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GAME THEORY AND POLITICS: RECENT SOVIET VIEWS
Thomas W. Robinson

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PREFACE

This Memorandum reports work done in 1967 and 1968 as part of Rand's study of Soviet military doctrine, their use of military strength for political ends, and changes in their strategy, tactics, and organization stemming from developments in their economic and political institutions. It appeared from the relevant literature that beginning in the middle 1960s the Soviets who had already used game theory in mathematics and the physical sciences, took an interest in what Americans had done in applying game theory to problems of strategy, tactics, and foreign policy, and began to inquire about the uses to which it could be put in the Soviet setting.

To the extent that game theory tends to support the rational and calculated use of power, its application to international politics should influence the development of political science in the Soviet Union, a story largely untold in the West. The present writing places the international political application of game theory in that development; traces the further development of the subject after official approval was denied the study of political science in 1966-67; and analyzes several articles to elicit specific and changing Soviet attitudes toward the political science and international relations applications of game theory.

Appended are the English versions of four such articles, the first two translated by the author, the last two by Lilita Dzirkals.

Acknowledgements are due Melvin Drescher and Oleg Hoeffding, who provided helpful comments, and Irene Agnew, who checked the author's translations.
SUMMARY

Game theory is a branch of mathematics that essentially analyzes situations involving conflicting interests in terms of gains and losses among the opposing players. It first appeared in the West about twenty-five years ago, and has since developed into a major field and has been applied to a wide variety of disciplines including economics, sociology, psychology, and political science. As regards the latter, interesting attempts have been made to demonstrate game theory's relevance to understanding theoretical problems in international relations and nuclear strategy. In the Soviet Union, game theory has been studied and applied to the solution of technical problems in the physical sciences and mathematics for over a decade. Only recently, however, have Soviet writers considered relating game theory to political, and especially international and strategic, questions.

Soviet writings on game theory and politics are marked by special problems stemming largely from the limits which the necessity to adhere to Marxism-Leninism sets upon free intellectual discussion. Political applications of game theory are especially open to ideological suspicion because game theory is mathematical and hence claims a high degree of objectivity, while at the same time it deals with politics, which is the essence of subjectivity. Marxist-Leninist discussion of this subject has therefore proceeded with caution, especially in the early period, 1966-1967, because of the connection made between game theory and political science. The latter
has long been a forbidden subject in the Soviet Union.

Soviet scholars made an attempt beginning about 1964 to free political science from the iron grip of ideology, first by "debunking" Western political science writings (as a safe means of introducing the subject to Soviet readers) and then by showing "methodological consciousness" (the beginnings of independent contributions to the field and presentation of the case for political science's legitimacy within the Marxist-Leninist framework). The first Soviet writings on game theory and politics appeared in 1966 and were closely associated with this "legitimation" of political science.

The campaign failed in late 1967, mostly because the Soviet Communist Party became concerned that political science, if given its ideological credentials, would seriously undermine the Party's position on important political, international, and strategic questions. Discussion of all matters concerning political science was thereby suspended. Writing on political applications of game theory also disappeared from print. This situation lasted approximately half a year.

By mid-1968, however, scholars had found another way to continue discussion of game theory and politics. This was to separate game theory from political science (which has since continued on the list of forbidden subjects) and instead link it to sociology, which had received ideological clearance some years previous. That move allowed publishing to resume, and the volume of literature increased during the latter part of 1968. There was a penalty attached, however: Soviet discussion of political
applications of game theory was thrown back to the debunking stage, from which it has not yet emerged.

Although most Soviet discussion of this subject is thus carried on as criticism of Western analyses, it is possible to discern the outlines both of future Marxist-oriented game theory and the debate within the Soviet Union over whether, and how far, game theory should be applied to political and military matters. In the former case, the problem is how to provide a class basis for game-theoretic analysis while retaining its mathematical and objective properties. Soviet writers have not solved this problem, which in fact may be interminable, although an East German, Georg Klaus, has outlined the path that must be followed. With regard to the Soviet debate over applications, a group (whose membership is unclear) seems to be advocating immediate application of the zero-sum model to international relations and nuclear strategy. The zero-sum model accords well, of course, with a Cold War-like, two-camp view of East-West relations and is therefore attractive to those in the Soviet Union who adhere to the orthodox position of total intransigence and opposition to the United States. Reference to military applications has for the most part been kept out of open publications, although what is available hints at the existence of such work.

Russian fascination with game theory stems partly from the well-known Soviet propensity to look for technical solutions to nontechnical problems. The same tendency is evident in Russian exuberance over the benefits that computerization and cybernetization are supposed to hold
for Soviet society. The Soviets are interested in game theory also because of the fear that the West might have a new weapon for overcoming Leninist socialism. It would thus appear that, despite the obstacles to pursuing the subject, Russian interest in game theory will continue. It is doubtful, however, whether the Russians will be able to make any substantive contributions until they decide whether they can afford to overcome their own ideological scruples.
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I. INTRODUCTION

In 1966, two articles appeared in Soviet periodicals which for the first time gave Soviet views on the implications of game theory for politics. The next contribution on the subject was published in mid-1967, and a fourth


2This is not to say that the Soviets had never before studied game theory. For some years they have actively translated Western-language classics in the field and have themselves contributed to the theoretical literature and carried out practical applications. For an example of the former, see the three-volume series edited by N. N. Vorob'ev and others: Matrix Games, Infinite Antagonistic Games, and Positional Games, Moscow: Physics-Mathematics Literature Publishing House, 1961, 1963, and 1967 respectively. For examples of Russian game theory, see Kiyoshi Takeuchi and Eugene Wesley (trans.), Selected Russian Papers on Game Theory, 1959-1965, Princeton: Princeton University Econometric Research Program, 1968. Examples of Soviet applications of game theory are given below (footnote 12). That game theory is actively being studied in the Soviet Union is shown also by the recent report that the First All-Union Conference on game theory was held at Yerevan State University, November 12-19, 1968. More than 140 scientists presented over 80 papers on game theory. Yerevan Kommunist, November 14, 1968, p. 4. See also V. Patsyukov, "First All-Union Conference on Game Theory," Izvestia Akademii Nauk SSSR, Tekhnicheskaia kibernetika, Moscow, No. 1, 1969, pp. 173-176 (translation in Joint Publications Research Service [JPRS], No. 48,377, July 9, 1969).

article appeared early in 1968.\textsuperscript{4} The fact that the Soviets waited until 1966, more than a decade after the first American publication on game theory and international politics, as well as the nature of the subject itself, raise questions about the Soviet attitude toward the use of game theory in political and other social sciences. How does that view differ from views held in the United States? Can we place Soviet game theory in the context of the development of the social, especially political, sciences in the Soviet Union? To what extent can a game-theoretic approach to the analysis of politics be made to conform or contrast with Marxism-Leninism? Which specific game-theoretic propositions are acceptable to the Soviets, which are rejected, and which are ignored? Here we shall attempt to give a preliminary answer to these questions by analyzing the earliest four major articles, as well as a number of Soviet writings on allied subjects,\textsuperscript{5} against


what we already know about Soviet game theory, the
development of the social sciences in the Soviet Union,
and the current status of game theory in the West. The
four articles have been translated and appended to this
study.

"Game Theory and Its Sociological Aspects," Vestnik
Moskovskogo Universiteta (Herald of Moscow University),
Philosophy Series, No. 4, 1968, pp. 49-59 (translation
in JPRS 46,710, October 21, 1968); D. Yermolenko,
"Sociology and Problems of International Conflict,
International Affairs, No. 8, 1968, pp. 47-53; G. L.
Smolian, "Printsi pi issledovaniia konflikta" ("Principles
of the Study of Conflict") Voprosy filosofii (Problems of
Philosophy), No. 8, 1968, pp. 35-41; and Georg Klaus,
"Philosophical Aspects of the Theory of Games," Voprosy
filosofii (Problems of Philosophy), No. 8, 1968, pp. 24-34
(translations of Smolian and Klaus in JPRS 46,951,
November 26, 1968, pp. 1-17).
II. SOVIET GAME THEORY AND THE DEVELOPMENT OF
THE SOCIAL SCIENCES IN THE SOVIET UNION

For some years, Soviet scholarship has witnessed
the emergence of various scientific disciplines from the
Marxist-Leninist matrix. Aside from developments in many
of the physical sciences brought about by Cold War competi-
tion with the United States, since the middle and late
1950s several of the social sciences have been accepted
in Soviet intellectual and economic life as elements in
the "transition to full communism." Cybernetics, 6 econ-
ometrics (especially mathematical economics and computer
methods), 7 and sociology 8 are branches of the social

6 See, inter alia, Loren R. Graham, "Cybernetics in
the Soviet Union," in W. Z. Laqueur and L. Labedz (eds.),
Press, 1965; idem, "Cybernetics," in George Fischer (ed.),
Science and Ideology in Soviet Sociology, New York:
Atherton Press, 1967; and two bibliographies: David D.
Comey, "Soviet Publications on Cybernetics," and L. R.
Kerschner, "Western Translations of Soviet Publications
on Cybernetics," Studies in Soviet Thought, Vol. 4, No. 2,
February 1964, pp. 142-177. The Rand Corporation since
February 1967 has published a monthly periodical, Soviet
Cybernetics: Recent News Items (since June 1969 retitled
Soviet Cybernetics Review).

7 The relevant literature is summed up in John Hardt
et al. (eds.), Mathematics and Computers in Soviet

8 See, in an already large literature, the two works
by George Fischer, Science and Politics: The New Sociology
in the Soviet Union, Ithaca, N.Y.: Cornell University,
Center for International Studies, 1964, and "Sociology,"
in Fischer (ed.), Science and Ideology in Soviet Society;
Alex Simirenko (ed.), Soviet Sociology: Historical Ante-
cedents and Current Appraisals, Chicago: Quadrangle
Books, 1966; the relevant articles in Soviet Survey by
sciences that have progressively freed themselves (although by no means completely) from the more constraining aspects of "scientific communism." In recent years, what the Soviets term the "political sciences" have shown signs of joining this trend. The dynamics of this latter movement help explain the new-found Soviet interest in the political aspects of game theory.

Political science as a separate branch of Marxism-Leninism has no history in the Soviet Union, but for at least seven years there have been glimmerings of the possibility of its legitimation in the future. The formation of the Soviet Political Sciences Association in 1960 initiated this development, which proceeded slowly for several years. Something of an explosion of interest took place in 1965 and 1966, with a proliferation of articles about political science and even open discussion as to its purpose and content. Since the report of the


Association's 1966 meeting, however, no further reports have been issued concerning the activities of the Association, and public discussion of political science as a possible branch of Marxism-Leninism has ceased. Discussion and criticism of Western political science has nevertheless continued, though more discreetly.

The first two of the articles on which this analysis of Soviet game theory and politics is based appeared at


10 See Sovetskoe gosudarstvo i pravo, No. 6, 1966, p. 135.

the height of the open debate on political science, while the other relevant articles (footnotes 3-5) were published after the apparent ban on open discussion of political science had gone into effect. The question that must be asked is what, if any, effect on game-theoretic


discussions of political matters is evident from the inability of Soviet discussions of political science to progress beyond a rather primitive stage. Since before 1966 Soviet thinking on game theory and politics was an integral part of the expansion of Soviet thinking about political science as a whole, and given the natural intellectual affinity between the two, we might assume that the official halt in the open debate over the nature and desirability of Marxist-Leninist political science would signal a similar cessation in the debate over game theory and politics. In fact, however, discussion was not completely shut off in either sphere, although development of political science became much more constricted than did that of game theory. The dynamics of and reasons for the relative rise and demise of political science must be investigated if we are to understand the present and likely future reputability of the political uses of game theory in the Soviet Union.

In the emergence of economics, cybernetics, and sociology as new subfields of Marxism-Leninism, a prescribed format seems to have been followed. In the first stage, the credibility of the field was established by showing its potential contribution to the construction of communism and its ideological fidelity to "scientific" communism. To do this, scholars typically wrote articles that "creatively debunked" Western scholarship in the field, subjecting it to harsh ideological criticism.\textsuperscript{13} The writers sought not only to establish their own

\textsuperscript{13}This discussion parallels that of Alex Simirenko in his "Introduction" to Soviet Sociology, pp. 20-35.
ideological credibility and that of the emerging field but also to convey information to their readers about the field. Thus Soviet scholars could legitimately inform themselves and their colleagues of past developments and the current status of Western studies in these areas. This same process occurred up to 1966, at least, in political science and its game-theoretic offshoot. In the second stage, "methodological consciousness," for the first time substantive scholarly contributions were permitted to be published, as long as they could demonstrate fidelity to communist ideology and relevance to communist construction. Later, emphasis increased on empirical research and theory for its own sake, and the stress on total ideological and practical relevance lessened somewhat.

The first Gerasimov article, published at the height of the debate on political science, is, expectedly, an archetypical creative debunking article. But by 1966, the debate on political science had progressed far enough to lead us to expect that succeeding written contributions would have entered the second, methodological consciousness, stage. And, in fact, the Vorob'ev article gives some evidence of rising above debunking to present arguments capable of standing on nonideological grounds alone. But once the decision came not to allow further overt development of political science, debate over both political science and the political aspects of game theory was thrown back to the first stage. The second Gerasimov article and the first Petrovskiaia article clearly reveal the limits beyond which scholars felt constrained not to proceed.
Study of the political aspects of game theory would probably have remained at this preliminary stage for some time were it not for the propensity of Soviet scholars to find other channels into which they could divert their intellectual discourse and thus see to its constant, if slow and cautious, development. In the case of game theory and political science, a substitute was readily at hand in the field of sociology, which (for reasons of its felt usefulness to the Party in the movement to construct communism and to provide a basis in the theory of scientific communism) has retained its Marxist legitimacy in the more recent period. Recent literature relevant to game theory and politics, therefore, attempts to draw explicit connections between game theory and sociology, not political science. (Publications cited in footnote 5 are all of that genre.)

Before considering the literature on game theory and politics in detail, we might first ponder the reasons for the cessation in 1966 of the open debate on political science and its relation to game theory, with the aim of understanding the limits that Soviet Marxism-Leninism currently imposes on these fields. Some of the possible reasons stem from ideological constraints imposed on the

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14 Soviet scholars interested in the development of political science in the Soviet Union have also adopted this mode of procedure. A number of the contributions mentioned above in footnote 11 seek to draw the connection between concepts that in the West belong to the field of political science and those of sociology as understood in the Soviet Union. On this new basis, both political science and discussion of the social science uses of game theory can now cautiously proceed.
Soviet study of political science itself. Others have to do with the apparent buildup of pressures, by partisans of political science in the Soviet Union, for a decision favoring continuation of their work. Evidently sometime in 1966 a decision was made, but it was unfavorable to the supporters of the study of political science. Probably the Communist leadership felt that if it gave permission to begin the objective study of politics, it would open up a Pandora's box. What would come under scrutiny can be seen from a listing of the subjects which Soviet supporters have proposed as proper for political science study: the state, the Party, non-Party political organizations, political roles of social institutions, political decisionmaking, political predictions, political elite studies, public opinion, international politics, area studies, foreign policy (particularly principles, mechanisms, and decisionmaking), Communist-non-Communist relations, conflict resolution, disarmament, ideology, and political theory, i.e., all the components of political science in the West. Although such a political science would surely, in the beginning, be very much in the Marxist-Leninist ideological syndrome, it would probably progressively wean itself from exclusive dependence on that viewpoint, as did the other subfields that emerged. But the political leadership in the Soviet Union is probably not yet so confident of its own power as to permit a relatively objective inquiry into Soviet domestic political processes -- especially the Party -- or into Soviet foreign policy. Development of the scientific (i.e., really objective and not just Marxist-
Leninist "objective") study of politics in the Soviet Union would have implications for the Soviet body politic that would be much more serious and destabilizing than those of cybernetics or mathematical economics or sociology. And as we shall see below, two of the articles on game theory do raise questions which, if their implications are traced out, hold serious consequences for Soviet foreign policy.

Two other "political" reasons may account for the current silence in the Soviet press on political science and game theory. In 1967 Russians celebrated the 50th anniversary of the establishment of Soviet power. In deference to the solemnity of the occasion, the pace of ongoing controversies was slowed or even halted that year. This may have occurred with discussions about political science. Another "reason" was advanced by a visiting staff member of the Institute of International Relations (Moscow) in conversation with the writer. In answer to a query about the future of Soviet political science, he recalled that in 1966 a number of groups were competing for assignment of funds to set up several new institutes

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15 The Central Committee Resolution on the social sciences ("On Measures for Further Developing Social Sciences and Heightening Their Role in Communist Construction," Pravda, August 22, 1967, pp. 1-2) neither mentions the political sciences nor does it list as fit for study by the social sciences any of the above-mentioned subjects proposed for inclusion in the political sciences. They could still be studied, however, if they were placed pro forma among the approved categories of economics, philosophy, history, law, and sociology. The resolution does speak of "other social sciences" as legitimate. But neither political science nor its adjuncts -- including game theory -- were mentioned directly.
in the social and natural sciences and that the group arguing for establishment of a political sciences institute was unsuccessful. This interpretation of events is interesting: the presence of articles in the Soviet press discussing political science is seen as an indicator that what proponents are after are funds for an autonomous institute. By the absence of such discussions in print it is understood that the funds have been disbursed elsewhere and will probably not be forthcoming. The trouble with this reasoning is that it is not sufficient grounds for suppressing discussion of the subject altogether.

Two final arguments can be inferred as alternative explanations for the discontinuation of written discussion of the political implications of game theory. First, the authorities, having noticed the ventilation of the subject and having understood its importance for foreign policy, may have decided that it was important enough to national security to keep out of the press. They would accelerate research and investigations into Western output, but would not allow open dissemination of results. Soviet awareness of the political, military, and strategic applications of game theory may have been increased by American debate on the subject (which, incidentally and perhaps significantly, is not alluded to in the four articles). The

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Russians may not have wanted to permit the Americans to make a "strategic breakthrough" in this area. The Soviet military and political leadership may have "discovered" game theory but wants to keep secret its present inferiority and the course of research. Thus the conspirational theory.

The other possible explanation is that perhaps the Russians have indeed "discovered" the political science uses of game theory but, like the Americans, are engaging in a controversy over its merits. Naturally, they would not want to inform the other side of these debates because they affect the future strategic posture of the Soviet Union as well as such important ideological questions as the real basis of class antagonism and the class nature of social science research. Indeed, all four articles and subsequent publications hint at the existence of such a debate. Why else should these articles have been published in the first place? Thus the "debate" theory. There seems to be no way of resolving these competing explanations. None seems completely to exclude the others, however; perhaps parts of each being true, a composite explanation may be more accurate.
III. ANALYSIS OF RECENT SOVIET WRITINGS ON GAME THEORY AND POLITICS

"THEORY OF GAMES AND INTERNATIONAL RELATIONS," BY G. GERASIMOV

The first section of Gerasimov's article (pp. 43-46 below) is a straightforward description of game theory, concluding that game theory is indeed applicable to international relations. The purpose of the second section (pp. 46-49) is quite different. It is to show that the "bad guys" -- the American militarists and their civilian hangers-on -- have turned game theory into a tool for their own evil purposes. They have thus come up with a potentially dangerous weapon, since game theory, being politically neutral, can be used by either side. In "proving" his point and disparaging American efforts in this field, Gerasimov confuses game theory (whether by design or by misunderstanding) with the advisory role of game theorists in the government, with the "McNamara revolution," with systems analysis, with the "scientific approach" to decisionmaking, with operations research, with Herman Kahn's work on escalation, with scenario writing and war gaming, and with the use of computers in international relations. All of these are seen to be manifestations of a single approach to international relations (he does not mention the "behavioral" context of all these "approaches"), which has intrinsic (but not insurmountable) difficulties, but which has been turned into a weapon of destruction by evil men. He then labels as pernicious such "zero-sum thinking" as international politics, and views the Cold War in particular as a product
of this kind of thinking by American militarists. The latter, according to the author, eagerly seized upon the zero-sum model as scientific proof in support of their arguments. He is careful, however, not only to point out that many aspects of international relations are better seen as non-zero-sum games (international law and peaceful coexistence are given as examples) but he also chooses to ignore the debate in the United States on the zero-sum case and its conclusion that even in war zero-sum thinking is misleading.\footnote{To admit that some Americans are on his side would be to admit that the "enemy" is not all "bad." Gerasimov's article thus seems a good example of unnecessary zero-sum thinking. He does state that some American authorities advocate non-zero-sum positions, quoting Bernard Brodie, formerly a Rand staff member. But he is quick to point out that the militarists and imperialists have also used non-zero-sum theory for their own ends.} In order to keep his proof clear, he attacks the ideas of Schelling, Kemeny \textit{et al}., and Kahn on cooperative bargaining, blackmail, and bluff, by selectively quoting and misquoting them. Especially in the case of Herman Kahn does Gerasimov resort to selectivity in quoting, for in the very section quoted, Kahn himself acknowledges the dangers of bluff-blackmail when applied to international politics and to East-West relations. The point for Gerasimov, however, is not only to make sure he has clear targets for attack, thus retaining his own ideological credibility, but also to find a reasonable excuse to present game-theoretic ideas that his own readers will find interesting and provocative. Having thus held his opponents in their corner, and having conveyed some of the basic ideas of the political uses of
game theory, Gerasimov is ready to enunciate his central point, the demonstration of which comprises the third section (pp. 49-63).

This is the argument that, despite its abuse by the Americans, game theory still can be useful in analyzing international affairs, if only it is placed in the safer hands of the Russians themselves. Thus, he hints that, having "discovered" that game theory can be useful in politics, the Soviets may now be engaged in a strenuous effort to beat the Americans in applying it. If a major effort has thus begun, controversy can be expected. Hence, he repeats as his own such standard injunctions as: don't be overenamored with the elegance and simplicity of the zero-sum approach; don't rush into rampant applications of game theory in all areas of international relations; don't tarry overly long with the two-person case but investigate several-person games (this holds implications for the post-Cold War world which we now seem to be entering); be aware of the difficulties in defining the value of the game in international politics; and realize that models, while necessary, are still only abstractions -- sometimes at too high a level -- which may not accurately portray international reality. He closes with a reasonable call for more political thinking in game-theoretic terms.

One problem that Gerasimov and other practitioners and advocates of game theory must constantly face is the question of the compatibility of game theory with Marxist dialectics. Gerasimov tries to make the case for compatibility by arguing that only the Marxist dialectic penetrates to the core of political and social reality
and thus only its own categories of thought -- such as historical materialism and the class nature of politics -- can successfully inform game-theoretic applications. He works hard to show that Marxism is more than a zero-sum, two-person game. But in the end it is not clear whether the inherent contradiction between the apparent Marxist bias in favor of that sort of game and Gerasimov's desire to study non-zero-sum, many-person games can indeed be overcome.

"SOME METHODOLOGICAL PROBLEMS OF THE THEORY OF GAMES,"
BY N. N. VOROB'EV

In the Vorob'ev article we are confronted with an entirely different sort of analysis, not only because the author is himself a respected game theorist but also because his analysis is both scientifically dispassionate and might be perceived as dangerous to Marxist ideology. This article shows up many of the latent conflicts between mathematics and science on the one side, and communist theory on the other, and demonstrates why game theory, especially in its applications to politics, may be looked on with considerable suspicion by the Soviet regime.

This is not a "debunking" exercise like Gerasimov's -- Vorob'ev probably would not have written such an article -- but rather represents the beginning of a transition to "cautious empiricism," which has characterized later stages of the development of other sciences in the Soviet Union. The article is noteworthy also in containing no reference to Marxism-Leninism (Vorob'ev substitutes the term "philosophy") and only minimal reference to the categories
of Soviet Marxist thought. The paper at first glance appears to be an informative exposition of some general aspects of game theory for the benefit of Soviet philosophers. This is in fact the purpose of the first section. Then, however, he turns to the question of whether game theory really is able to adequately model social -- especially class -- reality. He warns that social reality is much too complex to be represented with complete accuracy by games: even the identification of the players, a seemingly simple task, often presents a difficult obstacle to game theory. In Marxist theory the identification of antagonistic classes is always supposed to be a simple exercise: one merely looks at who possesses the means of production. Vorob'ev says that if one is to use game theory, this question will have to be investigated much more thoroughly, and one must be prepared to accept unforeseen, and perhaps unwanted, conclusions about the nature and identity of the contending parties.

In international relations also the implication may be startling to a Marxist: in order, for instance, to adequately model an international system based on "peaceful coexistence," one may have to include as major players not only the United States and the Soviet Union but also such states as Germany, mainland China, and India. Such a complex game would best be thought of as a composite of several sub-games, each with different players, with some games antagonistic and some nonantagonistic, and with the results of each game serving as inputs to each of the others. This way of considering international reality may lead to conclusions entirely at variance with official Soviet policy.
Vorob'ev makes essentially the same points with regard to the description of strategies of the players and the measurement of social phenomena. These arguments are often made in the West when social and political applications of game theory are proposed; the fact that Vorob'ev advances them here points not only to the reluctance of Soviet game theorists to become involved in the politicization of game theory but also to the existence of pressures in the Soviet Union for just such utilization. Vorob'ev defends his profession from political interference by pointing out some of the implications of game theory that are unpalatable to Marxism-Leninism and "scientific communism." It may be that Soviet decisionmakers, reading this message clearly, have indeed decided not to proceed further.

Vorob'ev puts forward other arguments regarding the relationship of game theory to Marxism-Leninism. His contention seems to be that the Soviet authorities will have to make a choice between using game theory for political analysis, thereby accepting the risk of eroding basic Marxist-Leninist concepts, and allowing game theory to remain in the hands of the mathematicians with no such political applications, thereby leaving Marxism-Leninism intact. Thus, Vorob'ev speaks of randomness as a "philosophic" category derived from game theory. Randomness is hardly an acceptable quality to Marxist-Leninists, especially in helping to make correct political-social decisions. It is also outside the bounds of Marxism-Leninism to suggest, as game theory does, that one's own strategy and goals are as dependent upon the goals
and strategies of the opponent as they are on one's own choices. Marxist-Leninists, it is true, must always take into account the activities and goals of the opponent, but not to the extent of setting their own behavioral choices and goals equal and opposite to those of the opponent and not to the extent of allowing their goals and actions to be a function, if only partially, of those of the opponent. Game theory indeed presents a serious challenge to the Soviet state if one applies Vorob'ev's central point to international strategy: "In unrestricted games it is not permissible . . . to consider one strategy absolutely good and another absolutely bad on the basis of only one [player's] description of them." Vorob'ev implies that Soviet Marxism must be prepared to bargain away Marxist-Leninist principles if the Soviets wish to embrace game theory.

Vorob'ev also points out that if game-theoretic presumptions are accepted, the strategist may not wish to attempt to maximize his gains. The communist ideologue would at the least be reluctant to accept such presumptions as bases for positive socio-political action. The principles of scientific communism might well be the loser. Soviet decisionmakers, therefore, might accept the author's conclusion that game theory is still at a very primitive stage and capable only of very low-level analyses and conclusions.

One argument has direct implications for Soviet foreign policy. The author states that one's goals must be feasible (and he equates feasibility with rationality, without further defining it), and that feasibility of
goals leads to situations in which the game is stable, or in equilibrium. If rational, feasible goals are to be adopted and, hence, equilibria are to be discovered and attained, a random strategy should be used. But then all the philosophical problems of randomness discussed above present themselves. In particular, if Soviet foreign policy is going to pursue the goal of spreading communism by piecemeal increments (a rational and possibly feasible goal), it must do so in the context of an East-West equilibrium and must adopt methods that are distinct, possibly conflicting, not sequentially connective, and that may lead to goals quite different from those intended by the Soviet leaders. The other problem is that within a single game there may be several, not just one, points of equilibrium. By implication, if Soviet foreign policy finds a policy of peaceful coexistence difficult to carry out by one means (or even if one kind of peaceful coexistence proves infeasible), it is still possible to adopt other means and find other definitions of peaceful coexistence. The goal, however, must remain some kind of equilibrium (can we say balance of power?) in East-West relations.

Finally, Vorob'ev's consideration of the problem of antagonism holds heterodox implications for Marxism-Leninism. He warns, in effect, that the Marxist-Leninist conception of antagonism should not be modeled by antagonistic games (as some in the Soviet Union may already have attempted). Instead, it should be realized that many seemingly antagonistic situations (Vorob'ev specifically mentions class conflicts and peaceful coexistence)
are best modeled by nonantagonistic games. Often points of mutual agreement and advantage can be found if contacts are maintained and negotiations begun. The implications for East-West relations are obvious.

"GAME THEORY IN THE SERVICE OF AMERICAN MILITARISTS,"
BY G. GERASIMOV

The second Gerasimov article returns to the "debunking" format, and evidences, in contrast with Vorob'ev's contribution, the changed framework within which Soviet scholars have had to write about game theory since 1967. But the return to the more primitive stage of development is not complete, since the author examines several ideologically sensitive subjects not dealt with previously. It is also apparent that Gerasimov has, since his previous contribution, read and learned much from Western literature on game theory, which, despite the title of this article, has given him some sophistication. Finally, the piece gives evidence of a closed-door debate on the degree to which game theory should be applied to questions of military strategy and international relations.

Superficially, Gerasimov's purpose seems to be to attack those "militarists," "civilian-militarists," and members of the "scientific-industrial complex" in the United States who have studied game theory and international relations. They are said to possess undue influence in the Pentagon and the White House, whose occupants have uncritically accepted their advice. The work of such people not only gives an overly militaristic complexion to practical applications of game theory (Rand in particular is criticized for allegedly devoting its
entire energy to limited strategic war) but also corrupts initially useful ideas. The game-theory-is-good-but-misused-by-the-bourgeoisie argument, of course, gives Gerasimov his opening to discuss the actual content of the theory of games.

In discussing international political applications of game theory, Gerasimov stresses the non-zero-sum nature of international relations. Berating some American strategists (especially Morgenstern and Schelling) for allegedly treating the Cold War as a two-person, zero-sum game, he recognizes that others now speak of Soviet-American relations as a non-zero-sum, or cooperative game. Thus, Gerasimov approves of such developments as joint research, cultural exchanges, increased trade, and disarmament. He also favors Schelling's efforts to combine game theory with psychology, although he accuses the latter of slipping back into zero-sum thinking. Lift these principles out of their bourgeois context, he asserts, and they can find their true usefulness.\(^{18}\) To his credit, Gerasimov does not shrink from the obvious conclusion: If nuclear

\(^{18}\) One suspects, in reading these sections, that Gerasimov protests too much against the "iniquities" of the bourgeoisie: by 1968 it should have been apparent to him that he was attacking a group of straw men. This may stem partly from the necessity to assure publication by "debunking," and partly from his desire to warn against such thinking in the Soviet Union itself. If the Russians have now "discovered" the political uses to which game theory can be put, their thinking is probably developing similarly to American study of the subject nearly a decade ago. Thus, if we accept his caricatures, for the moment, the Soviet Union may have its Morgensterns and Schellings.
war is too dangerous and if the Cold War is not zero-sum in any case, then the struggle for joint survival must take precedence over the choice of the form of socio-political existence. This puts him out on a limb, however, for such a view, like that of Vorob'ev, has heterodox implications for Marxism-Leninism, which holds a "zero-sum" view of reality, whether within societies (the class conflict) or among states (imperialism versus socialism). The dangers of game-theoretic thinking for Marxism-Leninism should therefore be apparent to most Soviet readers.

Gerasimov adduces the Prisoners' Dilemma as an example of what can happen when zero-sum thinking is applied to non-zero-sum situations. "Only collective rationality will help . . . to avoid the trap of the double double cross. At times we must learn the meaning of trust, or else both we and our opponent will invariably lose. . . ." A good example of Prisoners' Dilemma in international politics is disarmament, which Gerasimov considers not only desirable but, in the nuclear age, a necessity.

Gerasimov warns his Soviet readers against two further temptations in applying game theory to politics. One is the belief that proper game theory requires a payoff matrix, that is, quantitative valuations must be attached to the players' utilities. In international relations, he points out, either such values are impossible to obtain, as in nuclear war, or they lie outside the framework of game theory. Game theory cannot therefore be used for nuclear war calculations, nor have such analogies
as "chicken," Schelling's "hurt more criterion," and his "coercive damage" theory a place in international relations. Game theory models have not yet achieved a one-to-one correspondence with the real world, and it is dangerous to use such techniques as gaming, scenario-writing, and computer simulations to close the gap too rapidly.\(^\text{19}\) While these points are hardly new to Western readers, the relative stress they receive in this and similar articles indicates the nature of discussion in the Soviet Union.

This point is made explicit by the author himself in a final note of caution. The application of game theory to international politics, he states, is a thing of the future. Since international reality is non-zero-sum, and since that branch of game theory is not yet highly enough developed, we must reserve judgment about its present usefulness. Game theory is a two-edged sword. It frees the study of conflict from being bogged down in detail, is politically neutral, stimulates thought, and points out generalized, otherwise unapparent solutions. But it also disregards fundamental details, leaves out nonquantifiable but essential variables, and is still too simple in formulation to solve complex foreign policy problems. This would seem to be a rational and balanced view, which the author probably hopes will be taken to heart by Soviet decisionmakers.

\(^{19}\) Here, Gerasimov betrays a tendency to equate game theory with these other "behavioral" methods of American political science.
"ON A MILITARISTIC CONCEPTION OF INTERNATIONAL CONFLICT,"
BY L. A. PETROVSKAIA

The Petrovskaiia article is ostensibly an attack on Thomas Schelling's *Strategy of Conflict*. But in fact, its purpose appears to be to describe the Schelling theory to Soviet readers; to encourage the useful (i.e., Marxist) application of his approach to current problems of strategy; and to plead the case for including game theory within the framework of sociology, thus freeing its discussion to a degree from the political and ideological constraints now imposed on Soviet political science.

Petrovskaiia makes the now-standard points about the innate usefulness of game theory for political analysis, its "corruption" by the "civilian-military professional strategists," and the nonapplicability of zero-sum theories to international relations. She refers approvingly to the first Gerasimov article as the first step toward a Marxian approach to game theory. Surprisingly, her description and analysis of Schelling is more than neutral; it is admiring and even laudatory. Even on such topics as limited nuclear war, the virtues of a second strike capability, and other methods of preventing surprise attack, Schelling gains the author's approval. She does point out where Schelling goes wrong. He places too much stress, for instance, on nuclear blackmail, policies of strength, the virtue of unanswerable threats, and the political uses of new weapon systems. But it is not Schelling who is to blame for these errors as much as his bourgeois masters. In order to attract their attention, he must make "incorrect use of a theory which itself is correct."
Thus Petrovskaia argues that, with certain minor changes, Schelling's theory can be put to use by the Soviet Union. The author continues, it is "scientific (i.e., Marxist-Leninist) sociology" that must provide the correct basis for political applications of game theory. Only by such sociology can we tell whether zero-sum or non-zero-sum game theory is to be applied to given political situations. Such sociology can also help to set up the terms of the game correctly, that is, so as to avoid the false premises put forth by "bourgeois sociology" (which, accepted by Schelling, led to his false conclusions). "Scientific sociology" can also halt the unsophisticated application of the rationality principle to international politics. A reliable criterion for determining the kind and degree of "idealization" (i.e., level of abstraction and rationalization) is needed; only Marxist-Leninist sociology can be that criterion. Finally, "scientific sociology" cautions that game theory cannot yet express utilities quantitatively and that in "sociological" (read "political") conflicts, no quantitative measures yet exist.

OTHER WRITINGS

On the basis of these four articles, one might look for original Soviet contributions to the integration of game theory and political science. By 1969, however, such contributions had not made an appearance, at least in the open literature. Moreover, the evidence from published Soviet sources is that while the door has by no means been closed to the application of game theory to international relations and other areas of political science, there has
been considerable backtracking. The Russians have still to figure out whether, and to what extent, they can permit themselves to use game theory in any practical sense. It is true that some of this reluctance can be traced to an enhanced respect for the current limitations of game theory and for the complexities of international relations. But it also seems that inherent intellectual and ideological limitations still inhibit the Russians' ability to make up their mind on the subject. With these thoughts in mind, let us inspect the more recent Soviet literature on the social science, and particularly international relations, uses of game theory.

The major problem for Soviet writers in the period after Marxist-Leninist political science was denied legitimacy has been to establish a framework within which social science applications of game theory could continue to be discussed. Sociology was a natural choice, since that branch of learning, as we mentioned above, had received ideological clearance from the Party several years before. Thus, from 1968 forward, references to game theory in nonmathematical literature are made in sociological terms, and references to its possible application to problems of international relations are made in terms of the sociology of conflict. The retreat from political science to sociology was orderly and, judging from the volume of writing on the subject, successful. But it was a retreat, nevertheless, for it meant that most discussion could not proceed beyond the debunking stage. Since, as we have already seen, the limits of that stage had already been reached, and the first evidence of "methodological
consciousness" had made its appearance in the Vorob'ev article, there is a certain artificial quality in post-1967 Soviet writing on the subject. That artificiality is apparent not only when the Soviet writings are compared with recent Western writings but even when compared with the one available non-Soviet but Marxist contribution.20

The move to place game theory within the framework of sociology is apparent from inspection of several recent Soviet contributions. Thus, for instance, Shubkin21 calls for greater emphasis on game theory as one of the several branches of sociology (under stochastic models) that are less rigidly determined and that utilize quantitative data to measure qualitative matters. Afanas'ev,22 on the other hand, merely mentions that game theory is one of the exciting new methods available for use in sociology. A second Petrovskaiia article23 also places game theory firmly within the framework of sociology (not, in contrast to the first article, within political science), but goes on to specify why sociologists should be cautious in using this new method. And D. Yermolenko24 defines Marxist sociology of conflict in terms very close to those used by Western writers to define international relations. The subject matter is the same: history of international

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20Klaus, "Philosophical Aspects."
relations, diplomacy, international law, political ideology, international economics, geography, demography, international politics, and military matters. International conflict is to be studied with regard to its nature, sources, typology, stages, means, and ends.

But the tenor of these and other Soviet writings is negative. Almost without exception, they warn of too rapid and unthinking application of game theory, "overformalization," and the inherent difficulties of game theory. Yu. V. Orfeyev\textsuperscript{25} takes an entirely negative attitude. To him, game theory presents "serious difficulties of principle when applied to conflictual situations." He alleges that game theory does not distinguish between the tactical and strategic thoughts of the players; improperly presumes complete knowledge on the part of all players; lacks the means of analyzing the past behavior of the players; presumes, without foundation, to operate on the basis of "complex inductive probability hypotheses"; and defines the utility function either \textit{a priori} or without knowledge that it exists in real life. The second Petrovskaia article is even more explicitly negative: game theory has at least four inherent and irremediable defects, all relating to its abstraction from sociological aspects of conflicts. It does not study the genesis of conflicts, their symptoms, its dynamics, or the procedures of settlement. "A theory which avoids these aspects cannot

be called the sociology of conflict."^{26} Further, game theory need not be equated with the sociological study of conflicts just because its first applications were in that realm. Such conflicts as "too emotional" differences, opinion differences soluble by discussion, and conflicts whose outcomes are determined by chance or by "nonstrategic skills" need to be studied by non-game-theoretic methods. Finally, Smolian^{27} lists several other "inherent" defects of game theory. In real-world games, he says, the sides are never equal partners, contrary to game-theoretic assumptions; the condition of "equal" informedness (necessary for application of the maximin principle) is never really equal; the payoff matrix is either difficult to determine or is "altogether absent"; and psychological and moral attitudes of the players are ignored.^{28}

Many of these charges are attributed to American excesses. Petrovskaia, for instance, claims that American "sociologists" (i.e., not political scientists, even though her referents are mostly political scientists) sin either by equating game theory with the sociology of knowledge or by denying the connection altogether. The problem, however, is more than mere use of "bourgeois"

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^{26} Petrovskaia and Petrovskii, "Game Theory and Its Sociological Aspects," pp. 50-52. American game theorists, of course, would deny many of these alleged limitations on game theory's application to conflicts.

^{27} Smolian, "Study of Conflict," pp. 34, 35.

^{28} While many of these objections are overcome upon close reading of Western game-theoretic works, the fact that Soviet writers raised them at this point (and not, say, four or five years before) shows their increased knowledge of the subject.
sociology as a straw man for attacking "imperialism" or "militarism," or as a vehicle for discussing game theory itself. Acute difficulties of Marxism-Leninism are involved, as becomes clear when the problem of "formalization" (i.e., abstraction, or model-building) is considered. Yermolenko, for instance, grants that formalization is useful, but cautions that "absolute" formalization ("the dream of bourgeois sociologists") is dangerous to Marxian sociology. The problem seems to be the propensity of sociologists to abstract from the essentials of a conflict, which to Marxists is its class content. If game theory makes no provision for class analysis, it cannot be used. On the other hand, game theory is a powerful mode of analysis which the bourgeoisie may well use against Marxism. Hence, it must be studied and, to the extent possible, utilized. But until a way is found to breathe class content into game theory, Marxist sociologists will have to remain critics rather than contributors. As Petrovskaia remarks, "game theory can and should become a weapon of sociological analysis, although its possibilities should not be exaggerated.

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29. "Sociology and Problems of International Conflict," pp. 48-49. This article makes clear why Soviet writers continue to confuse game theory, simulation, and gaming. Apart from probable confusion arising from semantic similarity, Yermolenko places gaming and game theory in the class of mathematical abstractions (as opposed to building physical models) from reality. While there are certain common elements, the three fields have historically been separate.

converse is also a problem: if Marxist sociologists concentrate on the class content problem, they may end up destroying the usefulness of game theory, thus leaving the field completely open to Western social scientists and mathematicians.31

On using game theory in the study of problems of international relations, especially conflictual situations, recent Soviet writings are ambivalent. They retain a curious fascination for the writings of those they regard as the archetypical American game theory applies, the "civilian-military professional strategists." The "theory of strategic games" is still taken as the intellectual basis of the work of Herman Kahn and Thomas Schelling, while the broader base of their work is not mentioned and the American anti-game-theory literature (itself somewhat given to attacking straw men) is still largely ignored.32 Having again displayed the necessary anti-American credentials, and having taken account of the inherent limitations of game theory (those outlined above), Soviet writers were ready to essay further upon

31 Exactly the same dilemma was posed for Soviet scientists in the writings previously mentioned. Sociology, cybernetics, genetics, and portions of economics all had to go through the same process of analysis and justification in the Soviet Union before they gained official legitimacy. The caution in open literature may also owe to too-eager application, in the eyes of these writers, of game theory by military thinkers to practical problems. This is hinted at by Smolian, "Study of Conflict," pp. 35-36.
32 See Trofimenko, "The Theories of Limited Strategic War."
the comparative merits of game theory in the study of
international relations.

The second Petrovskaia article acknowledges two
useful contributions of game theory to the "sociology
of conflict." First, the "rich quantitative information"
of game theory can help make precise now vague, qualita-
tive factors. Game theory has already aided the under-
standing of antagonism, collaboration, agreement, obli-
gation, promise, threat, and communication. It can be
further applied to such topics as arbitration and coal-
tion formation.\textsuperscript{33} Second, certain topics can even now be
"solved" through game-theoretic means. These include
non-zero-sum bargaining games, n-person games, and "just"
methods of combining individual preference systems into
a collective preference system.

Future Soviet work should concentrate on solving
two different kinds of questions. First, there are such
mathematically unsolved problems as n-person non-zero-sum
games; insufficiently quantitative modeling of sociologi-
cal reality; and utility theory. More important, perhaps,
are methodological problems that must be resolved before
mathematization can take place. The payoff function, for
instance, must list realistically all strategies and all
payments. Present methods admit only of imperfect solu-
tion, and they do not take account of all possible

\textsuperscript{33} Soviet writers have so far ignored the two main
American contributions to the theory of coalition forma-
tion -- William Riker, \textit{A Theory of Political Coalitions},
New Haven: Yale University Press, 1962; and Theodore
Caplow, \textit{Two Against One: Coalitions in Triad}, Englewood
strategies. If they did, the number of strategies would no doubt be very high and solution would have to resort to "idealization" (i.e., model-building). But if idealization is to be acceptable, additional work will have to be done on the initial listing of all possible outcomes, on new methods for determining payments, and on the sociological factors affecting the range of outcomes. Furthermore, added effort must go into critically analyzing currently accepted postulates concerning the players. At present, the players do not know their own or their opponent's payout function with any precision, nor do they always act as rationally as the theory now presumes. Finally, there is an absence of fully adequate and sufficiently concrete mathematical models for many types of "sociological" conflicts. New models will have to be constructed.

While these are obstacles of a large order, it does not follow, according to Petrovskaya, that one should give up applying game theory to conflict situations. For "simplification and schematization are inherent to theoretical cognition." But the "scientific use of idealization always should be accompanied by a system of criteria which control them. . . ." It is up to the Marxist sociologist to find those criteria. But "as for the globally unique conflicts of the international type and such extreme forms as a world war, here the problem of satisfactory criteria as of now remains completely open."^34

In sum, Soviet social scientists find that game theory can be of great usefulness to the "solution" of "sociological conflicts," as well as in such other fields as military affairs, economics, psychology, and jurisprudence. Once game theory is provided with a proper class basis and scholars understand its inherent limitations, they can then go on to combat the bourgeois use of game theory and make substantive contributions to the "correct" solution of a wide range of problems. The job of making clear the shortcomings of social science applications of game theory, as currently understood in the Soviet Union, has largely been done by Soviet authors. It remains to be seen whether there can be such a thing as Marxist-Leninist game theory.

Although Western readers would probably answer that game theory, being a branch of mathematics, is by definition devoid of class or social bias, a differing viewpoint is provided by a German, Georg Klaus, in what appears to be the first substantive attempt to write about the problem. Klaus' article evidences a degree of understanding of game theory superior to that of any of the Russians considered so far, with the possible exception of Vorob'ev, who is a professional in the field. His being a Marxist (though possibly not a Leninist) perhaps allows him to proceed further than the Russian writers. His purpose is to defend and advance game-theoretic applications to social conflict and to provide a Marxist

35Klaus, "Philosophical Aspects." References are to the translated version.
basis for such application. He also wishes to establish a Marxist philosophical basis for the use of game-theoretic terminology in intellectual discourse.

Klaus defines games generally as a form representing the adaptation of higher organisms to their environment. Game-theoretic terms -- players, rules, etc. -- should also be seen in general context. Game theory was invented to deal with "artificial conventional games" (chess, poker), whereas "social games" are much more complex. Nonetheless, they too can theoretically be said to possess explicit and invariable rules, utilities, and payoff functions. Just as with poker, scientific methods can be used to investigate the characteristics of "social games." "Game theory should proceed from the precondition that it is always possible to have a completely correct objectivization of the utility of a certain thing or the advantage of a certain outcome of the game."\(^{36}\)

Klaus then attempts to correct the misplaced connection he perceives between game theory and pragmatism, that is, the assumption, which game theory and pragmatism seem to make, that truth derives from utility. Pragmatism is not the philosophical basis of game theory, says Klaus, and the presence of utility theory in the framework of the latter does not necessarily prove the correctness of the former. If this point is accepted, then Klaus has the opening he desires to draw lines of connection between game theory and Marxism. For the "truth" value of the payoff function depends on the "value" of each

\(^{36}\)Klaus, p. 8.
move, and the latter, in Marxian theory, is not a function of the marginal utility of a given move but of innate (Marxian-defined) value. In economics, "game theory cannot tell us [i.e., Marxists] anything about the amount of value of a commodity." That is what Marxian value theory is supposed to do. But it is wrong not to apply game theory to "political economy," for

In the first place, game theory is a strictly mathematical and well-based theory which has no relationship to the fundamental preconditions for any definite understanding of political economy. . . . Secondly, in the system of the theory of marginal utility . . . there is a definite quantity of theses which correctly describe certain aspects of objective reality.

Klaus then moves into a complex argument (the details of which need not concern us) about the differences between the theory of marginal utility and the Marxian theory of value, as applied to game theory. The important point, however, stems from the differences in Klaus' and Russian writers' approaches to game theory. The Russians view game theory with suspicion because of its Western origins and spend most of their time criticizing what to them are its inherent defects. Moreover, they are reluctant (perhaps rightly) to pursue its study further out of fear that the objective features of game theory will lead them to unpalatable ideological

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38 Klaus, p. 11.
conclusions, in both theory and application. By contrast, Klaus claims that game theory is ideologically neutral to begin with and can be provided with the necessary ideological credentials if it is divorced from the theory of marginal utility. He regards game theory as unique among scientific theories, for only it is not based on a prior theory of truth. Instead, it "formulates various requirements which have the nature of recommendations"\(^{39}\) which can be used by communist and capitalist as each likes.

Klaus goes further, however, by setting up two contrasting approaches to a theory of strategy. One he calls the empiricist, which is essentially a "muddle-through" strategy. Here, a player decides on his next move only on the basis of the present situation and his store of past information, and not at all in accordance with a previously thought-out plan. The other is the dogmatic,\(^{40}\) in which the player relies on a given, pre-defined strategy, come what may and with no reference to experience. Neither is optimal, but a preferred "strategy of strategy" can be derived by combining the two. A player begins with the dogmatic position, pursues it for a time, and then, on the basis of accumulated experience, changes the plan. A general strategy is thus built up out of a series of partial strategies. This reasoning, if pursued to its conclusion, holds fundamental implications for Marxism-Leninism and shows why Russian authors are unable to move beyond a certain point in

\(^{39}\)Klaus, p. 14.

\(^{40}\)A pejorative term in the Leninist lexicon.
their reasoning. For if the basic Marxist-Leninist tenets are thought to shape the original strategy of competition between the Soviet Union and the West (or, for that matter, the principles of Soviet development and social organization) and it is shown through experience that they lack utility, then they must be revised according to that experience. And if game theory basically is not connected with any particular theory of truth, it can serve the bourgeoisie equally well, and thus could introduce into Marxism-Leninism changes of principle that might, in the long run, lead it far astray.

Game theory is thus a good example of the problems besetting Soviet writers in attempting to cope with powerful intellectual tools imported from the West. It will be interesting to see how, and if, the Soviet Union will be able to adapt game theory to its own uses and not have to pay the ideological price.
Appendix

FOUR SOVIET ARTICLES ON GAME THEORY AND POLITICS

G. GERASIMOV: THEORY OF GAMES AND INTERNATIONAL RELATIONS

["Teoriia Igr i Mezhdunarodnye Otnosheniia" ("Theory of Games and International Relations"), originally published in Mirovaia ekonomika i mezhdunarodnye otnosheniia (World Economy and International Relations), Moscow, No. 7, 1966, pp. 101-108. Translated by T. W. Robinson; edited by Irene Agnew, LT-69-2. The article contains the following preface. "In the past the West has witnessed the spread of the application of game theory to international relations. Sensing the interest of readers in this question, the editors published an article, by G. Gerasimov, as the first instance of a critical airing of the question of the application of game theory for analysis of foreign policy and international relations."]

Upon first acquaintance, the word "game" may give rise to the reproach of frivolity. But here we have a phenomenon occurring with some frequency in science, wherein a word takes on new, specific content. Just as each incision is a distinct case of surgical operations in general, so also in game theory dominoes or baseball [Russ.: laptse] may figure only as an example [of games in general]. In this theory any conflictual situation is called a game, that is, [a situation] in which there is a clash of interests between two or more sides pursuing different goals.

The theory of games was propounded first in the book Theory of Games and Economic Behavior, by John Von Neumann and Oskar Morgenstern, appearing in 1944, and reprinted often since that time. "Strategic games" -- wrote Von Neumann -- "consist of a definite series of events, each of which is divided into a finite number of outcomes. For some of these events the outcome depends on the situation, that is, the probabilities of the separate possible outcomes are known, and no one is able to exert influence upon them. For all other events the outcomes depend upon the will of the various players S_1, S_2...Sn; this means
that for each of these events it is known that each player, \( S_m \), determines an outcome and [that] he also has, at the moment of his decision, information on the results of all the other (earlier) events."\(^1\)

Conflicts and clashes of interests may be divided into two groups: zero-sum games and non-zero-sum games. In the first case, the interests of the sides are directly antagonistic and irreconcilable. The victory of one side signifies the defeat of the other. So it is in chess or on the field of battle. A win may be designated as +1, a loss as -1; the sum of wins and losses equals zero. Such games are also called games of strict rivalry, or antagonistic games.

In non-zero-sum games the interests of the sides clash, but need not be considered as absolutely contradictory. There exists a more or less broad region of compromises, reciprocal connections, and cooperation of the rival sides. So it is in human collectives and in international relations. The outcome of the game is not nearly so determined as in the first instance. Non-zero-sum games are also called games of non-strict rivalry.

The sides in the conflict vary their behavior: each tries to discover [a strategy] which will lead to its own victory. In this quest the theory of games recommends [that the players] take account not only of their own wishes but also the intentions of the opponent. It also recommends [that the players] not count on the stupidity and possible mistakes of the opponent, but proceed on the assumption that he is at least not your inferior in mental faculties. The choice of behavior, taking into account the intelligence of the opponent, is one of the basic principles of game theory.

The totality of the varieties of strategy makes up a set of strategies. A combination of strategies, for example, strategy 1 for "blue" and strategy 4 for "red," defines one possible outcome. The possible [outcomes] may be depicted by means of a table. The squares show the wins of one side and the losses of the other, which

\(^1\) *Matrix Games*, Moscow, 1961, p. 174.
are termed payments. The table itself is called a payments matrix.

The participants of each game rather quickly discover that there are some heterogeneous elements in conflictual situations. Some of them depend upon personal choice, which each side completely controls. Others are controlled by the opposing side. A third class depends on chance or on the "indifference" of nature. Information about the intentions toward each other has significance for the action of a side and the choice of its line of behavior (strategy). Finally, psychological factors have significance too; that is, the possibility of bluff, reaction to threats, etc., should be taken into account.

The moves of the opponent must be considered and are completely classifiable. There are three sorts of moves: 1) the ability to hide from the opponent your own knowledge of the game (sham or pretense); 2) the ability to trick him with regard to your own intentions (bluff); and 3) the ability to discern his thoughts (insight). Not all of them are insuperable objects to the analysis of conflictual situations. Mathematicians have discovered ways of taking them into account in their formulas. 2

The theory of games aspires to universal application, insofar as the content of any relationship can be cast in the format of conflictual situations and the latter, in turn, formulated in terms of the model of a game.

Of course, although the model does not take into account many aspects of the object under scrutiny, it is acceptable if it correctly reflects those which are essential for the given case. It is important to consider the possibility of application of the theory of games to social relations [and] in particular (and this is our own purpose), to international relations. Although it is quite true that international collectives are extraordinarily complex, that fact cannot be controlling so far as the applicability or inapplicability of game theory is concerned.

2See, for example, K. Berzh, Various Aspects of the General Theory of Games.
The goal of the theory of games is the presentation of a recommendation for the best behavior in the face of the activities of the opposing side. The theory seeks to answer the question: what path is best from the viewpoint of my own interests? What series of paths, that is, what strategy, would be best?

It goes without saying that such questions confront not only the chess player. Every individual confronts them as he encounters personal, official, and global problems. Most of the time he confronts them in different form but they can be formulated in game-theoretic terms.

The Theory of Games and Militarism

Foreign policy activities include the seeking and acceptance of decisions which would be best from the point of view of the tasks posed before the political leadership. For imperialist politicians that activity is carried on under increasingly difficult circumstances. The past years have seen the end of their unchallenged rule, [thanks to] the strengthening of the forces of peace and socialism. The success of the national-liberation movement has meant even less effectiveness for the old colonial policy, and it has been necessary for imperialism to discover new methods for carrying out their plunder. It has mobilized all accessible means and resources and has even attempted to mobilize science. The openly anti-scientific atmosphere in the time of McCarthyism has given way in the United States to a period of politicians courting scientists. There has occurred, if it is possible to speak in such terms a second mobilization of scientists. The utilization of science for the purposes of modernization of technical weaponry is supplemented by its utilization for purposes of carrying out military strategy and foreign policy decisions.

Many articles have been published in the USA on the "organizational revolution" of the present incumbent in the Defense Department, Robert McNamara. Its essence [is found] in attempts to rationalize the process of arriving at decisions. Allen Enthoven, Assistant Secretary of Defense for so-called systems analysis (the phrase being
regarded as the single term for designation of the complex of methods of operations research and game theory), will strive, according to the journal *Fortune*, "to broaden the area of useful application of the new method. This signifies a stimulus to specialists in systems analysis not only to discover the answers to technical questions appearing before them but also to consider questions of a broader scope." The journal predicts that "the scientific approach to decision-making" will spread also to other elements of the governmental apparatus, surmounting official inertia and non-acquaintance with the new approach. In this connection, Arthur Schlesinger, Jr., former aid of President Kennedy, recalls that "whether for better or worse, the new generation of military intellectuals revolutionized that which earlier was a strategic act. The essence of their efforts was the application of quantitative systems analysis to strategic decision-making."³

The theory of games by itself is impasive and, like other scientific discoveries, may be utilized for the harm of mankind. There have already appeared in the United States a number of military-political ideologues, termed "the new civilian militarists": Herman Kahn, Thomas Schelling, Morton Halperin, one of the creators of the theory of games, Morgenstern, and others. It is correct to group them into the "theoretical games school." They are parasites of the well-deserved authority of theory of games and attempt to utilize it in the interests of more reactionary schools.

The London *Times* on 4 May [1966] wrote that the "theory of games" now exerts a direct and pernicious influence on the foreign policy decisions of the American government. In the opinion of the *Times*, the combination of the new military theories (together with their anachronistic approach to international relations) and presidential power has created a completely new situation," fraught with danger for the normal development of international relations.⁴

Indeed, the abstraction from reality, and the "intoxication" with theoretic game analysis, in particular with the concept of escalation, may be seen in the overestimation of the military and underestimation of the political consequences of the decision of the United States to extend its aggression in Vietnam [and] to begin the bombing of the territory of the Democratic Republic of Vietnam.

The critique of the works of the military strategists takes three forms. The first is from a moral and emotional position. Thus, for example, the inventor of radar, Robert Watson-Watt, condemns the inhuman arithmetical approach of Kahn to the problem of war, and Seymour Melman, Professor at Columbia University, regards the reasoning of Kahn as "savage dehumanization." Mathematician James Newman characterizes his book On Thermonuclear War as "a tract on mass suicide." Such a critique is completely correct, but it does not suffice. Kahn rebuts it with the sophism that it will not do to execute the messenger as did the princes of old, [just] because he brings bad news. He merely studies "a few aspects of human tragedy in a quantitative fashion."

The second form of criticism emanates from [those] professional American militarists [who] have not had the inclination to acquaint themselves, in their old age, with mathematics. It speaks, in a tone of animosity, of the "clever men" in the Pentagon who have not smelled gunpowder and are undertaking at present to advise the generals on what to do. Retired Admiral Arleigh Burke, known not so much for his valor as for his pathological anti-communism, has declared, to paraphrase a famous saying, that "war is too serious a matter to leave its evaluation in the hands of the game theorists." This criticism, with the narrow, departmental position of the generals, does not take into account that Kahn and company are doing their utmost to forward the interests of the militarists themselves.

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5H. Kahn, On Thermonuclear War (Princeton, 1960), p. 41. [The statement is misquoted: "objective and" should be inserted before "quantitative." -- trans.]
The third form of criticism transfers the battle from the sphere of moral considerations or of diffuse grumblings into the somewhat strange but, in its own way, logical world of the theory of game. Those who speak from the position of game theory itself and put forward an argumentative criticism of "the game theoretic school," include: Professor Anatol Rapoport, Irving Horowitz, Eric Fromm, the mathematicians R. Duncan Luce, Howard Raiffa, and others.

On the Character of the International Conflict

Basic to an evaluation of the foreign policy recommendations of the "game theoretic school" is the question of the character of foreign policy conflicts from the point of view of the theory of games.

It is a fact that the recommendations of optimal behavior in the class of zero-sum games is good only for this class. Non-zero-sum games possess their own, completely different rules, and therefore recommendations for the choice of an optimal strategy will be different there.

The game-theoretic model should reflect the real situation to a sufficient degree of truth, but should not distort it. "The correctness of sequential analysis," declares John Williams a [former] member of the [research staff of] the RAND scientific research corporation, "is at root dependent upon how much this form -- the set of strategies and the payment matrix -- corresponds to reality."6


Stanford University Professor Samuel Karlin reasons in an analogous manner. "True Poker," he writes, "is a

6J. D. Williams, Sovershennyi strateg, ili Bukvar' po teorii strategicheskikh igr (The Compleat Strategyst: Being a Primer on the Theory of Games of Strategy), Moscow: 1960, p. 37.
harmonious combination of the methods of probability analysis, bluff, stunning attack, risk, psychology, and so forth. Timidity and recklessness, inconsistency, and an obstinately logical character are in evidence during the course of this game. In many business dealings, politics, and war, there is a resemblance to poker. Therefore any achievement in the mathematical study of games like poker may be of interest in many similar life situations."

It is possible to name others. "Mathematicians, physicists, and economists," testifies the American diplomat George Lowe, "began [to engage in a] brisk sale of the theory of games in the strategic market place." An initial position of this sort, taken as a postulate, permits the construction of a seemingly completely logical system of reasoning, but in reality it will be incorrect, inasmuch as it rests on an incorrect premise. The interpretation of international conflict as a zero-sum game leads to a pseudoscientific justification of the cries by frantic reactionaries for the preparation and unleashing of nuclear war.

This [i.e., a zero-sum interpretation] proceeds according to the internal logic of the conflict of strict rivalry. Here it is necessary for the sides to proceed on the basis of a choice between all or nothing. Reasoning, conceived in absolute black and white terms, in terms of victory or of defeat, impressed the professional thinking of the reactionary militarists, which greeted those conclusions thus arrived at by the game theory specialists. These categorical arguments were augmented by a sentiment spreading in the United States, which the inventory of cybernetics, Norbert Wiener, termed "a tendency to regard war as an interesting football game in which, at a given moment, the final score will be tallied showing whether the game finally is won or lost." Furthermore,

8G. Lowe, The Age of Deterrence (Boston, 1964), p. 95. [The statement is misquoted, and should read "...mathematicians, physicists, and economists began to pump a flood of game theory into the strategic marketplace."]
pseudo-scientific reasoning may have an attractiveness for young officers with technical training. "The influence of pseudo-scientific doctrines on these people," declares the English publicist Paul Johnson in this connection, in the journal New Statesman, "would appear to be catastrophic, since their ideas about morality atrophied under the weight of the demands of the cold war."

Actually, since the theory of games is permeated by the spirit of the cold war, all methods for resolving the conflict of the two socio-economic systems, aside from direct military confrontation, disappear. Such is the position of the American "ultras" and, in particular, the defeated Republican candidate for President, Barry Goldwater. "His world," it has been said of Goldwater, "is a world of black and white, without transitions and shades, just like the sharp tones which the sun imparts to the desert in his native Arizona."10 Speaking in the language of game theory, the "ultras" regard international relations as a zero-sum game. It is not surprising that they all recommend the acceptance of the conclusions of Morgenstern and other "strategists."

American foreign policy at times reminds one of the adventures of Colonel Blotto, acting in the land of textbooks according to the theory of games. The Colonel thinks in terms of zero-sum games, which is fit for the battlefield but not for politics. In this regard, Professor John K. Galbraith wrote in the journal Atlantic, that "according to the tradition in its officially accepted verbal form, our relations with the Soviet Union are of irreconcilable enmity.... This abstract chatter and these lamentations speak of an irreconcilable conflict. But reality carries the necessity of compromise. The entire complexity of the problem apparently consists in the fact that both the government and the masses are misled by this abstraction."*

The interpretation of international relations or, in any case, of relations between capitalist and socialist countries, as a zero-sum game negates the norms of international law and the possibility of peaceful coexistence.


* [No more particular reference is given. -- trans.]
Thus, for instance, the principle of observation of treaties, *pacta sunt servanda*, from this position turns out to be composed "for fools." From the viewpoint of zero-sum games, after the concluding of a treaty, each side has the possibility either of electing the strategy of fulfilling it or of breaking it. If side "A" breaks the treaty, and "B" sticks to its principles, then side "A" has attained a one-side advantage. [But] if he sticks to the word of his signature, he risks holding the bag in the event that "B" breaks the treaty. The analysis from the point of view of zero-sum games dictates to both sides a strategy of deception. But a double deception leads to mutual defeat, inasmuch as it is assumed that the treaty was signed by virtue of the general interest [of the parties]. It is obvious that this analysis does not take into account the factor of faith, which the theory of games is powerless to safeguard. But it is impermissible to fault it for not answering such questions as how to safeguard faith, since this question arises outside the bounds of mathematics. Here the participants of the conflict themselves should understand that the peculiarity of non-cooperative, non-zero-sum games is that the decisions which both players take, in pursuing their own interests, turn out to be disadvantageous for both.\footnote{11}

International conflict is not to be regarded as a zero-sum game. We draw on the opinion in this connection of the former U.S. Assistant Secretary of Defense, Charles Hitch. "War, especially its contemporary, nuclear variant," he asserts, "is not a two-sided zero-sum game, that is, the sort of game in which only two participate and where a win by one side signifies an equivalent loss to the other.... In non-zero sum games, that which is better for one side is not necessarily worse for the other. If we take the extreme case, (although at present, when the opponent does dispose of "the absolute weapon, capable of destroying the world," it is still not the extreme), the worst option for us turns out to be using this weapon; but

\footnote{11}{U. Baimol, *Economic Theory and Operations Research* (Moscow, 1965). [Note that the quote refers to non-zero-sum games. Up to now, the author has been critically appraising zero-sum games. -- trans.]}

then the outcome will be worse (not better) also for the opponent himself. We would be committing an error if we were to build all of our strategy on option which is almost unacceptable to the opponent."\(^{12}\)

R. D[uncan] Luce and H[oward] Raiffa come to an analogous conclusion. "The majority of economic, political, and military conflicts of interests," they write, "may be set in the form of a game only in those circumstances when we do not inherently presume a strict rivalry."\(^{13}\) Finally, a staff member of The RAND Corporation, Bernard Brodie, author of the book, translated into Russian in 1961, *Strategy in the Missile Age*, [says] one of the merits of RAND is the conclusion that nuclear war is concerned with games of non-strict rivalry, since the opponents have a common interest, aside from a striving for victory, in avoiding a suicidal nuclear catastrophe. This conclusion, in Brodie's opinion, "has exerted a tremendous influence on strategy."\(^{14}\)

**The Strange World of the Game Theorists**

At base, this "influence," flowing from the endeavors of the American military-political ideologues, prepares "reserve positions" in the realm of non-zero sum game theory.

This area [i.e., of non-zero-sum game theory] is still very weakly worked out, because here mathematics touches upon psychology, and up to a short time ago these sciences did not experience any especial demands from the other. Nevertheless, "strategy" à la Kahn hastened to create false preconditions even here.

In particular, the theory of games, as stated, proceeds from the presumption that the behavior of the sides is


sensible. The American "civilian militarists" consider that this presumption does not extend to international relations. Therefore they fill their works with speculative "scenarios." William Polk, Professor at the University of Chicago, writes in the March [1966] issue of The Bulletin of the Atomic Scientists, that "foreign policy problems are boiled down to "scenarios" which are 'played out' and in that way solved." Thus, for instance, the theory of "central nuclear war" of M. Halperin or the 44 stages, thought out by Kahn, of a scheme for the escalation of an international conflict. The book by Edward Teller, The Legacy of Hiroshima is filled with conceptions of that sort inconceivable to the sober-minded person. He proposes, for instance, "to provoke the Russians" into the destruction of an American spy-satellite, and after that to declare a border war. Or "give the Russians an ultimatum" on a concrete question, for instance, on Berlin, and at the same time ordering all Americans to hide in shelters.

Here, in essence, we run up against intellectual pathology. The schizophrenic thinks in a similar manner. At first glance he thinks normally, since he governs himself by logical possibilities. He may for instance, fear that a brick might drop from a roof and refuse to venture out into the street. In the abstract this is not impossible, but one cannot work out a strategy of behavior on this basis. In sober politics as in everyday life, it is necessary to govern [one's actions] by relation to the facts, but not by reference to abstract possibilities. The American journalist Walter Millis is completely correct when he indict the scientist-strategist as living in a "world of fantasy," "armed with what the Russians 'might do' but not with what they, in all truth, do do.... They carry this principle to an absurd length when they apply it to the non-war structure of international relations." Millis warns that extreme versions of the abstractly possible should not be confused with the "probabilities of the world in which we live."15

As we see, Kahn, Teller, and the others have attempted not to connect game theory with psychology but

with psychiatry. More precise are the new methods of nuclear blackmail, preferred by Professor T. Schelling of Harvard to imperialist policy. The basic idea of Schelling, minutely worked out in his book *The Strategy of Conflict*, is the necessity, after exchange with the opponent of one's intentions, of ensuring the blocking of his answer. This it achieved through the creation of "constraining damages." The other side should be convinced that his opponent "has burned his bridges" and nothing is able to stop him from carrying out his threats.

As an example drawn from his own experience, Schelling presents a strategy for a pedestrian crossing an intersection bearing heavy traffic. The pedestrian may throw back his head or by other means demonstrate that he does not see the automobiles. The drivers will of necessity stop and let him pass. Of course it must be considered that the pedestrian will be hit but, as the journalist Arthur Herzog, speaking of this, has stated, "Schelling does not assert that intimidation is a game without danger. Schelling considers that often one state takes resource in that sort of behavior, unawares, in an attempt to dictate behavior to another state."\(^\text{16}\)

As an example from the realm of politics, consider the American troops in West Europe. If a war breaks out there, they would seem to be automatic participants and the United States would not be able, even if it wished, to remain on the sidelines.

Schelling acts as a parasite on the particular conclusion of game theory concerning the use of threats in especially restricted circumstances. The American mathematicians J. Kemeny, G. Snell, and G. Thompson wrote of "the interesting result of game theory" that "for the existence of an optimal strategy it is necessary in part for the players to engage in bluff."\(^\text{17}\) Schelling places bluff and blackmail on the level of scientific discovery


with the help of understanding the "hurt more" criterion [of Shelling]. It states that the "hurt" leads to "the refusal [to accept] the criteria of comparative utility." The threat is isolated from the payment for it and, consequently, [it] sounds convincing. "The theory of games," says Schelling, developing the thought, "adds insight to the strategy of bargaining by emphasizing the surprising circumstance that the threat does not depend on the threat-ener's having less to suffer than the threatened.... Threats of war, as also threats to make a scene may be understood only by denying the criteria of comparing utilities."\(^{18}\) Threats, it turns out, should not necessarily depend on the argumentation that "it will be worse for you than for me." It may be voiced also as: "it may get worse for me, but it won't be so good for you!" Thus there appears the possibility of blackmailing the opponent with the threat of nuclear war. The important thing, they say, is to do it skillfully, that is [to make it] appear that you really will not stop at the nuclear brink.

The most convincing threat is a mechanism which moves automatically and does not depend on the will. Therefore, reckless behavior is recommended. To wit, Henry Kissinger, Professor at Harvard University, in connection with this principle recommends the threat of "potentially irrational acts on our side." This theme has been worked out in great detail by Kahn.

As an example, Kahn introduces the game of "chicken" [Russ: _slabaka_]: two automobiles are on a collision course.

\(^{18}\)T. Schelling, _The Strategy of Conflict_ (New York, 1963), p. 131. [The quotation is inaccurate. The entire phrase reads: "On the whole, game theory adds more insight into the strategy of bargaining by emphasizing the striking truth that the threat does not depend on the threatener's having less to suffer than the threatened party if the threat had to be carried out rather than by exaggerating the possible truth contained in the intuitive first impression. Threats of war, of price war, of damage suit; threats to make a 'scene'; most of the threats of organized society to prosecute crimes and misdemeanors; and the concepts of extortion and deterrence generally cannot be understood except by denying the utility-comparison criterion." -- trans.]
course. The one who swerves away is the "chicken." "This game," declares Kahn in his latest work *On Escalation: Metaphors and Scenarios*, "is a useful analogy, because it brings out a few important aspects of international relations which should be emphasized....The skillful player gets into an automobile drunk, throwing whiskey bottles out of the window to convince everyone that he is drunk. He puts on dark glasses to show that he cannot see anything. As soon as the automobile gathers speed, he takes the steering wheel and throws it out the window."¹⁹ There is nothing left for the opponent to do but get out of the way.*

The "metaphors" of Kahn did not depart far from his "scenarios." Before us is a scientifically refined apology for the policy of "positions of strength," the recommendation to burn the world for the sake of attaining adventuristic goals. The theory of games whispers that in the game of "chicken" the optimal strategy demands of the participant [a high degree of] recklessness, obstinacy, thick-headedness, and decisiveness in asking for trouble. At the same time this theory demonstrates that when both sides adopt the optimal strategy, both lose. Just because both sides are correct and if they should elect the optimal strategy, the result is a double-edged defeat; the game itself possesses an internal flaw, and it is better to avoid

¹⁹ New York, 1965, p. 11.

* [This is, however, not Kahn's conclusion. The conclusion of his thought reads: "If his opponent is watching, he has won. If his opponent is not watching, he has a problem; likewise if both players try this strategy." Kahn goes on in the next paragraph: "Many people would like to conduct international relations the way a teenager plays 'chicken.' They believe that if our decisionmakers can only give the appearance of being drunk, blind, and without a steering wheel, they will 'win' in negotiations with the Soviets on critical issues. I do not consider this a useful or responsible policy. We may be willing to run some risks...but we will obviously benefit by having a reasonable degree of sobriety, a reasonable degree of clear vision, and a reasonable degree of self-control. The Soviets are likely to pursue a similar policy." -- trans.]
The English philosopher and mathematician Bertrand Russell took up this situation in the book *Sober Thoughts and Nuclear Weapons*. He came to the conclusion that it is necessary to abjure from basing policy on game theory because it fatalistically pushes the world to a catastrophe. The risk may be avoided for a while, but at any time the matter may also approach a clash.

The Theory of Games and Peace

The abuse of the theory of games by the aggressive circles does not signify that it is not impossible to use it in selected international decisions. As an example let us look at the problem of war and peace.

This theory demands a clear-cut definition of the payments in the game and a clear presentation of the mean anticipated result, termed the value of the game. But what sort of value of the game is there in the case of nuclear war, and may victory in such a war be defined by quantitative measures? The defenders of the thesis of the "acceptability" of nuclear war consider that it can [be so defined]. Morgenstern in particular asserts that the side in which several tens of millions of lives are spared after the war will be the victor over the side in which almost no one survives. But is there any sense from the point of view not of abstract arithmetic but of the national interest, to aim for a Pyrrhic victory? "What would 'winning' signify in conditions of thermonuclear war," asks, with reason, the American sociologist Arthur Waskow. ²⁰

Many American scholars, defending the theory of games from its prostitution by the militarists, discuss the unfitness of quantitative methods in evaluating the results of thermonuclear war. "Let us attempt to consider a two-person nuclear game between the United States and the Soviet Union," writes, for example, the physicist and publicist Ralph Lapp. "...some of our mathematical analysts are enthusiastic about the results of their computations. The computers convince them that under defined

conditions we can 'win' in nuclear war. Unhappily, the computer comes to such a conclusion because it does not have any organs of feeling and comes up with an answer with complete indifference.... If country 'A' loses 30 million dead and 27 percent of its economy, the computer considers 'A' as the victor. Does this state 'A' receive much happiness and consolation?"\(^{21}\)

The problem of payments, or the value of the game applied to thermonuclear war, disturbed Wiener and he frequently wrote about it. In his last book he again declared: "Because techniques in most instances acquire the ability to carry out the intentions of mankind, their mathematical formulation should, more and more, reflect ordinary matters." "If you play military games with a conditional interpretation of victory, then victory will be worth any value, even the value of the destruction of your own state. All that is necessary is that the preservation of the state's means of life not be programmed completely clearly in terms of [that] relative victory. This is no more than a naive paradox."\(^{22}\)

If we may borrow an expression from the realm of game theory itself, then we may say that on the chessboard human history is similar to an end-game. Marxists consider that through whatever finite numbers of paths [history proceeds], socialism will beat capitalism in peaceful competition. In our example, that competition will take the form, in one expression, of a chess game. The opponents of the Marxists correctly compute that they still have [some] chances for victory or a draw, and they work out promising versions. But the game is [only] possible as long as the sides observe the [rules of the] game correctly. If one of them in a fit of desperation upsets the board with chess-pieces, there will be no game. The task of the world society of all peace-loving forces, just as the task of the foreign policy of socialist countries, is not to


permit this. International peace -- this is the "general interest," within the bounds of which political rivalry between the antagonists should proceed.

The Defects and Possibilities of Game Theory

The theory of games, just as mathematics in general, operates with quantitative values. It may seem that reducing all of the data in the problem to quantitative relationships upsets the position of the dialectic of the unity of the quantitative and qualitative sides of objects and occurrences. But the dialectic method does not contradict the method of model-building, which the theory of games utilizes. It only warns of the possibility, when building models, of overlooking something essential for the given analysis and the acceptance, as a result of this, of incorrect conclusions. Ignoring the details leads to error. In particular, one of the dangers of game theoretic analysis consists in the tendency of ignoring the genesis of phenomena, of its historically conditioned nature. The other obvious danger may be the abstraction from the class character of politics.

As concerns the difficulty of quantitative evaluations of qualitative indices, it is not, in the opinion of many, insurmountable. Some assert, with reference to experiments already performed, that "even such subtle characteristics as the opinion of people about each other, the level of intellectual, moral, business, and violitional qualities may be expressed in quantitative form.... Not only objective but also subjective factors may be formalized...."

It stands to reason [that] in all political situations there is present an element of indeterminacy which is not eliminated by any sorts of computations or foresight. But this indeterminacy, engendered by games of chance, by an insufficient knowledge of the motives of the behavior of the opponent, or by other reasons, is still within the framework of higher and lower limits. And knowledge of

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their essential form will enable [one] to evaluate the situation and to find a better strategy.

One more difficulty of the utilization of game theory concerns the attractive quality of its external universality. It seems that it is possible to use it where [one] choses -- from family life (being from the point of view of this theory a rather elementary case of a conflictual situation) to philosophical categories -- all lending themselves supposedly to game theoretic interpretations.

Pretentions of such kind are, obviously, an unjustified extension of the theory of games to areas where it is not competent and where it must demonstrate its right to become involved. In general terms, the application of the theory of games to questions of international politics is a matter for the future. Therefore, also, judgment of the use of such application is highly problematic. Here is the opinion of a specialist: "Non-zero-sum game theory occupies an extremely important place in the development of the social sciences....Unfortunately, it turns out that, despite the great significance of games in the general sense (that is, both zero-sum and non-zero-sum variants -- G.G) for the social sciences, up to now sufficiently satisfactory research into such games has not taken place."24

Another specialist remarks on the necessity of working out the theory of games of several persons. "It is just here," he writes, "and not in [the case of] two-person game theory, that the question may be decided [as to whether] game theory as a whole will remain only a division of mathematics or [whether] it will become a part of science, studying society."25

The formulation of conflict situations is a double-edged weapon. It may turn out to be useful, freeing [the study of] the conflict from secondary details and pointing the way to its resolution. But it may lead to an abstraction

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25 A. M. Kondrarov, Numbers in Place of Intuition (Moscow, 1963), p. 31.
from existing and even basic details to the extent that in
game models the essence of the conflict itself will dis-
appear. "It is perhaps true," writes University of Michigan
Professor Kenneth Boulding, "that at the moment game theory
operates at a level of abstraction that is a little too
high to be immediately fruitful in practical consequences."26

One may regard the theory of games as one of the pos-
sible methods of analysis of situations, but for a success-
ful outcome a clear description of that situation is neces-
sary. The correctness of initial data assures also the
correctness of the game-theoretic analysis, but these
initial parameters should, obviously, be discovered through
other means. In this regard, Professor E. Meehan writes,
"at one time it seemed that the theory of games would give
workers in the field of the social sciences the significant
possibility of placing rationality at the base of the process
of decision-making....The chief impediment was the necessity
of evaluating the alternatives and the quantitative determi-
nation of a win or a loss as a result of the choice of one
or the other of the alternatives. If this had been done,
the theory would have successfully carried on its work even
in extremely complex circumstances. Unfortunately, the
theory never speaks of the means of defining the value
[of the game]."27

The initial prerequisites, goals, and ideas [of po-
titical analysis] were formulated beyond the bounds of
the theory of games. If these initial prerequisites,
goals, and ideas are faulty in and of themselves, reflect-
ing the interests of an historically doomed class, then
the conclusions, obtained after the transformation of
these ideas in the game-theoretic "machine," will also
be faulty. In return for correct initial prerequisites,
historically progressive goals and ideas may become high-
quality raw material for game-theoretic analysis.

26 K. Boulding, Conflict and Defense (New York, 1962),
p. 257.
27 E. Meehan, The Theory and Method of Political
This may give politics an unexpected but rightfully meritorious point of view. New, earlier unknown outcomes may emerge; seemingly firm conclusions may turn out to contain flaws, and on the basis of what one or another steps may be taken. Let game theory not give such a necessary and desired answer. In return it will be able to define the limits of the possible. Its approach demands a clear definition of the contents of the terminology and concepts; it is an enemy of diffuse reasoning, verboseness, and rhetoric. It necessitates a clear formulation of the conditions of the task and an examination of the goals and ideas of its attaining. Its approach may uncover the presence of relations and connections which frequently do not display ordinary logic, common sense, or intuition. At most, the theory of games supports the demand of the dialectic to study phenomena from all sides and in all of its forms.

In purely practical terms, the theory of games places emphasis on rational methods for studying international problems and maximum elimination of subjective elements in political decision-making.

We have already expressed the opinion that application of game theory to questions of international politics is something which must be postponed to the problematic future, since it is still not ready for entrance into the international arena.
N. N. VOROBOEV (LENINGRAD): SOME METHODOLOGICAL PROBLEMS OF THE THEORY OF GAMES

["Nekotorye metodologicheskie problemy teorii igr" ("Some Methodological Problems of the Theory of Games"), Voprosy filosofii (Problems of Philosophy), Moscow, No. 1, 1966, pp. 93-103. Translated by T. W. Robinson; edited by Irene Agnew, LT-69-1.]

For some time now more and more attention in mathematics has been paid to theories which not only study the surrounding world directly, gathering information about it, but also study the making of one or another decision on the basis of the information received. In this connection, in contemporary literature the center of gravity has changed from the more passive phase, of scientific research connected with the tasks of classical mathematics, to a more active phase, the making of decisions related to one or another activity.

A prime example of a mathematical theory of this sort is the theory of games. The specific tasks addressed by the theory of games relate to the fact that the relevant decisions take shape from partial decisions of people having different goals.

Usually the word "game" is used only in the sense of "a pastime," "a ritual," or in the sense of a "competition." In contemporary mathematics, however, the term "game" is subsumed under the mathematical model of a conflict. Here, when we speak of games we are referring to the term in this latter sense.

It is customary to date the theory of games as an independent scientific discipline from 1944, when the first monograph came to light: John Von Neumann's and Oscar Morgenstern's Theory of Games and Economic Behavior, (Princeton, New Jersey: 1944; second edition, 1947). From that time there have been published more than a thousand works connected with the theory of games. Broad applications of the methods of the theory of games have appeared, as well as consideration of a number of theoretical problems having a methodological and a philosophical character. These problems have been described in a
number of works on the theory of games, beginning with the monograph of Von Neumann and Morgenstern (see, for example, R. D. Luce and H. Raiffa, *Games and Decisions*, Inostrannaia Literatura, 1961; A. Rapoport, *Fights, Games, and Debates*, Ann Arbor, 1960), but in Soviet philosophical literature they still have not received the necessary attention. If a few survey articles are not counted (see N. N. Vorob'ev, "On the Question of the Philosophical Problem of Game Theory"; in *Cybernetics, Thought, Life*, pp. 157-163, "Mysl" [Thought] Publishing House, 1964), then it would seem that the present article is the first attempt to separate the more important philosophical and related methodological questions from the broad topic of the theory of games.

1. The Contents of Game Theory and Its Applications

Game theory concerns the theory of mathematical modelling of conflictual situation, that is, those situations in which the outcome depends upon the decisions ("strategies") taken by the various participants in the event ("players"), [each of whom] pursues different interests. A necessary condition is that the theory of games must be mathematically conceived, consisting in the possibility, in principle, of a quantitative measurement of the degree of implementation of the interests ("wins") of each of the players, and under such conditions that all players choose their own strategies. Usually it is the case that the players are fully informed of the rules and conditions of play (that is, they know all the [other] participants in the game), and they have a list of strategies of each of the players and their wins in all situations which may arise during the course of the game.

From what has been said, it follows that the number of players in the game should be not less than two (in a game with one participant, the possibility of any sort of realistic conflict is lost), and that each of the players should have not less than two strategies.

The foregoing description shows that the concept of a game as a mathematical formulation of every conceivable
[kind of] conflict between sides empowered to take decisions, by the very volume [of such conflicts], is a very common one. Concrete interpretations of the idea of a game are met with wherever the course of events depends upon a conflict between two or more sides, and where its outcome [also] depends on the making of one or another decision by the combatants; that is, where the outcome depends on their choice of strategy. Therefore, in principle the possibility of practical use of the theory of games turns out to be extremely broad.

In essence, the idea and results of the theory of games may be utilized in all situations when decisions are made under conditions of incomplete information about the situation. For example, a sequential game theoretic approach has substantially advanced such important and rich applied branches of mathematics as mathematical statistics (it is sufficient to refer to the monographs: A. Wald, Statistical Decision Functions, New York, 1950; and D. Blekuell and M. Girshik, The Theory of Games and Statistical Decisions, Moscow, Inostrannaia Literatura, 1958). A large number of concrete economic and military applications of the theory of games are described in the book by S. Karlin, Mathematical Methods in the Theory of Games, Programming and Economics ("Peace" Publishing House, 1964) and M. Dresher, Strategic Games: Theory and Applications ("Soviet Radio" Publishing House, 1964), and also in the collection The Application of the Theory of Games to Military Affairs, ("Soviet Radio" Publishing House, 1961).

It is rather unusual for games to be an object of study in contemporary mathematics. The concept of a game is not the principal concept of any axiomatic theory; furthermore, it does not have a clear mathematical definition. Strictly speaking, therefore, it is not proper to speak of any sort of unified mathematical theory of games. In essence, at the present time there are a number of separate, closely connected theories classed more or less as game theories.

An important class of games are the so-called non-coalition games, characterizing those games in which the players independently choose their strategies and, in
the ensuing situation, obtain from some source (specifically independent from each of the other sources) the win due them in this situation. The task of non-coalition games is determined by the paucity of information conveyed at the beginning of this section. [Such information] consists in knowledge of who the participant players are, the multitude of strategies of each of the players, and the wins of each player in each situation resulting from an independent choice, by the players, of their strategies. The wins of a player in a specific situation depends on and is a function of that situation. In the theory of games this function is usually called the function of a win.

The most important and, in this connection, the most well-studied particular case of non-coalition games is when the number of players is equal to two but their interests are diametrically opposed, that is, [when] the wins of one of the players exactly equal the losses of the other. Such games are called antagonistic games. Their mathematical analysis has been worked out in a large literature. We will return later to the philosophical problems connected with the concept of antagonism in the theory of games.

In the majority of cases relative to the theory of games, it is understood that the subjects are rational, are aware of their goals, and are capable of consciously adopting a strategy and actually adopting one or another decision. It seems possible also to extend this scheme to other situations in which the ability of the participants to set goals and make decisions has more of a conditional character.

Thus, for example, the conflict between man and nature, as every conflict, may also be modelled, in various situation, in the context of the mathematical theory of games. In this it is natural to consider as strategies of nature those methods of play described by the game phenomenon, which a person (in one or another concrete situation) can list but cannot predict the one which will be adopted. In essence this means that the rules of the games are described by means of laws already known, but that nature's choice of its strategy is described by laws [as yet] unknown. By the way, this situation gives
each of the game models of the conflicts between man and nature a historically transitional character. With the course of time, as the number of known laws of nature increases, and the number of unknown laws decreases, the number of rules of the game modelling the given concrete phenomena increases, and the number of strategies of nature decreases. In the ideal case, if all the laws which we study, at a given level of analysis, are known, but the analysis itself remains at its previous level, then the number of strategies of nature will decrease to one. As a result the struggle with nature will be reduced to finding the best utilization of the known laws of nature and will now be expressed in mathematical form, not with the help of the theory of games, but in some other way.

In order that nature can be considered as a player, it is necessary, in game situations, to attach to it a number of choices. This may be rendered by rather natural means and without considering nature in any anthropomorphic sense.¹ We must stress that we are speaking here only of the modelling (that is, of a partial idealization) of the relationships between man and nature.

A player moving against nature acts by pursuing some sort of goals. Therefore, in each situation arising as the result of the choice, by our player and by nature, of their strategies, we are able to impute a number characterizing the degree of the realization of these goals. Thus we are able (in principle, at least) to speak of a function of the outcome of the game. But the choice by nature of its strategy proceeds according to laws as yet unknown to the player. Consequently, if the player acting against nature proceeds always with circumspection (and the theory of games in its present status recognizes only such players), then in deciding upon his own strategy he should proceed from the presumption that there is a real law of nature, as yet unknown to him, which leads nature to act in a manner least favorable to him. This means that a win by nature in each situation is equivalent to

¹ For the part of anthropomorphism of nature in the terminology of games against nature, see R. Bellman (The Processes of Regularization With Adaption, "Nauka" Publishing House, 1964, page 181).
a loss (an expenditure) by the player. The game itself against nature is [thus] to be regarded as an antagonistic game.

One may, finally, discuss how certain phenomena, governed completely without participation of a subject consciously making decisions, [can be called] games. In this regard, the game-theoretic view of the evolutionary process would be of interest. Here, the biological species would be cast in the role of the players. Their strategies would be the paths of evolution in the emergent conditions and the wins would be one or another of the characteristics of the species as a whole, the optimization of which is acknowledged by contemporary biologists to be the basic tendency of the development of the species.

2. Sources of Methodological Problems in the Theory of Games and Goals in Their Analysis

The purpose of the theory of games, as all applied mathematical theory, consists in the construction and analysis of models which reflect a definite sector of the phenomena of objective reality, and also in the application of the requisite mathematical tools to practical tasks. The most general parts of this process, obviously, exceed the bounds of mathematics itself and should be regarded from a philosophical point of view. This circumstance already defines the basic directions of philosophical work connected with the creation of mathematical models of reality and processes.

The first and most important sphere of philosophic problems connected with the theory of games consists in a careful and all-around analysis of the adequacy of the representation, by means of models, of the phenomenon to be modelled. This means that the design of the model should be preceded by the emergence of basic, important laws of the process to be modelled. The problems of determining the importance or non-importance of this or that part of the phenomenon to be modelled, the necessity to reflect this part at the given level of modelling or, in the opposite sense, the possibility of disregarding it is,
in the essence of the matter, a form expressing a relationship of the subjective to the objective. In principle, this problem is not able to be solved at the moment without the addition of philosophic considerations.

What has been said is related to all mathematical models, including those which have a game-theoretic character. But the latter is in need of particularly close analysis from the philosophic point of view. Disregarding the schematization and idealization permitted in the process of modelling, the fact of the matter is that the mathematical models making up the theory of games (in contrast to mathematical models of physics, chemistry, or biological objects) are mathematical models of conflicts. Conflicts in the game-theoretic understanding of the word are possible only between conscious individuals capable of adopting goal-directed behavior. (The examples adduced in the previous paragraph -- the struggle of man with nature or the inter-specific struggle for existence -- in the present-day world should [really] be thought of not as phenomenon to be modelled by the theory of games but as instances of the opposite process -- the process of the interpretation [in game theoretic terms] of mathematical models already prepared and built on other grounds.) In other words, the theory of games consists of mathematical models of phenomenon occurring in human society and unavoidably having, therefore, a class, political character. Taking into account the extraordinary complexity of such phenomenon, where contemporary mathematics has available only comparatively weak means of analysis, there is an obvious necessity for working out in detail the methodological problems of game theory [so as to enhance] for the possibility of analysis on the qualitative level.

But let us assume that the question of the adequacy of a given game-theoretic model of a certain concrete conflict is decided positively, that is, that all parts of the phenomenon recognized, at the given level of analysis, as being essential, are reflected in the model. It still does not follow that we are able to analyze this conflict from the position of the mathematical theory of games. In order to make this really possible, it is necessary to construct a concrete game describing the conflictual situation being studied factually, i.e., in all its detail,
taking into account the given level of modelling, and not just "in principle." The latter signifies the ability to solve the corresponding game, that is, first, to list all of its players, second, to describe the possible strategies of each of the players and, third, to fix the exact (or perhaps the sufficiently exact) values of all functions of the outcome in each of the situations [comprising] the game.

But the mere listing of all of the players, seemingly very simple from the mathematical point of view, is fraught with subtleties sometimes escaping the researcher. What is of concern here is not the inability of each participant of the game to personally participate in the game (a "player" is made up of all those pursuing the same goals), but that, in methodologically incorrect analysis of conflicts, often wrong participants are identified. In such a manner even a correct answer to the comparatively simple question of the participants of the game is connected with the necessity of a correct methodological approach on the part of the analyst.

A description of the possible strategies of the players is a significantly more complex task. We touch upon it only from one point of view.

The strategies of a player in the theory of games are essentially a complete description of his behavior in all possible situations in the corresponding game. We stress that this definition of strategy does not have anything to do with its advisability: a strategy may be good, just as it may be completely lacking in reason. Consequently, all actions open to a given player must be included in the list of strategies. But [on the other hand], it would be a serious mistake to include in that list all physically (i.e., technically) possible modes of activity.

N. Wiener, in this regard, writes: "When Napoleon joined battle with the Austrians in Italy, his success was partly a function of his knowledge of the limited and traditional military thought of the Austrians, and he was able to predict, with a complete basis [in fact], that they were incapable of using the new decisive military methods of war, demanding decisive action, which were
introduced by the soldiers of the French Revolution."
(N. Wiener, New Chapters in Cybernetics, "Soviet Radio"
Publishing House, 1963, p. 21.) But Wiener draws an un-
expected conclusion from this and another (concerning the
actions of Admiral Nelson) instructive historical example:
there is a contradiction between the game-theoretic ap-
proach to military actions (the necessity of considering
all possible acts of the enemy) and the policy of Napoleon
(ignoring a number of actions of the enemy and utilizing
his mistakes). In this connection Wiener further expresses
his doubt concerning the possibility of placing military
operations within the context of a game model.

However, these contradictions are rather easily over-
come. In point of fact, we should speak not of the phys-
ically or technically possible actions of the contending
sides but of the actions corresponding to their military
and political possibilities, of their availability and
admissibility to the headquarters, [which] takes a def-
inite class, ideological (and, for the Austrian command
of Napoleon's time, also a nobility) point of view. The
military talent of Napoleon becomes apparent here not in
the neglect of those attitudes subsequently ratified by
the theory of games but in the clear understanding that
the court Austrian military leaders found it impossible
to take bold actions unrelated to the traditions of the
times. Undoubtedly, Napoleon set before himself a list
of the strategies of the enemies and this list was com-
paratively narrow.

Finally, the most difficult part of the matter in
the representation of concrete games is the description
of the functions of the wins of the players. Here we
shall not touch upon various methods for facilitating,
in different circumstances, the computation of the sig-
nificance of these functions, but consider only one
principal question.

The functions of a win are sequentially quantitative
elements of each game. If the players and their strate-
gies in a game were able to be characterized purely as
qualitative, according to their "names" (or, essentially
the same thing, according to their numbers), then the
functions of the win would definitely be determined by a
few systems of numbers. But in applied mathematical theory each number is the result of a series of measurements. The difficulties of measurement of variables, which arise in the modelling of economic, sociological, etc., phenomena, quite surpass, from the theoretical point of view, the analogous difficulties encountered in the physical sciences. Here, from the very beginning the thesis is rejected that it is possible to measure, in advance, any variable to any arbitrarily close [degree of] exactitude. It is just this circumstance that often blocks systematic application of [the proper] mathematical tools.

Even in modern physics the possibility of measurement is limited. It is sufficient to refer to the well-known Heisenberg uncertainty principle. But hardly anyone disputes the role of mathematical methods in this realm. As long as the subject of game theory, like other mathematical theories of research of operations, is connected with social phenomena and hence is immeasurably more complex than, say, theoretical physics, the theory of games naturally expects no less agnostic speculation concerning [its] basic ideas than there has been and continues to be in theoretical physics. Just as mathematical modelling formulates, in mathematical terms, the essential of a [given] phenomenon, so the most important parts of the model itself, taking the most general view, should correspond to definite philosophical categories, [since the latter] are their concretization and refinement. Research into these relationships is one of the most important philosophical problems concerning not only game theory but also the other natural and social sciences. Thus, modern science has seen fit, in concrete disciplines, to use widely the concept of the random occurrence, especially in statistical theories of natural science. The mathematical tools concerned with the analysis of randomness in the natural science sense were formulated in the theory of probability, and investigation of randomness as a philosophic category quite clearly was within the scope of that theory. Therefore, further investigation is necessary as to the relationships between the philosophical category of randomness and the similar concept encountered in the applied sciences.
With regard to game theory, interest also grew in other philosophical categories, from the point of view of their relation to similar natural science categories. We take up the role of randomness in game theory in the next section of this article.

3. The Rationality of the Actions of the Players

The final goal of each player in a game is to obtain as much of the win as possible, that is, to create the kind of situation in which the function of a win would be of greatest value. The decision a player makes as to his behavior in the game -- in other words, his choice of strategies -- also should define this goal.

But the theory of games essentially considers that the situation met in the course of the game and, indeed, the wins of the player depend not only on what sort of decision he himself adopts but also on what sort of decision the remaining players will adopt. And the goals of the others are different [from those of the given player]. Therefore, in unrestricted games it is not permissible, generally speaking, to consider one strategy absolutely good and another absolutely bad on the basis of description of these strategies alone. In comparing them each may have positive values, depending on the behavior of the remaining players. As N. Wiener says: "...the effectiveness of a weapon is dependent on what other weapons exist capable of opposing it." (N. Wiener, Cybernetics and Society, Inostrannaia Literatura, 1958, p. 127.)

The question as to what means the player should adopt in a given game so that his actions may be considered intelligent and well-thought out is not so simple as might appear at first glance. It is, in the theory of games where we are confronted with the most complex understanding of what is [considered] appropriate [activity], [an understanding which is] drawn from the level of common concrete-scientific (or, even further, simply every-day) notions but then expressed in terms of general categories having the most variegated interpretations and demanding philosophical analysis. In theories other than game theory, all of these interpretations are reduced to a striving to
maximize payoff, and the discovery of the necessary actions [to that end] may present only technical difficulties.

Games, including [those considered in] the theory of games, are so diverse that attempts to formulate a definition of appropriate game behavior by means of the traditional inductive enumeration of a large number of actual decisions are completely hopeless. Efforts in game theory should be directed to the discovery of certain general principles of reasonableness, of rationality, of expedient game behavior, and to the working out of criteria [for adopting] these forms of behavior. These tasks are exceedingly difficult and no general approaches to their resolution are as yet visible.

Aside from that, for separate, rather narrow classes of games one may formulate a number of sufficiently natural principles of reasonable game behavior. In essence, such games carry with themselves the possibility of mathematical analysis of the corresponding conflicts. In point of fact, if the inapplicable current criteria of rational game behavior were to be applied to a game, then decision-making by the players would be devoid of any sort of definite goals. (Those who have studied game theory may adduce a large number of examples of this sort.) The mathematical study of such a conflict would be reduced to the establishment of facts having purely informative value: any kind of game activity leads to any conclusion. While not disputing the importance and practical interest of such work, it is nevertheless not sound to relate it to game theory in the ordinary sense of the word.

One of the principles of rational game behavior in voluntary non-coalition games may be termed the principle of the feasibility of goals. The essence of this principle consists in the following:

Every player deals with the situations arising in a given game by choosing one of a number of well-defined strategies. Thus, in forming [strategy to be adopted in] each [foreseen] situation, every player exercises a unilateral "right to veto": if he adopts a strategy not corresponding to the situation, then that situation will no longer arise. Consequently, in order to deal with
such a situation, it is necessary (but, to be sure, not sufficient) that none of the players be interested in its collapse. In turn, this means that if any of the players in this situation changes his strategy, and the other players adhere to their strategies previously chosen, then the player changing his strategy, as a result of this change, should never increase his earnings. Situations having the described characteristics are called situations of equilibrium.

It is just [projections of] these kind of situations which can be regarded as feasible goals for the players. Actually, if the players were to take as their goal the creation of a certain non-equilibrium situation, then in such a situation at least one of the players would be able to come away with a big win by changing his strategy. Since in non-coalition games the players are concerned with increasing their wins, this change would actually be executed by the player and a non-equilibrium situation would not ensue.

Attaining a situation of equilibrium may be the subject of a treaty between the players: no player would have the basic right to overthrow such a treaty. On the contrary, every attempt to establish an equilibrium situation as a condition of the treaty is doomed to failure, for in every non-equilibrium situation there is [always] one player interested in violation of the equilibrium first.

Thus, the principle of feasibility of goals demonstrates for us one of the possible modes of action by the player, namely, action leading to situation of equilibrium. Incidentally, it is possible to compare the interpretation of feasibility of goals as rationality -- those acts are reasonable which are directed toward attainable goals; and the goal to be realized is attained as a result of reasonable actions (or, as game theory would have it, the players are able to find reasonable ways of acting and act accordingly) -- with the well-known thesis of Hegel: "What is reasonable is real; and what is real is reasonable." ([Friedrich] Hegel, The Philosophy of Right, in Collected Works, Vol. VII, p. 15, [Moscow,] Marx-Lenin [Publishing House], 1934 [in Russian].) A detailed analysis of this parallel is beyond the scope of the present paper.
In order that the principle of feasibility of goals in games of a certain type will hold real possibilities for the players to choose their own strategies, it is necessary for all games of this type to have situations of equilibrium. It turns out, however, that in many non-coalition games there is no situation of equilibrium. A characteristic mathematical method is used to extricate one's self from the dead ends thus created.

The condition of equilibrium of situations in each given non-coalition game is described by a certain systemic relationship. Therefore, the existence of situations of equilibrium in games signifies the existence of numbers satisfying this systemic relationship, and the discovery of the situations of equilibrium is reduced to the solution of this system. The impossibility of solving a system of equations describing the equilibrium of the situation resembles the condition that is often encountered in mathematics, when one or another important classes of equations have no solution. Usually, this leads to the introduction of new "generalized" units, to the extensions to them of those rules and relationships which were used in setting up the [original] equations, and to the discovery of solutions of the equations among these new "generalized" units themselves. As a rule, it turns out that the "generalized" units, which were not natural [units] at first glance, have rather transparent physical and material meanings and this (sometimes belatedly) completely justified the initial generalization. Thus, for the first time, [for instance] the impossibility of unrestricted promulgation of rules for the division of one whole number into another was overcome. In this manner mankind came upon the concept, now famous and rather clear to all, of the fractional number.

In like manner, the theory of games worked out a generalized concept of strategy -- the concept of a mixed strategy. Each mixed strategy of a player assigns, to each of his strategies, in the original understanding of this word (such strategies are further termed pure strategies), a certain probability. The latter is itself a random trial, whose outcomes are the pure strategies of the player. Carrying out a given mixed strategy consists in setting up a certain appropriately selected random
arrangement (tossing a coin, casting a dice, etc.), to each state of which the player's pure strategy responds. And this state is itself a function of the probability by which the corresponding strategy should be chosen. The wins of the players opting for mixed strategies will, obviously, be random in size, and their values will depend on the pure strategies which "fall out." The players adopt the average [value of the] wins in situations where mixed strategies are used. 2 John Nash (see John Nash, Non-Coalition Games, in the series "Mathematical Games," Physics-Mathematics Publishing House, pp. 205-221, 1961) and, for the case of antagonistic games, John Von Neumann ("On the Theory of Strategic Games," ibid., pp. 173-204) established that in those games of strategy produced by mixed strategies, there are always situations of equilibrium. 3 This means that the principle of feasibility of goals may effectively be applied to any non-coalition game.

Decision-making on the basis of the results of coin-tossing by one or another of the sides, guessing in which hand the match is, etc., may create the impression of a fatalistic or even simply a frivolous attitude toward the other. But in a number of cases just such methods of activity turn out to be wholly rational. Those who are not convinced by the numerous examples drawn together by John Williams (see John D. Williams, The Compleat Strategyst, "Soviet Radio" Publishing House, 1960) and the present author's work (N. N. Vorob'ev, The Mathematical Theory of Games, Leningrad, 1963) may be acquainted with factual examples of decision-making stemming from random experiments related to military operations (see R. S. Beresford, and M. H. Preston, "A Mixed Strategy in Action," Operational Research Quarterly, 1955, Vol. 6, No. 4, pp. 173-175) and ocean fishery (see M. H. Andreev, "On the Choice of Methods by Industrial Vessels for Hunting and Searching for Fish. (An example of Game Theory Application)," Fishing Economy, 1963, No. 5, and so forth).

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2 Here an average mean of a win is to be understood in the sense of a mean value, that is, as the sum of all possible wins multiplied by the probability of each win. Here we ignore the term "mean statistical win," because we assume average values even for singly occurring random experiments.

3 Here we do not consider those complex games in which the number of strategies open to the players is infinite.
A factual element of randomness has also been characteristic of certain goal-directed activities of humans even before the beginning of game theory. Perhaps these activities have corresponded to optimal strategies. For instance, is not the courtroom dual a mixed strategy intuitively discovered by the law-giver? By analogy, it may be appropriate [to mention] a question of concern to biologists: are not mutations in effect mixed strategies adopted by the species in the evolutionary process?

At present, practical utilization of mixed strategies by persons professionally associated with various sorts of concrete conflicts is still insignificantly small and has not taken advantage of the possibilities which have presented themselves.

The same non-coalition game may have several different situations of equilibrium. In these situations the principle of feasibility of goals should be supplemented by further indication as to just which of the feasible goals the players should pursue. Although this question has also been illuminated in a number of works (see, for instance, R. Duncan Luce and Howard Raiffa, Games and Decisions, Innostrannaya Literatura, 1961), no satisfactory answer has as yet been found. The point of view does exist that the multiplicity of situations of equilibrium is indicative of the unreasonableness of the theory of non-coalition games as such. This point of view is connected with the usual statements as to the uniqueness of solutions to equations describing physical processes, but it is hardly possible to agree with that. In social life, and, further, in its most primitive form in everyday life conflicts are found which can be modelled by games having more than one situation of equilibrium. The typicality of such situations is once again reported by John Von Neumann (see in this connection H. W. Kuhn and A. W. Tucker, "John Von Neumann's Work in the Theory of Games and Mathematical Economics," Bulletin of the American Mathematical Society, Vol. 64, No. 3 (1958), part 2, p. 103). Much interest, it is clear, is manifested in the determination of the principles of rationally choosing, from all the situations of equilibrium, a situation which would be most acceptable to the players. These principles, of course, lead not to a depreciation of the theory of situations of equilibrium but to its further development.
A large number of possible situations of equilibrium in many non-coalition games as well as the partial presence in them of mixed strategies, make their enumeration for some non-trivial games a highly complex matter. Therefore, the analysis of negotiated settlement of conflicts by the methods of game theory demands, first, systematic searches for situations of equilibrium, without denying the possibility of coming to terms, and, second, delineating situations, which are the objects of the negotiating players, as equilibrium or, on the contrary, as non-equilibrium.

4. The Problem of Antagonism

It will be recalled that a game is termed antagonistic if the number of participants in the game is two, and if their interests are diametrically opposed. The diametrical opposition of interests of the players in an antagonistic game consists in the fact that any increase in the wins of one of them signifies a numerically equal reduction in the wins of the other. It is useful to restate this formulation as follows: in an antagonistic game a loss of a certain sum by one of the players signifies a win of the same amount by his opponent. In such a manner, game theory understands antagonism as formal equality in magnitude and opposition in sign of the wins of the two participants, taking into account all configurations of a game. This limits the applicability of the theory of antagonistic games to a comparatively narrow spectrum of problems and to a comparatively crude level of modelling. We stress that the philosophical conception of antagonism is significantly broader than the concept of antagonism as formulated by game theory. Many contradictions, antagonistic in the philosophical sense of this word, lead to conflicts which should be modelled by non-antagonistic (in the mathematical sense) games.

It would be incorrect to identify antagonism in games with the extreme sharpness of the two-sided conflict which the game is supposed to model. As a matter of fact, if the goal of each of the players is the destruction of the opponent, it still does not follow, however paradoxical [it may seem], that the interests of the players are diametrically opposed: the striving of one of the sides to destroy the enemy is opposite to the attempts of the enemy to
escape from destruction, since it is just that attempt which wrecks the plans of his opponent. If each side takes as its goal the destruction of the other, then reciprocal destruction would seem to be mutual success and survival of both sides [could be looked on as] mutual failure.

What has been said has not only theoretical but practical significance, since attempts to destroy the enemy without regard for one's own safety dictate to the player one course of action, while deciding how to act in a situation where the loss of one's own life may be coupled with the survival of the enemy [may require something] completely different.

The conflict of two combating sides is also not always adequately modelled by antagonistic games, since the headquarters of one side does not unalterably set for itself goals opposite to those of the other side. The clearest example of this is the 1914 invasion of Alsace-Lorraine by the French army. The goals which stood before the invader also corresponded to the plans of the German General Staff, as reflected at the time in the well-known "Schlieffen Plan."

In like manner, antagonism of class interests between workers and bourgeoisie are not always sufficiently adequately reflected, in game theory, by the mathematical concept of antagonism. The theoretical possibility and the practical reality of peaceful coexistence of socialist and capitalist states, the fruitfulness of negotiations and the reciprocal advantages [derived from] trade [all] show that, for this aspect of class contradictions, the mathematical concept of antagonism may be used only as a first approximation.

The program of the CPSU, in this regard, is an example of the extremely possibility of non-antagonistic games. "It is not to be excluded that, under conditions of ever-greater growth in the forces of socialism, the strengthening of the workers movement, and the weakening of the position of capitalism in a number of countries, a situation may emerge in which, as Marx and Lenin foresaw, it may be advantageous for the bourgeoisie to concur in the ransoming of their basic means of production, to sell out to the proletariat." In antagonistic games, [such] mutually advantageous acts do not exist.
It should be noted that the non-antagonism of class conflicts, in the formal mathematical sense, is not a rule; there often appear class contradictions, the mathematical antagonism of which appears to be rather accurate.

In antagonistic games there can never be, in the essence of the matter, negotiations or agreements between the players: if, as a result of negotiations or agreements, one of the players is able to increase his wins by a certain amount, then his opponent loses an equal amount; therefore, for one of the players negotiations would have an unfavorable outcome and he will not enter into them. On the other hand, it is clear that if neither side can win, compromise loses any sense.

Conversely, if a game is not antagonistic, then negotiations between its participants over one or another matter is advisable. Furthermore, the desirability of such negotiations follows from the principle of feasibility of goals, since in the process a situation of equilibrium may be uncovered which may be acceptable to each side as the subject of a treaty.
G. I. Gerasimov: "Game Theory' in the Service of American Militarists"

["'Teoriia igr' na sluzhbe amerikanskikh militaristov" ('Game Theory' in the Service of American Militarists"), in Problemy voiny i mira (Problems of War and Peace), Moscow, 'Mysl', 1967, pp. 244-261. Translated by Lilita Dzirkals; edited by T. W. Robinson, LT-68-59.]

The beginning of the theory of games is usually associated with the appearance in 1944 of John von Neumann and Oscar Morgenstern's work, *Theory of Games and Economic Behavior*. It soon found practical application in military affairs and economics, in building electronic computers, and in cybernetics. Nine years later in the volume *The Nature of Conflict* published by UNESCO, the prediction was made: "A radically new form of mathematical model is presently in the stage of being created.... It is called the theory of strategic games."¹ Since that time this theory has made its first independent strides. "The theory of games," prominent specialists have written, "represents one of the first examples of complex mathematical deductions dealing exclusively with problems arising in social sciences."²

The term "theory of games" probably is not a good choice, inasmuch as it can evoke in the non-specialist associations with chess, card games and other associations depending on his personal experience. In actuality, games in the everyday sense are for the theory only a specific case. In this theory, any conflict of interests is called a game. Politics in general, and the problems of war and peace in particular, can be regarded as variations of conflicts of interests, that is, from the standpoint of game theory as a method for analyzing conflictual situations.

It is possible to argue the usefulness of such an approach, but it would be unfair to gainsay the right to such an approach offhand without having examined it. The

²R. D. Luce and H. Raiffa, *Igry i resheniia* (Games and Decisions), Moscow, 1961, p. 31.
stakes are especially high here: we are talking about the fate of mankind. In this basic question one must seek anew the correctness of all paths and all means of strengthening peace.

Regrettably, the militarists were the first to turn their attention to the possibility of using the new theory in their particular interests. One of its creators -- Morgenstern -- was engaged in this. Similar attempts were made also by H. Kahn, T. Schelling, M. Halperin, H. Kissinger, B. Brodie, A. Wohlstetter, K. Knorr, R. Osgood, and D. Brennan. These attempts are especially dangerous because neither the generals nor the broad public have the competence to verify the scientific foundations of the conclusions of Kahn and company, who have been named the "new civilian militarists" in the United States. Their conclusions are accepted on faith because the theory itself is believed and they themselves play the role of experts in this theory.

It was probably of them that D. Eisenhower spoke at the end of his term as the President of the United States, when he warned of the danger that state policy itself may become the "captive of the scientific-technological elite" [sic]. He was exaggerating, of course, since the "scientific-technological elite" fulfills a social order [directed toward class aims]. Nevertheless, a reciprocal influence is also present: the giver of the orders relies on the specialized knowledge of the experts. Such an influence by the game theory experts is clearly felt in the Pentagon and it is entirely possible for it to be extended to the White House. Sociology professor I. Horowitz in his book The War Game cautions on the danger of this peculiar "reciprocal connection." He writes: "The predictions of the new civilian militarists could come true not because they are based on scientifically precise foresight, but simply as the consequence of the general acceptance of the premises proposed by the game theory advocates."³

It is only natural that the "civilian militarists" should evoke antipathy and condemnation by the world public. Here are some reactions to their writings. Illinois

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University professor Charles Osgood sees in H. Kahn's arguments the "final degradation of the human intelligence." Mathematician J. Neumann has called Kahn's book On Thermo-nuclear War a "tract on mass murder" and the author's approach "bloodthirsty irrationality." The inventor of radar, R. Watson-Watt, has condemned Kahn's inhuman arithmetical approach to the problem of nuclear war.

The public's indignation is justified and understandable, but by itself it is not sufficient. The moral indignation aroused in every unbiased reader of the bloodthirsty works of the American strategists does not evoke any pangs of remorse in the authors. For example, H. Kahn in his book Thinking About the Unthinkable tries to refute accusations that he is a war-monger. One must not accuse the surgeon of bloodthirstiness, says Kahn, if his work involves dealing with blood. One must not, like the tsars of old execute the messenger for [bringing] bad news. After all, Kahn is studying "certain aspects of the human tragedy from their quantitative side."

It is not always easy for the advocates of peace to unmask the militarist appearing in the garb of a sage daring to think about the "unthinkable," i.e., about thermo-nuclear war. This sage harks back to the moral dispassionateness of science and stresses that he is only proposing strategic recommendations for arriving at a pre-defined goal, the ethical evaluation of which is altogether outside the range of problems examined by him. The outraged advocates of peace begin to look like simpletons lagging behind the times, while the strategists seem like bold spirits who have the courage to look the Gorgon Medusa of atomic war in the face and not become petrified. "The advocates of peace

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4 The Liberal Papers, Chicago, 1962, p. 185. [It should read: p. 165. -- trans.]


7 H. Kahn, Thinking About the Unthinkable, New York, 1962, p. 19. [This language does not appear on the cited page in Kahn. -- trans.]
and disarmament," warns Harvard University Professor H. Stuart Hughes, "will never be taken seriously until they can meet and answer the authority of a Herman Kahn."\(^8\) One can have effect on the scholar-strategists only by directing the fire of criticism onto their very own territory.

The reader is hereby presented with a minimum of game theory in the form of some of its basic concepts. The mathematical apparatus is omitted entirely.

In game theory, conflict and the clash of interests are divided into two classes: games with strict rivalry and games with non-strict rivalry. In the first case, the interests of the sides are diametrically opposed and irreconcilable. The victory of one side means the defeat of the other. This is so in card games or in war. The win can be designated +1, the loss -1. The sum of win and loss in games with strict rivalry equals zero. Hence, they are also called zero-sum games.

In a game with non-strict rivalry, the interests of the sides also clash, but they must not be regarded as diametrically opposed. There exists an area of compromises, mutual retreats, and cooperation. This is so in family life and in inter-governmental relations. The outcome of the game is not as definite as in the first case, and it is called the non-zero-sum game.

The sides in a conflict can choose behavior variants. It is assumed that each side strives to find such a variant as would lead it to a win. In these efforts one must take into account the intentions of the opponent who is to be regarded as not one's inferior in mental capabilities. The aggregate of the behavior variants constitutes the set of strategies. The combination of strategies, for instance, strategy No. 1 for Blue and strategy No. 4 for Red, gives one outcome variant. These variants can be presented in the form of a table called the payoff matrix. The win[s] of one side and the loss[es] of the other, called payoffs, are entered into the squares. For instance, +1 is entered into the square intersected by strategy No. 1 for Blue and strategy No. 4 for Red, which indicates Blue's

win and a corresponding loss by Red. It is very important to understand clearly what sort of payoffs are involved in a given conflict. In politics, the lives of thousands and millions of people can depend on that.

The meaning of game theory does not consist in a purely utilitarian seeking of ways to resolve conflict to the advantage of the side which knows this theory better. Often the conclusions of the theory convince one to the contrary, namely, the impossibility of easy roads to victory. Just as glasses correct nearsightedness, so game theory enables one to see the situation and the ways out of it better. However, in order to be useful the glasses must correspond to the defects of the vision. Game theory also can be employed only when the character of the conflict corresponds to the model of the game. Additionally, recommendations for the best conduct in a zero-sum game differ from recommendations for a non-zero-sum game and not infrequently are the opposite. Extending the number of participants beyond two also materially changes the situation, since there arises the possibility of setting up a coalition, or alliance, of two against the third, and so forth.

Game theory is well developed only for one class of games -- finite two-person zero-sum games. But this precisely is what the situation most often encountered on the international scene is not. If one were to approach international relations with the criteria of the first category of game theory instead of the more complex subsequent categories, then one could arrive at false recommendations, which are especially dangerous by reason of the outward pseudo-scientific manner of the process used to arrive at them. Since these recommendations usually coincide with the views of the most reactionary and militaristic circles, it is important to understand their scientific invalidity.

The intellectual handmaidens of American militarism are represented, first of all, by the staff members of the scientific-research corporation RAND which is almost completely occupied with the carrying out of the varied orders of the U.S. Air Force. "Mathematicians, physicists and economists," American diplomat G. Lowe has written about these staff members, "began in the strategic marketplace a
brisk trade in game theory. Thermonuclear war had become a game, and a two-player zero-sum game at that."

That is the position of Princeton University professor O. Morgenstern. An article of his, entitled "The Cold War Is Cold Poker," was published in the pages of the New York Times Sunday supplement. Abusing his scientific authority, he asserts that Soviet-American relations could be rightly regarded as a zero-sum game. Since poker also is [a zero-sum game], the study of the behavior of a skillful gambler is useful for American diplomacy. "Although the situations are not completely identical in poker and the cold war, they are similar enough so that something substantial can be learned from good poker principles." Morgenstern develops this same theme at greater length in his book The Question of National Defense. He states that in international poker the task of finding the best political course "cannot be solved by merely using the common-sense approach of military academies. This is the domain of the mathematical theory of games of strategy."

Arguments of this type by Morgenstern and his followers impart an allegedly scientifically grounded character to the aggressive policy of American imperialism. By their methods, which are unfathomable to people without a special training, the experts arrive at the banal views of the worst reactionaries.

This occurs for the reason that in a zero-sum game the sides usually have to choose between all or nothing, whence their behavior also often coincides with actions of the type "either prince or pauper" ["ili pan, ili propal"] and "either it is or it isn't" ["byla ne byla"].

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9 G. Lowe, The Age of Deterrence, Boston, 1964, pp.95-96. [Lowe: "From RAND headquarters at Santa Monica, Cambridge and Princeton, mathematicians, physicists and economists began to pump a flood of game theory into the strategic marketplace," etc. -- trans.].

victory or crushing defeat, appeal to the professional thinking of the reactionary military clique standing at the service of monopoly capital. For this reason they welcome the game theory specialists' views so suited to them. These categorical arguments correspond also to those attitudes widespread in the United States which the creator of cybernetics, N. Wiener, has termed a "tendency... to treat war as an absorbing football match in which at a definite moment the final score comes on showing whether the game ended with a victory or defeat."12 In addition, the pseudo-scientific nature of these judgments can exert an attraction for young officers with technological education. In this connection, the British publicist, P. Johnson, warns: "The influence on these people of pseudo-scientific doctrines can turn out to be catastrophic, inasmuch as their notions of morality have become atrophied under the burden of cold war demands...."13

Indeed, by saturating game theory with the spirit of the cold war, all means of resolving the conflict of the two socio-economic systems, except that of a direct military clash, disappear. That is the position of the American "ultras," and in particular of B. Goldwater, the defeated Republican presidential candidate in 1964. Commentator W. Lippman has written about Goldwater: "From his point of view all conflicts and arguments must end either in victory or in defeat."14 Speaking the language of game theory, the "ultras" look at international relations as a zero-sum game. It is not surprising that they advertise in every way the views of H. Kahn and similar "strategists" that suit them. "...The two-person, zero-sum game," it is stated in one of the basic monographs in game theory, "is characterized by the players' interests being diametrically opposed: that which is won by one player, is lost by the other. Consequently, here there are no conditions for an agreement between the players...."15

12 N. Wiener, Ia -- matematik (I Am A Mathematician), Moscow, 1964, p. 288.
15 D. Blackwell and M. A. Girshik, Teoriia igr i statisticheskikh reshenii (The Theory of Games and Statistical Decisions), Moscow, 1958, p. 20.
It is not hard to see that treating international relations, or in any case, relations between capitalist and socialist countries as zero-sum games leads to negating the norms of international law and the possibility of peaceful coexistence (there are no conditions for agreement on anything). But perhaps these views are correct? No. Here we have encountered a scientific falsification and an attempt to extend the recommendations for the zero-sum game to non-zero-sum conflicts which have completely different, almost opposite, laws.

Let us look at an example, which we have borrowed from Michigan University professor A. Rapoport, depicting the conflict situation which is the basis for Puccini's opera "La Tosca." Scarpia, the police inspector, promises not to punish Cavaradossi if Tosca grants him his desire. Tosca consents. But they double-cross each other: Tosca stabs Scarpia, and he has not given the order to shoot Cavaradossi with blank cartridges.

From the point of view of game theory the situation looks as follows. Tosca can save Cavaradossi, but at a very high price. If she double-crosses Scarpia so as not to have to pay the price, and he keeps his word, then Cavaradossi will stay alive, and she will be unmarried. Tosca chooses the strategy of double-cross. Scarpia reasons this way: he will achieve his ends with Tosca, but at the high price of reprieving his rival. On the other hand, if he double-crosses Tosca, and she keeps her word: not only will Cavaradossi be dead, but he will also have obtained what he desired. Scarpia [thus also] chooses the strategy of double-cross. The double double-cross leads to both of them losing.

The error lies in both of them having regarded the situation as a zero-sum game. From the standpoint of that game, both of them chose the only correct strategy. However, the real situation was from an "altogether different opera" -- in the area of non-zero-sum games. In that game the correct strategy for both would have consisted of carrying out the promise no matter how difficult it may have been for each of them. Then each would have obtained relatively satisfactory results, even if not the maximum of what they wanted.
A. Rapoport has written: "I have seen many research proposals and listened to long discussions on how hot and cold wars can be 'gamed'.... By far the most important conflicts that plague the human race do not fit into the two-person zero-sum category at all.... No argument addressed individually to Tosca or to Scarpia will convince either that it is better to keep the bargain than to double-cross the other. Only an argument addressed to both at once has this force. Only collective rationality will help them to avoid the trap of the double-double-cross.... At times we must learn the meaning of trust, or else both we and our opponents will invariably lose in games of the Tosca-Scarpia type."16

Let us adduce another variation of this game. Let us assume that two countries conclude an agreement on disarmament measures. In the future they can choose the strategy of violating the agreement or the strategy of observing it. If side #1 violates the agreement, but side #2 does not, then side #1 obtains significant advantage. If, however, it remains true to the agreement, then it risks being left in the lurch in case side #2 violates the agreement. The reasoning of side #2 is analogous. An analysis from the zero-sum game standpoint dictates to both sides the strategy of double-cross. However, double double-cross leads to mutual loss, since the sides again start up an arms race, although it is in their common interests to halt it.

These examples render obvious the invalidity of attempts to treat international politics from the standpoint of zero-sum game theory. "Peace," Harvard University professor R. Fisher states correctly, "is not a zero-sum game."17 "The antagonism of interests," it is stated in a basic work on game theory, "is a realistic proposition in the case of drawing-room games and military operations, as well as in some individual cases of making business decisions.... Outside of this rather limited area the

16 Scientific American, December 1962, p. 118.
assumption of antagonistic interests is too hard to be a precise reflection of the situation in a real game task."18

Meanwhile, the strategists from The RAND Corporation, not to speak of the strategists in the Pentagon, are treating Soviet-American relations as a zero-sum game. In particular, Morgenstern proceeds from the premise that the "intentions of the opponent are exactly the opposite of ours" and arrives at the most aggressive recommendations.

As the theoretical basis of the imperialist policy one can adduce the concept of deterrence, which the French General Beaufre has already termed the "main hidden spring of our epoch." The containment concept is based on the conclusions of zero-sum game theory. In his work Strategy and Conscience Rapoport writes: "The theory of deterrence rests squarely on the assumption that the all-consuming passion of the enemy is to destroy us and that only the realization of his own vulnerability prevents him from doing so....The zero-sum games assumption is most pronounced in the fact that we attribute to the other preferences for those courses of action which are most devastating to ourselves. The fact that the other does not as a rule carry those actions out is attributed almost exclusively to the effectiveness of deterrence."19 The lack of control experience permits this argument to be locked in the vicious circle of self-justification.

However, many sane-minded people in the United States are coming out for broadening the sphere of cooperation, or as they themselves call it, [the sphere] of the "common interest of the opponents." For instance, the work A Strategy of Interdependence, subtitled "A Program for the Control of Conflict Between the United States and the Soviet Union," by [Vincent P.] Rock, member of the [I]nstitute for [D]efense [A]nalyses, is devoted to attempts of this kind. The author writes of the necessity

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to create a "whole variety of non-zero-sum-games." Among them he lists joint scientific researches, cultural exchange, development of trade, and agreements on disarmament measures.

Political struggle and social progress are possible only under conditions of peace and the absence of nuclear war. In this connection A. Einstein has said: "Man must first ensure his survival; only when this is done can he pose the question of what form of existence he prefers."21

The importance of the struggle for peace is fully obvious also from the standpoint of game theory. Many eminent scholars stress the necessity for a precise definition of the payoffs in the game. What is the price of international peace? Both from the standpoint of the interests of all mankind in general and the standpoint of national interests, a world thermonuclear war has such a negative value as cannot be recovered by any planned [set of] wins. "One obvious difficulty, which the user of game theory must learn to live with, has to do with the need to measure things which do not afford secure bases for measurement," states a popular handbook.22 This observation is especially valid in the area of interstate relations.

Game theory deals with quantitative values. Is it possible to define victory in nuclear war by means of a quantitative measurement? Morgenstern, Kahn, Teller and other defenders of the thesis on the "acceptability" of nuclear war maintain that it is possible. They write about the possibility of lowering American losses in a thermonuclear war to an "acceptable" level of 50-80 million by means of large-scale construction of anti-atomic shelters. But does it make sense, not only from

22 J. D. Williams, Sovershennyi strateg, ili Bukvar' po teorii strategicheskikh igr (The Compleat Strategyst: Being a Primer on the Theory of Games of Strategy), Moscow, 1960, p. 225.
the standpoint of abstract mathematics, but also from the human standpoint to strive for such a Pyrrhic victory. "What does it mean to be the 'loser' in the circumstances of thermonuclear peril," asks American sociologist A. Waskow. Is it not more useful to concentrate intellectual efforts, including the use of the mathematical apparatus of game theory, on searching peaceful ways of solving international conflicts? "The sole experience of nuclear war," warns [N.] Wiener, "which does not immediately lead to catastrophe, is the war game experience. If we wish to use this experience as a guideline for our behavior in a real war, the values of the victory which we used in programming the game, must be the same values toward which we strive in the real war. An error in this regard can only mean swift, complete and final ruin."  

Many American scholars defending game theory against its misuse by the militarists, point out the uselessness of a quantitative criterion for estimating the results of thermonuclear war. Physicist and publicist Ralph Lapp, for instance, has written: "Let us try and picture a dual nuclear game between the United States and the Soviet Union.... Some of our mathematicians-analysts go into raptures about the results of their computations. Their computers assure them, that under certain defined conditions we can 'win' in a nuclear war. Unfortunately, the computer arrives at such a conclusion only because it has no organs of emotions and it puts out answers with complete indifference.... If country A loses 30 million killed and 27 percent of its economy, the computer declares country A a winner. Does this bring much happiness and consolation to country A?"  

A similar opinion is voiced by Rear Admiral (Rtd.) H. Eccles. "In many tactical encounters and in some strategic situations," he writes in his book Military Concepts and Philosophy, "it is possible to win. However, in most

24 N. Wiener, Novye glavy kibernetiki (New Chapters of Cybernetics), Moscow, 1963, p. 29.
25 R. Lapp, Ubiistvo i sverkhubiistvo (Kill and Over-kill), Moscow, 1964, pp. 95-97.
major international crises the popular connotation of 'winning' may be both false and harmful to our thinking."

The scholar-militarists' thesis on the acceptability of nuclear war is an example of the pseudo-scientific use of the method of abstraction whereby a real political problem is stripped of its "flesh and blood," and the remaining "skeleton" is dealt with as if it were the live material.

This type of thinking is altogether typical of writings cleaving to the game theoretic spirit. They are filled with an over-accumulation of different variants of moves in the game, regardless of the degree of their relation to the real situation. Moreover, in game theory itself, variants which are obviously disadvantageous or absurd are rejected. In addition, one of its basic axioms is that the theory assumes the players are rational. However, H. Kahn and his followers disagree with this. The Hudson Institute headed by him games so-called scenarios employing irrational assumptions which are prohibited by game theory.

In a U.S. News and World Report interview, published on July 7, 1965, H. Kahn proposes the usual "scenario, beginning...with the destruction of two Soviet bridges by nuclear weapons. After this the Russians are informed: You did not believe that we would resort to the use of nuclear weapons? Now you see we did. And once we have used two rockets, maybe we will want to use all twenty. It would not hurt you to at least think about that." Further, Kahn discusses at which stage one side will yield to the other, fully taking into account that if each side should try to succeed in being the one to deliver the last strike, both will tumble down into nuclear catastrophe.

A somewhat similar [situation] is studied by the authors of the book Limited Strategic War. They propose, for instance, such a scenario: country A destroys one city of country B, and in retaliation B destroys two of

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A's cities. A is faced with the problem: to continue the "exchange of cities" or to yield? Let us assume that A decides to continue the limited strategic war. Then B is faced with an analogous problem and so forth.

"The reader may ask," it is stated in the work, "what relation does all this have with reality....The world of limited strategic war is a very strange world."27 Nevertheless the entire, abundantly financed, work of The RAND Corporation is devoted to it.

The late Laborite theoretician J. Strachey demonstrated a similar kind of thinking. In his last work On the Prevention of War he wrote: "It is improbable that Russia will set out to conquer the world by military means....But improbable events sometimes happen. And think of what would be at stake if this improbable event did happen."28

How is one to counteract this intellectual pathology? The American philosopher and psychologist E. Fromm writes about this kind of schizophrenic-type thoughts and actions: "Most Americans today think about Russia in a paranoid fashion; namely, they ask what is possible rather than what is probable....If we think only of possibilities, then indeed there is no chance for realistic and sensible political action."29 The method used by many American scholar-strategists of over-accumulating all possible variants in the game leads precisely to this progressive political blindness.

Disengagement from concrete political life and moving in the narrow, small world of abstract payoff matrices is a characteristic trait of the "scientific" works of nuclear strategists. A member of The RAND Corporation, R. Levine, justifies such a position by claiming that it would be "impossible in any meaningful

way to show that any single policy value is wrong.\textsuperscript{30}
The sides are free to choose any "hierarchy of values" and, for example, proceed in their actions from the principle that "it is better to be dead than red." From this it is possible, to be sure, to arrive at a game with a suicidal outcome; however, the very posing of the question is false: it is not necessary to choose between dead and red but between a sensible peaceful coexistence policy and a cold war policy fraught with danger.

Upon close familiarity with the subject, the vulnerability of the positions of the advocates of treating international politics as a zero-sum game is quite clearly apparent, and this circumstance was pointed out by many American authors, among them R. D. Luce, H. Raiffa, I. Horowitz, W. Mills, the Englishman P. Blackett, and others. The critics emphasized the disregard of the psychological factors which influence decisions. Harvard University professor T. Schelling came forth with an attempted "counterattack" on the part of the "game" theoreticians. In The Strategy of Conflict Schelling has attempted to combine game theory with psychology. He deems it possible to call this strategy also the "theory of non-strict rivalry" or the "theory of interdependent decisions." Here the game theoretic analysis of conflict situations is combined with recommendations to bluff, intimidate, blackmail and double-cross the opponent. Regrettably, when the author turns to a discussion of international politics, he directs his intellectual efforts not toward seeking ways to peace but toward developing the theoretical aspect of the "position of strength" policy.

His dubious contribution in this area includes the formulation of the idea of "coercive damage" and the argument that the credibility of the threat does not depend on the loss caused oneself by carrying out the threat. In Schelling's terminology this is called the "theory of the skillful nonuse of military forces." A threat, he writes, is credible only to the extent that the threatener shows that he will not be able to refrain from carrying it out in case the threat by itself does not work.

People often resort to "coercive damage." In such cases they say that they have "burned the bridges." A smoker, having decided to quit this harmful habit, can intentionally leave his cigarettes at home when going on a lengthy fishing trip. Certainly, he will be bothered by withdrawal symptoms, but he will no longer be able to take a puff, since the "coercive damage" he had brought about has removed the objective possibilities to have a smoke once more. An example from the area of international politics: at the time of the so-called Berlin crisis in 1961, the United States transferred to Western Europe additional contingents of troops. A threat was implied: since the troops have already been transferred, under "emergency circumstances" they "willy-nilly" will have to be employed.

Game theory, Schelling says, developing his line of thought further, "adds more insight into the strategy of bargaining by emphasizing the striking truth that the threat does not depend on the threatener's having less to suffer than the threatened party.... Threats of war, [...] threats to make a scene [...] cannot be understood except by denying the utility-comparison criterion." It seems the threat must not necessarily be based on the reasoning: "It will hurt you more than it will hurt me." It may also be expressed thus: "So it will hurt me, but it will hurt you, too!" In this way, the opportunity arises for blackmailing the opponent with the threat of nuclear war. The main thing is to do it skillfully, i.e., showing that one indeed will not halt on the "nuclear threshold."

One method is that very same "coercive damage." In its simplest form this is the breaking off of communications channels with the opponent after having transmitted one's ultimatum. Another variant is irrational conduct. H. Kissinger of Harvard University, in particular, recommends threatening with "potentially irrational actions on our part." This theme is especially thoroughly developed by H. Kahn. As an example he adduces the game of "chicken."

Its rules are: two cars drive toward each other at top speed. The first driver to swerve aside is "chicken." "This game," asserts Kahn, "is a useful analogy because it brings out some aspects of international relations that are important.... The skillful player gets in the car quite drunk, throwing whisky bottles out the window to make it clear to everybody just how drunk he is. He wears very dark glasses so that it is obvious that he cannot see anything. As soon as the car reaches high speed, he takes the steering wheel and throws it out the window."\(^\text{32}\) To the opponent nothing else remains but to get out of his way.

Such a theory of international blackmail especially suits the West German revanchists. In the opinion of the Hamburg newspaper \textit{Die Welt}, the government of the FRG has become convinced that the "security of West Germany can be ensured only on the basis of the strategy of threats (strategia ustrashenii)." The Schelling-Kahn theory has found practical application: "Even if it hurts West Germany, nevertheless, if you do not yield and do not grant our political demands, we are ready to blow up ourselves and the world!" The revanchists hope to realize their aims by playing "chicken" with the use of nuclear fire.

But are not the stakes too high? This again is a question on the values of payoffs which is outside the framework of game theory. The English philosopher and mathematician B. Russell has written about "chicken": "This game can be played a few times without unfortunate occurrences, but at some time it will be decided that insult hurts more than death from the nuclear bomb."\(^\text{33}\) Then the world will be dragged into a catastrophe which, possibly, no one even desired. The sons of millionaires can play the game of "chicken," but it is criminal to recommend it as a behavioral norm in the international arena.


However, it is precisely now, at a time of the intensification of the U.S. aggressive course, that dangerous counsels to more boldly employ international blackmail are sounded ever more frequently. One may even speak of a stream of corresponding literature which in its fashion, so to speak "theoretically" reflects the growing role of the Pentagon in American foreign policy. The authors of these books urge American political leadership to even greater recklessness, asserting: the more irrational, the better. Thus, for instance, staff members of the scientific-research corporation RAND, Arnold Horelick and Myron Rush, criticize the White House for its being allegedly affected by excessive "restraint" in the "political employment of strategic nuclear threats."34 Similarly, Bernard Brodie expresses dissatisfaction with the "shyness" of the American government.35 Schelling in his latest work rebukes some of his colleagues for a passion for the word "restraint" and for forgetting the word "coercion." He expresses the desire to rename the American defense ministry the "ministry of offense."36

The application of game theory to the problems of international politics in general and to the questions of war and peace in particular is a thing of the future. Therefore, also judging the usefulness of such application is a thing of the future. This is because game theory itself simply is not ready to enter the international arena. This is a specialist's opinion: "...non-zero-sum game theory occupies an especially important place in the development of social sciences.... Unfortunately, it happens that, despite the great importance of general games (i.e., zero-sum as well as non-zero-sum games) for the social sciences, there is not available so far any treatment of such games which can be regarded as even reasonably satisfactory."37

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34 A. Horelick and M. Rush, Strategic Power and Soviet Foreign Policy, Chicago, 1966, p. 10.
The formalization of the conflict situation by examining it from the standpoint of game theory is a two-edged sword. It may turn out to be useful, freeing conflict of secondary details and showing the ways to its solution. It may, however, lead to disregarding essential or even fundamental details and to the very essence of the conflict being omitted from the game model. "It is perhaps true at the moment," writes Michigan University professor K. Boulding, "that game theory operates at a level of abstraction that is a little too high to be immediately fruitful in practical conclusions."38

The basic difficulties in applying game theory to international situations lie in the lack of development of many of its categories, in the necessity to define quantitative payoffs which in life often do not lend themselves to a quantitative estimate (what is the "price" of the high moral spirit of a people fighting for its liberation?), and in the necessity to take into account all political and moral factors having a bearing on the conflict situation.

The simpler the situation, the easier it is to make use of the aid of game theory. Foreign policy, however, is complex. It is extraordinarily difficult, if not impossible, to translate many political problems into formal mathematical language. If an algorithm for political problems were successfully discovered, then it may prove to be possible to program the computers accordingly and, entrusting the solution of these problems to them, send all diplomats and generals into retirement. This kind of "electronic death" does not threaten, at least not yet, even chess which is simpler than politics.

However, recognition of the inadequacy of game theory must not lead to an indiscriminately negative attitude towards it, nor must the attempts to use it for the theoretical justification of an aggressive foreign policy lead to this either. The deliberate deflection from the most important political, social and class factors which is necessary to the imperialist ideologists for the

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pseudo-scientific justification of an aggressive policy, must not provoke peace advocates to the contemptuous dismissal of game theory as just another reactionary concoction. In itself, game theory as a mathematical method of analysis is neutral. The use of some of the ideas prompted by it can prove to be useful. One must agree with one of the leading critics of the militarist use of game theory, Rapoport, that in itself resorting to this theory can prove to be useful, since it "stimulates us to think about conflict in a novel way." However, one must always keep in mind the dangers of an excessive enthusiasm for this theory and the chances for its ill-intentioned distortion.

L. A. PETROVSKAIA: ON A MILITARISTIC CONCEPTION OF INTERNATIONAL CONFLICT

["Ob odnoi militaristskoi kontseptsi mezhdunarodnogo konflikta" ("On a Militaristic Conception of International Conflict"), Nauchnye doklady vysshei shkoly -- Filosofskie nauki (Scientific Papers of the Higher School -- Philosophical Sciences), Moscow, No. 3, 1968, pp. 94-103. Translated by Lilita Dzirkals; edited by T. W. Robinson, LT-68-52.]

In the present epoch the problem of war and peace, always occupying an important place in people's lives, has become one of the central problems of mankind. Today it assumes the form of an alternative: either progressive development of peoples in the conditions of peace, or a catastrophic thermonuclear war threatening the very foundations of civilization.

Marxist sociology, naturally, devotes special attention to this problem. An important aspect of scientific analysis of the problem of war and peace is critique of those pseudo-scientific concepts of contemporary bourgeois sociologists which justify the policies of position of strength and balancing on the brink of war.

The aim of the present article is to critically examine the concepts of the so-called "professional strategists." This designation encompasses a group of American bourgeois sociologists, closely connected with the U.S. military-political apparatus. The researches of the "professional strategists" are carried out on the orders of the Defense Ministry and the State Department, and their recommendations influence the formation of the military-strategic and foreign policy course of the government. The "professional strategists" close practical and ideological intimacy with military circles has permitted their designation as the "new civilian militarists" (see, for example, I. L. Horowitz, The War Game: Studies of the New Civilian Militarists, New York, 1963). As concerns the methods of research, at the basis of the "professional strategists" concepts lies speculation on the mathematical theory of games.
The theory of games, which is often called the theory of strategic games, is a new area of mathematics, since pure games of chance and games of skill do not enter into the subject matter of its study. To a considerable extent, the term "game" is employed qualifiedly, since the object of the theory reaches far outside the framework of simple entertainment and generally encompasses any conflict of interests. The theory of games is understood to be a discipline that studies mathematical models of so-called conflict situations. These are situations where the two or more sides present pursue (at least partially) contradictory goals, [and where] the result of the actions of each side depends on the line of action chosen by the opponent. The aim of the theory of games is to give recommendations for rational conduct in that sort of a conflictual situation. The theory of games has had successful application in various areas of science, technology, economics, and military affairs. Even certain aspects of man's struggle with nature can be successfully modelled by its means. Thus, the fruitfulness and usefulness of the theory of games cannot be doubted. This, however, cannot be said about the sort of application to analysis of international conflict which it has received at the hands of modern bourgeois sociologists. (We note that in the area of Marxian critical analysis of bourgeois game theoretic concepts of international conflict, only the first steps have been taken. See, for example, G. Gerasimov's article "The Theory of Games and International Relations" in the journal Mirovaia Ekonomika i Mezhdunarodnye Otnosheniia [World Economy and International Relations], No. 7, 1966.)

The first attempts of a game theoretic approach to the study of international conflict were based on the two-person zero-sum game theory. The two person zero-sum game is understood as a conflict situation model in which the interests of the two participants are diametrically opposed, i.e., the win of one exactly equals the loss of the other, and therefore the sum of wins always equals zero. Such a game is also called a game of strict rivalry: any common interest, agreement, or cooperation between its players is ruled out. Naturally, approaching international relations with the yardstick of the game of strict rivalry leads to negating the possibility of peaceful coexistence and rules out all methods of solving the conflict of the two systems except through a total military clash.
However, to the extent that the new correlation of forces in the world arena and the qualitative change in the means of conducting war are becoming ever more clearly apparent, even the bellicosely disposed "professional strategists" are compelled to admit that a global military encounter can no longer serve as a means for solving international arguments. In these circumstances, an ever greater number of bourgeois sociologists recognize the inadequacy of the international conflict model based on the two-person zero-sum game theory, reject it, and turn to the area of non-zero-sum games. "Since the demise of American nuclear monopoly," notes A. Rapoport, "the non-zero-sum aspects of the global strategy [Rapoport: struggle1] have forced themselves on the strategists. Statements to the effect that no one can win a nuclear war appear in practically all the writings of the past five years or so, even in the writings purporting to show how such a war can be won" (A. Rapoport, Strategy and Conscience, New York, 1964, p. 110).

Among the various attempts to construct a model of international conflict based on non-zero-sum game theory, a particular reputation and recognition among bourgeois sociologists is presently enjoyed by Professor T. Schelling's model, as set forth by him in his book The Strategy of Conflict (T. C. Schelling: The Strategy of Conflict, Cambridge, Mass., 1960) and subsequently elaborated in detail in a number of other works. J. Bernard thinks, for instance, that "the biggest 'news' in the theory of conflict [in the last few years] is, perhaps, the revolutionary breakthrough of T[homas C.] Schelling in the conceptualization of game theory and its transformation into a theory of social interaction" (J. Bernard: "Some Current Conceptualizations in the Field of Conflict," American Journal of Sociology, No. 4, 1965, p. 444). This assessment coincides with the opinion of the journal The Annals of the American Academy [of Political and Social Science] which states in its review that in the area of international conflict "the author's analysis goes considerably beyond the limits of that which has been done earlier. This is the best, most penetrating and most stimulating book on

1[Brackets in the text of the citations are used throughout to correct deviations of the Russian translation from the original English text. -- trans.]
the given subject" (cited from the cover of T. C. Schelling, op. cit., 1963 edition). It should be noted also that T. Schelling is not only an important but also a sufficiently characteristic figure among the "professional strategists." The basic conclusions in the area of international conflict and the general methodological features of his conception are typical of the present state of the trend under discussion. All this justifies a special examination of Schelling's conception.

According to Schelling, his book *The Strategy of Conflict* is a "mixture of pure and applied research" (op. cit. [1960 edition], p. vi). Schelling first creates a certain abstract theory of the non-zero-sum game situation, which he terms a mixed-motive game, and, second, applies this abstract theory to the study of modern international conflict. Both of these aspects are joined in a clearly obvious way, but in a critical analysis it is necessary to separate them, since they are different in content and merit different evaluations. Having this in mind, we will first examine Schelling's abstract theory and, following that, its application.

By a mixed-motive game Schelling understands a situation where, in addition to the opposition of interests between the players, there is also present a certain common interest. The boundary cases in such a situation are pure conflict and pure cooperation. The first variant is studied by the classical theory of zero-sum games, while the second is specially studied by Schelling, since the analysis of pure cooperation throws light on the general case of the mixed-motive game.

In any game which includes common interests, it is necessary to coordinate the players' intentions. In the example of situations of pure cooperation, Schelling shows that players can to a certain degree coordinate their intentions, even if communication between them is impeded or altogether absent. In the latter case, the means for achieving coordination is the so-called focal point, i.e., a certain unique feature of the situation which both players assume the other can recognize and take into account. Let us assume, for example, that two parachutists have been dropped in different parts of an unfamiliar locality and must meet each other. Neither one knows where the other
is, and there is no prior agreement between them regarding the meeting place; however, both know that they have identical maps of the locality on which, among various unspecified details, an isolated house stands out. Experiments have proved that, in this situation, in the majority of cases the meeting does take place and, as a rule, at the house which represents the focal point. If communication is impeded to the extent where players cannot talk to each other, but still can follow the partner's moves, then, apart from the focal point, the moves themselves can be used as a means for obtaining coordination of intentions. This is because the moves contain definite information about the intentions of the player, the system of his preferences, and so forth.

The study of pure cooperation has a secondary role in Schelling's abstract theory, and the key object of study is the mixed-motive game, which he has named the "bargaining" game. In this context, Schelling examines the concepts of commitment, promise, communication, and threat. But the latter concept dominates, so that the whole abstract "bargaining" theory amounts essentially to a threat theory.

In essence, Schelling formulates a new approach to the game theoretic problem of threat. Usually it was thought that threatening is followed by an action causing worse damage to the opponent than to the threatener (this is the opinion of H. Raiffa, R. Luce, M. Kaplan and others). Schelling rejects the criterion of comparative utility. In place of the principle "this will hurt you more than it hurts me," he admits threat according to the principle "even if it is bad for me, nevertheless it will not be good for you either." In using this approach, the basic task consists in making the threat credible: the opponent must believe that the threatener will proceed to carry out the threat even in the case where this causes significant damage to himself. Schelling proposes a number of ways of solving this task. One is that the player declaring the threat binds himself to an obligation from which it is impossible to retreat. For instance, in a society where the custom of taking an oath is tantamount to an unbreakable law, it suffices to swear that the oath will be carried out. Another way is irrational conduct: having
observed the actions of the threatener, the opponent must arrive at the understanding that in order to carry out the threat the former is prepared to take any rash step which would cause significant damage to himself. "For maximum threat credibility," Schelling states, "it is essential to leave as little room as possible for judgment or discretion [in carrying out the threat]" (ibid., p. 39 [should read p. 40]). It is true that if the threatener has previously recommended himself as a careful and reasonable person, he will not himself be in a position to adopt the tactics of irrational behavior. In this case, Schelling proposes resorting to the method of delegating, whereby the move which carries out the threat is entrusted to a third party outside the control of the threatener and known to be sufficiently irrational or unrestrained. However, the threat is made credible also by introducing a rational agent if he is materially or in any other way interested in carrying out the threat. It is precisely in this manner, says Schelling, that some prison authorities are acting when they entrust sadists with the supervision of prisoners.

To demonstrate the threatener's resolve, breaking off the channels of communication after transmitting the ultimatum is also proposed. Finally, in Schelling's opinion, often the threat can be made credible if the declaration of threat is accompanied by carrying out a part of it. In cases where such a proposed splitting up of the threat cannot be realized by ordinary division, the desired goal can be attained with the assistance of the mechanism of chance. To illustrate this, Schelling adduces the example of a bandit who attempts to rob the driver of a moving car by threatening him with a gun. To escape being robbed, the driver can resort to threat and state that he will kill both of them if the robber does not throw out the gun. His threat will appear more credible if, simultaneously with that declaration, he accelerates to the point where a real danger of a crash, and both of them perishing, arises. Essentially the situation is such that the driver carried out part of the threat, thus consciously creating a certain credibility of a crash. Here risk serves the role of the chance mechanism dividing, as it were, the threat in part.

Within the framework of the "bargaining game," Schelling examines one more case of the mixed-motive game,
the situation of mutual distrust. The essence of this situation is illustrated by the following example. A homeowner comes out because of a suspicious noise and encounters a burglar. If both of them are armed, there is the danger of an outcome which probably neither one of them wants. Even if the thief simply wants to leave, and inwardly the homeowner wishes for the same, there is the danger that the thief could think that the homeowner wants to shoot and therefore would hasten to shoot first. The situation is further complicated by the fact that the homeowner has an analogous motivation. Studying the problem of how to achieve stability in game theoretic situations of this type, Schelling proposed depriving the players of first-move privileges. In the given illustration this is tantamount to replacing the ordinary weapons both have with ones which do not kill instantly and which therefore permit each of the antagonists to reply to a sudden attack by the other.

Concluding the summary of the basic features of Schelling's mixed-motive game theory, one must note its essential difference from traditional game theory. The latter assigns an "absolutely central position to the danger of having a strategy which has been found out by the opponent" (J. von Neumann and O. Morgenstern, Theory of Games and Economic Behavior, Princeton, 1947, p. 147). In a traditional game, the striving to keep one's own strategy secret is so great that a player at times prefers not to know his own choice and therefore resorts to the mixed-strategies mechanism based on chance. By contrast, the stress in Schelling's theory is not on secrecy but on coordinating the players' intentions as well as their actions. Another peculiarity of mixed-motive games is that genuine ignorance, unreasonableness, and the absence of the freedom of choice, of communications, and initiative may be to a player's advantage if these are known to the opponent and taken into consideration by him. This paradoxical situation, wherein a player's weakness is the source of his strength, does not have an analogy in zero-sum games. Hence the abstract mixed-motive game theory

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[The exact wording in von Neumann and Morgenstern is as follows: "...we have placed considerations concerning the danger of one's strategy being found out by the opponent into an absolutely central position." -- trans.]
is an original contribution of Schelling's which is of interest. However, the situation changes when Schelling applies this abstract theory to the sphere of contemporary international relations. Here his conclusions are far from original and can be considered only as the object of the most resolute criticism.

According to Schelling, the present relations between the two opposite blocs include, besides conflict, essentially a common interest manifested in the striving to avoid a global nuclear clash. However, that does not mean that he has developed a variant of the theory of peaceful coexistence. On the contrary, his concept is a vivid example of the pseudo-scientific substantiation of the policy of strength, constant balancing on the brink of war, and unrestrained arms race. It is easy to ascertain this by examining the basic conclusions that Schelling arrives at when trying to analyze contemporary international conflict with the help of his mixed-motive game theory.

The thesis of the abstract theory -- that it is possible to threaten effectively with those means which bring equal damage to the threatener and to his opponent -- is transmuted into the reckless recommendation to blackmail the socialist countries by threat of a thermonuclear war. In Schelling's opinion, constant intimidation with nuclear war must become the axis of the entire foreign policy course of the United States. However, in this case the "problem" arises of making it credible that the United States will go so far as to unleash a war disastrous for itself if the demands contained in the threats are not fulfilled. To solve the "problem," Schelling recommends a whole array of means. These means cleave essentially to the spirit of the American "madmen," but the extremeness of some of them could shock even some of the adherents of the "ultras." Nevertheless, Schelling sets them forth with the same dispassionate and smooth tone with which he considered abstract game theoretic problems, and this cold smoothness creates, if you please, a more sinister impression than the ravings of the modern "madmen." First, he coolly teaches that having made a threat, the U.S. government can in one way or another (for instance, openly linking the carrying out of the threat with its prestige) place itself in situations where it is not in a position to back
down. Second, from Schelling's point of view, it would be advantageous to execute foreign policy affairs so as to present oneself in the eyes of the opponent as capable of steps bordering on recklessness. Third, it is proposed to use the method of delegation, by which the carrying out of the threat is handed over to an ally who in certain situations is capable of "harder" actions than the United States itself. For instance, in Schelling's opinion, "the proposal to put nuclear weapons in the hands of European governments is justified as strengthening [Schelling: has been explicitly argued on grounds that it would enhance] deterrence by giving the visible power to retaliate to countries that might in certain contingencies be thought more resolute [Schelling: less irresolute] than the United States" (ibid., p. 142). Fourth, the United States can demonstrate its resoluteness by disrupting the channels of communication after transmitting the ultimatum. Finally, a special place among Schelling's recommendation is occupied by the threat of risking thermonuclear war, the mechanism corresponding to the above-described motorist's threat. Simultaneously with declaring the threat he proposes to take actions which would place the world at the brink of a thermonuclear catastrophe. Such actions can be limited war, individual reprisals (Schelling, for instance, proposes blockading Soviet ports, destroying ships, disrupting communications, and even occupying individual cities or delivering nuclear strikes against individual points), and other actions creating a real risk of general thermonuclear war.

Schelling attaches the greatest significance to limited war as a means of risk threat. In this connection he tries to solve the problem of how to contain the war within limits. Since under war conditions negotiations are difficult or altogether impossible, the task consists of coordinating the intentions of the opposite sides when communications are completely or partially absent. Schelling asserts that this task is solved by means of the focal points mechanism and the informational function of moves. In doing this he cites the experience of the Second World War and the war in Korea. In the first case a tacit agreement was successfully reached regarding the non-use of poison gases, and in the second case, regarding the non-use of nuclear weapons. In Schelling's opinion,
in these cases the focal point was the understanding on the part of both sides that it was difficult to limit in degree the employment of the stated military means and, therefore, that they had to be limited in principle by abstaining from their use altogether.

The concluding portion of the work deals with the problem of surprise attack. Schelling thinks that given the present situation of mutual distrust between the opposite blocs, a surprise attack by one upon the other is possible simply because one fears attack by the other and that, therefore, a world war may break out even if neither side wants this. In order to eliminate surprise attack and thus stabilize the international situation, Schelling proposes to deprive the opponents of first-strike advantages by permitting them to arm themselves with weapons which can survive the first strike and carry out "retaliation." In other words, for the sake of achieving a stable peace he recommends a continuation of the arms race in the area of the most advanced means of waging war (mobile rockets, atomic submarines, etc.). According to Schelling, "disarmament, in the literal sense, aimed [indiscriminately] at weapons of all kinds or even selectively aimed at the most horrifying weapons of mass destruction, could produce not stability but, on the contrary, an unstable situation... [Schelling: instability rather than stability....]" (ibid., p. 237).

These are the basic features of Schelling's foreign policy conception. It must be noted that despite the endless threats with nuclear arms, he is not a conscious advocate of unleashing a thermonuclear war. He understands its destructiveness and considers the very threat of a general thermonuclear war as useful and making sense then only when fulfillment of demands is obtained without carrying it out. Having this in mind, Schelling calls his conception the "theory of the skillful non-use of military forces" and constructs it as a strategy of peace in the nuclear age, a strategy based on the balance of terror and the arms race. However, it is not hard to ascertain that the means recommended by Schelling profoundly contradict his proclaimed goals. Adopted as the basis of foreign policy, they will not ensure peace, but, on the contrary, will lead to the most destructive use of military force in the whole history of mankind.
Indeed, for instance, what does Schelling's recommendation addressed to the U.S. government mean, to consciously place itself in a position where it is no longer possible to go back on the threat of carrying out nuclear "retaliation"? Inasmuch as the U.S. ruling circles are not noted for striving to present demands acceptable to the other side, such a recommendation in practice would mean a decisive step in the direction of a thermonuclear war. Obviously, Schelling's counsel, consciously to conduct a reckless policy, needs no commentary. Least appropriate for preventing thermonuclear war is the method of delegation. True, there is no denying that Schelling could find executors of nuclear blackmail to fit the requirements of his conception, inasmuch as, for instance, under "European governments" one must, after all, understand West Germany. Not only are the West German "executors" "hard," but they have also managed to recommend themselves as sufficiently reckless politicians. However, is not entrusting nuclear arms to those forces, which twice already have embroiled the world in the most destructive wars in the whole history of mankind, a sure road to that thermonuclear catastrophe which Schelling, as he asserts, would want to avoid?

The same must be said concerning his recommendation to threaten the risk of thermonuclear war, in which recommendation limited war is assigned a central place. The very interpretation of limited war as a factor of peace is hypocritical enough. But that is not all that is involved. The proposed methods of limiting a war can appear satisfactory only to people devoid of a sense of proportion and reality. It suffices to recall the example with the parachutists discussed above to be convinced of how precarious are the hopes allowed, by the Schelling focal points method, for obtaining a coordination of intentions of the two opposing sides. Such a degree of reliability can do in any other situation, but when the fate of hundreds of millions of people is involved, then to settle for this is tantamount to proceeding recklessly in the highest degree. On the other hand, when Schelling tries to appeal to historical facts and names the Second World War as an example of how military means were limited successfully, he does not consider that the Second World War quickly disproves his point of view. In fact, that conflict started as a
local war, limited in the geographical sense; but subsequently it was not contained within those limits and became global. To take exception with Schelling, one may recall also his own thesis that it is difficult to limit in degree the use of the most destructive military means. It is entirely correct to extend this thesis to the concept of war in general. This means that in the present circumstances a course toward limited wars is a direct road into the abyss of thermonuclear catastrophe.

Finally, the methods which Schelling proposes for preventing surprise attack are just as unlikely to guarantee peace. In recommending a race in the latest types of armament as the means for averting preventive war, he undoubtedly finds favor with the desires of the militarist circles of contemporary America, including also the real masters of that same RAND Corporation whose orders in the area of strategic studies he is carrying out (see, for example, the journal Za rubezhom [Life Abroad], No. 43, 1967, pp. 24-26). However, these proposals perform a bad service for the cause of peace. Redundant armament always has caused aggressors to be tempted to use it at an opportune moment, and an equilibrium of the retaliation forces Schelling is counting on is too unreliable a device [on which to depend] in the circumstances of modern, leap-like development of the means of attack and defense. Furthermore the abundance of complex armaments gives rise to a real danger of accidental war through technological causes. The crashes of American strategic bombers carrying hydrogen bombs are a convincing proof of that. The most reliable guarantee of averting preventive war, and also all war in general, is general and complete disarmament under effective international control. But Schelling rejects this road and recommends to the peoples a method which condemns them to live on a powder keg and, moreover, to pay for this a truly fantastic price in the form of exorbitant military expenditures.

The content of Schelling's foreign policy concept leaves no doubts about the class nature of his sociological researches. Schelling, like all the "professional strategists," is an ideologue of the militarist circles of the American bourgeoisie, and this to a significant extent explains the depraved nature of his conclusions. However,
taking into account this one circumstance does not yet enable one to explain how it could happen that by applying to international conflict the abstract game theoretic model, which in itself does not give rise to objections, Schelling arrives at erroneous results. This particular problem concerns not only Schelling's conception alone, but to an equal extent the conception of any "professional strategist," since they all make use of a correct mathematical theory and, at the same time, arrive at erroneous foreign policy evaluations and recommendations. In order to throw light on the cause of this circumstance, [which seems] strange at first glance, it is necessary to turn to the methodological aspects of the trend under discussion. Analysis of these shows that the cause lies in the incorrect use of a theory which itself is correct. In other words, the erroneous sociological conclusions of the "professional strategists" are determined not by game theory but by a series of methodological flaws in its application. Establishing that the game theory is not implicated in the erroneous sociological conclusions permits [one], on one hand, to remove possible unjustified reproaches directed at it, and, on the other hand, to show that the attempts of Schelling and his colleagues to rely on the authority of game theory when defending militaristic ideology are without foundations.

A necessary condition for making use of the game theory apparatus in studying social conflict is the use of a scientific sociological theory. First, the very selection of the mathematical apparatus must be based on a sociological evaluation of the phenomenon to be modelled. For instance, giving preference to zero-sum games is possible only after having made certain that the interests of the participants in the conflict are diametrically opposed, i.e., the win of one always equals the loss of the other, and alliances and agreements are ruled out, etc. Secondly, a sociological evaluation is necessary in order to set up the game correctly. The sociologist, relying on scientific theory, must explain the preference systems of the players, their possible strategies, etc. A characteristic peculiarity of the conceptions of the "professional strategists" is their confidence that there is no need for a sociological theory in addition to the game theory. However, inasmuch as it is actually impossible to avoid a sociological evaluation, its place is
taken by the current notions of bourgeois sociologists and bourgeois propaganda. As a result, deliberately false premises are introduced into the apparatus of the game theory, which naturally leads to false final conclusions.

This is precisely what happens with Schelling's conception. Schelling constructs his abstract mixed-motive theory as a copy of the relations of the type driver-robber, homeowner-burglar, etc. Then he employs this theory to describe the relations between the United States and the USSR. Why does he consider such an application possible and why does he regard his mixed-motive game theory as an adequate model for the stated area of international relations? Because Schelling is relying on a matching socio-political evaluation of the United States and the USSR, an evaluation in which the USSR is regarded as an unrestrained aggressor and the United States as a peace-loving power striving to defend itself from a cruel and crafty enemy. Having evaluated the opposite sides in this manner and having obtained the "right" to apply the game theoretic model developed by him to the relations between the United States and the USSR, Schelling has performed the decisive step, since all of his subsequent conclusions and recommendations in essence follow automatically as a reformulation of the basic theses of the abstract game theoretic model. Thus, the cause of Schelling's militaristic views is not the abstract game theoretic model itself, which describes correctly the relations of the type "homeowner and thief" and "driver and robber," but the false socio-political evaluation of the area of international relations to be studied, which results in the stated abstract model being applied to an area of reality foreign to it. In turn, on the methodological plane this false socio-political evaluation is the consequence of rejecting a scientific sociological theory when studying international conflict with theoretical game methods. This refusal bars the way to a true, scientific evaluation of the phenomenon to be modelled and places Schelling under the sway of the hardened notions of bourgeois propaganda: Schelling's initial premise about the notorious aggressiveness of the USSR is a propaganda thesis of anti-communism.

The second characteristic methodological flaw of the conceptions of the "professional strategists" is connected
with the problem of idealization. Game theory in any of its variants incorporates the following assumptions: a) every player knows his own alternatives, the alternatives of his opponent, and the corresponding outcomes; b) if the game contains a chance mechanism, then every player knows the different possibilities and the corresponding probabilities; c) every player knows his own system of preferences regarding the game's outcome and the opponent's system of preferences. The enumerated assumptions, usually summarized by the principle of rationality, are never fully realized in such complex social conflicts as international conflict. Therefore, using game theory in this area means a high degree of idealization. True, simplification in itself is not dangerous. For example, it always accompanies the application of mathematics in such sciences as physics, astronomy, etc. However, in all sciences of this kind there exists a special mechanism which controls the degree of simplification and does not permit its developing into a real error; whereas in the constructs of bourgeois sociologists, relying on game theory, an analogous mechanism is absent, the problem itself is not subject to proof, and as a result wide opportunity opens up for arbitrary schematizations.

It must be noted that some of the "professional strategists" are aware of the difficulty noted here. Schelling is also specifically conscious of it. To him the difficulty presents itself especially acutely (for instance, if in two-person zero-sum games [one wishes] to know the players' systems of preferences, it suffices to know the preferences system of one of them; but in non-zero-sum games the problem becomes significantly more complicated). Schelling even offers a method, resting on the informational properties of moves, which permits [him] somewhat to lessen the gap between the players' knowledge and the factual state of the matter. Nevertheless, this does not provide a solution to the problem. What are needed are not methods permitting [one] to lessen to some extent the degree of idealization (to eliminate it entirely is not possible anyway), but knowledge of a criterion which in each concrete situation would afford a determination as to whether or not the given degree of idealization is admissible.

Finally, the essential difficulty of the game theory application in question is connected with the quantitative
expression of utilities. In order to set up the game, it is necessary to represent its outcomes as numerically defined costs; however, up to this time an objective method for solving this task has been lacking. For instance, J. Bernard admits: "So far as the sociologist is concerned, one of the most serious difficulties is that involved in assessing costs. Unlike economic costs, which can [often] be translated into monetary units or even military costs, which can often be translated into quantitative units...the costs in many sociological conflict situations are [in terms] difficult to state quantitatively. They may be in the nature of 'honor,' 'face,' 'status' or subjective psychological mechanisms [such as compensatory devices or escape mechanisms]. What exactly, is the unit of measurement in such cases? A great many sociological payoffs are of this nature." (J. Bernard, "The Theory of Games of Strategy as a Modern Sociology of Conflict," The American Journal of Sociology, No. 5, 1954, p. 422.)

The difficulty noted is especially great in such complex situations as international conflict. However, the "professional strategists" prefer not to take notice of it. As a result, in their works there is an overabundance of arbitrary quantitative estimates of utilities, which, naturally, renders the resultant conclusions and recommendations unfounded.

In summing up, it can be said that the theoretical constructs of the "professional strategists" are a typical example of the pseudo-scientific conceptions of bourgeois sociologists, wherein shrewd speculation on valid scientific knowledge is used to substantiate the ideology of the reactionary classes. In this connection it must be remarked that the criticism set forth must not be understood as a rejection of the application of game theory to the analysis of international relations. If one successfully overcomes the methodological difficulties connected with the problem of idealization and the numerical expressions of utilities, then within the framework of scientific sociology the application of game theory to the area under discussion can become fruitful.