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FORECASTING IN INTERNATIONAL RELATIONS: PROBLEMS AND PROSPECTS

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The author argues that forecasting is a problem of reasoning, of reducing uncertainty, and of bounded speculation, and she identifies four types of forecasting goals: (1) understanding the unknown (i.e., prophecy), (2) controlling future outcomes, (3) understanding the overall dynamics of a system to appreciate present conditions, and (4) planning for the immediate future. The author then specifies alternative forecasting methodologies, from least to most systematic: normative, exploratory-projective, model-based (both statistical and functional), simulation-based, and artificial intelligence. A forcast may further be anchored in four types of initial conditions: structure, probability, preference, and trends and projections (the most prevalent type today). A forecast may also have various purposes, each with an attendant time frame: retrospective, long range, or short range. Having made a forecast, it may be validated in many ways, including interrogation processes, statistical methods, and comparisons with data. In considering the policy implications of forecasts, the researcher must identify a system's manipulables, the costs of manipulations, and the sensitive points. In conclusion, the author notes some critical imperatives for further developments in international relations forecasting.

I. INTRODUCTION: FORECASTING AND THE IMPERATIVES OF INTERNATIONAL RELATIONS

Forecasting is a problem of reasoning, of reducing uncertainty, and of bounded and disciplined speculation. Exploring the unknown, identifying possibilities associated with different outcomes, and isolating likelihoods of occurrences constitutes the essence of forecasting. In the social sciences the problem is one of minimizing uncertainty. Reducing variances around alternative estimates of the unknown provides the lowest common denominator among different modes and techniques of forecasting. Beyond that, the approaches to forecasting are as numerous as they are varied. What one sees, after all, depends on how one looks at it. In the same vein, the methodologies one employs, the assumptions one holds, and the values one espouses all influence how one will look at the future and what one will see. This paper examines key issues in international relations forecasting and specifies the ways by which we might increase our ability to develop reliable views of future outcomes.

Reality wears many guises: it is at the same time the actual, the possible, the potential, the probable, and the preferable. Reality may also be the undesirable, the negative, the chiliastic, or the apocalyptical. Although many other views of reality undoubtedly exist, we tend to define futures in terms of " goods " and " bads." However, if we interject probabilities, contingencies, and conscious specification of alternatives and utilities, we will obtain a more enlightening view of possible futures than if we adopt such simplistic and dichotomous views. Indeed, the critical distinction between prediction and forecasting involves contingencies and probabilities.

A prediction usually dispenses with probabilistic interpretations; a forecast is always conceived within a certain probability range. A prediction is generally made in terms of a point or event; a forecast is made in terms of alternatives. A prediction focuses upon one outcome; a forecast involves contingencies. The composite distinction between prediction and forecasting—in terms of probabilities, contingent outcomes, and conscious specification or alternatives—lies at the core of existing approaches to the future.

The major issues in international relations involve the following: (1) the different roles of nations, their positions in global politics, and the means by which they conduct their relations with other states; (2) the determinants of power and weakness and the global implications of imbalances in capability and military inequalities; (3) the imperatives of resource scarcities, availabilities, and usages; (4) the political implications of technological development and the distribution of knowledge and skills; (5) the political consequences of demographic profiles, the implications of added numbers, and the consequences of increasing loads

upon the surface of this earth; (6) the configuration of national perceptions, attitudes, and cognitions; (7) the global implications of nonterritorial actors, multinational corporations, international institutions, and transnational organizations; and (8) the relation of international politics to international society and the interdependence between international politics and international economics.

These issues all converge around the causes of war and the preconditions for peace. Each of these questions bears directly upon propensities for and probabilities of violence. For forecasting purposes, therefore, we must obtain some reliable means of gauging changes and developments along every one of these critical issue areas and of assessing the extent to which national systems are war-prone or peace-prone. Different forecasting methodologies are appropriate for examining different problems. And the time frame within which the forecast is undertaken is a critical determinant of the methodology selected and of the type of forecast obtained.

When forecasting international outcomes, we are concerned with the ranges of possibilities and the contingencies and probabilities associated with each. A successful forecast must account for at least the following: the direction of the activity modelled, the direction of sharp breaks or reversals, the extent of change, the period over which change is likely to persist, the points in the system most amenable to manipulation, and the costs of manipulation.

Forecasting in international relations is particularly challenging in view of the large number of variables in question, the magnitudes of the unknowns, and the propensities for random factors or exogenous shocks. All the complexities associated with forecasting as such are compounded by the uncertainties of tomorrow's international realities. This paper is addressed to five key issues in international relations forecasting: (1) the prophecy implications of forecasting, (2) the role of theory, (3) alternative forecasting methodologies, (4) alternative purposes and time perspectives, and (5) the policy implications of forecasting. By way of conclusion we shall note some requisites for viewing the future more successfully than has been done to date.

II. FORECASTING AS SCIENTIFIC PROPHECY: ALTERNATIVE MOTIVATIONS AND DIRECTIVES

Since ours is a technocratic age, forecasting is sometimes viewed as scientific prophecy, and controlling the unknown emerges as its necessary corollary. Together, prophecy and control make forecasting important to the direction of modern science, which is rooted in technocratic hermeneutics and liberative prediction.[1] In forecasting parlance, hermeneutics refers to a disciplined but intuitive feeling for the structure of the unknown and for understanding the future, and liberative prediction refers to liberation from the conceptual constraints of the present.

The function of prophecy is complex and involves the creation of images of the future that imply alternative "goods" or "bads." The possible/desirable becomes the domain of policy planning which, in turn, results in some institutionalized imperative for forecasting. Studying the future results, to some extent, in creating it: the forecasters and theorists of the past generation frequently become the realists of the present. Forecasting thus serves to link the past and the future. And in order to forecast, new outcomes which are not bound by present information must be created. In this sense forecasting becomes prophecy, an important requisite for planning.

Our conception of future realities rests almost exclusively on our understanding of the past and present. The various motivations for forecasting can operationally justify linking our conceptions of the present with our expectations for the future. The utopian and the strategist, two polar opposites, both seek to impose order upon the unknown and provide some framework for assessing observations and data. Whatever objective information each draws upon, they see their interpretation of this information as truth.

The forecaster who views forecasting as scientific prophecy seeks, like all scientific inquirers, greater understanding of the unknown; he emphasizes the procedures of forecasting. The forecaster interested in controlling future outcomes seeks to manipulate, develop and implement policies; he emphasizes identification of sensitive points in a system and areas in which critical decisions might lead to different choices and to different outcomes. The forecaster interested in long-range futures seeks to understand the overall dynamics under consideration in order to better appreciate present conditions; he emphasizes long-term system behavior. The forecaster interested in tomorrow morning's outcomes seeks to plan for immediate contingencies; he emphasizes the decision-making process.

Each of these motivations entails different

procedures of forecasting, with associate costs and benefits. Forecasting forces us to think of *alternatives*. " Goods " and " bads " assume the same theoretical importance in the forecasting design; the distinction between them is imposed upon future realities by the motivations, preferences, and expectations of the forecaster.

The value-neutral posture of science is sometimes confused with the value-driven imperatives of prophecy, resulting in an undifferentiated and often methodologically unsound use of both theory and method. So, too, we tend to confuse what *is* with what *ought* to be, without appreciating that the discrepancy between the " is " and the " ought " is an important datum bearing directly upon the results of the forecast. For these reasons the forecaster must make explicit his beliefs about the past and the present, the relationship of the individual to society, the relationship of societies to each other, and the nature of the decision systems governing interactions among societies. These underlying beliefs—or theories—inevitably affect the nature of the forecast, and when investigators differ in their underlying beliefs and assumptions about each of these considerations, the forecasting outcomes will almost certainly differ.[2] And for forecasting purposes, systematic structuring of negative images (or prophecies) is as important as systematic structuring of positive ones. Our underlying values differentiate the positive from the negative; there is nothing absolutely good or bad. How we interpret data, observations, and present or past facts depends largely upon our theories of presents and pasts and upon the ways we employ theory to guide our search and understanding of alternative futures.

III. THE ROLE OF THEORY IN INTERNATIONAL RELATIONS FORECASTING

Theory generally performs several functions in the course of empirical investigation: it provides a coding scheme for storing and retrieving information, and it serves as a search instrument which guides the investigator toward the relevant questions and appropriate data. Theory preserves and facilitates inspection of data; theory also preserves and focuses attention upon what the theorist sees as relevant. Through its built-in capabilities for dissociating and recombining information (in terms of first- and higher-order symbols), theory provides means of accommodating new information and new combinations of ideas and concepts.[3]

The formalized and semiformalized tenets of social science theory provide important clues for thinking about global futures and for developing appropriate frameworks within which the forecast may be undertaken and the results interpreted meaningfully. More specifically, theory performs two important tasks: (1) it provides guidelines, propositions, and in some cases, validated findings concerning the relationships among critical variables or among components of the system investigated, and (2) it provides the criteria for evaluating the performance of the forecast and assessing its outcome. These criteria also bear upon the forecaster's understanding of the " realities " at hand, an understanding which is made explicit through a series of theoretical statements and then made to relate, also explicitly, to other people's understanding of these realities and to empirical findings emerging from previous analysis or from the conventional wisdom on the issue at hand.

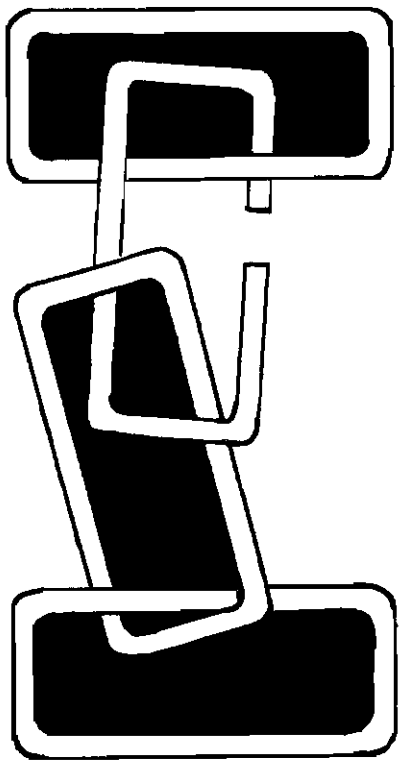
In short, theory orients thinking and thinking directs the forecast. Without theory, forecasting becomes crude prophecy. With theory, forecasting assumes scientific proportions. And the methodological question of *how to forecast* is then placed in proper perspective. There are at least five levels of analysis in international relations where social science theory yields important clues for forecasting and where existing knowledge can provide a systematic framework for the forecasting design.

We know something about the behavior of *individuals* under a variety of conditions, and psychological theory is rich with propositions regarding cognitive processes and mechanisms of psychological adaptation to the external environment. We know something about the operation of groups and of *social systems*, including social behavior, group behavior, economic behavior, and political behavior. We also know something about interactions among large units termed *nation-states*. And we know something about the societal implications of *large numbers* of entities harbored in ecological systems, demographic systems, and so forth. Finally, we have some initial theoretical developments concerning the means by which these levels interrelate, given some *meta-level of analysis*, such as general systems theory or, more operationally, system dynamics.

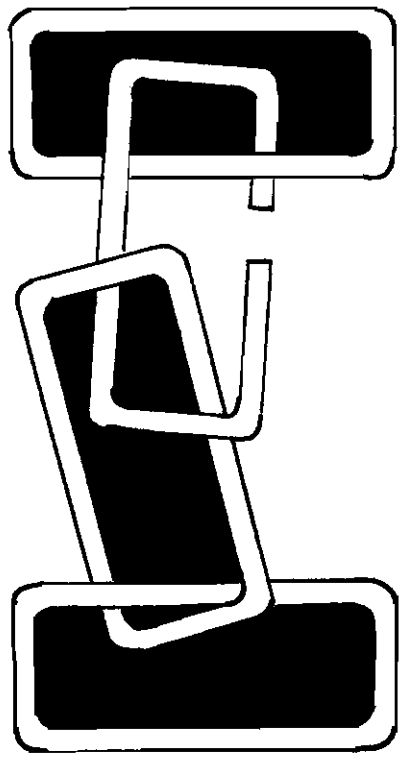
At each of these levels, social science theory has made considerable inroads toward developing formalized tenets of human behavior. But much

yet remains to be done. For forecasting purposes, such formalized thinking is imperative. But forecasting may also be employed as a means of developing and testing theory. In many ways, a symbiotic relationship exists between forecasting as scientific prophecy and social science theory as formalized understanding and explanation of individual and social behavior.

When viewed in the context of international relations, social science theory provides important clues toward understanding inter-societal interactions. These clues are conventionally thought of as *international relations theory*. But this is a misnomer; the most significant theoretical developments in international relations have come not from scholars engaged in the analysis of international " realities " in the context of conventional



and traditional wisdom, but from scholars actively engaged in breaking down the barriers among the social sciences and employing international relations as a laboratory within which to test propositions about human behavior and inter-societal relations. From these concentrated efforts emerge several " islands of theory " which yield important insight into international relations—past, present and future.[4]



There is a modicum of " international relations " theory about the political implications of national attributes and capabilities, about modes of international relations, about systematic constraints on national behavior, about national goals and objectives, about armament competitions and other forms of competition, about system change, and so forth. Such theory, though far from polished, sets forth some partial findings and assessments. Much more needs to be done, however, before we can rely upon international relations theory for valid guidance in thinking about the future.[5]

The *operational* statement of theory in a research design is made in terms of a model. The most important purpose of a model is to structure the inquiry, but its actual relevance depends upon the purpose of the forecast and the desired rigor of the research design. Verbal and functional models are the least systematic. Statistical, mathematical, and simulation models all represent more complex

statements of theory and greater precision for thinking about the future.

Perhaps the most important theoretical problem for forecasting involves causal relations. One's beliefs about causality determine in large part the methodologies one adopts for forecasting and the types of values one chooses to accommodate. There are at least five different concepts of causation, each with an attendant interpretation of international realities. The most common view involves *time precedence*, one thing followed by another. But this is a rather simplistic notion, and philosophers of science tend to agree that causality in terms of *asymmetrical relations* is more realistic. Others maintain that causal relations involve *unidirectional* or recursive relations and that causality cannot, by definition, accommodate mutual dependencies. Conversely, still others argue that *simultaneous* relations are not inconsistent with causal notions and that the " real " world is of this nature. And, by way of accommodating such differing perspectives, some attempts have been made to think of causality in terms of mutual dependencies and in terms of unidirectional relations. This compromise is based upon a *block recursive* view of reality. This perspective assumes that, within a localized domain, causal relations are unidirectional, but that these localized systems of relations are imbedded in larger structures characterized by simultaneous dependencies.[6] Thus, according to this last view, in international relations, one can think of the domestic sources of foreign policy as a localized system composed of unidirectional influences—from the system to the leadership and eventually to the external environment—but these localized relations are influenced by external considerations (international alliances, ongoing armament competitions, and so forth) which themselves are fairly independent from the internal determinants of foreign policy. In this way a block recursive view of international realities accommodates a unidirectional concept of causation as well as one which stresses mutual and simultaneous dependencies.

These different views of causation dictate different ways of structuring the research problem and of approaching the forecast design which, in turn, determines the choice of methodology. But causality is also related to the purpose of forecasting and to the time perspective involved. If one were interested in tomorrow morning's outcomes, it would not be wise to opt for a block recursive view of causation, nor to employ an associated methodology. The outcomes of tomorrow might best be viewed through a unidirectional perspective or through one which stresses time precedence, rather than one which involves an unnecessarily complex view of reality.

In sum, then, different models and different perspectives upon causality serve different purposes, and since what we see depends upon how we look at something, the forecaster must appreciate the consequences of selecting one type of model or one view of causal relations rather than another as the basis of the forecasting design. A realistic appraisal of what can in fact be done given the tools at our disposal amounts to a necessary prerequisite for forecasting in international relations. The following section indicates the range of forecasting methodologies available. Further along we shall pull the pieces together and illustrate the convergence between different problems in international relations and different types of forecasting methodology.

IV. ALTERNATIVE FORECASTING METHODOLOGIES: MULTIPLE REALITIES AND MULTIPLE PERSPECTIVES

A first step in the development of a forecasting design is an assessment of the implications of different methodologies. Our conception of reality is often misleading, and perceptions which seem objective may often be subjective. The distortions imposed upon our understanding of futures are inevitably transmitted through our use of methodology, unless sufficient care is taken to render the assumptions underlying the forecasting mode employed as explicit as possible. Often, too, an unrecognized but symbiotic relationship exists between personal values and biases, on the one hand, and the assumptions of methodology on the other.

At the most general level of abstraction, one can distinguish among forecasting methodologies in terms of the degree of explicit theory employed, the use of systematic procedures, the use of empirical data, and the purposes of the forecast. Again, how we look at the future determines in large part what we see. Ranging from the least to the most systematic, alternative forecasting methodologies include (1) normative forecasts, (2) exploratory projections, (3) model-based forecasts, (4) simulation-based forecasts, and (5) artificial

intelligence. The more precise the methodology is, the greater are the probabilities of obtaining valid forecasts, but at the same time, the greater are the forecaster's inputs into the forecasting design. And, when reducing uncertainty itself involves working with uncertainty, precision becomes a liability and not an asset.

Normative forecasts involve specifying the " ought " rather than the " is." They are based on implicit theory, little or no use of formalized methodology, and almost no resort to systematically collected data. Such forecasts amount to little more than undisciplined speculation about futures, and as yet, no formalized procedures exist by which such forecasts can be undertaken systematically and their reliability increased. The purpose of normative forecasts is to identify those conditions that lead to desired outcomes rather than to develop and use models for systematically investigating intervening processes. The result is often in the nature of self-fulfulling prophecies. A group-opinion procedure to obtain images of such futures—known as the Delphi method—contains a built-in regression toward the mean, in that consensus is obtained at the expense of precision and verification through reality checks.[7]

Slightly more systematic forecasting methods include *exploratory projections*, trend extrapolations, or heuristic forecasts. Such forecasting modes represent a step in the direction of explicit theorizing and the use of systematic methodology. But they are appropriate for forecasting only those conditions which do not change or change very gradually and as such are relevant only to a very small subset of international relations. Such forecasting modes cannot account for reversals, system change, or the identification of points at which critical decisions may contribute to system change. Demographic trends, ecological factors, and international transactions such as trade, business factors, and the like, can be forecasted in such manner, but micro factors, such as the nature of tomorrow morning's decision, or macro factors, such as the probabilities of war and violence, cannot be satisfactorily investigated with trend projections or exploratory forecasts.[8]

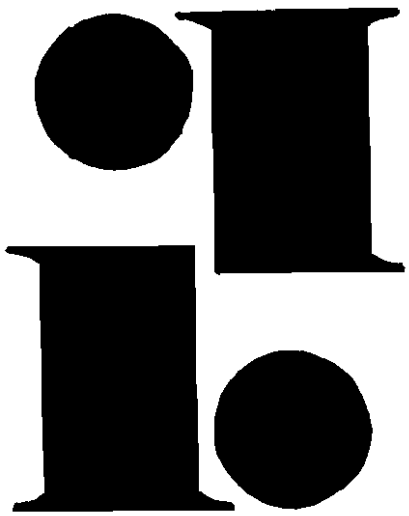
Forecasting methodologies predicated upon the *explicit use of formal models*—descriptive, explanatory, or predictive—represent further development in the direction of precision and reliability.[9] Such models may be statistical or functional, based on parameter selection rather than parameter estimation, based upon empirical data, or based on decision analysis and Bayesian algorithms. Each type of model alerts the forecaster to different aspects of reality.

Statistical models, based upon explicit theory, formalized methodology, and empirical data, accommodate a primarily unidirectional view of reality and of causality, although in some cases mutual causation can also be accommodated. *Functional models*, where the purpose is to identify the interrelationship among components of a system rather than its stochastic properties or the probabilistic interdependence of its components, are based on a view of reality that explicitly rejects simultaneous causation and incorporates only the unidirectional causal perspective. Such forecasting modes also make little use of empirical data for the development of the underlying model (the emphasis being upon obtaining a stable system structure), and empirical data are therefore not a necessary requisite for the forecast. Statistical and functional forecasting models are complementary, although most investigators tend to employ one method or the other rather than employing them in supplementary fashion, and for this reason their joint use for forecasting is yet to be explored.[10]

Decision analysis (Bayesian statistics), another approach to uncertainty, confronts the unknown directly rather than through inferences based upon conventional probability distributions, but it involves some a priori specification of the structure of the problem. In the Bayesian view of causality conditionality prevails, and mutual dependencies are accommodated within a context of contingencies which serves to provide bounds and constraints upon uncertainty.[11] The same general assessment may be made of *Markov processes*, which are statistically based, involve explicit use of theory, empirical data, and systematic methodology. The Markov view of causality, also unidirectional, holds that movements from one state or condition to another can be specified; and the probabilities associated with such movements and transitions become the purpose of the forecast. But the movement is only in one direction. Reversals and sharp changes cannot be taken into account. Thus, if the forecasting problem at hand can be meaningfully investigated within such bounds, Markov processes are likely to be a reliable mode of forecasting. To date, however, little or no work has been done employing either Bayesian or Markov models explicitly in a forecasting mode.[12]

Simulation analysis for forecasting purposes is a sophisticated and complex approach to uncertainty

analysis and to alternative futures. There are many modes of simulation, and they all involve some explicit use of theory, some formal model, and some systematic procedure for drawing inferences about the nature and behavior of the system in question. All-man simulations are particularly useful for the analysis of decision making under crisis conditions; considerable inroads have been made in such simulations. All-computer simulations are most appropriate for highly analytical approaches to the unknown, but by their very nature they abstract from reality that which is generic and systematic, and there is almost no way to incorporate or account for the idiosyncratic or erratic[13] Unfortunately, the erratic often governs the outcome of international realities. At one level of analysis, however, all-computer simulations are extremely useful for forecasting, but at another,



their relevance is less apparent. The more immediate the problem, the higher the costs associated with an erroneous forecast, and the more idiosyncratic a system's characteristics, the less advisable it is to rely upon an all-computer forecast. In the last analysis, however, the choice of a simulation-based method for forecasting depends upon the purpose of the forecast. Without a clear statement of purpose, it is difficult to determine which of the approaches to forecasting is most suitable to the issues at hand.

The most recent addition to the repertoire of systematic analysis in the social science is *artificial intelligence*, a mode of all-computer simulation developed for the analysis of adaptive behavior and learning, for investigating endogenous system change and self-changing structures, for the analysis of the influence of precedence upon behavior and decision making, and for the analysis of the implications of accumulating experience in any environment. So far almost no attempts have been made at employing artificial intelligence in a forecasting mode. Such a venture would require a successful adaptation of systematic modes of analysis to forecasting—particularly those noted here—so as to generate self-changing probabilities associated with system behavior and system adaptation. Methodologically, at least, artificial intelligence is a challenging approach to forecasting, particularly when applied to macro-level questions concerning system behavior and long-range forecasting, as well as to the ambiguities associated with tomorrow's outcomes. But much work remains to be done before we can reliably evaluate the usefulness of artificial intelligence to international relations forecasting. This is undoubtedly the most profitable of investigations for expanding our knowledge of forecasting modes and methodologies.[14]

The phenomenological critique of the social sciences can aid the assessment of alternative approaches to forecasting by pointing to the complexities at hand. This critique assumes that what we often view as objective within a social science context is little more than the projection of subjectivity, perception, and cognition upon external realities and that such projection in itself creates that reality which we so judiciously seek to investigate through " objective " and " reliable " modes of analysis. To date the conventional wisdom in the behavioral and social sciences has not deemed it necessary to confront the phenomenological critique directly nor to specify the ways by which we might counter such charges. The fact remains, however, that all respectable social scientists do indeed claim to guard against such distortions specified in the phenomenological assessment, but little is in fact done.[15]

The phenomenologists levy against the most systematic social scientists the same kind of criticism that methodologists raise against normative forecasters, descriptive scholars, or traditional analysts. This formalized reaction to conventional social science raises two issues which are central to any forecasting exercise. One involves anchoring the forecast, and the other pertains to the extent to which forecasting is a reality-creating enterprise

V. ANCHORING A FORECAST: THE CHOICE OF AXIAL PRINCIPLE

The realities we perceive are very much conditioned by the methodologies we employ, and for operational purposes the forecast is always anchored in some initial conditions.[16] The anchor provides the operational bounds and limitations of the forecast, as well as the expected range of permissible behavior of the system investigated. The choice of anchor is thus the first step in the actual conduct of a forecast.

Anchoring a forecast involves holding constant at least one—perhaps more—critical dimensions of the future while allowing the others to vary accordingly and observing the implications of the forecast. A special case of anchoring involves holding all relevant aspects of the future constant and allowing one to vary. The actual selection of an anchor depends almost entirely upon the purpose of the forecast.

In practice, forecasts can be anchored in at least four different types of initial conditions.

First, with *structural anchors*, a forecast is predicated upon careful specification of the structural attributes of the system in question, and then the research design observes the implications of these structural characteristics under different sets of contingencies. In international relations, such structural factors include demographic and ecological considerations, aggregate resource profiles and flows, institutional and governmental factors, and so forth. The purpose of forecasting in such cases is to inquire into the alternative behavioral correlates which might accompany these structural factors under different conditions. Second, the forecast may be anchored in *probabilities and degrees of possibilities*. The inquiry would then be grounded in alternative probability structures or distributions, and the objective would be to inquire into the behavioral or structural correlates associated with outcomes of different probabilities. The focus here would be the possible, or the likely, as opposed to the desirable. Third, a forecast can be anchored in *preference structures*. When the forecaster's purposes are normative, the anchor is in the nature of preference ordering, where the " ought " is specified as the initial anchoring condition, and the object is to identify the behavioral correlates of such preferred outcomes and, hopefully, the means by which these might be realized. Under ideal research situations, a combination of preference specification and an identification of the paths to make the " ought " congruent with the " is " would be a feasible research objective. Another, more conventional, anchor involves *trends and projections* of some aggregate systematic factor, which is generally characterized by linear attributes; the forecast is then assigned to observe the implications of the trends in question. By far the greatest thrust of contemporary forecasting is of this nature. United Nations projections regarding future population involves projections of this kind; the task of international relations forecasting is to specify the implications of such projections for global and regional politics, or for particular structural, political, or behavioral conditions.

In sum, then, forecasts anchored differently look different and say different things. The choice of an anchor is difficult to make, for often one is interested in more than one anchor, thus complicating considerably the task at hand. Nonetheless, the selection of an anchor is a necessary step toward assigning a specific meaning to the realities we seek to forecast.

Are some anchors better than others? It depends. One's purpose in forecasting determines the selection of anchor. In the last analysis, however, a judicious choice of anchor is critical to the forecasting enterprise, and the forecaster should be prepared to defend his choice. Without sound justification for its anchor, the forecast loses much of its critical validity.

VI. PULLING THE PIECES TOGETHER: THE TIME PERSPECTIVE AND THE PURPOSE OF THE FORECAST

The plethora of issues discussed so far raises further queries. How can we make use of these different types of forecasting methodologies and different anchoring principles in ways that would enhance our abilities to forecast? Are some forecasting modes more applicable to certain problems than others? How can different forecasting methodologies be employed in complementary fashion? In short, how do the pieces fit together?

To answer these questions, we must consider (1) the purpose of the forecast, and (2) the time frame within which the forecast is undertaken. The purpose of the forecast determines the initial requirements of the design and identifies the variables of interest. A forecast aimed at planning and policy making will focus primarily upon

manipulable variables that can be controlled by the policy maker. A forecast which aims to gain insights into the structure of international systems in the next century will focus primarily upon aggregate structural conditions which are stable over the short term and therefore not readily amenable to manipulation. In the first case the emphasis is upon short-term forecasting; in the second, it is upon the long-range. The methodologies and the requirements of the forecast differ, as do the criteria employed for assessing its outcome. The variable of time can serve as an important organizing device around which different forecasting modes converge. An analysis of the past through retrospective forecasting helps us think about the future and about ways to orient our analysis of short-range and long-range futures. Different forecasting methodologies suit different time frames. Figure 1 below indicates the relationships of forecasting mode to time perspective, and the following discussion illustrates how different forecasting methods apply to different time frames and different forecasting purposes.

Retrospective forecasting (or forecasting over known data) has great import for international relations, where the past represents a rich laboratory of experience and data for thinking about futures. For forecasting large-scale system change and development, the history of international relations over the past several centuries contains myriad examples of system breaks (such as wars), integrative processes (such as nation building, alliances, and overall community formation), global transactions (such as international trade and investments), global confrontation and cultural clashes (such as colonialism, classical imperialism, or ethnic hostilities), and so forth. The past may not hold the key to the future, but the past once was the future. Viewed in this fashion, therefore, retrospective forecasting assumes paramount importance.

Long-range forecasting (for futures in the time frame of 15 to 50 or 100 years from now) can best be approached through system dynamics or econometric analysis. Both of these methods can also be employed for analysis of short-range outcomes, but their capabilities particularly suit long-range forecasting. System dynamics, a functional approach to the study of nonlinear, large-scale social systems, is based on feedback loops and the interdependence of levels and rates of change. By contrast, econometric analysis, a statistical approach to modelling, is based primarily upon linear approximations of complex systems and parameter estimations as a prerequisite of forecasting. Each has advantages and disadvantages; the choice depends upon the problem at hand, the investigator's conception of causality, his familiarity with the system in question, how much data are needed and what kind, and finally, how robust the coefficients are to be. These queries all assume that the investigator wishes to employ explicit theory, systematic procedure, and empirical analysis. Normative forecasting, or Delphi procedures, provides nonrigorous alternatives for long-range forecasting.

For *short-range forecasting* (from tomorrow morning to three or five years from now) decision analysis, Markov processes, and events analysis are three appropriate techniques. These methods can also be used for long-range forecasting—the algorithms do not preclude this possibility—but their capabilities (noted below) are uniquely suited for analysis of short-range outcomes.[17] If the problem at hand involves reducing uncertainty associated with decision making, the Bayesian approach to short-range forecasting, which accommodates idiosyncratic factors directly in the research design through analysis of subjective conditions, will serve best. If the problem at hand involves depicting changes over the short range, the Markov models approach to forecasting, which is designed to assist in identifying the probabilities associated with transitions from one state to another, is the more appropriate. A third approach to short-range forecasting, events analysis, enables the forecaster to develop reliable early warning systems which generate signals of future events long before the events come to pass. Early warnings with respect to the outbreak of international violence are aided by tensiometers or conflict barometers. If we develop reliable measurements of international scope, we could forecast future outcomes more systematically than has been done so far. This kind of forecasting is still very experimental, but recent developments suggest its potential promise.[18]

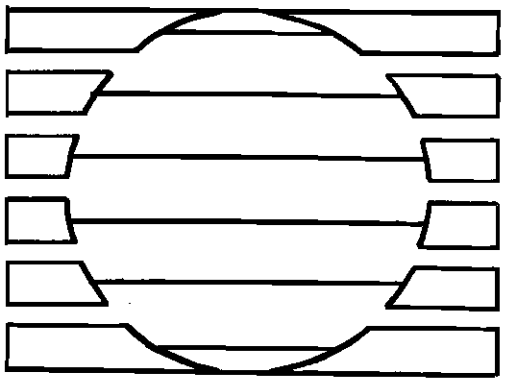
One of the most frequently used instruments for early warning is the generic inter-nation interaction scale designed to tap the implications for violence imbedded in actions and interactions among nations. There are many versions of this scale. The most commonly used one has interval properties which greatly facilitate statistical analysis, and has been employed in analysis of events and actions for forecasting purposes involving systematic

identification of the line of normal relations among states to identify significant departures from normality. Because normal relations among states are situation specific, this approach to forecasting takes into account the uniqueness of the situation and related idiosyncracies. For example, the line of normal relations between Canada and the United States is probably around level 2 or 5 on a 13-point conflict scale (with 1 indicating cooperation and 13 violence), while that between Israel and the Arab states is undoubtedly closer to 11 or 12. We cannot therefore apply the same criteria for forecasting probability of conflict between the opposing parties, and the forecast must take into account the difference in these two situations. If U.S.-Canada interactions were to jump to a mean of 8 on a 13-point conflict scale the implications would be quite different than if Arab-Israeli interactions were to converge around a mean of 8. In the first case, the forecast would point to greater propensities for violence; in the second, to a reduction of hostilities.[19] Although forecasting international events can be undertaken for analysis in the long as well as the short run, events analysis is perhaps best suited to short-range forecasting. It is possible, in this time frame, to acquire fairly sensitive indicators of subtle shifts in national behavior.

How then do we link short-range and long-term forecasting? How can we forecast tomorrow's outcomes while still keeping an eye upon longer range outcomes? No one has satisfactorily demonstrated the operational linkage between the two. We do, however, have some operational clues to this problem of *intersection between time perspectives*. The problem involves (1) defining the parameters of a situation and determining when variables become parameters and the reverse, and (2) identifying nonlinearities in the system and determining when nonlinearities become breakpoints and signal system change. We know that immediate short-range factors are imbedded in a larger societal context which is invariably conditioned as much by time as by habit, inertia, and social history. These conditions become the *parameters* of a situation in the shorter range. But in the long run, over years and decades, they change and take on new attributes and characteristics. Today's idiosyncracies become tomorrow's parameters. The forecasting problem is this: If we can identify the conditions under which variables become parameters, and if we can determine how and why this change takes place, then we would resolve the problem of moving from short-range considerations to long-range imperatives. The methodological task is to incorporate this information in the forecasting design so as to alert us to the probabilities of change in the system under consideration.[20] The other consideration in the intersection problem, *identification of nonlinearities and breakpoints*, involves the analysis of system breaks. A breakpoint represents a sharp change (which in regression analysis is exemplified by a change in the regression slope), but a nonlinearity indicates a gentler departure from linearity the nature of which can often be captured by conventional nonlinear functions. Nonlinearities generally represent a functional relationship among variables. Complex systems are invariably nonlinear. If we expect linearities, and we sensitize our forecasting tools to search for linearities, then we almost certainly will generate invalid forecasts. The world around us is complex and nonlinear and cannot be reduced to the simplistic approximations imposed by conventional statistical or intellectual tools. If we look only for linearities we may observe nonlinearities, and we will draw the erroneous inference that a system break has occurred, when the system may in fact be nonlinear but stable, regular, and exhibiting orthodox behavior. When it comes to the identification of breakpoints the situation is much the same; because there is a tendency in the social sciences to confuse breakpoints with nonlinearities when observing system breaks, we must guard against the erroneous inference that it is a system break. It may be so, but it may not.[21]

In international relations we tend to view a large-scale war as a system break. On the other hand, we consider changes in diplomatic representation, modification of trade patterns, or change in alliance structures more appropriately as nonlinearities or, alternatively, as discontinuities. But there are no hard and fast rules governing the assignment of meaning to these factors. In the last analysis, breaks and nonlinearities are situation bound, and monitoring for breaks or for nonlinearities becomes crucial to forecasting. The critical international sectors where *monitoring for breaks* has important implications for forecasting include demography and ecology, technological development and innovations, economic change, social and political departures from current patterns, cultural change and religious or ethical conditions. These are all large-scale macro characteristics which, in the long run, are variables in

any particular situation, but in the short range when change is imminent, become the parameters in question. It is also true, however, that when change is imminent, or when a break emerges, these factors are variable also in the short range.



It is desirable to distinguish between breaks due to quantitative changes and those due to qualitative change. For example, changes resulting from sudden increases or decreases in population may well have different effects upon a social order than breaks originating from a significant qualitative change, such as a new invention or technological innovation. This is an important distinction. The conjunction of qualitative and quantitative change is extremely challenging to the forecaster since the unknowns converge, thus compounding uncertainty. Where one looks for breaks depends almost entirely upon the problem at hand and the anchor of the forecast. It is also true that breaks in such systems characteristics tend to have spill-over effects in that their consequences are rarely contained, and the forecaster must take the ramifications into account.

Undoubtedly the most difficult problem for forecasting purposes involves the nature of the system *beyond* the break. For example, recent studies in quantitative international politics have traced the origins of conflict and warfare to increases in levels and rates of population growth in conjunction with imbalances in levels and rates of growth in technological development and access to critical resources. These aggregate societal factors provide the context within which day-to-day politics unfold and, in the long run, the parameters of a conflict situation where the belligerents confront each other in hostile stance. A large-scale war represents a system break. And the question is, how does the system change following such a break?

If we look at population, resources, and technology carefully, we might be able to put together the alternative scenarios upon which politics, governance, and structural considerations could be predicated. Students of political demography are beginning to investigate the consequences of war upon population dynamics in order to determine the nature of systems following large-scale breaks and to construct alternative futures based upon such analyses.

Since we know, for instance, that wars often affect the demographic composition of a state, which in turn affects the structure of the social order, we can introduce into our forecasting design some consideration for potential changes in demographic characteristics. The same must be done for the other parameters of a situation. If we developed some systematic procedures for recording expected departures from system behavior, and if this procedure were generalized to issue-areas other than population, resources, and technology, we might begin to construct forecasts of probable outcomes beyond system breaks.[22]

By combining the information and insights obtained through long- and short-range forecasting and their intersection, we can infer the types of decisions that would be made in different situations. By recording forecasting information along each of these time frames and according to the issue-areas of interest, we can then develop a two-dimensional matrix summarizing the relevant data and related inferences. In this way, a cross-impact method of identifying cumulative or interactive effects of departures from trends or expectations can systematically explicate some of the forecast's potential implications.

A comprehensive forecasting design along those lines would allow us to account for endogenous system change without any external intervention. The forecast itself would adapt to different time frames and to different levels of analysis; the design would, by its very nature, incorporate those decision points at which a system change is likely to take place. Forecasting capabilities of this nature would be predicated upon the least amount of intervention by the forecaster. This simple consideration will enhance the internal validity of the forecasting design in that factors exogenous to the forecast could not contaminate its outcome. It would then be easier to identify weaknesses in the

forecasting design and isolate problems resulting from intervention by the forecaster.

Figure 1 shows the critical factors for different stages in the development of a conflict situation and, by inference, the transformation of variables as long-range determinants of conflict to parameters in the short term. Also included in Figure 1 are the "islands" of international relations theory that most aid understanding of each developmental stage. This illustration pertains to conflict dynamics. But the same *rationale* is relevant to any other

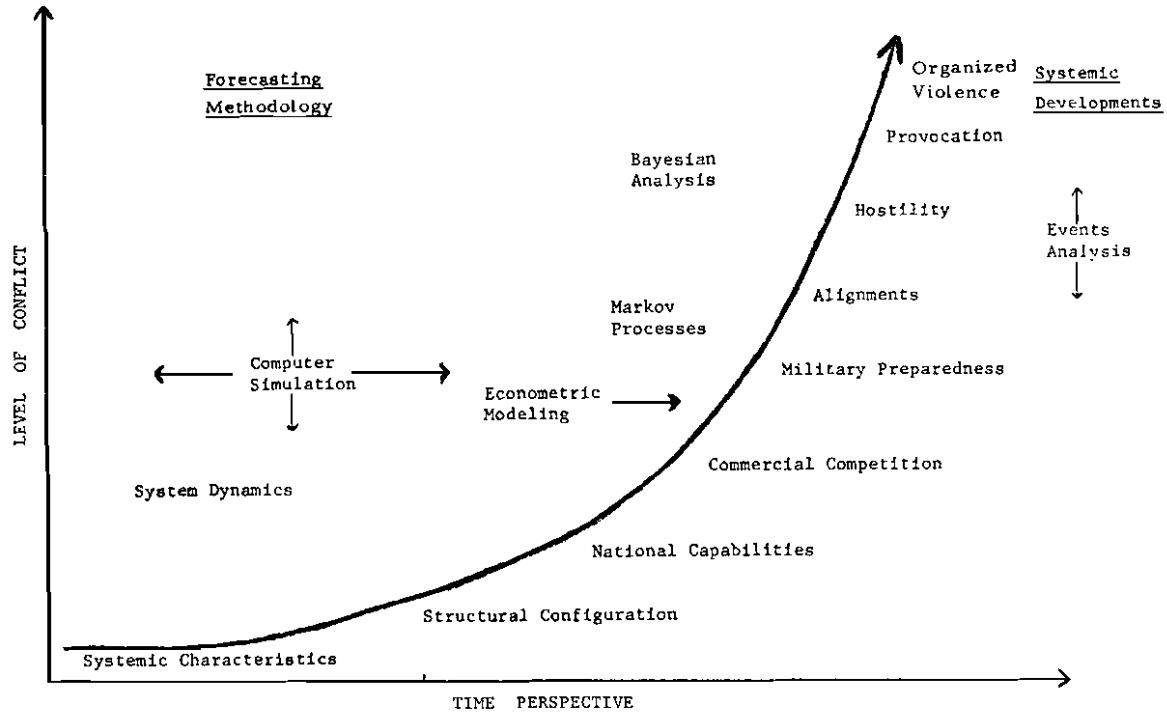


FIGURE 1 Integrating Forecasting Methodologies: An Illustration From Conflict Analysis.

issue or problem in international relations. When variables, theory, and methodology are juxtaposed, a more comprehensive picture of a design for forecasting international violence emerges. To date we have approached the different time frames separately, but the intersection problem is yet to be solved.

VII. VALIDATION, SALIENT DANGERS AND RECURRING ERRORS

When is a forecast good enough? How do we gauge the reliability of a forecast? What criteria do we employ for evaluating its performance? When reality is unknown, the success of a forecast rests upon some a priori set of criteria determined partly by theory and partly by the purpose of the forecast.

Despite our increasing methodological sophistication, certain dangers are common to all forecasting efforts. Some of these problems are particularly striking in international relations, where we have insufficient expertise to guard against common errors. An overcommitment to existing situations often means a refusal to evaluate unexpected findings and a tendency to place evidence upon data or upon problems and solutions of the recent past; a short memory appears to be one of the most serious problems characteristic of many forecasters.[23] Other recurring errors include a disregard for potential sources of change and an implicit assumption that all crucial innovations in international relations have already occurred. Most forecasters tend to adopt a position of persistent pessimism, or persistent optimism, or a random mixture of the two, without a solid underlying rationale. This situation amounts to the introduction of systematic bias in the forecast,

a danger that even the most sophisticated analysts find difficult to avoid.

Not unrelated are the distortions which arise from adopting a narrow focus upon specific issues without regard for possible ramifications. But the most common error of all is a tendency among forecasters to adopt a parochial view of their subject, resulting in an a priori emphasis upon certain variables that appear critical in one's own context—without adequate validation or reality check. This problem is especially pertinent in Delphi and normative forecasts.

At least three general sets of procedures exist for evaluating the performance of a forecast: (1) interrogation processes, (2) validation processes, and (3) comparisons of forecast outcome with empirical data. The first is most appropriate for technological forecasting; the second for forecasts based on statistical or empirical models, quantitative data, and systematic procedures; and the third for retrospective forecasting.

Interrogation processes of evaluation are based upon systematic queries concerning (1) the purpose or need of the forecast, (2) the underlying causes in terms of the forecast's objective and its basic causal network, (4) the extent of reliability of the information processed by the forecasting design, and (5) the general reliability of the forecasting enterprise itself.[24] Inferences about the validity of the forecast design can be drawn from the responses to these queries. This is a " soft " procedure in the sense that few external criteria of validity are involved in drawing inferences concerning the extent of built-in errors or biases. Nonetheless, such interrogation allows us to determine the extent to which the forecast is subject to the dangers noted above.

Evaluating forecasts through *validation procedures* involves comparing outcomes with some a priori set of criteria for determining the extent to which outcomes result from the research design or built-in biases and errors.[25] *Face validity* means the extent to which the outcome of the forecast appears reasonable to the educated public. Conventional wisdom, the only external judge, is often not the best source of validation. *Internal validity* means the degree to which the forecasting outcome coincides with the process and structure which has produced the results. Great inconsistencies or incongruencies between outcome and research design should be suspect, although such discrepancies might provide important clues for further research. Still other forms of validation involve classical *statistical methods* for evaluating the parameters of a model and the relative strength of determining variables. The criteria employed include a comparison of the outcomes of the analysis with the probability distribution to determine significant departures from chance. The more statistically significant the results, the greater the validity of the forecast, and the sounder are inferences about the future likely to be. Statistical validation is particularly applicable to the structure of a research design, interconnections among critical variables, and the causal network or underlying relationships. Conventional validation tools are fairly well established for model building and estimation, but much needs still to be done regarding the validity of a forecast.

The third major type of validation involves *comparing the forecasting outcome with empirical data*, a procedure that applies only to retrospective forecasting. History is a rich laboratory for forecasting over known data. Systematic comparisons of forecasts based on different methodologies—with different costs and different benefits—allow us to evaluate the extent to which forecasting outcomes are conditioned by the methodology in question.

Systematic assessment of the forecasting outcome requires strict non-interference with the forecasting process; otherwise it is not possible to isolate the inferences drawn on the basis of the forecast *outcome* from those based on the effects we have imposed upon the forecasting *process* itself. The two are interconnected. But we must then validate both the process and the outcome. In the last analysis, however, the question, valid for what? depends upon the purpose of the forecast. And the type of validation employed depends upon the nature of the problem as well as the extent of reliability needed.[26]

VIII. THE PROBABLE AND POSSIBLE: SOME POLICY IMPLICATIONS OF FORECASTING

For policy purposes we must identify the manipulables in social and international systems, the costs of manipulation and social intervention, and the choice points or the sensitive areas in a system. The relevance of a policy forecast to decision making is directly proportional to the extent to which we take these three issues into account.

The *manipulables* in social and international systems are those factors which can be changed by

policy intervention. Some variables can be manipulated on short order, others cannot. And the *cost* of manipulation is generally related to the ease with which effective intervention can take place. Accurate assessment of the *choice points* in a system involves identifying those areas most sensitive to manipulation—given the constraints of a priori cost. Obviously it is more difficult to change aggregate societal factors like population than variables like a budgetary allocation and the assignment of national priorities. And the costs of intervention always directly affect the type of policy adopted.

Forecasting must precede planning; a good plan requires a good forecast. Forecasting assigns likelihoods and probabilities to alternative futures, and planning defines parameters of future action. Planning is an attempt to confront alternative risks and to assure that any risks taken are the right risks, while forecasting involves reducing uncertainty around the implications or consequences of planning. Thus, for the forecaster concerned with the accuracy of a forecast, related policy implications become apparent when alternative outcomes crystallize. However, the unanticipated consequences of planning may often have implications not identified by the forecast. *Operationally*, both forecasting and planning aim to reduce uncertainty and specify risks. A society's allocations to research and development indicates its degree of concern for converting uncertainty into potential risk and potential risk into desired risk.

There are at least two types of forecasting for policy analysis. One involves *alternative budgeting*, that is, examining ways to pursue national priorities through different allocation systems. This type of inquiry assists us in looking at the implication of alternative allocation formats and alternative structures of national priorities. When viewed in forecasting mode, alternative budgeting processes provide an operational handle on critical manipulables. The most readily manipulable factors in any society are budgetary allocations.[27] The other mode of forecasting for policy analysis involves *alternative contingency analysis*, that is, systematic confrontation of " what if . . . ? " questions by " if . . . then . . ." answers and associated costs and benefits. The higher the costs associated with alternative risks, the more likely will policy involve contingency analysis. These " if . . . then . . ." queries are also central to forecasting and policy analysis in econometrics, system dynamics, or subjective probability modes.

Once the forecasts are made, the next task is to identify possible ways to realize them. These paths which are associated with alternative contingencies or alternative allocations of national priorities are a critical aspect of forecasting for policy purposes. Strategic analysis and defense policy are generally of this nature.

One of the most pressing problems of forecasting for policy and planning involves bureaucratic politics. Deviation from norms and expectations are not encouraged in bureaucracies, and a built-in regression toward the mean gives rise to many of the forecasting errors and salient dangers noted above. These errors generate distortions which invariably affect the outcome of the forecast and, by extension, the planning process. The bureaucratic politics of forecasting reflect the tensions between the policy planner-bureaucrat and the forecaster-scientist generated by the structural characteristics of bureaucracies. Those in government who need forecasting most, are often least willing to accommodate to the requirements of forecasting or to acknowledge the implications of a forecast.[28]

IX. INTERNATIONAL PERSPECTIVES AND GLOBAL POLITICS: THE ROLE OF FORECASTING IN SHAPING THE FUTURE

Many of the theoretical and methodological issues noted above can be reduced to a choice between forecasting trends versus forecasting events. The two are not mutually exclusive. Often forecasting one assists us in forecasting the other. Some interdependencies in international relations allow us to forecast events through trend analysis just as we can forecast trends through the analysis of discrete actions and events.

Trend analysis assists in reducing uncertainty surrounding the probabilities and implications of particular outcomes. Trends provide the context within which events gain meaning in the short range. Patterns of events eventually become trends and constitute the context within which new events take place in the long run. Because of this interdependence, the distinction between trends and events loses much of its significance. When discrete political, economic, and social events are placed within an international context, trends and events provide eomplementary approaches to the unknown. And when the forecast is anchored in one particular aspect of reality, the entire exercise is then brought

to bear more sharply upon the purpose of the forecast.

All this is to suggest that contingent explanations of alternative futures is not only possible but scientifically desirable. The "what . . . if?" question is thus endemic to every forecast, and the forecaster must confront it directly (theoretically and methodologically) to produce a sound design.

In conceptual terms at least, forecasting in itself involves creating the future or making forecasted outcomes more probable. Reality begins in the minds of men; and policies which make this reality increasingly probable begin in the forecasts we make about the unknown. The mere act of forecasting does not make the forecasting outcome likely, but the probabilities of outcomes becoming realities of the future increase, particularly if that reality appears desirable and/or is predicated upon today's unknowns. And when this importation of today onto tomorrow is undertaken as a matter of course, the probabilities of erroneous forecasts and the occurrence of salient dangers increase accordingly. The use of a priori criteria for evaluating the forecasting design, albeit for its development in the first place, becomes critical to the forecasting exercise, and the role of international relations theory assumes paramount importance in highlighting the issue areas of potential interest and providing some guidelines for the development of the forecasting design.

Five substantive issue-areas have critical political implications for forecasting global futures: (1) the characteristics and attributes of dominant actors in the international system, (2) the conditions under which international systems change and transform, (3) the role of nonterritorial actors in international politics, (4) the dictates and imperatives of territorial actors, and (5) the view of the international perspectives from below as perceived by the poor and the nonprivileged. In addition, any forecasting design which focuses upon any of the international questions noted at the onset must recognize demography and ecology, governance, technology, resources, politics, and culture—all critical structural dimensions of international systems.[29]

The *dominant actors* of today include the United States, the Soviet Union, China, Japan, and some West European states—depending upon one's criteria. Since it is a truism that "might makes right," forecasting the membership of the dominant actor group in future international politics amounts to more than simply a numerative exercise. Dominant powers tend to control the rules of the game, just as they control the structure of the international system and draw the bounds of permissible behavior. Dominant actors set the pace for world culture and institutionalize its attributes and characteristics. Who the dominant actors of tomorrow will be can be inferred from current levels and rates of technological development, from levels and rates of population growth, from levels and rates of economic growth, and from the extent to which they are today engaged in violent behavior which depletes resources and taxes overall capabilities. The simple ratio between the loads upon a system and its capabilities provides important clues into the probabilities of attaining (or maintaining) dominant-power status in years to come.[30]

The dominant *world culture* of today is a western-scientific one. The characteristics of tomorrow's world culture can be inferred from past and present cultural attributes. Without the benefit of a sophisticated forecast, one could anticipate the persistence of scientific values, but it would be foolish to assume that such values would not change and adapt to emerging world problems and global realities. Change is already apparent, given current queries about the wisdom of continued growth. Further reassessments will undoubtedly continue.[31]

Forecasting the *transformation of the international system* is always of major concern to theorists of international relations. Although we can successfully explain changes in the international system after they have occurred, we cannot as yet identify clues of potential transformation. Again, careful monitoring of changes in the critical international dimensions noted above provides important insights into possible structures and future outcomes, but these insights must be formalized and incorporated systematically in a forecasting design.[32]

The prevalence of *nonterritorial actors* in today's international system—and proliferating structures and functions—is one of the most distinguishing characteristics of the present global system. We now define certain problems as being global in nature—such as environmental control and human rights—and approach them from a global perspective. If such developments continue, nonterritorial actors will invariably assume a greater role in international politics than they do today. The prevalence of such actors depends upon the extent to which they can avoid threatening territorial actors and national security. The wider the definition of "national security," the less

probable is it that nonterritorial actors will assume permanent status in the international system. Nonterritorial actors are becoming institutionalized, but this process will not necessarily persist in years to come.[33]

Despite the high degree of penetration among states and the increasing importance of nonterritorial actors, *national territoriality* remains the guiding principle of the day. The effect of dominant actors on all other actors in the international system is becoming increasingly pervasive (reinforced no doubt by increasing communication and military technology and by control over resource extractive techniques), providing a paradoxical situation in a system dominated by the contrast between the myth and the reality of national sovereignty for nondominant actors. In the last analysis, the effective exercise of sovereignty depends upon the capabilities of a state in question, upon the issue-area, and upon the extent to which other states honor conventional sovereignty. In practical terms, therefore, the effective sovereignty of dominant powers is always more extensive, greater, and more institutionalized than the sovereignty attributed to nondominant actors. Again the explanation is simple: in international politics, might does indeed make right.[34]

The *view from below*—the international system as perceived by nondominant actors—provides important insights and information into the potentials for system change and transformation. This issue is conventionally treated as involving a conflict of interest between the status quo and non-status quo powers, and between the satisfied and less satisfied states, not to mention the common dichotomy between rich and poor.[35] The critical question for forecasting is not whether such differentials are likely to persist, but what the implications of these differentials are likely to be, for whom, in what manner, and why. We can obtain some initial answers to these queries by looking at the international system from the perspective of less privileged actors, while taking into account their attributes and characteristics and their role in shaping the major international questions (as noted in the first section of this paper).

An analysis of the view from below may be anchored in either (1) preferences and values, such as liberal humanitarian values of greater equality, justice, and so forth, or (2) hard realities of power politics. In the first instance, the inquiry may be motivated by the search for better patterns of international relations, ones which might distribute scarce goods more equitably, perhaps on a per-capita basis rather than on a per-power-unit basis. In the second instance, the hard reality that most of the mineral and energy resources critical to industrial processes are located in less developed countries spurns new interests in examining the societal and political contexts within which deposits of needed resources are located. Whatever the anchor may be, the view from below will become increasingly important to international relations forecasting.

X. CONCLUSIONS: CRITICAL IMPERATIVES FOR INTERNATIONAL RELATIONS FORECASTING

The most critical imperatives for forecasting involve managing social complexity and the explosion of knowledge, and incorporating existing data about social and political systems in ways that are parsimonious, theoretically useful, and methodologically sound. We must now formulate developmental constructs for thinking about futures and for orienting our inquiries into the unknown.

Many years ago, Harold Lasswell presented a verbal model of technological society in military stance which he termed the "garrison state." Lasswell depicted the characteristics of such a society and suggested ways by which we might think about the military implications of complex social systems.[36] Years later, Christian Bay presented an analysis of some of the conceptual requisites of human freedom and presented ways by which we might think about the significance of freedom in complex systems.[37] Later still, Arthur Stinchcombe put forth a summary of the ways by which we might think of the organizations and complexities of social orders and human behavior.[38] And many others have added important insights to the existing repertoire of constructs for thinking about human societies and social behavior. There have even been some attempts to apply such constructs to the analysis of international politics. But these have been disparate and disjointed. We have barely begun to scratch the surface.

Perhaps the most useful contributions in terms of systematic thinking about complex systems and potential applications for international relations forecasting have been made by Hayward R. Alker and J. W. Forrester. Each, in his own way, has presented us with novel ways of thinking about international relations and has put forth a set of

analytical constructs which will undoubtedly have great effect upon forecasting efforts for years to come.

Alker (1969) has summarized the costs and benefits of different statistical approaches to social behavior. His survey was not carried explicitly to cover the forecasting capabilities of various statistical algorithms, but the implications are clear and the groundwork has been laid for extending this analysis to forecasting. The same may be said of Alker's first major effort of this sort, in which he attempted to explicate the mathematical implications of integration theory and various strands thereof. Again, the groundwork for extending our thinking about integration to forecasting analysis of future outcomes has been laid. We are now confronted with the task of developing forecasting designs predicated upon these meticulous expositions. Hayward Alker's papers highlighted directions for further research. We must now extend such work into forecasting.

The controversial volume by Jay Forrester entitled *World Dynamics* represents another important contribution of thinking about, and forecasting, social and complex systems. Forrester's work represents a nonstatistical approach to the analysis of complex systems predicated on functional relationships and based on feedback loops and delay structures, ranging from simple to complex lags. The shortcomings of this approach to complex systems have been discussed extensively elsewhere.[39] Here we note only that the nonstatistical nature of the analysis provides a drawback of major importance: for forecasting purposes, explicit recognition of the role of chance and of uncertainty is critical. We must now introduce a statistical perspective within this system dynamics framework—one that would allow the analyst to generate critical functions from empirical data, validate these by application of the conventional statistical tools, and then proceed to project the interdependencies into the future, real or retrospective as the case may be.

In a methodological vein, therefore, the critical imperatives in international relations forecasting involve pulling the pieces together, assessing the costs and benefits of alternative ways of viewing the future, and identifying those problems that are best examined by one methodology rather than another and one mode of forecasting rather than another. Second, analytical and methodological integration is yet to be done. In a theoretical vein, the task is one of imagination, exploration, and disciplined speculation about future outcomes—much as Lasswell, Bay, and Stinchcombe, among others, have done. These are steps in the right direction, however incomplete, tentative, and preliminary they now appear to be.

Where do we go from here? We now realize that certain theoretical, methodological, and substantive requisites for forecasting in international relations must be attended to in any forecasting design. The following requisites provide sound direction for further developments in the area of forecasting.[40]

1) We must always adopt a dynamic orientation toward the future and not a static structural orientation. Change is unquestionably difficult to think about and account for, but the real world is ever changing, and we must confront this reality directly. The present provides intellectual blinders when thinking about futures. But these blinders are not insurmountable.

2) We must be aware of the implications of the questions we raise, the methodologies we employ the assumptions upon which they are grounded, and the values we hold. Often the definition of the problem is made in terms of implicit values and premises. An essential prerequisite to forecasting is a clear explicitation of underlying premises and preferences.

3) We must consciously try to clarify the nature of the gap between things as they are (or will be) and things as they ought to be (or should be). We commonly confuse the " is " with the " ought." A sound analysis of potential futures will not be served by this confusion.

4) We must recognize that the images of the future, as well as the models we employ to think about futures, are both constrained and conditioned by our understanding of the present and the past. Our positions in social and international stratification condition in large part our definition of problems and our view of the world. We would be mistaken to assume that our perceptions mirror " reality."

5) We must attempt to maximize the relevance of the intellectual tools at our disposal. Substitution of space for time may assist us in coping with the issues of change, development, and adaptation to structural or systematic transformation. The past or the present at one point or location or issue-area may serve as a model for the future at another point, location, or issue-area.

Substitution of space for time is common practice among development analysts, but we have not yet begun to exploit this possibility for thinking about futures.

6) We must consciously seek to import the future into the present. Social designs and assessments of the implications for the present if certain futures were realized and of the implications of the future if certain presents persists must be actively considered as part of the forecasting exercise as adapted to the particular problem at hand or issue-area of concern.

7) We must be willing to make possidictions, that is, prophesy the possible. Possidictions involve systematic evaluations of what present trends are likely to produce, assessments of ranges in expected outcomes, and expectations of the alternatives associated with each potential outcome.[41] And we must begin to specify how we get from here to there. Making possidictions can also be viewed as a means of preventing things from happening. Possidiction is the forecaster's contribution to planning. The planner's contribution to forecasting lies in the area of problem solving. The conscious selection of alternatives (or preferred) futures and a systematic explication of the road from here to there is the essence of planning. The planner suggests how preferred futures might be realized; the forecaster delineates the structure of alternative futures.

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NOTES

1. See Habermas (1968) for a discussion of issues revolving around the notion of technocratic hermeneutics. The notion of liberative prediction comes from the classical behavioral and social science literature.
2. See especially Bell, Mau, Huber, and Boldt in Bell and Mau (1971) concerning the interconnections among these sets of beliefs. Their discussion of these factors is more elaborate than noted here, but there is very little analysis of the implications of the *contents* of these beliefs.
3. The most recent and complete synthesis of the role of theory in social science research is found in Deutsch (1972). The following paragraph draws upon Deutsch's survey of the role of theory and the discussion in this section extends the arguments further.
4. The idea of " islands of theory " is common in international relations and is attributable to Harold Guetzkow, who has argued many years ago that the most profitable approach to theory building in international relations is through empirically based, piecemeal, analysis of empirical relationships, and that through limited efforts of this nature will develop " islands " of verifiable knowledge. This view of theory building is now part of the orthodox behavioral approach to systematic study of international relations. See Guetzkow (1950 and 1969).
5. See Rosenau (1969) and Alker and Bock (1972) for a survey of recent thinking in international relations and Bobrow (1972), Whiting (1972), and Young (1972) for a critique of novel approaches to the analysis of international politics.
6. The entire volume edited by Ando, Fisher, and Simon (1963) is devoted to issues of this nature. It is surprising that few students of international relations have seized upon these ideas in the course of systematic inquiry.
7. See Dalkey (1969) as one example of the Delphi method. There are many others, as exemplified primarily in RAND publications. In the last analysis, it may well be that this approach to forming group opinion is more an exercise in the dynamics of group behavior than it is a systematic approach to forecasting. For applications of Delphi procedures to technological forecasting, see especially Martino (1972, chapter 2). The references in Martino indicate the extensive literature on this subject.
8. For a survey of trend analysis techniques, see particularly Bell (1964) and Brown (1963). For applications to technological forecasting, see Martino (1972, chapter 5).
9. See especially Christ (1966) and Laponce and Smoker (1972), among others.
10. See Choucri, Laird, and Meadows (1972) for a system dynamics formulation of theoretical relations, which were specified initially in statistical terms in Choucri and North (1972) and in econometric terms in Choucri (in press).
11. See Ashley and Choucri (forthcoming 1974) for the application of Bayesian analysis to forecasting in international relations, especially to the analysis of conflict situation. See also Ben-Dak and Mihalka (1972) for applications of Bayesian analysis to peace research. For a general survey, see Holstein (1970).
12. Zinnes and Wilkenfeld (1971) have provided some initial illustrations of applications of Markov processes to the study of international conflict. See Ross (forthcoming 1974) for adaptation of Markov modelling to forecasting in international relations.
13. See Laponce and Smoker (1972) and Inbar and Stoll (1972). Also see Leavitt (forthcoming 1974) for a critical survey of applications of computer simulation to forecasting. For a combination of man-computer simulations see Guetzkow (1969), Smoker (1968), and Hermann and Hermann (1967). For recent applications of simulation approaches to political analysis, see also Coplin (1968); and for application to crises in foreign policy, see Hermann (1969). For an extensive compilation of recent works

on simulation in the social and administrative sciences, see Guetzkow, Kotler, and Schultz (1972).

14. See Alker and Christensen (1972) for the first application of artificial intelligence thinking to forecasting in international relations.
15. See Habermas (1968) for extensive treatment of such issues.
16. I am grateful to Michael Washburn for clarification of the role of an anchor in the forecasting design. Implicit reference to anchor conditions is found in Bell and Mau (1971).
17. See Azar (1970a) for a summary of events analysis and Azar (forthcoming 1974) and McClelland (forthcoming 1974) for applications of events analysis to forecasting in international relations. Choucri and North (1973) and Choucri (in press) provide applications of events analysis to retrospective forecasting in international relations within the context of econometric modelling and simulation.
18. The idea of an early warning system was first put forth operationally by Edward Azar, with particular reference to the Middle East conflict. See Azar (1970a) and (forthcoming 1974).
19. See Moses *et al.* (1967) for the first internation interaction scale and Azar (forthcoming 1974) for subsequent developments.
20. For an initial operational perspective upon this problem, see Choucri (in press) and Choucri and North (1972 and 1973). See also Azar (in preparation) for approaches to this problem in the context of events analysis.
21. It is instructive to note that a table function in system dynamics plays the same role in empirical analysis as does a coefficient in statistical inquiry or econometric modelling; however, the identification of breakpoints necessitates different procedures in each case. It is easier to isolate a breakpoint in statistical inquiry predicated upon assumptions of nonlinearity in variables and parameters than it is in functional analysis of dynamics, where the entire modelling exercise is predicated upon the isolation of nonlinear, complex relationships.
22. See Choucri and North (1973) for empirical and philosophical approaches to these questions. Professor Organski of the University of Michigan, Ann Arbor, is currently examining the demographic implications of conflict and warfare. This investigation should clarify the conditions under which violence results in significant demographic changes, and the implications of these changes for society, polity, and international relations.
23. These observations are based upon chapters 19 and 20 of Martino (1972).
24. See Martino (1972, chapter 21) for a discussion of the interrogation model for evaluating the performance of a forecast, particularly with respect to technological forecasting.
25. See Blalock (1960) and Blalock and Blalock (1968); see also Christ (1966), Johnston (1972), or any econometrics text. For a critical appraisal of the validation problem in international relations forecasting, see Hermann, Philips, and Thorsen (forthcoming 1974), and Hermann (1967); and for criteria for evaluating forecasts, see Bobrow (in preparation).
26. Different validation procedures are applicable to different forecasting modes and different computer-based approaches to complex systems. The contrasts in validation procedures employed for forecasting based on econometrics and forecasting based on system dynamics are indicative of the issues in question.
27. See especially Schultze *et al.* (1971) and Rivlin (1971) as illustrations of this type of analysis and associated imperatives.
28. See Allison (1969) and Allison and Halperin (1972) for evidence and analysis regarding bureaucratic politics and the organizational imperatives of institutions and organizations.
29. See Choucri (with Bennett 1972) for a critical analysis of the implications of population, resources, and technology for future international orders and related cultural considerations. The relations of population, resources, and technology to international conflict and violence are discussed theoretically in Choucri and North (1972), and a critical survey of the literature is presented in Choucri (1972). These are first thrusts into systematic exposition of the interconnections of political and nonpolitical considerations for thinking about global dynamics and international futures. See also the World Order Studies sponsored by the World Law Fund for institutional structural aspects of alternative futures. Bell and Mau (1971) provide insights into ways of thinking about futures.
30. The merging power configuration in the changing relationship between the United States and Japan in indicative of such developments as in the apparent rapprochement between China and the United States. Global politics among super-powers might increasingly involve a four-power international system: U.S., USSR., China, and Japan.
31. The recent volume *Civilization and Science* (1972) provides a philosophical perspective on the critical issues at hand and highlights some of the more intricate philosophical and scientific dilemmas of our time, particularly as related to alternative futures.
32. Rosecrance (1963) and Bozeman (1960) illustrate alternative approaches to systematic treatment of large scale transformations of international systems.
33. See especially Koehane and Nye (1972) and Kay and Skolnikoff (1972) for insights into these impending developments. Ruggie (1972) presents a different perspective upon future developments in global politics.
34. This statement is in tribute to Hans Morgenthau, who has long been ignored by behavioral scientists concerned with international politics. This oversight on their part testifies to the theoretical and intellectual paucity of the behavioral "revolution" in international politics. Greater attention to more "traditional" writings might provide the behavioral scientists with valuable insights into "real-world" dynamics.
35. To date little exists concerning the view from below other than the naive literature on political development which emerged from the structural-functional literature of the '50s and early '60s. One notable exception is the volume edited by Bhagwati (1972) and, to a much lesser extent, the series on political development sponsored by the Center for International Studies at Princeton University. The latter are nonempirical in contrast to the Bhagwati volume—the separate chapters of which are all empirically based.
36. See Lasswell (1941).
37. See Bay (1958), which stands as a landmark in political theory literature.

38. Stinchcombe (1968) combines empirical and theoretical approaches to social systems. See also Russett (1972).
39. The most notable critique of conventional wisdom in the social sciences from a phenomenological perspective include Thevenaz (1962), Husserl (1965), and Natanson (1963) among others.
40. These observations draw upon Bell and Mau (1971, pp. 6–44).
41. The term " possidiction " is employed by Bell and Mau (1971) and attributed to Wascow (1969).

REFERENCES

Alker, Hayward R., Jr. 1969. " Statistics and Politics: The Need for Causal Data Analysis," in *Politics and the Social Sciences*, pp. 244–313, Seymour Martin Lipset, ed. New York: Oxford University Press.

Alker, Hayward R., Jr. 1970. " Integration Logics: A Review, Extension, and Critique." *International Organization*, Vol. 24, pp. 869–914.

Alker, Hayward R., Jr. and Bock, Peter. 1972. " Propositions About International Relations: Contributions from the International Encyclopedia of the Social Sciences," in *Political Science Annual: An International Review*, Vol. III, pp. 385–495, James A. Robinson, ed. Indianapolis: Bobbs-Merrill.

Alker, Hayward K., Jr. and Christensen, Cheryl. 1972. " From Causal Modeling to Artificial Intelligence: The Evolution of a U.N. Peace-Making Simulation," in *Experimentation and Simulation in Political Science*, J. A. Laponce and Paul Smoker, eds. Toronto: University of Toronto Press.

Allison, Graham T. 1969. " Conceptual Models and the Cuban Missile Crisis." *American Political Science Review*, Vol. 63, pp. 689–718.

Allison, Graham T. and Halperin, Morton H. 1972. " Bureaucratic Politics: A Paradigm and Some Policy Implications," in *Theory and Policy in International Relations*, pp. 40–79, Raymond Tanter and Richard H. Ullman, eds. Princeton, N.J.: Princeton University Press.

Analyse et Prevision. 1966. Bertrand de Jouvenel, ed. Paris: SEDEIS.

Anderson, Stanford, ed. 1968. *Planning for Diversity and Choice: Possible Futures and Their Relations to the Man-Controlled Environment*. Cambridge, Mass.: M.I.T. Press.

Ando, Albert; Fisher, Franklin; and Simon, Herbert A. 1963. *Essays on the Structure of Social Science Models*. Cambridge, Mass.: M.I.T. Press.

Ashley, Richard and Choucri, Nazli. [In preparation]. " Decision Analysis in International Politics: The Imperatives for Forecasting." Cambridge, Mass.: M.I.T., Center for International Studies.

Ashley, Richard and Choucri, Nazli. [Forthcoming 1974]. " Decision Analysis (working title)," in *Forecasting in International Relations: Theory, Methods, Problems, Prospects*, Nazli Choucri and Thomas Robinson, eds. San Francisco: W. H. Freeman.

Ayres, Robert U. 1969. *Technological Forecasting and Long-Range Planning*. New York: McGraw-Hill.

Azar, Edward E. 1970a. " Analysis of International Events." *Peace Research Reviews*, Vol. 4, No. 1.

Azar, Edward E. 1970b. " The Dimensionality of Violent Conflict: A Quantitative Analysis." Peace Research Society (International) *Papers*, Vol. 15 (Cambridge Conference), pp. 122–67.

Azar, Edward E. [Forthcoming 1974]. " An Early Warning Model of Inter-nation Hostilities (working title)," in *Forecasting in International Relations: Theory, Methods, Problems, Prospects*, Nazli Choucri and Thomas Robinson, eds. San Francisco: W. H. Freeman.

Baier, Kurt and Rescher, Nicholas, eds. 1969. *Values and the Future*. New York: Free Press.

Bay, Christian. 1958. *The Structure of Freedom*. Stanford, Calif.: Stanford University Press.

Bean, Louis H. 1969. *The Art of Forecasting*. New York: Random House.

Beckwith, Burnham Putnam. 1967. *The Next 500 Years: Scientific Predictions of Major Social Trends*. New York: Exposition.

Bell, Daniel. 1964. " Twelve Modes of Prediction—a Preliminary Sorting of Approaches in the Social Sciences." *Daedalus*, Vol. 93, pp. 845–80.

Bell, Daniel. 1967. " Notes on the Post-Industrial Society (I and II)." *The Public Interest*, Vol. 6, pp. 25–35; Vol. 7, pp. 102–18.

Bell, Daniel. 1967. " The Year 2000—the Trajectory of an Idea." *Daedalus*, Vol. 96, pp. 639–51.

Bell, Wendell and Mau, James A. 1970. " Images of the Future: Theory and Research Strategies," in *Theoretical Sociology: Perspectives and Developments*, pp. 205–34, J. McKinney and E. Tiryakian, eds. New York: Appleton-Century-Crofts.

Bell, Wendell and Mau, James A. eds. 1971. *The Sociology of the Future*. New York: Russell Sage Foundation.

Ben-Dak, Joseph D. and Mihalka, Michael. 1972. " Bayesian Analysis: An Exposition and Implication for International Peace." Paper read at the First Annual Meeting of the Peace Research Society (International) Southern Section, April, at the University of North Carolina at Chapel Hill.

Bertram, Christoph. 1968. " Models of Western Europe in the 1970's—the Alternative Choices." *Futures*, Vol. 1 (December), pp. 142–52.

Bestuzhev-Lada, Igor. 1969. " Forecasting—An Approach to the Problems of the Future." *International Social Science Journal*, Vol. 21, pp. 526–34.

Bhagwati, Jagdish N., ed. 1972. *Economics and World Order; From the 1970's to the 1990's*. New York: Macmillan.

Blackman, Wade A. 1972. " Forecasting Through Dynamic Modeling." *Technological Forecasting and Social Change*, Vol. 3, pp. 291–307.

Blalock, Hubert M., Jr. 1960. *Social Statistics*. New York: McGraw-Hill.

Blalock, Hubert M., Jr. and Blalock, Ann B., eds. 1969. *Methodology in Social Research*. New York: McGraw-Hill.

Bobrow, Davis. 1969. " International Indicators." Discussion draft paper read at the Annual Meeting of the American Political Science Association, September, in New York City.

Bobrow, Davis. 1972. " The Relevance Potential of Different Products," in *Theory and Policy in International Relations*, pp. 204–28, Raymond Tanter and Richard H. Ullman, eds. Princeton, N.J.: Princeton University Press.

Bobrow, Davis. [Forthcoming 1974]. " Criteria for Valid

Forecasting (working title)," in *Forecasting in International Relations: Theory, Methods, Problems, Prospects*, Nazli Choucri and Thomas Robinson, eds. San Francisco: W. H. Freeman.

Bozeman, Adda B. 1960. *Politics and Culture in International History*. Princeton, N.J.: Princeton University Press.

Bright, G. R., ed. 1968. *Technological Forecasting for Industry and Government*. Englewood Cliffs, N.J.: Prentice-Hall.

Brody, Richard A. 1963. " Some Systematic Effects of the Spread of Nuclear Weapons Technology: A Study Through Simulation of a Multi-Nuclear Future." *Journal of Conflict Resolution*, Vol. 7, pp. 663–753.

Brown, Harrison. 1954. *The Challenge of Man's Future*. New York: Viking Press.

Brown, Harrison; Bonner, James; and Weir, John. 1957. *The Next Hundred Years*. New York: Viking Press.

Brown, Harrison *et al.* 1967. *The Next Ninety Years*. Pasadena: California Institute of Technology.

Brown, Robert Goodell. 1963. *Smoothing, Forecasting and Prediction of Discrete Time Series*. Englewood Cliffs, N.J.: Prentice-Hall.

Brunner, Ronald. 1968. " Some Comments on Simulation Theories of Political Development," in *Simulation in the Study of Politics*, William D. Coplin, ed. Chicago: Markham.

Buchholz, A. 1968. *Die Grosse Transformation*. Stuttgart (Germany): Deutsche Verlagsanstalt.

Butler, William F. and Kavish, Robert A. 1966. *How Business Economists Forecast*. Englewood Cliffs, N.J.: Prentice-Hall.

Calder, Nigel. 1965. " Summing up," in *The World in 1984*, (Vol. 2), pp. 191–97, Calder, ed. Baltimore: Penguin Books.

Calleo, David P. 1965. *Europe's Future: The Grand Alternatives*. New York: Horizon Press.

Cantril, Hadley. 1965. *The Pattern of Human Concerns*. New Brunswick, N.J.: Rutgers University Press.

Cetron, Marvin, J. 1961. *Technological Forecasting: A Practical Approach*. New York: Technology Forecasting Institute.

Chase, Stuart. 1968. *The Most Probable World*. New York: Harper and Row.

Choucri, Nazli. 1972. " Population Dynamics and International Violence: Propositions, Insights, and Evidence." Mimeographed. Cambridge, Mass.: M.I.T.

Choucri, Nazli. [In press]. " Applications of Econometric Analysis to Forecasting in International Relations." Peace Research Society (International) *Papers* (Philadelphia Conference, 1972).

Choucri, Nazli. [Forthcoming 1974]. " The Problem of Intersection: Linking Long-Range and Short-Range Forecasting (working title)," in *Forecasting in International Relations: Theory, Methods, Problems, Prospects*, Nazli Choucri and Thomas Robinson, eds. San Francisco: W. H. Freeman.

Choucri, Nazli with Bennett, James P. 1972. " Population, Resources, and Technology: Political Implications of the Environmental Crisis," in *World Eco-Crisis; International Organizations in Response*, pp. 9–46, David A. Kay and Eugene B. Skolnikoff, eds. Madison, Wisconsin: University of Wisconsin Press.

Choucri, Nazli; Laird, Michael; and Meadows, Dennis L. 1972. *Resource Scarcity and Foreign Policy: A Simulation Model of International Conflict*. Cambridge, Mass.: M.I.T., Center for International Studies.

Choucri, Nazli and North, Robert C. 1972. " Dynamics of International Conflict: Some Policy Implications of Population, Resources, and Technology," in *Theory and Policy in International Relations*, pp. 80–122, Raymond Tanter and Richard H. Ullman, eds. Princeton, N.J.: Princeton University Press.

Choucri, Nazli. [In preparation: revised February 1973] *Nations in Conflict: Population, Lateral Pressure and War*.

Choucri, Nazli and Robinson, Thomas, eds. [Forthcoming 1974]. *Forecasting in International Relations: Theory, Methods, Problems, Prospects*. San Francisco: W. H. Freeman.

Christ, Carl F. 1966. *Econometric Models and Methods*. New York: Wiley.

Civilization and Science: In Conflict or Collaboration? A Ciba Foundation Symposium. 1972. The Hague: M. Nijhoff.

Commission on the Year 2000. 1967. " Working Session I." *Daedalus*, Vol. 96, pp. 652–704.

Coplin, William D. 1968. *Simulation in the Study of Politics*. Chicago: Markham.

Cornish, Edward S. 1969. " The Professional Futurist," in *Mankind 2000*, pp. 244–50, Robert Jungk and Johan Galtung, eds. Oslo: Universitetsforlaget.

Dalkey, N. 1969. " An Experimental Study of Group Opinion: the Delphic Method." *Futures*, Vol. 1 (September), pp. 408–26.

Deutsch, Karl W. 1972. " Experiments and Political Theory," in *Experimentation and Simulation in Political Science*, pp. 19–38, J. A. Laponce and Paul Smoker, eds. Toronto: Toronto University Press.

Dror, Yehezkel. 1968. " The Role of Futures in Government." *Futures*, Vol. 1 (September), pp. 40–45.

Drucker, Peter. 1968. *The Age of Discontinuity: Guidelines to Our Changing Society*. New York: Harper and Row.

Ellul, Jacques. 1963. " Western Man in 1970," in *Futuribles: Studies in Conjecture*, Vol. 1, pp. 27–64, Bertrand de Jouvenel, ed. Geneva: Droz.

Eulau, Heinz. 1958. " H. D. Lasswell's Developmental Analysis." *Western Political Quarterly*, Vol. 2 (June), pp. 229–42.

Evans, George William; Wallace, Graham F.; and Sutherland, Georgia L. 1967.

Simulation Using Digital Computers. Englewood Cliffs, N.J.: Prentice-Hall.

Ewald, William R., ed. 1968. *Environment and Change: The Next Fifty Years*. Bloomington: Indiana University Press.

Ewald, William R., ed. 1968. *Environment and Policy: The Next Fifty Years*. Bloomington: Indiana University Press.

Feigenbaum, E. A. and Feldman, Julian, eds. 1963. *Computers and Thought*. New York: McGraw-Hill.

Fishman, George S. and Kiviat, Philip J. 1967. " Digital Computer Simulation: Statistical Considerations," prepared for United States Air Force Project RAND, Memorandum RM-5387-PR, November. Santa Monica, Calif.: The RAND Corporation.

" Forecasting the Future." 1967. *Science Journal*, Vol. 3 (October).

Freymond, Jacques. 1965. " Introduction—Forecasting and

Europe," in *Futuribles: Studies in Conjecture*, Vol. 2, pp. xiii–xxx, Bertrand de Jouvenal, ed. Geneva: Droz.
Friedlaender, Saul. 1965. "Forecasting in International Relations," in *Futuribles: Studies in Conjecture*, Vol. 2, pp. 1–112, Bertrand de Jouvenel, ed. Geneva: Droz.
Furnas, Clifford C. 1936. *The Next Hundred Years: The Unfinished Business of Science*. New York: Reynal and Hitchcock.
Futures: The Journal of Forecasting and Planning. 1968. London: Unwin.
Futuribles—Supplement to Bulletin Sedeis. 1961-1965. Bertrand de Jouvenel, ed. Paris: SEDEIS.
The Futurist. A Newsletter for Tomorrow's World. 1967. Washington, D.C., World Future Society.
Gabor, Dennis. 1964. *Inventing the Future*. New York: Knopf.
Galtung, Johan. 1969. "On the Future of the International System," in *Mankind 2000*, pp. 12–41, Robert Jungk and Johan Galtung, eds. Oslo: Universitetsforlaget.
Galtung, Johan. 1970. "On the Future of Human Society." *Futures*, Vol. 2 (June), pp. 132–42.
Gordon, Theodore J. 1965. *The Future*. New York: St. Martin's Press.
Gordon, Theodore J. 1969. "Cross-impact Matrices: An Illustration of their Use for Policy Analysis." *Futures* Vol. 1 (December), pp. 527–31.
Gordon, Theodore J. 1969. "The Feedback between Technology and Values," in *Values and the Future*, pp. 148–92, K. Baier and N. Rescher, eds. New York: Free Press.
Gordon, Theodore J. and Hayward, H. 1968. "Initial Experiments with the Cross Impact Matrix Method of Forecasting." *Futures*, Vol. 1 (December), pp. 100–16.
Groennings, Sven; Kelley, E. W.; and Leiserson, Michael, eds. 1970. *The Study of Coalition Behavior: Theoretical Perspectives and Cases from Four Continents*. New York: Holt, Rinehart and Winston.
Guetzkow, Harold. 1950. "Long Range Research in International Relations." *American Perspective*, Vol. 4, pp. 421–40.
Guetzkow, Harold. 1959. "A Use of Simulation in the Study of Inter-Nation Relations." *Behavioral Science*, Vol. 4, pp. 183–91.
Guetzkow, Harold. 1968. "Some Correspondences Between Simulations and 'Realities' in International Relations," in *New Approaches to International Relations*, pp. 200–69, Morton A. Kaplan, ed. New York: St. Martins.
Guetzkow, Harold. 1969. "Simulations in the Consolidation and Utilization of Knowledge About International Relations," in *Theory and Research on the Causes of War*, Dean G. Pruitt and Richard C. Snyder, eds. Englewood Cliffs, N.J.: Prentice-Hall.
Guetzkow, Harold; Kotler, Philip; and Schultz, Randall L. 1972. *Simulation in Social and Administrative Science; Overviews and Case-Examples*. Englewood Cliffs, N.J.: Prentice-Hall.
Habermas, Jurgen. 1968. *Knowledge and Human Interests*. Boston: Beacon.
Hacker, Frederick J. 1969. "Human Implications," in *Mankind 2000*, pp. 233–41, Robert Jungk and Johan Galtung, eds. Oslo: Universitetsforlaget.
Harrison, Annette. 1967. *Bibliography on Automation and Technological Change and Studies of the Future* RAND Publication No P-3365-2, March. Santa Monica, Calif.: The RAND Corporation.
Hayashi, Yujiro. 1969. "The Direction and Orientation of Futurology as a Science," in *Mankind 2000*, pp. 270–77, Robert Jungk and Johan Galtung, eds. Oslo: Universitetsforlaget.
Heilbroner, Robert L. 1960. *The Future as History*. New York: Harper.
Helmer, Olaf. 1966. *A Use of Simulation for the Study of Future Values*. RAND Publication No. P-3443, September. Santa Monica, Calif.: The RAND Corporation.
Helmer, Olaf. 1969. "Simulating the Values of the Future," in *Values and the Future*, pp. 193–213, K. Baier and N. Rescher, eds. New York: Free Press.
Hermann, Charles. 1967. "Validation Problems in Games and Simulations with Special Reference to Models of International Politics." *Behavioral Science*, Vol. 12, pp. 216–31.
Hermann, Charles. 1969. *Crises in Foreign Policy Making: A Simulation of International Politics*. Indianapolis: Bobbs-Merrill.
Hermann, Charles and Hermann, Margaret G. 1967. "An Attempt to Simulate the Outbreak of World War I." *American Political Science Review*, Vol. 61, pp. 400–16.
Hermann, Charles; Philips, Warren; and Thorsen, Stuart. [Forthcoming 1974]. "Alternative Types of Validation (working titles)," in *Forecasting in International Relations: Theory, Methods, Problems, Prospects*, Nazli Choucri and Thomas Robinson, eds. San Francisco: W. H. Freeman.
Hetman, Francois. 1970. *Le Langage de la Prevision*. Paris: SEDEIS.
Holstein, Carl-Axe S. Stael von. 1970. *Assessment and Evaluation of Subjective Probability Distributions*. Stockholm: The Economic Research Institute.
Hubbard, Earl. 1969. *The Search Is On: A View of Man's Future from the New Perspective of Space*. Los Angeles: Pace Publications.
Husserl, Edmund. 1965. *Phenomenology and the Crisis of Philosophy*. New York: Harper and Row.
Iklé, Fred Charles. 1967. "Can Social Predictions be Evaluated?" *Daedalus*, Vol. 96, pp. 733–58.
Inbar, Michael and Stoll, Clarice S. 1972. *Simulation and Gaming in Social Science*. New York: Free Press.
The Institute for the Future. 1968. *The Institute for the Future (A Prospectus)*. Middletown, Conn.: Institute for the Future-Riverview Center.
Israeli, Nathan. 1932. "The Social Psychology of Time." *Journal of Abnormal and Social Psychology*, Vol. 27 (July), pp. 209–13.
Jantsch, Erich, ed. 1967. *Technological Forecasting in Perspective*. Paris: Organization for Economic Co-operation and Development.
Johnston, John. 1972. *Econometric Methods*. New York: McGraw-Hill.
Jouvenel, Bertrand de. 1963. "La prevision des idees." *Futuribles* (No. 68)—Supplement to Bulletin Sedeis 870 (December 1).
Jouvenel, Bertrand de. 1965. "Political Science and Prevision." *American Political Science Review*, Vol. 59 (March), pp. 29–38.
Jouvenel, Bertrand de. 1967. *The Art of Conjecture*. New York: Basic Books.
Jouvenel, Bertrand de. 1968. "On Attending to the Future," in *Environment and Change: The Next Fifty Years*,

pp. 21–29, William R. Ewald, ed. Bloomington: Indiana University Press.

Jouvenel, Bertrand de. 1969. " Technology as a Means," in *Values and the Future*, pp. 217–32, K. Baier and N. Rescher, eds. New York: Free Press.

Jungk, Robert. 1967. " The Future of Future Research." *Science Journal*, Vol. 3 (October), pp. 3–40.

Kahn, Hermann. 1960. *On Thermonuclear War*. Princeton, N.J.: Princeton University Press.

Kahn, Herman. 1966. " On Alternative World Futures: Issues and Themes." New York: Hudson Institute, Inc.

Kahn, Herman. 1968. " The Alternative World Futures Approach," in *New Approaches to International Relations*, pp. 83–137, Morton A. Kaplan, ed. New York: St. Martin's Press.

Kahn, Herman, and Weiner, Anthony J. 1967. " The Next Thirty-Three Years: a Framework for Speculation." *Daedalus*, Vol. 96, pp. 705–32.

Kahn, Herman. 1967. *The Year 2000: A Framework for Speculation on the Next Thirty-Three Years*. New York: Macmillan.

Kaplan, Abraham. 1964. *The Conduct of Inquiry*. San Francisco: Chandler.

Kaplan, Abraham; Skogstad, A. L.; and Girshick, M. A. 1950. " The Prediction of Social and Technological Events." *Public Opinion Quarterly*, Vol. 14, pp. 93–111.

Kay, David A. and Skolnikoff, Eugene B., eds. 1972. *World Eco-Crisis; International Organizations in Response*. Madison: University of Wisconsin Press.

Keohane, Robert O. and Nye, Joseph S., Jr., eds. 1972. *Transnational Relations and World Politics*. Cambridge, Mass.: Harvard University Press.

Laponce, J. A. and Smoker, Paul, eds. 1972. *Experimentation and Simulation in Political Science*. Toronto: Toronto University Press.

Lasswell, Harold D. 1941. " The Garrison State." *American Journal of Sociology*, Vol. 46 (January), pp. 455–68.

Lasswell, Harold D. 1966. " The Changing Image of Human Nature: The Socio-Cultural Aspect (future-oriented man)." *American Journal of Psychoanalysis*, Vol. 26 (No. 2), pp. 157–66.

Leavitt, Michael. 1970. " Thoughts on Computer Simulation of International Relations." Paper read at the Sixty-sixth Annual Meeting of the American Political Science Association, September, in Los Angeles.

Leavitt, Michael. (Forthcoming 1974). " Computer Simulation (working title)," in *Forecasting in International Relations: Theory, Methods, Problems, Prospects*, Nazli Choucri and Thomas Robinson, eds. San Francisco: W. H. Freeman.

Martino, Joseph P. 1972. *Technological Forecasting for Decision-Making*. New York: American Elsevier.

Massenet, Michel. 1963. " Introduction a une sociologie de la prevision." *Futuribles* (No. 60)—Supplement to Bulletin Sedeis (Pt. 2) 857 (June 20).

Massenet, Michel. 1963. " Les methodes de prevision en sciences sociales." *Futuribles* (No. 66)—Supplement to Bulletin Sedeis (Pt. 2) 867 (November 1).

McClelland, Charles. (Forthcoming 1974). " Analysis of Actions and Events (working title)," in *Forecasting in International Relations: Theory, Methods, Problems, Prospects*, Nazli Choucri and Thomas Robinson, eds. San Francisco: W. H. Freeman.

McHale, John. 1968. " A Global View," in *Social Policies for America in the Seventies*, pp. 195–216, Robert Theobald, ed. Garden City, N.Y.: Doubleday.

McHale, John. 1969. *The Future of the Future*. New York: George Braziller.

Meier, Robert C.; Newell, William T.; and Pazer, Harold L. 1969. *Simulation in Business and Economics*. Englewood Cliffs, N.J.: Prentice-Hall.

Michael, Donald N. 1968. *The Unprepared Society: Planning for a Precarious Future*. New York: Basic Books.

Milburn, T. W. and Milburn, J. F. 1966. " Predictions of Threats and Beliefs About How to Meet Them." *American Behavioral Scientist*, Vol. 9 (March), pp. 3–7.

Moore, Wilbert E. 1964. " Forecasting the Future: the United States in 1980." *Educational Record*, Vol. 45 (Fall), pp. 341–54.

Moses, Lincoln E.; Brody, Richard A.; Holsti, Ole R.; Kadane, Joseph B.; and Milstein, Jeffrey S. 1967. " Scaling Data on Inter-Nation Action." *Science*, Vol. 156 (May 26), pp. 1054–59.

Natanson, Maurice Alexander. 1963. *Philosophy of the Social Sciences. A Reader*. New York: Random House.

Naylor, Thomas H., *et al.* 1968. *Computer Simulation Techniques*. New York: Wiley.

Ozebekhan, Hasan. 1966. *Technology and Man's Future*. Report No. SP-2494, May 27. Santa Monica, Calif.: System Development Corporation.

Ozebekhan, Hasan. 1968. " The Triumph of Technology: ' Can ' Implies ' Ought ',' in *Planning for Diversity and Choice*, pp. 204-19, Stanford Anderson, ed. Cambridge, Mass.: M.I.T. Press.

Perspectives: Studies in Social and Political Forecasting—Supplement to the Indian Journal of Public Administration. 1965. L. P. Singh, ed. New Delhi: Indian Institute of Public Administration.

Picht, Georg. 1969. *Mut zur Utopie: Die Grossen Zakunftsaufgaben*. Munich: R. Piper and Co., Verlag.

Piganiol, Pierre. 1969. " Introduction: Futurology and Prospective Study." *International Social Science Journal*, Vol. 21, pp. 515–25.

Platt, John R. 1968. *The Step to Man*. New York: Wiley.

Polak, Fred L. 1961. *The Image of the Future: Enlightening the Past, Orienting the Present, Forecasting the Future*. 2 Vols., New York: Oceana Publications.

Polak, Fred L. 1969. " Towards the Goal of Goals," in *Mankind 2000*, pp. 307–31, Robert Jungk and Johan Galtung, eds. Oslo: Universitetsforlaget.

Prehoda, Robert W. 1967. *Designing the Future: The Role of Technological Forecasting*. Philadelphia: Chilton Books.

Prospective. 1958. Centre d'Etudes Prospectives (Association Gaston Berger). Paris: Presses Universitaires de France.

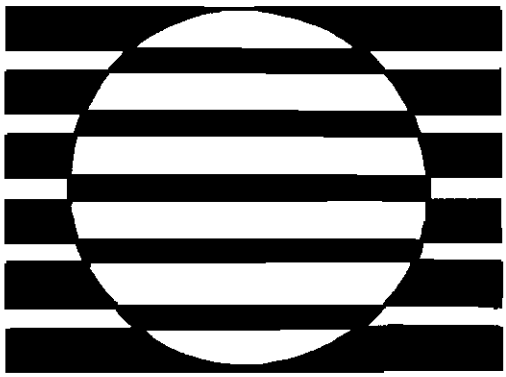
Richta, Radovan and Sulc, Ota. 1969. " Forecasting and the Scientific and Technological Revolution." *International Journal of Social Science*, Vol. 21, pp. 563–73.

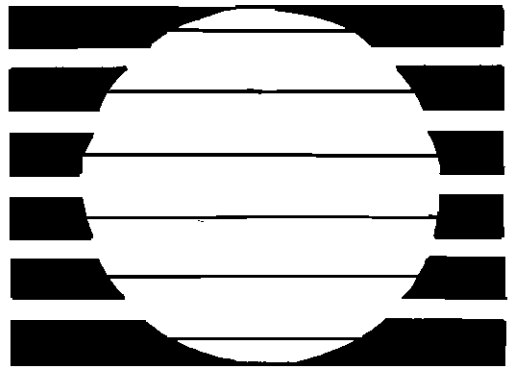
Rivlin, Alice M. 1971. *Systematic Thinking for Social Action*. Washington: The Brookings Institution.

Rolbiecki, Waldemar. 1969. " Prognostication and Prognoseology," in *Mankind 2000*, pp. 278–85, Robert Jungk and Johan Galtung, eds. Oslo: Universitetsforlaget.

Rosecrance, Richard N. 1963. *Action and Reaction in World Politics; International Systems in Perspective*. Boston: Little, Brown.

Rosenau, James N., ed. 1969. *International Politics and*





Foreign Policy: A Reader in Research and Theory, 2nd ed., rev. New York: Free Press.

Ross, Scott. (Forthcoming 1974). " Process Models: Markov Chains (working title)," in *Forecasting in International Relations: Theory, Methods, Problems, Prospects*, Nazli Choucri and Thomas Robinson, eds. San Francisco: W. H. Freeman.

Ruggie, John Gerard. 1972. " Collective Good and Future International Collaboration." *American Political Science Review*, Vol. 66, pp. 874–93.

Russett, Bruce M., ed. 1972. *Peace, War, and Numbers*. Beverly Hills: Sage Publications.

Savage, Leonard J. 1954. *The Foundations of Statistics*. New York: Wiley.

Schon, Donald A. 1967. " Forecasting and Technological Forecasting." *Daedalus*, Vol. 96, pp. 759–71.

Schultze, Charles, *et al.* 1971. *Setting National Priorities: The 1972 Budget*. Washington: The Brookings Institution.

Shubik, Martin. 1967. " Information, Rationality, and Free Choice in a Future Democratic Society." *Daedalus*, Vol. 96, pp. 771–78.

Shubik, Martin. 1968. *Simulation of Socio-Economic Systems*. New Haven: Yale University, Cowles Foundation for Research.

Smoker, Paul. 1968. " An International Processes Simulation: Theory and Description." Mimeographed. Evanston, Ill.: Northwestern University, Simulated International Processes Project.

Stinchcombe, Arthur L. 1968. *Constructing Social Theories*. New York: Harcourt, Brace and World.

Sulc, Otto. 1969. " Interactions Between Technological and Social Changes: a forecasting model." *Futures*, Vol. 1 (September), pp. 402–07.

Thevenaz, Pierre. 1962. *What is Phenomenology?* Chicago: Quadrangle.

Toffler, Alvin. 1965. " The Future as a Way of Life." *Horizon*, Vol. 7, pp. 108–16.

Toffler, Alvin. 1969. " Value Impact Forecaster—A Profession of the Future," in *Values and the Future*, pp. 1–30, K. Baier and N. Rescher, eds. New York: Free Press.

Toffler, Alvin. 1970. *Future Shock*. New York: Random House.

Udall, Stuart L. 1968. *1976: Agenda for Tomorrow*. New York: Harcourt Brace and World.

Umpleby, Stuart. 1969. *The Delphi Exploration (A Computer-Based System for Obtaining Subjective Judgements on Alternative Futures)*. Social Implications of Science and Technology Report F–1. Urbana, Illinois: Computer-Based Education Research Laboratory, University of Illinois.

Unesco. 1969. " Futurology." *International Social Science Journal*, Vol. 21 (December).

United Nations. 1971. *World Plan of Action for the Application of Science and Technology to Development*. New York: Department of Economic and Social Affairs.

Wascow, Arthur I. 1969. " Looking Forward: 1999," in *Mankind 2000*, Robert Jungk and Johan Galtung, eds. Oslo: Universitetsforlaget.

Whiting, Allen S. 1972. " The Scholar and the Policy-Maker," in *Theory and Policy in International Relations*, pp. 229–47, Raymond Tanter and Richard H. Ullman, eds. Princeton, N.J.: Princeton University Press.

Wilcox, Wayne. 1970. " Forecasting Asian Strategic Environments for National Security Decision-making: A Report and a Method." Memorandum Rm–6154–PR, June. Santa Monica, Calif.: The RAND Corporation.

Young, Michael. 1968. " Forecasting and the Social Sciences," in *Forecasting and the Social Sciences*, pp. 1–37, Young, ed. London: Heineman.

Young, Michael, ed. 1968. *Forecasting and the Social Sciences*. London: Heineman.

Young, Oran R. 1972. " The Perils of Odysseus: On Constructing Theories of International Relations," in *Theory and Policy in International Relations*, pp. 179–203, Raymond Tanter and Richard H. Ullman, eds. Princeton, N.J.: Princeton University Press.

Zinnes, Dina A. 1967. " An Analytical Study of the Balance of Power Theories." *Journal of Peace Research*, No. 3, pp. 270–88.

Zinnes, Dina A. and Wilkenfeld, Jonathan. 1971. " An Analysis of Foreign Conflict Behavior of Nations," in *Comparative Foreign Policy: Theoretical Essays*, pp. 167–213, Wolfram F. Hanreider, ed. New York: McKay.