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PSYCHOPHYSIOLOGICAL STATUS OF THE DRIVER AS A STOCHASTIC FACTOR OF TRAFFIC**ПСИХОФІЗІОЛОГІЧНИЙ СТАН ВОДІЯ ЯК СТОХАСТИЧНИЙ ФАКТОР ДОРОЖНЬОГО РУХУ****Burlakova G. Y. / Бурлакова Г. Ю.***s.t.s., as.prof. / к.т.н., доц.*

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Abstract. *The "human factor" remains one of the main stochastic factors affecting road safety. To reduce adverse effects, as well as to take into account the individual physical, psychological, behavioral and other characteristics of drivers in monitoring and operational planning of transport processes, it is advisable to systematize psychophysiological conditions, determine the preconditions that shape them and develop methods for further use of collected data.*

Keywords: *transport, automobile, influence, stochastic, driver, condition, mental, physical, medicine.*

Introduction.

Road traffic is a complex multi-level process, which, in addition to predicted factors, is influenced by a number of stochastic factors. A significant role in the stochastic influence is played by the peculiarities of the psychophysiological state of drivers, which can cause dangerous situations, lead to traffic accidents, congestion, etc. To combat such adverse effects, it is important to summarize individual psychophysiological influences, establish links between them, and analyze ways to prevent possible dangers.

Analysis of recent research and publications.

There are many works devoted to individual influences, but so far no clear systematization has been developed, without which the provision of such data to computational and planning systems seems impossible.

Driving requires from the driver complete concentration on the road, constant monitoring of changes and prompt response to them. In this case, the human body undergoes significant emotional, mental and physical stress, which can lead to dangerous consequences. This situation can be exacerbated by chronic or acute illness, stress or depression, and other external factors that affect the driver's health, ability to make and implement decisions related to driving. [1, 2, 6]

Setting objectives.

Considering the traffic flow as a set of interconnected transport units moving within the city's road network, it is easy to imagine how important the psychophysiological state of drivers plays for safe and uninterrupted traffic. [7] Since it is not possible to formalize it precisely in the form of a mathematical description, it is advisable to consider this factor as stochastic, using probability theory to predict



possible driver errors, as well as expert information to establish logical relationships between them and other factors affecting Road traffic. [6, 7] To do this, you need to find out what elements make up a person's psychophysiological state and what exactly leads to changes in it.

Presenting main material.

Factors that shape the psychophysiological state of the driver can be divided into two broad categories: previous and current. The first category includes chronic human diseases and their exacerbations that occur before the start of movement, pharmacological effects (including alcohol, tobacco, drugs, medicines), long-term mental and emotional states. [2, 7, 11] These factors are prolonged in time, they can and should be taken into account to assess the driver's ability to get behind the wheel in a certain period of time. Current factors include those conditions that occur directly during movement, such as fatigue, stressors, false sensations (visual, auditory and other illusions). [1, 6, 10] Graphically, the elements of these categories and the relationships between them are formalized in fig. 1.

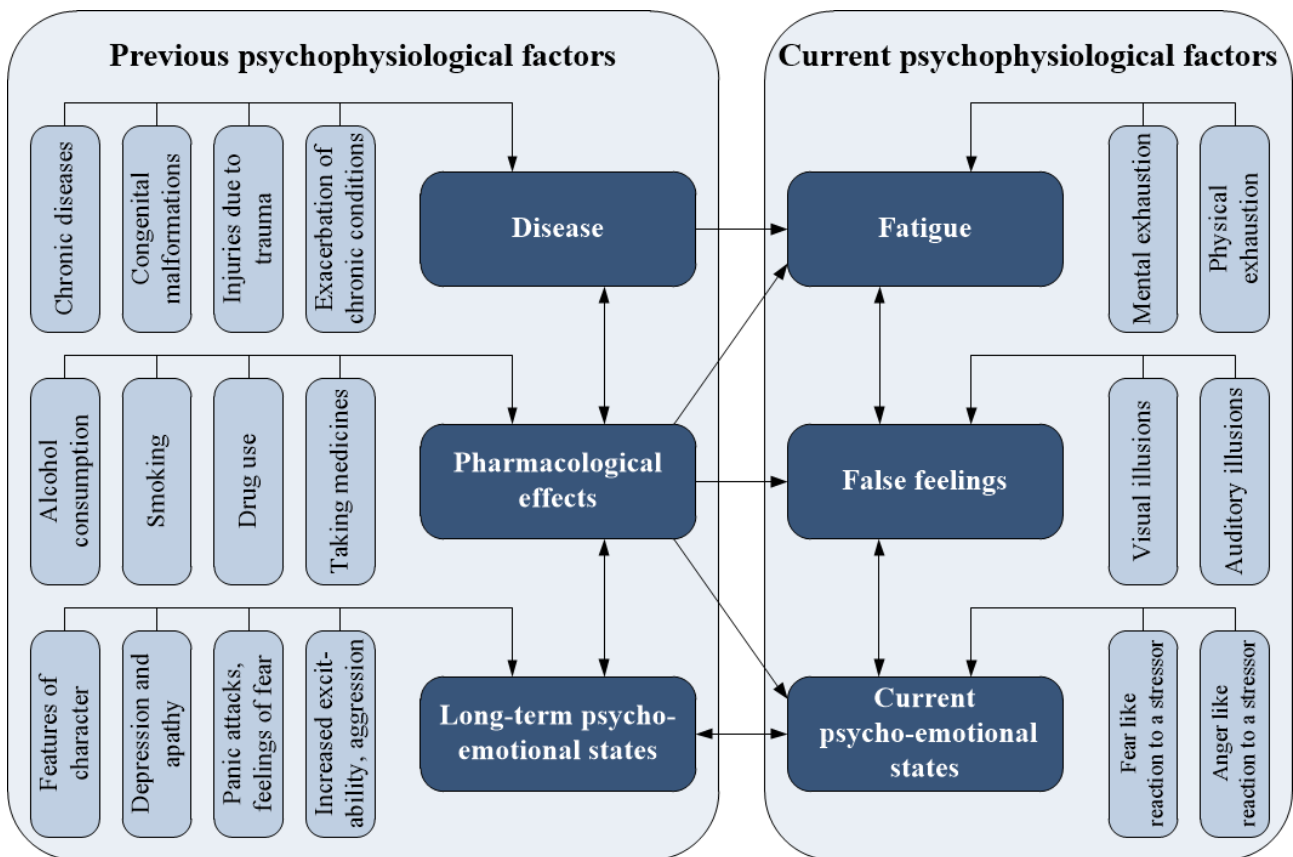


Fig. 1 - Classification of factors that shape the psychophysiological state of the driver, and the relationship between them

Analyzing the above scheme, we can conclude that previous psychophysiological factors are, in most cases, partially predictable and controlled, and current factors are seen as completely unpredictable. That is, long-term changes in the driver's condition can be taken into account by analyzing statistics and creating mathematical approximations based on the collected information, while short-term effects on the driver's psychophysiological condition can only be described using a



known frequency factor. It is important to understand that such statistics are not conducted due to the excessive complexity and subjectivity of this task. [3, 7]

Chronic conditions of drivers, exacerbations of chronic diseases, congenital and acquired defects, as well as injuries due to trauma or natural aging of the body means a set of physical factors that affect a person's ability to respond to external stimuli and take action to ensure their own safety and the safety of others road users. An important role is played by syndromes and diseases that directly or indirectly affect human perception, the rate of fatigue. [7, 13] Equally dangerous are injuries in which the driver is physically unable to perform certain actions, such as applying sufficient force to the vehicle's controls. Such conditions must be carefully analyzed during the medical examination for a driver's license, but there are numerous cases where a person's health has deteriorated significantly in a short period of time. [10]

Human diseases are directly and inversely related to pharmacological effects on the body. In the first case, the presence of the disease requires the driver to take drugs, some of which may to a greater or lesser extent affect the central nervous system, inhibiting the reaction and causing other changes in behavior. [1, 6] More detailed information on this subject is given in fig. 2.

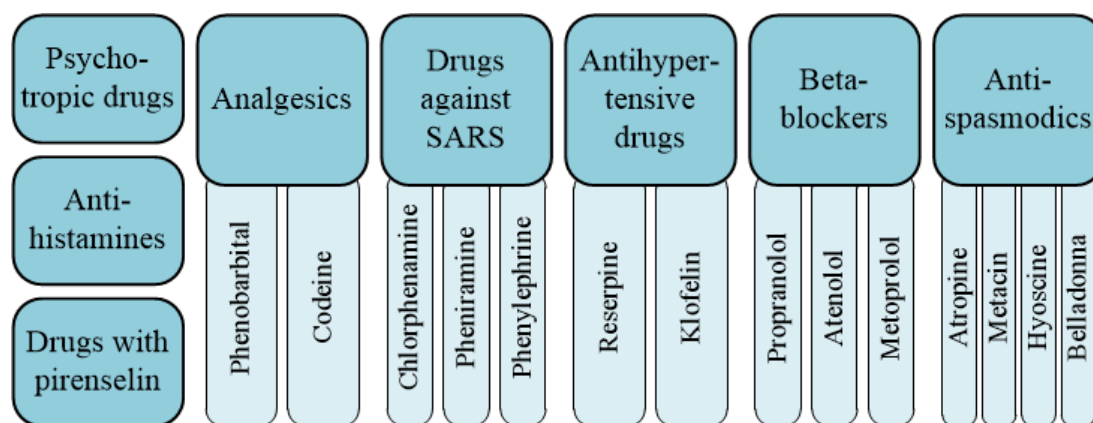


Fig. 2 - Some groups of drugs which affect the speed and accuracy of the driver's reaction

Sometimes the disease causes the intake of dangerous substances (alcohol, some drugs) that suppress pain and other unpleasant sensations, but they also have a destructive effect on the nervous system, distort behavioral reactions. More common feedback in this system, ie the emergence of the disease as a natural reaction of the body to the systematic intake of hazardous substances (alcoholism, drug addiction, substance abuse, smoking, etc.). This can damage various organs and systems, leading to both physical and psychological defects. [7]

As for the typical psycho-emotional state of the driver, it is formed by a number of external factors, which are completely subjective. First of all, it is about the nature and peculiarities of the worldview of a particular person, but they are joined by an individual reaction to certain life situations, more or less logical causal relationships of mental state with the interaction of the subject with others. [1, 8, 11] Characteristic destructive phenomena are apathetic disorders, in particular depression, chronic stress, post-traumatic stress disorder, etc. Prolonged panic



attacks, feelings of fear or aggression (reactions such as "fight or flight") are also quite common. Unlike apathetic disorders, they not only reduce concentration and inhibit the driver's reaction, but also make his behavior unpredictable - a person in this state can completely neglect both their own safety and the safety of other road users. [11, 12] Of course, such conditions also have a two-way relationship with a group of pharmacological effects. In some cases, they are either caused by or taken by certain substances.

An important factor in understanding the possible behavior of the driver on the road is his temperament. Thus, people with "strong" temperament types (sanguine, choleric, phlegmatic) act in a controlled and predictable way, although not always safe for others. Practice shows that sanguine and phlegmatic are the most responsible drivers, while the reaction of choleric to the pathogen can be inadequate and dangerous for him and others. As for melancholics, in difficult road situations they are prone to apathy and stupor, almost incapable of active action to prevent danger or combat its consequences. [5, 9, 13] Of course, the above models of behavior are isolated hypertrophied temperaments, which are very rare in real life. Therefore, to predict the behavior of drivers by the statistical method, taking into account their temperament, it is advisable to use the so-called "Eysenck's Circle", shown in fig. 3.

The information collected from Eysenck's psychological test allows us to determine the approximate percentage of drivers' temperaments and use this data to globally predict their behavior on the road. At the same time it becomes possible to model the behavior of intra-temperamental subgroups. [1, 11]

Long-term psycho-emotional states of the driver play a key role in understanding his short-term state of mind. Enhanced by stress before the start of traffic or directly on the road, they can form an unexpected emotional reaction, cause destructive actions or, conversely, a state of complete inactivity when activity can save lives (stupor). [5, 9] The role of stressors can be played by an obvious problem, such as an accident or inappropriate behavior of other road users, and factors that are relevant only to this particular person, such as irrational fears, reminders of traumatic events and more. Such an unpredictable reaction is one of the biggest threats in the driver-car-road system. [2, 5, 6]

A common current factor that affects traffic safety is false feelings, ie those that seem real to the driver but do not reflect reality. The most famous of these are visual illusions - distorted perception of distances, sizes, shapes and colors of objects. In conditions of rapid changes in the road situation and a large number of distractions (noise, flashes of light), they occur even in completely healthy people. [1, 7] At the same time, the driver often does not understand that he is dealing with an illusion - his consciousness uses this image as the only true one and is guided by it for making operational decisions. The consequences of such mistakes can be catastrophic. Less common auditory illusions. They can be related to incorrect perception of sounds (for example, normal engine operation may seem incorrect in certain circumstances), perception of sounds when they do not exist, or, conversely, temporary psychosomatic deafness to all or certain sounds. The last situation is especially dangerous when the driver is not able to react in time to the sound signal or noise of the approaching vehicle. [1, 2, 8]

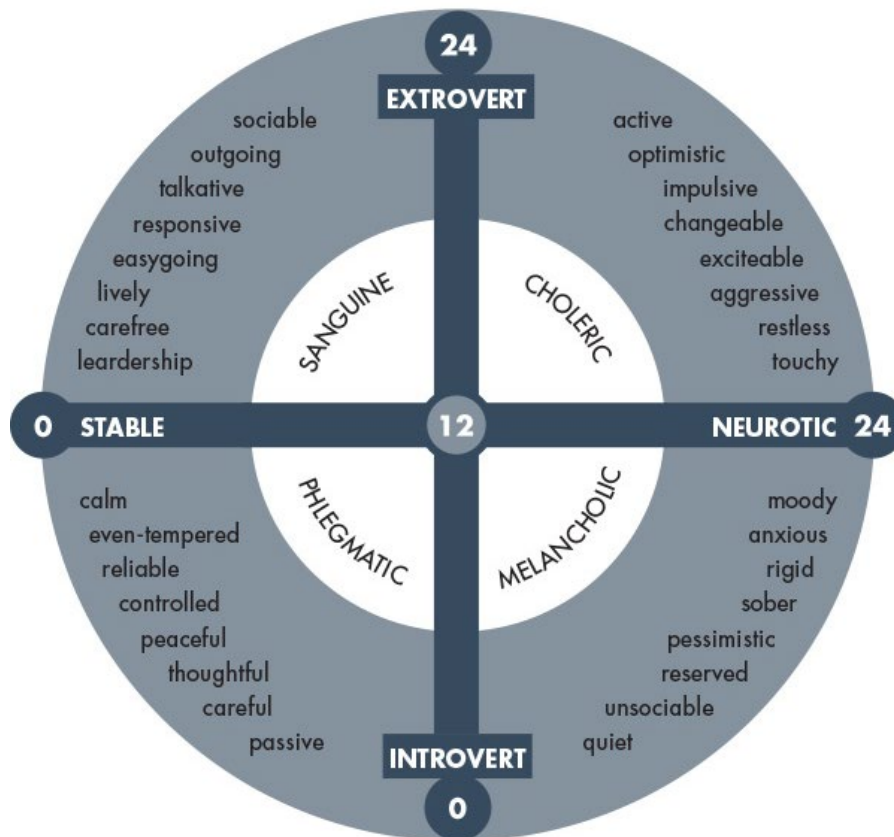


Fig. 3 - Results of the Eysenck Personality Questionnaire

The connection between false sensations and the level of driver fatigue has been proven - the longer a person stays behind the wheel, the less he can trust his own senses. In addition, it is obvious that false feelings can be caused by exposure to psychotropic substances. It is, first of all, about alcohol and drugs - the distortion of feelings caused by them often leads to road accidents and other serious consequences. [2, 6, 10] Fatigue is now considered one of the main problems that leads to errors in driving. In the professional activity of drivers, the time spent behind the wheel is strictly regulated, additional intervals for rest are introduced, intensive driving is prohibited for several days in a row. [11, 12]

But it is important to understand that the degree of fatigue is a subjective quantity that depends on gender, age, health and other individual characteristics. Therefore, the task of fatigue control is largely the responsibility of the person - he must analyze their own condition and take measures to avoid mistakes due to excessive overload. [9, 12, 13]

A special phenomenon is the traffic crime, when actions that led to the death or injury of people, damage to property and other dangerous consequences were committed by the driver intentionally. Often such actions are masked by the offender under the influence of psychophysiological factors. [4, 12] The task of separating the real crime from accidental driver errors is the responsibility of law enforcement agencies, but such actions should also be taken into account when predicting the stochastic effects of individual condition of drivers on the transport process. [3, 4, 6]

Collecting analytical information and identifying approximations to calculate the probability of stochastic effects of a psychophysiological nature is a complex multi-



level process that requires additional research. Based on the above classification and the establishment of direct and feedback links, it is possible to form a theoretical basis for future study in this area.

Conclusions. The general psychophysiological state of the driver is a complex system of his long- and short-term psycho-emotional states, chronic and acute diseases, pharmacological influences, false sensations, fatigue and other factors that are in constant interaction. This complicates the collection of information on the psychophysiological states of road users, but does not make it impossible - with the help of statistical arrays, inductive and deductive methods based on external influences of other stochastic factors, you can not only form a general picture of drivers, but also roughly model the behavior of most road users. Regulatory restrictions, psychological and pharmacological examinations, information systems and other means of external influence also make this system sufficiently controlled. In their development, as well as in the development of planning and analytical mechanisms, is the key to a "healthier" and safer movement.

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