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CONTENTS

HUMAN FACTORS

ENGINEERING PSYCHOLOGY OR ERGONOMICS

Moscow VOPROSY PSIKHOLOGII in Russian No 3, 1980 pp 88-100

[Article by A. A. Piskoppel' and L. P. Shchedrovitskiy, Faculty of Psychology, Moscow State University]

[Text] The history of inception of engineering psychology in our country dates back 20 years already; however, even now, it cannot be maintained with every justification that this discipline has been conclusively defined with regard to both its object and the basic concepts, conceptions and methods. It is still in the formative process, broadening the range of its object and revising its subject-related content. The existence of significant changes within a relatively short period generates numerous difficulties, both scientific-theoretical and administrative [organizational].

As a result, the concepts and conceptions constituting the subject of engineering psychology at different stages of its formation are often viewed as being equivalent. Within the framework of one discipline, directions are beginning to coexist that are based not only on different, but diametrically opposite conceptions of the same object. For this reason, the concern of a number of researchers in the field of engineering psychology becomes understandable; we refer to the "vagueness" or "unwarranted expansion" of its range. At the same time, this shows once more that the question of the status of engineering psychology, of its specific subject, has not been removed from the agenda.[1]

An answer to the question of the subject of any discipline cannot be accepted without consideration of its correlation with the subjects of allied disciplines, both in the sense of joint functioning in the "organism" of modern science, and genesis proper, since scientific endeavor, like any other form of human endeavor, is based on continuity and tradition. The most complex and, at the same time, the most debatable issues in this regard are questions of correlation between engineering psychology, ergonomics and industrial psychology. Evidently, an entire cycle of studies, both historical-critical and theoretical-methodological, will be required for a more or less extensive discussion of correlations between the three concepts, engineering psychology, industrial psychology and ergonomics. In this article, we have a much more modest objective, that of discussing some aspects of the correlation between the concepts of "engineering psychology" and "ergonomics."

In the last few years, there has emerged a distinct tendency toward distinguishing between and formulating "engineering psychology" and "ergonomics" as different concepts. The view is even held that this difference ensues directly from the

difference in the corresponding terms in establishing their linguistic meaning. This tendency appears to be so obvious to some authors, that the discussion of other points of view is declared unjustified and useless.[2]

Perhaps the solution to this problem is indeed so obvious that it does not require any special discussion. However, even a superficial glance at the actual history of introduction and use of these concepts is sufficient to realize the illusory nature of this obviousness. To demonstrate this, let us refer to comparative interpretation of the main elements of the concepts of "engineering psychology" and "ergonomics," namely, their objects, subjects, main tasks and directions of practical work (in works published at the same time, at that).

It is easy to see that in both the case of "engineering psychology" and "ergonomics," modern man-machine systems are considered as their objects. Sometimes they are called "man-work tool-work object-industrial environment" systems (for example, in [24, 9]), or "man-machine-environment" systems (for example, [10]) and occasionally simply "man-machine systems" (for example, [7, 16, 19], but this does not alter the substance.[3]

In both cases, man's activity in modern automated systems is the specific subject. For example, it is maintained that "man's work is the subject of ergonomics"(for example, [9, p 12]), and in the case of engineering psychology it is "the activity of man controlling modern equipment" [18, p 20].

A coincidence is also demonstrable when one refers to the specifications for the main problems that are solved (or should be solved) by these disciplines. The task of planning human work in modern man-machine systems emerges as such a problem at this time (recent works on this topic include, for example, [18, 9].

Finally, we can also point to some similarity of directions of practical work in engineering psychology [12, 13, 17] and ergonomics [6].

Thus, we are faced with all of the circumstances to question the obviousness of difference between the concepts of engineering psychology and ergonomics in our country, and to discuss this matter specially. Apparently, we should start with an analysis of the actual history of introduction and use of these concepts into the area of Soviet science.

If we refer to the history of the matter, we can easily distinguish two periods in the literature of our country of interpretation of the content of the concepts of engineering psychology and ergonomics and, accordingly, the correlations between them. The first period is referable to works published between the late 1950's and late 1960's, and the second to those of the late 1960's and 1970's. Let us consider the first of these periods.

Already in the first Soviet monograph on engineering psychology, B. F. Lomov, in describing the new scientific direction and summarizing both foreign and Soviet use of different terms--"engineering psychology," "human engineering," "ergonomics," etc.--observed that they are essentially synonyms, different names for the same discipline and, consequently, different terms for expressing the same concept.[4] There was the same interpretation of correlation between concepts (terms) of engineering psychology and ergonomics in the works of other prominent specialists in this field (for example [5, 21]).[5]

Thus, it can be obviously stated that by the mid 1960's there existed in the mind of prominent Soviet specialists a one-only scientific direction (or discipline, movement, etc.) and, accordingly, one concept to express it, for which various terms (depending on the author's taste or organizational considerations) were used: "engineering psychology," "ergonomics," and occasionally "human engineering." The term "engineering psychology," enjoyed the greatest popularity. To become convinced of this one need only to refer to the titles of the pertinent conferences and scientific works on this topic published in the 1960's. Moreover, all of the basic translated works in this direction were called "engineering psychological," in complete accordance with the conception that "human factors," "engineering psychology," "human engineering," etc., are essentially synonyms.[6]

Our description of the situation would be incomplete if we failed to discuss the interpretation of correlations between these concepts (and, accordingly, areas of endeavor) which was formed abroad, especially since formation thereof in our country, in the late 1950's and early 1960's, occurred under the influence of foreign experience.

First of all, it should be noted that there were several different terms that were very popular abroad (chiefly in the United States) to designate disciplines in the area under discussion and, first of all, engineering psychology (from which the Russian term, "inzhenernaya psikhologiya" is taken), human engineering ("chelovekotekhnika" or "chelovecheskaya inzheneriya") and human factors. Most American specialists believed (and still believe) that these terms are synonymous, designating the same discipline (for example, [33, 37, 30, 31, 47, 41, 42, 34]). For example, in the first chapter of the basic work entitled "Systems Psychology," summarizing the work of American specialists dealing with human factors in the area of systems, K. deGreene writes: "The choice of the term, 'human factors,' or 'engineering psychology,' is a matter of individual preference" [34, p 5].

Nevertheless, efforts to view engineering psychology and human engineering as different concepts and, consequently, as different areas of endeavor, were made in the past and are being made at the present time. In particular, A. Chapanis proposed that engineering psychology be considered a part of human engineering, its psychological part. But even A. Chapanis himself practically failed to follow this suggestion, considering the engineering psychologist and specialist in human factors as occupationally identical figures [31].

It should be immediately noted here that no effort to interpret engineering psychology as a direction related solely to the psychological aspects of developing and operating systems could succeed, since it contradicts systems ideology; a system cannot be effectively developed and operated if individual aspects, even if they are psychological, are singled out as an independent subject. This statement of ours is not in contradiction, however, with emphasis on the leading role of psychological resources for such systems projects [45, 20].

The effort made by the American specialists, D. Hunt, W. Howell and S. Roscoe at differentiating between engineering psychology, on the one hand, and human engineering, human factors, etc., on the other, may be considered the most consistent. Their radical point of view is that engineering psychology should not differ in any way from the areas of psychology, in which emphasis is laid on scientific research, rather than applications of knowledge. Thus, from their

point of view, the "educational programs" for training engineering psychologists "should be oriented toward graduating primarily psychologists" [35, p 80]. For these authors, engineering psychology is an area of psychology (while specialists working in this field are research psychologists).[7] However, it is quite obvious that such engineering psychology cannot set as its main task the "design of man's work in modern automated systems." Being singled out as a special branch of psychology, it should also occupy a cognitive position in relation to its object, and it cannot be governed by an engineering (designing) task, since it is a cognitive discipline [3].

Such engineering psychology (if we were to consider this plan accomplished) could not be equated either with Soviet engineering psychology or American engineering psychology, without overlooking the real history of their formation.

In view of the above comments, it can be maintained that, by the mid 1960's, in the United States, as well as in the USSR, there was actually one discipline and one concept expressing it, while the corresponding terms, engineering psychology, human factors, human engineering, etc., emerged as synonyms.

The situation in England was immeasurably simpler, where such a discipline is known by the name of ergonomics. It is not difficult to become convinced of the similarity of this discipline with its American analog, both in the actual practice of specialists and their minds [32, 40, 46].

By the mid 1960's, engineering psychology and ergonomics were already formed as mature disciplines, and no basic changes in their status have been recorded since that time. If we were to characterize these disciplines as a whole, we could mention the following main features thereof.

Both are characterized by a deliberate "engineering" orientation (for example, [39, 45, 47, 48]). This orientation implies the use of knowledge from different scientific fields.[8] Both disciplines single out the systems approach as their methodological basis [47, 43, 44, 45, 40]. This, in turn, automatically means that they accept the "conception of systems development" [43, 44, 45, 40]. Both disciplines advanced the idea of designing "personnel subsystems" in "man-machine" systems [36, 38, 43].

All this means that foreign engineering psychology (human engineering, human factors) and ergonomics were very similar to the engineering psychology of our country which 1) had a systems orientation (see, for example, [19]), 2) was notable for interdisciplinary complexity (see, for example, [11, 5, 17]), 3) considered man as the subject of work, and tools and machines as the organs of his activity (see, for example, [14]). The conception of "key operator" abroad [43, 44] was similar to this interpretation of the correlations between man and machine (but was expressed within the framework of another system of concepts), 4) strived to proceed from activity as a whole in solving its problems (see, for example, [5]), 5) assumed as its main task that of designing the activity of an operator in automated systems [17, 19].

In summary of this brief discussion of the first phase of interpretation of correlations between the concepts of "engineering psychology" and "ergonomics," it can be asserted that the task assumed by Soviet engineering psychology as its

main task, that of designing the performance of an operator in automated systems makes it impossible to qualify engineering psychology as a learning-oriented discipline or an engineering psychologist as a research scientist.[9] On the contrary, there is every reason to maintain that engineering psychology was formed as an engineering (technical) discipline, based on application of theoretical scientific knowledge and conceptions of man's activities. Engineering psychology is engineering in subject, as an activity directed not only and not so much toward gaining knowledge about its object, i.e., cognition thereof, as toward creation, development and design of its "object," and its mode of thinking is to solve practical problems by means of theoretical scientific knowledge, resources and methods [3].

The second period that we have singled out (late 1960's and 1970's) is characterized expressly by the fact that, in a number of cases, the terms "engineering psychology" and "ergonomics" began to be interpreted as expressing two different concepts. And it is maintained that there are two different directions of work in our country, rather than a one and only direction.

Let us discuss the main attempts at presenting ergonomics and engineering psychology as different areas of endeavor.

One of the first such attempts was made by K. K. Platonov. In his opinion, "there is no validity to the tendencies to equate ergonomics and engineering psychology, the object of whose study are work tools, machines that man controls, while the subject is the conformity of these machines with the requirements of psychology" [26, p 124].

But, as we know, already in the early 1950's, it was not the work tools and machines, but the "man-machine" system as a whole that emerged as the object of engineering psychology. Let us also mention that the opinion that machines are the object of engineering psychology is incompatible with the conception of designing man's work in an automated system as the principal task of engineering psychology. As for the interpretation that was advanced of the subject of engineering psychology, in our opinion it was based on a misunderstanding. "Conformity" cannot emerge as the subject of independent scientific interest. If we are dealing with conformity of a machine that is already developed with the requirements of engineering psychology, then this "conformity" is the positive result of an engineering psychological evaluation; but if we are dealing with the design of new equipment, then this "conformity" is a design specification that must be executed, etc. In both cases, this conformity constitutes special aspects of engineering psychological practice (a form of engineering psychological work), but by no means all of it. Thus, K. K. Platonov's distinction of engineering psychology and ergonomics is based on the interpretation of engineering psychology that had meaning in the late 1940's, but it is not consistent with current conceptions.

In this respect, the interpretation of correlations between the concepts of engineering psychology and ergonomics advanced by S. G. Gellershteyn is also significant. "In the narrow sense, ergonomics is engineering psychology that limits its tasks to development of constructions that best conform with the psychological capabilities of man. In the broader sense, ergonomics is a complex science dealing with comprehensive study of correlations between man and all his inherent abilities, interests, on the one hand, and work, machines, environment, on the

other.... Thus, the range of ergonomic problems in the broad interpretation is considerably wider than the range of problems that ensue from the desire to design machines rationally, in view of the role of the psychological factor. In this respect, engineering psychology is merely one of the sections of ergonomics" [2, pp 210-211].

Indeed, with this interpretation, ergonomics is broader than engineering psychology, which becomes one of the sections of ergonomics. However, it is not difficult to become convinced of the fact that the interpretation of engineering psychology proposed here is virtually the same as the interpretation of K. K. Platonov, and for this reason the above comments apply to it to an equal extent. Interestingly enough, S. G. Gellershteyn contradicts himself here, since he was among the first to proclaim that the design of man's endeavors is a "difficult, honorable and positive task" for engineering psychology [1, p 160]. But the task of designing human endeavors by no means conforms with the interpretation of problems of engineering psychology that "ensue from the desire to design a machine rationally," even if one considers the role of the psychological factor.

A large series of studies published in the collections entitled "Ergonomics. Principles and Recommendations," the course has been set toward viewing engineering psychology as a branch of ergonomics. However, it was not followed systematically, since the result is that a part (engineering psychology) turns out to equal the whole (ergonomics). In order to illustrate this, let us compare several theses. Ergonomics as a special discipline and area of endeavor is singled out by its specific goal, which is to "optimize man's working conditions" [28, p 9]. Further, it is maintained that the "problem of optimization of work activities must be solved in two directions: adaptation of equipment to human factors and adaptation of man to working conditions. Both directions are interrelated, and optimum solutions of this problem can be found in the course of complex design of exogenous and endogenous means of human endeavor" [28, p 3]. At the same time, the same series of studies determines that the main task for engineering psychology "is the complex design of exogenous and endogenous means of human endeavor" [28, p 10]. Thus, we find that the goal of ergonomics is reached by engineering psychology.

Of some interest is the attempt made to differentiate between the concepts of engineering psychology and ergonomics by interpreting the subject of engineering psychology as the study and coordination of "psychological traits of the operator and technical specifications of a complicated complex that he controls, in order to obtain maximum efficiency of the entire system" [4, p 5]. This definition of the subject of engineering psychology, as its authors see it, "makes it possible to exclude from consideration a large number of problems that also have a direct bearing on coordination of human and machine characteristics" [4, p 6]. However, this interpretation of the subject does not rule out consideration of a large number of problems, but only adds new ones to them. They can be "excluded" only if we remove from the above definition the words "coordination" and "to obtain maximum efficiency of the entire system." But since we are dealing expressly with maximum efficiency of the entire system, to "exclude from consideration a large number of problems that also have a direct bearing on coordination of human and machine characteristics" means in essence that one abandons the task. How could one seriously coordinate, without deliberately considering problems that have a direct bearing on coordination? We find such an approach to be intrinsically contradictory. Engineering psychology, having realized the need for a systems approach, has long since considered all problems having a direct bearing on man's performance

in automated systems. Only such an approach can assure a real solution of its main problem, that of designing man's activities in such systems.

V. P. Zinchenko, V. M. Munipov and G. L. Smolyan made an attempt at separating the concepts of "ergonomics" and "engineering psychology" by indicating the main "factors" setting the boundaries of the corresponding fields of endeavor.[10] singled out six groups of "ergonomic" factors, they assert: "It is not difficult to single out the subject of engineering psychology; the fourth group of factors 'belong' to this discipline" [10, p 5].

However, it is difficult to share the optimism of these authors, that this would make it easy "to single out the subject of engineering psychology." First of all, we are impressed by the lack of any grounds to prove that indeed "factors" were singled out, rather than something else, and that they are expressly ergonomic and not some others. Why are there exactly six ergonomic factors, no more and no less, and why these and not some others, etc.? In our opinion, these questions are not without grounds. It should be noted that all six theses cannot be considered of the same rank, since they are categorially different. Some have the categorial characteristics of an "object" (i.e., they are referable to the man-machine system as such), and they are the factors of the second, third and fourth groups; others have the categorial characteristics of a "subject" (i.e., they are referable to the discipline, that the authors single out by indicating the "factors" that it studies), and they are the factors of the first, fifth and sixth groups. All six groups of factors are so vague, that it is not deemed possible to draw any clear line between them. Thus, the modes (algorithms) of man's work in man-machine systems (third group of factors) are apparently the characteristics of the "human" components of man-machine systems, i.e., they are referable to the fourth group of factors according to their content. Similarly, the factors in the sixth group (methods of training, occupational screening of people and monitoring their condition) are the means of assuring maximum efficiency, safety and comfort of work, i.e., they belong to the fifth group of factors, etc.

In our opinion, the attempt to distinguish between two ergonomics as a means of eliminating the contradictions in interpretation of its subject, ergonomics in the broad and narrow sense, is also a failure. Ergonomics in the broad sense is what constitutes the six groups of factors. The "fifth group of factors refers to ergonomic parameters of the work process.... The discipline that deals with these erognomic parameters should, in the authors' opinion, be called ergonomics in the narrow sense."

"Consideration of ergonomics in the broad and narrow sense eliminates a number of contradictory interpretations of its subject, warns against the often little-founded claims that ergonomics covers universally the problems of scientific organization of labor, coordinates new and traditional conceptions and, in the authors opinion, makes it possible to trace more distinctly the correlation between ergonomics and other sciences" [10, pp 4-5].

As we see, the authors of the work in question have high hopes for the distinction they have made. To what extent are they justified?

The authors referred to the fifth group the "conditions and means of assuring maximum efficiency, safety and comfort of work." Apparently, if we have knowledge about the conditions and the means of assuring maximum efficiency, safety and comfort of

labor, we thereby also have the solution of the problem of "complex optimization" of man-machine-environment" systems. Since precisely this is the task for ergonomics in the broad sense (as the authors interpret it), we find that ergonomics in the narrow sense solves the problem for ergonomics in the broad sense, i.e., these ergonomics are actually identical in their problems [tasks]. They are also identical in subject matter, since the fifth group of factors--conditions and means--is generic in relation to all the rest. Indeed, both the criteria of optimization (first group) and organization of interaction in man-machine systems (second group), as well as mode of work (third group) and characteristics of human and technical components of man-machine systems (fourth group), methods of training, occupational screening of people and monitoring their condition, are all either the conditions or means of assuring maximum efficiency, safety and comfort of labor.

Thus, instead of eliminating contradictory interpretations of the subject of ergonomics and coordination of new and traditional conceptions, distinction of ergonomics in the broad and narrow sense adds new difficulties.

The most extensive attempt at separating the conceptions of "engineering psychology" and "ergonomics," and substantiation thereof were made recently by V. M. Munipov. V. M. Munipov writes: "Being a branch of psychology, engineering psychology deals only with specific aspects of interaction between man and machine, and in this respect it emerges as well as one of the sections of ergonomics, one of whose tasks is the complex study of various aspects of interaction between man and machine, the man-machine system and the environment" [22, p 9].

But Soviet engineering psychology did not, at least not so far, limit itself (as we have indicated above more than once) "only to specific aspects of interaction between man and machines." Moreover, it has "grown up" to the task of integral design of operator work in automated systems.[11] Thus, we were always dealing with the complex study, design, etc., rather than aspects.[12] But if V. M. Munipov discusses what engineering psychology should deal with (in contrast to what it dealt with before or, at least, planned to deal with), then we need special substantiation of why and how ergonomics will perform the task that engineering psychology sort of contracted to perform.

"It can be stated," V. M. Munipov continues, "that any engineering psychological study is ergonomic; however, not every ergonomic study can be defined as an engineering psychological one" [22, p 9].

This thesis virtually contradicts the interpretation advanced by V. M. Munipov of the correlations between engineering psychology and ergonomics. For if "any engineering psychological study is ergonomic," it means that any engineering psychological study is a complex study. Herein, as V. M. Munipov sees it, are the specifics of an ergonomic study.[13] Then what does "not every ergonomic study can be defined as an engineering psychological one" mean?

Referring to history, V. M. Munipov observes that "engineering psychology and ergonomics originally developed as one direction of research." He also recognizes[14] the pattern of expansion of the field of engineering psychology and its systems orientation. But then, defining the interdisciplinary nature of research in the field of engineering psychology and identity of the concepts of "human engineering" and "engineering psychology,"[15] V. M. Munipov draws an unexpected conclusion, that

is the opposite in meaning of the preceding statements. "Thus," he writes, "on the basis of engineering psychology there was formation of ergonomics, or the study of human factors in engineering, as an interdisciplinary field with a broader range of tasks and problems" [22, p 10]. The unexpectedness of this conclusion is compounded as well by the fact that it is utterly incomprehensible why ergonomics had of necessity to develop on the basis of engineering psychology, rather that on its own basis, for, in the words of V. M. Munipov himself, "engineering psychology and ergonomics originally developed as one direction" [22, p 9].

If engineering psychology and ergonomics developed as the same direction, apparently there should have been a qualitative separation and polarization of different theoretical subject systems within the framework of this direction, and it is only after this that two different directions could develop from the originally single one. However, as we have shown above, there are actually no qualitative differences between engineering psychology and ergonomics. It is not in vain that no one even tries to indicate when ergonomics and engineering psychology existed as one direction and when or why two were formed from it. At the same time, it is necessary to point to qualitative differences when advancing the view that there are two different directions (disciplines), and this compels V. M. Munipov to construct engineering psychology as a discipline that is a branch of psychology, and one that deals only with specific aspects (apparently, "psychological") of interaction between man and machine. Apparently, the interpretation of this is that when engineering psychology and ergonomics were the same direction both dealt with these "psychological" aspects, but after they were "separated," engineering psychology dealt only with "psychological" aspects, as before, while ergonomics began to deal with the complex development of different aspects.

However, it is common knowledge that the "psychological" aspect (if it is set against all others) began to acquire its just place in the system of engineering psychological science only with the passage of time, as engineering psychology (ergonomics) developed, without replacing or ejecting all others, but merely reorganizing the entity. And this process is still far from completion. For this reason, at the early stages of development, alas it was not the "psychological" aspects that were in first place in engineering psychology (ergonomics). To become convinced of this, it is enough to glance at any of the early works dealing with engineering psychology.

Thus, to sum up our discussion of the correlations between the concepts of "engineering psychology" and "ergonomics," we can maintain that, at the present time, we are actually confronted with one concept and two different terms. The efforts that have been made to introduce two different concepts are not sufficiently founded. All them, as a rule, amount to formulation of definitions of what some author considers to be engineering psychology and what he considers as ergonomics. We consider it incorrect to differentiate between the concepts of engineering psychology and ergonomics without any serious analysis of the actual history of their use and the content that was formed as a result of such use. But if, however, we bear in mind that we are dealing with concepts that fix the definite nature of entire areas of endeavor and, for a long time, "were projected" on the same area, the introduction of such concepts implies the need to separate this previously single area (direction) into two, starting with the methodological conceptions and ending with the area of relevant empirical material, and this in such a manner as not to contradict their actual history.

Of course, the fact that no one who has tried so far has succeeded in significantly separating the concepts of engineering psychology and ergonomics does not mean that this cannot be done. Such a separation is, of course, possible and, perhaps, even necessary by virtue of some circumstances or other, for example, organizational. However, since it is inadmissible to rewrite a predated real history of a discipline, this separation, which is not a fact of the past, could only become a fact of the future. But there are also difficulties along this route.

In this regard, the most recent works of "ergonomists" dealing with the distinction between engineering psychology and ergonomics are interesting. Emphasis is laid on the fact that the "theoretical boundary between them is beginning to be recognized for the reason that engineering psychology is referable to psychology" [23, p 34] and that it is imperative to have a stricter definition and narrowing down of "the area of studies in engineering psychology for it to develop effectively as a branch of psychology in charge of the section of psychology of man's work activities" [8, p 28]. In other words, it is suggested that all complex studies be relegated to ergonomics and only those that are related to purely psychological aspects of performance in automated systems to engineering psychology.

At first glance, it could appear that this is a rather good and logical solution to the problem of distinction between engineering psychology and ergonomics. But this is only at first glance. The fact of the matter is that most specialists are unanimous in believing that the term, "engineering psychology," is extremely unfortunate. For this reason, in revising the content of the concept and abandoning the traditional use of the term, there is no reason whatsoever to retain this ill-chosen one; this had some sense only for the sake of tradition. Thus, in this respect, the program was simply not carried through to its logical conclusion. On the other hand, if engineering psychology is viewed solely as a section of industrial psychology, there is no need for a special term (after all, the section of industrial psychology that deals with the psychological aspects of work performance in nonautomated systems is managing without a special name). But the main objection to this program is that making a distinction between engineering psychology and ergonomics is replaced in fact by making a distinction between ergonomics and indsutrial psychology, i.e., instead of one problem, another is discussed.

In other words, those who wish to make a distinction between engineering psychology and ergonomics (no matter the aspect, past or future) must conduct some special work to separate them. Such a separation cannot be arbitrary; it must have very definite grounds, without submittal of which all efforts to make a distinction between engineering psychology and ergonomics are inconsistent. We believe that there are two types of such grounds: the proponents of separation must demonstrate either the necessity thereof, indicating the devastating (or undesirable) consequences of confusing these concepts (in particular, naming the theoretical, organizational or practical contradictions arising in this case), or else its expediency, demonstrating the definite benefits (advantages) of such differentiation. For the time being, neither has occurred. Instead, the proponents of separating engineering psychology and ergonomics repeat the same thing, over and over again: "ergonomics is broader," "engineering psychology is narrower."[16]

However, there is another possible approach to this problem. This approach is based on the rather "transparent" set that "specialists in the field of engineering psychology," on the one hand, and "ergonomists," on the other, who claim to have the

best, most adequate coverage of the relevant problems, advance basically different programs for development of the discipline, and precisely because the differences in the programs they do not want them to be confused. In this case, it would be more correct to refer to differentiation between different conceptions and programs (one of which its authors like to call "ergonomics"), rather than differentiation between the concepts of engineering psychology and ergonomics. For, as everyone concedes, it is not a problem of a name.

But then, there should also be a change in the formulation of the question: discussion of the problems dealt with by "engineering psychology and ergonomics" should be translated into the form of "engineering psychology or ergonomics." The answer to this question must depend on which of the programs is better founded and more consistent with modern scientific theoretical conceptions and social practical demands.

FOOTNOTES

1. In this respect, engineering psychology is no exception. Suffice it to mention here the debate about the subject of psychology proper, which took place in 1975.

2. For example, V. M. Munipov believes that "in those cases where such a distinction is not made, when ergonomics is equated with engineering psychology, there are often fruitless debates, the cause of which is terminological misunderstanding, and not differences in views" [22, p 9].

3. Let us only mention that a "system" cannot include "environment" in its concept. Otherwise, this is no longer a system, but a "universum."

4. "Engineering psychology is one of the newest scientific directions. For the time being this direction does not yet have a universally recognized name. It appears under different names: 'engineering psychology,' 'psychotechnology,' 'ergonomics,' 'human factors engineering,' 'applied psychology,' 'technical psychophysiology,' 'human engineering,' etc." [15, p 10].

5. For example, at one time V. M. Munipov stated that the term, "ergonomics," "gradually gained wide popularity, although other names were also used, for example, 'human engineering, engineering psychology, studies of 'man-machine' systems, studies of human factors and, for short, human factors" [21, p 3].

6. Thus, the work of W. Woodson and D. Conover, the original English title of which is "Human Engineering Guide for Equipment Designers," was translated with the title "Guide on Engineering Psychology for Engineers and Designers."

   The book by D. Meister and D. Rabedeau [actual name is Ronald G. Rabedeau], "Human Factors Evaluation in System Development," was published in our country under the title of "Engineering Psychological Evaluation in Development of Control Systems."

   The remarkable work of C. Morgan, A. Chapanis, D. Cook and M. Land, the literal title of which is "Guide on Human Engineering for Equipment Design," has the translated title of "Engineering Psychology as Applied to Equipment Design."

7. "Engineering psychology can continue to justify its existence only if specialists are trained and used as scientific psychologists" [35, p 84].

8. See, for example, the following statements of A. Chapanis: 1) "Engineering psychology combines different branches of science: psychology, physiology, anthropometry, toxicology, medicine, biology and industrial psychology" [27, p 38]; 2) "Ergonomics is a multidisciplinary branch of science. It is on the borderline of many scientific and occupational disciplines, and it gleans data, information and principles from all these disciplines. Ergonomics is a blend of psychology, physiology, medicine, anatomy, toxicology, research on problems of control and engineering" [22, p 7].

9. Of course, this does not mean that there is place for research as a type of endeavor within the framework of engineering psychology, but only that it is subordinated to designing problems.

10. "Ergonomic factors include the following: 1) general system (including social) criteria for optimization of man-machine systems; 2) organization (structures and processes) of information and energy interaction in man-machine systems; 3) modes (algorithms) of man's performance in man-machine systems; 4) characteristics of 'human' and 'engineering' components of man-machine systems; 5) conditions and means of assuring maximum efficiency, safety and comfort of work; 6) means of training, occupational screening of people and monitoring their condition" [10, p 4].

11. This is what V. M. Munipov also believed at one time: "At present, engineering psychology has moved to the second phase, i.e., synthesis, design of human work in major data processing man-machine systems, in control systems of the organizational type. It considers the design of such systems as the design of new forms of human activities: [9, p 69].

12. "Engineering psychology is a branch of ergonomics adjacent to systems analysis, whose task is the complex design of exogenous and endogenous means of operator work" [25, p 10].

13. "The distinctive feature of ergonomics is that the results of ergonomic research cannot be obtained within the framework of any of the existing disciplines alone" [22, p 4].

14. "In the course of studying the complex performance of man in control and monitoring systems, it became increasingly obvious that man's performance as a whole was important, rather than individual functional abilities referable to perception, thinking and action; one must take into consideration all of the circumstances upon which the success of the work depends. The study of human factors, on which the efficiency and reliability of operation of control and monitoring systems depends to a significant extent, determined the gradual enrichment and expansion of the area of research in engineering psychology" [22, p 10].

15. "Psychologists started to work," states F. Taylor, "and with the help of anatomists, physiologists and, of course, engineers, they founded a new area of interdisciplinary research directed toward improvement of machine design, which had different names: human engineering, psychotechnology or engineering psychology" [22, p 10].

16. Interestingly enough, when changing their work place (moving to another organization), "ergonomists" readily change into "engineering psychologists" and vice versa, without changing in any way the nature of their work.

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[26-10,657]
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CSO: 1840

PSYCHOLOGICAL PROBLEMS OF MUTUAL ADAPTATION OF MAN AND MACHINE IN CONTROL SYSTEMS

Moscow PSIKHOLOGICHESKIYE PROBLEMY VZAIMNOY ADAPTATSII CHELOVEKA I MASHINY V SISTEMAKH UPRAVLENIYA in Russian 1980 signed to press 11 Mar 80 pp 2-6, 319-320

[Annotation, Foreward and table of contents from book by B. F. Lomov et al., "Nauka", 3,600 copies, 319 pages]

[Text] The book, prepared by specialists from the USSR, Bulgaria and Czechoslovakia, examines the theoretical and practical questions of raising the efficiency of control through optimization of information interaction of man and machine.

Foreword

Progress in the field of automated control systems, power engineering, industrial technology and astronautics has given rise to a multitude of new functions for man as the operator and new types of "man--machine" systems. Traditional approaches to the optimization of such systems, based on a separate and independent solution of tasks of engineering psychology in selecting machine parameters corresponding to the psychological features of operators and tasks of labor psychology in the selection and training of people for the growing demands of operation of equipment, are increasingly untenable.

An attempt is made in this collective monograph to construct a systems theory and methodology of mutual, counter adaptation of man and machine for the purpose of optimizing informational interaction between them.

Many-sided theoretical and experimental research on this new problem and the practical verification of a methodology developed over the course of several years have become possible due to the active participation in the work of representatives of many Soviet as well as Bulgarian and Czechoslovak scientific organizations, closely cooperating with the Institute of Psychology of the USSR Academy of Sciences in accordance with plans of joint researches by CEMA member-countries in the field of psychology and ergonomics.

Chapter 1 (authors--B.F. Lomov, V.F. Venda, Yu.M. Zabrodin) provides a survey of pertinent psychological problems in the field of "man--machine" systems and is based on the use of a new approach founded on reciprocal adaptation of man and machine for the optimization of such systems.

Chapter 2 is concerned with the development of principles of constructing and modeling systems of adaptive informational interaction of man and machine.

Important significance is to be attached an all-around validation--social, economic, psychological and technical--of choice in the precision of reciprocal adaptation of man and machine in a system of operation. The work shows that five levels of precision in such cooperation are possible--total, contingent, group, individual and individual-operative. In § 2.1 V.F. Venda and B.V. Pul'kin present a number of mathematical models of processes of adaptation in "man--machine" systems at different levels of precision and with different means and methods of adaptation.

In § 2.2. V.M. Akhutin examines an extremely broad class of adaptive biotechnical systems. Ya.Z. Tsypkin in § 2.3 discusses the relation of concepts and problems of control, adaptation and training in engineering. A number of new results in the modeling of adaptive aspects of human behavior are published by V.Yu. Krylov and Yu.I. Morozov in § 2.4.

In Chapter 3, psychological methods of adaptation of concrete "man--machine" systems are examined.

In § 3.1, which is written by the well-known Czechoslovak psychologist Y. Daniel, considerable space is given to methods of psychological analysis of the labor of operators of automated production operations. The author presents copious factual materialon the level of mental load of operators under different regimes and conditions of their operation. Questions of reduction of the mental load of operators through the precise coordination of means and structure of informational internation in the system with psychological features of operators are examined by the Bulgarian scientists Yu.P. Marinov and P.Ts. Spasov in § 3.2. V.A. Vavilov in § 3.3 offers a substantiation of the basic principles of adequate reproduction in a laboratory psychological experiment involving the fundamental traits of adaptive informational interaction of man and machine. In § 3.4, G.Ye. Zhuravlev and V.F. Rubakhin discuss the relation of processes of heuristic and adaptation in the adoption of operative decisions. V.F. Venda and S.S. Zorin present in § 3.5 data on adaptation of information to individuals with complex anomalies of view.

Chapter 4 examines methods of modeling and optimization of structures of adaptive "man--machine" systems, including autonomous-type systems (§ 4.1--authors V.F. Venda and V.V. Pavlov), systems operating under critical conditions (§ 4,2--author G.I. Ryl'skiy). A.I. Galaktionov in § 4.3 examines a method of engineering-psychological planning of information systems on the

basis of analysis of idealized strategies of solving operational problems. An individual example of the use of the structural-psychological approach to the planning of information systems based on the comparison of theoretically optimal (idealized) and real strategies of operators is presented by V.F. Venda and A.N. Zheleznikov in § 4.4.

In Chapter 5, different aspects of the use of the idea of reciprocal adaptation of man and machine to the training of operators are examined. Models of adaptation of "man--machine" systems in the course of training operators in tracking functions are dealt with in § 5.1 (authors--Yu.M. Zabrodin and A.P. Chernyshev). Algorithms of adaptive training are proposed by I.I. Malashinin in § 5.2. The realization of such algorithms on an adaptive simulator [trenazher] for the training of operators of power facilities is discussed by V.F. Venda, I.I. Malashinin, Ye.A. Chertorizhskiy and O.P. Luksha in § 5.3. In the concluding § 5.4 V.F. Venda, F.L. Kakuzin and Yu.D. Belousov present data on adaptive properties of certain types of teaching aids of representation of sign and graphic information, making it possible to equalize the learning rates of different operators through the synchronization of their work in a single functional group.

The collective of authors of this monograph hopes that it has succeeded in not only outlining a new direction in applied psychological research and formulating theoretical-methodological problems connected with it but also in providing examples of the practical solution of problems of optimization of "man--machine" systems on the basis of reciprocal adaptation of the chief interacting components of these systems.

Such an approach expands the methodological bases of engineering psychology and the actual object of their researches. In addition to the study of the informational interaction of man and machine in the traditional static variant the accent is placed on the dynamic, adaptive aspects. Interrelated investigation of the dynamics of characteristics of man (in the process of selection and especially training) and machine (for example, in the regulation of intensiveness of the flow of signals and reorganization of the structure of means of representation of information) opens up essentially new possibilities in the concrete realization of the systems approach in applied psychological researches.

Taking into account these new and important theoretical and applied aspects, the collection of authors directed its further efforts to the development of a general systems methodology of engineering psychology and the psychology of labor and control. At the present time, work is being concluded on a collective monograph on the methodology of these branches of psychological science which can be examined as a direct continuation of the book proposed to the reader.

The cooperation of psychologists of socialist countries, which finds its reflection in this book, is expected to be further expanded during 1981-1985, directing the main efforts toward the practical use of theoretical and methodological developments and raising of the social and economic effectiveness of applied psychology.

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THE MORALE FACTOR IN MODERN WARS

Moscow MORAL'NYY FAKTOR V SOVREMENNYKH VOYNAKH in Russian 1979 signed to press 28 Feb 78 pp 2-4, 223

[Annotation, introduction, and table of contents from book by S. K. Il'in, Voyennoye izdatel'stvo ministerstva oborony SSSR, Moscow, 30,000 copies, 223 pages]

[Text] The book examines popular and army morale as a major factor influencing the course and outcome of a modern war. The author demonstrates that the morale of the Soviet Union and other socialist countries is superior to that of the imperialist countries. He also analyzes ways and means of instilling high morale and political, psychological, and combat qualities in Soviet soliders.

The book is intended for officers and party actives.

Introduction

The Communist Party does whatever it must to keep the Armed Forces of the USSR at the level of modern demands. This was emphasized with renewed vigor at the 25th CPSU Congress. As comrade L. I. Brezhnev put it, "The Soviet people can rest assured that the fruits of their constructive work will be safeguarded."*

The Party shows its constant concern for building morale among the Armed Forces as it takes steps to equip the army and navy with the latest war

*Materialy XXV s"yezda KPSS (Proceedings of the 25th CPSU Congress). Moscow, 1976, p 83.

machines and weapons and improves the training of personnel. In the course of the enormous transformation taking place in our country and realization of our social, economic, political, and ideological goals, the morale and political unity of Soviet society grows stronger and the workers' awareness increases. This means the spiritual foundation of our military organization is becoming even more solid.

Today as never before, it is important that we make fuller use of the favorable opportunities now available for strengthening morale in view of the steadily increasing demands placed on the training of the armed protectors of the motherland. What are these demands and how can they best be realized? Success in solving the problem largely demands on our thoroughly understanding the issues involved.

Relying on the experience gained in past wars and taking into account the nature and qualities of present-day soldiers, the author analyzes the significance of the morale factor and presents sound ways and means of strengthening it. The problem is examined in the light of both the hostility currently existing between the two social systems and the changes that have taken place in warfare as a result of the scientific and technological revolution.

This edition of the book discusses the theoretical aspects of the problem more thoroughly than did the two earlier editions. It also generalizes the experience gained with morale building and political and psychological preparation in the army and navy.

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ANTICIPATION IN THE STRUCTURE OF PERFORMANCE

Moscow ANTITSIPATSIYA V STRUKTURE DEYATEL'NOSTI in Russian 1980 signed to press 18 Jan 80 pp 2-4, 276-277

[Annotation, foreword and table of contents from book by Boris Fedorovich Lomov and Yevgeniy Nikolayevich Surkov, Izdatel'stvo "Nauka," 3200 copies, 280 pages]

[Text] This monograph deals with the main theoretical and applied aspects of the problem of anticipation. The hypothesis is expounded of levels of anticipation processes and, on the whole, the authors demonstrate the methodological significance of studying anticipation for psychology.

This book is intended for psychologists, philosophers and pedagogues.

Foreword

At the present stage of development of psychological science, researchers referable to different schools and directions are very interested in the problem of anticipation, which has been little-studied, both theoretically and experimentally. Although the total number of theoretical and experimental works completed to date is small, many researchers are quite aware of the importance of this problem and its practical significance.

Studies of sensory organization of man, which were conducted by B. G. Anan'yev and his coworkers [11, 12], revealed that anticipation emerges as a sort of "connecting link" between sensation and perception, from perception to conception and from conception to thinking.

V. M. Teplov demonstrated with particular clarity the role of anticipation in thinking processes in his brilliant work, entitled "The Mind of a General" [192]. It has been stressed in general theoretical conceptions of performance (A. N. Leont'yev [107], S. L. Rubinshteyn [155]), as well as studies of specific types of performance (S. G. Gellershteyn [58, 59] and others) that anticipation is a mandatory element thereof.

Physiologists concerned with the neurophysiological bases of behavior also address themselves to the problem of anticipation. In functional system theory, expounded by P. K. Anokhin [14, 16, 17], a role of paramount importance is attributed to those elements that are related to anticipatory reflection (acceptor of action results). Equally large importance is attributed to anticipation processes in the conception of physiology of activity of N. A. Bernshteyn [31]. The problem of anticipation has been clearly demonstrated in studies of development of the intellect (J. Bruner [37], J. Piaget [133]).

Thus, the problem of anticipation permeates, so to speak, all problems of psychological science. It appears in some form or other in studies of both mental processes and mental states, as well as mental properties of man. Work on this problem is important to the solution not only of theoretical, but practical problems that arise in the area of production, education, public health, sports, art, etc.

One of the main objectives of this publication was to systematize and summarize the experimental data that have been accumulated in psychology and, in part, in adjacent disciplines.

Another, equally important task was to discuss the hypothesis of levels in the structure of anticipation processes on the basis of analysis and generalization of empirical data. This hypothesis ensues from the general principles of systems analysis of mental phenomena. The data accumulated in psychology warrant the statement that the system of mental phenomena consists of many levels and, apparently, it is constructed hierarchically.

In this regard, it is very important to single out the main levels of the system of phenomena under study, to disclose their correlations and conditions, under which some level becomes the leading one. In systematizing data referable to the problem of anticipation, we have singled out several interrelated and, at the same time, relatively independent levels: sensorimotor, perceptual, conceptual, verbal-thinking and subsensory. The authors are far from believing that the hypothesis of levels of anticipation covers all aspects of this complex and multifaceted problem. But, it appears to us, that an effort to consider the problem of anticipation from the standpoint of the systems approach could be useful to development of general theory of psychology.

Only a general theoretical scheme of the approach to the study and analysis of anticipation processes as integral-systemic elements is outlined and illustrated in this book. In future studies and, first of all, with the accumulation of new empirical data, the proposed scheme of analysis could, of course, be submitted to some changes and clarifications.

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PHYSIOLOGY

UDC 612.82.014.49

MECHANISMS OF ADAPTIVE ACTIVITY OF THE BRAIN

Moscow EKOLOGICHESKAYA FIZIOLOGIYA MOZGA (Ecological Physiology of the Brain) in Russian 1979 signed to press 27 Aug 79 pp 1-6

/Annotation, table of contents and introduction from book by Nikolay Nikolayevich Vasilevskiy, Izdatel'stvo Meditsina, 3,250 copies, 200 pages/

/Text/ The book contains the latest data on the neurophysiological mechanisms of the adaptive activity of the brain. It examines the mechanisms of adaptive plasticity and self-regulation of neurodynamic processes at cellular and systemic levels in low- and high-frequency ranges of rhythmic activity. An evaluation of the characteristics of the plasticity of nervous processes made it possible to develop promising approaches to the elaboration of the problem of individual differences in the adaptive activity of the brain. Phase and tone and specific and nonspecific regimes of adaptive response are singled out, the characteristics of the effect of some factors on the developing brain are shown, tracking processes under the effect of rhythmic afferent signals are examined in detail and problems of selective response of the brain to simple and complex signals are analyzed. The mechanisms of adaptive evolution of the brain are connected with the progressive development and ecological specialization of its analyzer and associative systems by way of an adequate reflection and combinatorial association of nervous processes at every level of integration.

The book is intended for physicians, physiologists, biologists and specialists interested in the problems of physiological adaptation.

It contains 58 illustrations, 3 diagrams and a bibliographic index with 294 titles.

Contents

Introduction

Ecology is defined as the science of interactions of human and animal organism with the environment. Whereas previously, as indicated by A. P. Avtsyn (1972), ecology mainly studied problems of animal heat and trophic

chains in biocenoses, at present its tasks have expanded considerably. Several trends based on biological, medical and socioeconomic approaches have now been formed clearly. The physiological approach in ecology pursues a fundamental objective—to unravel the mechanisms of physiological adaptation. The solution of this task requires an overall inclusion of physiological processes with due regard for their evolution, diversity and close interaction.

Among the various physiological mechanisms of adaptation of the human and animal organism nervous mechanisms of adaptive response are put in the forefront. An investigation of the nervous mechanisms of adaptation presupposes not only the disclosure of connections between the state of the brain and existing environmental factors, but the determination of the mechanisms of control of the adaptive process at systemic and cellular levels as well. Several closely interrelated problems can be noted in this direction.

The first problem pertains to the methodological aspect and envisages general approaches to the investigation of adaptive mechanisms of brain response. At present considerable attention is given to the substantiation of the idea of regulatory brain systems as combined systems with "disturbance" and "deflection" control reflecting the relationship between rigidly determined and probabilistic (flexible) links (Bekhtereva, N. P., 1974), which makes it possible to interpret the individual characteristics of the brain in a new way and to forecast the stability of its functional state.

It is promising to develop the investigations of individual differences in the adaptive process in the direction of evaluations of automatically controlled parameters of functional systems. Work on this program made it possible to accurately evaluate not only the parameters of plasticity, but also of stability, lability and reserve of functional systems. It is important to stress that the determination of these parameters is connected with rhythmic processes. At the same time, the dissimilar physiological value of low- and high-frequency components of the rhythm activity of the brain is detected clearly.

The second problem lies in the study of the specific mechanisms of plasticity of nervous processes and, first of all, an experimental trend is envisaged in its development. This research trend, being connected with an analysis of brain functions by means of classical conditioned reflex methods, is promising in many aspects; for example, for a directed correction of intrabrain homeostasis by way of modification of the parameters of rhythmic neurodynamic processes, for the clarification of the degree of specialization of individual combinations of neurons in the control of specific functions of the organism and for the functional typification of central neurons according to the parameter of plasticity.

To understand the automatically controlled processes of adaptation, we made an attempt to utilize several principles. The transformation of the structure of biorhythms by means of synchronization of some of their components with afferent information flows is one of them, feedback, owing to which the system acquires a greater stability in the regulation of internal homeostasis, another principle and, finally, the principle of connectedness of discrete microstates of the system; for example, in the form of repeated patterns of activity.

Adaptation of the organism lies not only in the maintenance of the energetic and structural equilibrium, but also the equilibrium of information processes. Such factors in the habitat as hypodynamia and sensory insufficiency affect the activity of the brain. The individual characteristics of activity of the human brain are most vividly manifested in adaptation. The final form of human adaptation is the product of biological, psychological and social factors operating in a combined way.

An all-around description of the adaptive response of the brain requires not only the determination of the types of adaptive responses, but also the clarification of the phylo- and ontogenetic patterns in the development of these reactions. Extreme environmental factors affect the developing brain in a special way. At the same time, ecological factors--adequate sensory stimuli (Bogdanov, O. V., 1978)--with which the first contact is especially optimal during the critical period of brain development, are of key importance.

Examining the sensory factors affecting brain development, we have analyzed the models of sensory motor and visual deprivation, because they have been studied most fully and give clearer results in the cellular mechanisms of injury to brain processes during deprivation.

The fixability of tracking phenomena in the brain has been debated for a long time. Two views are contrasted. According to one of them, the brain fixes the entire flow of sensory information. According to the other, on the contrary, only information significant in a motivational way is fixed. In this connection it is necessary to dwell on the phenomena of information flows devoid of any motivational significance and representing ordinary rhythmic messages. An analysis of the cellular mechanisms of tracking processes has disclosed a number of important data on the informational capacity of the nervous system.

At every stage in the evolution the brain possesses the potential for the reception of significant volumes of information greatly exceeding the needs for providing vital activity under the specific conditions of the habitat. At the same time, its high specialization for the processing of information obtained by means of so-called ecologically adequate stimuli is disclosed. This specialization is manifested in the structural organization of receptor systems and in the structural and functional organization of the brain as a whole.

Ideas of the discrete organization of selective-classifying memory mechanisms, according to which the accumulation of information is ensured by the associative mobilization of a certain number of neurons, formed the theoretical basis for the approach in the investigations at the cellular level.

The functional organization of the central nervous system was adapted by evolution for the distinction of the pattern (composition) of excitation at the receptor fields of analyzers, which is transmitted to the brain through the bundles of parallel afferent fibers. It is precisely this fact that determined our aspirations for the composition approach, which makes it possible to examine the mechanisms of activity of analyzer, associative and effector brain structures from a single point of view. We utilized the same approach during an analysis of the connections of cellular systems selectively responding to complex natural signals designated by D. A. Biryukov (1960) as ecologically adequate stimuli.

Of great interest is the further development of the composition approach in an analysis of the controlling systems of the brain regulating the gradations in its state. We hope that the composition approach, leaning on the idea of discreteness of biological processes not only at the molecular, but also at the cellular and systemic level, will fill the concepts of organization of physiological processes and the mechanisms of their plasticity and stability with a specific content. The composition approach is especially promising in decoding the cellular mechanisms of memory and conditioned reflex response.

Not so much a shortage of factual data as of new ideas giving impetus to more complete and more accurate investigations is now felt in many sections of ecological physiology. What is "on this side of the facts" is the most attractive side of scientific research. To find a satisfactory explanation at times is more valuable than hundreds of other experiments, because it directs research to more promising areas. In this connection we are aware of the inevitably fragmentary nature of the review data of the book. However, this shortcoming is made up for by the recently published monographs on some problems of the ecological physiology of man and the theory of adaptation (Kaznacheyev, V. P. and Subbotin, M. Ya., 1971; Kaznacheyev, V. P., 1973; Vasilevskiy, N. N. et al., 1978 and others), in which the reader will find many facts and propositions of interest to him. The modern tendency to combine theoretical (experimental) and applied aspects was taken into consideration during the preparation of this book. As it will be evident from the subsequent account, these two aspects merge in the understanding of the mechanisms of intrasystemic interactions and memory, with the activity of which the adaptation of both man and animal is connected.

[8144/0018-11,439]

11,439
CSO: 8144/0018

MECHANISMS OF NERVOUS ACTIVITY

Leningrad MEKHANIZMY NERVNOY DEYATEL'NOSTI in Russian 1977 signed to press 19 May 77 pp 2-4, 214-222

[Annotation and abstracts of papers from the All-Union Scientific Conference, December 1975, Leningrad University, 1095 copies, 224 pages]

[Text] Proceedings of the All-Union Conference commemorating the 100th anniversary of A. A. Ukhtomskiy's birth are published in this collection. The conference was organized by the Leningrad University Physiology Institute and the USSR Academy of Sciences Scientific Council on Complex Problems of Human and Animal Physiology.

The majority of the articles are devoted to the dominance principle, the basic mechanicsm of the interaction of nervous centers in normal and pathological states considered from the standpoint of evolutionary neurochemistry. In a number of articles new data is presented on the responsiveness and lability of nerve cells, on the functioning of synaptic transmission during optimal and pessimal rhythmic activity and on the regulatory mechanicsms of certain biological processes including the biosynthesis of brain lipids.

This collection is intended for clinical physicians and for scientific workers interested in human and animal physiology and the physiology of higher nervous activity.

ABSTRACTS

UDC 612,0+591,181

THE CREATIVE GENIUS OF A. A. UKHTOMSKIY AND THE PROGRESS OF PHYSIOLOGY AT LENINGRAD UNIVERSITY. Grachev, I. I., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 3-19.

In a paper dedicated to the 100th anniversary of the birth of the great Russian physiologist A. A. Ukhtomskiy, the life course of A. A. Ukhtomskiy and his creative genius are described from the youthful years to his becoming a prominent scientist. His important discoveries--the theory of dominance, the principle of rhythm aquisition, the problem of physiological lability and others--are briefly stated. Particular note is given to the service of A. A. Ukhtomskiy in continuing the legacy of his teacher N. Ye. Vvedenskiy and his role in the growth of many divisions of Soviet physiological science. A talented teacher and scientific organizer, A. A. Ukhtomskiy created in Leningrad University the Physiological Scientific Research Institute which now bears his name. The progress of research in the institute and his achievements in problems studied are briefly presented in the article. It is stressed that the laboratories of the institute provide an experimental base for training highly qualified specialists: physiologists, biochemists, biophysicists and science teaching personnel--candidates and doctors of science.

UDC 612.82/83

THE STUDIES OF A. A. UKHTOMSKIY ON MECHANISMS OF NERVOUS ACTIVITY AND PROSPECTS FOR FURTHER PROGRESS. Golikov, N. V., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 19-29.

The most important discoveries and generalizations of the Leningrad University School of Physiology underlying A. A. Ukhtomskiy's principle of dominance and his teachings on mechanisms of nervous activity are presented. The role of local processes in nervous activity and the importance of rhythm aquisition processes (the synchronization of neural activity) and simple and specific stimulation traces (the memory of neurons) in forming and reproducing the responses of nervous centers are stressed. There is a strict difference between responsiveness (referring to a local reponse) and excitability) the ability of a response to be conducted without decrement). The principle of dominance, which appears in any reflex acts, should be distinguished from the state of dominance determining the behavior of a man or an animal in its environment for a rather long period of time.

The role of associative zones of the cerebral cortex in information storage and regulation processes is underlined. Courses for further research are outlined, and the significance of studies at the Leningrad University School of Physiology is pointed out not only for physiology and medicine but also for psychology, education, cybernetics and computer design. Bibliography--39 references.

UDC 001.47/612

A. A. UKHTOMSKIY--TEACHER. Redashevskiy, S. Ye., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 29-33.

The author shares his recollections of the teaching activity of Aleksey Alekseyevich and conversations with him. Bibliography--5 references.

UDC 612.825.1

DOMINANCE AND PROBLEMS OF INTERCENTRAL CONNECTIONS. Kryzhanovskiy, G. N., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 34-49.

Two basic principles in the determination of neural activity and intercentral connections are discussed: the principle of dominance and the principle of decisive transmission stages (DTS). Dominance is the principle underlying intersystem connections and reflects mainly the stochastic type of determination of nervous activity, whereas the DTS principle underlies intrasystem connections and primarily reflects the type of nervous activity determined by a rigid program. These principles are not mutually exclusive. They compliment one another and represent a common mechanism for the integrative activity of the nervous system. The importance of the DTS principle in the pathology of the central nervous system is specifically discussed. Figures 4, bibliography--25 references.

UDC 612.8.012

ON THE INTERCONNECTION OF EXTEROCEPTIVE SYSTEM CENTERS AND THE SKELETAL MUSCULATURE. Uflyand, Yu. M., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 50-58.

Both the decrease and strengthening of visual stimulation entails a shift in the bioelectric activity of muscles. The direction and character of electromyogram changes are extremely varied and depend both on the state of the visual system and on the functioning of motor centers.

Noise stimulation as a rule increases muscle bioelectric activity. Excitation of the vestibular apparatus affects the electromyograms of antagonistic muscles in different ways and depends on the stimulus strength. Mechanical stimulation of cutaneous receptors has a reflex stimulating effect on the generation of electrical muscle potentials. Bibligraphy--7 references.

UDC 612.82

CONVERGENCE MECHANICSMS IN THE ACTIVITY OF CORTICAL NEURONS. Bateyyev, A. S., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 58-67.

In development of the convergence principle for cortical neurons the intracellular and extracellular postsynaptic responses of cells to multimodal stimulation was studied. Habituation of a neuron response to a one second input was observed during simultaneous facilitation of the response by stimulation of another modality. Long IPSIs (on the order of 600-700 msec), intracortical in nature, were recorded. Their length was caused by dispersed thalamic activation. It is proposed that inhibitory mechanisms are an important factor in the coordination of afferent currents converging to one cortical neuron. Figures 5, bibliography--23 references.

UDC 612.76

ON DOMINANT INFORMATION IN THE CONTROL OF HUMAN MOVEMENTS. Farfel', V. S., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 67-70.

Different types of information about motion on which the conscious control of movement is based are discussed. The idea is advanced that "dominant information" is preferentially used by the motor control system for the solution of a given motor task. Experimental data is presented which indicates that information about the spatial accuracy of movement is dominant with respect to information about muscle force, visual information about spatial accuracy is dominant with respect to motor information, information about movement rhythm is dominant with respect to information about movement amplitude, auditory information about rhythm is dominant with respect to motor information, and objective information about movement parameters is dominant with respect to subjective information.

UDC 612.821

OPERATIVE REST AND HUMAN WORK ACTIVITY. Tochilov, K. S. and Shabanov, A. I., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 71-75.

The concept of operative rest is discussed in connection with a study of new (automated) types of work. Three basic features of operative rest are distinguished: 2) spatial orientation, b) prediction, and c) formation of a particular program of movement based on tracking. Data from the literature are presented which attest to the interrelation and predominance of one of these features of operative rest in a specific work situation. Bibliography--7 references.

UDC 616.8-009

DOMINANCE MECHANISMS AND CERTAIN PROBLEMS IN THE PSYCHIATRY OF ALCOHOLISM. Timofeyev, N. N., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 75-76.

Alcoholism is considered as a pathological dominance, being very inert and stable. Successful treatment of alcoholism is possible only by breaking down the alcoholic dominance and replacing it with another, socially useful one. Bibliography--1 reference.

UDC 612.82

THE COMMON PATHWAY PRINCIPLE OF C. S. SHERRINGTON AND THE DOMINANCE PRINCIPLE OF A. A. UKHTOMSKIY. Merkulov, V. L., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 77-86.

The scientific path of C. S. Sherrington, the role of his principle of a common pathway in coordination and convergence processes, and his influence on the theoretical ideas of A. A. Ukhtomskiy are discussed from a historical standpoint. Bibliography--5 references.

UDC 612.814

PARABIOSIS, PESSIMUM AND CERTAIN PROBLEMS OF CONTEMPORARY NERVE AND MUSCLE PHYSIOLOGY. Matyushkin, D. P., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 87-99.

Literature data on the increased K^+ concentrations in intercellular spaces of muscles and the brain when they are active are discussed. It is experimentally established that the $[K^+]$ increase in these regions causes a two phase change of the resting potential and the action potential amplitude in deinnervated frog nerve.

Data is presented on the shift E of the reversal potential to the left when the neuromuscular synapse is active. This attests to the accumulation of muscle K^+ (up to 10 mM) in the synaptic cleft. It is shown that the increase of $[K^+]$ in the medium causes a two phase change in the quantal composition of synaptic transmission.

A hypothesis is formulated about a potassium functional inverse relation (FIR) at the synapse. Data is presented which supports the participation of the potassium FIR in the phenomena of postactivational potentials and presynaptic pessimum at the neuromuscular synapse. Hypotheses are proposed about participation of a potassium FIR at neuro-neuronal synapses in the phenomena of conditioning and dominance. Figures 5, bibliography--18 references.

UDC 612.824.1+612.822

THE FUNCTIONAL STATE AND PHYSIOLOGICAL LABILITY OF THE NEURON. Sologub, M. I., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 99-111.

The functional state of a living unit is the qualitatively and quantitatively determined metabolic level, the structural organization, and the excitability at a given moment of time. The physiological lability of a unit, like the rates of elementary reactions which underlie life activity, is a general indicator of the functional state. The physiological lability of a neuron is determined by the rates of system activity which permits the movement of ions during the excitation process, and it can be measured by the first derivative of the intracullular neuron spike. Figures 4, bibliography--27 references.

UDC 612.821.6

ON THE MECHANISM OF THE CLOSING OF TEMPORARY CONNECTIONS IN LIGHT OF THE VVEDENSKIY-UKHTOMSKIY THEORY. Mnukhina, R. S., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 112-126.

In this paper a two phase change of the basic cortical rhythm, evoked potentials and the constant potential of the cortex during the development of a conditioned reflex is shown. When potentials from the deep cortical layers are eliminated a successive migration of local excitation in the spreading closure of temporary connections is shown.

A negative shift of the constant cortical potential appears at the moment a temporary connection is closed and indicates a state of stationary excitation (depolarization). On the cellular level this corresponds to the establishment of polysensory neuron activity which accompanies the increased action potential duration.

When the conditioned reflex is strengthened, a slow positive potential develops in the auditory cortex in response to a conditioned sound stimulus. At the cellular level this corresponds to a transition of the neuron from a bursting mode in the intersignal periods to a mode of single rhythmic discharges during the action of the conditioned stimulus. This indicates a reduction of excitability at the cortical level of the signal analyzer. Figures 6, bibliography--23 references.

UDC 612.743/813

THE AURAL FIELD IN LIGHT OF THE DEVELOPMENT OF A. A. UKHTOMSKIY'S IDEAS ON THE ROLE OF BIOLOGICAL ELECTROMAGNETIC FIELDS. Gulyayev, P. I., Zabotin, V. I., Shlippenbakh, N. Ya., Yegorov, V. N. and Molchanova, O. V., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 127-137.

It is experimentally demonstrated that the bioelectric activity of living tissues is accompanied by constant and varying electric fields in the space around them. These fields are termed aural fields by the authors. They are sources of new physiological information, including information which is largely inaccessible through other methods. Thus the idea of A. A. Ukhtomskiy about the presence of active fields of an electromagnetic nature in the CNS is confirmed.

The results of studies on the fine structure of the field of an isolated nerve are presented. The first aurascopic studies of the parabiotic field of a muscle demarcation potential are published. The task of studying the interaction of biological units by means of the aural field is posed. The theoretical scientific significance of auratronics is discussed. Figures 3, bibliography--21 references.

UDC 591.481.12:591.81.086

MORPHOFUNCTIONAL CHARACTERISTICS OF INTERNEURONAL SYNAPSES. Babmindra, V. P., Mekhanizmy nervnoy deyatel'nosti, Leningrade, Leningrad University, 1977, pp 137-145.

Ultrastructural studies of synapses make it possible to judge their functional characteristics. For synapses with chemical transmission the presence of a 25-30 nm synaptic cleft is characteristics, while electrical synapses are characterized by a reduction of the synaptic cleft to 10 nm or even complete fusion of the presynaptic and postsynaptic membranes. Synapses with spherical vesicles are excitatory, and synapses with flattened vesicles are inhibitory. Synaptic complexes serve as morphological substrates for the convergence or divergence of nerve impulses. Figures 2, bibliography--45 references.

UDC 612.603

THE PRINCIPLE OF DOMINANCE AS A MECHANICSM FOR REALIZATION OF THE NEGENTROPIC INFORMATION VALUE AND TRANSFORM FACTORS IN ONTOGENESIS AND PHYLOGENESIS. Arshavskiy, I. A., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 146-161.

The role of the dominance principle as a physiological mechanism for the integrity of an organism, beginning from the moment of its origin as a zygote is covered. Its role as a mechanism for selecting required information varies in different age periods. The negentropic value of the information results from the fact that in causing adaptive motor activity it becomes a factor in inducing anabolism and increasing the nonequilibrium state of the developing organism.

It is substantiated that the dominance principle in connection with information obtained from the environment is a factor in the decoding of genetic information, i.e. a program of individual development encoded in the genome. Figures 5, bibliography--45 references.

UDC 612.822.3:612.019

INTERCENTRAL AND SYNAPTIC CONNECTIONS IN THE NERVOUS SYSTEM OF INSECTS. Vereshchagin, S. M. and Lapitskiy, V. P., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 162-168.

The nonspecific effects of suprapharyngeal and subpharyngeal ganglia on the excitability of segmental centers were studied in the cockroach Periplaneta americana. It was established that electrical stimulation of

of the head ganglia changes the frequency of the background bioelectric activity and the threshold of evoked neural responses in the metathoracic ganglion. The application of gamma-aminobutyric acid (0.1 M) to the suprapharyngeal and subpharyngeal ganglia was shown to reduce the frequency of the background activity of segmental neurons, probably through the activation of inhibitory structures. Figures 5, bibliography-- 6 references.

UDC 534.88:597.6/599,7:576.12

STAGES OF THE EVOLUTION OF ACOUSTIC LOCALIZATION IN TERRESTRIAL VERTEBRATES. Konstantinov, A. I., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 168-184.

Based on comparison of certain examples of birds and bats possessing sound ranging systems it is proposed that the development of echolocation in terrestrial vertebrates is possible only when they adapt to totally dark caves and undergo a transition to flight in open three dimensional space. The stages of the development and improvement of echolocation for distance orientation are presented.

Based on phylogenetic comparison of echolocation systems in 13 families of bats and the development of this function in ontogenesis it is concluded that the processing of location signals proceeded in the direction of removing secondary harmonic components from the spectrum, increasing the carrier frequency and expanding frequency modulation.

Data is presented on the morphological and functional reorganization of the auditory system of echolocating animals in comparison with others not possessing the ability of distance orientation. In contrast to an opinion stated previously, the hypertrophic development of subcortical auditory centers in echolocating animals is explained not by ultrasound reception as much as by complex system control by an echolocation apparatus. Figures 4, tables 2, bibliography--33 references.

UDC 612.8.015

BASIC REGULATORY MECHANISMS OF BIOCHEMICAL PROCESSES. Prokhorova, M. I., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 185-198.

Recently self regulating systems on the molecular and supramolecular levels have begun to attract attention in neurochemistry. Regulatory enzymes, which as a rule are elaborate multienzyme complexes, have a

special role in these systems. In the presence of regulatory enzymes biological systems acquire the capacity for self assembly and self regulation; thus they automatically maintain a specific rate of the biochemical processes which underlie physiological functions including dominance.

In our work four important regulatory enzymes--pyruvate dehydrogenase, fatty acid synthetase, isocitrate dehydrogenase and glutamate dehydrogenase--and their participation in oxidative and biosynthetic processes occurring in the brain are considered. The role of regulatory enzymes is particularly great in the activity of the nervous system. Consequently, close examination of them in the brain is one of the pressing problems of contemporary neurochemistry. Figures 4, bibliography--32 references.

UDC 15/591.150

REGULATION OF CREATINE KINASE IN ANIMAL CELLS. Dyzlova, S. N., Mekhanizmy nervnoy deyatel'nosti, Leningrad, Leningrad University, 1977, pp 199-211.

By example of the enzymy creatine kinase (ATP:creatine-phosphotransferase: 2.73.2) different mechanisms for the regulation of enzymatic activity are traced both at the genome level and at the level of synthesized enzyme molecules. Data are presented on the qualitative and quantitative changes of enzyme content, the relation between the functional state of the cells and the activity of creatine kinase, and the participation of creatine and hormones (insulin, thyroxin, adrenaline) in the regulation of enzyme activity. The importance of compartmentalization of the enzyme and its substrates for the regulation of activity is shown. The possibility is discussed of enzyme regulation through the interaction of creatine kinase with myosin and participation of the creatline phosphate-creatine kinase system in the regulation of respiration, glycolysis and glycogen synthesis. Figures 7, bibliography--31 references.

9342
CSO: 1840

NEUROPHYSIOLOGIC MECHANISMS OF MEMORY

Moscow NEYROFIZIOLOGICHESKIYE MEKHANIZMY PAMYATI in Russian 1979 signed to press 13 November p 2-4, 165.

[Annotation, introduction and table of contents from book by Tat'yana Nikolayavna Grechenko, Moscow Izdatel'stvo "Nauka", 3300 copies, 165 pages]

[Text] This monograph examines the mechanisms of retrograde amnesia and its relationship to the basic premises of the theory on consolidation of memory tracts. Phenomena, observed in experiments on disturbances in the tracks of short term memory, are analyzed in the book. These experiments focus on the relationship of changes which occur both on the behavioral and neuronal levels.

The book is intended for psychologists and neurophysiologists.

Introduction

Methods of electrophysiologic investigation can be applied successfully to the study of certain questions related to the mechanisms of memory. Current experiments examine how tracks of memory are formed using the positive method. At the onset of training of the experimental animal or individual neuron electrical phenomena are examined to determine how they are related to the formation of memory tracks on the level of changes in the summary activity of the brain, in cohesive discharges and synaptic processes. This analysis is accomplished by means of recording the summary activity of individual brain structures, the electrical activity of one or several neurons using intracellular microelectrodes and the electrical activity of individual neurons using microelectrodes introduced inside the cells. This approach enables scientists to understand how neuronal reaction changes not only in cohesive activity but also in synaptic activity. Utilization of recording the intracellular electrical processes adds to our understanding

of the exact mechanisms for such forms of nervous system plasticity as habituation, facilitation and formation of conditioned responses.

In addition to the positive experimental approach, a negative method was also used to study the mechanisms of memory given disturbances in the tracks--experimental retrograde amnesia. This approach helps to elucidate the conditions necessary for the normal state of memory as well as to understand the causes which lead to its deterioration. Use of experimental retrograde amnesia to analyze the electrophysiological phenomena of memory is applied very cautiously and is virtually limited to recording of experiences which develop on the macrolevel. Although the accumulated experimental data awaits thorough analysis of the phenomena which occur on the level of intracellular processes in individual neurons, we have obtained a clearer representation of the mechanisms involved at the macrolevel. Thus, experiments on the behavioral level showed the erroneous nature of the consolidation hypothesis: the memory tracks, after alteration by the amnesic agent, are retained. The electrophysiologic nature of this phenomenon can be studied at the neuronal level, but data on the functional localization of engrams suggest the existence of neurons which possess a high sensitivity to the effect of the amnesic agents. Study of the electrophysiologic phenomena which develop on the synaptic level elucidates the causes of memory disturbances.

In our study, we proceeded from the following assumption: if the experiments on the behavioral level show reduction of memory tracks after application of the amnesic agent, then one can expect that the cause of retrograde amnesia is a prolonged and stable disturbance of the electrical activity of the nerve elements leading to functional disorganization of the neuronal system. The amnesic agent can cause changes in cohesive generation and synaptic transmissions. Normalization of these processes must lead to reduction in the plasticity of the neurons.

The results of these experiments using the method of experimental retrograde amnesia to study its effect on the behavioral level, on summary electrical brain activity and on the electrical activity of individual neurons will be presented in the following chapters.

Contents

9139
CSO: 1840

ARTIFICIAL SENSE ORGANS

Moscow ISKUSSTVENNYE ORGANY CHUVSTV in Russian signed to press 15 June 79 pp 2-4, 180

[Annotation, foreword, and table of contents from book by S. V. Fomin, Ye. N. Sokolov, and G. G. Vaytkyavichyus, Izdatel'stvo "Nauka", 1979]

[Text] The book describes the construction of artificial human and animal sense organs. The analyzer systems containing a mechanism for increasing differential sensitivity code stimuli by the number of the maximally excited channel. Intensity, light, orientation, tilted line, and velocity and spatial position of objects analyzers are discussed.

The book is intended for neurophysiologists, biophysicists, and specialists designing sensors for robots.

There are 74 illustrations and a bibliography containing 111 references.

Foreword

The book sums up 15 years' work with psychophysical, neurophysiological, and cybernetic methods. The man-neuron-model scheme was used in the research. Study of specific sensory functions at the psychophysical level in experiments with humans was paralleled by animal experiments designed to elucidate the neuronal mechanisms of these functions. The final stage of the research was a model on which rigorous demands were made. The model as a whole reproduced the psychophysical characteristics of the functions under study while each neuron-like element reproduced the characteristics of the corresponding real neuron.

The models were constructed according to the neurophysiologically substantiated principle of coding signals by the number of the channel-detector. This principle assured the coordinated transmission and processing of information in a large number of parallel channels.

Study of specific light, intensity, motion, orientation, and depth analyzers made it possible to formulate general principles for constructing artificial sense organs from neuron-like elements. It is

these general principles for constructing artificial sense organs with characteristics of natural neuronal analyzers which are the main subject of the book.

In realizing the principle of coding by channel number in artificial sensory systems it is necessary to consider the use of the information thus made available for purposes of control. It was concluded from electrophysiological studies in master neurons which coordinate movements by means of their systems of communication with motor neurons that control can be achieved by switching on or off detectors from the master neurons. The results of this analysis were formulated in the description of the conceptual reflex arc.

An aggregate of receptors, primary detectors, and selective secondary detectors forms a neuronal analyzer. This analyzer is a realization of the biological analyzer discovered by I. P. Pavlov. An external signal produces an excitation vector by stimulating independent primary detectors. By acting on the fan of communication vectors that connect the primary detectors to the secondary ones, the excitation vector creates a single peak of excitation on one element of the population of secondary detectors, with the signal coded by the site of the peak of excitation.

It follows from the principle of coding by channel number that many stimuli are reflected on a n-dimensional sphere formed of neurons/detectors. When a signal changes, the peak of excitation reflecting this change shifts over a quasireceptive surface consisting of numerous secondary detectors.

Reflection of a signal on the sphere has led to a new approach in human psychophysics and metrics of perceptive space of a robot. The subjective difference between stimuli in a human being and a robot equipped with neuronal analyzers is measured by a small arc on the circumference of the n-dimensional sphere. This arc connects the points at which the secondary detectors representing the corresponding stimuli are located.

The precision of the work of a human or animal analyzer is increased by the functioning of mechanisms for the adaptation of primary detectors and by lateral inhibition of the analogous primary detectors belonging to different local analyzers. Emphasis on the differences between signals is expressed in successive and simultaneous contrasts. The introduction of adaptation and lateral inhibition in artificial sense organs increases their differential sensitivity and produces in them illusions similar to the illusions of human perception.

Thus, artificial sense organs from neuron-like elements completely duplicate the structure and functions of human sense organs. The general principles followed in constructing artificial sense organs from neuron-like elements may find practical application in two different fields:

(1) the creation of sensory prostheses directly linked to the neuronal structures of the human brain and (2) the design of sense organs for robots possessing elements of an artificial intellect.

Sergey Vasil'yevich Fomin whose ideas underlie this book will unfortunately not see its publication because he died in the final stage of preparation of the manuscript.

Contents

[169-5214]

5214
CSO: 1840

ADAPTIVE BIOCONTROL IN NEUROLOGY

Leningrad ADAPTIVNOYE BIOUPRAVLENIYE V NEVROLOGII in Russian 1978 signed to press 21 June 78 pp 2-8, 134

[Annotation, foreword, introduction, and table of contents from book by N. V. Chernigovskaya, Izdatel'stvo "Nauka", Leningradskoye otdeleniye 2,300 copies, 134 pages]

[Text] The monograph demonstrates the urgency of finding new methods of stimulating the natural reserves of the body, specifically those of the brain. Based on recent published Soviet and foreign data and on her own research, the author examines a new approach in theoretical and practical medicine - adaptive biocontrol or active training of certain physiological systems and functions in diseases of the nervous system. Bibliography--219 references, illustrations--36, tables--2.

Foreword

One of the most important tasks of medicine is undoubtedly to find effective therapies that do not produce side effects and, therefore, to use therapy as close to the physiological as possible. This is the subject of N. V. Chernigovskaya's monograph.

As shown by the results of the author's research, it is possible deliberately to stimulate the structural and functional reserves of the brain in neurological diseases in whose pathogenesis a persistent pathological condition is a major factor. The need for special methods of doing so is largely due to the minimization of the cerebral components of several functional support systems that arises in ontogeny and is followed by the fixation of such minimization in the corresponding matrix of long-term memory. N. V. Chernivogskaya shows that an effective way of utilizing the brain's potential is to restore or develop a learning capacity, that is, to create conditions for overcoming the limitations imposed by the memory matrix and thereby control bodily functions.

The outlook for this approach, as the author rightly emphasizes, is wide and at the same time limited. The limitations are mostly due to the incompleteness of our knowledge of the most effective ways of "intervening in the brain's mechanisms that control the various bodily functions and expecially those which consolidate changes therein, and create and fix a new stable condition.

The author, a highly professional neurologist who works closely with neurophysiologists and engineers, attempts to determine the clinical value of training patients in adaptive biocontrol. It seems to me that she succeeded in her attempt. Based on her own and published data and on studies of healthy and sick persons, N. V. Chernivogskaya advances some ideas on the possible brain mechanisms responsible for the effects of biocontrol. The publication of her monograph will lead to further study of these mechanisms and provide internists with an additional noninvasive therapeutic modality.

Basic science is practical. Development of the theory of bioconetrol will undoubtedly usher in new advances in medicine, pedagogy, and various fields of the physiology and pathology of work.

N. P. Bekhtereva

Introduction

Advances in modern clinical medicine are largely dependent on progress in allied fields of science. For example, virological, immunological, and genetic research has shed new light on the etiology and pathogenesis of certain diseases of the central nervous system. Yet clinical medicine is often helpless in treating many of them and it is in need of new approaches to the therapy and study of the pathogenesis of diseases. Nor are the possibilities of allied disciplines limited. This is particularly true of neurophysiology, a science that is extremely close to clinical neurology. On the other hand, neurologists are becoming increasingly interested in such complex processes as memory, learning, behavior, and adaptation.

Modern technological progress (introduction of new machines and high-speed production) keeps placing new demands on man because of his increasingly stressful way of life. The accelerated pace of life is combined with overstrain - sensory, informational, and mental. Emotions always served as stimulants of muscular activity in the course of evolution. Besides increasing mental stress, our times are also characterized by diminishing motor activity.

The result of all this is a rising incidence of neurological and mental diseases and an impetus to determine and study man's adaptive capacity as well as to find ways of altering it. The control of man's adaptibility is a major aspect of the adaptation problem, one closest to the goals of medical science.

Present-day living conditions (urbanization, isolation from natural influences) place increased demands on man's adaptive mechanisms at the same time that they greatly reduce his adaptive capacity.

Clinical medicine also faces new and urgent tasks with regard to man's adaptation. They arise from the increasing frequency of chronic diseases in general and of neurological diseases in particular. As a result, pharmacotherapy is increasingly resorted to and, what is most important, drugs are used for longer periods of time and frequently in an uncontrolled fashion. Such overuse of drugs clearly requires reasonable correction, especially since the abundance of pharmacological agents leads to attempts at potentially harmful self-treatment.

These considerations make it clear why fundamentally new therapeutic and corrective approaches are needed. They should be based mostly on the vast natural reserves of the body, especially the potential functional capacity of the brain. Adaptive biocontrol is one such approach. It involves the control of individual physiological systems of functions, i.e., it is an unusual form of training.

An important distinctive feature of the training of various somatic and autonomic systems is that it permits the regulation and control of involuntary functions. However, many difficult and thorny questions relating to adaptive control have to be answered. For example, is it a promising approach? The answer will come only after long and persistent study.

It should be borne in mind that the methodological significance of scientific ideas and research methods is determined not only by their nature but also by their timeliness. One thing is clear. Adaptive biocontrol of physiological functions or retraining of pathologically altered functions is a problem that applies equally to human adaptation and to restoration of functions if they are pathologically impaired. Questions of medical and social rehabilitation naturally cannot be regarded apart from the theoretical aspects of adaptation. It is therefore important to note that all these matters are concerns of both theoretical and practical medicine.

Our aim was to draw attention to the research that has been conducted in the field, to show some of the results of using adaptive biocontrol on the basis of our own observations, and to assess its prospects.

Research has been intensively conducted abroad in recent years on what is called "biofeedback-training". There are widely differing appraisals of the approach in physiology and medicine from hailing it as universal and indispensable to totally denying its value. This is partly due to the publicity that surrounded the early research. The method, like any other, clearly has limited possibilities and prospects.

Adaptive biocontrol of physiological functions has different, although interrelated, aspects - clinical, neurophysiological, and psychological. The clinical use of the method is a medical problem that assumes a study of the indications and contraindications for its application to specific nosological entities or syndromes both neuropathological and general somatic in nature.

The neurophysiological approach makes it possible to study the regulatory characteristics of the central nervous system and its pacemaker mechanisms. It also creates the preconditions for research on previously unknown ways of regulating physiological functions. The psychological aspect is related to questions concerning the "conscious" and "unconscious" and it also has implications for deontology. All this calls for steady special and thorough examination, and not only in this monograph.

Our monograph contains information from the literature as well as some data obtained by a group studying the mechanisms of rehabilitation in neurological diseases. The group, a unit of the Institute of Experimental Medicine of the USSR Academy of Medical Sciences, works in an oblast clinical hospital. The monograph presents, in addition, some results of research done by a clinical group of the Laboratory of General Physiology of the I. P. Pavlov Institute of Physiology working in the 7th Hospital for Mental and Neurological Diseases. Data were also provided by N. L. Artemchuk, I. L. Knorozova, S. A. Movsisyants, A. N. Timofeyeva, and A. S. Tsukerman. V. G. Markman, B. P. Rumyantsev, and A. S. Tsukerman assisted in constructing the experimental and therapeutic equipment employed in the work.

A. A. Vereshchagina and I. P. Koptelova did the psychological research. Some of the studies on regulating of the bioelectric activity of the brain (alpha rhythm) in healthy persons were carried out jointly with Dr. S. Potolicchio, a colleague of ours from the United States.

The data were processed by evaluating the means according to the Student-Fisher criterion using regression, correlation, and factorial analyses assisted by Minsk-32 and Dnieper computers.

The computer programs were prepared by staff members of the Laboratory for Processing Biomedical Information, Institute of Experimental Medicine of the USSR Academy of Medical Sciences (director, N. I. Moiseyeva). Some of the work was done in the Interinstitute Biology Computer Center administered by the I. P. Pavlov Institute of Physiology of the USSR Academy of Sciences (chief, Zh. A. Pershin).

In conclusion, I should like to thank N. P. Bekhtereva, academician of the USSR Academy of Medical Sciences and corresponding member of the USSR Academy of Sciences, for recommending to me the subject of this research and for her continuing interest in it.

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PSYCHOLOGY

CLASSIFICATION OF UNCONSCIOUS PHENOMENA, AND THE CATEGORY OF ACTIVITY

Moscow VOPROSY PSIKHOLOGII in Russian No 3, 1980 pp 43-53

[Article by A. G. Asmolov, Faculty of Psychology, Moscow State University]

[Text] Can analysis of the unconscious on the basis of such an important category of Soviet psychology as the category of activity deepen our knowledge about the nature of unconscious phenomena? And is there, in general, a need to involve this category in analysis of the unconscious?

To answer this question let us try to conduct a mental experiment and take a look, through the eyes of the participants at the first symposium on the problem of the unconcious, at the recent symposium dealing with the same problem which convened in Tbilisi. Evidently, H. Munsterberg, T. Ribot, P. Janet and B. Harte would have felt at home at this symposium. As he did in Boston (1910), H. Munsterberg would have divided all of the participants into three groups: the public at large, physicians and psychophysiologists. The representatives of the first group refer to the cosmic unconsciousness and extrasensory communication of consciousnesses. Physicians discuss the problem of the role of the unconscious in pathology of the personality, resorting to different variants of conceptions of dissociation and splitting of the "ego." Physiologists, however, very clearly declare that the unconscious is nothing other than the product of brain activity. The theses of only two theories would have been utterly unexpected for H. Munsterberg. We refer to the set theory of D. N. Uznadze and activity theory of L. S. Vygotskiy, A. N. Leont'yev and A. R. Luriya. The basic novelty consists primarily of the initial premise of these conceptions: in order to study the world of psychic phenomena one must go beyond their confines and find a unit of analysis of the psychic that itself would not belong to the realm of the psychic.

If this condition is not met, we return to the situation at the Boston symposium. The fact of the matter is that to try to comprehend the nature of unconscious phenomena solely on the basis of these phenomena themselves, or on the basis of analysis of physiological mechanisms or subjective conscious phenomena is tantamount to trying to comprehend the nature of cost from analysis of monetary symbols [1]. Of course, one can detect some dynamic forces and impulses that prompt behavior in the nature of an individual. However, as shown by the entire development of general psychological theory of activity, it is only through analysis of the system of activities of an individual that express his life in society that one can discover the meaning of multilevel psychic phenomena. A. N. Leont'yev has expressed this idea with utomost clarity. He writes: "Involvement of living organisms, the system of processes of their organs and their brain in the objective,

objective-discrete world results in the fact that the system of these processes is given a content other than their intrinsic content, a content that belongs to the objective world itself."

"It is the question of this 'gift' that generates the subject of psychological science!" [22, p 13].

By analyzing the unconscious within the context of general psychological theory of activity, it becomes possible to introduce the characteristic of substance of qualitatively different classes of unconscious phenomena, to disclose the function of these phenomena in regulation of activity and to trace their genesis.

In order to single out the bases for classification of unconscious phenomena, let us discuss two principles of theory of activity, the principle of objectivity [related to subject or subjects] and principle of dependence of mental reflection on the place of the reflected object in the structure of activity.

In the precise expression of V. V. Davydov [14], the principle of objectivity is the core of activity theory. Expressly this principle, and the phenomenon of objectivity that is closely linked with it that make it possible to draw a clearcut line between the so-called activity approach and various behavioral approaches that are based on the "stimulus-reaction" scheme or its numerous modifications. The substance of the objectivity principle consists of the fact that "the subject's activity, which is regulated by an image, itself changes into a 'dormant property' of its objective product. Through this objectivization it changes into the ideal extrasensory [supersensory] aspect of the things it does" [14, p 31].

A series of facts was obtained in experimental psychology, mainly in the research of K. Levin and K. Dunker, that graphically illustrate the existence of what we are calling here the phenomenon of objectivity ["predmetnost']. We refer to the "nature of demands" and "functional fixation" of objects phenomena described by K. Levin and K. Dunker. The "nature of demands," like "functional fixation," is referable to the properties of an object given to an object only when it penetrates into an integral system, some phenomenal field.

A team of psychologists headed by A. N. Leont'yev, who worked in Khar'kov in the early 1930's (L. I. Bozhovich, P. Ya. Gal'perin, A. V. Zaporozhets, P. I. Zinchenko and others) encountered analogous facts in their study of the practical intellect. In these studies, among which the work of P. Ya. Gal'perin can be singled out with regard to the aspect we are discussing, which is entitled "Psychological Study of the Tools of Man and Aids of Animals, and Significance Thereof" (1935), it was shown convincingly that it is only by deobjectifying the meaning fixed in a social object into a tool that a child advances from the logic of "manual operations" to the logic of "instrumental [tool] operations."

A. N. Leont'yev and his coworkers, who had an experimental study of the meaning fixed in tools dealt with the same reality as K. Levin and K. Dunker. But, unlike them, the former were able to disclose the actual origin of this reality, of these "systemic traits" of an object [20], and to view it as activity that "settled" on objects in the human world. And this discovery, which subsequently led to the distinction of objectivity as a constitutional feature of activity, is of first and foremost significance to comprehension of one of the classes of unconscious phenomena, the class of supraindividal, supraconscious phenomena.

As for the principle of dependence of psychic reflection on the place of the reflected object in the structure of activity, to disclose its content we must indicate the units that form the structure of activity. The activity of an individual has a level-related hierarchic structure. In this structure, there emerge such units as special activity prompted by a motive (object of a need), action that is controlled by a conscious anticipated goal, operation (mode of performing action) related to conditions of an existing situation and psychophysiological mechanisms, the effectors of actions and operations (A. N. Leont'yev).

In regulation of activity, the function and nature of reflection of some object depend on the place it holds in the structure of activity. For example, it was shown that the nature of remembering depends on the elements of activity (motives, goals or conditions of activity) that are related to the object to be remembered [16,p 28]. If we were to try to classify various unconscious phenomenon on the basis of the psychological structure of activity, they would fall into two classes, the class of unconscious motives and meaningful sets that prompt and stabilize activity as a whole (see [3]) and the class of unconscious forms of reflection, which emerge in the form of goal-oriented and operational sets that regulate the performance of such low-level units of activity as operations.

Thus, it is deemed possible to single out three different classes of unconscious phenomena on the basis of the principles of objectivity and dependence of reflection on the place of the reflected object in the structure of activity: the class of supraindividual supraconscious phenomena; the class of unconscious activity-stimulating elements (unconscious motives and meaning-related sets); the class of unconscious regulators of actions and operations.

We shall try to describe the directions, in which research proceeded on these classes of unconscious phenomena, as well as the main distinctions of each class.

1. Supraindividual Supraconscious Phenomena*

Let us begin with a description of supraindividual supraconscious phenomena since, in the first place, these phenomena have always been covered with the cloud of mystery and served as the grounds for the most curious mythological conjectures; in the second place, it is expressly on the example of these phenomena that the social genesis of the unconscious realm as a whole emerges in relief.

From our point of view, the actual fact of existence of the class of supraindividual supraconscious phenomena emerges in various hypostases in all directions dealing with the problem of transmitting the experience of mankind from generation to generation or the problem of discreteness that intersects it, i.e., the continuity of consciousness (see [26]).

Such concepts as "inborn ideas" (R. Descarte), "archetypes of the collective unconscious" (C. Jung), "the cosmic unconscious" (Sudzuki), "cosmic conscious" (E. Fromm), "the unconscious as the speech of another" (J. Lacan), "collective conceptions" (E. Durheim, L. Levi-Brulle) and "unconcscious structures" (K. Levi-Stross, M. Fuko).

*The conceptions of supraconscious and its role in the creative activity of a scientist are developed in the extensive series of works by M. G. Yaroshevskiy (see, for example, [37]).

But how is one to delve into all these supraindividual, supraconscious structures? What is their origin? In most cases, the answer to these questions is very similar to the story book answer in the "Blue Bird" by Maurice Maeterlinck. In this fairy tale, the good fairy gives children a miraculous diamond. One need only turn this diamond and people begin to see the concealed spirits of things.

As in any real story, there is much truth in this one. The objects of human culture that surround people do indeed have a "spirit" [soul]. And this "spirit" is nothing other than the field of meanings that exist in the form of schemes of action, objectified in the course of activity into work tools, in the form of roles, concepts, rituals, ceremonies, various social symbols and norms. It is only if the child, with the help of an adult, becomes involved in the stream of activities (and not the stream of consciousness!) and assimilates, through the system of activities, the objectified meanings in the human world that it will become a personality. Activity is the diamond which, the child, usually without realizing it at all, turns together with other people in order to see the "spirit" of objects and to acquire his own "spirit."

In other words, there exists objectively a special dimension in the world around man, which is created by the aggregate of human activity, the field of meanings [18]. This field of meanings is found, as noted by A. N. Leont'yev "by the individual as something 'existing outside of him,' something that he perceives and assimilates therefore as that which is contained in his image of the world" [22,p6].

As they organize their activities in accordance with the field of meanings, people thereby continuously confirm the reality of its existence. In order to comprehend the process of assimilating meanings, in Soviet psychology one usually draws upon the conceptions of L. S. Vygotskiy on interiorization [12], on the transition from the interpsychic to the intrapsychic. These conceptions require further development and definition of mechanisms of interiorization and transformations that the learned forms of meanings undergo. But the main idea contained in them, already voiced in 1925, is the idea that the genesis of the individual is referable to the social, it is derived from it and remains as the guide in analysis of development of personality and conscious [13].

Thus, the ideas of stream of consciousness, archetypes of collective unconscious, etc., have a very real ["earthly"] basis. Underlying all these conceptions is the real fact of existence of the supraindividual supraconscious, which has a clearly traceable social genesis and which consists of the field of meanings that is generated by the entire aggregate of mankind's activity.

2. Unconscious Stimuli of Activity (Unconscious Motives and Meaning-Related Sets of the Personality)

The unconscious triggers of personality activity have always been the central subject of investigation in traditional psychoanalysis. They participate in regulation of activity, emerging in the form of meaning-related sets. Without repeating here the conceptions we are developing of the hierarchic level-related nature of sets as mechanisms of stabilization, "cementing" the activity of the personality, let us merely recall that, according to the main structural units of activity, a distinction is made of levels of meaningful, goal-oriented and operational sets, as well as the level of psychophysiological mechanisms of set [3].

According to their function and place in the structure of activity, unconscious stimuli that are studied in psychoanalysis are definitely referable to motives of the personality's activity. For this reason, unlike other unconscious phenomena, one of the main characteristics of these is their dynamism. But dynamism is a purely functional (formal) characteristic of activity stimuli, while actual psychological analysis of these phenomena begins when their essential feature is disclosed, i.e., when they are represented in man's consciousness. As A. N. Leont'yev writes: "their function (the function of motives--A. A.) considered from the aspect of consciousness is that they, so to speak 'assess' the vital significance to the subject of objective circumstances and his actions, they impart a personal meaning to them, which does not directly coincide with their objectively interpreted meaning" [21; 150]. These objective circumstances include the products of socio-historic practice that have been idealized in meanings--modes of action inherent in a given culture, objective values, various roles, etc. They also include the acting subject himself, and primarily the level thereof that I. S. Kon calls the existential "ego."

In the opinion of I. S. Kon, the existential "ego" is a typical example of a deep meaning-related element, which can be examined only by going beyond its boundaries. The "ego" may appear to be something internal to the subject. In reality, it always appears in opposition, "self"--"nonself," it is value and meaning related, and it contains a tendency toward self-realization, a desire for suprasituational activity [19].

The existential "self" [ego] has all the typical features of meaning-related elements. Like other semantic elements, it is embodied in such units of dynamics of activity as persistent dispositions of the personality, semantic sets, which are an expression of the personal meaning in the form of readiness for some activity or other. Just like a thought is effected in a word (L. S. Vygotskiy), so the personal meaning is effected in a semantic [meaning-related] set, which determines the stability of activity, and then, through this activity is objectified in various cultural phenomena [3, 4]. We have devoted here special attention to such a semantic element as the existential "ego," since expressly it is being discussed more and more vigorously in various directions of modern psychoanalysis (see [8]).

Thus, the personal meanings, "the meanings to me" of any event in the world, including one's "ego," is the basic characteristic that constitutes the core of the described class of unconscious phenomena, the class of unconscious motives and semantic [meaning-related] sets (see [3, 8, 36].

The phenomena of this class cannot be transformed under the influence of any unilateral verbal factors. This thesis, which is based on a number of facts obtained in experimental research [23, 29, 30], in turn leads us right up to the distinction of semantic elements that determines the methodological routes for studying them. This distinction is that a change in semantic elements is always mediated by a change in the subject's activity itself [3, 5]. Expressly consideration of this extremely important distinction of semantic elements (systems of personal meanings and semantic sets that express them in activity) enables us to shed some light on some metamorphoses in the development of psychoanalysis, the explanation of which emerges as a sort of verification of the classification that we propose.

In the first place, the ineffectiveness of psychotherapy limited to purely verbal, unilateral elements, i.e., the therapy that S. Freud had so caustically derided

in his work, "On 'Wild' Psychoanalysis" [34],explains the fact that semantic elements are insensitive to verbal influences that are purely informative. We repeat, meanings change only in the course of reorganizing activity, including communication, in which "verbal work" occurs (J. Lacan). It is not by chance, therefore, that Jacques Lacan who coined the slogan "Back to Freud," has something in common in this respect with the founder of psychoanalysis, observing that: "The function of language does not consist of informing, but stimulating. It is expressly the answer of someone else that I seek in speech. It is expressly my question that constitutes me as a subject" (J. Lacan quoted from [2, p 420].* In other words, only activity, including the activity of communication, which expresses some meaning-forming motives and serves as the basis for emotional identification with another [alter] [9] can alter the semantic meanings of the patient.

In the second place, in our opinion, the ineffectiveness of the influence of this type of verbal influences on meanings--effects, which often replace a dialog between the psychoanalyst and patient, should be considered one of the causes of the obviously existing shift from individual methods to group psychotherapy methods, for example, such methods as psychodrama, T groups, etc., in which there is reconstruction, in some way or other, of the activity that ultimately leads to a change in personal meanings and semantic sets that express them in activity.

To sum up the conceptions on the nature of unconscious stimuli of activity and their essence, let us list the main distinctions of semantic elements of the personality: 1) derivation from the system of the subject's activities, his social position; 2) intentionality (orientation on the object of activity; the meaning is always addressed to someone or something, the meaning is always the meaning of something); 3) independence of consciousness (the personal meaning may be recognized by the subject, but awareness per se is not enough to alter the personal meaning); 4) impossibility of embodiment in meanings (L. S. Vygotskiy, M. M. Bakhtin) and of formalization (F. V. Bassin); 5) phenomenologically, the semantic elements are manifested in the form of seemingly chance, unmotivated "deviations" of behavior from the norm for a given situation (for example, slips of the tongue, excessive movements, etc.; see [5]).

3. Unconscious Regulators of Actions and Operations

Many psychologists of the pre-Freudian period concentrated on this class of phenomena. The representatives of psychology of consciousness devoted quite a few pages to colorful descriptions of the transition of states of consciousness from the focus of the conscious to its periphery (W. Wundt, W. James, P. Janet and others).

S. Freud, who did not specially delve into analysis of the essence of these phenomena, characterized them as the preconscious [33].

*Cf. "The very being of man (both external and internal) is the deepest communication. To be is to communicate. To be means to be for another and through him for oneself. Man does not have an internal sovereign territory, he is entirely and always on the boundary, looking within himslef he looks into the eyes of another and with the eyes of another," writes M. I. Bakhtin [10, p 212].

Perhaps one of the first attempts to formulate a general law to which unconscious phenomena of this class applies can be attributed to Claparede. He formulated the law of awareness, which consists of the following: the more we use some action or other, the less aware of it we are. But as soon as an obstacle appears on the way of a customary action and a need for awareness arises, it then becomes the cause of having the action again controlled by consciousness. However, the law of Claparede only describes the phenomenological dynamics of this class of phenomena. To explain the appearance of awareness by the appearance of a need for awareness is tantamount to explaining the origin of bird wings by the appearance of the need to fly [12].

A cardinal step in development of conceptions of the essence of unconscious regulators of activity was made in Soviet psychology. Without presenting here all of the experimental and theoretical research on this layer of the unconscious, let us merely indicate the two directions in which this research proceeded.

In the genetic aspect, the study of the "preconscious" was inseparably linked with analysis of the problem of development of voluntary regulation of higher forms of human behavior.* "The voluntary aspect of any function is always the obverse of its awareness," wrote one of the ideological inspirations and founders of this direction, L. S. Vygotskiy [12]. The question of voluntariness--awareness of behavior--was submitted to in-depth analysis in the well-known works dealing with voluntary and involuntary regulation of activity [16, p 28; 15, p 24; 24].

In the functional aspect, the study of unconscious regulators of activity is directly included in the problem of automation of various forms of external and internal activity. Thus, A. N. Leont'yev analyzed the process of transformation, in the course of learning, of an action directed toward a conscious, foreseeable goal into an operation, the conditions of performance of which are only "presented" to the subject.

Thus, awareness is based on a change in the place of the objective content in the structure of activity, which is the consequence of the process of automation-deautomation of activity.

The solution to this problem proposed by A. N. Leont'yev was developed in some original research of unconscious regulation of thinking activity, in which the cycles of studies by Ya. A. Ponomarev and O. K. Tikhomirov stand out. In the studies of Ya. A. Ponomarev, there is development of the conception of correlation between the direct (conscious) and indirect (unconscious) product of action, shedding light on the mechanisms of solving creative problems, on the nature of intuitive solutions [27]. The work of O. K. Tikhomirov and his colleagues was directed, in particular, toward analysis of the meaning and functions of verbalized (unconscious) elements in the structure of the thinking process [31].

One of the immediate followers of D. N. Uznadze, Z. I. Khodzhava demonstrated in his study of skills [35] that automated forms of behavior are based on the mechanism of unconscious sets, i.e., precisely the sets that stabilize and regulate the deployment of operations [3].

*V. P. Zinchenko makes special mention of the link between voluntary and involuntary forms of behavior with unconscious sets [17].

As for the description of psychophysiological mechanisms that implement actions and operations, the classical studies in this area of automation of movements, conducted by the oustanding Soviet scientist, N. A. Bernshteyn, and first of all his idea that conscious afferentation always occupies the leading level in control of movements, while afferentation of the background, rough levels of movement control is not represented in consciousness [11], have still not been improved upon.

All these studies advanced substantially the conceptions of the nature of unconscious forms of reflection that regulate deployment of actions and operations.

* * *

In conclusion, let us note that our objective was primarily to outline the range of questions that arise when one studies the unconscious within the context of general psychological theory of activity (A. N. Leont'yev) and to demonstrate the explanatory potential of this theory on the basis of the data obtained from analysis of a wide stratum of unconscious phenomena.

The basic principles of activity theory, namely the principle of objectivity and principle of dependence of mental reflection on the place of the reflected object in the structure of activity, which served as our basis for classification of unconscious phenomena, enabled us, in the first place, to single out of the variegated stream of such phenomena three qualitatively different classes (supra-individual supraconscious phenomena, unconscious motives and semantic sets of the personality, unconscious mechanisms of regulation of actions and operations), to designate the genesis and function of phenomena in different classes in a subject's activity; in the second place, they enabled us to outline the problems and directions, in the mainstream of which studies were made of the phenomena of our classes (problem of transmission and assimilation of experience; problem of determination of activity; problems of voluntary regulation of higher forms of behavior and automation of various forms of external and internal activity).

It is necessary to have such a classification because the reduction of all these heterogeneous phenomena to one common denominator, which is encountered in some cases, leads to the loss of their specifics and makes it substantially more difficult to advance along the difficult road of studies thereof. Yet it is only the demonstration of the specifics of these "hidden" plans of consciousness (L. S. Vygotskiy) that will permit discovery of adequate methods of studying them, disclosure of their function in regulation of activity and thereby not only to enlarge upon, but to alter the existing conceptions of activity, consciousness and personality.

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DYNAMIC CHARACTERISTICS OF THE NERVOUS SYSTEM, AND THE QUESTION OF INBORN APTITUDES

Moscow VOPROSY PSIKHOLOGII in Russian No 3, 1980 pp 101-108

[Article by M. K. Akimova, Scientific Research Institute of General and Pedagogic Psychology, USSR Academy of Pedagogic Sciences, Moscow]

[Text] The result or range of possible achievements in any form of activity cannot be absolutely independent of the processual aspect, i.e., the methods, procedures and operations, with which it is achieved.

In studies of manifestations of typological traits, it is usually stressed that people with different nervous system properties can obtain equally high results in most forms of endeavor [6]. The mechanism of this equal achievement is the individual style of performance, i.e., the aggregate of individual procedures developed by man on the basis of his inherent combination of properties of the nervous system in accordance with the objective requirements for the types of activity he performs the most often. We cannot fail to mention that there is some stability to the individual style, in view of the fact that it undergoes formation, and this formation is based on stable properties of the nervous system, as well as conformity with the requirements of the types of activity that a given subject usually performs. Individual style is a phenotypic formation.

But a relatively stable individual style of performance could also lead to dissimilar achievement by people with different combinations of properties of the nervous system in some forms of activity: we cannot rule out the fact that the objective requirements for a specific activity performed at the present time demand a change and, occasionally, radical reorganization of the formed individual work style. Of course, in such cases, some additional effort and much time are needed to master a new form of work. For a certain period (sometimes quite long), work achievement of individuals who are compelled to alter their individual style will be poorer than of those whose typological distinctions and style formed on their basis confirm with the requirements of the new activity.

This is what happened in our experiments (see below) dealing with teaching the tabular method of solving logic problems to individuals with different parameters of strength of the nervous system.

This method makes it possible to solve a rather large class of logic problems without making any mistakes by applying simple rules and procedures [4].

Use of the table method is taught with an aid that provides the algorithm for solving the class of problems put to the subjects [3]. The main stipulations in using the tabular method were as follows: 1) strict adherence to the sequence of solving steps; 2) precise classification of problem conditions; 3) consistent use of each of the problem conditions; 4) successive performance of each stage of the solution.

If we consider that the tabular method implies the mandatory use of a pencil and paper, as well as reducing to a minimum mental operations, it becomes obvious why it is similar to the repeatedly described individual style of mental activity of people with a relatively weak nervous system [9]. Let us recall, that they are characterized by thoroughness of information gathering, tendency to systematize it and consistency in reaching the goal.

For this reason, the process of teaching "weak" subjects was faster and involved fewer difficulties than the instruction of the "strong" ones. The latter had to alter the style of mental work, which they formed mostly in an elemental manner, in which we often observed inconsistency of actions, scattering, uneconomical efforts, inadequate systematization of information and planning of activity. The "strong" ones differed in that they did not have the habit to systematically perform the same operation with regard to all of the problem conditions. They seldom checked their progressive solution, they were more confident in applying rules, which was not always justified. The table method, however, implies the systematic performance of instructions, in strictly the same order of steps, of the "educational aid." The "strong" ones did not do so immediately. The experimenter had to refer them repeatedly to the "educational aid," and insistently ask that they follow it exactly. These distinctive features in their work were the cause of numerous mistakes, dead ends and repeated trials to solve the problems. Moreover, instruction by the tabular method was so difficult for the "strong" subjects that some of them tried to reject it entirely, trying to solve the problems by means of logical reasoning in their head [3].

The other elements of individual style of mental performance of "strong" subjects that we noted were quite stable, causing the process of learning the tabular method to be slow and difficult, as well as inadequate achievement in solving logic problems at the end of the teaching course. Thus, according to the data of our last experiments, 38.3 min was the mean problem-solving time for practice problems in the "weak" group (10 people), versus 124.3 min in a group of the same size of "strong" subjects. This difference is statistically significant at the level of $p<0.01$. The "weak" subjects tried to solve the same practice problem 1.1 times and the "strong" ones 2.1 times.

The mean time taken to solve test problems with the same number of conditions as the practice ones constituted 29.7 min in the "weak" group and 81.7 min in the "strong" one. This difference is also statistically reliable at the level of $p<0.01$. Mean number of trials constituted 1.2 and 1.7, respectively.

Thus, individuals with a relatively weak nervous system had an advantage in solving both practice and test logic problems.

Does this mean that individuals with a relatively strong nervous system have a limited aptitude for solving logic problems?

The question of individual aptitude for achievement can be properly answered only with due consideration of correlations between the genotype and phenotype. Each genotypic trait may present a range of manifestations in the phenotype.

Since performance style is formed and, consequently, is referable to a subject's phenotypic traits, it can be altered, of course within certain limits. In our experiments with logic problems, this was indicated by the unceasing training of "strong" subjects and gradual raising of their results to the level achieved by the "weak" subjects.

Evidently, the prognosis of individual achievements in some form of activity must be favorable on the whole if performance depends on formation of an optimum individual style, rather than the nature of nervous system properties themselves.

It must be noted that an adequate individual style more often equalizes the achievement of subjects in a rather complex activity, which permits full demonstration and development of the innate traits that are favorable for this activity, as well as compensation of unfavorable ones.

Yet, there is no opportunity in some cases for the compensatory role of individual style to manifest itself when performing different simple procedures, operations and practicing simple skills [6]. In such cases, the result is directly related to whether the individual has a trait or combination of traits favorable or unfavorable for a given activity. In other words, the phenotypic traits do not offer unlimited possibilities to meet the requirements of a situation.

Consequently, the level of possible achievement by individuals is limited, in some cases, to the essence of their nervous system properties.

One of the early studies, which demonstrated the limitations of achievement related to properties of the nervous system, was conducted by V. I. Rozhdestvenskaya [13]. She established a correlation between quality of development of a functional mosaic in the auditory analyzer and parameters of strength of the nervous system.

Several works dealt with the influence of strength of the nervous system on performance under extreme conditions [5]. It was found that, in such situations, weakness of nervous processes leads to disorganization of performance, and thus serves as a certain limitation to the possible achievements of "weak" individuals.

In our study, we demonstrated a correlation between quality of formation of a high-speed motor skill and lability of nervous processes in the motor analyzer [1]. The results of the laboratory experiments were confirmed in a study of two types of professional activity (wireless operator and juggler) [2].

It was learned that success in the occupation of juggler, which depends on the degree of development of a speed-related skill, is largely determined by an innate property, lability of the nervous system for excitation. Students at a circus school who had inert nervous process (we refer to low degree of lability) had learned with difficulty to juggle with only 3-4 objects by the end of the first year. Their technique was poor and the objects were often dropped. They passed their year-end exam in juggling with a grade of 3. In spite of their positive

motivation with regard to the occupation of juggler, at the end of the first year all of the "inert" students examined had to choose other circus professions.

At the same time, labile students learned 2-3 times faster than the inert one; by the end of the first year they had learned to juggle 5-7 objects. They performed each exercise in several combinations with high technical skill and for a long time. They received only excellent ratings at the juggling examinations.

It is important to stress that the limitations of achievement that arise at the "fault" of the nervous system property itself, i.e., that ensue from its essence, make it necessary to give a poor rating for a given form of activity to individuals with this property.

In our experiments with logic problems, with the change to problems with a larger volume of information, the advantage of "weak" subjects, which had appeared because of the adequacy of their individual style for the tabular solution method, disappeared. Three of the "weak" subjects were virtually unable to solve the first of the problems with a large volume of base data. Problem solving time in such cases increased radically in most "weak" subjects, as compared to the "strong" ones. Thus, the group of "weak" subjects (10 people) spent a total of 26 experimental days on the last experimental problem of the above-mentioned type, while the "strong" group required only 13 days.

We believe that the drastic decrease in achievement of the "weak" group with the use of the tabular method to solve problems with a large volume of information is attributable to the limited volume of information that these subjects can cope with.

It is important to note that this limitation is attributable to the very essence of a weak nervous system. Apparently, because of the low sensitivity threshold, which is inherent in a weak nervous system, the organism must have some defense mechanisms for its normal vital functions and safety in complex life situations. These mechanisms also include the limitation on volume of information, with which a "weak" individual deals. This is conformed also in the above-mentioned study of V. I. Rozhdestvenskaya [13].

Since the properties of the nervous system are genotypically determined and, consequently, change little, the prognosis of individual achievements by "weak" subjects in solving logic problems with a large volume of information must be poor, unless a methodological procedure is found to overcome this requirement of the nervous system (for example, combining and enlarging information units). In our experiments, the critical volume of information limiting the achievements of "weak" subjects constituted 8 tags.

Thus, there are data that indicate that the quality of performance could depend on individual typological distinctions. This is a dual dependence.

On the one hand, the result of performance could be related to the extent that the individual performance style is consistent with, close to the log, organization and optimum procedures of the performed activity. This form of influence of properties of the nervous system on work achievement is temporary, since the inadequacy of individual style can be overcome. Sooner or later (depending on the objective and subjective conditions of activity), the optimum individual style of performance will be formed.

On the other hand, achievement can be directly related to whether the subject has properties of the nervous system that are favorable or unfavorable for a given activity. The pace, number of stimuli and their strength are the objective conditions whose influence is unsurmountable (until some methodological innovation appears) and strictly individual, depending on the main features of the subject's nervous system.

All of the foregoing must be borne in mind when determining the significance of typological properties of the nervous system for expression and development of abilities.

In Soviet psychology, abilities refer to the individual distinctions of subjects that are related to their achievement in some specific type of activity. Abilities are not only manifested in activity, they are also formed in this activity. In our work, we studied one of the special types of mental abilities [aptitudes], that of solving logic problems.

At the present time, the conception that aptitude is a blend of inborn and acquired elements is widely recognized. Abilities cannot be inborn, but they are based on inborn aptitudes. The following statement of B. M. Teplov is well-known: "We cannot interpret ability ... as the inborn aptitude of the individual.... Only anatomical physiological distinctions can be inborn, i.e., the aptitudes that are the basis for development of abilities, while abilities themselves are always the result of development" [17]. This view on ability has a dual meaning. "To relate.... the problem of abilities to the question of development means to recognize, on the one hand, that abilities cannot be implanted from without, that there must be prerequisites, internal conditions in the individual for their organic growth and, on the other hand, that they are not predetermined, they are not given in ready form, prior to and without any development" [15].

The individual gradations of nervous system properties are referable to the innate aptitudes that determine development of ability. B. M. Teplov called attention to this: "... the general properties of the nervous system are significant, not only to the problem of temperament, but the problem of general ability" [16].

This thesis is proven by the disciples and followers of B. M. Teplov. N. S. Leytes, who singled out activity and self-regulation as the universal conditions of intellectual ability, collected considerable material dealing with their relationship to properties of the nervous system [10]. Thus, it was shown that the individual typological properties are manifested in self-regulation of thinking processes by "mental endurance," "speed and stability of mental work," style of work and recreation, whereas in mental activity they manifest themselves as "ready arousal of mental activity, its intensity and duration" [10].

Researchers, who have rejected after B. M. Teplov the "evaluation approach" to properties of the nervous system, stress that the individual differences they determine deal with the processual-dynamic aspect of human activity [12]. Ability, however, as we know is considered responsible for the achievement of activity, its result.

Yet the implicit rift between processual and result-related aspects of activity contained in this thesis leads to recognition of the fact that the main properties

of the nervous system do not influence the content of ability and level of possible achievements in the relevant forms of activity. And this is fraught with the danger of two types of mistakes.

On the one hand, the innate basis of ability is given such a negligible role that, in essence, it is suggested that it be disregarded. Indeed, if only the processual aspect of activity depends on typological distinctions, but not its success, this implies the influence of innate aptitude of this type only on the process and forms of manifestation of ability, but not its level. Consequently, it remains to concede that determination of the degree of development of ability must be entirely related to the effects of exogenous, environmental factors.

One of the theories that solve the problem of ability, theory of interiorization, maintains that tangible action, being interiorized, determines the composition of a mental action. According to this theory, ontogenetic formation of intellectual ability amounts to "assimilation of historically developed operations" [11]. In this interpretation, typological distinctions occupy a very modest place in development of ability; they only determine the distinctions of the process of formation of some ability. The level of development of an ability is entirely determined by the nature of education and other environmental factors. According to this theory, properly organized education makes it possible to obtain the same high level of development of ability in everyone. Individual differences in achievement ability are an artefact, which is related to flaws in the education process.

S. L. Rubinshteyn, who critized interiorization theory, wrote this about it: "The correct thesis of social determination of human thinking and human abilities is overlapped in interiorization theory by mechanistic interpretation of this social determination, which severs any correlation and mutual determination of the exogenous and endogenous" [15]. It is difficult not to agree with this remark.

A rather sharp turn in the direction of recognizing only the exogenous determination of level of ability is manifested in the conception that denies the existence of innate aptitude; the concept of aptitude in this conception is "merely a logical conjecture ... a verbal cloak for unknown causes" [17].

One of the consequences of underestimation of typological properties as aptitude, psychomorphologism, was described exhaustively by S. L. Rubinshteyn [14]. It "is manifsted in the conception of aptitude, according to which an intrinsic aptitude is made ready for each ability, and it is contained in the fixed distinctions of the morphological structure of the brain, the body's nervous system.... The flaw of the teaching on aptitudes is the projection of abilities that render man fit for a specific type of professional activity in an aptitude and the consequent conception that man is destined to be chained to a specific occupation once and for all by virtue of his innate organization...." [14, pp 290-291].

Some of the statements of V. A. Krutetskiy give us reason to also detect some signs of a psychomorphological point of view in them. Thus, in a study of mathematical aptitude, V. A. Krutetskiy concluded that there are some special, inborn functional properties of the brain in people gifted for mathematics. Here is one of his statements: "The brain of some people is uniquely oriented (tuned in) to singling out of the outside world stimuli of the spatial type, numerical relations and symbols, and to work at an optimum level with expressly such stimuli" [8].

Aside from the fact that recognition of the above functional distinctions of the brain has not yet been proven by anyone, it appears to us that the very hypothesis of existence of such aptitudes is vulnerable from the standpoint of theory of dialectical materialism.

Indeed, in this case the researcher recognizes as a mathematical aptitude the special orientation of mental ability, which V. A. Krutetskiy called mathematical orientation of the mind. The existence of such orientation in some individuals raises no objections per se. We cannot fail to note that V. A. Krutetskiy also submits evidence of the specificity of mathematical abilities: biographical data and statements of gifted mathematicians, results of tests showing lack of coincidence of general mental giftedness and creative mathematical giftedness. However, we cannot accept the existence of such a special orientation of mental ability to be the cause of development of mathematical abilities. It is felt that the specifically mathematical orientation of the mind is not a structural and functional distinction of the brain, but the result of development of mental abilities in a direction that is determined by the conditions and nature of occupation of the individual. It is inconceivable that the orientation of the brain toward singling out mathematical relations and symbols and working with them could appear without having studied mathematics prior to the work with mathematics (be such study unsystematic, elementary, without special training, possibly at an early age). Unquestionably, such an orientation is a phenotypic property, rather than an innate trait referable to "structural and functional distinctions of the brain" [14, p 399]. Perhaps, it is based on some genotypic aptitudes that may have numerous phenotypical manifestations, depending on external conditions, nature of work and the subject's needs. Otherwise, it would be logical to recognize the existence of special linguistic functional distinctions of the brain, or of structural distinctions of the brain that are instrumental in development of ability for natural sciences, etc.

Recognition of such aptitudes does not differ in any way from recognition of the inborn potential of giftedness, "innate inclinations," "innate strength," since they predetermine the content of future abilities without any activity. Thus, in this instance, against the will of the researcher, development of abilities is reduced to deployment of innate potential (true, under specific social conditions), while a secondary role is relegated to the influence of environmental factors.

Thus, underestimation of typological properties that emerge in the role of aptitudes, inadequate interpretation thereof lead to mechanistic understanding of the process of development of abilities, to a rift between endogenous and exogenous phenomena, on the one hand, and recognition of predisposition, existence of innate, genetically set aptitudes, on the other hand.

These mistakes, which perhaps arise against the will of researchers, which are rooted in underestimation of the role of the main properties of the nervous system in development of abilities, can be overcome with a dialectical approach to analysis of the dynamic and result-related aspects of activity.

Let us sum up. At the present time, the thesis is widely recognized that one of the forms of innate aptitudes are the main properties of the nervous system. At the same time, there are data indicating that success of performance may depend on individual typological distinctions of the nervous system. Then we cannot fail to conclude that the quantitative and qualitative aspects of abilities depend on the main properties of the nervous system.

We must stress once more that the question of influence of nervous system properties on achievement of some form of activity, and this means on the level of development of relevant abilities as well, must be settled in accordance with conceptions of genotypic and phenotypic elements of the human mind.

One should refer to the limits of possible achievement with regard to the forms of activity, in which the requirements made of man touch upon the very essence of genotypically determined traits, for example, properties of the nervous system, whatever their phenotypic manifestations. The latter are determined by what geneticists call the norm of genotype reaction, and they are not manifested beyond its boundaries; in other words, they are manifested only within a specific range.

When the results of activity are related solely to phenotypic properties, there are no grounds to conclude that achievements are limited.

The issues discussed here are based thus far on the study of two properties of the nervous system, force and lability of excitation. It is probably time at this stage to turn to the study of other properties of the nervous system in the light of the problems discussed: lability, dynamism, equilibrium. Comprehensive analysis of style formed on the basis of these properties will be required, as well as determination of the limits of possible achievement by individuals related to them.

Unquestionably, these questions are very important for development of ability theory, in particular for differentiation between qualitatively unique types of mental abilities.

If the success of solving specific types of problems is related in some way or other to the individual characteristics of nervous system properties, in other words, if people differ in "ability" to solve different types of problems because of differences in typological distinctions, we are confronted with the problem of psychological classification of types of problems. Such a classification, based on individual typological traits of a subject, will perhaps enable us to analyze some types of mental abilities of individuals. For example, the basis for separating people according to abilities for the precise and humanitarian sciences is still not clear. Is this some sort of preference for a given type of problems that is related to some innate aptitudes [inclinations] of people?

However, all of the foregoing does not minimize in any way the role of other factors in both development of abilities and sucessful achievement in different types of activities. Thus, motives, emotions and some characterological traits of a subject are definitely not indifferent to performance. Moreover, it cannot be believed that the properties of the nervous system exhaust the individual innate aptitudes. Perhaps, there are also other innate distinctions, unknown and unstudied thus far, that determine the individual uniqueness and level of development of abilities.

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DEVICE FOR THE STUDY OF HUMAN BEHAVIOR IN STOCHASTIC MEDIA

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[Article by S. A. Koshman, Institute of Psychology, USSR Academy of Sciences, Moscow]

[Text] In recent years, an important place has been given in psychology to the study of human behavior in stochastic media [probabilistic environments?]. Such studies are being pursued on a particularly wide scale in engineering medical and differential psychology.

In developing experimental models of stochastic media, one generally uses tables of random numbers prepared in advance [2, 3, 9 and others]. The experimental models created in this way are artificial, to some extent, while the sequences of events presented many times are virtually pseudo-random.

Various game machines and roulettes [1, 5 and others] are often used to create a "natural, spontaneous" random sequence.

With these methods of creating random media, it is difficult to make an ongoing evaluation and to process the results of subject achievement, as well as to change the probability of events in the course of the epxeriment. It involves much manual labor and loss of valuable information.

The model we propose is significantly free of these flaws. Being relatively simple and reliable to operate, it permits the creation of various stochastic media of the Bernoulli type with great accuracy and recording the characteristics of prognostic activity dynamically. The device can be assembled from series-produced instruments that are usually available in research laboratories.

The flowchart of a binary variant of a model of a stochastic medium is illustrated in Figure 1. It operates as follows: The subject makes a prediction about the occurrence of a specific event (for example, a light going on or off) and depresses the appropriate button (S_1 or S_2). Depression of the button causes formation of an acute-wave positive pulse that is delivered to the coincidence circuit. In parallel, a continuous sequence of positive square-wave pulses is delivered from a generator to this circuit. If the acute-wave pulse reaches the coincidence circuit concurrently with the square-wave pulse, it passes to a stimulator and causes appearance of the stimulus event. If, however, the acute-wave pulse arrives at the coincidence circuit between square-wave pulses, the stimulator is not triggered.

By smoothly altering the spacing of the square-wave pulses, the experimenter can change the probability of coincidence of acute- and square-wave pulses, i.e., he can alter the probability of triggering the stimulator and, ultimately, the probability of appearance of some stimulus or other (virtually from 0 to 100%). By precalibrating the master clock [generator] (in %), one can present events with the required probability. The frequency of the master clock is set relatively high, for example, 1 kHz, to rule out the possibility of random adjustment to it by the subject.

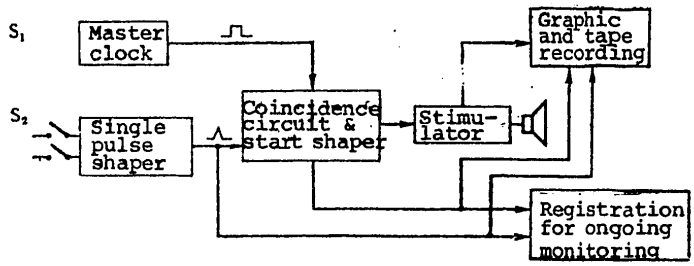

Figure 1. Flowchart of device

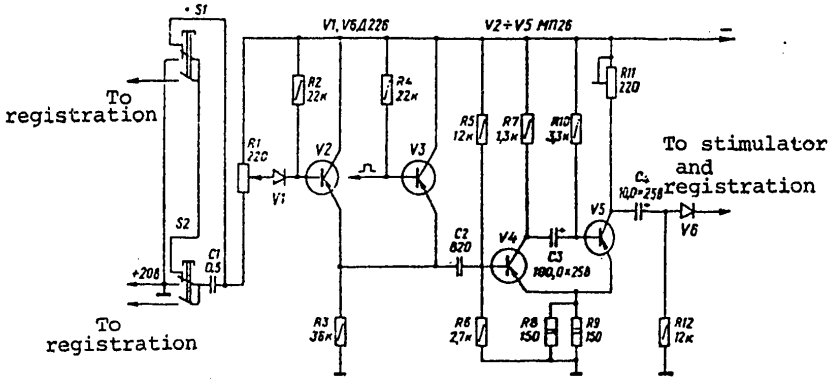

Figure 2. "I" circuit and slave multivibrator

One can use any series-produced low-frequency generator of square-wave pulses, with a wide range of changes in pulse spacing, as the master generator. One can also use electrostimulators of the ESU-1, ESU-2, etc., types.

Chain C R (Figure 2) is the single-pulse shaper. The well-known "I" (V_2, V_3) circuit was used as the coincidence circuit. The stimulator is actuated by the slave multivibrator (V_4, V_5), which is also the adjustable delay line (by altering C_3, R_7, R_{11}, if the experiment requires a spread in time of making the prediction and appearance of event).

Tape recorders or automatic tracing devices (N3020-3, SDR-41, and others) can be used as recorders, and they permit numerous reproductions of experimental results.

Electric digital instruments of the ChZ-33, ChZ-35, F-480 and others can be used for visual monitoring and preliminary evaluation of the results of predicting; they can be used to fix the frequency rate of predictions, confirmation or nonconfirmation thereof, and to measure the time taken to make the prediction and for it to occur. The digital output of these instruments makes it possible to feed the data into a computer for further processing.

The output signals of the device can be used to start instruments that record evoked potentials and other bioelectrical characteristics of subjects.

If necessary, one can increase the number of alternative stimuli presented to the subject by using several master clocks and adding the appropriate number of coincidence circuits.

As shown by the use of this device in the laboratory of differential psychology imeni V. D. Nebylitsyn at the Institute of Psychology, USSR Academy of Sciences, the probability of events set by the experimenter is established already after 100-150 tests with a 1-2% error factor. Some of the results obtained with the use of the proposed device have already been published [1, 6, 7, 8].

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EXPERIMENTAL AUTOMATED SYSTEM FOR MEDICOPSYCHOLOGICAL EXAMINATIONS

Moscow VOPROSY PSIKHOLOGII in Russian No 3, 1980 pp 145-148

[Article by A. M. Zhdanov, V. P. Zaytsev, M. M. El'yanov, A. M. Kireyev and V. S. Shirokov, Moscow]

[Text] Psychological questionnaires are finding increasing applications in medicine for the study of the role of psychological factors in the etiology and pathogenesis of different diseases, to assess the efficacy of medical intervention, as well as to settle questions of expert determination of work fitness and employment of patients.

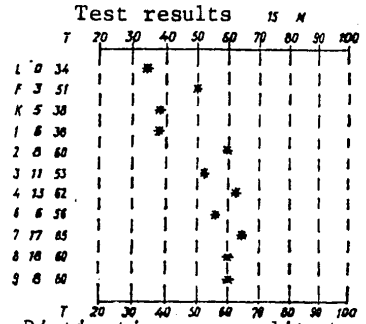
However, the introduction of psychological questionnaires into medical science, especially public health practice, is significantly delayed by the labor-consuming process of examining a patient. Thus, the experience of the laboratory of clinical psychology, Institute of Cardiology imeni A. L. Myasnikov at the All-Union Cardiological Center of the USSR Academy of Medical Sciences, indicates that two laboratory technicians and a psychologist can test about 15 patients in a 7-h work day using the MMPI questionnaire. Such a large amount of labor does not permit mass scale psychological surveys of the public within the scope of practical public health.

The process of psychological testing with the use of questionnaires can be divided into the following stages: a) registration and patient instruction; b) presentation of questions to patient; c) collecting and recording answers to questions; d) processing base data; e) submitting results to psychologists; f) analysis of the results by the psychologist, his talk with patient and conclusion. The problem is to automate the main stages of the survey as much as possible, in order to increase the labor productivity of medical personnel. Although the possibility of partial automation was demonstrated in a number of works [2, 3, 4, 6, 8], the proposed systems did not find wide use in Soviet public health.

In this article, we describe an experimental system that we developed, which permits automation of the main stages of a medicopsychological survey with the use of questionnaires and provides for evaluation of a patient's condition on the basis of the complete multifactor questionnaire for examining the personality, as well as its abbreviated variant.

The Russian modified variant of the multifactor questionnaire (Minnesota Multiphasic Personality Inventory--MMPI) proposed by F. B. Berezin et al. [1], consists of 384 statements. The abbreviated multiphasic personality inventory (SMOL) containing

71 statements was developed by V. P. Zaytsev. This method is an adapted and restandardized variant of the Mini-Mult test, which is a derivative of the MMPI test. In the system, there is automation of the following main stages of the psychological survey: a) presentation of instructions and statements to subject; b) input in a computer of answers to the statements; c) processing of initial data; d) print-out of test results submitted to psychologist for his conclusion.



Distinctive personality traits

The hardware or set of equipment (KTS) of the system was developed on the basis of series produced equipment. The KTS has an ASVT M-6000 control computer complex, complex No 3 [9], with which three Ekzamenator [Examiner] type checking and teaching instruments are directly joined [5].

There is a 16-bit sensor [7] assembled in each Ekzamenator instrument, the outputs of which are connected by a cable to the corresponding inputs of the modified module for input of discrete information. The following data are received from the sensor output:

Instrument number code -- 3 bits
Frame number code -- 7 bits
Answer code -- 5 bits

Input of base data in the control computer complex which correspond to the subject's answers is performed on a real time scale. There is a trigger in the module for input of discrete information which implements operation of the system, with interruption of the program and synchronization of signal read-out from the sensor.

The statements contained in the questionnaire, as well as instructions to the subject for working with the questionnaire are printed on special cards [5], which are photographed on 36-mm film, on frames 12×22 mm in size. One can load the Ekzamenator with film 1000 frames long.

The frames projected on the dull, semitransparent screen of the instruments are at least 120×215 mm in size.

There are five buttons on the front panel of the instrument. When working on the SMOL and MMPI tests, the subject uses only two buttons, marked "true" and "false."

The hardware of the system and operating personnel are situated in two rooms. In one room is the control computer complex, ASVT M-6000, and operator, and in the other are the Ekzamenator instruments and laboratory technician who registers the subjects and organizes the test. The medicopsychological examination of patients is conducted as follows.

The technician asks three subjects to come in the room, shows them their places at a table, on which there is an Ekzamenator instrument, presets the code (for which purpose he uses all five buttons on the front of the instrument), inputs the serial number of the subject and sex in the control computer complex. He then

sets a frame for each patient with instructions on how to conduct the test. If the subject has any questions while reading the instructions, the technician helps clarify them. If the subject understands everything, a frame is projected to him with the text of the statement, to which he responds by depressing the proper button, "true" if he agrees with the statement and "false" if he disagrees with it. After this, there is automatic presentation of the frame with the next statement. The following is printed on the last frame: "Thank you. You have completed the answers, please tell the technician about this."

Then automatic processing of initial data begins, and the print-out of the results for the psychologist.

The chart of the medicopsychological examination is printed on a printing device with the Consul-260 keyboard of the ASVT M-6000 control computer complex. When several people are tested at the same time, a precedence [queue] for print-out is formed as the reports are received that the tests on the Ekzamenator instruments are finished. The request for print-out of a result that is first in line is serviced first and then removed from the line. If the line is not exhausted, the next request is serviced, etc. Input of data is combined in time with processing of data and print-out of examination chart.

The mean time required for patients to answer questions in the SMOL and MMPI tests constitutes 10-12 and 50-60 min, respectively. The algorithms for doing the SMOL and MMPI tests for clinicopsychological survey of patients are essentially the same. For this reason, all of the following concerning processing of base data and printing out the results applies equally to both tests.

Processing of base data consists of the following. The set of test statements is divided in advance into intersecting subsets (scales), each of which is related to a specific variable of the personality. Each personality variable is expressed by the sum of numbers of significant [meaningful] responses in the corresponding subset, i.e., the primary result is submitted as follows:

$$y_i = \sum_{j=1}^{n} x_j, \tag{1}$$

where $x_j = 1$ if the answer to question j is considered significant for the ith scale. So-called "raw scores" are computed in this manner.

Then the obtained figures are adjusted, depending on the value of scale K, known in advance, which is intended for making a correction for excessive reserve of subjects.

To assess the primary results obtained, one uses the mean value and standard deviation of the personality variable obtained for each scale in a given population. This evaluation is made in T points [1], using the following formula:

$$T_i = 50 + \frac{10_i Y - M_i}{\sigma_i} \tag{2}$$

where Y_i is the primary result (raw score) obtained in this test, M_i and σ_i are the mean and standard deviation of personality variable on the ith scale of the representative population sample.

Since the doubled standard deviation limits the tested set with 95% probability, a score of 70 on the scale can be virtually considered the top range of normal fluctuations [1].

To calculate T it is more convenient to use a transformed version of equation (2):

$$Ti - a_i Y_i + b_i \qquad (3)$$

where $a_i = 10/\sigma_i$ and $b_i = 50 - 10\ M_i/\sigma_i$ are precalculated coefficients that are constant for the i scale; Y_i, M_i and σ_i are the primary result, mean and standard deviation of the primary result, respectively, for the ith scale.

It must be borne in mind that M_i and σ_i, and consequently a_i and b_i are different for men and woman; therefore, the sex of the subject must be taken into consideration when processing base data.

The data are then automatically analyzed and interpreted using a solution rule that we evolved by the heuristic method. According to this rule, four classes of psychological states of subjects are determined for the SMOL and MMPI tests: I--stable resistant to psychotraumatic factors; II--norm, without any distinctions; III--distinctive personality traits present; IV--deviations present that require more definition.

This classification is the goal of preliminary screening of individuals who require additional examination using other tests and a more detailed examination by a specialist.

The test results are printed out for submittal to the psychologist in the following form: 1) subject's identification number; 2) sex of the subject; 3) primary result; 4) result in T points; 6) result of automatic classification (see Figure).*

Printing the chart does not take more than 2 min. The print-out is small and convenient to file.

Automation of the examination using this device makes it possible to reduce testing time and number of mistakes made by the patient in filling out questionnaires, in addition to the drastic reduction in time required to process the data (by more than a factor of 10). It precludes mistakes by the technician in processing the results, simplifies training of intermediate-level personnel for conducting this examination.

The design of the ASVT M-6000 control computer complex makes it possible to expand the system's capability by increasing the number of Ekzamenator instruments connected into the system, by adding an SID-1000 (display) indicator station and bulk [auxiliary] storage files on magnetic disks and magnetic tape.

*Translator's note: item 5) omitted from this series in source.

The throughput of the system increases with increase in number of Ekzamenators added. But one must take into consideration the specifications of the devices, the modules of the ASVT M-6000 control computer complex, which could limit the carrying capacity of the system. For example, the time required for the SMOL test is 10-12 min, and print-out of the examination chart by the keyboard printer takes almost 2 min. Consequently, the throughput of the system cannot exceed 30 people per hour. In this case, no more than five Ekzamenators can be connected to the ASVT M-6000. When developing a system with a carrying capacity of more than 30 people per hour, one must make use of a high-speed printer, or else use several keyboard-equipped printers in the system.

The presence of bulk storage on magnetic disks and tape within the ASVT M-6000 control computer complex makes it possible to form data banks. In this case, it would be possible to store and make use of file data on psychological tests, for example, to automate the process of dynamic observation of patients, process the results of patient examinations for research purposes, etc. The testing results can be submitted on the SID-1000 data display station, which is contained in the ASVT M-6000, to the psychologist, who can analyze them, enter additionally the findings of clinical examination of the patient and conclusion, as well as to give the instruction to store and (or) print the results of the examination. In this case, the psychological examination chart with the psychologist's conclusion is stored and (or) printed.

At the present time, several ASVT M-6000 control computer complexes are being put in service to perform the above-described operations, and the appropriate software, information and organizational back-up are being developed.

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SYSTEMS ASPECTS OF BEHAVIORAL NEUROPHYSIOLGY

Moscow SISTEMNYYE ASPEKTY NEYROFIZIOLOGII POVEDENIYA in Russian 1979
signed to press 21 Nov 79 pp 2-4, 301

[Annotation, preface and table of contents from book edited by Professor K. V. Sudakov, Nauka, 2,850 copies, 303 pages]

[Text] The book includes works by colleagues of the laboratory of training neurophysiology in the Institute of Psychology of the USSR Academy of Sciences. From the position of Academician P. K. Anokhin's theory of the functional system, they study experimental data from an investigation of the neurophysiological mechanisms of purposeful behavior. It is shown that the activity of different cerebral regions in integral behavior is purposeful and is determined by a number of factors that influence the formation of the goal of behavior.

Preface

The problem of purposeful behavior is the leading in modern physiology and psychology. In the course of many years it has been productively developed on the basis of the classic reflex theory. In recent years, however, new trends have been outlined in the study of mechanisms for purposeful behavior.

The systems approach is beginning to be introduced more and more actively in the behavioral physiology of living creatures. In the generally accepted concept it designates consideration of numerous physiological parameters in the activity of living creatures during their completion of purposeful behavioral acts. Here, in addition to muscular activity, consideration is made of different autonomic manifestations: respiration, cardiac and vascular activity, secretion of different glands, electrical and chemical activity of cerebral structures, composition of blood, etc.

The theory of functional systems that was proposed in our country by Academician P. K. Anokhin, has a qualitative difference from the systems approach.

The functional systems, as P. K. Anokhin indicated many times, represent dynamic, self-regulating organizations, all of whose components mutually further the attainment of various useful results that are adaptive for the organism.

From the viewpoint of the theory of functional systems, each purposeful behavioral act is an active link in a certain functional system that guarantees satisfaction of a certain biological or social need of animals and man.

From these positions, any purposeful activity of man serves the satisfaction of his social needs in the acquisition of knowledge, occupational habits to attain different production results, etc. From here it becomes understandable why it is necessary to study different manifestations of purposeful activity of living creatures not as an individual phenomenon, but in integral self-regulating functional systems of the organism.

One should focus attention on another feature of the approach to purposeful activity based on the theory of functional systems. As P. K. Anokhin wrote, living creatures have been "inscribed" into the continuum of spatial-temporal relationships of their surrounding world. Here they have been "inscribed" actively, affecting the environment for the purpose of satisfying their needs. Thus, in the continuum of behavioral activity of living creatures we have the possibility of isolating discrete systems "quanta" of behavior.

Each such "quantum" of behavior from the systems positions includes the emergence of a biological or social need, formation on its basis of a dominant motivation, purposeful activity to satisfy the given need, attainment of the intermediate and final results that satisfy the need, and their evaluation by means of reverse afferentation.

Individual behavioral "quanta" in turn, are determined by the systems organization of the cerebral processes, which, as P. K. Anokhin indicated, include the successive stages of afferent synthesis, decision making, formation of an acceptor for the action result, efferent synthesis that determines the purposeful behavioral act, and finally, the stage of comparison of the reverse afferentation going from different parameters of the attained result, with the action acceptor.

This monograph, written by a group of colleagues from the laboratory of training neurophysiology in the Institute of Psychology of the USSR Academy of Sciences headed by the pupil of P. K. Anokhin, V. B. Shvyrkov, discloses different aspects of neuronal participation of various cerebral structures in the implementation of individual "quanta" of food-procurement and defense behavior.

The authors convincingly demonstrate that the theory of functional systems is a productive methodological principle that makes it possible to set up and solve specific experimental tasks in a broad range of problems of behavioral physiology.

The original systems approach of the monograph authors to the problem of purposeful behavior, in our opinion, is very promising. It forces us to glance at many previously established facts from basically new positions.

The reader will be able to find in the book, in addition to interesting factual material, a number of new hypothetical concepts.

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EMOTIONAL MEMORY, ITS MECHANISMS

Moscow EMOTSIONAL'NAYA PAMYAT' I YEYE MEKHANIZMY in Russian 1980 signed to press 2 Jul 80 pp 2-4, 180-181

[Annotation, foreword by Academician M.N. Livanov and table of contents from book by Ye.A. Gromova, Nauka, 180 pages]

[Text] The book generalizes data in the literature and the results of experimental researches by the author and her colleagues in the analysis of the functional connections of emotions and memory. The newest materials are presented on the neurophysiological and neurochemical bases of emotional memory. The role of monoaminergic systems of the brain are examined in mechanisms of memory, emotions and attention. The importance of emotional memory in complex forms of animal and human behavior is shown. The significance of its disorders in pathology is revealed. An experimental basis is provided of the possibilities of directed influences on emotional memory through the metabolism of biogenic amines.

The monograph is intended for a wide range of specialists--physiologists, psychologists, biochemists, clinicists and other researchers interested in the problems of memory.

Foreword

In the ideas developed by us of memory as a system phenomenon, important significance is attached to the study of metabolic bases of adjustment [sonastroyka] of neuron activity occurring in the process of fixation of information. The proferred monograph of Ye.A. Gromova deals with the study of neurochemical mechanisms of the memory, in particular one of its forms--emotional memory, which undoubtedly plays an important role in the forming of personality traits of the individual. From this the pertinence of the theme of the given monograph clearly emerges.

The main direction of these studies generated in the Department of Problems of Memory of the Institute of Biological Physics of the USSR Academy of Sciences is the investigation of the role of biogenic amines in memory

mechanisms. In this connection the main attention is devoted to an analysis of the role of serotonin and noradrenergic compounds in neurochemical and neurophysiological mechanisms of the functional connection of emotions and memory (Chapters V and VI).

The author has obtained original data in this field which together with those available in the literature permit speaking of reciprocation of the functional interrelations of serotonin and catecheloaminergic systems of the brain and their connections with the emotional reactivity of the organism and of the leading significance of these systems in the mechanisms of emotional memory.

This direction is being intensively developed in the laboratories of the whole world, but the subject of investigation is so complex that, despite the large number of works, no bases exist so far for speaking of concrete mechanisms of coding information. Nonetheless investigations of the neurochemical mechanisms of the memory should be welcomed, especially if one considers that they provide a perspective of directed influences on the memory with the help of pharmacological agents connected with the metabolism of biogenic amines.

The monograph reflects contemporary ideas of the structural-functional organization of memory (Chapter I), the neurophysiological bases of emotions (Chapter II) and the role of attention in memory mechanisms (Chapter III).

Everything described above makes it possible to believe that Ye.A. Gromova's monograph would be of interest for neurophysiologists, psychologists and clinicists and of use for the development of our knowledge of memory mechanisms.

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SYMPOSIUM ON PSYCHOLOGICAL ASPECTS OF SPEECH SUMMARIZED

Leningrad RECH', EMOTSII I LICHNOST' (Speech, Emotions, and Personality) in Russian 1978 pp 2, 195-197

[Annotation and Table of Contents from book edited by V. I. Galunov and E. M. Kazakova, USSR Academy of Sciences Scientific Council for Integrated Problems in Human and Animal Physiology, and the Combined Scientific Council for the Integrated Problem "Physical and Technical Acoustics"]

[Text] This collection contains summaries of reports and communications delivered at the All-Union Symposium "Speech, Emotions, and Personality" held in Leningrad in February 1978. The symposium was convened on the initiative of the speech sections of the USSR Academy of Sciences Scientific Council for Integrated Problems in Human and Animal Physiology and the USSR Academy of Sciences Scientific Council for the Integrated Problem "Physical and Technical Acoustics." Convocation of the symposium was elicited by growth in interest in problems associated with analyzing variability of spoken communications, arising in response to individual features of the speaker and changes in his emotional state.

Reports associated with the following directions were discussed at the symposium:

dependence of speech characteristics on the personality traits of the speaker;

dependence of verbal manifestations of emotions upon the personality characteristics of the speaker;

modeling emotional and individual variability of speech.

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PSYCHOLOGY OF THE PERSONALITY AND HIGHER NERVOUS ACTIVITY (PSYCHOPHYSIOLOGICAL ESSAYS)

Leningrad PSIKHOLOGIYA LICHNOSTI I VYSSHAYA NERVNAYA DEYATEL'NOST' (PSIKHOFIZIOLOGICHESKIYE OCHERKI) in Russian 1980 signed to press 24 Jan 80 pp 2-10, 197-198

[Annotation, foreword (by B. F. Sergeyev, editor in chief) and table of contents from book by Viktorin Sergeyevich Deryabin, Izdatel'stvo "Nauka", 7700 copies, 199 pages]

[Text] This scientific work is a publication of the scientific legacy of a prominent physiologist and psychiatrist. The monograph consists of three sections, to which the author gave the following titles: "On Consciousness," "On the Ego" and "On Happiness." In the section "On Consciousness," the problem of consciousness is discussed in two aspects: content of consciousness (social aspect) and its material substrate (psychophysiological aspect). In the section entitled "On the Ego," the author examines the ego as a subjective reflection of functional unity on the level of the cerebral cortex of affectiveness, intellect and activity. "On Happiness" deals with psychophysiological analysis of the experience of happiness from the standpoint of psychology, physiology of higher nervous activity and psychopathology; it also discusses in detail the social aspect of the question. These sections of the monograph cover both content dealing with pressing problems of modern psychology and common nature of examination from the standpoint of dialectical materialism and psychophysiological unit. The routes are outlined for development of problems of "structure of personality," "role of feelings and emotions and motivation of the personality" and others, with due consideration of specific psychophysiological mechanisms. Bibliography lists 207 items.

Foreword

The book offered to the reader is a continuation of publication of the scientific legacy of Prof V. S. Deryabin, the prominent Soviet physiologist and psychiatrist. The first part of this legacy, "Feelings, Attractions and Emotions" was prepared for publication and published by Nauka Publishing House in 1973. This book contains several quite independent, but closely interrelated psychophysiological essays: "On Consciousness," "On the Ego" and "On Happiness."

These essays, which were written as complete and independent works, were not published while the author was alive; however, the manuscripts were found to be rather well prepared for publication, so that only insignificant stylistic corrections were made in editing them. Put together, they are perceived as a whole work dealing with problems of paramount importance in the area of psychology of personality. Since consciousness, self-awareness and other problems of psychology of personality are discussed by the author from the standpoint of psychophysiology in the light of the patterns of higher nervous activity, when the book was published it was given the title of "Psychology of the Personality and Higher Nervous Activity."

Viktorin Sergeyevich Deryabin developed interest in psychophysiological problems throughout his long life (1875-1955). Viktorin Sergeyevich wrote as follows in a letter to his grandson about what prompted him to study these problems: "I once believed that man is a rational being, endowed with free will, but when the lives of many people in different situations passed before me I realized that this is not so simple, that in essence I do not know what man is.... Man knows himself with regard to his feelings, wishes, hopes, fears, sympathies and antipathies, his thoughts and intentions, but he does not know how and why they appear, he does not know their material physiological determination. Many self-delusions, illusions and confusion ensue from this ignorance, which man does not suspect. He very often does not realize that feelings, desires, egotism, ambition, etc., rule over his reason. When I realized this, I was faced with the question: what is man with his 'free will' and deeds? So I became a psychiatrist, studied psychology and physiology of the central nervous system, and this determined the orientation of all my work, it became a vital cause. 'Science of man' [anthropology?]--comprehension of man and, consequently, of oneself can now be based on scientific data, although there are some fragments of knowledge that have not yet been joined into one. I have tried to systematize the facts, at least in part, in my works: 'Feelings, Attractions and Emotions,' 'On the Ego,' 'On Consciousness,' 'On pride' and 'On Happiness.' "

Biographic data about the scientific endeavors of V. S. Deryabin are contained in the book by D. G. Kvasov and A. K. Fedorova-Grot, "The Physiological School of I. P. Pavlov" (Leningrad, "Nauka," 1967) and in the foreword to his book entitled "Feelings, Attractions and Emotions" (Leningrad, "Nauka," 1974). This enables us to merely recall briefly the landmarks that determined the range of scientific interests of V. S. Deryabin. Having been expelled from two universities in Russia--Moscow and Yur'yev universities--for his active participation in the revolutionary student movement, he was compelled to leave for Germany in 1906 to complete his medical education. While studying on the medical faculty of the University of Munich, V. S. Deryabin listened with fascination to the lectures of the great psychiatrist, E. Kraepelin. It is precisely during this period that he developed a profound interest in man's mental life, which determined his subsequent choice of psychiatry as a specialty. The important stages

in the scientific life of V. S. Deryabin are referable to the periods of work under the guidance of I. P. Pavlov in his laboratories at the Military Medical Academy and Institute of Experimental Medicine in 1912-1914 and 1933-1936. This work was not only an excellent education in physiological experimentation, but determined his interest in physiology as an objective scientific method of studying mental phenomena.

The many years that V. S. Deryabin worked as a psychiatrist, in particular his research on psychopathological changes associated with epidemic encephalitis (1926, 1928) and syphilis (1934), strengthened his conviction of material determination of mental phenomena. However, the state of psychiatry at that time was most unsatisfactory to V. S. Deryabin. In an autobiographical note he writes about this as follows: "While working in psychiatry, I arrived at the conclusion that psychiatry, being governed by the clinical psychological method of investigation, entered a blind alley after establishing the main nosological entities, that only materialistic investigation and, first of all, physiology and pathophysiology of the nervous system could shed light on the pathological essence of mental diseases" (Kvasov, Fedorova-Grot, 1967, p 98). This prompted V. S. Deryabin to leave the chair of psychiatry at the East Siberian Medical Institute in Irkutsk, where he was a professor, in 1933, and to turn to work in the field of physiology. If we consider that V. S. Deryabin was 58 years old at that time, this action is indicative of the great courage and purposefulness of this scientist. Starting in December 1933, V. S. Deryabin worked as a first-category scientist at the VIEM [All-Union Institute of Experimental Medicine imeni Gor'kiy] in the department of special and evolutionary physiology under the guidance of Academician L. A. Orbeli, which definitely determined his desire to consider the functions of the human body in the aspect of their inception and development.

V. S. Deryabin accomplished his main physiological work in the last 20 years of his life, and it dealt chiefly with experimental development of problems of higher nervous activity confronting psychiatry. This refers to his work on the effect of injury to the thalamus and hypothalamic region on higher nervous activity (1946), and his study of the mechanisms of bulbocapninic catatonia in dogs (1947a-1947d, 1951b). During the same period, V. S. Deryabin also wrote a number of psychophysiological works. He had prepared the first version of his monograph, "Feelings, Attractions and Emotions," over which he worked to the end of his life, as far back as 1927-1928. Thus, V. S. Deryabin was a pioneer in the study of emotions in our country. In 1944, his article entitled "Emotions as a Source of Strength" was published. Later on, he published articles entitled "On the Routes of Development of the Teaching of I. P. Pavlov Concerning Higher Nervous Activity" (1951a) and "Affectiveness and Patterns of Higher Nervous Activity" (1951c), in which he again drew the attention of researchers to the study of feelings, attractions and emotions as important elements of higher nervous activity. It is a great credit to V. S. Deryabin that he developed the known conceptions of affectiveness into an original teaching on its role in mental activity and evolution of

affectiveness. These views are expounded in his book, "Feelings, Attractions and Emotions" (1974) and in this monograph, in the sections entitled "On the Ego" and "On Happiness."

The long-standing interest of V. S. Deryabin in psychophysiology is attested to by his published works: "On the History of Psychology" (1925), "Patterns of Mental Phenomena" (1927) and "The Spirit and the Brain" (1940). However, the principal works of V. S. Deryabin dealing with the psychophysiological problem were not published entirely. In 1933, V. S. Deryabin began to work on his monograph, "On Happiness," which he revised in the postwar years. The essays entitled "On Consciousness" and "On the Ego" were written in 1946-1947, and he also worked on them in subsequent years.

We must mention an important distinction that left an imprint on the content of all of the psychophysiological works of V. S. Deryabin: his profound adherence to the ideas of dialectical and historical materialism. Interpretation of materialistic dialectics as a science dealing with the interrelation and mutual determination of phenomena was reflected in his synthetic approach to issues that make up the content of the book being offered to the reader. It is only through the channel of Marxist-Leninist methodology that it was found possible to come close to solving problems of psychology of the personality. At the present time this has been recognized rather broadly. It is not in vain that the opinion is being voiced in the West, more and more often, that dialectical materialism is the only alternative to methodological and theoretical conceptions of modern bourgeois psychology.

Representatives of different specialties--psychologists, sociologists, philosophers, pedagogues, psychiatrists, etc.--are focusing on questions of psychology of the personality, in particular, consciousness and self-awareness. But they were studied to a much lesser extent with consideration of psychophysiological mechanisms. Yet a profound enough interpretation can only be obtained with integration of biological, psychological and social elements of these problems. And one should not forget the fact that the most complex mental phenomena (including socially determined ones) are psychophysiological processes with respect to the mechanisms of their occurrence in the brain. This was repeatedly indicated by the leading figures in Russian physiology, I. M. Sechenov and I. P. Pavlov. In his famous work, "Materialism and Empiriocriticism," V. I. Lenin stressed that "sensation, thought and consciousness constitute the supreme product of matter that is organized in a special way." For this reason, we find the author's psychophysiological approach to the problems confronting psychology of the personality--consciousness and self-awareness, motivation, etc., to be methodologically correct.

In his works, V. S. Deryabin consistently adheres to the principle of materialistic monism which, as applied to man, is defined as the principle of psychophysiological unity. The second most important principle is the dialectical principle, according to which man is the result of philogenetic,

evolutionary development and, at the same time, he is the product of long-term sociohistorical development. The systematic application of principles of materialistic dialectics enabled V. S. Deryabin to avoid dualism in consideration of the biological and social nature of man. As a result, concentrating chiefly on consideration of problems from the psycho-physiological point of view, the author did not substitute the social element of the human personality with the biological.

The issues discussed by the author are, in essence, borderline, interdisciplinary, since they include psychophysiological, philosophical, sociological, physiological and other aspects. The author's broad erudition in matters of physiology, psychology, psychiatry and Marxist-Leninist philosophy enabled him to avoid bias in examining the phenomena he studied. All of the foregoing warrants the belief that V. S. Deryabin's monograph is valuable and timely.

The first two sections of the book deal with consciousness and self-awareness. In accordance with the well-known conceptions of K. Marx and F. Engels, the author states that the social life of the individual determines the content and orientation of his consciousness. With the change in methods of social production, with the transition from one socioeconomic system to another there is also a change in the consciousness of people. It is important to note that the question of mutual influence of living conditions on consciousness and consciousness on living conditions is discussed in accordance with the requirements of materialistic dialectics, and the active role of consciousness is stressed.

From the psychophysiological point of view, consciousness is viewed as a function of the brain, which is directly related to its mechanisms and, first of all, the mechanisms of higher nervous activity. The author stresses that consciousness does not excist as a special mental function, separate from other mental functions. The author's statements are backed up by recent psychopathological data, which indicate that weakening, impairment or elimination of one or several mental functions elicits some impairment of consciousness.

In the section dealing with the limitations and incompleteness of human consciousness, the author solves the problem of correlation between the conscious and unconscious in mental activity, determinism and indeterminism of human behavior in a methodologically correct way. With respect to the last question, V. S. Deryabin emerges as a systematic determinist, stressing the objective determination of human attractions, emotions and behavior (affectiveness), their dependence on the physicochemical composition of blood, condition of the autonomic and endocrine systems. The author stresses that affectiveness does not dominate over the psyche of the individual in a human society, but is governed by the correcting influences of the cerebral cortex determined by the upbringing and sets of a given social class.

In the section entitled "On the Ego," the author describes in detail his views about the structure of self-awareness. The author considers affect to be the most important component of the ego; on the basis of temporary associations it interacts with intellectual elements. Affectiveness and its traces (emotional memory) influence ongoing life and the structure of the ego. There are compelling mechanisms and consistent processes underlying personal will and free will to act. The author demonstrates that although it appears to man that mental activity is most arbitrary in the control of thinking, attention and recollection, we are dealing here with objective dependence on affectiveness representing the interests of the individual, while the will of the ego is a function of affectively colored conceptions. Thus, it becomes obvious that activity is not the function of some autonomous element of the ego, but the result of integrative activity of the entire brain.

Of particular interest are those sections of the essays where the author discusses questions of inception and development of social consciousness and demonstrates that consciousness is determined by the material life of society and class to which the individual belongs.

Of definite interest are the social aspects of development of self-awareness of the personality, those of its traits that man acquires in the system of social relations, formation of a positive social awareness ["feeling"] in some individuals, which is typical of representatives of a socialist society, and negative social feelings--egotism, egocentricity--which are primarily inherent in a society based on class exploitation, in others. The sources of psychological unity and solidarity of the Soviet society and individuals advancing on the road toward socialistic development, where the interests of a subject coincide objectively with the interests of society, then become understandable. The author dwells on yet another aspect of the correlation between individual and social consciousness. He demonstrates the mechanism of change in the consciousness of the individual in the direction of the positions of a more progressive class or regression to psychological positions of a less progressive class, but one that is prevailing at a given time. These sections will help us understand the extremely complex problems of change in a man's consciousness which occur in a human society.

The issues discussed in the essay entitled "On the Ego" are quite timely, since the author approaches man as a complexly organized system in the psychophysiological unity that is necessary to maintain homeostasis and equilibrium with the external biological and social environment. This approach, which was advanced by the author three decades ago, is presently a priority. This applies in particular to the formulation of the following problems: integration of somatic sensations, somatopsychic integration, higher psychophysiological integration and higher integration of mental functions. The author's views of the structure of consciousness and self-awareness are extremely important to interpretation

of the personality, not only as an aggregate of socially significant mental traits, but as a reflection of the general psychophysiological organization of man, who is, at the same time, a social being.

The third section was given the title "On Happiness" by its author. It is monographic in nature and constitutes a unique study, since happiness had never before been the subject of comprehensive scientific investigation and, in particular, of psychophysiological analysis. At the present time, happiness is viewed as a sociological category in our philosophical literature. At the same time, happiness is a complex psychophysiological experience. Thus, there is a concentrated expression of the problem of correlation between biological and social elements in this phenomenon.

The author's general approach to the problem of happiness is from the standpoint of dialectical materialism: the phenomenon in question--happiness--is discussed in its numerous interrelations and, in addition, in development, as the result of evolutionary and historical development. The dialectical approach is manifested in V. S. Deryabin's discussion of the evolution of the positive, sensory tone of sensations and "general feeling" in the direction of appearance on their basis of positive emotions, first joy, gaiety, which are philogenetically older, and then more complex ones.

The views of V. S. Deryabin on the evolution of affectiveness, which appears to be the central point of his psychophysiological studies, enables us to understand quite convincingly the genesis of the experience of happiness by man as a complex, socially determined psychophysiological phenomenon, in the development of which the ethical, cultural and esthetic development of the personality plays the most important part.

We consider it important that the author singled out various forms of experiencing happiness in different sections: "Ecstasy," "Happiness as a Special Type of Experience" and "Chemical Induction of 'Happiness'." In the last section, the author stresses that alcoholic beverages and drugs cannot by any means lead to happiness, pointing to the devastating effect of drugs on the mind.

We must mention an important distinction that is inherent in all parts of the monograph. As a psychiatrist and neuropathologist with much experience, with considerable erudition, V. S. Deryabin cites numerous clinical data pertaining to impairment of consciousness, self-awareness and pathological experiences of happiness in the presence of various mental and neurological diseases. His examples are not only demonstrative, but serve as convincing proof that the mind depends on its material substrate, the cerebral cortex. In this respect, the material submitted by the author is of interest to neuropathologists and psychiatrists, as well as philosophers, in view of his discussion of material determination of mental phenomena.

This work bears the indelible imprint of the author's personality, a Russian scientist who was actively involved in the building of a new life from the very first years of Soviet Power. Viktorin Sergeyevich Deryabin has a blend of the best traits of the prior intelligentsia with the traits of a new man, an active builder of a socialist society, a citizen and patriot. In this respect, these published works of V. S. Deryabin are an interesting monument of the times when they were written.

Lofty humanism, a passionate desire to make people happy, to spare them from many mistakes and confusions related to ignorance of the human mind, is particularly typical of V. S. Deryabin. All of his aspirations in life were dedicated to this goal.

In spite of the fact that this monograph is being published for the first time 25 years after the death of its author, it is of enormous interest, since it helps us understand many questions of inception of the personality that have not yet obtained scientific interpretation or submitted to experimental investigation; and it also outlines the directions for further development thereof. At this stage of the building of communism in our country, questions of formation of the new man, the fighter for the bright ideals of communism, are moving to the fore. This is why the monograph of V. S. Deryabin is particularly timely. It will make a sizable contribution to the development of theoretical and applied psychology.

The proposed book will undoubtedly be read with interest, not only by specialists in the field of physiology and psychology, but the broadest circle of readers, first of all, young people, as well as pedagogues, physicians, workers on the ideological front, all those whose activities are related in some way or other to the rearing of the young generation, questions of organization of labor, human relations and problems of formation of the human personality.

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THE BIOLOGICAL BASIS OF THE PSYCHOLOGICAL DIFFERENCES OF INDIVIDUALS

Moscow BIOLOGICHESKIYE OSNOVY INDIVIDUAL'NO-PSIKHOLOGICHESKIKH RAZLICHIY in Russian 1979 signed to press 13 Nov 79 pp 2-4, 351-352

[Annotation, introduction and table of contents from book by V. M. Rusalov, Nauka, 4250 copies, 352 pages]

[Text] This monograph is dedicated to theoretical and experimental research on the structure of the inborn factors of human individuality.

The book contains the most recent data on the content and the structure of the most important human levels--the somatic, the neurodynamic and the psychodynamic.

The monograph is intended for psychologists, physiologists and teachers.

Introduction

Of all the interests of man the most deep-seated is his interest in man himself. Consequently, it is not accidental that the problem of man is beginning to gradually occupy a central position in science (27). Man is studied as a bearer of industrial relationships (and all other social relationships), as the main element of the productive forces of society, and as a product of biological evolution (156).

Comprehensive studies of man are now acquiring foremost importance. Psychology has a special place in these studies. Systemizing the achievements of social, natural and technological sciences, psychology currently advances the most complete knowledge about the essence, structure and nature of man. Nevertheless, not all aspects of human psychology are equally developed. In fact the question of human individuality remains unsolved and without substantial progress. The importance of this problem is without doubt. The theoretical and experimental studies of psychology are most effective only when they are applied to each individual separately. Hence arises the need for thorough study of the mechanisms forming human individuality.

No matter how great the role of the social process in man's existence, his being, as B. F. Lomov believes (156), is not exhausted by the activity and association during which social and sociopsychological characteristics are formed. The biological development of man is no less important a factor in forming psychological characteristics. "The individuality of a man...," said B. G. Anan'yev, "can be understood only as the unity and interaction of his characteristics such as personality and occupation, in the structure of which the inborn individual characteristics of a man function" (26, p 334).

Thus human individuality is a product of specific social and biological influences. The cardinal difference between these influences, according to S. L. Rubinshteyn, V. M. Teplov, K. K. Platonov and others, is that social factors are responsible for the interesting aspects of psychology (interest, conviction, knowledge, etc.).

Among the biological factors determining the characteristics of human individuality, the central nervous system has a predominant role. The idea of I. P. Pavlov that the basic properties of the nervous system are fundamental parameters of individuality has received extensive experimental confirmation not only in the works of the school of B. M. Teplov and V. D. Nebylitsyn but also in the studies of other scientific groups (B. G. Anan'yev, V. S. Merlin, Ye. A. Klimov). Other biological subsystems of man (biochemical, humoral and others) also play an important role in determining individual variations of human behavior.

The intent of this book is first to consider from a systems analysis perspective certain general theoretical propositions concerning the problem of human individuality, for example the correlations of social and biological influences and personality and the individual. Secondly, based on the concept of the human constitution the foremost levels of human biological organization (build, neurodynamics and psychodynamics) are singled out and subjected to careful experimental study. Thirdly, these levels are compared and a certain typology of human individuality is outlined.

Understanding the complexity of the biological basis of human individuality, we would particularly like to note that many of the hypotheses and proposals advanced by us are not yet sufficiently substantiated. But the experimental data collected here may prove to be useful for future work in this field.

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PSYCHOPHYSIOLOGICAL ASPECTS OF LABOR PERFORMED BY WORKERS DEALING WITH SERVICES

Leningrad PSIKHOFIZIOLOGICHESKIYE ASPEKTY TRUDA RABOTNIKOV SFERY OBSLUZHIVANIYA in Russian 1979 signed to press 19 Apr 79 pp 2-4, 167

[Annotation, introduction and table of contents from book by Lidiya Viktorovna Donskaya and Edgar Emil'yevich Linchevskiy, Izdatel'stvo "Meditsina", 8000 copies, 168 pages]

[Text] This book deals with physiological and psychological analysis of two professional categories referable to services, in which the factor of communication plays a dominant role: medical and trade workers.

The principles for classification of labor of workers dealing with services are expounded, and differences within this occupational group are discussed.

The work of physicians in different specialties is described on the basis of changes in physiological functions as related to the work and data on health status. There is a special section dealing with the distinctions of communication between physician and patient.

The physiological characteristics of the labor of workers in the trades (sales persons, cashiers, cashier-checkers) are based on professiographic and structural analysis of work operations, dynamics of physiological processes during work, evaluation of health status. The principles of setting standards for trade work are formulated, and various work modes are evaluated. A study was made of the psychological aspect of labor of trade workers.

The book ends with recommendations on improving working conditions and nature of labor of workers in the area of services; there is discussion of the means of increasing the efficiency of such work, and the need for occupational screening is stressed.

This book is intended for industrial physiologists and psychologists, physicians at SES [sanitary and epidemiological stations], public health organizers, workers in laboratories of scientific organization of labor and labor safety departments.

The book contains 33 figures, 38 tables and the bibliography lists 290 items.

Introduction

Physiological analysis of professional work is based on evaluation of the requirements made of the body in the course of work and on studies of concomitant physiological reactions. All work contains elements of a mental and physical load. For this reason, in describing the physiological aspect of an occupation, it is more correct to speak of the share of each of these elements in specific forms of labor.

For this reason, physiological analysis of work includes the study of information and motor components, determination of quantitative correlation between them, demonstration of the specific distinctions inherent in any form of work and evaluation of functional changes in functional and supporting physiological systems.

Unlike many hygienic factors, physiological loads are not regulated by official documents. Moreover, the present status of the science does not permit, in most cases, determination of the optimum level or permissible flucutations of many of them. For example, we can refer to the well-known adverse consequences of both motor loads and hypokinesia; however, the problem of optimum motor activity is still far from being solved.

A specific level of nervous and emotional tension is the integral background of any professional activity. An inadequate or excessive emotional background has an adverse effect on both the results of work and health (R. M. Jerkes, J. D. Dodson, 1908; P. K. Anokhin, 1971; A. S. Yegorov, V. P. Zagryadskiy, 1973; F. D. Gorbov, V. I. Lebedev, 1975). Yet industrial physiology does not even have approximate data about the optimum emotional tension with due consideration of its qualitative features.

In order to gain a fuller idea about work activity, physiological analysis must be supplemented with psychological analysis which examines its psychological essence, distinctions of the worker's personality and his interaction with the environment where the work is performed. Psychological analysis determines, on the one hand, the requirements every occupation makes of its performer and, on the other hand, the presence or absence of the necessary professional abilities to successfully function in a given occupation, as well as the means of developing the required properties, favorable and unfavorable effects of an occupation on the personality and many others.

There is very modest representation of data on industrial physiology and psychology referable to workers dealing with services in the biomedical literature.

In most cases, there are disparate studies or observations made by various specialists, generalization of which is extremely difficult. We succeeded in gathering a certain amount of data that offer an idea about the physiology and psychology of work activity in only two occupations--physicians and trade workers. It is quite possible that this is not a chance distribution. Medicine and trade are not only the largest branches in the services sector, but also the most important to the public with respect to nature and volume of services.

The desire to write this book was motivated by two circumstances. On the one hand, our many years of work in the area of industrial physiology and psychology referable to occupations dealing with services (particularly trade) enabled us to gather rather rich factual material that may be interesting and useful to a specific circle of readers.

However, as we acquired experience in such work, as we analyzed and generalized the material and, especially, as we worked on this book, our professional medical approach to this problem was considerably reinforced as well by our desire, as recipients of services, to improve the situation in the area of services.

For expressly this reason, we deemed it expedient to systematize the factual material accumulated to date, as well as to share our thoughts concerning the possible means of optimizing labor in the area of services.

We would like our book to serve as an impetus for serious research in industrial physiology, hygiene, psychology, and ergonomics as related to occupations dealing with services, since this determines, to a significant extent, the efficiency and health of each of us and the entire population.

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COLLECTION EXPLORERS MATHEMATICAL MODELING IN PSYCHOLOGY

Moscow VOPROSY KIBERNETIKI in Russian No 50, 1979 pp 2, 138

[Annotation and table of contents from the collection "Mathematical Modeling in Psychology" edited by G. Ye. Zhuravlev, Yu. M. Zabrodin, and V. F. Rubakhin, 138 pages]

[Text] The unique features of mathematical modeling in psychology stemming from the systematic nature of mental phenomena are analyzed. Common traits in the content of the objects of psychology and cybernetics are noted, and the mutual influence these two sciences have upon each other is revealed. It is demonstrated with psychophysics as the example that application of cybernetic theories permits generalization of psychological laws. This collection presents modeling results, accounting for psychological factors, to be used in solving practical problems in economics, technology, and other areas.

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