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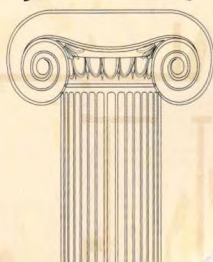
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SGEM CONFERENCE ON  
**ANTHROPOLOGY  
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INTERNATIONAL MULTIDISCIPLINARY  
SCIENTIFIC CONFERENCES ON SOCIAL SCIENCES AND ARTS  
SGEM 2014

**ANTHROPOLOGY, ARCHAEOLOGY,  
HISTORY AND PHILOSOPHY**

CONFERENCE PROCEEDINGS



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**ANTHROPOLOGY, ARCHAEOLOGY  
HISTORY, PHILOSOPHY**  
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## THE CONTRIBUTION OF TOMSK RESEARCH AND EDUCATIONAL PARK TO DEVELOPMENT OF RESEARCH ON CYBERNETICS IN THE 1950-1960s<sup>1</sup>

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### ABSTRACT

The author analyzes the process of formation and development of research in the field of cybernetics. The 1950-1960s became a flourishing era for computer technology and the highest achievements in the scientific field of cybernetics in the USSR. Siberian Physical-Technical Institute (SPhTI) at Tomsk State University (TSU) became the Center of the formation and development of research in the field of cybernetics in the 1950s. in the east of the USSR. In the early 1950s at the department of radiophysics of TSU the associate professors F..P Tarasenko, G.A. Medvedev, senior research associates A.D. Zakrevsky and V.P. Tarasenko organized a group of young teachers and students of TSU and SPhTI. They decided to start the implementation of a major government topic - developing the applied issues of information theory and the development of electronic computers. Later that year the first computer in Siberia "Ural-1" set up in SPhTI marked the beginning of scientific school in the field of informatics. In the 1950s Tomsk Polytechnic Institute (TPI) implemented the research in the field of automation of particle accelerators, mathematical modeling and the use of computer technology, automation and optimization of systems organizational management of the university. In a short time the intense pace of research in the field of cybernetics turned Tomsk research and education complex into a research center in that on a national scale. The research in the field of cybernetics had important theoretical and practical significance. The studies developed into large schools of thought, conducted the research in the most promising areas of cybernetics. The employees SPhTI under A.D. Zakrevsky developed the logical representation language synthesis algorithms of discrete automata (LYaPAS) and its more sophisticated systems, as well as a number of automatic synthesis of digital machines for design and research organizations in the USSR. On the basis of LYaPAS-71 for the computer programming system of the 2nd generation was created, which anticipated numerous ideas that were developed abroad only by 3rd generation machines. The electron synchrotron "Sirius" designed and launched in 1965 by TPI's employees was the most powerful in the country and one of the largest in the world. The basic research in physics of the acceleration of charged particles, nuclear physics and elementary particle physics, solid state physics were conducted on 'Sitius'.

**Keywords:** Tomsk research and educational park, cybernetics, history of science

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## INTRODUCTION

The period of the 1950-1960th became an age of progress for computing technology and of the highest achievements in the field of cybernetics in the USSR. Thus, in the early 1950th because of the ideological confrontation between the communistic views and the capitalist ones that coincided with the period of foreign policy relations aggravation between the USSR and the USA, in the Short philosophical dictionary cybernetics was characterized as "a reactionary pseudo science", "brightly expressing one of the main lines of bourgeois outlook - its brutality, aspiration to turn workers into a car appendage, into an instrument of production and a war tool". At the end of 1950-1960th that science was perceived as one of the advanced and fundamental ones, almost significant for needs of the national economy. The turning point in the vision of cybernetics is explained by the policy of the country government. They highly appreciated importance and prospects of computing technology development and research on the field of cybernetics.

**Materials and Methods.** The required materials can be found in both published sources and archive funds. The main historical source for writing is materials of Siberian Physical-Technical Institute Archive, the State Archives of Russian Federation (GARF), the State Archives of the Tomsk region (GATO). There is reports documents of the activities of Tomsk universities and research institutes, minutes of meetings of scientists and engineers, memoranda, appeals to scientists, research topics, etc.

In this paper we used the comparative-historical method which allows to reveal the essence of the phenomena studied and the similarity and difference of their intrinsic properties. In determining the various quantitative and qualitative characteristics of research widely we used statistical method, historical and sociological analysis.

**Results.** In the 1950-1960th the Siberian physicotchnical institute at Tomsk state university became the center of formation and development of research on the field of cybernetics in in the eastern part of the country. SPHTI created in 1928, became the first large research center in the eastern part of the country which conducted research on both fundamental and applied science. Since 1932 SPhTI has been a division of Tomsk state university and its first high school scientific research onstitute in the east of the country. Along with the fundamental research on physics, mathematics, mechanics, cybernetics, radio electronics the practical problems, within modernization of the national economy were also solved in SPhTI [1].

The origin of the research on the field of cybernetics is connected with the arrival of P.P. Biryulin, the graduate of postgraduate study at the chair of radiophysics at Moscow State University. He arrived in Tomsk in August of 1954 by the invitation of professor V. N. Kessenikh [2]. In the early 1950ths P.P. Biryulin organized group of young teachers, graduate and undergraduate students on the chair of radiophysics at TSU. They decided to get engaged in working out the large governmental topic of applied issues development the the theory of information and creation of electronic computers. At that time cybernetics yet was not recognized as an independent science, but the group of young scientists got approval and support from the division head professor V.N. Kessenikh. P.P. Biryulin, A.D. Zakrevsky, G.A. Medvedev, brothers V.P. Tarasenko and F.P. Tarasenko B. S. Ryabyshikin, etc. were a part of that group, many of them worked simultaneously for SPhTI. Subsequently, many of them defended their master's and doctoral dissertations, became the founders and heads of



well-known schools of thought, the talented organizers and heads of chairs and laboratories. Let us give some examples. A.D. Zakrevsky laid the foundation to studying the automatic synthesis of discrete automats. In 1967 he defended the doctoral dissertation 'Algorithmic language of LYaPAS and automation of discrete automaton synthesis' at the Institute of automatic equipment and telemechanics (Moscow). In 1971 Zakrevsky became the head of the laboratory at Institute of technical cybernetics of Belarus Soviet Republic Academy of Sciences (at present National Academy of Sciences of Belarus). In 1972 he was elected a corresponding member of the Academy [3. File 53. L. 47]. G.A. Medvedev defended the doctoral dissertation 'Probabilistic problems in the theory of automatic search systems, signals intelligence and radio counter measures' in 1967. In the years 1970-74 He headed the chair of calculus and applied mathematics, from 1970 to 1973 G.A. Medvedev was the first dean of the department of applied mathematics (at present the department of applied mathematics and cybernetics) at TSU [4. P. 249-252]. Later he moved to Minsk where since April, 1974 he headed the chair of probability theory and mathematical statistics at Belarusian University. F.P. Tarasenko defended the doctoral dissertation "Information transfer problems through channels with partially or completely unknown noise distributions (information theory, nonparametric statistics)" in 1975. In 1960-1964 he held the chair of electronic computing technology and automation at the department of radiophysics at TSU, from 1970 to 1977 he headed the department of cybernetics at TSU [3. File 53. L. 54]. Thus, that group of researchers had a considerable scientific potential and was capable to solve critical scientific problems, having laid the foundation to research onto programming automation and logical synthesis of discrete devices, automatic control, in the field of mathematical statistics and information theory.

In 1956, the research on cybernetics and information theory (PP. Biryulin, A.D. Zakrevsky, G.A. Medvedev, A.A. Utkin, V.P. Tarasenko and F.P. Tarasenko) and the quantum theory of solid body (V.A. Chaldyshev) was initiated in SPhTI.. In 1958 the research on automatic programming and logic synthesis of discrete devices (AD. Zakrevsky), Automatic Control (P.P.Biryulin, GA Medvedev, VP Tarasenko) was launched. Later that year the first computer in Siberia "Ural-1" set up in SPhTI marked the beginning of school of thought in the field of informatics.

The important factor which accelerated considerably the development of the research on the field of cybernetics, was successful formation of material and technical basis. Thus, in 1965 between SPhTI and Tomsk plant of mathematical machines a five-year contract for joint organization of a computing center [3. File 62. L. 114]. The center was equipped with the electronic computer M-20 which was under the control of an SPhTI division. According to the contract the computing center consisted of two departments (Tomsk plant of mathematical machines and the Siberian physics and technology institute) whose activity was differentiated by the scope of rights and duties. Thus, SPhTI had the right to define the structure, the number and the subject of its department, and was obliged to perform mathematical supervision of the mathematical machines department, to support normal functioning of M-20 machines and to provide monthly 70 working hours on the machines to plant employees. In exchange, the department of Tomsk mathematical machines plant committed to provide maintenance and repair of the computing center premises, to make payment for electricity, heating and water, to supply the materials, products and tools necessary for the center work [3.

File 62. L. 115]. Thus, SPhTI provided the scientific supervision of the center work, while the mathematical machines plant provided the administrative and economic support. Y.P. Kunchenko, candidate of physical and mathematical sciences, headed the computing center. The idea to establish the center appeared among SPhTI management in the early 1960th. They planned to organize the computing center by establishing a university problem laboratory of computing devices [3. File 62. L. 81].

In 1975 the laboratory of computing systems was opened at the department of cybernetics of SPhTI on the basis of the computing center. The laboratory director became Y. P. Kunchenko, the research supervisor – assistant professor B. A. Gladkikh. The laboratory successfully developed works on mathematical software of automated control systems and on automation of scientific research [5. L. 56]. In the 1960th under the leadership of the professor G. A. Medvedev, and then his former student B. A. Gladkikh the system of radio physical information modeling and processing was developed by M-20 computer. During carrying out research on the chair of statistical radiophysics of the department of radiophysics (at present the chair of radiophysics of the named department), the research team was formed from the department graduates (I.A. Ivashintsov, Y.L. Kostiuk, V. V. Matushevsky, V. I. Polyakov, Y.V. Potapov, A.D. Makiyenko, I.Y. Makukha, A.D. Terra, etc.) under the leadership of B. A. Gladkikh. That team conducted the research of problems of data and machine graphics processing [6].

The research on the field of cybernetics conducted at SPhTI was developed by the joint efforts of the staff from the problem laboratory staff and the chairs of automatic equipment and computing technology and the one of statistical radiophysics (the department of radiophysics, TSU) under the leadership of associate professors F.P. Tarasenko, G. A. Medvedev, the senior research associates A.D. Zakrevsky and V.P. Tarasenko. The main research field was focused on studying the issues of discrete automata synthesis automation and operating processes optimization [7]. Under the leadership of the senior research associate of the problem laboratory of computing devices A.D. Zakrevsky the cycle of the works was conducted which resulted in the development of the logical representation language synthesis algorithms of discrete automata (LYaPAS) [8]. In 1964 the system of programming programs for universal digital M-20 computers and Ural was created on the basis of the developed logical language LYaPAS. By means of those programs the algorithms written in LYaPAS language were automatically transformed into the system of machine commands and then the solution of the set problem was automatically completed. The research results allowed to increase tenfold labor productivity while programming synthesis problems and other logical tasks [9]. The laboratory performed computing works on the orders of higher education institutions and the enterprises of Tomsk, Novosibirsk, Barnaul. In the 1960th the inquiries in that area rose in such a way that the laboratory could not satisfy completely the orders because of the limited number of software engineers and the deficit unproductive equipment, as, for example, the machine Ural [3. File 62. L. 102].

Within a short period the intensive rates of research development in cybernetics, carried out by the employees of TSU and SPhTI, turned Tomsk into a national research scientific center. As the proof of it one can name the fact that in 1964 I National colloquium on finite-state machine language was held by the initiative of A.D. Zakrevsky and the corresponding member of Academy of Sciences of the USSR M. A. Gavrilov in Tomsk. The colloquium showed that the research developed in the problem

laboratory of computing devices, were highly appreciated, and gained the recognition of scientific community [3. File 53. L. 54]. In 1966 the research results were summarized in the collective work of the discrete group headed by A.D. Zakrevsky, "Logical language for expressing synthesis algorithms of relay devices", published in the Moscow publishing house "Nauka" [4. P. 244]. In 1967. the group of authors was awarded with TSU prize for that work. In 1969 the book was translated into English and printed by the American publishing house "Akademik-Press" in the USA. Later in Czechoslovakia, GDR, Poland, Yugoslavia a series of translators from LYaPAS language on various machines was developed. And in 1973 the interpreter from "Russian of programming of LYaPAS" for IBM-360 system computer was published in the USA [3. File 53. L. 54].

The problem laboratory of computing devices together with the chair of electronic computing technologies and automatic equipment at the department of radiophysics, TSU initiated training of specialists in that new area of science and technology. Only in 1960-1961 67 specialists in "electronic computing technology and automatic equipment" graduated from that chair [3. File 62. L. 103]. The result of rapid research development in cybernetics, computing technology and programming of the 1960th caused the lack of experts in those areas. As a result, the departments of cybernetic profile appeared at many universities of the USSR, the department of applied mathematics and cybernetics opened in TSU in 1970 was among them [10].

Thus, the research on cybernetics carried out in SPhTI had important fundamental and practical value and gained wide recognition among the world scientific community. Subsequently within the named research field the elaborated systems of LYaPAS – LYaPAS-71 and LYaPAS-M were created as well as a number of systems of discrete automats automatic synthesis of for design and research organizations of Moscow, Leningrad, Omsk, Miass, Novosibirsk, Voronezh, Kazan, etc. The programming system for the second generation computers which anticipated numerous ideas realized abroad only by the third generation machines was created on the basis of LYaPAS-71. The Council for Mutual Economic Assistance recommended LYaPAS for distribution as and international logical language taking into consideration the scientific and practical value of the research.

The research on cybernetics laid the foundation to emergence of various schools of thought. In the 1960th and the schools of thought under the leadership of A.D. Zakrevsky, V.P. Tarasenko, F.P. Tarasenko, G. A. Medvedev were created and actively developed. The school of thought under the leadership of professor V.P. Tarasenko who were the first in the country to develop the theoretical bases of correlation and extreme navigation control systems was widely known among experts. Those systems had high precision and noise stability, and the correlation and extreme coordinators developed on their basis successfully passed industrial tests for the development of aircraft, sea and river crafts, industrial robots. Later many former students of V.P. Tarasenko defended their master's dissertations and made significant contribution to the further development of that scientific area. One can name V. I. Alekseeva, A. M. Korikov, V. M. Mokhov, S. Y. Pashnov, O. M. Ravodin, etc. [11].

The main area of research conducted by the school of thought under the leadership of G. A. Medvedev was focused on studying statistical research methods for automatic control systems [4. P. 244]. The school of thought included the candidates of science

A.P. Serykh (since 1972 – the head of the statistical methods laboratory at SPhTI), B. A. Gladkikh (in 1971-1976 – the theoretical cybernetics chair at TSU), A.M. Gortsev and A.P. Ryzhakov (in 1972-1977 – deputy deans of the department of applied mathematics and cybernetics at TSU), etc. [3. File 53. L. 55].

In the 1960th years the school of thought of F.P. Tarasenko gathered together the highly qualified specialists working on the theory of information detection and filtration [4. P. 244]. Y.I. Parayev (since 1975 until the present – professor, the head of the chair of applied mathematics), V. V. Poddubny (since 1970 – professor, the head of the information systems laboratory at SPhTI, and since 1977 – the director of the department of cybernetics at SPhTI), A.F. Terpugov (from 1972 to 1977 – the head of the probability theory and mathematical statistics department, the dean of the department of applied mathematics and cybernetics at TSU) [4. P. 244] were among those specialists.

At the same time in the early 1970-ies the scientific research on cybernetics in SPhTI was damaged because of A.D. Zakrevsky and G. A. Medvedev's departure. Their moving was connected with poor living conditions in Tomsk and lack of real prospects of improvement in that situation. On the other hand, part of leading researchers working in the field of cybernetics passed to pedagogical work in the university. As a result, that scientific area was weakened for many years that was shown in a personnel issue of completing the staff of laboratories and cybernetics department administrative board [12]. However, the authority and an essential reserve of the scientific research developed at SPhTI and TSU, served further as the base for large-scale development in the field of cybernetics in the Asian part of the USSR.

In the 1950th the research on cybernetics were developed in the chair No. 24 and the laboratory No. 4 of the electrotechnical division of the physics and technology department of Tomsk polytechnical institute (TPI, at present National research Tomsk polytechnic university). The scientific group under the leadership of associate professor V. N. Titov developed the methods and devices of technological control for nuclear power, in particular, sorting automatic machines for the account of fuel elements, signaling devices of humidity of SV-1, SV-2, SV-15, GP-1 and GPD-1, the multichannel relay and pulse regulator etc. The considerable part of the devices and inventions developed by TPI scientists was introduced at the enterprises of medium machine-building industry and nuclear power [13. P. 195]. In 1958, the Institute of nuclear physics, electronics and automatic equipment (at present the scientific research institute of nuclear physics) was founded on the basis of three laboratories (the one of photonuclear research, No. 2 – the one of electronic accelerators development, No. 3 – the cyclotron laboratory) at the physics and technology department [14]. The Institute provoked the formation of schools of thought and research areas in the field of cybernetics. The research on automation of charged particles accelerators was initiated under the supervision of professor V. M. Razin. That resulted in creating betatrons automatic control systems which allowed to increase their productivity developed, to stabilize parameters on energy of radiation dose rate. That invention had wide range of application in medicine, at the enterprises of aircraft, ship-building and chemical industry [13. P. 195]. One of the key tasks of the Institute was development of electrons synchrotrons accelerators whose maximum energy of the accelerated electrons considerably exceeded the energy in betatrons. As a result, the model start-up of the electron synchrotron 'Sirius' took place on April 12, 1961 and its successful physical

start-up on 1,5 GeV was carried out [14]. The Main committee of All-USSR Exhibition Centre awarded the large group of scientists headed by the rector of TPI A.A. Vorobyov with honor diplomas, gold, silver and bronze medals for the achievements in the organization of research works, development and creation of the electronic synchrotron 'Sirius'. The synchrotron "Sirius" was the most powerful in the country and one of the world's largest ones. The fundamental research on physics of charged particles acceleration, nucleus and elementary particles physics, and solid-state physics was conducted by 'Sirius'. The research results became an impulse for development of the work in the field of mathematical modeling and application of computing technology [13. P. 196]. Thus, the scientists of the computing technology and automation laboratory headed by professor V.A. Kochegurov conducted the research on modeling bunches of charged particles and working out the hardware, algorithmic, program instrumentation for accelerators control automation. In 1967 the digital electronic BESM-4 computer, allowing to apply the digital modeling method not only for bunch systems, but also for electronics of physical installations was installed in the laboratory [13].

In 1967 the management laboratory was created at TPI. In that laboratory the researches in the field of automation and optimization of organizational management of university systems was carried out under the leadership of professor V. Z. Yampolsky. The research results gained wide recognition. Since 1978 the laboratory became the head organization for ACS development for the USSR Ministry of Higher Education Institutions by the Ministry order [13. P. 198, 204].

**Conclusion.** Thus, in the 1950ths the basic and applied research on cybernetics was conducted on the basis of Tomsk scientific and educational complex for the first time in Asian part of the USSR, many of research projects were pioneer. The research results had important practical value and had a wide range of application at the industrial and branch enterprises. During the studied period, the large schools of thought conducting research on the most perspective areas of cybernetics were created in Tomsk higher education institutions (TPI, TSU) and scientific research institutes (SPhTI, Institute of nuclear physics, electronics and automatic equipment). That made Tomsk scientific and educational complex turn into a national research scientific center in the stated field.

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