

R-1218-ARPA
June 1973

Scenario Designs: An Overview

Peter deLeon

A Report prepared for
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

25th
Year

Rand
SANTA MONICA, CA. 90406

The research described in this Report was sponsored by the Advanced Research Projects Agency under contract No. DAHC15-73-C-0181. Reports of The Rand Corporation do not necessarily reflect the opinions or policies of the sponsors of Rand research.

R-1218-ARPA

June 1973

Scenario Designs: An Overview

Peter deLeon

A Report prepared for

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY



PREFACE

This report was originally written to fulfill the course requirements for "Models, Simulations, and Games," offered in the fall quarter, 1972, and taught by Garry Brewer in The Rand Graduate Institute for Policy Studies. It has been rewritten and amended in the belief that its subject matter has direct operational and scientific value to those interested (professionally, intellectually, or both) in modeling or gaming. In the former instance, it is related to the current series of political/military games being conducted under the auspices of Project RAND, "Crisis Operations of Strategic Forces." In the latter instance, it serves as one component of a more general ARPA-sponsored study, "Models, Simulations, and Games: Theory, Substance, Evaluation, and Applications." Both projects will be detailed in subsequent reports.

SUMMARY

An important element of most models, simulations, or games is the "scenario," which delineates the modeler's conception of whatever he is attempting to represent. This report focuses upon the designing of scenarios for the political/military, free-form games, but the underlying assumptions regarding the function of scenarios will be shown to apply to a wide range of modeling exercises.

Political/military, free-form gaming is characterized by a number of participants acting as "national" teams and a "control" team. The game is activated by the initial scenario and is then motivated by the actions of the antagonist teams and the control team. These exercises are used to focus research efforts, encourage interdisciplinary perspectives on crisis situations, and provide an education in crisis management for potential decisionmakers. They should not be viewed as a predictive or operational tool.

The most critical consideration in the design of a scenario is the purpose the game or simulation is to serve. The structure of the game is a second consideration; it dictates certain elements of the scenario. Both of these are particularly important for the burgeoning number of scholars performing research in crisis management. A final consideration is the depth the scenario goes into the crisis situation before it permits the teams to begin their moves.

In the composition of the scenario, there are four general considerations that must be explicitly addressed. The first is the time setting; the second is the environmental settings; the third is the level of detail necessary; and the fourth concerns the level of expertise of the game participants. The issues of credibility, plausibility, and predictability will be addressed in this section. Finally, a scenarist should weigh the advantages of providing a menu of action options for the players.

This report concludes by suggesting that the lessons drawn from political/military gaming scenarios are applicable across a much broader spectrum of models, games, and simulations. It also compares the bounding of the simulation, the treatment of data, and the identification and alteration of pivotal parameters between the political/military games and the broader context of models and simulations.

ACKNOWLEDGMENTS

This report owes a great deal to Garry Brewer—who provided the initial and continual stimuli for the paper—and William Jones—who, as the program manager, provided the experience in scenario writing and free-form gaming that enabled me to write the paper. Simply, the paper would not have been written without their encouragement and support.

The report benefitted from the editorial comments of John Despres, Edward Quade, and John Koehler. The thorough and thoughtful reviews of Marvin Lavin, Harvey DeWeerd, and Arnold Horelick were invaluable. With such advice, any and all remaining errors in logic must obviously be of my own making.

CONTENTS

PREFACE.....	iii
SUMMARY	v
ACKNOWLEDGMENTS.....	vii
Section	
I. INTRODUCTION.....	1
II. FREE-FORM POLITICAL/MILITARY GAMES	3
III. SCENARIO CONCEPTUALIZATION AND DESIGN	6
IV. SCENARIO COMPOSITION.....	10
V. CONCLUSION	14
BIBLIOGRAPHY	17

I. INTRODUCTION

An important element of most complex models, simulations, or games is their "scenario." The scenario delineates the modeler's conception of whatever process or system he is attempting to represent; it is "a statement of assumptions about the operating environment of the particular system"¹ being analyzed. It should combine the factors the modeler is inputting, as well as those he hopes to test. The fundamental position of the scenario is set forth by Seyom Brown:

After all, it is from our anticipations of the environments in which our systems are to operate—the state-of-the-world, the conflict situations, and the tasks these systems are expected to accomplish—that many of our criteria for *evaluating the performance* of a given system emerge. Thus, having a casual attitude toward the scenario is often tantamount to having a casual attitude toward the selection criteria. If we accept the proposition that our analyses can be no better than the criteria we employ, then we must accept the corollary proposition that . . . our analyses can be no better than our scenarios.²

The scenario is at the very heart of the modeling process. Yet for all its importance, the scenario appears to be generally neglected in the model/simulation/gaming literature; for example, Charles Hermann does not have a single reference to the formulation and construction of scenarios in his book on the simulation of foreign-policy crises.³

This report focuses upon the designing of scenarios for a specific type of game: the political/military, free-form game,⁴ which differs from other games or models as a function of the latitude of decisions and actions the model structure permits. However, the underlying assumptions regarding the roles of scenarios should apply to any modeling exercise. Three widely disparate studies serve as examples of these exercises. Paul Samuelson constructed an equation representing the national income and posited that two parameters—which he termed the "multiplier" and the

¹ The quoted definition is Seyom Brown's, in "Scenarios in Systems Analysis," *Systems Analysis and Policy Planning: Applications in Defense*, E. S. Quade and W. I. Boucher, (eds.), American Elsevier Publishing Company, New York, 1968, p. 300.

² *Ibid.*, p. 300; emphasis in original.

³ Charles F. Hermann, *Crisis in Foreign Policy: A Simulations Analysis*, Bobbs-Merrill, Indianapolis, 1971.

⁴ The terms are from Martin Shubik and Garry D. Brewer, *Models, Simulations, and Games—A Survey*, The Rand Corporation, R-1060-ARPA/RC, May 1972, p. 5.

"accelerator"—had major impacts upon the value of the national income.⁵ He then tested his hypothesis within a scenario by altering the values of the parameters. Jay Forrester's *Urban Dynamics* translated his scenario of the decay of an urban area into a number of mathematical relationships which were, in turn, programmed for computer simulation.⁶ For example, specified ranges of a per capita tax ratio (between the urban area and the outside environment) were defined to either attract or deter additional people from moving into the city. A final example is Richard Brody's simulation of the spread of nuclear weapons, in which he had students interacting with a computer.⁷ In order to initiate this man/machine simulation, he provided each of his players with a detailed scenario of the state of the world and the manner in which proliferation was effected. The players' moves were then read into the computer, which analyzed them.

Obviously, given this report's focus on political/military free-form gaming, some of its statements about scenarios will seem less applicable than others to the wide spectrum of models, simulations, and games, and this is a valid observation. Still, the concepts underlying the development of political/military scenarios will be shown as generally applicable to the conceptualization of scenarios for most forms of modeling and simulation.

Section II of this report briefly examines the structure and purpose of free-form political/military gaming. Section III is concerned with the broad, basic questions that must be considered when designing a scenario. Section IV describes a few of the more specific observations that should be included in the scenario itself; an important part of this section treats the issue of scenario credibility. Section V extends the specific arguments of the report to games other than the political/military and serves as a conclusion.

Finally, it should be stressed that this paper is not intended to act as a cookbook for scenario writing; it does not offer page-by-page suggestions and ingredients. Rather, it covers the broader issues and leaves the detail for the scenarist to manipulate according to his needs.

⁵ Paul Samuelson, "Interactions Between the Multiplier Analysis and the Principle of Acceleration," *Review of Economics and Statistics*, Vol. 12, 1939, pp. 75-78.

⁶ Jay W. Forrester, *Urban Dynamics* The M.I.T. Press, Cambridge, Mass., 1969, p. 28.

⁷ Richard A. Brody, "Some Systemic Effects of the Spread of Nuclear Weapons Technology: A Study Through Simulation of a Multi-Nuclear Future," *Journal of Conflict Resolution*, Vol. 7, December 1963, entire issue.

II. FREE-FORM POLITICAL/MILITARY GAMES

Before the design of scenarios for political/military games is examined, one needs a brief description of this genre of gaming.

These games typically propound various crisis situations and permit the examination of the actions and reactions of a number of actors (playing as members of designated "national" teams) to the crisis. The game managers—the control team—interweave the teams' moves in response to both the unfolding crisis and the other participants' actions and define the rules of the particular game. The game is played strictly between the respective teams (i.e., there is no machine or computer interaction built into the game structure); the control team rules upon the validity and arbitrates the outcomes of the team moves. The control team also plays the part of Nature (fate, fortune, whatever) as well as that of nations not directly represented by teams. Thus, the control team is in a position to motivate—within limits—most of the game.⁸ Variations in the game structure have included computer interfaces, but such hybrids fall outside the traditional definitions of a political/military game.⁹

The value of the game is that it frees the potential decisionmaker and the researcher from the traditional national-actor syndrome of crisis management.¹⁰ They no longer need operate under the constraints of *ceteris paribus*. "In any clash between nations, military capacity is only one factor, and often not the most important one in deciding the outcome. Politics, both domestic and international, are usually more significant, and so are the nature of the opposing cultures and the psychology of the peoples and their leaders."¹¹ A team that can bring political,

⁸ This form of gaming is elaborated upon in Sidney Giffin, *The Crisis Game: Simulating International Conflict*, Doubleday & Company, Garden City, New York, 1965, Chap. 4; Herbert Goldhamer and Hans Speier, "Some Observations on Political Gaming," *World Politics* Vol. 12, No. 1, October 1959, *passim*; and Harvey Averch and Marvin M. Lavin, *Simulation of Decisionmaking in Crises: Three Manual Game Experiments*, The Rand Corporation, RM-4202-PR, August 1964.

⁹ See Harold Guetzkow, et al., *Simulation in International Relations: Developments for Research and Teaching*, Prentice Hall, Englewood Cliffs, N. J., 1963, for an early report on the Inter Nation Simulation (INS) project; also, Brody, *op. cit.*

¹⁰ Although the political/military game can portray a nation's responses as the result of the interplay between a number of actors (a failure of the INS games), it cannot hope to capture the full richness of the bureaucratic models that have been increasingly coming to the fore; see Graham T. Allison, *Essence of Decision: Explaining the Cuban Missile Crisis*, Little, Brown & Company, Boston, 1971, Models II and III; also Alexander L. George, "The Case for Multiple Advocacy in Making Foreign Policy," *American Political Science Review*, Vol. 66, No. 3, September 1972, pp. 751-785. However, it can help isolate the decision process from extraneous bureaucratic "noise."

¹¹ Richard N. Goodwin, "The Unthinkable and the Unanalyzable," *The New Yorker*, 17 February 1968, p. 127.

military, sociological, and economic perceptions to bear on a given situation is well chosen. That is, a broader set of more diverse phenomena can be included when the structure of the game is free-form. Schelling commented upon this enlarged scope in a review of Kenneth Boulding's *Conflict and Defense*:

One needs a model that can cope not only with the overall size of the force, measured somehow, but with its relevant characteristics. If one examines, with respect to several of these variables, the kind of force that one side seems to be developing, one gets not "the" arms race but a variety of interactions, some benign, some malignant, some neutral. One not only is closer to bridging the gap between theoretical analysis and policy problems, but is on the way to enriching the models themselves.¹²

What, then, is the general purpose of such an exercise? Some games are nothing more than educational devices for college students; the initial INS series at Northwestern and many games created by Lincoln Bloomfield at M.I.T. fall into this category. On a higher level, political/military games can also act as educational—perhaps *sensitizing* is the proper adjective—devices for actual or potential decision-makers. The Studies Analysis and Gaming Agency (SAGA)—formerly the Joint War Games Agency (JWGA)—designs and runs games that often include pivotal Washington decisionmakers. In one of the few public allusions to the exercises, Lt. Colonel T. J. McDonald described the following purposes:

In the Joint War Games Agency, these games are used to assist in the analysis of national objectives, policies, plans, programs, and organization by illuminating future possible contingencies. They are not intended to be predictive. They are played by top level officials from the White House, State and Defense Departments, and the Services for the following benefits: Simulated crisis environment; realistic communications obstacles; exercise of command, control and intelligence systems; build interagency and interechelon rapport; point up weak spots in coordination, etc.; provide "feel" for Cold War "bargaining," negotiation, and escalation processes; broad overview for specialists; cross-fertilize ideas between agencies.¹³

Although this is a lengthy, it is hardly an exaggerated, set of objectives. Games can be an education for even the most practical analyst or decisionmaker by forcing him to examine a broader picture and to abandon his cherished metaphors; Fred Iklé's warning that metaphors always present dangerous traps for the policy analyst¹⁴ might best be heeded by the analyst's participation in a series of well designed political/military games.

A second function of such games is that they can focus research efforts. Reporting on a series of games conducted by The Rand Corporation during the mid-1950s, Goldhamer and Speier noted: "... we found that one of the most useful aspects of the political game was its provision of an orderly framework within which a great deal of written analysis and discussion took place."¹⁵ They explicitly state that they

¹² Thomas C. Schelling, "War Without Pain, and Other Models," *World Politics*, Vol. 15, No. 3, April 1963, p. 475.

¹³ Lt. Colonel Thomas J. McDonald, "JCS Politico-Military Desk Games," in *Second War Gaming Symposium Proceedings*, Washington Operations Research Council, 16-17 March 1964, p. 63; cited in Griffin, *op. cit.*, p. 70.

¹⁴ Fred C. Iklé, *Every War Must End*, Columbia University Press, New York, 1971.

¹⁵ Goldhamer and Speier, *op. cit.*, pp. 77, 78, respectively.

did not expect, and in fact did not find, that the political game enabled them to "test strategies or to forecast political developments with any real degree of confidence."¹⁵ Finally, they assert, "the major benefit lay in the fact that the game served to suggest research priorities . . . and to define these problems in a manner that would make the research more applicable to policy and action requirements."¹⁶

Lastly, it is important to note what these games do *not* do: they do not provide the policymaker with a *predictive*, operational tool, a point emphasized by both McDonald and Goldhamer-Speier. They do not form a theoretical construct; they cannot make allowances for idiosyncratic characteristics of decisionmakers;¹⁷ nor do they explicitly provide a measure for determining reality. That an occasional scenarist can be seen in retrospect to have made accurate assumptions and predictions about future events is not, however, completely serendipitous; a skillful scenario writer may be able to postulate future events that, in retrospect, can be seen to be remarkably accurate.¹⁸ This is part of his craft.

This brings us, then, to the conceptualization of scenario design and writing.

¹⁶ *Ibid.*, p. 79.

¹⁷ Averch and Lavin have observed that "... no game can reproduce the emotional environment in which actual decisionmaking is embedded." Averch and Lavin, *op. cit.*, p. 6. For example, the following crisis assessment would have been virtually impossible to find in any game. In response to his brother's vacillation regarding the decision to blockade Cuba, Robert F. Kennedy replied: "I just don't think there was any choice," I said, "and not only that, if you hadn't acted, you would have been impeached." The President thought for a moment and said, "That's what I think. I would have been impeached." From Robert F. Kennedy, *Thirteen Days: A Memoir of the Cuban Missile Crisis*, W. W. Norton, New York, 1969, p. 67.

¹⁸ For an example of such a scenario, see Harvey A. DeWeerd, *An Israeli Scenario for a Laboratory Simulation*, System Development Corporation, SP-3139, March 1968; cited in Martin Shubik, G. D. Brewer, and E. Savage, *Gaming Literature Review: A Critical Survey of Literature on Gaming and Allied Topics*, The Rand Corporation, R-620-ARPA, December 1971, p. 59.

III. SCENARIO CONCEPTUALIZATION AND DESIGN

The most critical consideration in the design of a scenario is the function the game or simulation is to serve. A second consideration is how the structure of the game dictates certain elements of the scenario. These are both predicated on the basic consideration of the exercise: what are the purposes and goals of the model?¹⁹

If the purpose of the game or simulation is to offer policy recommendations or implications, the scenario acquires a dominant role. Without a set of accurate and relevant assumptions and predictions in the scenario, the policy purposes would not be realized and the game must, a priori, be found worthless. Given the vagaries of history, the likelihood of constructing an accurate scenario is rather scant. Many scholars cite Richard Brody's simulation of nuclear proliferation²⁰ as an illustration of the dilemmas that the nth-country problem might produce.²¹ These appraisals completely overlook the unrealistic nature of his scenario, in which nuclear capabilities were developed simultaneously by a number of countries. This simply has not proved to be the case. In short, if a game has policy applications as its goal, the scenario is compelled to assume predictive powers that it cannot be reasonably expected to evince. The scenarist would be better advised to moderate his goals than to attempt to devise such a scenario.

Bounding the problem is critical. Once the modeler has posited a set of manageable and achievable purposes,²² he should define explicitly the problem to be examined. This definition process will fundamentally shape the boundaries of his scenario. The most important definition is the designated purpose: is it to simulate the New York Stock Exchange, the National Security Council during a time of national crisis, the budgetary process of Detroit, or variations in the national economy? Clearly this selection determines the setting, a potential list of actors, many of the "rules of the game," and other parameters that are vital to the scenario. For an

¹⁹ For a number of general possible answers to this question, see Garry D. Brewer, *Politicians, Bureaucrats, and the Consultant: A Critique in Urban Problem Solving*, Basic Books, New York, 1973 (forthcoming). See especially Part I, "The Appraisal Function."

²⁰ Brody, *op. cit.*

²¹ This extrapolation of Brody's dissertation is, in a way, unfortunate and was probably not originally intended by Brody. As a thesis project, he was more concerned with the methodology. However, by 1968 he was willing to defend this extended interpretation of his simulation. He admitted the inaccuracy of his scenario but pointed out that the literature of the period made no distinction between serial and parallel proliferation. (Personal conversation with Professor Brody, 4 January 1968.)

²² Goldhamer-Speier and McDonald have outlined such a set for political/military games in the references cited in the previous section.

example of such a specification, in what period is the scenario set? If it were set within the very near future, the scenarist would have a difficult time justifying radical or fundamental changes in the environment. For example, there will almost certainly be no unilateral disarmament by the United States or the Soviet Union within the next three years; therefore, if the game is intended to indicate the steps a superpower would take to rearm itself, the time frame had best be set in the distant (perhaps Elysian) future. Another bounding element is spatial: geography or topography. A scenario designed to test command and control capabilities in an urban guerrilla environment would be ludicrous if the spatial reference were rural. A final example of bounding would be the organizations and ethos involved: a scenario should reflect some of the organizational characteristics of the process being modeled. An American President cannot be ascribed Hitlerian powers without seriously distorting the game and its purposes. As obvious as these three simple examples appear, it is disconcerting to note how frequently their principles are overlooked or ignored.

Goldhamer and Speier offer a series of general guidelines to scenario design: Rand's scenarios were conceived for the "exploration of novel strategies" and the "clarification of issues" defined under the research project; these objectives were limited by the "plausibility of the game events" and the "simulation contingent factors."²³

Once beyond the broadest conceptualization stage, the scenarist may begin to examine some of the general issues that the game raises. Again, the scenarist must be cautious and must scrutinize his own objectives in order to guide without overly biasing his design. Harvey DeWeerd, an acknowledged master scenarist, has written that the scenario

... may be prepared for a number of purposes. First, it may be looked upon as a general background against which defense policies are considered. Second, it may be designed to provide the opening or setting for a war game. Third, it may be prepared to provide an environment in which to examine the functioning of a weapons system or strategy. Fourth, what is far more dangerous and objectionable, a scenario may be prepared for the express purpose of making a particular weapons system or strategy look good in that environment. Finally a scenario may be used as a background for contingency planning.²⁴

DeWeerd's last two points are well taken and merit elaboration. Given the great control the game director has over the game (he may prepare the scenario and choose the evaluative criteria as well as playing control), it would be a relatively easy task to design a scenario and direct a game that results in the validation of a thesis advocated by the director.²⁵ However, there are legitimate objectives that a game is designed to enlighten, objectives that it must achieve. While the border between research and advocacy objectives can often be indistinct, this should not excuse the scenario writer from the burden of honoring this distinction.

²³ Goldhamer and Speier, *op. cit.*, p. 76.

²⁴ Harvey A. DeWeerd, *Political-Military Scenarios*, The Rand Corporation, P-3535, February 1967, p. 2. This is a valuable paper whose guidelines have assisted me in both the professional preparation of operational gaming scenarios and the writing of this report. (All further DeWeerd references are to this paper.) Also see Giffen, *op. cit.*, p. 75.

²⁵ The importance of these positions is stressed by Brown, *op. cit.*, p. 304.

DeWeerd accurately comments that scenario design is becoming increasingly important as crisis management and contingency planning are stressed; both, of course, rely heavily upon scenarios of future occurrences. In her admirable book *The Conventions of Crisis*, Coral Bell cites former Secretary of Defense Robert McNamara's retrospective appraisal of the Cuban missile crisis and its Ex. Comm: "There is no longer any such thing as strategy, only crisis management."²⁶ While the general validity of this statement is questionable, the thrust of much current research in international politics offers at least academic confirmation.²⁷ A great deal of policy-oriented crisis management is predicated upon the efficacy of contingency plans; Alastair Buchan has cogently described the role of contingency planning in the work of the Berlin study task force.²⁸ Although the emphasis on crisis management has increased the demand for scenario construction, one still must be extremely cautious in evaluating the policy value of such work. Despite three years of contingency planning regarding Berlin among the U.S., French, British, and German governments, the Allies were caught unprepared when the Soviet Union built the Berlin Wall in 1961. President Kennedy is reputed to have telephoned an American member of the Berlin task force to ask, "Why, with all those plans, do you never have one for what happens?"²⁹ Although one cannot be certain, it is very likely that the value of contingency planning had been oversold to Kennedy.³⁰ These relatively recent demands and attention should serve to make the scenarist more conscious of his scenario design.

A final consideration in the conceptual design of the scenario is the scenarist's technique for involving the teams in the game. This can be done in one of two general ways. The scenario can take the teams so deeply into the crisis that when they are presented with an opportunity to act, they can not avoid taking some form of assertive action; alternatively, the control team can style its actions (and reactions to team moves) in such a way that the teams are forced to be positive in their responses. Both approaches have their strengths and weaknesses. The first (the "scenario goad") goes beyond the initial recognition of the crisis and imposes several moves on the teams, thereby depriving them of several initial decision points at which they might have chosen different policy options had they been allowed earlier freedom of moves. On the favorable side, such games have little trouble getting the teams actively involved in the game, because the scenario leaves little choice, unless the team refuses to play without rewriting the scenario—not an uncommon occurrence. There is the question, however, of credibility: a crisis would rarely be allowed to ferment to such a great extent and erupt before the nation's decisionmakers had focussed their attention upon it.

²⁶ Coral Bell, *The Conventions of Crisis: A Study in Diplomatic Management*, Oxford University Press for The Royal Institute of International Affairs, New York, 1971, p. 2.

²⁷ For an excellent review of recent literature, see Ole Holsti, *Crisis, Escalation, War*, McGill-Queens University Press, Montreal, 1972, and Allison, *op. cit.*; for earlier work, see Robert C. North, (ed.), "Decision-Making in Crises," *Journal of Conflict Resolution*, Vol. 6, No. 3, September 1962; crisis management has been expanded to include international economics by Edward L. Morse, "Crisis Diplomacy, Interdependency, and the Politics of International Economic Relations," *World Politics*, Vol. 24 (Supplement), Spring, 1972, pp. 123-150.

²⁸ Alastair Buchan, *Crisis Management: The New Diplomacy* The Atlantic Institute, Boulogne-Sur-Seine, France, 1964, Chapters 3-5.

²⁹ John C. Ausland and Colonel Hugh F. Richardson, "Crisis Management: Berlin, Cyprus, and Laos," *Foreign Affairs*, Vol. 44, No. 2, January 1966, p. 30.

³⁰ The pros and cons of contingency planning are judiciously weighed in Buchan, *loc. cit.*

The second strategy (the "control goad") necessitates a more active role for the control team; should the players be reticent or cautious, control must structure and manipulate the game environment in order to provide such incentives (either positive or negative) that the team will play. A characteristic problem is that the players often perceive their main adversary as the control team rather than the opponents. The advantage of this type of goad is that it preserves more moves for the team by turning the situation over to the team at the earliest signs that a crisis is developing. The scenarist's choice between these two is often dictated by the skill and knowledge level of the game's participants. For example, university students (such as those who participated in the INS games at Northwestern) would best play if they were goaded and directed by events in the scenario, whereas SAGA participants could be expected to bring enough prior knowledge to the game that they can promote their own actions and, with the prompting of control, intensify the crisis. The scenario goad carries the scenario much further into the crisis than the control goad, but, in either case, the scenario is directly influenced by the choice the scenarist makes.

Once the scenario writer has addressed these basic questions regarding his scenario, he will have a broad outline of purpose and some constraints. He can then begin to write the scenario itself.

IV. SCENARIO COMPOSITION³¹

As in the preceding general description of scenario elements, the actual composition of the scenario is based primarily upon the game's perspective. "There is no universal rule for scenario writers which tells one what to include and what to omit. Neither is there a universal form in which they should be presented. They vary greatly according to the use to be made of them."³² For example, the scenarist might wish to expand upon Rosenau's five-dimension (idiosyncratic, role, governmental, societal, and systemic variables) role model and arrange the scenario materials in such a manner that the crisis characteristics would be perceived in the appropriate congeries.³³ In brief, "What is required is an adequate presentation of the context in which the problem is to be studied. . . . Without this context, there can be few guidelines for decisionmakers. . . ."³⁴

There are four general considerations entering into the scenario composition that have been determined in the scenario design and are explicitly addressed in the writing of the scenario. First is the temporal setting; second, are the environs and environmental settings; third is the level of resolution or detail; and the fourth concerns the level of knowledge, gaming experience, and sophistication of the game participants.

The time setting is an important parameter. It should not be so near at hand that current events can overtake the game. Goldhamer and Speier commented on this concern: "In our first attempts at political gaming, we started with the historical present as a backdrop. From then on, game events moved into the future under their own momentum. It sometimes proved difficult to prevent the initial action in the game from being overtaken by or becoming entwined with developments reported in the daily newspaper."³⁵ This cannot be remedied by posturing the game in the distant future: the scenario "must also avoid moving so far ahead that it outruns

³¹ This section is not meant to serve as a writing primer (e.g., prepare an outline, use graph paper, etc.); rather it offers some considerations that are important to any scenario. Furthermore, it is assumed that the scenarist is knowledgeable on the subject or the area he is addressing; nothing will abort a game as quickly as the scenario which is factually inaccurate or naive. "Know your subject matter," is the imperative axiom in scenario writing.

³² DeWeerd, *op. cit.*, p. 5.

³³ James Rosenau, "Pre-Theories and Theories of Foreign Policy." *Approaches to Comparative and International Politics*, R. Barry Farrell, (ed.), Northwestern University Press, Chicago, 1966. Similarly, Holsti, *op. cit.*, posits any number of behavioral relations that might be tested.

³⁴ DeWeerd, *op. cit.*, p. 6.

³⁵ Goldhamer and Speier, *op. cit.*, p. 74.

the capacity of the players to conceive a consistent future. After all, in most games it will prove impracticable to provide, or to assimilate, more than a minimum of artificial background material—normally, [it will be possible to provide a background] just sufficient to make the simulated situation plausible in the setting of the real world, most of which has to be conceived as little changed from what the players know of it.³⁶ Another temporal consideration is the lead time necessary for the audience of the game results to implement useful findings. A time setting too close to the present would not give the decisionmaker an opportunity to implement changes, whereas a setting too far removed chronologically might not command his attention. The time setting, then, should be viewed as a fundamental decision for the game: the game should not ensnarl the players in current events, nor should they be confronted with events projected so far into the future that current perceptions, strategies, and policy implications are undermined by uncertainty and rendered useless.

The second setting is virtually all-encompassing. It includes a general political history of the world from the present to the specified game time; particularly, there should be no great phenomena (such as the Russian Revolution) left unexplained. Major political reversals and other social discontinuities must be carefully chronicled, especially if the affected nation is to play a significant role in the game. There are several facets of what has been termed the "International Contextual Description"³⁷ that should be addressed either implicitly or—in the case of the more important aspects—explicitly. These include the general distribution of military and economic power, the international alignment of powers (blocs, allies), national capabilities, demographic distributions, and geographic/topographic descriptions (especially if the players are unfamiliar with the area being considered).³⁸ Obviously, some aspects are easier to alter than others. It is relatively straightforward to define a new system of alignments and, since allies are notably mercurial, this would not be difficult for the players to accept; on the other hand, the Pacific Ocean and the Himalaya mountains must be treated as relatively unalterable.³⁹ These elements are necessary in the general scenario context and should be focused to offer finer detail when concentrating upon the specific areas and motivations of a crisis.

The third consideration then arises in a natural fashion as the scenario is brought into detailed focus on its problem or study area. Many of the features enunciated on the international sphere for the second consideration can now be paralleled on the regional level, but with greater specificity, clarity, and precision. The importance of alignments, the relative strengths, the capabilities, and even the personalities are of much greater importance than they were when considered in the international context. Whereas a scenario would address the role of the United Nations in the international description, the detailed local role of the UN or possible regional organizations would be relatively more important. The local conditions for

³⁶ Giffin, *op. cit.*, p. 74.

³⁷ I am grateful to Daniel Weiler of The Rand Corporation for sharing some of his ideas on scenario writing. His identification of the International Contextual Description and its elements are in an unpublished paper.

³⁸ Although these descriptions are couched in the phraseology of international politics, it is relatively simple to visualize analogues between them and elements involved in simulating the budgetary process; see John P. Crecine, *Governmental Problem-Solving*, Rand McNally, Chicago, 1969.

³⁹ The American logistics efforts for Vietnam demonstrate that such obstacles are not insurmountable.

the geographical areas that are related to the conflict should be carefully explicated. At the same time, the scenarist must guard against becoming entangled in excessive detail for two reasons. First, the players can absorb and manipulate only a finite amount of data; to overload them with essentially trivial data would defeat the purpose of the game. Second, concern with such unduly fine detail tends to distract the writer from his overall purpose. This trade-off between need for detail and simplicity can vary from situation to situation in response to many factors (e.g., purpose, participants' skills, etc.), but the balance should be thoughtfully considered and observed.

Finally, the participants must be considered. The fewer skills, background, and knowledge the players bring to the game, the more thorough the scenario must be. Brody's use of high school students required a detailed scenario,⁴⁰ whereas the Rand games could afford to use more general scenarios, because the players brought significant professional skills to the games and could be expected to fill in vaguer scenarios with the necessary details.⁴¹ Both approaches have their relative merits. The first allows the researcher to observe inexperienced teams whose actions are based upon fewer preconceptions or vested interests; on the other hand, its results are likely to lack relevance and realism and hence, meet greater skepticism. The second approach permits the scenario to be less detailed and the outcome less directed, but the players' knowledge might lead them to reject the scenario, thus undermining the game's purpose.

Credibility⁴² is an issue of major concern to the writer throughout the scenario; however, it is at the composition level that credibility must be directly treated. This issue has two primary considerations. First, credibility and prediction accuracy should not be confused or interchanged. "Critics of the credibility of scenarios must recognize that preparing a well structured scenario and predicting single future events are two different things. In the case of predicting single events, one mistake invalidates the whole effort, but in a well-developed scenario, the weakness of a single element is compensated for by the credibility of the remainder."⁴³ DeWeerd's point is well taken. A plausible and consistent set of conditions—carefully researched, without unexplained or radical alteration from the present environment—is the hallmark of a good scenario. This criterion should be violated by incredible or illogical elements or events only if the research objectives should so demand.

Herman Kahn exaggerates the importance of consistency by virtually rejecting the role of credibility. Sidney Giffin relates the following anecdote regarding Herman Kahn: "As early as 1963 at the Hudson Institution, Herman Kahn was offering \$500 for a scenario that *plausibly* brought on a general war between the United States and the Soviet Union. I believe this to have been a *bona fide* offer, although when I asked Mr. Kahn who would be the judge of the plausibility, he said with massive dignity, 'Me.'"⁴⁴

⁴⁰ Brody, *op. cit.*

⁴¹ Goldhamer and Speier, *op. cit.*

⁴² Some writers, especially DeWeerd, *op. cit.*, attempt to distinguish between plausibility and credibility. Although the distinction can be made, this report will avoid the necessary semantic differentiations and will treat them as synonyms.

⁴³ DeWeerd, *op. cit.*, p. 11.

⁴⁴ Giffin, *op. cit.*, fn., p. 188, emphasis in original.

Second, it would be a relatively easy task to dissect and discard each scenario as being "unrealistic" or a "dead issue," but such an exercise would be, for a number of reasons, only minimally productive. First, the underlying purpose of a gaming scenario is not to predict the future perfectly; it is to organize verisimilar crisis situations in such a manner that one can study the reactions of the game participants and—much more important—the options they generate. Harvey DeWeerd quotes Herman Kahn as saying that scenarios are meant to "stretch the mind and force a planner to envisage the future in concrete terms," advice Kahn has certainly chosen to practice as well as preach. Further, DeWeerd argues that "scenarios should be looked upon as suggestions of what *might* happen, not as predictions of what *will* happen."⁴⁵ Finally, if a scenario is carefully conceived and executed, the vagaries of history would argue against its cavalier or out-of-hand rejection on the grounds of unrealism. A Berlin crisis in 1981 might have a very low probability, but it is equally as improbable, and certainly more dangerous, to assume that there would be *no* Berlin crisis in 20 years. Tito's defiance of Stalin in the late 1940s, the China/India War in 1962, and the Soviet emplacement of IRBMs in Cuba that same year are all concrete examples of unique historical occurrences that might have been rejected as "unrealistic scenarios."⁴⁶ In his autobiography, former General Matthew Ridgway relates the skepticism that met his 1940 scenario that predicted a war in the Pacific predicated upon a surprise Japanese air attack on Pearl Harbor.⁴⁷

A final element might be to provide a menu of options, or actions that a team might choose to exercise while playing the game. The explicitness of these "handles" is largely dependent upon the sophistication of the players. However, as before the scenarist must be careful not to bias his scenario unconsciously so as to make some options more attractive than the others. Also, such a menu might possibly limit a team's capability and incentive to devise novel options. That is, the scenario should present a situation that permits—indeed, encourages—the exploration of a wide variety of levers, old or new.

In sum, the scenarist should strive for a consistent, well researched and detailed set of circumstances that are sufficiently plausible that the participants can understand and identify the situations, conditions, and strategies that prevail. Credibility and consistency are the key qualities. One operational test of credibility might be the degree of acceptance by participants of the scenario. This is not to say that the writer should be timid and avoid predicting future events, but he should not permit himself to become such an avid crystal-ball gazer that he seriously distorts the fabric of the scenario. The scenarist who attempts to wear the mantle of a seer will produce such conservative scenarios as to vitiate their applicability; they will hardly "stretch the mind."

⁴⁵ These are noted in one of H. A. DeWeerd's unpublished papers.

⁴⁶ Indeed, William Jones of The Rand Corporation relates that a China-India War and Soviet missiles in Cuba were both proposed as JWGA games in 1961 and rejected as being too unrealistic.

⁴⁷ Matthew B. Ridgway, *Soldier: The Memoirs of Matthew B. Ridgway*, Harper & Sons, New York, 1956, pp. 46-47; cited in DeWeerd, *op. cit.*, p. 13.

V. CONCLUSION

This report has presented a general set of criteria for constructing a scenario for a model, game, or simulation (MSG).⁴⁸ Personal experience has dictated that most of the examples be drawn from scenarios designed for, and used in, free-form political/military games. This conclusion is addressed to expanding the specific criteria so that their applicability can be seen as relevant to a broader range of MSG purposes and uses. Nonetheless, there are a few specific exceptions that should be pointed out.

The general questions are essentially those posed in Section III. Whatever type of exercise is to be conducted, the modeler's and user's purposes must be made explicit and evident to all concerned—especially the modeler. Without a concise recognition and statement of purpose, the MSG is almost certain to fail, to flounder without direction. The scenario defines the context for the MSG, so—similarly—it must also suffer irreparable damage, i.e., is not usable, without a precise explication of purpose. Indeed, a scenario might be even more disaster prone because of a faulty or inadequate statement of purpose. If an author were not clear regarding his objective, a simulation might nevertheless "muddle through" to "something interesting" that "requires further work in the field;" a scenario, however, cannot be constructed without a carefully defined purpose. In such a situation, the MSG cannot take even the first step, let alone begin to muddle.

A second general consideration that is explicit within the defining of the MSG is the bounding of the model. Jay Forrester and colleagues aside, the steadfastly holistic approach to the complexities inherent in social, political, and economic problems is far more likely to cloud the relevant processes than to reveal much regarding the nature of the system in which they are embedded. Forrester does place physical and geographic bounds on his "System Dynamics" but allows migratory and economic pressures to flow freely across these boundaries. To his credit, Forrester did not attempt to list all the elements that impact upon a city.⁴⁹ This is a limitation which his colleagues should have observed; *The Limits of Growth* addresses virtually everything in the world without hope of measuring many vital elements ("marginal productivity of agricultural capital" is but one example of an

⁴⁸ Shubik and Brewer, *op. cit.*, suggest that these terms are practically all but synonyms and are routinely used interchangeably. Although Shubik and Brewer provide semantic differentiations, they use "MSG" to cover the generic field, a convention this conclusion adopts as well.

⁴⁹ Forrester, *op. cit.* However, he later expanded his horizons. See Jay W. Forrester, *World Dynamics*, Wright-Allen Press, Cambridge, 1971.

unmeasurable element), let alone defining many of them from other than a parochial perspective e.g., "pollution" and "crowding").⁵⁰ Again, the MSG's purpose should be examined to help set the boundaries; if the stated purpose fails to define boundaries that are workable, the purpose should be reconsidered.

A final general consideration—one that serves as a ready transition into the more descriptive elements of a scenario—is the data source. Relatively speaking, a free-form political/military game can, within the limitations described in the previous two sections, have its data fabricated for game purposes. There is, of course, a certain amount of research necessary for verisimilitude, but, generally, this type of game has its data custom-tailored to fit its purposes. Furthermore, the control team can continue to fine-tune the data as the game continues. Most MSGs do not have this luxury; they must obtain their data from the "real world" (assuming that their purpose is more than educational or heuristic). These data requirements must be carefully attended to throughout the modeling process. Indeed, the nexus between general theory and data should be properly characterized as an iterative process in which interaction between these two requirements is vital to the success of the MSG. Lack of data results in models that cannot be validated; lack of theory results in mindless number-crunching.⁵¹ Scylla and Charybdis are as alive and dangerous for the modern modeler as they were for the Mycenaean mariner.⁵²

An unpleasant part of almost every MSG is the data search. Scenarios cannot be honestly constructed without the prerequisite research being performed. For computer-based MSGs, this means first establishing whether the data even exist; if they do, are they in usable form, can they be made machine-readable, etc.? Similar to the information the political/military scenarist uses, these data fill in the fine detail, describe the milieu, and provide the necessary inputs to begin and operate the exercise. Last (and hardly least), these data provide the necessary link to whatever it is that is consensually recognized as reality; that is, the data must ultimately be used to validate or reject the MSG, for data are the model's links to the "real" world. One of the fundamental shortcomings of *Urban Dynamics* is that Forrester generated his own data to read into the simulation, thereby making validation of his model impossible.⁵³ The reason for this procedure should not be surprising: the

⁵⁰ D. H. Meadows, D. L. Meadows, Jorgen Randers, and William Behrens II, *The Limits of Growth*, Universe Books for the Potomac Associates, New York, 1972. This grandiosity is not restricted to computer simulations; many of the same problems may be found in Hans Morgenthau, *Politics Among Nations*, Alfred A. Knopf, New York, 1966, 4th Edition, the most famous being his definition of "balance of power," that is, his central thesis.

⁵¹ These points are illustrated in Ronald D. Brunner and Klaus Liepelt, "Data Analysis, Process Analysis, and System Change," *Midwest Journal of Political Science*, November 1972, or in *A Policy Approach to Political Development and Change*, G. D. Brewer and R. D. Brunner, (eds.), The Free Press, New York, 1973 (forthcoming).

⁵² For example of an elegant paradigm with little hope of acquiring adequate data, see Arthur D. Little, Inc., *Model of the San Francisco Housing Market*, San Francisco Renewal Program, Technical Paper No. 8, January 1966; for endless numbers with little theory, see Community Analysis Bureau, *A Strategy for City Survival, 1970: Synthesis or Social Disintegration*, The Community Analysis Bureau, City of Los Angeles, 1971. Two (respective) analogies from international relations literature are William J. Riker, *The Theory of Political Coalitions*, Yale University Press, New Haven, Conn., 1962 and Rudolph J. Rummel, "Dimensions of Dyadic War, 1820-1952," *Journal of Conflict Resolution*, Vol. 9, No. 2, June 1967, pp. 176-183.

⁵³ I apologize for the pillorying of Forrester, *op. cit.*, but the prominence and the shortcoming of the book combine to make it a very convenient reference. This particular point concerning validation, as well as many others regarding *Urban Dynamics*, is incisively made by Garry D. Brewer and Owen P. Hall, Jr., *Policy Analysis by Computer Simulation: The Need for Appraisal*, The Rand Corporation, P-4893, August 1972, p. 24.

actual data needed to fit his MSG were either nonexistent or available only at great expense in monetary and research terms.

A final parallel between political/military gaming and other types of modelling exercises is useful. The control team can alter the play of the game by adjusting the data the teams receive during the exercise; the purpose is to see what changes in team actions these alterations produce. Likewise, a computer simulation model may operate with changing parameters for similar reasons.⁵⁴ This technique has the technical label of "sensitivity testing;" i.e., the measurement of changes in the outcomes as a response to measured changes in the inputs. Naturally, care must be exercised, both in the choosing of the parameters and their ranges of variation; "the research questions determine the design of the testing equipment."⁵⁵ The design of the sensitivity analyses should thus reflect the hypotheses about the MSG's behavioral characteristics and produce questions about the accuracy of the replicated changes as they might occur in the "real" world.

In summary, considerations that might have appeared at first glance to have to have been primarily concerned with the construction of political/military scenarios can be seen as easily generalized to a more general field of MSGs without doing a serious disservice to either.

⁵⁴ This altering of parameters and observing their effects was the purpose of Samuelson's model; Samuelson, *op. cit.*

⁵⁵ Brown, *op. cit.*, p. 302.

BIBLIOGRAPHY

- Allison, T., *Essence of Decision: Explaining the Cuban Missile Crisis*, Little, Brown & Company, Boston, 1971.
- and M. H. Halperin, "Bureaucratic Politics: A Paradigm and Some Policy Implications," *World Politics*, Vol. 24 (Supplement), Spring, 1972, pp. 40-79.
- Arthur D. Little, Inc., *Model of San Francisco Housing Market*, San Francisco Renewal Program, Technical Paper No. 8, January, 1966.
- Ausland, C., and Colonel H. F. Richardson, "Crisis Management: Berlin, Cyprus, and Laos," *Foreign Affairs*, Vol. 44, No. 2, January 1966, pp. 291-303.
- Averch, H. A., and M. M. Lavin, *Dilemmas in the Politico-Military Conduct of Escalating Crises*, The Rand Corporation, P-3205, August 1965.
- , *Simulation of Decisionmaking in Crises: Three Manual Gaming Experiments*, The Rand Corporation, RM-4202-PR, August 1964.
- Bell, Coral, *The Conventions of Crisis: A Study in Diplomatic Management*, Oxford University Press for the Royal Institute of International Affairs, New York, 1971.
- Brewer, G. D., *Politicians, Bureaucrats, and the Consultant: A Critique in Urban Problem Solving*, Basic Books, New York, 1973-forthcoming.
- , and O. P. Hall, Jr., *Policy Analysis by Computer Simulation: The Need for Appraisal*, The Rand Corporation, P-4893, August 1972.
- Brody, R. A., "Some Systemic Effects of the Spread of Nuclear Weapons Technology: A Study Through Simulation of a Multi-Nuclear Future," *Journal of Conflict Resolution*, Vol. 7, December 1963, entire issue.
- Brown, Seyom, "Scenarios in Systems Analysis," *Systems Analysis and Policy Planning: Applications in Defense*, E. S. Quade and W. I. Boucher (eds.), American Elsevier Publishing Company, New York, 1968, pp. 298-310.
- Brunner, R. D., and Klaus Liepelt, "Data Analysis, Process Analysis, and System Change," *Midwest Journal of Political Science*, November, 1972, or in *A Policy Approach to Political Development and Change*, G. D. Brewer and R. D. Brunner (eds.), The Free Press, New York, 1973 (forthcoming).
- Buchan, Alastair, *Crisis Management: The New Diplomacy*, The Atlantic Papers, NATO Series II, Boulôgne-Sur-Seine, France, The Atlantic Institute, 1964.
- Coser, Lewis, *The Functions of Social Conflict*, The Free Press, New York, 1956.
- Community Analysis Bureau, *A Strategy for City Survival, 1970: Synthesis on Social Disintegration*, City of Los Angeles, Community Analysis Bureau, 1971.

- Cyert, Richard, and James March, *A Behavioral Theory of the Firm*, Prentice-Hall, Englewood Cliffs, N. J., 1964.
- DeWeerd, H. A., *Political-Military Scenarios*, The Rand Corporation, P-3535, February 1967.
- Forrester, Jay W., *Urban Dynamics*, M.I.T. Press, Cambridge, Mass., 1969.
- George, A. L., "The Case for Multiple Advocacy in Making Foreign Policy," *American Political Science Review*, Vol. 66, No. 3, September 1972, pp. 751-785.
- , D. K. Hall, and W. R. Simons, *The Limits of Coercive Diplomacy: Laos-Cuba-Vietnam*, Little, Brown, & Company, Boston, 1971.
- Giffin, Sidney, *The Crisis Game: Simulating International Conflict*, Doubleday & Co., Garden City, N. Y., 1965.
- Goldhamer, Herbert, and Hans Speier, "Some Observations on Political Gaming," *World Politics*, Vol. 12, No. 1, October 1959, pp. 71-83.
- Goodwin, Richard N., "The Unthinkable and the Unanalyzable," *The New Yorker*, 17 February 1968, pp. 120-131.
- Guetzow, Harold, et al., *Simulation in International Relations: Simulating International Conflict*, Prentice-Hall, Englewood Cliffs, N.J., 1963.
- Haas, Michael, "Communication Factors in Decision-Making," Peace Research Society: Papers XII, Cambridge Conference, 1968.
- Hermann, Charles F., *Crisis in Foreign Policy: A Simulation Analysis*, Bobbs-Merrill, Indianapolis, Ind., 1971.
- Holsti, Ole R., "Cognitive Dynamics and Images of the Enemy," *Image and Reality in World Politics*, John C. Farrell and Asa P. Smith (eds.), Columbia University Press, New York, 1967.
- , *Crisis, Escalation, War*, McGill-Queens University Press, Montreal, 1972.
- Iklé, F. C. *Every War Must End*, Columbia University Press, New York, 1971.
- Jervis, Robert, *The Logic of Images in International Relations*, Princeton University Press, Princeton, N. J., 1970.
- Kennedy, Robert F., *Thirteen Days: A Memoir of the Cuban Missile Crisis*, W. W. Norton, New York, 1969.
- McDonald, Lt. Col. Thomas J., "JCS Politico-Military Desk Games," in *Second War Gaming Symposium Proceedings*, Washington Operations Research Council, 16-17 March 1964, p. 63; cited in Giffin (above).
- Meadows, D. H., D. L. Meadows, Jorgen Randers, and William Behrens, II, *The Limits of Growth*, Universe Books for the Potomac Associates, New York, 1972.
- Morgenthau, Hans, *Politics Among Nations*, 4th Edition, Alfred A. Knopf, New York, 1966.
- Morse, Edward L., "Crisis Diplomacy, Interdependency, and the Politics of International Economic Relations," *World Politics*, Vol. 24 (Supplement), Spring, 1972, pp. 123-150.
- Nicholson, Michael, *Conflict Analysis*, The English Universities Press, London, 1970.
- North, Robert C. (ed.), "Decision-Making in Crises," *Journal of Conflict Resolution*, Vol. 6, No. 3, September 1962, entire issue.
- Riker, William J., *The Theory of Political Coalitions*, Yale University Press, New Haven, Conn., 1962.
- Rosenau, James, "Pre-Theories and Theories of Foreign Policy," *Approaches to*

- Comparative and International Politics*, R. Barry Farrell (ed.), Northwestern University Press, Chicago, 1966.
- Rummel, Rudolph, "Dimensions of Dyadic War, 1820-1952," *Journal of Conflict Resolution*, Vol. 9, No. 2, June 1967, pp. 176-183.
- Samuelson, Paul, "Interactions Between the Multiplier Analysis and the Principle of Acceleration," *Review of Economics and Statistics*, Vol. 12, 1939, pp. 75-78.
- Schelling, Thomas C., "War Without Pain, and Other Models," *World Politics*, Vol. 15, No. 3, April 1963, pp. 465-487.
- Shubik, Martin, and G. D. Brewer, *Models, Simulations, and Games—A Survey*, The Rand Corporation, R-1060-ARPA/RC, May 1972.
- , and E. Savage, *Gaming Literature Review: A Critical Survey of Literature on Gaming and Allied Topics*, The Rand Corporation, R-620-ARPA, December 1971.
- Tanter, Raymond, and Richard H. Ullman, "Introduction: Theory and Policy in International Relations," *World Politics*, Vol. 24 (Supplement), Spring, 1972, pp. 3-7.
- Weiner, M. G., "Gaming," *Systems Analysis and Policy Planning: Applications in Defense*, E. S. Quade and W. I. Boucher (eds.), American Elsevier Publishing Company, New York, 1968, pp. 265-278.
- Whiting, Allen S., "The Scholar and the Policy-Maker," *World Politics*, Vol. 24 (Supplement), Spring, 1972, pp. 229-247.