the end of training.

At the beginning of training course SVMR 250.30 ± 5.20 ms ($p = 0.004$); So, was 262.0 ± 5.40 ms, after exposure time at the beginning of training was 345.70 ± 16.32 ms at the end of training, the figure was 245.0 ± 15.92 ms ($p < 0.0001$); CRTA – time in the sample with an exposition of alternatives elections early 377.0 ± 9.08 ms (393.70 ± 8.46 ms, after $p < 0.005$). The number of premature reactions in the sample exposure alternatives election was reduced and, accordingly, at the beginning of training $0.82 \pm 0.21\%$, at the end of the research it was $0.18 \pm 0.09\%$ ($p = 0.004$).

At the same rate of premature SVMR improved to $0.68 \pm 0.24\%$, SVMR time in to 7.30 ± 0.59 ms – the sample with an exposition of alternatives elections to $0.43 \pm 0.06\%$ – ms and error during execution of the sample but these changes were not statistically significant ($p > 0.05$). Visual-motor reactions period is considered by many authors as an indicator of the functional state of the nervous system, varying in its excitation or inhibition, as well as

under the influence of fatigue, emotional stress and other negative factors. There are studies proving the possibility of training and advancing in its result of the improved visual-motor reactions [3]. In our study, not simulators used special techniques or to improve them, but recorded a change SVMR and CRTA in the sample with an exposition of alternatives elections. In this case, reducing the time of visual-motor reactions may indicate the formation of operational readiness to implement the system of the management of the car.

Figure 1 shows that it is the time of exposure to a greater extent than other indicators; it was sensitive to changes that occur during the development of driver's activity. This supports the assumption that the change of information activity base, that is, the installation is one of the key mechanisms that reflect the degree of operational readiness management information activity base.

By any objective criteria for the operational readiness of the external changes were observed, recorded by experts as a result of visits (Table 1).

Table 1. Dynamics of driving success, T avg. ± m

Indexes	Indexes mean values		Distinction significance, p
	at the beginning of training	at the end of training	
Driving correctness TC, points	4.00±0.09	4.60±0.07	p<0.0001
Right vehicle position on the road, points	4.11±0.08	4.54±0.10	p<0.0001
Attention, points	3.90±0.09	4.37±0.08	p<0.0001
Confidence, self-sufficiency, points	4.0±0.09	4.40±0.08	p<0.0001
Glaring faults, %	1.40±0.22	0.31±0.08	p<0.0001
Secondary faults, %	2.63±0.23	1.06±0.13	p<0.0001
Insignificant faults, %	3.29±0.13	2.03±0.28	p<0.0001
Faults total, %	7.31±0.64	3.40±0.28	p<0.0001
General ride success assessment, points	3.78±0.28	4,23±0.08	p<0.0001

Significant reduction of glaring, secondary and insignificant faults number, accordingly reduced their total number. Reducing the fallacy indicates an increase in the reliability of TC management. Also observed a qualitative improvement in driving skills on the overall assessment of the success of departure, which was given by the experts at their base is the overall impression of each individual exit (p < 0.0001). Thus, by the end of training in a driving school was significantly reduced fallacy, increased driving success and, therefore, the willingness to reliable vehicle management.

Conclusions.

1. Features of activity of the driver of vehicles make high demands for its operational readiness, which is regarded as the original and fundamental condition for safe operation of the vehicle.

2. Formation of the structure of driver activities at the stage of its development is confirmed by the presence of significant changes in the results of expert assessments on

the following criteria: the accuracy of vehicle management, mindfulness, correct location of the vehicle on the roadway, confidence, independence, errors, an overall assessment of the success of departure (p < 0,0001).

3. With the formation of the driver's activity qualitatively improved operational readiness to drive that appears to change the basic components of driver activity. A statistically significant reduction in the time change information basis of activity (p < 0.0001), a simple visual-motor response (p = 0.003), a complex visual-motor response (p < 0.005) and a decrease in the number of premature responses (p = 0.004) in the sample exposure to alternatives elections.

4. The principle of assessing readiness for the driver's activity by measuring the time change information basis of activity and visual-motor reactions can be laid in the foundation of hardware and software for monitoring the operational readiness of the driver before departure.

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Гаража М.В.

Психологические особенности формирования оперативной готовности к деятельности водителя автотранспорта

Аннотация. В статье рассматривается проблема формирования и оценки оперативной готовности к деятельности водителя автотранспорта. Представлены результаты исследования динамики зрительно-моторных реакций и времени смены информационной основы деятельности в процессе овладения водительской деятельностью. Рекомендовано использование данных показателей в оценке оперативной готовности водителя к управлению транспортным средством.

Ключевые слова: деятельность, оперативная готовность, водители автотранспорта, информационная основа деятельности, зрительно-моторные реакции, экспертные оценки