AMERICAN AND SOVIET DISCUSSIONS OF THE FOUNDATIONS OF CYBERNETICS AND GENERAL SYSTEMS THEORY

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Since 1981 scientists in the United States and the Soviet Union have been meeting to discuss the foundations of cybernetics and general systems theory in their two countries. Several different methods of communication have been tried and a wide range of topics have been covered. Most of the conversations have focused on issues involving epistemology, methodology, and management. The discussions have turned up several differences in approach. A few of the differences suggest new avenues for research. Two ideas may help to shed light on theoretical approaches in the two countries and on differences between the two societies. The two ideas are "cognitive efficiency" and "collective intelligence".

BACKGROUND

Those who are unwilling to reexamine deeply held assumptions should not become involved in cross-cultural projects. That is one lesson I have learned from my experience over the past few years in working with Soviet scientists. These experiences have not only led me to modify my political views, they have also given me a deeper understanding of the cultural foundations of political systems.

This intellectual and emotional adventure began at a meeting of the Society for General Systems Research in Toronto, Canada, in January, 1981. I proposed a "correspondence project" to Vadim Sadovsky from the Institute for Systems Studies in Moscow. At the time I was serving as President of the American Society for Cybernetics, and I had been thinking about ways of strengthening that Society. I knew that cybernetics was then or had been in the past a rather large activity in the Soviet Union, whereas cyberneticians in

the United States had split up into many separate societies to address specific areas of interest. I felt that the time was right to bring American scientists together again to reexamine basic concepts. One way of doing this would be as part of a dialogue with Soviet scientists. That is, in order to formulate the American position on the current state of cybernetics, it would be necessary to bring American scientists together in an effort to reach a consensus.

My initial idea was to do this through correspondence. An American team and a Soviet team would be formed. They would agree upon a set of questions and each side would answer each question. The questions and the answers from each side would appear in both an American and a Soviet journal. Sadovsky responded positively to this suggestion in Toronto and we discussed the idea further at a conference in Bonn, W. Germany, in April, 1982. In the meantime through the Institute for Sino-Soviet Studies at George Washington University I had found out about the International Research and Exchanges Board (IREX) which sponsors scientific programs involving American and Soviet scientists. The people at IREX indicated a willingness to support a program on the Foundations of Cybernetics and General Systems Theory.

Sadovsky then invited me to Moscow in June, 1983, to give a couple of lectures and to make plans for the first of several small conferences. At the Institute for Systems Studies in Moscow I gave two lectures. My first lecture was on computer conferencing and its use as a medium for communication among groups of scientists. This was a report on a two and a half year project sponsored by the National Science Foundation for which I had been the principal investigator (Umpleby, 1979). The second lecture was a description of several systems theories which had been developed in the United States in recent years with an explanation of their differences, origins, and applications (Umpleby, 1981). I also had an informal conversation with a smaller group of people in the Institute of Philosophy of the Soviet Academy of Sciences. In this conversation, which I shall describe in more detail below, I focused on second order cybernetics and its implications for the philosophy of science. I was interested to know whether similar work had been done in the Soviet Union.

I also met with the editor of a philosophical journal with a very large circulation in the Soviet Union. None of the journals in the systems and cybernetics field in the US had comparably large circulations. Partly for this reason but also because of doubts on both sides about the wisdom of the correspondence project, we eventually decided to drop this project and proceed only with a series of meetings.

It was during my conversations with Sadovsky in Moscow that the first of several difficulties arose. Before leaving the US for Moscow I had sent to Sadovsky a list of the "American team" for the correspondence project. Included on the list was the name of Vladimir Lefebvre, a mathematician and psychologist who had emigrated from the Soviet Union to the United States a few years before. I had invited Lefebvre to be a member of the American team because I felt that having someone involved in our group who was familiar with both societies would facilitate communication. This fundamental error in my understanding was the beginning of a long series of conflicts and negotiations which were resolved or died out after about two years. These events were very instructive in terms of learning what the Soviet government is sensitive to and in learning how the Soviets negotiate. Most of this history has been described in letters to the members of the American team (Umpleby, 1983).

Partly as a result of my interest in East-West relations I spent the spring semester of 1984 on sabbatical at the International Institute for Applied Systems Analysis (IIASA) just south of Vienna, Austria. This East-West think tank was thought up in the Johnson administration and set up in the Nixon administration as an exercise in detente. It is the only place in the world where Soviet and American scientists work side by side on the same projects for a period of a few years. I worked with two groups. One group called for System and Decision Sciences is concerned with theory and methods. A second group, then called the Clearinghouse, was actually a collection of projects dealing with management and technology.

At about this time I also arranged a panel on American and Soviet perspectives of cybernetics and general systems theory for the European Conference on Cybernetics and Systems Research held in Vienna, Austria, in April, 1984. The participants on the panel were Ernst Von Glasersfeld, Francisco Varela, Vladimir Lefebvre, Vadim Sadovsky, and myself. Some rather heated exchanges that occurred during the discussion with the audience led us to conclude that discussions between American and Soviet scientists are easier to conduct in small groups when an audience is not present.

The arrangement we have settled upon as most productive is to hold a meeting every two years involving eight American and eight Soviet scientists. The location of the meetings alternate between the US and the USSR. The meetings are being arranged through the same organizations that arrange all US-Soviet scientific programs. On the Soviet side the arrangements are coordinated by the Soviet Academy of Sciences. On the US side programs in the physical and natural sciences are arranged by the US National Academy of Sciences. Programs in the social sciences and humanities are handled by the American Council of Learned Societies (ACLS). Within ACLS programs with Soviet and Eastern European scientists are managed by the International Research and Exchanges Board (IREX). Within IREX our project comes under the Philosophy of Science Division. The Soviet organization which is immediately responsible for this series of meetings is the Institute for Systems Studies in Moscow. In the US the project is being conducted under the auspices of the American Society for Cybernetics.

To conclude this background description it might be worth noting that the exchanges were not begun because we wanted to learn what the Soviets were doing in cybernetics and general systems theory, even though we knew very little about their work in our field. Contacts with the Soviets were initiated as one strategy for achieving conceptual integration among cyberneticians in the United States. The meetings with Soviet scientists have been only very modestly successful in achieving this goal, due primarily to the small number of American scientists involved.

A second motivation emerged during the early years of these efforts. This series of meetings was initiated at a time when American-Soviet relations were deteriorating. Ronald Reagan had recently been elected President and had initiated a foreign policy more hostile toward the Soviet Union. Although the meetings with the Soviets were proposed for reasons having to do with the American scientific community, a principal motivation for me in 1982 to 1984 was to make some small contribution to the maintenance of communication between the two countries during a period of increasing tension. However, after several years of working directly with Soviet scientists and reading more about the Soviet Union, I now have a better understanding of the various points of view in both countries and greater sympathy for the difficulties encountered by professional diplomats.

The rest of this article describes the first meeting in the series and what we learned about cybernetics and general systems theory in the Soviet Union as a result of that meeting. In general I have learned more—both new approaches to cybernetics and about cybernetics in the Soviet Union—by talking with emigre scientists now living in the US than by talking with scientists currently living in the Soviet Union. However, I have found the Soviet Union itself to be quite a fascinating place as an example of a social system very different from the US. Since cybernetics has been defined as the science of communication and control, the Soviet Union can be regarded as the case study of communication and control in a social system. This case study approach has now become the principal motivation for my continuing with

the project. When Soviet scientific papers are interesting, it is generally due less to the scientific content per se and more to the fact that they were generated in a very different social system.

THE MAY 1985 MEETING

The first of a series of conferences between American and Soviet scientists on the Foundations of Cybernetics and General Systems Theory was held in the United States May 17-19, 1985. Eight American and eight Soviet scientists met at Airlie House near Washington, DC. The papers were grouped into three topics—epistemology, methodology, and management. The American can side was particularly interested in epistemology. Recent interest in cybernetics in the US has focused on observing systems, or subjectivist epistemologies, rather than the earlier interest in observed systems, which assumed an objectivist epistemology. The Soviet side was interested in methodology, which they interpreted to include mathematical modelling. Mathematical modelling has long been a central concern for Soviet scientists because of their efforts to improve the efficiency of the central planning process in their economy. Both sides were interested in the management of social systems.

Appendix A lists the names and affiliations of the American and Soviet scientists who took part in the May 1985 meeting. Appendix B lists the papers presented and the order of presentation. These papers are found in *A Science of Goal Formulation*, Proceedings of a Conference among American and Soviet Scientists on the Foundations of Cybernetics and General Systems Theory, May 17-19, 1985, edited by S. A. Umpleby and V. N. Sadovsky.)

PHILOSOPHY

Some of the American participants were especially interested in discussing subjectivist epistemologies, because of their belief that acceptance of the newer epistemology tends to produce greater tolerance of people with different points of view. The Soviets were polite in listening to these views but seemed uninterested in pursuing them. During the meeting the Soviet scientists expressed a commitment to an objectivist point of view. This Soviet position was consistent with what I had encountered earlier.

When I was in Moscow in 1983, I spoke with a group of philosophers in the Institute of Philosophy at the Soviet Academy of Sciences about philosophical topics currently being discussed among cyberneticians in the US. I

spoke about the work in second order cybernetics and the constraints imposed on observations by the physiology of the observer. At first they confused these observer effects with the Heisenberg uncertainty principle and special relativity. I explained the difference between these concepts and the neurophysiological limitations being discussed by cyberneticians. I then suggested that this work, if it were to become widely accepted on both sides, might have some long range implications for relations between our two countries. My impression was that the Soviet philosophers were able to follow my argument, but I was told that they did not feel there would be much interest in these ideas among their colleagues.

Soviet philosophers are still working to establish logical positivism within the USSR. For example, Sadovsky has recently translated some of Karl Popper's work into Russian. Although Popper's work has long been available to Soviet philosophers who could read German or English, it has not previously been available in Russian.

Between 1983 and early 1986 I assumed that the interest in positivism by Soviet philosophers might be an effort to establish an alternative ideology to Marxism-Leninism—an ideology of empiricism which would give greater authority to the scientific community vis-a-vis the Communist Party. This interpretation has met with skepticism from at least two groups of people—American liberal academics and Soviet emigres now living in the US.

The first group, American liberal academics, have criticized logical positivism on the grounds that it has been used as an ideology to increase the power of federal bureaucrats vis-a-vis citizen interest groups (Lilienfeld, 1979).* They believe that a subjectivist epistemology is more likely to lead to a society that recognizes individual rights. Also, they seem to be uncomfortable with the idea that the Soviet Union may be several decades behind the US in developing a philosophy of science or in being ready as a society to accept certain philosophical points of view. That is, suppose that we define three philosophical systems through which the Soviet Union may pass in the years ahead—Marxism-Leninism, logical positivism, and a subjectivist epistemology. The liberal academics seem to assume that Soviet scientists, like their opponents in the US, are using a positivist epistemology. Soviet philosophers, who are probably in fact using a Marxist-Leninist philosophy,

*Precisely the opposite view has been presented by a student of mine who works for the federal government. He acknowledged the ideological role of systems analysis but claimed that the appearance of scientific objectivity helps him, as an advocate of the general welfare, to cope with highly paid corporate scientists and lawyers arguing in behalf of special interests.

are not inclined to correct this error in perception on the part of the Americans.

A second interpretation for why Soviet scientists express an interest in logical positivism comes from Soviet emigre scientists. They suggest that Soviet scientists profess a devotion to positivism because the idea of objectivity, when combined with Marxism-Leninism, permits the Communist Party to claim that it has a monopoly on truth. According to this view, what Soviet scientists say among themselves is quite different from what they say to American scientists. This view is consistent with definitions given in a glossary of a recent text on the USSR (Hecht, 1982).

Whenever we, in the West, read a newspaper which contains the text of a recent speech by a Soviet dignitary, or the wording of a Soviet communique, we hit upon terms which are highly familiar to us, but which are used in a way which seems to distort the original meaning. The following are a number of the more common terms which are interpreted in accordance with the Soviet definition: . . .

Objectivity: The concept that all questions should be considered objectively, i.e., with an open mind, without pre-conceived ideas. This concept completely disregards all the socio-economic lessons which mankind has learned over the centuries . . .

Subjectivism: The healthy manner of looking at all socioeconomic questions with clear pre-conceptions based on Marxist-Leninist doctrine. This creates invulnerability to the tricky, pseudo-attractive arguments of capitalism.

Hence the proclaimed Soviet devotion to positivism and lack of interest in subjectivist epistemologies, at least as they have been developed in recent years in the West, can be interpreted in several different ways. It may even be that each interpretation has some merit.

Near the end of the conference Ernst Von Glasersfeld asked the two Soviet philosophers, Sadovsky and Lapin, to explain the current status of Marxist thought in the USSR. Both Sadovsky and Lapin replied with fairly long explanations. However, I think it would be fair to say that these explanations were not very informative for the American scientists. Both descriptions made the current Soviet debate on Marxism sound like an arcane subject which could only be understood by, and probably would only be of interest to, those immediately involved. I detected no major conceptual shifts or innovations. Perhaps I should give an example of what I would consider

to be an innovation. In conversations with East European scientists in the past few years I have detected increasing references to incentives and the need to reward people for superior work. In the May meeting I heard nothing which would help to provide an ideological justification for work incentives nor a hint that the role of ideology might be declining in the Soviet Union.

As I have tried to indicate, philosophical discussions between American and Soviet scientists are difficult. Probably the primary source of the difficulty lies in the very different training of American and Soviet philosophers. In the United States philosophy is usually divided into ethics, aesthetics, logic, and the philosophy of science. At Moscow State University the Faculty of Philosophy is divided into twelve departments. As Leo Hecht (1983) writes, "Most of them have little to do with the study of philosophy according to western standards."

1. Dialectic Materialism
2. Historical Materialism
3. Theory of Scientific Communism
4. Logic
5. History of Marxist-Leninist Philosophy
6. History of the Philosophy of the Peoples of the USSR
7. History of Foreign Philosophy
8. Theory and History of Atheism and Religion
9. Marxist-Leninist Aesthetics
10. Marxist-Leninist Ethics
11. Methods of Concrete Social Research
12. History of Socialist Teachings

Paradox is a subject that has been discussed rather frequently in the West in recent years. Ian Mitroff's paper on the paradoxes involved in nuclear strategy had two positive effects on the May meeting. First, it set forth an American's concern about the arms race and the lack of clarity in strategic thinking. Knowing that American scientists shared their concern about the arms race, seemed to help to put the Soviet scientists at ease. Second, Mitroff's discussion of paradox was one of several efforts to focus our attention on the difficulties involved in conceptualizing large social systems and strategies for improving them. Hence, during much of the discussion at the meeting we were able to go beyond talking about specific analytic techniques

and turn our attention to how to increase awareness of our conceptualizations and their limitations.

METHODOLOGY

The American participants were particularly intrigued by the presentations on artificial intelligence by Dmitry Pospelov. In addition to his talk during the meeting at Airlie House, Pospelov also made presentations at George Washington University and at the Society for General Systems Research conference in Los Angeles.

In his first of three presentations Pospelov referred to a program that he and his colleagues had written which made use of Eric Berne's (1964) idea of parent, adult, and child logics. The task of the program was to determine which logic would be most fruitful at any given time in a conversation and then converse using that logic.

In his second presentation Pospelov referred to work done by Paul MacLean and others on the different parts of the brain and their different functions. He suggested that true artificial intelligence should model all parts of the brain and the struggle for dominance among them. He noted that currently artificial intelligence only models the part of the brain which controls rational thought. Also, artificial brains have never had a childhood. Their cognitive processes have not evolved in the way a child's do.

In his third presentation Pospelov pointed out that artificial intelligence does not yet encompass the meaning of good and evil. He referred to Issac Asimov's three laws of robotics which were intended as an effort at codifying ethical robot behavior (1950). They do not work, however, because one can always find exceptions. Pospelov then gave a definition of stupid behavior. Suppose a person tries to fool an opponent. His friends may say that is good, but his conscience bothers him. If the results are not what he expected, for example the other person does not act like an opponent, his friends may say that he is stupid. But his conscience still bothers him. Pospelov then speculated about a model of altruistic behavior.

Pospelov's presentations revealed important differences between Soviet and American conceptions of cognition and hence in approaches to artificial intelligence. Whereas Americans tend to assume at least a normative and usually a factual correspondence between word and deed, the Soviets apparently make no such assumption. Soviet scholars seem not to assume that what a program reports and what it ''intends'' are the same thing. Soviet

models of cognitive processes thus begin from more complicated assumptions than those typically used by American scientists.

A reasonable question to ask would be whether Pospelov's approach to artificial intelligence is typical of Soviet scientists working in this field or whether it is unique to him as an individual. In order to answer this question one can point both to Pospelov's key position as director of the computer center in the Soviet Academy of Sciences and to the fact that his views are consistent with other descriptions of Soviet culture (Lefebvre, 1977 and 1982). I have not read articles on artificial intelligence by other Soviet scientists.

A book written for foreign students learning how to write English suggests that different cultures structure arguments in different ways (Bander, 1983) (see Fig. 1).

A basic feature of the English paragraph is that it normally follows a straight line of development . . . The paragraph often begins with a statement of its central idea, known as a topic sentence, followed by a series of subdivisions of the central idea . . . In following a direct line of development, an English paragraph is very different, for instance, from an Oriental paragraph, which tends to follow a circular line of development. It also differs from a Semitic paragraph, which tends to follow parallel lines of development. A paragraph in Spanish, or in some other Romance language, differs in still another way: its line of thought is sometimes interrupted by rather complex digressions. Similarly, a paragraph in Russian often contains digressions. In different cultures, the various approaches to making a written statement are related to each culture's culturally influenced patterns of thinking, none of which is necessarily better than any other . . .

My experience in dealing with Soviet scientists suggests to me that a useful diagram of Soviet discourse would be graphed as three roughly parallel sequences of events—one for statements, one for actions, and one for intentions. The ''game'' is to infer intentions from statements and actions (see Fig. 2).

Game theory is a subject which was referred to a few times in the discussion at the May meeting but on which no paper was presented. Nevertheless it is an important topic to understand when trying to understand Soviet work in cybernetics and systems theory. While at IIASA I was struck by the large number of papers that had been written on this subject. Vladimir

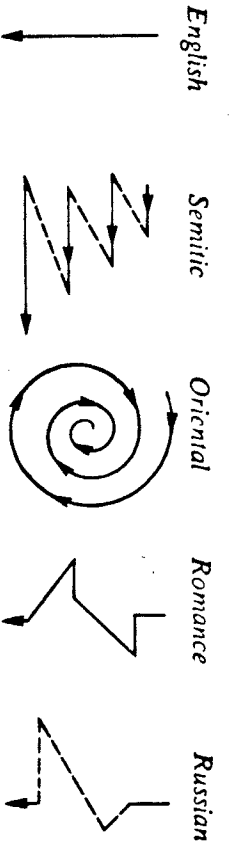English   Semitic   Oriental   Romance   Russian

FIGURE 1. Diagram from Robert B. Kaplan, "Cultural Thought Patterns in Inter-Cultural Education," *Language Learning*, 16, nos. 1 and 2: 15. Referred to in Bander, 1983.

Lefebvre's work assumes a game perspective. Pospelov's work also begins from assumptions similar to those of a game. Anatol Rapoport, perhaps the leading American game theorist, left the Soviet Union with his parents as a child.

The dramatic difference between American and Soviet styles of thought suggests to me the concept of "cognitive efficiency." If Soviet scientists and managers spend a large amount of time figuring out how to outwit or out-maneuver their colleagues, supervisors, rivals, etc., this surely must reduce the amount of attention that can be focused on substantive problems of science or administration. If such a diversion of intellectual resources is occurring in the Soviet Union, this may in part account for the relatively poor performance of Soviet scientists and the Soviet economy. Using techniques from artificial intelligence it should be possible to simulate the efficiency of different cognitive strategies once each strategy has been explicitly formulated and incorporated into a computer program.

MANAGEMENT

Nicholai Lapin's presentation on "innovation games" came as a surprise to the American participants because we did not know that such work was being done in the Soviet Union. His work seemed very similar to American

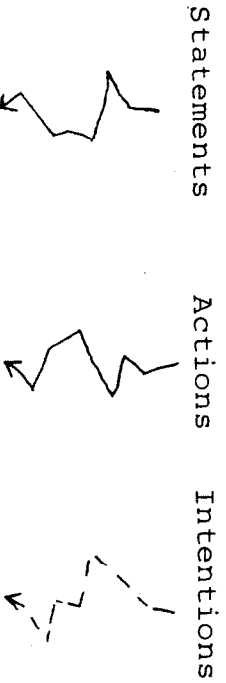Statements   Actions   Intentions

FIGURE 2. An alternative interpretation of Soviet discourse.

work in organizational behavior. (Note the use of the word "game" when talking about methods to help people work together more smoothly.) Apparently Lapin is having some success in using "innovation games" as a training experience for high level executives in at least one ministry. According to another Soviet participant in the May meeting a recent government report recommended more widespread use of these training exercises.

My experience at the International Institute for Applied Systems Analysis (IIASA) during the spring of 1984 had led me to believe that such work was not being done in the Soviet Union. While I was at IIASA I had proposed a one day planning meeting to discuss some of the labor-management conflicts which had arisen at the Institute. This meeting was originally approved by the Canadian director and American deputy director but was cancelled after objections were expressed by the Soviet deputy director. My impression of IIASA at that time was that the Americans were vetoing projects involving high technology while the Soviets were vetoing projects that looked at sociological, cultural or political issues (Umpleby, 1984). The remaining permissible topics concerned minerals, the environment, or mathematics.

Since then there has been a change in American opinion toward the idea that some high technology, such as electronic mail or computer conferencing might put additional pressure on the Soviet government to allow greater freedom in the flow of information. Also, since Gorbachev came to power, there seems to be a greater willingness in the Soviet Union to discuss management issues. Indeed, the strategic management of technological development is now on the research agenda at IIASA and cultural differences in strategic planning methods were discussed in at least one IIASA planning conference (Umpleby, 1985).

Computer conferencing is a topic which was not discussed at the May 1985 meeting but on which I made a presentation in Moscow in 1983. Electronic mail and computer conferencing systems have been established in a number of major cities in the US in the past year. So many systems are now in place that an organization called the Electronic Networking Association was formed in New York City in April, 1985, to share information on the innovations being made on the various systems.

Four Soviet scientists currently have accounts on the Electronic Information Exchange System (EIES) based at New Jersey Institute of Technology. But no privately accessible computer conferencing system exists in the Soviet Union today. Indeed, after my talk on computer conferencing systems in Moscow in 1983 one Soviet scientist said, somewhat under his breath,

"Maybe in a hundred years," Loren Graham has listed several reasons why the Soviet Union is not participating in the information revolution (Graham, 1984).

I believe that the subject of computer conferencing is important in understanding the competition between the US and the USSR over the long term. Computer conferencing is likely to become a key element in what has been called "collective intelligence." A society which can freely exchange technical and managerial information within a large population should have a significant long term economic advantage over a society which impedes the free exchange of information. Hence computer conferencing is becoming one more factor reminding the Soviets of the need to choose between economic development or authoritarian government.

CONCLUSION

A general observation, made by an American participant at the end of the May meeting, was that the focus of interest within cybernetics and general systems theory has shifted from the analytical techniques associated with achieving goals to the conceptual, philosophical, and ethical problems involved in formulating goals. These two foci of attention were evident at this meeting with the newer concerns being expressed more frequently.

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APPENDIX B: PAPERS PRESENTED

Epistemology

1. E. Von Glasersfeld
"Knowing in Self-Regulating Organisms: A Constructivist Approach"

2. V. N. Sadovsky
"Philosophical and Methodological Foundations of Systems Theory"

3. I. Mitroff
"The Complete and Utter Failure of Traditional Thinking in Comprehending the Nuclear Predicament: Why It's Impossible to Formulate a Paradox-Free Theory of Nuclear Policy"

4. S. A. Umpleby
"Conceptual Difficulties Involved in Relations between the United States and the USSR: The Role of Cybernetics and General Systems Theory"

5. I. A. Apokin
"Development of Cybernetics and the Theory of Cognition"

Methodology

1. O. A. Kossov
"On Some New Lines of Research in Cybernetics and Systems Modeling"

2. G. Klir and E. C. Way
"Reconstructability Analysis: Aims, Results, Open Problems"

3. D. A. Pospelov
"Logic in Artificial Intellectual Systems"

4. M. Zeleny
"Spontaneous Social Orders"

5. I. A. Lavrov
"The Use of the Theory of Algorithms in General Systems Theory"

Management

1. V. S. Rapoport
"Methodological Unity of Systems and Contingency Approaches to the Analysis of Management Systems"

2. W. Reckmeyer
"Managing Complexity in the Systems Age: A Unified Systems Perspective"

3. N. I. Lapin and B. W. Sasonoff
"The Activity-Systems Approach to Development of the Human Factor in Innovation"

4. B. Allyn
"A Systems Approach to International Relations: A Comparison of US and Soviet Models"

5. V. M. Munipov
"The Development of Ergonomics as a Systems Discipline"

6. M. Ben-Eli
"Cybernetic Tools for Management: Their Usefulness and Limitations"