***ESSAY***

***“Key Methods of Engineering Psychology”***

***ENGINEERING PSYCHOLOGY***

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***Fall, 2011***

***Key Methods of Engineering Psychology***

*Subject of engineering psychology...*

With technological progress, mechanization and automation of production, with the advent of many new professions, a specific technical problem appeared - the problem of accounting for human psychological capabilities while working with technology. An intensive study of the limits of human capabilities, speed of information processing, investigation of the laws of fatigue when working on certain technical facilities began. All these fields of study lead to the intention of designing a new technique, adapted to the possibilities of man.

This trend became known as Engineering Psychology. Thus, Engineering Psychology studies the objective laws of interaction processes of human and technology in order to use it in practice, design, build and operation of “man-machine” systems.

It often happens, that human make mistakes, not because he has not mastered his profession, but because his physiological capabilities are limited: the rate of information transmitted exceeds the capacity of the man senses, the shape of the signals is difficult for the comprehension of man, etc... If mental qualities of human: patterns of perception, attention, memory and thinking, are not taken into account during the process of a new technology creation, equipment will be designed as the equipment of "pre-laid" human error in it.

*Methods of engineering psychology...*

*General characteristics of the methods...*

Engineering psychology is characterized by a systemic approach to dealing with the processes and phenomena being investigated. Multidimensional and multilevel nature of mental processes require the use of different methods for more complete study of the human operator in man-machine systems, and above all, the information side of this activity.

“For a correct understanding of the applied methods in engineering psychology, their classification is necessary. It is based on the most convenient way: way of getting the data about the activities of the operator. From this point of view, one can distinguish the psychological, physiological, mathematical and simulation techniques.” [1]

*Psychological methods.*

The main psychological methods are observation and experiment. The purpose of observation as a method of engineering psychology – is to identify significant features of a professional mental processes by studying and comparing the external manifestations of human activity, facial expressions, speech, and the results of his labor.

Observation is usually supplemented by a number of ways of objective registration of the phenomena. These include, in particular, photography or recording of posture or facial expression, speech, sight lines and workers' movements. Observation can be improved with the help of measurements. It can be measured geometrical dimensions of the workplace, the time of sequence of work and rest during the working period, run-time measurements of individual actions and movements.

In addition, measurements of the latent periods of different sensorimotor and sensori-speech reactions are included in the practice of observation. Physiological indicators of human: heart rate and respiration, blood pressure, electrical activity of the heart, brain, muscles, etc. could also be measured.

Erroneous actions of the operator are of the great importance in the observation. Error analysis allows to identify practical ways to address them. With the undoubted advantages, the method of observation has a significant drawback. Observing does not change the studied activity, so in the course of his may not always appear exactly the situations that are most interesting to the researcher.

Observations are usually supplemented by interviews with operators. Survey method is typical in the psychological method of complementary activities study.

The disadvantage of observation method then could be solved by adding the experiment method. The experiment in engineering psychology - the study of the psychological characteristics of the operator, due to changing conditions, goals or ways of performing this activity. The experiment may be laboratory or natural.

The laboratory experiment is a type of simulation of the operator activity. Its meaning lies in the fact that there is the task in the laboratory to perform certain actions, which are as much closer to real as possible. This modeling allows the laboratory to study any real work with great accuracy of measurement and recording.

The most productive method for studying the activity of the operator is a natural experiment that can be done in different forms. The simplest one is a solution of the "introductory tasks." Nevertheless, the natural experiment is still not applied in all cases. First of all we are talking about situations, where man-machine system is in development yet.

At the present time, while there is an increase of complexity of man-machine systems, combination of a natural experiment with mathematical modeling is widely used.

*Physiological methods...*

Physiological methods in engineering psychology are used for the following reasons:

* Physiological characteristics are important for the control of the operator condition.
* Any psychological manifestation has the physiological basis.

In order to study the physiological processes during the production of human activities, as well as to identify the limits of the organism in emergency situations, the following measurements are performed: electroencephalogram, electromyogram, galvanic skin response, electrocardiogram, electrooculogram, pneumogram, voice response.

*Mathematical methods...*

The discussed above psychological and physiological techniques can be applied only to the actually existing man-machine systems or machines which are represented as models, simulators and test benches. When the system is still at the design stage (drawings, etc..), the application of these methods is impossible. It is a case when mathematical methods are involved.

There are the following methods of mathematical modeling: information theory, queuing theory, the theory of automatic control systems, automatic theory, statistic decision theory. However, each of these methods is optimal for only one or two variables, in other words, successfully describes only certain aspects of the operator. Therefore, the solution of specific engineering and psychological problems often include a combination of different methods approach.

*Simulation methods ....*

Previously discussed methods cannot be used in some cases for the study and analysis of the operator. In these cases, very useful results are obtained by using statistical modeling. It is based on the method of statistical trials (Monte Carlo). The method is based on the drawing (simulation) of the impact of random factors on the activity of the operator.

“The meaning of the method is a multiple implementation of simulated process by computer. Each implementation has a random character. The reliability of the final decision is reached by statistical processing of the intermediate results on a variety of implementations”.[2]

From this it follows that the simulation methods occupy an intermediate position between the experimental and mathematical methods. According to the way of obtaining data on the activities of the operator it is a mathematical method, while according to the nature of its acquisition and use, it copies the experimental method. Therefore, simulation methods are also called machine or mathematical experiment.

During the simulation many characteristics of an operator are computed: the degree of loading, periods of employment, timeliness, problem solving, etc. Knowing them, we can determine the permissible density and limits of load of operator, reveal the nature and frequency of occurrence of different events in the “man-machine” system.

***We can conclude, that the importance of engineering psychology lies in the aim of this science. This particular study concerns as efficiency of the work of people and machines together, side by side, as security of the exploitation of these machines.***

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