

EXPERIMENTAL STUDY OF PSYCHOPHYSIOLOGICAL FEATURES OF VISUAL-MOTOR REACTION IN STUDENTS

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Annotation. In this paper, the results of experimental studies of normal indicators of motor reaction (OCD) in students are analyzed. The study involved 9 students aged 18-22. The experiment was performed with the psychophysiological diagnostic apparatus Neurosoft. In the study process, participants' response time to visual stimuli was recorded in milliseconds.

The results obtained showed that the sensor-motor reaction rate in the majority of participants was within the range of the physiological norm. Whereas relatively high reaction rates were observed in some participants, a significant slowdown in reaction time was noted in one participant. The results of the study confirm that a normal behavioral reaction is an important diagnostic indicator in assessing a person's psychophysiological state.

Keywords: normal visual reaction, psychophysiology, sensory-motor processes, reaction time, central nervous system.

INTRODUCTION.

Normal Cognition-Motor Response (OCHR) is one of the most important indicators in the study of the functional relationship between the sensory and motor systems of a person in the science of psychophysiology. This indicator represents the process of responding to a visual stimulus through action in a minimal amount of time after it occurs. Normal visual reactions are one of the main indicators characterizing human psychomotor activity, which allows assessing the functional state of the central nervous system, stability of attention, as well as the speed of information processing.

In the fields of psychology and neurophysiology, a lot of scientific research devoted to the study of sensory-motor reactions has been conducted. Among these studies, Gibson's theory of ecological perception occupies an important place. According to Gibson's concept, the process of perception is formed as a result of active interaction of a person with the environment, and the reception of visual

information and the formation of a corresponding reaction of action are an integral component of human activity. This approach emphasizes that the process of visual information reception is inextricably linked to the natural environment and shows that it takes place through the integration of sensor systems and the movement system [1].

In the field of neuropsychology, Alexander Luria's scientific work is also important in understanding sensory-motor processes. Luria believes that human activity takes place on the basis of a complex interrelationship between the functional systems of the central nervous system. In his research, it is emphasized that the process of receiving sensory signals and forming corresponding motor responses is closely related to the activity of different functional zones of the brain hemispheres. Luria's neuropsychological concept allows us to interpret a normal visual response as an integrative activity of the central nervous system [2].

In the physiological explanation of sensor-motor responses, the theory of functional systems also plays an important role. According to this theory, any activity in the human body occurs as a result of the mutually integrated functioning of various functional systems. It is through the interaction of these systems that the reception of visual signals, its processing in the central nervous system and the formation of the motor response occur. According to the concept of anochin, the organism has the ability to respond quickly to information coming from the external environment, and this process provides adaptive behavioral mechanisms [3].

Of particular importance in modern neurophysiological research are the research conducted by Eric Kandel and his collaborators. In their work, the conduction of nerve impulses, synaptic plasticity, and the biological foundations of brain activity are investigated in detail. Kandel's research shows that the interactions between sensor and motor systems take place through complex neural networks. These processes play an important role in the formation of reaction time and its individual differentiation [7].

The theory of motor control, developed by Richard Schmidt and Tim Lee, also plays an important role in the study of motor activity. According to this theory, any motor movement is carried out on the basis of motor programs formed in the central nervous system. After receiving a visual signal, the central nervous system quickly activates the appropriate motor program, resulting in a motor reaction. This mechanism is one of the major factors determining the formation of reaction speed and its stability [5].

In the science of psychology, research devoted to the study of attention processes is directly related to normal cognition-action response (OCR), and the interintegration of these two psychological processes is important in understanding human sensory-motor activity. The attention process performs the main regulator function in selective reception of visual information, its rapid processing and the formation of an appropriate motor response.

In classical research by Michael Posner, it has been scientifically proven that focus, selectivity, and stability are inextricably linked to the speed of sensory-motor reactions. According to Posner's model, effective allocation of attention resources reduces response time to visual stimuli, whereas distraction or decreased attention leads to longer reaction time. This suggests that OCD is not only physiological, but also dependent on cognitive control mechanisms [9].

In modern psychophysiological approaches, a normal visual reaction is considered as an integral indicator of the activity of the central nervous system. This indicator assesses the speed of sensory information processing of the cerebral cortex, the efficiency of the transmission of nerve impulses and the dynamics of the formation of the motor response. OCHR is therefore interpreted not only as a normal motor response, but as a final expression of complex neurophysiological processes.

The scientific literature notes that the mean value of a normal visual response for a healthy young population is usually in the range of 190–230 milliseconds. However, this indicator is significantly dependent on individual characteristics, including age, gender, level of physical fitness, psychoemotional state, level of fatigue, and stability of attention. Prolonged reaction time is often explained by a decrease in the functional state of the central nervous system or an increase in cognitive load.

In modern neuropsychological approaches, assessment of OCD is widely used as a diagnostic tool. This indicator determines not only the individual psychophysiological state, but also the effectiveness of educational activities, the ability to make quick decisions in sports, and the degree of stress resistance. In this context, OCHR is an important practical indicator for sports psychology, clinical psychodiagnostics, educational psychology, and occupational psychology.

And the student period is one of the most active stages in the development of sensory-motor systems, during which attention, quick decision-making and coordination of actions are significantly formed. Therefore, the study of OCR indicators in students is relevant for assessing their psychophysiological capabilities, identifying individual differences in educational and sports activities, and monitoring their functional status.

This study is aimed at determining the indicators of normal behavioral reactions in students in experimental conditions, analyzing their individual differences and covering the psychophysiological features on a scientific basis, and serves to enrich the current research in this direction in terms of methodology and practicality.

RESEARCH METHODOLOGY

This study was carried out in laboratory conditions on the basis of psychophysiological experimental methods. The study design was based on a controlled experimental approach to identify indicators of normal behavioral response (OCD) and analyze their psychophysiological characteristics. The task was also to

evaluate the speed, stability, and characteristics of individual differentiation of sensor-motor reactions.

The study involved 18 students between the ages of 22 and 9. Participants were all individuals who were in a healthy state and had voluntarily consented to participate in the experiment. Before the experiment began, they were fully explained the purpose of the study, its tasks, the procedure for execution, and safety and ethical standards. They were tested under a pre-prepared standard setting to minimize the distractions of the participants.

The experiment was performed with the psychophysiological diagnostic apparatus Neurosoft. This device is a modern technical device that makes it possible to record sensor-motor reactions with precision of milliseconds. During the experiment, participants were given the task of responding to a red visual signal that appeared on the monitor screen at random time intervals by pressing a button as quickly as possible. Each participant was presented with a stimulus 10 times, and each response response time was automatically recorded in milliseconds. Based on the results obtained, the average reaction time of each participant was calculated, and individual indicators were cross-compared.

During the experiment, the following key parameters were calculated: average reaction time, stability of the reaction, level of functional system, level of functional capabilities and efficiency. These parameters made it possible to comprehensively assess the sensor-motor activity of participants and determine their psychophysiological state.

The results were processed using the methods of statistical analysis, and the average values, minimum and maximum values for the group were determined. Variation indices were also taken into account to assess individual differences. This approach served to increase the reliability of the results.

In the process of conducting the experiment, standardized conditions were created for all participants. In particular, room lighting, distance with the monitor screen, as well as external noise factors were strictly controlled. Providing such uniform conditions helped to improve the objectivity and reliability of the research results.

RESULTS

In the process of analyzing the study results, the participants' indicators of normal cardiopulmonary reaction (OCD) were studied in detail. During the experiment, each participant was presented with 10 visual stimuli and the response time to each stimulus was recorded in millisecond precision. Based on the individual results, the average reaction time for each participant was calculated, and common statistical indicators were formed for the group.

A total of 9 students participated in the study and were all tested under the same experimental setting. Analysis of the results showed that in the majority of

participants, normal visual-motor response indicators were located in the physiological norm range. However, individual differences were also observed, with relatively high velocity in some participants and slightly longer reaction times in others, suggesting that sensor-motor processes are dependent on individual characteristics.

Below are the main indicators of the study results in tabular form:

Table 1

Normal Indicators of behavioral reaction in students

№	Participants	Reaction time (ms)	Mean Difference (ms))	Ranking (speed)
1	Bozorova T	170.7	-56.0	1
2	Murodov R	185.2	-41.5	2
3	Hotamov A	189.1	-37.6	3
4	Egamberdiyev D	203.9	-22.8	4
5	Sattorova M	212.4	-14.3	5
6	Hamidova S	218.6	-8.1	6
7	Ro‘zimbayev U	220.3	-6.4	7
8	To‘raqulov Z	230.1	+3.4	8
9	Mamaraimov I	410.3	+183.6	9

As can be seen from the table, the reaction time metrics of participants varied widely. This is explained by the individual psychophysiological characteristics of individuals. According to the study, the average reaction time across the group was 226.7 milliseconds. The minimum reaction time was 170,7 ms, which was recorded in Bozorova T. The maximum reaction time was 410.3 ms and was observed in Mamaraimov I. This difference in indicators may be associated with individual features of psychophysiological processes, attention level, fatigue state, or the degree of development of psychomotor activity.

The analysis of the results showed that in 7 out of 9 participants, normal visual-reaction indicators were within the normal range. This indicates that the functional state of their central nervous system is stable. High-speed reaction indices were observed in two participants. Such results may indicate a highly advanced sensor-motor process. Rapid reaction indicators are usually observed in individuals who are engaged in sports activities or whose psychomotor activity is well developed. In one

participant, a significant increase in reaction time was observed. This condition may be associated with the predominance of inhibitory processes in the central nervous system, fatigue or psychological stress. Graphs and diagrams were used for a more accurate analysis of the results.

Bu grafik ustunli diagramma shaklida tasvirlanadi. Grafikda har bir ishtirokchining reaksiya vaqti alohida ustun ko‘rinishida aks ettiriladi. Grafik tahlil natijalariga ko‘ra ishtirokchilarning aksariyatida reaksiya vaqti 190–230 millisekund oraliq‘ida joylashgani kuzatiladi. Bu esa fiziologik norma diapazoniga mos keladi. Grafikda eng past ko‘rsatkich Bozorova T. da, eng yuqori ko‘rsatkich esa Mamaraimov I. da qayd etilganini ko‘rish mumkin.

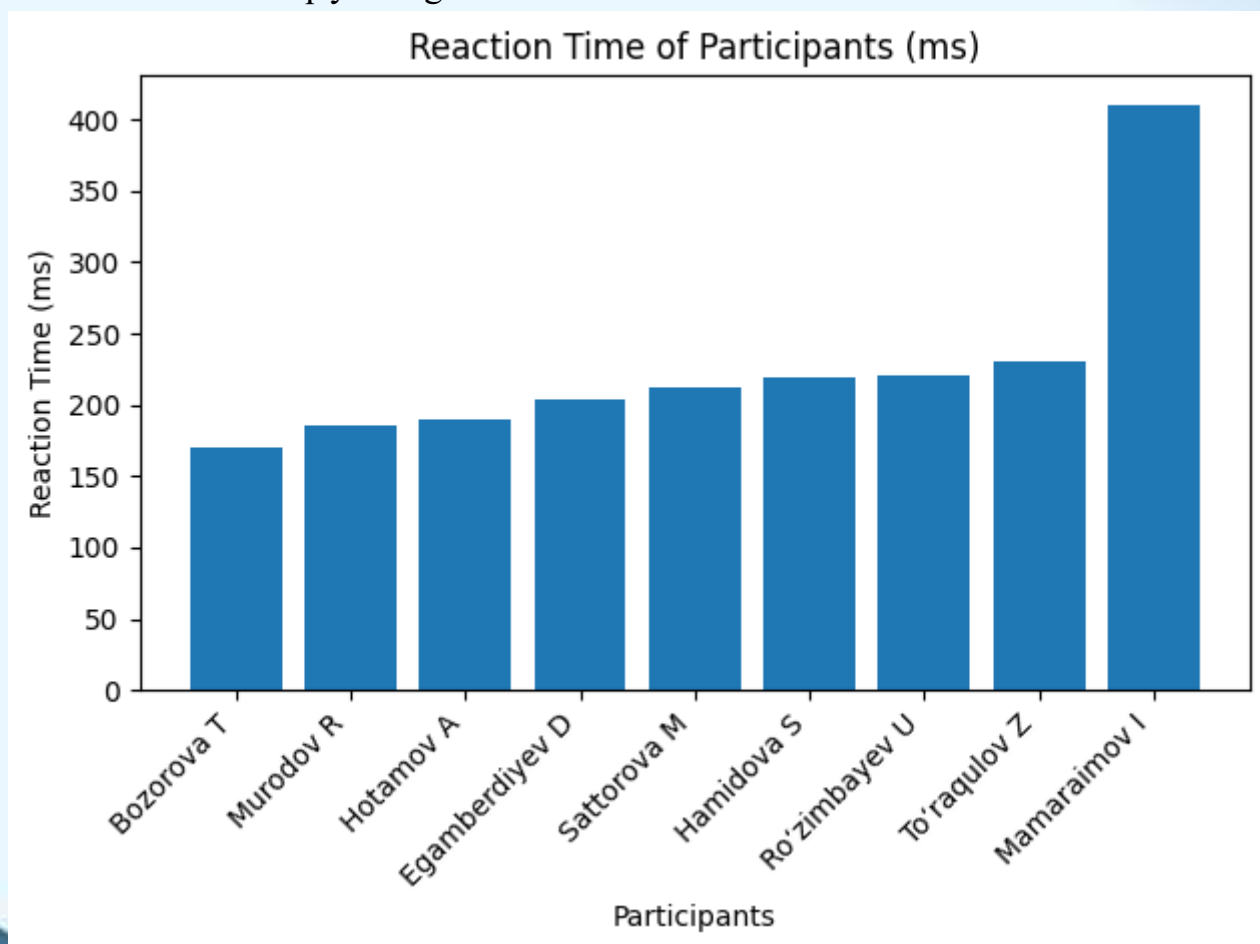


Figure 1. Diagram shows participants' reaction times (ms) in English labeling.

A histogram diagram was used to analyze the results statistically. This diagram shows the overall distribution of reaction times. The diagram shows that reaction times accumulated in the majority of participants in the range of 180–230 milliseconds. This indicates that the sensor-motor reaction indicators for the group are generally at the normal level. Only one participant experienced a sharp increase in reaction time. The results show that normal behavioral reaction is an important indicator in assessing a person's psychophysiological state. The results of the study showed that sensory-motor response rates among students were generally stable.

The results of this study made it possible to psychophysiologicaly analyze the rate of normal visual reactions (OVHR) in students. The resulting data indicate that, as a general trend, reaction time is within the normative physiological range in a large proportion of participants. This condition implies the functional stability of the central nervous system, the effective organization of the processes of receiving and processing sensory information.

In the psychophysiological literature, normal cognitive response is regarded as one of the most sensitive indicators in assessing the human psychomotor system. This indicator allows you to infer not only the speed of nerve impulse transmission, but also the level of concentration, cognitive processing efficiency, and the accuracy of motor responses. In this respect, the results obtained are interpreted in harmony with Gibson's theoretical views on the integration of perception and movement, Luria's higher nervous activity system, and Kandel's theoretical views on synaptic plasticity.

DISCUSSION

According to the results of the analysis, reaction times in the bulk of the participants were recorded in the range of approximately 190–230 milliseconds. This indicator corresponds to the normative range adopted for healthy young people and indicates an adequate formation of sensory-motor integration processes. Such results, in turn, confirm that the processes of excitation and inhibition in the central nervous system are in a balanced state.

One aspect requiring special attention is that relatively high rate reaction rates were observed in some of the participants. This condition is explained by a rapid conduction of nerve impulses, a higher efficiency of synaptic transmission, and a well-developed psychomotor coordination. In practical terms, such rapid reactions are often more common in individuals engaged in regular physical activity, particularly athletes. Because during sports activity, the mechanisms of quick decision-making and precise execution of movement are constantly being improved.

However, the study also noted a significant slowdown in reaction time in some participants. This condition can be associated with various physiological and psychological factors. In particular, the predominance of inhibitory processes in the central nervous system, general fatigue, decreased concentration, emotional stress, or lack of sleep are most likely to adversely affect the reaction speed. Scientific sources have also extensively covered the slowdown of sensory-motor responses in states of stress and fatigue.

As a general conclusion, it can be said that normal behavioral reaction is an important diagnostic criterion in a comprehensive assessment of the psychophysiological state of a person. It is possible to draw reliable scientific conclusions about the functional state of the central nervous system, the effectiveness of cognitive processes, stability of attention, the level of psychomotor training. The results have practical value for the improvement of an individual approach to sports

and education, as well as the development of psychophysiological monitoring systems.

CONCLUSION

This study was devoted to the experimental study of normal behavioral reaction indicators in students. The results of the study showed that sensory-motor responses are important in assessing a person's psychophysiological state. During the study, 9 students participated, and their speed of response to a visual signal was recorded in milliseconds. The results obtained showed that the average reaction time across the group was 226.7 milliseconds. Analysis of the results showed that in most of the participants, reaction rates were within the range of physiological norms. This indicates a stable activity of the central nervous system, as well as a sufficiently developed psychomotor process. High-speed reaction rates were noted in some participants. This condition is explained by a rapid transmission of nerve impulses, as well as a well-developed sensor-motor coordination. A marked increase in reaction time was observed in one participant, which may be due to fatigue or a predominance of inhibitory processes in the central nervous system.

In general, the results of the study confirm that normal behavioral reactions are an important diagnostic indicator in assessing a person's psychophysiological state. This indicator can be widely used in the fields of psychology, sports psychology and occupational psychology. In the future, it will be scientifically important to conduct more extensive research in this direction, to increase the number of participants, and to cover different age groups.

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