Chapter 12
Psychological and Social Problems of Automation and Computerization

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ABSTRACT
This chapter discusses the ergonomic, psychological and social problems of operators of large complex systems. It is noted that the category of activity is the most important one in the Russian ergonomic and psychological knowledge. It is analyzed the relationship between information models and conceptual-image ones. It emphasizes that in the Soviet Union the notion of cognitive revolution makes not sense because cognitive processes were treated in the works of L. Vygotsky, S. Rubinstein and A. Leontiev as forms of activity. The article indicates the influence of works of G. Bradley on the development of social and psychological aspects of ergonomics in the former Soviet Union and Russia.

INTRODUCTION
In the former Soviet Union, as in the USA, ergonomics bore clearly psychological orientation because just psychologists in the country began to develop ergonomics. The solution of ergonomics problems is impossible without psychological competence. At the same time ergonomics formulates new problem before psychology and set requirements and criteria when solving these problems. The development of psychology is stimulated by the problems of ergonomics which introduces into its context new kinds of human activity, means of its realization and means of studying it. The bringing ergonomics into psychology closer open possibilities for serving important theoretical problems and practical tasks of humanization of working life – development of standards of hazard prevention, development requirements regarding machines, workplaces and human working techniques. Basic goals were: reducing risk of accidents; environmental influences such as noise vibration, concussion, and hazardous substances; as well as physical and psychological stress and strain at work (Munipov, 1976). The first subject of ergonomic investigations was...
large complex systems, focusing on the human and social aspects of them. Many investigations are devoted to ergonomic problems of design, construction and utilization of automatic control systems. Ergonomists who take part in improving existing and designing new automatic systems of controlling complex production processes. Ergonomists participate in studying problems of man-computer interaction, including working out languages for their dialog. In VNIITE (All-Union research institute of industrial design) study of visual thinking was conducted. Visual thinking is defined as a kind of human activity, the product of which consists in the origin of new image, in the creation of new visual forms bearing a certain meaningful load and making the meaning be visual (Zinchenko et al., 1973). Also in VNIITE the investigations were conducted concerning the system of control of the computer user’s safety and the method of estimating a visual fatigue when working with displays.

Ergonomic investigations become important in solving scientific and technological tasks in the field of space flight. Space ergonomics is also passing from special psychophysiological studies to the investigation of activity of cosmonauts on board the space ship. Ergonomists, together with other specialists, are solving tasks of effective organization of all aspects of space ship team’s performance, paying special attention to studying motivation, physiology of the working organism, psychological climate, group interaction, and psychophysiological aspects of cosmonaut’s leisure time organization. Keeping up all these aspects of cosmonaut’s performance to a necessary level provides for a success of the entire flight.

Aviation ergonomics has much in common with space ergonomics. Aviation ergonomics is to provide good dynamic properties of aircraft and effectiveness of information presentation. The automation of aircraft control put forward the problem of effective pilot-equipment interaction under performance conditions. Flights at supersonic speeds and extremely low altitudes brought essential changes into the pilot’s performance and required ergonomists’ participation in solving a number of complex problems. Ergonomic studies are considered very important for the design and operation of the ground control systems.

Human factors problems are of vital importance for the shipbuilding industry, as complex automation of control processes. In shipbuilding, as well as in aviation and some other fields, methodological principles of ergonomic design are being intensively worked out (Munipov, 1978, 1979).

Large complex systems are managed by controllers and operators, whose activity is being justly compared with the activity of commander tackling important strategic tasks. One need merely mention the operators of the Space Telecommunications Centre or the Integrated Power System of the USSR. In highly automated areas of production man’s executive functions become functions of control. Here, man is the governor of the process as a whole, with the emphasis in his activities switching to the development, planning and prognosis of the process of human activity. There is the characteristic redistribution of the functions of human activity towards creative mental activity, having the decisive role to play. In the characteristic of the operator’s qualification there is a corresponding shift of the accent from skill to knowledge.

The main function of the operator (a group of operators) in an automated control system is to take decisions, which usually implies the processing of information enabling man to work out a sequence of purposeful acts aimed at resolving a problem situation and achieving the necessary goal. Optimising decisions on the basis of automated data processing become the pivotal problem in automated control. Because of the complexity of the organizational and functional structures of control in any field of human activity this problem becomes ever more urgent and acute. It assimilates the approach to the tasks and methods of fulfilling them from various fields of knowledge: natural, technical and humanitarian sciences.