JPRS L/10071

26 October 1981

USSR Report

LIFE SCIENCES

BIOMEDICAL AND BEHAVIORAL SCIENCES

(FOUO 14/81)

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APPROVED FOR RELEASE: 2007/02/09: CIA-RDP82-00850R000400060048-9

JPRS L/10071

26 October 1981

USSR REPORT

LIFE SCIENCES

BIOMEDICAL AND BEHAVIORAL SCIENCES

(FOUO 14/81)

CONTENTS

BIOCHEMISTRY

UDC 576.858.23

FACTOR PROMOTING COMPLETE TRANSLATION OF ENCEPHALOMYOCARDITIS VIRAL GENOME

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 258, No 4, 1981
(manuscript received 13 Feb 81) pp 1013-1015

[Article by Yu. V. Svitkin and V. I. Agol, presented by Academician A. S. Spirin on 1 February 1981, Institute of Poliomyelitis and Viral Encephalitides of the USSR Academy of Medical Sciences, Moscow, M. V. Lomonosov Moscow State University]

[Text] The RNA of the encephalomyocarditis (EMC) virus with cell-free protein-synthesizing systems, depending on the conditions is considered either completely, or the translation is limited primarily by the 5'-end region of the viral genome [1-5]. Limited translation is governed by the functioning of a relatively weak "terminating signal" which is located in the viral RNA somewhere on the boundary between the 5'-end region that codes the precursor of the structural protein (preA), and the central region, in which the nonstructural polypeptide F is coded.

Under optimal conditions, termination does not occur at this site, however, the rate of translation still is noticeably reduced [6]. Similar, although weaker, "terminating" or "inhibiting" signals are apparently found on other sections of the RNA of the EMC virus. Slowing down of translation on definite sections of the matrices has been described in nonviral systems.

We recently advanced a hypothesis on the existence of a special factor of translation which promotes overcoming of similar weak "terminating signals," and called it the elongation factor X (EF-X) [4,5]. This report presents the first data which confirm this hypothesis. Our experimental approach consisted of the following. We initially obtained a system by artificial means in which translation on the boundary between the RNA sections of the EMC virus which code the preA and F components was drastically slowed down. We then attempted to overcome this translation barrier by addition of different protein fractions isolated from the uninfected cells.

Glycerine to a final concentration of 10% was added to an extract made of Krebs-2 cells (fraction S_{30}) [1,2] treated with micrococcal nuclease. Nine millimeters of this extract were superposed on 4.5 ml of 1.25 M of sucrose prepared on buffer solution A (65 mM KCl; 3.3 mM $MgCl_2$; 30 mM tris-HCl; pH 7.6; 0.1 mM EGTA; 2 mM dithiotreite, DTT) and centrifuged (12 h, 44,000 rpm, 2°C) in a Ti-50 rotor (Beckman).

The test tube contents were divided into 3 portions: upper 6 ml (fraction S_{120}), lower 4 ml ("sucrose layer") and precipitate (ribosomes). Whereas the proteins contained in the sucrose layer were precipitated out by ammonium sulfate, the protein precipitates were dissolved in buffer B (100 mM KCl; 20 mM tris-HCl; pH 7.6; 0.1 mM EDTA; 1 mM DTT; 5% glycerine), dialyzed against the same buffer and stored at -70°C. Protein concentration was defined according to [7].

The reconstructed cell-free system (25 µl) contained 12 µl (0.05-0.07 units of A_{260}) of fraction S_{120} (preliminarily passed through a column with sephadex G-25 balanced by buffer A with 3.3 mM DTT), 0.5 µl (0.4 units of A_{260})of ribosomal suspension in buffer A, 2 µg of RNA of EMC virus, 2.5 of the studied factor preparation, KCl (final concentration 130 mM), $MgCl_2$ (3.3 mM), ^{35}S-methionine (10 µCi, 2 µM), 19 unmarked amino acids, nucleotides and ATP-regenerating system [1,2]. Incubation was done at 30°C under 50 µl of Bayol F. The reaction was stopped by adding 50 µl of dissociating mixture and the products were analyzed by electrophoresis in a 15-% polyacrylamide gel [1].

According to the previously obtained results [1,2], when an unfractionated extract (S_{30}) is used as the cell-free system, complete translation of viral RNA occurs (figure 1A, track a, see insert). This is indicated by the presence among the products of translation, besides the preA polypeptide and products of its splitting (A, B, D1, α, G, p 14, p 12) coded in the 5'-end section of the genome, also of polypeptides F (central region), C, D, and E (3'-end region). In contrast to this, the system which is reconstructed from the ribosomes and S_{120}, having high total protein-synthesizing activity, does not guarantee effective formation of polypeptides coded in the central and 3'-end regions of the genome (figure 1A, track c). Since in the high-molecular region of the gel, certain nonstructural polypeptides are covered by incomplete chains of preA, it is convenient to judge the presence of a barrier which prevents translation of the central region of the genome from the presence or absence of polypeptide F. Incomplete translation in the reconstructed system is apparently not associated with a deficiency of tRNA, since addition of a surplus of tRNA practically does not affect the nature of the formed products (figure 1A, track d).

The capacity of the reconstructed system to implement complete translation of RNA of the EMC virus is restored as a result of addition of protein fractions which are isolated from the "sucrose layer" by precipitation with ammonium sulfate (fig 1A, tracks e-i). We assume that the fractions contain EF-X. For further purification, material was taken which was precipitated from the "sucrose layer" with saturation of $(NH_4)_2SO_4$ between 50 and 70%, since in this material, there are relatively few ballast proteins. As is apparent on figure 1B, the active beginning (EF-X) is adsorbed on DEAE-sephatsel and can be eluted at 225 (but not at 100) mM KCL.

The obtained result can be explained by the presence in the "sucrose layer" of a factor which promotes the overcoming of weak terminating signals (i.e,, EF-X). However, the possibility of another interpretation also existed. It could be assumed that our reconstructed system is defective not for elongation, but proteolytic activity required for the formation of viral proteins (including F) from the corresponding precursors. From this viewpoint, the appearance of F in the presence of active fractions of the "sucrose layer" would be explained by the presence in them of the necessary proteases. In order to clarify the correctness of this hypothesis, the reconstructed system was incubated with viral RNA for 3 h.

Elongation was stopped by adding cylcoheximide, and incubation was continued for another 15 h either in the presence or in the absence of material containing EF-X. It was found that incubation of polypeptides synthesized in the reconstructed system with EF-X preparation did not result in the appearance of polypeptide F (fig 1C). Thus, the hypothesis on protease nature of the factor we studied was not confirmed. We note that during lengthy incubation (18 h), a certain quantity of polypeptide F is formed in the reconstructed system even without the addition of material from the sucrose layer. This agrees with the already mentioned concept that the block preventing synthesis of polypeptide F can be manifest not in complete stopping, but only in a considerable delay in translation. It still remains unclear whether this slow overcoming of the translation block is associated with residual quantities of EF-X, probably present in the reconstructed system, or with the fact that slow movement of the ribosomes in the corresponding region is also possible with complete absence of EF-X.

An important question is whether EF-X corresponds to the known components of the protein-synthesizing apparatus. The answer to this question requires further studies, in particular, purification of EF-X. However, even now one can note that EF-X is apparently not the RNA-bonding protein, since it is not adsorbed on the poly-(V)-cellulose (fig 1I'). In this respect, it is distinguished from the previously described eukaryote factors of elongation (EF-1 and EF-2) and the majority of factors of initiation of eukaryote translation [8,9].

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9035
CSO: 1840/284

UDC 576858.25

INTEGRATION OF GENOMES OF RUSSIAN TICK-BORNE ENCEPHALITIS VIRUS (TEV) AND CELL DURING CHRONIC INFECTION INDUCED BY TEV AND OV40

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 258, No 4, 1981
(manuscript received 16 Jan 81) pp 1000-1002

[Article by I. D. Drynov, L. V. Uryvayev, V. V. Nosikov and Active Member of the USSR Academy of Medical Sciences V. M. Zhdanov, D. I. Ivanovskiy Institute of Virology of the USSR Academy of Medical Sciences, Institute of Molecular Biology of the USSR Academy of Sciences, Moscow]

[Text] The development of a chronic viral infection, according to one of the theories, may be associated with integration of genomes of the virus and the chronically infected cell [1]. Experiments on transfection of sensitive cells with DNA preparations made of chronically infected cells in a number of cases confirm the possibility of including the DNA-copy of the genome from an RNA-containing infectious nononcogenic virus in the cellular genome [2]. The presence of a limited number of virus-specific sequences in nuclear DNA of chronically infected cells [3] has been shown by the method of molecular hybridization.

In order to study precisely the integration variant of viral persistence development, we used combined infection of cells with Russian tick-borne encephalitis virus (TEV) and OV40. In combined infection, it is hypothetically possible to conjugate the processes of reproduction of the genomes from both viruses, and to incorporate the TEV genome into the cellular DNA similarily to incorporation of the OV40 genome into the DNA of the transformed cells [5]. Direct detection of virus-specific sequences in the cellular DNA is possible by the method especially designed to establish localization of individual genes in the DNA fragments which develop under the influence of different restrictases [4]. This method was successfully used to study the nature of OV40 genome incorporation into the DNA of the transformed cells [5].

L_{1210} cells were infected with TEV, strain "MF" which was isolated from chronically infected cells grown for several years [11]. The original TEV strain "Sof'in" during infection of the cells jointly with OV40 did not induce the appearance of transfixing activity of the DNA preparations made of infected cells. After incubation of the culture cells with TEV, reinfection with OV40 was done. The cells were then repassivated several times. DNA was isolated from the nuclei of the infected cells by the method of phenol deproteinization with preliminary treatment with pronase and subsequent treatment with RNA-ase [6]. The obtained DNA preparations were used for transfection and for work with the restrictases. In the experiments to transfect kidney cells of pig embryos with SPEV, DNA preparations were used for the infection (20-40 $\mu g/10^5$ cells). The control was DNA preparations treated with DNA-ase and RNA-ase (50 $\mu g/ml$).

RNA of TEV was isolated from a purified virus by the standard method of phenol deproteinization. The genome RNA of TEV is typical messenger RNA with molecular weight on the order of 3.0 MD (40 S).

Restrictases were isolated by the method of Green [7] and Bickle [8]. DNA preparations from infected, uninfected cells and thymus of a calf were exposed to splitting by restrictases. DNA from uninfected cells L_{1210} and the DNA of calf thymus were used as the control. The latter was selected as the control because during synthesis of ^{32}P-kDNA by TEV RNA, the seed crystal was thymus DNA that was fragmented into short chains under the influence of DNA-ase I. The material was further applied to lamellar gel of 1% agarose. Fragments of DNA of the λ-phage formed under the influence of restrictase were used during fractionating of the material by electrophoresis as the markers to determine the dimensions of the DNA fragments.

DNA fragments from the agarose gel were transferred to nitrocellulose filters by the method of Southern [4]. After drying, the filters were incubated for 24 h at 65°C in Denhardt's solution [9]. After addition of labelled preparations, kDNA hybridization was done in the same solution at 65°C for 48 h.

The dried filters were exposed after hybridization and washed of the free labelled material with RT-1 films at room temperature for 3-12 days.

^{32}P-kDNA was synthesized with the help of revertase using scattered or statistical inoculation, short DNA fragments formed under the influence of DNA-ase I on DNA of calf thymus. The reaction was done according to the method of Taylor [10] with concentration of the seed crystal 0.25 μg/ml.

After a preliminary series of experiments to select suitable restrictases, the virus-specific sequences were detected in the DNA fragments of the cells infected with TEV and OV40. Figure 1 (see insert between pp 916-917) presents the results of radio autographic finding of virus-specific sequences in the restriction fragments of nuclear DNA. The following are clearly revealed: DNA fragment after resctriction of Eco RI with molecular weight of 6.0 MD, DNA fragment after restriction of Bgl II with molecular weight of 11.0 MD, and DNA fragment after restriction of Pst I. In the case of DNA treated with Hind III, no obvious bands of hybridized material were noted. The latter can be governed by the fact that small DNA fragments developed, while the rate and level of hybridization were proportional to the molecular weight of the interacting fragments. With equal experimental conditions, part of the DNA fragments with high molecular weight first becomes a hybrid. In the control DNA of the L_{1210} cells and the DNA of the calf thymus, no hybridization band was observed.

The sizes of the restriction fragments of DNA that hybridize with kDNA by TEV RNA, according to the molecular weight of one chain coincide with the dimensions of the genome RNA of TEV in the case of Eco RI, or exceed the dimensions of RNA in the case of fragments which develop under the influence of Bgl II and Pst I restrictases. The latter can be governed by the presence in the fragments of DNA sequences that adjoin the continuous sequence of the DNA-copy of the viral genome from two sides. This may be entirely associated with the fact that under the influence of various restrictases, one DNA fragment develops which bears the virus-specific sequences.

The findings first of all confirm the possibility of incorporating the DNA-copy of the TEV genome as a single block. For more complete discussion of the results it is expedient to present data on the transfixing activity of cellular DNA [11], reducing them to Table 1 which is convenient for examination. The data presented in the table indicate the absence of infectious properties of the DNA from the cells infected with TEV only. The infectious properties of cellular DNA appear after combined infection with TEV and OV40 (TCD_{50}/ml=6.0). Infection of the cells with TEV jointly with the virus of the Rous sarcoma (RSV) results in the emergence of infectious properties of DNA (TCD_{50}/ml=3.5). The greatest infectiousness is noted in DNA from cells jointly infected with TEV + OV40 + RSV (TCD_{50}/ml=6.25). It is noted that DNA infectiousness is completely removed by the effect of DNA-ase, but not RNA-ase. Data on titration of full-value infectious virus TE which develops after transfixing of sensitive cells with DNA preparations made of chronically infected cells not only confirm the incorporation of the full DNA-copy of the TEV genome into cellular DNA, but , mainly, indicate the complete expression of the DNA-provirus.

Table 1. Transfection of SPEV Cells with DNA Preparations Made of Cells Infected with TEV Jointly with Oncogenic Viruses

Viruses	Original quantity of DNA, μg per 10^5 cells	Final dilution of DNA	Titer of transfixed virus, TCD_{50}/ml	
			without antiserum	with antiserum
TEV	22.0	0	0	0
TEV+RSV	19.0	1:80	3.5	0
TEV+OV_{40}	24.4	1:120	6.0	0
TEV+RSV+OV_{40}	37.0	1:160	6.25	0

The presence of onco-RNA-viruses in the TEV-infected cells plays a significant role in the formation of the DNA copy of the TEV genome, the DNA from cells which are jointly infected with TEV and RSV during transfection induce the appearance of an infection virus. The absence of infectiousness of the cellular DNA infected only with TEV forces us to assume a stimulating effect of OV40 on the activity of the onco-RNA-virus usually present in the cells. Stimulation of activity of onco-RNA-viruses on the part of OV40 is quite probable. The OV40 stimulates the output of adenovirus with the combined infection of cells [12],and OV40 in its action in this respect is analogous to the effect of iododesoxyuridine [13]. In terms of the studied question on incorporation of the TEV genome, all that has been listed in relation to OV40 is additionally strengthened by the known data on stimulation of cellular DNA synthesis during infection with OV40 [14].

Based on the available data, one can hypothesize a possible path for formation of a DNA-copy of the genome of an RNA-containing nononcogenic virus and its incorporation into chromosomal DNA of cells jointly infected with TEV and OV40. The initial stage, synthesis of the DNA-copy can be associated with manifestation of the activity of onco-RNA-viruses usually present in the cells. Their inverse transcriptase does not have specificity in relation to the matrix. The subsequent stage, incorporation of the DNA-copy can be associated with the possible conjugation of the processes of preproduction of the TEV genome and the processes of reproduction of viruses which reproduce in parallel and are capable of incorporation.

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9035
CSO: 1840/284

MEDICINE

UDC 615.339:578.245

INTERFERONS IN MEDICAL THEORY AND PRACTICE

Moscow INTERFERONY V TEORII I PRAKTIKE MEDITSINY in Russian 1981
(signed to press 12 Mar 81) pp 2-4, 398-400

[Summary, introduction and table of contents from "Interferons in Medical Theory and Practice" by Valentin Dmitriyevich Solov'yev and Tagir Abdullayevich Bektemirov, USSR Academy of Medical Sciences, Izdatel'stvo "Meditsina", 2021 copies, 400 pages]

[Text] Eleven years have elapsed since the publication of the first edition of this book. During this interval of time a very great amount of data, both experimental and clinical, has been amassed; these data dictated the need for the present edition. The monograph has been almost completely rewritten. It gives a description of viral interference, considering in detail interference not caused by interferons.

The book examines the properties of interferon, the interferonogenic activity of different families and groups of viruses and their sensitivity to interferons. Considerable space is given to data on interferon production by leucocytes and macrophages, as well as to methods of obtaining and purifying leucocyte, lymphoblastoid and fibroblast interferon. The role of interferons in the pathogenesis of viral infections and their significance as an index of reactivity under normal conditions and in pathology are presented in detail. The book correlates materials on experimental and clinical application of exogenic interferon and stimulators of endogenic interferon of viral and nonviral nature. Great attention is given to nonantigenic inducers of interferon. Data are presented on the non-antiviral action of interferons and their inducers, including the effect on antibody production and cellular immunity. A special chapter is devoted to oncogenic viruses and interferon. In it the mechanisms of the formation and action of interferons are described. In conclusion, an evaluation is given of the theoretical significance of interferons and the prospects of their use in practice.

The monograph is intended for virologists, immunologists, biologists and physicians.

The book contains 33 tables and 37 figures; the bibliography, 585 titles.

For summary see page 396.

Reviewer: Yu. Z. Gendon, doctor of medical sciences, professor, head of the

Department of General Virology of the NII [Scientific Research Institute] of Viral Preparations of the USSR MZ [Ministry of Health].

INTRODUCTION

The first edition of our book, "Interferon in Medical Theory and Practice" was published in 1970. In that edition the existing studies in the literature were correlated; the results of our own research were presented, and the outlook for further research was given. The book received a high appraisal from readers and was awarded the D. I. Ivanovskiy Prize. In 1973 the book was translated into Czech and published in Prague by the Avicenum Publishing House. In the same year a somewhat supplemented edition was translated into English and published by Plenum Press in New York.

Since then many experimental findings and results of clinical observations have been amassed. This fact accounts for the need for the present edition. Into it went completely revised materials and the results of studies by Soviet and foreign scientists up to 1980. We are unable to give a complete bibliography of studies on interferons since it would exceed the scope of the present monograph. Accordingly the bibliography gives only studies published since 1970.

The range of research has also expanded incommensurately with the past. Evidence of the existence of several types of interferons and their action has been obtained not only in viral infections but also in normal cells and cells undergoing malignant changes. It has also been demonstrated that interferon obtained from human blood leucocytes is capable of being highly concentrated and purified of inactive proteins. Such a concentrated preparation, containing up to 1 million or more activity units per 1 ml of volume, may be, and is being, employed in diverse pathological conditions, not solely those of viral etiology.

The newest trend is the use of interferons in clinical oncology. It is more advisable to use concentrated preparations for therapeutic use in this pathology.

The difficulties associated with obtaining human donor blood, which serves as a source for obtaining leucocyte interferon, necessitated a search for other producers. Following up the species specificity of interferon, we unexpectedly discovered that swine leucocytes are capable of producing interferon which acts on human diploid cells in the same way as human interferon.

In the USA, England and other countries research is being conducted in the direction of obtaining interferon-forming cells outside the organism. Here two methods have been established: one consists of using cultured lymphoblastoid cells; the other, of using diploid producer cells. Both these methods are also being used in our country's laboratories. Up to now, however, they have been at the stage of experimental study and have not entered medical practice.

Ten years ago we formulated the so-called interferon reaction of leucocytes. It consists of the fact that the general immunoreactivity of an organism can be evaluated according to the activeness of interferon production by lymphoid tissue. After numerous tests we recommended this reaction for evaluating the condition of the reticuloendothelial system under normal conditions and in pathology.

Interferons are now viewed as an indispensible component of immunological reactivity which to a significant extent ensures the stability of the organism's internal environment. The significance of interferons as factors of antiviral immunity is being increasingly evident. It is most likely that interferons are the regulators of many immunity reactions. They are known to influence cell division, the activity of normal killer cells, DNA synthesis in lymphocytes, the delayed type of hypersensitivity reaction and transplantaton immunity.

Recent years have been marked by numerous studies in immunobiological and cytogenetic directions, which have revealed new facts characterizing the mechanisms of the formation and action of interferons.

In conclusion, a word must be said about the stages of development of the study of interferons. For many years the scientists of the USA and England did not consider studies on exogenic interferon of current interest and sought substances and means inducing the formation of endogenic interferon, working on different synthetic preparations of the type of polynucleotides. But beginning in 1976, foreign scientists' interest in exogenic interferon--i.e., in the direction which Soviet investigators had been developing since 1964--sharply increased.

At the recent Fourth International Virology Congress the reports of foreign scientists were devoted to presentation of experimental and clinical experiments on successful use of exogenic interferon obtained from leucocytes of donor blood.

The monograph offered to the reader retains the previous title in only slightly changed form. The title successfully reflects the contents, which have been almost completely rewritten.

The authors sought not only to present the current data as accurately as possible but also, principally to reflect the results of studies by Soviet scientists engaged in the study of interferons. Realizing the complexity of the task in hand, we will gratefully accept critical remarks and suggestions.

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CSO: 1840/297

PHYSIOLOGY

HOW WE SEE WHAT WE SEE

Moscow KAK MY VIDIM TO, CHTO VIDIM in Russian 1979 (signed to press 29 Mar 79) pp 2-5, 207

[Annotation, foreword by Academician O. G. Gazenko and table of contents from book "How We See What We See", by Vyacheslav Yevgen'yevich Demidov, "Science and Progress" series, Izdatel'stvo "Znaniye", 100,000 copies, 208 pages]

[Text] The problem of perception of the outside world with the organ of sight is one of the interesting natural scientific problems. We find the names of many outstanding people of different times and nations among those who made their contribution to it. At present, major scientific teams, armed with the most modern investigative methods, are working on this problem. Among them is the Laboratory of Physiology of Sight, Institute of Physiology imeni I. P. Pavlov, USSR Academy of Sciences, in Koltushi near Leningrad, which used the principles of holography to explain the "mechanism" of processing visual information of our brain. In discussing the work at this laboratory, the author makes broad use of material obtained by other Soviet and foreign researchers. This scientific and literary book is intended for a broad circle of readers.

Foreword

The author of this book is not only a reporter, but an engineer. The book itself is the result of 5 years of fruitful collaboration with scientists from the Laboratory of Physiology of Sight, Institute of Physiology imeni I. P. Pavlov, USSR Academy of Sciences. For these entire 5 years, the author attentively watched the progress of its staff and constantly published articles about their work.

The problems discussed in this book are presented by V. Demidov on the basis of the holographic hypothesis of brain function, which is being actively developed in recent times by scientists of the entire world (in all fairness, let us mention that this conception is not shared by all researchers). Among these studies, the work of Soviet scientists occupies a prominent place, particularly those working at the Institute of Physiology imeni I. P. Pavlov. And, since holography is the child of engineers, it becomes understandable why one of them was able to make sense, easily and without constraint, out of the sea of diverse information that appears scattered outwardly but actually demonstrates a profound unity of material essences of the world revealed to us, using a holographic compass.

The solitary approach the author used to the most varied problems brought him deserved success. Demidov finds good explanations for "mysterious" phenomena

and advances plausible hypotheses by examining from the same positions the question of identifying visual images and causes of the "whims" of fashion, perception of color and structure of different systems of the optical tract, visual illusions and formation of the internal model of the world. Such discoveries include, for example, the hypothesis of reasons for changes in fashions, the explanation of the "secret" of Penrose's triangle and "impossible pictures"; the author uses a unique and curious approach to the problem of essence of abstractions and concept of beauty. There is convincing disclosure of a seemingly paradoxical thesis that visual illusions are a reflection of the automatic accuracy of function of the visual system, a reflection of accuracy of the model of the world formed as a result of man's prior experience.

The lucidity, understandability and, at the same time, scientific strictness of presentation of material are definite qualities of the book that you have in your hands. The bibliography used by the author is referable to the works of the greatest scientists dealing with problems of vision, both Soviet and foreign. Demidov knows many of his heroes personally; he has visited scientific laboratories, witnessed experiments and, for this reason, he has conveyed the atmosphere of scientific search in an entertaining and convincing manner.

A good, graphic language is used to present extremely complex problems of neurophysiology and psychology, cybernetics and medicine; the author never falls into vulgarization. He operates freely with the concepts of many sciences, cites good and vivid examples, so that it will be unquestionably interesting to the reader to follow the logic of development of the subject. The problem of holography is a mathematical problem in many respects, and it is all the more pleasing that he succeeded in explaining it without formulas, on a level that is quite understandable to the broadest reader. It is very important that Demidov refers to the most recent works, the results of which were literally just published, in 1977, and one feels the pulse of modern times in the book, it is timely and fresh.

The history of learning about the mechanisms of function of the visual system is the history of the struggle of science against idealism. The results of current research confirm, again and again, the materialistic thesis that it is possible to gain knowledge about nature in all of its manifestations, including such extremely complex ones as sight and thinking. Science puts electrochemical processes in neuronal networks of the brain, which are amazing in their refinement, in the place of the "soul." With each year, experimental techniques grow more and more sophisticated, and we are delving deeper and deeper into the essence of things. Man is learning more and more about himself and penetrates into mysteries that make those of the oceans and space paler. At the same time, the language of science is growing increasingly complex; science is breaking down into more and more narrow disciplines, so that scientists working in one laboratory have difficulty in discerning problems of their neighbors in the next laboratory. The volume of information is growing like a snowball, and for this reason the role of scientific popularization, particularly when it generalizes the achievements in related and allied disciplines, is ever growing in our times. Not infrequently, a scientist will glean some useful information from such works. Demidov's book is one of them--a successful attempt at summarizing results obtained by specialists working in the most varied areas of knowledge. He not only was able to summarize, but relate these results to vital problems that are close to literally everyone, blending the seriousness of the scientist's approach to the vitality of a writer's style.

Contents

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CSO: 1840/999

UDC: (577.4+577.1)001.57

METHODS OF MATHEMATICAL BIOLOGY, BOOK 2: METHODS FOR SYNTHESIS OF ALGEBRAIC AND PROBABILISTIC MODELS OF BIOLOGICAL SYSTEMS

Kiev METODY MATEMATICHESKOY BIOLOGII, KNIGA 2: METODY SINTEZA ALGEBRAICHESKIKH I VEROYATNOSTNYKH MODELEY BIOLOGICHESKIKH SISTEM in Russian 1981 (signed to press 9 Jan 81) pp 4-8, 10

[Annotation, introduction to Part I and table of contents from book "Methods of Mathematical Biology. Book 2: Methods for Synthesis of Algebraic and Probabilistic Models of Biological Systems", by Viktor Mikhaylovich Glushkov, Yuriy Gur'yevich Antomonov, Vasil Kabulovich Kabulov, Khusan Kadyrovich Kadyrov, Svetlana Ivanovna Kiforenko, Andrey Mikhaylovich Klochkov, Alina Borisovna Kotova, Todor Angelov Popov and Anatoliy Aleksandrovich Stogniy, edited by Academician V. M. Glushkov (chief editor), approved by the Ukrainian Ministry of Higher and Secondary Specialized Education as a textbook for students in biological specialties at VUZ's, Izdatel'skoye ob"yedineniye "Vyshcha shkola", 2000 copies, 312 pages]

[Text] There is discussion of methods of choice of experimental material in the structure of an algebraic model and determination of the coefficients of the model for describing various static functional modes of biological systems. The use of functions and regression equations is demonstrated for synthesis of mathematical models of biological systems.

Methods are described for primary processing of experimental data, for equalizing statistical series, determining the reliability of differences, determination of laws of distribution in correlation and spectral analysis of random biological processes and use of Markovian random processes.

This book is a textbook for courses on "Biological Cybernetics," "Bionics," "Medical Cybernetics," "Mathematical Modeling of Biological Systems" and "Biophysics" for students at universities, medical and pedagogic institutes and institutes of physical culture; it may be useful to scientists concerned with problems of mathematical biology. Figures 76, tables 37, references 69.

Introduction [to Part I]

Methods of modern algebra are used extensively in various branches of science--mathematics, mechanics, physics, cybernetics and mathematical biology. They include linear algebra, logical algebra, matrix albegra, set algebra and algorithm algebra.

In constructing biosystem theory and solving various problems, modern biology and medicine make extensive use of methods of quantitative analysis of the link between

output coordinates and input factors. Use is made of the conception of a link in the form of tables and graphs, from which one turns to mathematical descriptions. The simplest mathematical description of the link between output coordinates of biological systems and input factors can be obtained by means of various algebraic functions. In this case, the mathematical description is a functional model of the biosystem.

The diversity of interactions between biological systems and the environment makes it necessary to use both elementary functions and superpositions thereof varying in complexity in order to describe them. There is discussion here of algebra methods that permit solving problems of synthesis of various functional models of biological systems; however, listing all of the methods of functional relations and equations used in modern mathematics is not an end in itself. Attention is devoted chiefly to the methods and specific types of functions that have now become quite popular in mathematical biology.

This book, which deals with applied algebra as a science but theory of biology, is concerned with methods of searching for types of functions according to experimental data, investigation of applicability of algebraic models to solving biological and medical problems.

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CSO: 1840/999

UDC: (577.4+577.1)001.5(07)

METHODS OF MATHEMATICAL BIOLOGY, BOOK 3: METHODS OF SYNTHESIZING DYNAMIC MODELS OF BIOLOGICAL SYSTEMS (VUZ TEXTBOOK)

Kiev METODY MATEMATICHESKOY BIOLOGII, KNIGA 3: METODY SINTEZA DYNAMICHESKIKH MODELEY BIOLOGICHESKIKH SISTEM (UCHEB. POSOBIYE DLYA VUZOV) in Russian 1981 pp 4-10

[Annotation, introduction and table of contents from book "Methods of Mathematical Biology. Book 3: Methods of Synthesizing Dynamic Models of Biological Systems (Textbook for VUZ's)" by A. M. Molchanov, Yu. G. Antomonov, A. B. Kotova and M. A. Khanin, Izdatel'skoye ob"yedineniye "Vyshcha shkola", 328 pages]

[Text] Methods are described of theory of differential equations, which permit synthesis of mathematical models of the dynamics of biological systems. There is discussion of linear equations with constant and variable coefficients, typical nonlinear equations, first and second order partial [differential?] equations. Much attention is given to proper investigation of equations for phase and structure profiles. Methods are described for writing differential equations for biological systems with gradual complication of physiological conditions, which permit expression in the model of different properties of biological systems.

This book is a text for course of "Biological Cybernetics," "Bionics," "Medical Cybernetics," "Mathematical Modeling of Biological Systems" and "Biophysics" for students at universities, medical and pedagogic institutes and institutes of physical culture; it may be useful to scientists concerned with problems of mathematical biology. Figures 136, tables 2; references 46.

Introduction

In mathematical biology, wide use is made of methods of differential equation theory for the synthesis of mathematical models of dynamic modes of biological systems.

Thus, to describe the function of biological systems, use is made of theory of linear differential equations; first or second order differential equations are used to describe the function of biological systems with reference to one parameter; systems of linear differential equations are used to synthesize mathematical models describing the dynamics of many parameters; the entire spectrum of formal mathematical methods for solving differential equations, including methods of computation ["computing mathematics"?], is used for concrete modeling.

It is known that the dynamic behavior of biological systems is quite complex and so multifaceted that mathematical models based on linear differential equations can only be considered modeling in the first approximation.

In this textbook, the biological examples are included virtually everywhere in the descriptions of methods of writing and solving the appropriate differential equations; they are often an adequate description of the dynamics of variables and conform with the objectives and tasks of modeling.

The distinction of the presentation also lies in the fact that the sections of differential equation theory that are the easiest to comprehend and most used to solve biological and medical problems are very concise. The more difficult sections dealing with nonlinear equations, equations with variable coefficients are more comprehensive.

Unity of structure and function is inherent in the function of biological systems. Whenever this must be reflected in mathematical models, it is often (and will be more and more often in the future) necessary to use methods of describing the form of different structures (organ, vessels) and distribute among structures the variables (concentration, potential, pressure) that determine functional states. For this reason, we devoted much attention to description of theory of partial equations with the use of examples.

It is known that partial differential equations have found wide applications in physics as an effective tool that permits describing different physical phenomena which include, in particular, heat conduction diffusion, electric and magnetic fields, propagation of diverse waves and quantum fields. The intensive development of mathematical biology in the last decades has led to expansion of the area of application of partial differential equations of the second order. We can arbitrarily single out two main directions. The first is related to development of mathematical theory of biological phenomena, which are based on physical processes (diffusion, head conduction, etc.), described by second order partial equations. Use of partial second order equations to describe the propagation of pulse waves in blood vessels, diffusion of oxygen and other substances in cells, in the microcirculatory system and other phenomena are illustrations of this direction.

The second direction of using second order partial equations is related to quantitative description of biological processes which are in essence biological, even though they present some analogy to certain physical processes. This direction can be illustrated with examples of theory of inflammatory processes.

Discussion of biological applications of second order partial equations is limited to a small section, which briefly describes the classification of second order partial equations and the most frequently encountered boundary value problems.

The methods of solving partial equations are described in the sections dealing with specific biological problems. Of course, the material presented in the foregoing does not cover all of the branches of mathematical biology making use of second order partial equations developed to date. The examples are given here in such a manner as to illustrate as broadly as possible the different methods of solving problems in the field of biology to which these problems refer.

In the presentation of specific sections, considerable attention is devoted to biological validation of the mathematical system used.

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CSO: 1840/999

CHANGES IN ENDOCRINE GLAND FUNCTION DURING EXERCISE: ENDOCRINE MECHANISMS OF REGULATION OF THE BODY'S ADAPTATION TO MUSCULAR ACTIVITY

Tartu IZMENENIYA FUNKTSIY ENDOKRINNYKH ZHELEZ PRI FIZICHESKIKH NAGRUZKAKH: ENDOKRINNYYE MEKHANIZMY REGULYATSII PRISPOSOBLENIYA ORGANIZMA K MYSHECHNOY DEYATEL'NOSTI in Russian 1980 pp 166-167

[Table of contents from book "Changes in Endocrine Gland Functions With Physical Loads: Endocrine Mechanisms of Regulation of the Organism's Adaptation to Muscular Activity", by N. N. Yakovlev et al., 167 pages]

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CSO: 1840/999

RADIATION BIOLOGY

UDC: 535.23:577.1:591.443

BIOCHEMICAL BASES OF ACTION OF RADIOPROTECTIVE AGENTS

Moscow BIOKHIMICHESKIYE OSNOVY DEYSTVIYA RADIOPROTEKTOROV in Russian 1980 (signed to press 3 Jul 80) pp 2-5, 167-168

[Annotation, list of abbreviations used, foreword and table of contents from book "Biochemical Bases of Action of Radioprotective Agents", by Yevgeniy Fedorovich Romantsev, Vera Dmitriyevna Blokhina, Zoya Ivanovna Zhulanova, Nikolay Nikolayevich Koshcheyenko and Igor' Vladimirovich Filippovich, Atomizdat, 1190 copies, 168 pages]

[Text] This book analyzes the mechanism of action of agents that modify radiation lesions on the molecular level. Much attention is devoted to molecular interactions between radioprotective agents, radiosensitizers and biologically important endogenous macromolecules. An original conception is developed of a complex biochemical mechanism of action of agents that modify radiation lesions; special attention is given to processes of temporary inhibition of replicative processes and stimulation of DNA repair processes. Analysis is made of data on the significance of temporary formation of mixed disulfide bonds between radioprotective agents--amino thiols--and protein-enzymes having a sulfhydryl group. The existing hypotheses concerning the mechanism of action of radioprotective agents are discussed critically. This book is intended for radiobiologists, biochemists, physicians, senior year students at biological VUZ's and medical institutes. Tables 1, figures 14; references 570.

List of Used Abbreviations

tsAMF--adenosine 3':5'-cyclic phosphate
APAETF--aminopropylaminoethyl thiophosphate (gammaphos)
ATP--adenosine-5'-triphosphoric acid
AET--2-aminoethylisothiuronium
BSA--bovine serum albumin
GTF--guanosine-5'-triphosphoric acid
GED--guanidoethyl disulfide
dATF--deoxyadenosine triphosphate
dGTF--deoxyguanosine triphosphate
Diamide-bis--(N,N-dimethylamide)-diazene of dicarboxylic acid
DNK--deoxyribonucleic acid
DTT--dithioerythrite
dTsMF--deoxycytidine monophosphate
dTsTF--deoxycytidine triphosphate
iRNK--messenger RNA
MPA--β-mercaptoethylamine
MEG--2-mercaptoethylguanidine

NADN--nicotinamide adenine dinucleotide
$NADFN_2$--nicotinamide adenine dinucleotide phosphate
OMF--orotidine monophosphate
PGPS--prostaglandin-like compounds
PPS--peroxide-like compounds
PKhMB--*n*-chloromercuribenzoate
RNK--ribonucleic acid
rRNA--ribosomal RNA
yaRNA--nucleic RNA
TMF--thymidine monophosphate
TTF--thymidine triphosphate
UMF--uridine-5'-monophosphoric acid

Foreword

The problem of change in radiosensitivity of the organism by means of various chemical compounds--modifiers--is still one of the most pressing ones that are being worked on intensively in modern radiobiology.

In the Soviet Union, much attention is given to development of this direction. The first monograph analyzing the state of the question of chemical protection of organisms against ionizing radiation was published by Ye. F. Romantsev and A. V. Savich in 1958. Since that time, many books have been published shedding light on different aspects of modification of radiation damage by means of chemical compounds (Yu. B. Kudryashov, P. G. Zherebchenko, A. G. Sverdlov, N. N. Suvorov, V. S. Shashkov, S. P. Yarmonenko, L. Kh. Eydus, A. S. Mozzhukhin, F. Yu. Rachinskiy and others).

However, radiobiology is developing so rapidly, that there is an urgent need to periodically report the achievements in this branch of natural science in the form of summarizing works. This book describes the concept of complex biochemical mechanism of radiation lesion modifiers, which is developed by the authors, and analyzes the status of the problem as a whole.

It is of basic importance to comprehension of the triggering effects of radiation to conduct studies of the molecular mechanisms of action of radiation modifiers. At the same time, identification of the molecular mechanisms of the effects of radiation on cells opens up the prospect of new approaches to the search for effective radioprotective and radiosensitizing agents. For this reason, we deemed it expedient to shed light on a number of basic sections of radiation biochemistry, with emphasis on biochemical mechanisms of interphase death of irradiated cells. Modifiers intervene actively in virtually all biochemical processes that determine individual and species-specific radiosensitivity. For this reason, analysis is made in relevant chapters of data on the effects of radioprotective and radiosensitizing agents on DNA metabolism, RNA biosynthesis, processes of DNA replication and repair, protein synthesis in animals and energetic processes in the cell. It was judged necessary to discuss briefly the state of the question of possible role of cyclic adenosine monophosphate and prostaglandins in the mechanism of radioprotective agents. Much attention is devoted to analysis of molecular mechanisms of manifestation of activity of radiation damage modifiers, questions of temporary inhibition of replicative processes and optimization of conditions for DNA repair. At the end of the book, there is discussion of some general patterns in the molecular mechanism of radiation damage modifiers, and a scheme is offered for different stages of their biological activity.

It so happened, historically, that radioprotective agents were studied as compounds intended to protect eukaryotes against absolute minimal lethal doses of ionizing radiation ("hemopoietic form" of radiation sickness). At the same time, it is already apparent that it is possible, in principle, to provide protection against considerably larger doses of penetrating radiation. This increases interest in the problem of modifying radiation effects with chemical compounds.

Modern molecular radiobiology and radiation biochemistry are developing quite rapidly. For this reason, we are aware of the fact that, by the time this book is published, new data will appear concerning the mechanism of radiation damage modifiers.

The authors will be grateful to all readers for any critical comments they may have.

Contents

10,657
CSO: 1840/999

HUMAN FACTORS

UDC 6297.06(082)

MATHEMATICAL MODEL OF HUMAN OPERATOR USED IN FLIGHT SIMULATORS

Moscow AVIATSIONNYYE TRENAZHERY in Russian 1978 (signed to press 5 Jul 78) pp 14-20

[Section 1.3 from book "Flight Simulators", by Vasiliy Afanas'yevich Bodner, Rafael' Abdullovich Zakirov and Inna Ivanovna Smirnova, Izdatel'stvo "Mashinostroyeniye", 3600 copies, 192 pages]

[Text] 1.3. Mathematical Model of the Human Operator

We will examine some psychophysiological characteristics of the operator which should be considered in formulating the information similarity criteria. Of these characteristics, the most important are the transmission functions and transmission information capacity on visual, acceleration and auditory channels.

The operator's transmission functions are determined by his psychophysiological features and properties of the control loop in which the operator is working. If the operator controls a stationary loop of control, for example, FV [flight vehicle], then his transmission function in the perception of visual information and transmission of signals to the control units will look like

$$W_0(s)=\frac{ke^{-\tau s}(a\tau_1 s+1)}{(\tau_1 s+1)(\tau_2 s+1)}, \qquad (1.19)$$

where k--amplification coefficient; τ--time for formation of response reaction to input signal; τ_1 and τ_2--time constants characterizing the transmission of signals on nerve fibers; a--coefficient which takes into consideration the degree of training, experience, simulation, fatigue and type assignment. The average values for the transmission function coefficients (1.19) are presented in table 1.

It is apparent that for different frequencies of the perceived signal, the parameters of the transmission function adopt different values. This indicates the adaptive properties of the operator. The operator, working in the control loop, adapts by changing the parameters τ_1, τ_2 and k, striving, as studies have shown, to minimize the standard error and to maintain the phase margin on the order of 40°. In other words, the operator is a natural system of optimization.

The operator's transmission function, presented in the form of expression (1.19) does not take into consideration all the features of the operator (nonlinearity, adaptivity). Expressions were therefore suggested which take more complete consideration of the psychophysiological characteristics of the operator. One of these

Table 1.1.

Signal frequencies	τ_1	τ_2	τ	a	k
0,16	25	0,67	0,15	0,08	100
0,32	9,1	0,22	0,20	0,055	40
0,48	5	0,09	0,25	0,067	15

mathematical models which describes the operator's transmission properties is presented in figure 1.4. This model takes into account the zone of insensitivity in signal perception, displacement equivalent to the noise generator (remnant), dynamics of formation of the response reactions in the central nervous system, and dynamics of signal transmission to the arm muscles.

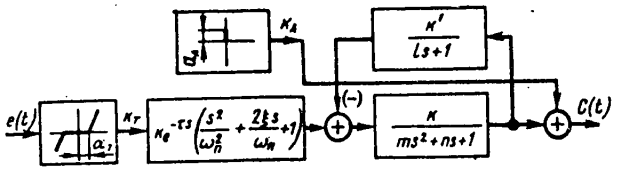

Figure 1. Structural Plan of Model of Perception of Human Operator

The examined model of transmission properties of the operator can be presented in the form of an analytical expression

$$W_0(s)=k_\tau k e^{-\tau s}\left(\frac{s^2}{\omega_n^2}+2\xi\frac{s}{\omega_n}+1\right)W_k(s)+k_A, \qquad (1.20)$$

where $W_k(s)$--transmission function of the arm, and

$$W_k(s)=\frac{a_0 s+1}{a_1 s^3+a_2 s^2+a_3 s+1}; \qquad (1.21)$$

$$k_\tau=1-\operatorname{erf}\left(\frac{a_\tau}{\sigma_\tau}\right)+\sqrt{\frac{2}{\pi}}\left(\frac{a_\tau}{\sigma_\tau}\right)e^{-\frac{1}{2}\left(\frac{a_\tau}{\sigma_\tau}\right)^2}; \qquad (1.22)$$

$$k_A=\sqrt{\frac{2}{\pi}}\left(\frac{a_A}{\sigma_A}\right), \qquad (1.23)$$

k--amplification coefficient.

In these expressions, a_A and a_T are mathematical expectations, and σ_A and σ_T are the standard deviations of the element characteristics on the assumption of normal distribution. The numerical values of the coefficients which are included in expression (1.20) are given in table 1.2.

Acceleration information plays a large role in flight control, therefore we will examine the features of its perception. The main biological sensor which perceives accelerations and supplies man with information on the change in spatial position

is the vestibular analyzer. Its purpose is static and dynamic orientation of the head and orientation of the eyes in any position of the head.

Table 1.2.

τ, c	a_0, c	a_1, c^3	a_2, c^2	a_3, c	ω_n rad/s	ξ	b_0
0,2	0,05	0,098	0,007	0,002	4,17	0,523	2

The vestibular analyzer contains otoliths and semicircular canals.

The otolithic apparatus includes the utriculus and sacculus. The structure of these organs is characterized by a fixed part, the macula, and movable parts, like pendulums, the otoliths. Movement of the heavy otolith above the macula causes a sensation of inclination or movement. It is believed that the utriculus reacts to linear accelerations, while the sacculus perceives vibrations.

Linear accelerations generated by the gravity force or active forces are the input quantity of the otolithic appparatus. In this case, the following conclusion is correct: the utriculus perceives forces of any direction (vector quantities) and is stimulated by shearing forces in the plane of the otolith. The quantity of information obtained by man through the otoliths is determined by their dynamic characteristics.

Studies have shown that a redamping pendulum which reacts to linear accelerations of any direction is a mathematical model of the otoliths. The otoliths, like any pendulum, do not distinguish accelerations of active forces and the gravity force. Man can therefore correctly determine the position of the local vertical only with a fixed position or with rectilinear uniform movement.

The otolithic transmission function can be presented in the form

$$W_{jx}(s)=\frac{k_1}{(T_1s+1)(T_2s+1)}, \qquad (1.24)$$

where T_1=10...11 and T_2=0.66--time constants, s; k_1--amplification coefficient; j--input acceleration; x--movement of otolith.

The amplitude-frequency and phase-frequency characteristics of the otolith are shown in figure 1.5. The characteristics of the otolothic apparatus change depending on the frequency of the perceived acceleration: at low frequencies, $\omega \ll 1/T_1$, it operates as an acceleration sensor, at medium frequencies $\frac{1}{T_1} < \omega < 1/T_2$ it operates as a velocity sensor, and at high frequencies $\omega > 1/T_2$, it operates as a sensor for human body movement in space. It follows from here that high-frequency, and partially medium frequency accelerations play the main role in the human spatial orientation. In addition, because of the property of the body's adaptation to constant and low-frequency accelerations, information about these accelerations is not used to determine the spatial position.

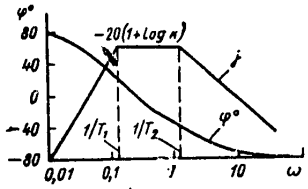

Figure 1.5. Amplitude- and Phase-Frequency Characteristics

The otolothic apparatus has a threshold of insensitivity which is not reflected by transmission function (1.24). A more accurate mathematical model of the otolithic apparatus is shown in figure 1.6. In this model, the first link depicts the orientation of the otoliths, the second link is the dynamics, the third is the threshold of perception (sensitivity), the fourth is the amplification properties of the central nervous system, and the fifth link with transmission function F(s) is the boosting properties. Without consideration for the zone of sensitivity, the transmission function of the otoliths adopts the appearance of expression (1.24).

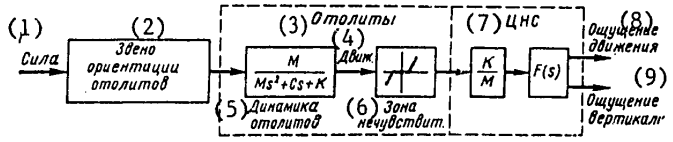

Figure 1.6. Structural Plan of Mathematical Model of Otolithic Apparatus

Key:
1. Force
2. Link of otolithic orientation
3. Otoliths
4. Movement
5. Dynamics of otoliths
6. Zone of insensitivity
7. Central nervous system
8. Sensation of movement
9. Sensation of vertical

The mathematical model of the semicircular canals as elements sensitive to angular accelerations ε can be presented in the form of a transmission function

$$W_{\varepsilon\eta}(s)=\frac{k_2}{(T_3s+1)(T_4s+1)}, \qquad (1.25)$$

where T_3=9...12 and T_4=0.003-0.03--time constants, s; k_2--amplification coefficient; η--displacement of endolymph during accelerations.

The amplitude-frequency and phase-frequency characteristics of the semicircular canal are shown in figure 1.7. At low frequencies, man does not distinguish the constant angular rotation velocity and does not have low sensitivity to the low-frequency changes in this velocity. At medium frequencies, $0.07 < \omega < 300\ s^{-1}$, the semicircular canals operate as rotation velocity sensors, and at high frequencies, $\omega > 300\ s^{-1}$, they operate as sensors of human body rotation.

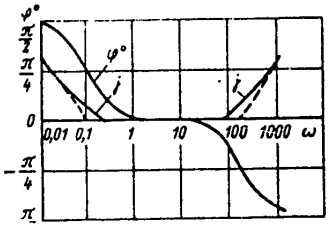

Figure 1.7. Amplitude-Phase-Frequency Characteristics of Otolithic Apparatus

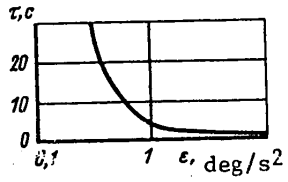

Figure 1.8. Thresholds of Perception of Angular Acceleration

The semicircular canals have a threshold of perception which depends on the delay time, i.e., on the moment of development of the acceleration to the moment of its perception (fig 1.8). It is apparent that the maximum value of threshold acceleration is 0.5 deg/s^2, while the threshold of perception with delay time of 0.1 s is 5 deg/s^2.

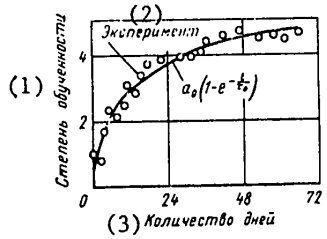

Figure 1.9. Characteristics of Degree of Training

Key:
1. Degree of training
2. Experiment
3. Number of days

During the perception of angular velocities, the human operator also has threshold values which, with a delay of 0.1 s are: 3.2 deg/s for heeling; 2.6 deg/s for pitching, and 1.1 deg/s for yawing.

The vestibular system and vision are linked so that the image on the retina is stabilized during rotation of the head. Discrepancy between movement of the eyes and sensations of the vestibular system does not exceed 0.1 s. Negative illusions develop with greater discrepancy.

The examined transmission functions are mathematical models of pilot activity in the control loop of a FV or simulator. Acquisition of habits and the knowledge necessary for correct functioning is attained in the training process, including on the simulator. During training on the simulator, the pilot acquires knowledge that increases as the training time increases. Experimental studies show [10] that increase in knowledge during the training process occurs by the exponential law.

In examining the transmission function (1.19) the degree of operator training was characterized by the coefficient a. This coefficient increases in the training process and reaches a certain limiting value at which training can be considered finished. The transmission function which characterizes the training process according to the experimental data may be presented in the form of a lag network

$$W_{o6}(s) = \frac{1}{\tau_0 s + 1},$$

where τ_0--time constant of training which averages 25 days.

The coefficient of training a, according to the transmission function $W_{o6}(s)$ can be presented in the form

$$a(s) = \frac{a_0}{\tau_0 s + 1},$$

where a_0--limiting value of training coefficient.

Figure 1.9 gives a graph for the process of increase in the degree of training as a function of time. It also shows the experimental points. It is apparent that the model of training in the form of the transmission function a(s) agrees well with the experimental data. The process of training the operator is several orders longer than the process of control, therefore the coefficient a in formula (1.19) should be considered constant.

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CSO: 8144/1610

UDC 62-50

REDUCTION IN ADAPTATION TIME IN ERGATIC CONTROL SYSTEMS

Kiev AVTOMATIKA in Russian No 5, Sep-Oct 79 (manuscript received 19 Feb 79) pp 59-62

[Article by V. V. Pavlov and A. M. Meleshev, Institute of Cybernetics, UkSSR Academy of Sciences]

[Text] The possibility of rapid compensation for the consequences of failures in the control system plays an exceptionally important role in ergatic systems in which the human operator performs so-called manual control of an object and the control process takes a short time (less than 5 minutes). During failures, the control object becomes somewhat different for the human operator. Time for "adaptation" to the "new object" is needed in order to maintain the previous control quality. The adaptation time for the mentioned processes can comprise a significant part of the time for the entire control process. Its reduction is therefore an important task for ergatic control systems. One of the methods for reducing the "adaptation" time t_a is visual depiction of the main properties of the control object (for example, tables of a ship's maneuver characteristics [3], etc.). This may be a graphic relationship, or any other picture illustrations which permit unequivocal illustration of the necessary data. Images on cathode-ray tube screens are the most valuable. They permit rapid illustration in a real time scale of the characteristics depending on the technical condition of the control object and the formed situation. For ergatic systems with manual control, it is convenient to depict in axes associated with the control object the quantities of the controlling factor developed by the control units, depending on the deviation of the control lever from the neutral position. We will call this graphic picture DCF, "diagram of controlling factors."

In order to clarify what has been said, we will examine a simple ergatic system of compensator tracking (fig 1). The human operator sees in the visual indicator errors ε_x, ε_y which are proportional to the deviation of the center of mass of the control object from the zero position in the OX_0Y_0 coordinate system (fig 1, b, d). By deviating the control lever in the necessary direction, the human operator creates the controlling factor T which is proportional to deviating the control lever from the neutral position $T^x=c\delta$, $T^y=c\gamma$ (fig 1, c d). Thus, the human operator manually controls the object with the task of keeping, for example, the error modulus ε_x,ε_y less than the assigned value λ (i.e., tracking with the assigned accuracy λ).[y] It is easy to see that under the conditions stipulated above, the orientation of the T vector of the controlling factor coincides with the orientation of the R vector of the control lever deviation, i.e., $\beta=\alpha$.

If we now fix the vector modulus R and change the angle of orientation α=0-360, then the end of vector T outlines a curve in the plane of associated OXY coordinates whose visual depiction we will call the diagram of controlling factors. The DCF provides a graphic idea regarding the quantity of the controlling factor in the direction of control lever deviation. In our case, DCF will have the appearance of a circle with radius proportional to the deviation of the control lever from the neutral position.

We now assume that a malfunction develops in the control system (fig 1). As a result, the component T^y of the controlling factor is reduced by 1/3: $T^x=c\delta$, $T^y=0.66\ c\gamma$. In this case, the DCF will be considerably altered, i.e., the quantity of the modulus of the controlling factor and the angle of orientation of vector T will change, i.e., $\beta\neq\alpha$. For this case, figure 1,e presents the DCF where the

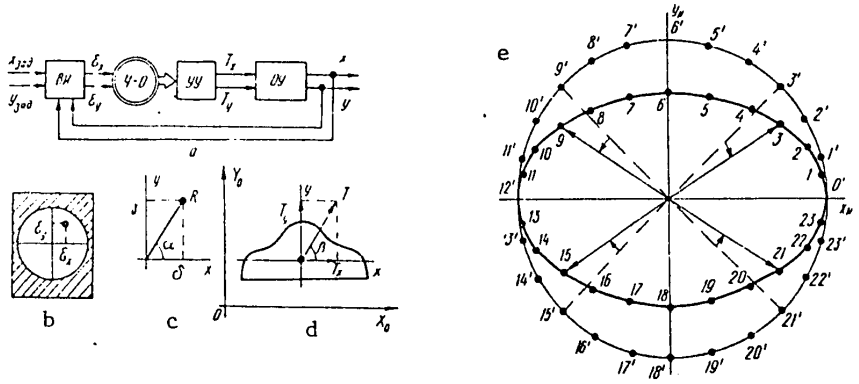

Figure 1. Structural Plan of Control System and Basic Correlations

Key:

a. structural plan
b. picture observed by human operator in visual indicator (ε_y, ε_x--quantities proportional to deviations of regulated coordinates from assigned);
c. R--vector of control lever deviation from neutral position (α--orientation angle of vector R in associated axes)
d. T--vector of controlling factor applied in center of mass of control object (β--angle of orientation of vector T in associated axes; OX_0Y_0--system of reference coordinates)
e. $y_и$, $x_и$--axes of visual indicator for diagram of controlling factors that coincide in direction with the corresponding associated axes of the control object.

numbers with the stroke indicate the corresponding points for the DCF of the original system. The points correspond to the 24 fixed values of α. It is apparent in figure 1, e that, for example, with α=45° (point 3') in the original system β=45°, and in the system with failure β<45°.

Experiments have shown that if the human operator performed tracking with accuracy λ before the failure, then at the moment of failure, this condition is disrupted and is only restored after time t_a (in [2], the time which is close in meaning is called "time for entering the task"), during which the human operator creates an

"image representation" of the developed situation and makes the necessary corrections in his actions. If the human operator is given a DCF, then adaptation time t_a can be significantly reduced. Figure 3,a shows a plan to determine the adaptation time t_a, and figure 3, b shows the mathematical expectation $M[t_a]$ during

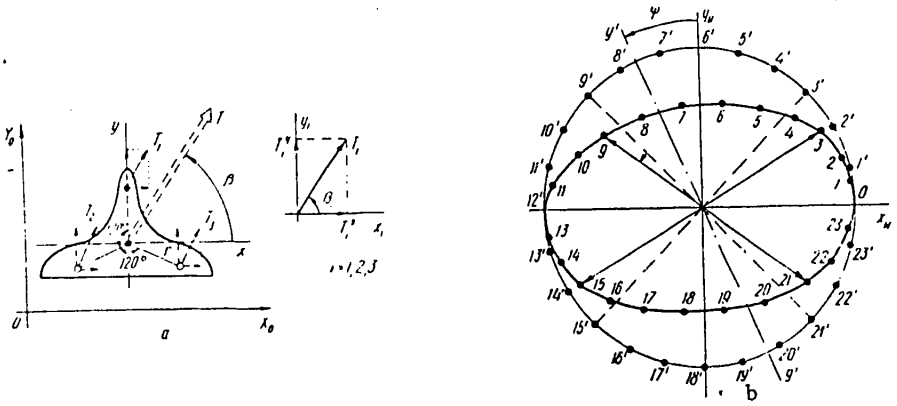

Figure 2. Basic Correlations for Control Object with Three Controlling Organs

Key:
a. T--vector of resulting controlling factor
T_i--vector of i-th controlling factor (β--angle of orientation of vector T in associated axes)
b. diagram of controlling factors

failure and in the absence of DCF (hatched column). Next to it is the column for values of mathematical expectation $M[t_a]$ (in percents of the hatched) when the human operator is given a DCF. As we see, the knowledge of the DCF by the human operator significantly reduces the adaptation time. The experiment was conducted for an object of the second order without damping for the sinusoidal input signal.

We will examine a more complicated case. Assume that the control object has controlling devices whose actions are equivalent to the action of the three controlling units located at distance r from the center of mass at angle 120° to each other (fig 2,a). Assume that the components T_i^y and T_i^x of the controlling factors of each controlling unit are proportional to the γ and δ components of the vector of deviation of the control lever. Then the orientation of vectors T_i coincides with the orientation of vector R, i.e., $\beta_i=\alpha$, correspondingly, the total vector of the controlling factor T (applied in the center of mass) has an orientation which coincides with the orientation of vector R of the control lever deviation, i.e, $\beta=\alpha$.

For the object of second order without damping, the movement in plane OX_0Y_0 will be determined by the equations:

$$m\ddot{y} = \sum_i T_i^y, \quad m\ddot{x} = \sum_i T_i^x, \quad J_{\varphi}\ddot{\varphi} = \sum_i M_i^x + \sum M_i^y,$$

where ϕ--orientation angle of associated axes oxy of the control object in relation to the reference axes $0x_0Y_0$; M_i^x, M_i^y--moments of i-th controlling unit created by the components T_i^x and T_i^y respectively.

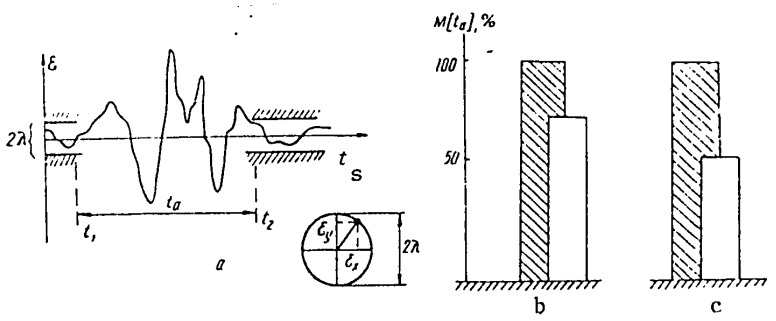

Figure 3. Adaptation Time of Human Operator to Change in DCF and Plan of His Determination

Key:

λ--radius of tube of permissible deviations of regulated coordinates from assigned

t_a--adaptation time

t_1--moment of failure in control system

t_2--moment of stable entrance into tube of permissible errors,

$M[t_a]$--mathematical expectation of adaptation time

It is easy to note that under the conditions stipulated above, the control system for the human operator will be two-channel. The control object is moved in the $0X_0Y_0$ plane without changing its orientation, i.e., ϕ=const.

We assume that a failure has occurred, resulting in component $T_3^y=0$. This results in the appearance of an expanding moment which disrupts the orientation of the control object ($\phi\neq$const), and naturally, the control system becomes three-channel, i.e., now the human operator needs to compensate for the change in ϕ and take this into consideration in the control. Experiments show that the quality of control in this case is drastically diminished. It is therefore expedient to fulfill (in relation to the control channels) the principle of "stationariness" [1]. Assume that the expanding moment has been compensated for, for example, by the introduction of additional signals into the laws of controlling components T_i^x, i.e., $T_i^x=c\delta+k\gamma$ (where the coefficient k is defined from the condition of compensation for the moment). As a result, the control system with $T_3^y=0$ will again remain two-channel. Analogously to the previous case (fig 1), only the modulus of the general vector T of the controlling factor will change for the human operator, and the condition $\beta=\alpha$ will be disrupted.

The DCF obtained for this case (fig 2,b) is significantly altered. Thus, the axis y'y' on which the displacement angle $\Delta=\alpha-\beta$ equals zero is seemingly turned to angle ψ. For comparison, on fig 1, e, these axes coincide with the direction of the associated axes. Experimental data for time of adaptation to the examined

failure show a significant advantage if the human operator knows the DCF. Figure 3,c presents values of mathematical expectations for the adaptation time in the presence and absence (hatched part) of information regarding the DCF. Decrease in $M[t_a]$, as we see, is significant. It should be noted that for certain versions of failures in the system of figure 2, the quantity of $M[t_a]$ when the human operator knows the DCF was less than 50% of the $M[t_a]$ of "adaptation" time in the absence of DCF.

Thus, as shown by the experimental data, even for the examined, fairly simple control objects, visual presentation of the DCF in ergatic systems is very useful, especially in control systems in which the controlling factor is formed by the total action of many controlling units. In this case, if individual controlling units fail, the human operator who makes a decision on object control is not always able to mentally imagine how much the DCF was distorted as compared to the original. In preparing a decision for maneuvering, etc., it may happen that planned maneuvering is only possible with a definite orientation of the object (DCF) to the plane of maneuvering. Consequently, knowledge of the DCF makes it possible to do this. As a result, the active role of the human operator in decision making is increased, and the quality of control of the ergatic system as a whole rises.

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CSO: 8144/1628

UDC 681.327.12:621.39:534.78

AUTOMATIC SPEAKER IDENTIFICATION BY VOICE

Moscow AVTOMATICHESKOYE OPOZNAVANIYE GOVORYASHCHEGO PO GOLOSU in Russian 1981 (signed to press 29 Dec 80) pp 2-12, 211-221, 223-224

[Summary, foreword, introduction, bibliography and table of contents from book "Automatic Speaker Recognition by Voice", by Guram Solomonovich Ramishvili, Izdatel'stvo "Radio i svyaz'", 7000 copies, 224 pages]

SUMMARY

[Text] A survey is given of the current status of the problem of investigating individual features of the voice and automatic speaker identification systems.

The book is intended for scientific workers and specialists working on equipment for vocal communications and man-machine contact.

FOREWORD

The necessity of developing automatic systems for speaker identification by voice is chiefly dictated by practice. Thus, for example, it is necessary to confirm (verify) a particular individual at control and admission points in order to ensure the admission of only a limited group of persons to the controls of special purpose mechanisms or to different information systems. What is more, the problem of automatic identification of the individual voice is of great significance in solving a number of criminalistic problems and in military matters, particularly in electronic reconnaissance, etc.

On the other hand, these questions are closely related to automatic identification of the semantic content of speech and the necessity of developing improved systems for machine recognition of verbal utterances (by eliminating individual variation of the voice as an impeding component) or, on the other hand, by constructing devices tuned to the individual voice of a speaker (for the purpose of abstracting from individual coloring of the voice).

Despite the urgency of such tasks, it can be said that not all our specialists are yet aware of the importance of research on the individual properties of the speech signal. At the same time, great attention is being given to these questions abroad (for example, in the USA and Japan). It is enough to indicate that at the present time dozens of prominent foreign centers financed by military, justice or commerce departments are working on automatic speaker identification. At the

present time many of these studies are already being widely discussed from the perspective of their concrete practical application.

The undertaking of the present book is to familiarize the Soviet reader with this problem and to facilitate more active and effective interest in it. The publication of such a book is also justified by the fact that there is still no work in the specialized literature which correlates in accessible form all questions associated with the solution of this problem. The author's monograph "The Speech Signal and the Individual Voice" (published by "Metsniyereba" Publishing House, Tbilisi in 1976) is devoted to the investigation of individual properties of the human voice and deals with only those questions on the solution of which he himself worked. It did not set the goal of presenting everything that had been done in this field and reflected in the specialized Soviet and foreign literature.

Meanwhile, the demand for information of this type unquestionably exists. It is needed not only by specialists engaged in technical cybernetics but also by a wider scientific community which wishes to become more closely acquainted with the literature on pattern recognition, especially auditory patterns which are closely associated with the nature of human sensory perception.

We would like to believe that this book will to some extent be capable of filling the existing gap in publications of this nature.

INTRODUCTION

In everyday life we constantly encounter the fact of recognition of people by their voices alone. You ring the doorbell. Behind the door they ask, "Who is there?" You answer involuntarily, "It is I," not thinking that the pronoun "I" does not contain information on concrete identity. You subconsciously present the listeners with your voice as an object for identification.

Just as often people identify each other by voice alone when talking by telephone, listening to the radio, etc. For the blind, the voice is the sole means of speaker recognition.

It is interesting to note that even newborn children have the capacity to recognize voices, principally their mothers', as has become known from the research of psychologists. This fact demonstrates that man is not born entirely unprepared--he is equipped with the functional capacities necessary to meet his vital requirements as early as this period of development.

What is the problem of building systems for automatic voice identification? The solution of this problem necessarily presumes preliminary analysis and establishment of parameters in accordance with which classification of individual voices by machines must take place. The basic complication here consists of the fact that the person speaking must be recognized; identification occurs as he talks. But this means that one and the same source has several different functions; one and the same elements characterize both the uniqueness of voices and the transmission of semantic information. Thus, far from one factor influences and is responsible for the different specific characteristics of a

speaker's voice. In beginning analysis of this complex, integral system, the first thing that we can say apriori and indisputably by virtue of its obviousness, is that the speaker's voice is governed by the anatomical properties of his articulation apparatus.

The fact that, as a rule, we are capable of distinguishing a child's voice from an adult's, a young person's from an old person's and a man's from a woman's is due precisely to the anatomical and physiological features of the vocal tract. Each defect in the corresponding organs is reflected and makes itself known in the speaking voice (burrs, lisps, nasality, etc.).

But, as we have already said, reducing the individuality of the voice to merely the physical (or biological) properties of this apparatus is, of course, impossible. These properties are most important, however they do not alone determine the character of a speaker's voice. The fact that not only biological, but also social, patterns and social determination of any kind of human activity are of significance here, is as important. Speech activity is the specific capability of man which initiates social experience and, in so doing, the insurmountable abyss between man and animal.

Individuality always forms under the conditions of a particular society. The person's contact with the outer world, the development of different strategies in the struggle for existence and the formation of his mental potentialities and his individual consciousness are accomplished under these circumstances and through them. It is precisely this circumstance that gives man absolute uniqueness.

An important condition for the feasibility of social experience is man's capacity for language. Accordingly, the task of transmitting semantic information is the main and most important function of speech. The acoustic aspect of speech is adapted to fulfilling precisely this function. For exactly this reason aural language is people's primary means of communicating with each other. All other types (written language, the language of deaf mutes, various codes, etc.) are secondary in relationship to it, having developed on its basis.

What is more, together with semantic information, sound also carries information about the speaker himself, his age, his sex, and also about his physical and "inner," i.e., mental, state.

Specifically, for example, the voice may convey specific emotions of the speaker, his agitation, happiness, sadness, depression, fear. It may also convey his attitude toward his interlocutor and toward the subject of the statement (for example, an impression of horror or delight at a reported event or enthusiasm for a solemn appeal). The sound of conversational speech may also contain information about a person's more persistent mental properties, about certain features of an individual's character, about his placid or nervous temperament. It is on this fact that different physiognomonic and pathognomonic studies on

sound are based. The former attempt to establish the characteristics of an individual's personality, and the latter--his current emotional state*).

In connection with this multifaceted information contained in uttered sound, the fact that the vehicle of these functions and the source of such diverse information are one and the same creates a particularly complex problem. At the same time, the objective of building an automatic system for identifying given auditory patterns requires segregation of data of one informational aspect from those of other aspects such that the latter do not mask or drown out the needed information.

What conclusion should be drawn from all the aforesaid? It would be most natural to recognize that all characteristics of the vocal tract and all parameters of the vocal signal without exception are subject to speaker differences. Hence, in turn, the converse conclusion--namely, that it is scarcely possible to find speech characteristics which participate exclusively in the formation of the phonetic qualities of sound and are unrelated to the properties of the individual voice, and vice versa. For example, while we assume that an individual can be identified by such a criterion as vocal timbre, here it should be remembered that the timbre of a sound, which constitutes the distribution of energy along a spectrum, is also the basic criterion for distinguishing different sounds--phonemes. It is much the same with other criteria, say, with the manner of pronunciation (accent, dialectal pronunciation) or even with speech defects, for example stuttering or burrs. But at the same time, it is obviously also necessary to take into consideration the fact that the latter properties are manifested in a certain way in a specific context, i.e., with certain phonemes, syllables or words. Even such pathological properties of phonation as nasality or lisping cannot appear constantly against the background of all sounds.

* Studies on physiognomonics are usually conducted along the lines of psychological research, particularly characterological studies. For example, Rudert (187) studied the conversational voice from the perspective of the variation of tonal pitch and rhythm of the process. By rhythm was meant the segmentation of speech by pauses between syllables, words and phrases and accentuation of components. Consequently, he divided the test subjects into two types: a "melodic class" and a "rhythmic class," associating corresponding character traits with these voice types. Among other things, he considered sharply segmented and dynamically accented speech to be a "militaristic" type of speech characterizing a more resolute set of personality.

Also well known are the studies of other authors who tried to determine, on one hand, the acoustic properties of an individual's speech and, on the other, certain features of his character, which were studied using various psychological methods.

It cannot be denied that sometimes we actually draw certain conclusions about a speaker's character from his conversational voice. Elevating this to a universal principle, however, and expecting that character may be determined on the basis of vocal properties, does not seem to us to be valid or to inspire confidence in the approach to facts from the perspective of scientific exactingness.

For this reason, most specialists in automatic voice identification naturally use basically the same speech parameters and characteristics as those used by specialists in speech diagnosis.

In this case, what, then, is the invariant in solving a given task? How does auditory perception solve the problem of distinguishing information streams which are so closely related and interwoven in the physical properties of the speech signal?

It seems to us that the answer must be sought in thorough investigation of the nature of the speech signal as a product of the action of the complex, multifunctional vocal mechanism. Specifically this should mean that in constructing automatic speech recognition systems one must keep in mind that those elements of speech being identified which differentiate meaning must always be studied under conditions of, and taking into consideration, the functioning of their specific, i.e., individual source, and conversely, in constructing automatic voice identification systems one should keep in mind that the individual voice must be examined under conditions of real speech activity, always bearing some semantic information and characterized by certain dynamics of word pronunciation.

But how should this system of relationships be isolated from the interlacing of the different systems which participate in speech?

In order to solve this problem, let us try to describe how human hearing distinguishes, for example, the sounds of a desired instrument or singer from the most complex auditory signal, corresponding to the playing of an entire orchestra. And how does man identify a familiar voice or speech occurring through a communications channel with components which have highly nonlinear and nonuniform frequency characteristics and which thus significantly change the spectral picture of the natural signal? Finally, how is the "cocktail party effect"--consisting of the fact that it is possible to follow any one of transposed private conversations in society, tuning out all the other conversations--achieved (200)?

Obviously, such selection and identification is accomplished through the inner consistency of elements which help us follow one integral system against the background of others. The pattern, in the form of a complete whole, is distinguished from the remaining background as a structure subject to a specific pattern (the law of figure and ground in psychology).

Automatic recognition systems should assume the task of achieving an effect analogous to human perception in this respect. Analogy to the laws of constancy of human perception may prove to be of use in accomplishing this task. Thus, for example, in the visual modality human perception succeeds in seeing and determining white as such only by taking the general lighting conditions into consideration. Otherwise, in shadow or on an overcast day white should be indistinguishable from dark gray for our vision with respect to its physical characteristics, and with full midday lighting black should be perceived as being close to gray. But our perception, as it were, unconsciously takes into

consideration the general lighting conditions and whether the color is appropriate to the given object and interprets the true color of the object accordingly. Thus, color perception is the complex product of the dynamic correlation of a whole variety of phenomena.

Matters are also analogous with perception of the size and form of an object. Miscalculation of distance may transform a fly or spider on a window pane into a monster on a mountain, as described in Edgar Allen Poe's tale "The Sphinx." Miscalculation of the visual angle in looking through a hole in a piece of paper at plates placed on a table will create the impression that the plates are not round but oval. However, we do not make such mistakes because subconsciously we always take the environment into consideration, i.e., we do not look through the "narrow aperture" but take various additional factors into consideration.

It has not been ruled out that something similar also takes place in the auditory modality. Let us take as an example perception of a loud voice carrying from a distance. It will be very difficult to trace the discernibleness of loudness to the intensity of the sounds made since a sound carrying may prove to be physically less intensive than a normal sound made by someone standing close by. Recognition of the quality of loudness of a carrying sound must occur only if the remoteness of the sound source and other conditions of articulation are taken into account.

In all these cases, perception of a given pattern (color, size, form, loudness) occurs only by allowance for different features which are interconnected in a system of relationships and produced in the form of a single integral pattern and its environment. In precisely the same way, the speech signal is a complex of simultaneously occuring messages of different types; the regular, dynamic system of the interrelations of these messages creates the phonetic quality, on one hand, and the specific nature of the individual voice, on the other. Hence it may be said that only thorough investigation of the speech signal is capable of more or less satisfactorily bringing us closer both to the goal of recognizing an individual voice and to recognition of speech in general.

A given property must be determined by taking into consideration, and contrasting to it, other components blended with it and not by filtering the latters. In other words, in perceiving a given pattern it is necessary to take the environment into consideration, and not to view this pattern through a "narrow aperture," ignoring what often is capable of shedding light on its nature. In other words, an object cannot be extracted from its environment and examined without reference to its surroundings.

Such an approach to solving problems of perception in general and to perception of speech in particular brings into the foreground and emphasizes the importance of such procedures as normalizing procedures.

It seems to us that failure to take such factors into consideration explains why the relevant devices recognize orders in the pronunciation of only a limited group of voices and with standard characteristics of the signal transmission channel. This also explains the fact that it is much easier to identify speakers when standard speech segments are pronounced and under standard conditions than with an arbitrary text and under conditions of any communications channel, any physical or

mental condition of the speaker, etc. .

Under the conditions of natural speech perception the listener does not care what the person being identified is saying at a given moment or what his emotional state is. In order to identify someone speaking to us by telephone, it would never occur to us to force him to say some standard sentence, whereas fulfillment of this condition is almost inevitably required for successful verification by automatic systems.

It is now difficult to give concrete prescriptions for realizing integrated systems for recognition of auditory patterns based on the principle of thorough consideration of the diverse information included in the speech signal. At the same time, with a number of practical problems it is sometimes sufficient to build devices which will identify or verify a limited group of speakers with predetermined reliability. In such a case methods of analyzing speech signals which reflect only some given aspect of the manifestation of individuality may be used.

Generally speaking, at this stage complete implementation of a comprehensive approach is an ideal rather than a real possibility, and its realization is a matter for the future. However, the one thing certain is that even today it is necessary to be guided by precisely such an approach and to introduce gradually features of system-integrated solution of individual problems. Some questions of building speech recogntion systems with preliminary adjustment to the human voice are covered in chapter 5.5. These questions, however, are examined not with the object of disclosing the complex nature of human perception, which was mentioned above, but with the intention of finding practical methods of realizing systems for recognition of semantic information which would somehow use and take into consideration the speaker's vocal properties. As will be demonstrated (chap 5.5), such methods are often particularly empirical.

Nonetheless, based on common sense, they provide a definite increase in the reliability of the functioning of speech recognition systems compared to analogous systems which do not first examine the vocal charactersitcs of a specific speaker.

To the abovesaid it should be added that it was basically practical interest that stimulated the development of most of the systems for speaker recognition by voice described in our book. It must be supposed that consideration and study of potentialities and the difficulties they face will make it possible to evaluate the current status of the problem of automatic speaker identification by voice in the best way possible and thus to note the basic ways to solve it. This is precisely the basic objective of this book.

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CSO: 1840/296

UDC: 51.001.57:612

SPECIFIC LAWS OF BIOLOGICAL REGULATION

Leningrad SPETSIFICHESKIYE ZAKONY BIOLOGICHESKOGO REGULIROVANIYA in Russian 1981 (signed to press 10 Dec 80) pp 2-5, 133-134

[Annotation, introduction and table of contents from book "Specific Laws of Biological Regulation" by Geliy Aleksandrovich Kalimov, Boris Alekseyevich Karpov and Viktor Vasil'yevich Zelenkin, Izdatel'stvo "Nauka", 2600 copies, 135 pages]

[Text] Conceptions of structural organization and mode of function of biological systems of the lowest level, their specific and nonspecific parts, are formed on the basis of modern theory of automatic regulation. A mathematical model was constructed of the system of adopting exogenous rhythms, which offers a mathematical interpretation of the genesis of "prediction" and pathological phenomena caused by an increased share of anticipation in the function of a system. Illustrations 36, references 99.

Introduction

The law of regulation is a strict concept of theory of automatic regulation. Law of regulation refers to the mathematical function, according to which the error signal, which is the input signal of an automatic regulator, is transformed into a controlling action. The law of regulation is entirely determined by the structure and parameters of the regulator, regardless of the complexity of design of the latter.

The concept of law of regulation is also applicable to biological regulatory systems. As in the general case, in a biological object the law of regulation is determined by the structure of the regulatory organ, and it is a synonym for a means of stable control of the system's state.

Physiologists have long since studied the regulatory function of organs and systems, and it is unquestionable that one can gain profound understanding of the content of processes in regulatory systems only if these processes are considered from the standpoint of automatic regulation theory.

Evolution of the concept of reflex arc into the concept of reflex circuit stressed even more distinctly the significance of theory of systems with feedback (another name for regulation theory) to physiologists. And ever since it was learned that sensoperceptive processes are also a function of systems with feedback (Sokolov, 1958; Pribram, 1975; Zabrodin, 1976), it became simply necessary to apply automatic regulation theory to physiology and psychophysiology.

The first stage of merging of physiology with regulation theory was quite encouraging. Moreover, long before the "official" unification of different science into a general science of control (cybernetics), many researchers raised basic questions of theory of biological regulation. The authors of many works (Claude Bernard, 1858; Samoylov, 1930; Bernshteyn, 1934; Anokhin, 1935; Cannon, 1937; Beritov, 1961; Sherrington, 1969) have advanced, overtly or implicitly, the idea of negative feedback, whereas in theory of functional system of P. K. Anokhin, the idea of closed control acquired its finished form.

On the basis of these achievements, it became a real possibility to turn from the statement of general similarity of structures of biological and technical regulatory systems to strict mathematical description of the concrete laws of biological regulation. Many interesting linear and nonlinear models of biological regulatory elements, different systems of the body and even man as a whole--human operator--were published (Grodinz, 1966; Braynes, Svechinskiy, 1968; Milsum, 1968; Stark, 1968, and many others). However, expressly such a large number is indicative of the lack of profound understanding at the present time of the actual structure of the controlling element in a biological regulatory system. Now, as before, researchers are often compelled to resort to the concept of "specificity" of biological laws of regulation, which implies, in essence, that these laws cannot be reduced to categories of precise sciences.

In the book offered to the reader's attention, an effort was made to overcome the chronic difficulties of merging physiology with automatic regulation theory. This problem is solved in two main directions.

The first direction is developed in the second, "General Properties of Biological Regulatory Systems," in which analysis is made of the distinctions of structure, statics and dynamics of biological regulatory systems. There too, the most difficult problems are resolved with respect to conformity of the main elements of biological regulatory systems with the basic conceptions of automatic regulation theory. Such "difficult" questions include, for example, those of the input and output points in the system of regulation, the master [driving] element, closed and open systems of regulation. Special attention is given to the problem of "anticipation" [prediction], which is sometimes interpreted from the anthropocentristic point of view and causes the greatest basic difficulties in mathematical modeling.

The second direction, construction of concrete dynamic models with rather general properties, is developed in the other two sections of the book. The section, "Structural Features of Lowest Automatism," deals with algorithmic description of the simplest and most widespread biological regulatory mechanism. A hypothesis is expounded on the basis of comprehensive analysis of the properties of this mechanism concerning the form of interaction between specific and nonspecific regulatory systems of the organism.

In the section, "Following Rhythm in Biological Regulatory Systems," a model is constructed of the regulatory system of rhythm following, which offers a mathematical interpretation of the genesis of "anticipation" in biological objects. This model combines the properties of already known models, constructed for cases of tracking predictable and unpredictable signals. Analysis is made of pathological phenomena related to increased share of anticipation in control.

This book is intended for physiologists and psychologists with adequate training in the area of automatic regulation theory. The last two sections may be of interest to neuropathologists and psychiatrists, as well as specialists in automatic regulation theory.

There were some digressions from concise presentation, so that the sections were constructed in such a manner that bypassing the reading of purely mathematical material would still enable the reader to assimilate the main ideas without any special mathematical education.

Chapters 1-4 and 9 were written by G. A. Kalimov, and Chpaters 5-7 by all of the authors. The experiments involving recording of eye movements, which served as the basis for material in the last section of the book, were performed by B. A. Karpov with A. N. Karpova on the premises of the Third Leningrad Psychiatric Hospital imeni I. I. Skvortsov-Stepanov.

Contents

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CSO: 1840/999

UDC: 629.7.018.2.001.2

VISUAL SITUATION SIMULATORS IN AIRCRAFT TRAINERS

Moscow IMITATORY VIZUAL'NOY OBSTANOVKI TRENAZHEROV LETATEL'NYKH APPARATOV in Russian 1978 (signed to press 4 Oct 78) pp 2-4, 143

[Annotation, foreword and table of contents from book "Simulators of Visual Situation in Aircraft Simulators" by Valeriy Sergeyevich Babenko, Izdatel'stvo "Mashinostroyeniye", 1330 copies, 143 pages, illustrated]

[Text] This book deals with the general principles of modeling the visual situation in aircraft trainers and simulators. Simulators of the visual situation based on principles of physical and mathematical modeling are given theoretical validation. The principles involved in construction, distinctive features and direction of development of visual situation simulators are described. This book is intended for engineers and scientists. It may also be useful to students of the relevant specialties.

Foreword

In recent times, increasing use is being made of the modeling method to solve many problems related to the design and operation of aircraft, training and screening of flight personnel, research and optimization of the pilot-aircraft system, etc., and various models and complexes are being developed. Among them, there is a group of simulating devices that plays an important role, by means of which the main features and processes of flight and aircraft control are reproduced on the ground (with some degree of accuracy). This group includes trainers and simulators of aircraft.

Aircraft simulators, which are sometimes called modeling units [benches?], are designed to study and optimize aircraft performance and operation of equipment installed on them in the course of design and production; aircraft trainers are used to develop skills in flying and working with the equipment of series-produced aircraft. Use of aircraft simulators in designing aircraft and aircraft trainers for pilot training permits the following:

1) Reduction of testing (training) time as a result of refining processes referable to any phase of flight without performing the other phases; possibility of stopping a flight at any time with return to the base state, working independently of meteorological conditions, etc.

2) Increased effectiveness of studies (training) thanks to deeper refinement of flight processes under difficult conditions with diverse malfunctions,

even emergencies [accidents], as well as because of more complete and objective recording and processing of flight results.

3) Increased economic effectiveness of design (training) due to lesser expenditure of fuel, less wear and tear on equipment, less expenditure on maintenance of equipment, etc.

4) Reduced load on airports caused by test (training) flights, relieving aircraft and pilots previously involved with such flights.

5) Increased safety of tests (training), less environmental pollution by fuel exhaust, lower acoustic effects on objects and people in the airport area, etc.

The use of aircraft simulators and trainers does not rule out the need for test and training flights in aircraft; however, a significant part of flight practice is already being transferred to simulator systems. In the future, in connection with the development of new multipassenger and high-speed aircraft, as well as flights under difficult weather conditions and refinement of simulator devices, the role of aircraft simulators and trainers will grow even more.

Modern aircraft simulators and trainers consist of many subsystems: simulators that imitate the operation of various devices aboard aircraft and influence on the environment, equipment for interaction between the test pilot (instructor) and simulator system and pilot, etc. One of the most important subsystems of aircraft simulators (trainers) is the simulator of the visual situation (SVS), which simulates the external visual picture of the space visible to the pilot from an aircraft cabin during flight. Problems related to visual flying can be solved by means of SVS in aircraft simulators and trainers.

This book deals with a wide range of questions related to theoretical validation and technical execution of SVS for aircraft trainers (simulators). The first part of the book (first and second chapters) deals with the general principles and theory of simulating the visual situation. The second part (third-fifth chapters) is concerned with the principles of construction and distinctions of optical-mechanical, cinematographic and television SVS and SVS with electrical synthesis of images based on substantially different engineering principles. It concentrates primarily on simulating the visual situation in a complex aircraft trainer for pilots at the take-off and landing phases. In principle, in view of the end purpose, initial, limiting and other conditions, the main conclusions can be transferred to other instances of simulating the visual situation: in aircraft simulators, other types of aircraft trainers, for other crew members, etc.

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10,657
CSO: 1840/999

PSYCHIATRY

UDC 616.891.7

CLINICAL ASPECTS OF PSYCHOPATHIC DYNAMICS

Kishenev KLINIKA NEKOTORYKH VARIANTOV DINAMIKI PSIKHOPATIY in Russian 1980 (signed to press 11 Mar 80) pp 2-14, 227

[Annotation, foreword and table of contents from book "Clinical Aspects of Certain Variants of Psychopathic Dynamics", by Aleksandr Grigor'yevich Naku, Mircha Grigor'yevich Revenko and Nikolay Andreyevich Oprya, edited by Professor N. I. Felinskava, Moldavian SSR Ministry of Health, Kishinev State Medical Institute. Izdatel'stvo "Shtiintsa", 6135 copies, 228 pages]

[Text] The book analyzes particularities of the formulation and development of various dynamic deviations in psychopathic personalities: psychopathic (characterological) reactions, compensations, and decompensations. Certain variants of abnormal personality developments are also examined -- paranoic and psychogenic (post-reactive), and psychopathic (pathocharacterological). Questions relating to the forensic-psychiatric evaluation of these deviations are also addressed. The book is written for psychiatrists, pediatric neuropathologists, lawyers, and specialists in allied disciplines.

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Research relating to the historical development of the study of psychopathy (M.A. Chalisov, 1950; O.V. Kerbikov, 1958; O.V. Kerbikov and L.L. Rokhlin, 1961; A.G. Galach'yan, 1965) has established that at the end of the previous century (70's and 80's), when the very foundations were developed, psychopathy was ascribed a static nature, and its genesis was viewed as lying outside any causal relationship with the environment. Those conditions which today are treated as psychopathies were described with various titles: "degenerating characters" (Ph. Pinel, 1809), "moral insanity" (Prichard, 1835), and toward the latter half of the XIX century, as "degenerative" and "constitutional" psychopathies.

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It must be noted that the authors cited were then discussing the inconstancy of various character anamolies and the possibilities of congenitally based onsets of various illnesses. They were, however, far from the contemporary concept of psychopathy dynamics, and those opinions which they advanced bore an episodic nature.

The term "degeneration" owes its origin to Morel (1857), who, relying upon the law of continuous transformation of the species, concluded that deviations from the normal human type might occur in specific families over a number of generations and result in deterioration, or degeneration. Psychopathy was viewed as unchanging over the course of the individual's lifespan. The theory of degeneration impeded the study of the dynamics of psychopathy for a considerable period of time.

A body of psychiatrists began to view the study of inherited or hereditary predisposition as a science, an "illuminating the world" science regarding the causes of all psychic disorders. The study was supported and developed by Schule (1878), Schnitzer (1921), Minkowska (1923), Schneider (1923, 1958), R.Ya. Golant (1929), et al. In Soviet psychiatry, these views at a particular point in time were shared partially by V.P. Osipov (1931), D.A. Amenitskiy (1934), Z.A. Solov'yeva (1935), et al.

Morel's concept was also embraced by I.L. Koch (1890), who wrote in his initial works that the chief factor in cases of psychopathic inferiority was an "inherited degenerative condition," remaining constant over the entire lifetime. However, in his later works, the author indicated that psychopathic conditions might not only be of congenital origin, but acquired as well. The very concept of psychopathy found in his work was extremely broad, and was associated with certain stages of mental disorders, considering that only quantitative gradations existed between psychosis and psychopathic inferiority.

The question of psychopathy dynamics was not reflected in Kraepelin's (1913) work. If in the study of nosological forms, Kraepelin differentiated the course of the disorder, i.e., examined them in a dynamic context, then in the describing of psychopathies, he departed from this principle. Psychopathic personalities, according to Kraepelin, were individuals with congenital "psychic malformations" which were considered constant throughout their entire lifetimes. The classification of psychopathies advanced by Kraepelin was extremely complex and unwieldly; it included with the clinical groupings such variants of psychopathic personalities as "liars", "asocial", and "rogues". Such congenital and unvarying psychopathic deviations were retained in the thinking of I.A. Sikorskiy (1899), Kraft-Ebing (1903), S.A. Sukhanov (1907, 1912), V.P. Serbskiy (1912), Bleuler (1914), A.S. Griboyedov (1914), Jaspers (1923), Ewald (1923), Dupre (1925), M.P. Kutanin (1926), Birnbaum (1926), Delmas (1932), and S.N. Davidenkov (1947).

K. Schneider (1923), particularly in his first works , ascribed great significance to biological factors in the formulation of psychopathies. He considered that they constituted the basis for congenital anomalies. In his last works, published in 1958 and 1959, the author recognized to a certain degree the role of external conditions, but in the concept of "social conditions", he included different content (infections, accidents-trauma, alcohol, living conditions), and did not

dwell upon social relationships in the broad sense of the word. In all of his works devoted to psychopathy, Schneider treats psychopaths as individuals who, as a result of their pathological peculiarities suffer, themselves, or force those around them to suffer.

The static nature of psychopathy was emphasized to even a greater extent by the adherents of the constitutional-biological school. One of its most fervent proponents was Kretschmer (1920), who advanced the concept of the dependence of characterological peculiarities upon the physical constitution. From the position advanced by this theory, Kretschmer isolated two types of constitutions: the cycloid and the schizoid, and attempted to allocate all pathologic temperaments or natures to those categories. Psychopathies, in his opinion, were congenital conditions, remaining constant, and totally independent of the effects of any external factors. According to this theory, man is born with inherited tendencies toward the future psychopathy, and the latter "thunder out" at a particular point in life. Despite the groundlessness of this concept, which reduced the entire human typology to just two variants, a considerable number of psychiatrists (R. Birnbaum, 1915, 1933; K. Schnitzer, 1921, 1923; T.I. Yudin, 1928; M.O. Gurevich and M.Ya. Sereyskiy, 1928; N.I. Sklyar, 1931; and Hoffman, 1932) adhered to it for many years.

In the opinion of the constitutional concept adherents, the dynamics of psychopathy constituted only an exacerbation of the psychopathic personality traits, the origin of psychopathic reactions, mental disturbances as defined by the type of constitution. The very indications of psychogenesis associated with a conflict situation, and the development of pathological personality traits served them as justification for the diagnosis of psychopathy. For example, M.O. Gurevich (1913, 1928) spoke of the "invariability of the constitutional character structure", but the stability of psychopathy and the absence of the ability to compensate he incorporated in his definition of psychopathy.

Abroad, a number of authors considers that psychopathy can only be established in those cases where characterological peculiarity traits are manifested in early childhood and remain more or less unchanged throughout life (Claud, 1932; Henderson , 1942; Gruhle, 1952; Petrilowitsch, 1960; Guze, Perley, 1963; et al.).

In the appreciation of a segment of foreign scientists, psychopathy remains constant under all circumstances. Certain researchers negate psychopathy as a nosological entity. Wirch (1955) considers that no specific premise is required for psychopathic behavior, as that behavior is occasioned by a specific predisposition, and not by external events, for even with favorable conditions present, a psychopath will commit wrongful acts.

Karpman (1948, 1949), replaces the term "psychopathy" with "anethopathy", asserting that psychopaths despite all attempts to alter their nature, remain obtuse, egoistic, indifferent, and generally, unchanged with all the efforts. As a proponent of the "psycho-dynamic" school, Karpman employs the word "dynamics". In his opinion, the concept of the "psychopathic personality" should be removed from scientific nomenclature. Karpman's successors (Miller, 1951; W. McCord, J. McCord, 1956; Donnelly, 1964; et al.) establish various criteria to define psychopathy, incorporating as their basis traits of asociability (absence of conscience, guilt feelings, love, etc.).

Attempts to convert from the static view of psychopathy to the dynamic concept were noted long ago. During the period in which psychopathy was viewed as a congenital and immutable condition, individual authors, both native as well as foreign, expressed the idea of the necessity for studying psychopathy in a dynamic context.

The study of the dynamic aspects of psychopathy was more fully developed by native psychiatrists, primarily by V.Kh. Kandinskiy (1863, 1890), who incorporated precise clinical content in this concept. In the article "A Case of Questionable Condition Before A Jury", V.Kh. Kandinskiy provided a vivid description of conditions, which, from our point of view, must be treated as reactions by a psychopathic personality within its characterological peculiarities. He demonstrated that these transitory morbid conditions of "total mental disorder" were possible because they were nothing more than temporary exacerbations of common conditions, which must also be termed psychopathic conditions.

Emphasizing the relative nature of the concept of "constancy" in psychopathies, V.Kh. Kandinskiy pointed out that the psychopathic condition itself bears the conditions for its own progressive intensification, the onset of which is often associated with fortuitous conditions. These opinions clearly contain the thread concerning the possibility of the genesis during psychopathy of those deviations which are currently evaluated as psychopathic reactions and decompensations.

The idea of the possibility of vacillations in the intensity of psychopathic manifestations was advanced also by I.M. Balinskiy (1885). In the conclusion regarding the case of Semenova, I.M. Balinskiy emphasizes the inconstancy and mutability of psychopathy, particularly the tendency toward deteriorization of condition (sharpening of psychopathic peculiarities) under the influence of an unfavorable situation.

B.M. Bekhterev (1886) wrote also of heightened sensitivity to environmental influences as one of the most characteristic peculiarities of the psychopathic personality. He stated that pathologicity in psychopathies is detected under the influence of external factors and the abnormal condition is felt primarily in acute conditions (mis-placed self esteem, use of alcohol, etc.).

S.S. Korsakov (1901) emphasized in his works that the equilibrium of psychopathic constitutions, (i.e., psychopaths), was extremely easy to disrupt under the effect of relatively insignificant factors, and in this respect, a tendency was manifested toward the occurrence of the affects of sadness, fear, delight, anger, etc. The author describes a series of dynamic deviations (age crises, tendency toward disturbances and psychotic episodes), occurring from time to time for one reason or another in psychopathic personalities. Of interest here are the opinions expressed by S.S. Korsakov on the possibility of compensation of psychopathic peculiarities under favorable environmental conditions. He indicated that if the fate of psychopathic personalities was "favorably organized", they might then conduct personal and public affairs.

The Belgian psychiatrist, Delmas (1932) describes in a number of patients the manifestation of "disequilibrium" under the influence of unfavorable environmental factors, which, in his opinion, may contribute to a future formulation of

psychopathy. The study by Delmas was developed by the Swiss psychiatrist Tramer (1949), who termed the condition preceding psychopathy as "pre-psychopathic". The work of Delmas and Tramer demonstrated that one of the stages which psychopathy undergoes in the formation period is that of the "pre-psychopathic" stage.

E. Kahn (1933) also wrote of the dynamics of psychopathy. He considered that the personality consists of three strata--inclination, temperament, and character, and indicated in this respect that psychopathies are quantitative deviations in one or all of those strata. The life of the personality is an uninterrupted concatenation of psychopathic manifestations, periodically expressed to a greater or lesser degree in the form of "accentuations" of psychopathic symptoms. External circumstances or conditions play only a developing role, determining only the degree of the manifestation of the "neurotic superstructure". Proceeding upon these proposals, Kahn concluded that the course of the life of a psychopathic personality was "the course of life generally", and differed from the latter only by "accentuations".

It should be noted that according to Kahn, psychopathy is a condition which is inherited and the environment influences the formation of the personality only to the extent that the personality's constitution is capable of perceiving it. Thus, Kahn describes psychopathic personalities as isolated from real life and emphasizes the hereditary dependence of the phenomenom.

A series of authors attempted to approach the question of psychopathy dynamics in one way or another, but only through the works of P.B. Gannushkin (1933) did the dynamic principle of studying psychopathy receive convincing clinical foundations. P.B. Gannushkin not only provided a definition for the concept of "psychopathic dynamics", but established appropriate limits as well.

The views of P.B. Gannushkin regarding psychopathic dynamics were more fully reflected in his book "Clinical Aspects of Psychopathy, Statics, Dynamics, and Systematics". In the foreword to the monograph, he defined the bases for his approach to psychopathies. He indicated that the psychopathic personality must be studied in all its associations with the environment, in all its encounters with that environment, in all its reactions and psychic contradictions, but must always be studied as an integrated, whole entity. In the statics of psychopathy, P.B. Gannushkin saw the "actual content of a subject", and in the dynamics, he saw "chiefly the types, laws, and formulas for the development of psychopathy".

According to his viewpoint, statics were very conditional and amounted basically to the preservation of a known element of personality, whose background developed special dynamics: psychopaths very easily react pathologically to psychic trauma, to extremely difficult living conditions, and we observe in them particularly exquisite and vivid pathopsychological developments (paranoid, neurotic), etc.

P.B. Gannushkin considered that under different conditions, psychopathic peculiarities might be first sharply manifested, then remain virtually stable, and that psychopathy frequently "attains the level of clinical fact only in the presence of sufficiently intense external factors". The role of the external factor in the clinical aspects of psychopathy, according to P.B. Gannushkin, has particular significance as a developing agent for that which under different condtions would have remained latent.

Primary dynamic points in the life of the personality (pathological), according to P.B. Gannushkin are in the phase of reaction and development. As "reaction" he understood the manifestation of psychopathic syndromes, and the sharpening of psychopathic symptoms as a response to various psychic stimulants. This type of dynamics is undoubtedly one of the most freqent encountered. "Development" in his opinion, is constituted by a series of reactions, which under the effect of repeated shock based upon the mechanism of securing conditional reflexes, have a tendency toward fixation.

Emphasizing the conditionality and relativity for such a subelement of dynamic deviations, he pointed out that there exists sharp delineation between phases and reactions on the one hand, and between reactions and development, there is none.

P.B Gannushkin regarded dynamic shifts or deviations as psychogenic reactions (shocks, delayed reaction conditions), which are not particularly specific to psychopathies, but can occur with any personality.

The opinions advanced by P.B. Gannushkin regarding the dynamics of psychopathy were developed further in the works of other Soviet psychiatrists: P.M. Zinov'yev (1927), V.A. Vnukovo (1934), N.I. Ozeretskiy (1934, 1938), A.Ya. Levinson (1934), V.I. Akkerman (1937), A.M. Khaletskiy (1938), Ye.K. Krasnushkin (1940), N.E. Granstrem (1954), and others.

Ye.K. Krasnushkin (1940) spoke more decisively about the dynamics of psychopathy, proposing that through the effects of external factors upon the personality, psychopathy itself of a type might result. The social form of psychopathic manifestations, in his opinion, was most inconstant and mobile, "here situational factors are at work: the same psychopath under certain conditions is a pathological jealous person, and under other condtions is transformed into a conscientious individual, and under still other conditions, a neurotic."

"The expressability of psychopathic traits is dependent upon the situation", wrote Ye.K. Krasnushkin. He considered that depending upon the situation, "previously uncharacteristic qualities, contrasting qualities, might erupt on the surface of the psychopathic personality". Against a background of a given constancy of psychopathic forms, maintained over the course the life of the psychopath (in the form of a given type of psychopathy), under the influence of the environment, disturbances could occur.

The study of psychopathic personalities in a dynamic context was further reflected also in the works of Ya.P. Frumkin (1940), who wrote that psychopathic personalities are relatively constant. Throughout the course of their lives, pathological traits or characteristics may change or level off, or may vary depending upon factors of the living environment.

A new stage in the study of dynamics in psychopathy was the work of O.V. Kerbikov (1952-1965). The author advanced the idea that psychopathies might be not only congenital (nuclear), but also "fringe or borderline", formed as the result of pathocharacterological development. O.V. Kerbikov demonstrated that the recognition of the possibility of fringe psychopathy made the question of psychopathy formation a subject for research. Here he focused attention on the fact that psychopathy, forming over the course of lifetime, does not erupt in the finished stage, but

undergoes specific developmental stages, including the initial, the pre-psychopathic stage, which is characterized by the manifestation of characterological peculiarities under certain conditions. During this period, the symptom of totality is lacking and the ability for correct behavior maintained.

Duration of the pre-psychopathic stage is variable, and depends upon the type of psychopathy: it is shorter with excitable types of psychopathy and is more significant in inhibited psychopathic personalities. Psychopathic manifestations in this stage are indistinct and unstable, dependent upon the situation or somatic state of the patient, and the syndromes of any psychopathy (excitable, inhibited, hysteroid, others) may replace one another or capriciously combine.

The peculiarities of the pre-pathological stage, writes O.V. Kerbikov, as with the stage itself, are characteristic of psychopathic development, movable through the effects of unfavorable living conditions: family upbringing, intra-family environment, extended psychogeneses.

In nuclear psychopathy, in the opinion of O.V. Kerbikov, it is more appropriate to address not pre-psychopathic stages, but latent psychopathy, which may be either manifested or unmanifested by environmental conditions. He emphasized that in latent psychopathy, the role of external factors is different--that of "developing, modeling".

The study of the life course of psychopathic personalities led O.V. Kerbikov and V.Ya. Gindikin (1960, 1962) to conclude that a specific correlation exists between characteristics of the psychopathically deformed personality and conditions under which this personality developed. Thus, there is a connection between conditions of upbringing and the formation of various forms of psychopathy.

O.V. Kerbikov emphasized that dynamics with various forms of psychopathies differ. Additionally, he indicated that one mechanism may be observed in all types of psychopathic personalities. That is the so-called psychopathic cycle, wherein the psychopathic personality creates a conflict situation. This is often facilitated by the onset of dysphoria (characteristic of psychopaths--unmotivated mood disorders or disruptions, marked by sadness, malice, alarm). The patient himself responds with a pathological reaction to the conflict situation which he has created; that reaction may take the form of psychopathic or characterological. At its conclusion, the psychopathic personality discovers a strengthening of pathological traits which are characteristic.

The merit of O.V. Kerbikov lies not only in the fact that he isolated or identified the "fringe or border" form of psychopathy, but in that he demonstrated that in the field of minor psychology, the delineations between individual clinical manifestations not so much as differentiate as they combine these forms. In addition, the author points out that the entire field of minor psychology is characterized by change, dynamics, and the presences of transitional and intermediate forms.

With the establishment of the "fringe" form of psychopathy, it became possible to discuss the reversible dynamics of these conditions. I.L. Kulev (1963) conducted catamnestic studies of individuals with childhood diagnoses of: "psychopathy", "pathological development", "neurotic reactions with psychopathization", and others. His research primarily related to a group of disorders termed "organic" psychopathies. Catamnestic study of the dynamics of these conditions indicated that in a majority of

cases, with increased age, an amelioration and disappearance of psychopathic traits, equalization or leveling of psychopathic peculiarities is observed primarily after the age of 16, which attests to the considerable role the period of puberty plays in psychopathic dynamics.

The dynamic approach to the study of psychopathy promoted the researching of the psychopathic personality over the course of the entire life. Thus, V.V. Kovalev (1973), is conducting research on the dynamics of psychopathy and psychocharacterological development in childhood. V.Ya. Semke (1967) studied the dynamics of psychopathy in later age. The author notes that at the age of reverse development, a transformation from one form of psychopathy to another is frequently observed. At any stage of psychopathic dynamics in later life, the primary role is that of an organic process (vascular and senile), and a lessening, in some cases a total disappearance of psychopathic traits is observed as the result of new pathological characteristics being manifested. At times, psychopathic episodes have occurred during this stage.

Forensic psychiatrists have made a considerable contribution to the study of the dynamics of psychopathy. Progressive representatives of forensic psychiatry during the period when the biological concept still reigned spoke against the static concept of psychopathies. Soviet forensic psychiatry very early on adopted the dynamic view of psychopathies.

N.I. Felinskaya (1963, 1965, 1971) devotes considerable attention to the study of psychopathy dynamics. Her clinic undertook a number of projects devoted to this complex problem. N.I. Felinskaya differentiates in the dynamics of psychopathy temporary variances (psychological phases, decompensations, and psychopathic reactions) and the more clearly expressed dynamics (pathological and psychogenic personality development). Temporary changes, in her opinion, although they influence subsequent development of the psychopathic personality, do not determine its path entirely. In pathological and pathogenic development, the dynamics are more expressed and occasioned by the effects of psychogenic factors. With pathologic development, these factors influence the formulation of a psychotic syndrome, and in psychogenic, these transferred reaction factors are the beginning of pathological character formation.

The possibility of psychogenic development occurring after transferred reactive psychoses was confirmed in the works of V.A. Gur'yeva (1963, 1971), and K.L. Immerman (1969).

O.Ye. Freyerov (1971), established the conditions of compensation and decompensation, psychotic reactions, acute psychopathic conditions, psychotic episodes, and pathological development as versions of psychopathic dynamics, and in so doing, emphasized the conditional aspects of those versions which he defined.

The study of psychopathic dynamics in the forensic psychiatric aspect has been the topic of works by V.A. Gur'yeva (1959, 1971), B.V. Shostakovich (1963, 1971), G.D. Volkov (1968), G.F. Kolotilin (1968), V.K. Ochnev (1969), L.P. Vasil'yeva (1971), N.A. Oprya (1971), L.N. Stepanova (1972), V.Ya. Gindikin (1973), Revenko, M.G. (1971), and others.

V.A. Gur'yeva, studying the dynamics of psychopathy in juveniles and youth, isolated three basic stages in their formation. The first stage was characterized by a small range of syndromes, their elementary nature, and non-differentiation. The second features a process of complication and differentiation of clinical symptoms. Finally, during the third stage, psychopathic traits undergo reinforcement and a specific psychopathic structure is formulated.

B.V. Shostakovich evaluates "profound psychopathies" as a variant of psychopathic dynamics, and emphasizes the frequency of biological and psychogenic effects during such in childhood.

As can be seen from the literature data cited, there exists many controversial ideas in the study of psychopathic dynamics. There is no totally mutual understanding among psychiatrists as to the problem of differentiating psychopathic reactions and decompensations. Certain authors treat psychopathic reactions as purely psychogenic within the confines of psychopathy, and not as dynamic deviations of them. There exists no specific criteria for the establishment of paranoid reactions and paranoid development of the personality occuring within the phenomenom of psychopathy.

To the present time, moot questions exist regarding the psychogenic and psychopathic development of the personality. Not all authors recognize the possibility of the formation of borderline-fringe psychopathies. Questions have not been fully developed regarding the forensic-psychiatric evaluation of various dynamic deviations in psychopathies. All this has motivated us to correlate our own data and to express our view point regarding this controversial problem.

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PSYCHOLOGY

PROBLEMS OF GROUP UNITY

Moscow PROBLEMY GRUPPOVOY SPLOCHENNOSTI in Russian 1979 (signed to press 20 Feb 79) pp 2-4, 128

[Annotation, foreword and table of contents from book "Problems of Group Unity" by Aleksandr Ivanovich Dontsov, Izdatel'stvo Moskovskogo universiteta, 4910 copies, 128 pages]

[Text] This book explores the unity [solidarity] of small groups and collectives; it analyzes Soviet research on this problem, discloses the content of socially determined joint object-related activity as the basis of group integration; it criticizes bourgeois sociopsychological conceptions of unity. It is intended for scientists in the field of social psychology, instructors, graduate and undergraduate students on humanities faculties.

Foreword

At the present stage of the building of communism, studies of sociopsychological aspects of formation and function of work groups are acquiring much importance with regard to implementing the most important sociopolitical objective of a Soviet society, that of joining the achievements of the scientific and technological revolution with the advantages of socialism. It was stressed in the summary report of the CC CPSU to the 25th Party Congress that "The party and government require investigation of problems related primarily to comprehensive development of industry and control of industry, of recommendations that would permit increasing its effectiveness substantially."* One of the pressing needs of such problems is that of uniting groups: by providing optimum conditions for joint work, unity emerges as a substantial factor of group productivity.

In recent years, the question of unity has become more and more often the subject of special investigation in Soviet social psychology. Performance of a broad front of concrete investigations makes it imperative to work out unified theoretical base principles, development of a general conceptual scheme of sociopsychological analysis of the very phenomenon of group unity. Heretofore, insufficient attention had been devoted to this matter in the Soviet literature. There are several reasons why special theoretical work must be done in this direction. The main one is that solving the problem of unity is one of the basic elements in constructing general group theory--the most fundamental task for all of Marxist

*"Proceedings of 25th CPSU Congress," Moscow, 1976, p 72.

social psychology. At the same time, experience in studying solidarity, which has been gained by Soviet social psychologists, is extremely diversified and, to some extent, contradictory, so that there is a need to generalize and specify, to consider it in the light of the general methodological positions of Soviet psychological science as a whole.

Nor can we fail to take into consideration the fact that the traditional conceptions of the nature, and this means of experimental methods as well, of studying group unity were formed within the framework of the positivistically oriented American social psychology, and they were largely predetermined by its inherent internal limitations. Under such conditions, critical analysis of the conceptual schemes for studying unity, which prevail in the West, is necessary, particularly in order to solve the problem, which is particularly acute because of the shortage of experimental methods, of validity of using concrete methods for measuring the level of group unity.

This group of reasons was involved in the special attention that is given in this book to analysis of theoretical aspects of group unity. On the basis of such analysis, an effort was made to single out the chief methodological principles of investigating group unity and outline a single theoretical scheme for investigating integrative processes in groups. Examination of these issues served as the starting point to prepare a program for experimental investigation of solidarity of work groups, which was conducted on the basis of material referable to pedagogic groups in secondary schools.

This author expresses his appreciation to L. K. Balyasnaya, candidate of pedagogic sciences, deputy RSFSR minister of education, Prof G. M. Andreyeva and A. V. Petrovskiy, member [active] of the USSR Academy of Pedagogic Sciences, for their great help in conducting this study and their comments during preparation of the manuscript.

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