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CRISIS FORECASTING AND CRISIS: A CRITICAL EXAMINATION OF THE LITERATURE

DECISIONS AND DESIGNS INCORPORATED

Richard W. Parker

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CRISIS MANAGEMENT PROGRAM

CYBERNETICS TECHNOLOGY OFFICE
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
Office of Naval Research • Organizational Effectiveness Research Programs

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CRISIS FORECASTING AND CRISIS:

A CRITICAL EXAMINATION OF THE LITERATURE.

by

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Richard W. Parker

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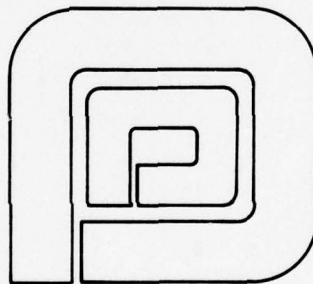
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SUMMARY

Introduction

This report examines and evaluates a large body of academic and nonacademic literature which concerns international crises, general forecasting, and crisis forecasting. It also makes recommendations for future research in these areas.

Background

Since the early 1960's, a great deal of research (much of which has been supported by ARPA) has concerned international crises. More recently, such research has led to attempts to forecast the outbreak of these crises. While efforts have been made to coordinate and evaluate the literature in specific areas of crisis, such as crisis decision making and crisis management, little attention has been placed on linking together literature on all areas of crises, and virtually no attempt has been made to examine and evaluate literature which might be useful to crisis forecasting. The need to determine what has been done and what remains to be done in the areas of crisis research, forecasting research, and crisis forecasting research became acute at Decisions and Designs, Incorporated (DDI) in the beginning stages of an effort to construct a prototype system for applied crisis forecasting. Thus, research in this report was conducted to meet this need in order to discover and use previous research in the above areas.

Approach

In order to examine and evaluate the literature, several categories were established for each area of research:

Crisis Research

- General Research,
- Conceptual and Theoretical Research,
- Beginning of Crises,
- Crisis Behavior, and
- Crisis Management and Resolution;

Forecasting Research

- Epistemology of Forecasting,
- General Forecasting Methods, and

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- Application of Forecasting to International, and Relations Problems; and

Crisis Forecasting

- Forecasting Conflict,
- Forecasting War, and
- Forecasting Crises.

Results

After the literature in each area was examined, critical evaluation was conducted with the following conclusions:

- Crisis research has been of use to applied crisis forecasting by providing useful generalizations about behavior;
- Forecasting methods are well suited to crisis forecasting data although much work needs to be done before sophisticated techniques such as econometrics and subjective methods can be used; and
- Crisis forecasting research has been specific in country focus and conducted in the context of specific time frames and is thus useful to future crisis forecasting.

Recommendations

The following suggestions for future research are made:

Crisis Research

- Practical theories of crisis must be developed,
- Typologies of crisis need to be expanded and refined, and
- More comparative crisis analysis is needed;

Forecasting Research

- Present techniques must be refined and adapted,
- New techniques (particularly subjective techniques) must be explored,

- Greater contact between crisis researchers and forecasters in other fields needs to be initiated, and
- A unified forecasting capability needs to be developed; and

Crisis Forecasting Research

- More political, economic, and military crisis indicators need to be developed and tested,
- Internal crisis indicators need to be developed,
- Crisis probabilities need to be developed,
- Domestic, global, and economic crises need to be examined and forecasted,
- A generalized, real-time crisis forecasting capability needs to be developed, and
- Findings of crisis research should be merged into general theories of international political behavior and into practical use.

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CRISIS FORECASTING AND CRISIS:
A CRITICAL EXAMINATION OF THE LITERATURE¹

1.0 INTRODUCTION

The purpose of this report is to examine and critically evaluate a large body of academic and non-academic literature relevant to international crisis, forecasting in general, and forecasting international crisis. Although every attempt has been made to be comprehensive, not all crisis, forecasting, and crisis forecasting research has been addressed. A great deal of work in these areas is still in progress,² while other work does not fit into the breakdown of research areas examined in this report

The examination itself was undertaken in conjunction with applied crisis forecasting research currently in progress at Decisions and Designs, Incorporated (DDI) and described in Andriole (337). It was conducted for the Advanced Research Project Agency's Cybernetics Technology Office (ARPA/CTO) during the period from January 1, 1976 to September 30, 1976. The research in progress at DDI is aimed at the design and development of an integrated, computer-based crisis early warning system. This general goal DDI hopes to realize through the construction of prototype warning systems. Since the research project is extremely integrative in nature and highly dependent upon existing and on-going research, this survey of the literature as well as those surveys which are to follow constitutes a vital part of the overall research effort. Specifically, this survey was conducted in order to determine how we might best benefit from existing research and conduct that which has been ignored.

The report is divided into three major sections. Section 2.0 presents a descriptive examination of the literature, Section 3.0 evaluates the literature on the basis of how it might contribute to the design and development of an integrated warning system, and Section 4.0 suggests the nature and direction of the most vital future research.

¹Another version of this report appears in International Studies Quarterly (March 1977).

²See Andriole (337), Andriole and Young (312), Brecher (61), McClelland (324), Belden (317), Martin (323), Tanter and Stein (332), among others.

2.0 EXAMINATION OF THE LITERATURE

This section is divided into three major sections, each of which is examined in turn: first, general crisis research; second, general forecasting research; and third, international crisis forecasting.

2.1 Crisis Research

2.1.1 General work on crises. Some of the most popular general books on crisis include George (17), Rosecrance (36), Aron (3), Weintal and Bartlett (45), Kleiman (28), and Scheinman and Wilkinson (37). Those interested in specific crises should see Larson (29), Abel (1), Chayes (9), Halper (20), Divine (13), Gerberding (76), Allison (2), Pachter (33), and Walton (172) for historical examinations of the Cuban missile crisis; Schick (39), Davison (12), Scheinman (143), Heller and Heller (21) and Tanter (42) for discussions of the Berlin crises; Paige (34) and Snyder (158, 159) for discussions of the Korean crisis; and Wagner (43, 44) and Young (48), and Brecher (6, 59) for examinations of the Middle East crises.

In order to survey crisis literature, we shall divide it into four groups: (1) conceptual and theoretical literature, (2) literature concerning the beginning of crises, (3) that focusing on behavior during crises and (4) literature dealing with the management and resolution of crises.

2.1.2 Conceptual and theoretical literature. Perhaps the most widely read and most important theoretical work on crisis is McClelland's (108), which discusses the various conceptions of crisis and their impact on crisis research. Criticizing the traditional power approach to the study of politics as confining and inadequate for the resolution of very complex problems, McClelland argues that a new approach, the "interaction" approach, is needed to stimulate more useful and comprehensive research and to provide a means for dealing with large amounts of information.

Another well-known theoretical work is Hermann's (78) essay on the use of crisis as a "situational" variable. Hermann discusses the systemic view of crisis formulated by McClelland and Rosecrance but abandons it for the "situational" perspective. Crisis is considered as an independent variable causing differences in crisis behavior and decision-making.

These two essays constitute the basis for nearly all subsequent writing on crises. Those in the

tradition of McClelland have tended to describe or explain crises at national or systemic levels, while those following Hermann have studied the behavior of individuals. Tanter (167) argues unconvincingly that these two perspectives can and should be synthesized.

Other conceptual research has been done by Edwards (14) and Morse (122). Edwards discusses the need for a model or theory of international crisis which would include the stages, the determinants, and the types of crisis. He attempts to build a "descriptive" model based upon illustrations from the Berlin and Cuban crises. Morse discusses the rise of international economic crises and attempts to develop a theory of crisis based upon the notion of economic rationality by using "opportunity costs" and "possibility functions."

Attempts to define crisis are plentiful in the literature. Discussions of such attempts can be found in Hermann (22, 80), Robinson (140), and Moore (218). Moore also uses the various definitions of crisis to construct an inventory of international crises from 1946 to 1973, which includes descriptions, actors, and duration dates. A more general inventory of crises may be found in Butterworth (8).

2.1.3 The beginning of crises. Literature which seeks to describe or explain the beginning of crises is somewhat limited, yet again McClelland provides the impetus for research. McClelland et al. (215) develops quantitative measures of volume and variety of activity to describe the buildup of the Quemoy and Tachens crises. Elsewhere, McClelland (110) uses the same measures to examine the beginning and abatement of the Berlin and Taiwan crises. These studies influenced much of the systematic and quantitative work on crisis forecasting and crisis in general. Azar (53) also uses statistical methods to examine the escalation and de-escalation phases of the Suez 1956 crisis. Using a social scientific research design, he reports a symmetry of actions between the nations in the escalation phases of a crisis but not during the de-escalation phases, a finding which suggests that at some point costs of hostile actions increase to such an intolerable level that they must be reduced regardless of the other side's actions.

More speculative examinations of the beginning of crises are Wright's (181) and Kahn's (27). Wright attempts to explain the escalation of conflicts by using perceptual measures of the costs of conflict, national interest, and vulnerability. His measures are subjectively

derived (they are his own personal estimates) although he describes how more objective measures might be generated. Kahn also attempts to elucidate scenarios of possible nuclear crises by discussing several categories of nuclear crises and the boundaries (thresholds) between them. Kahn implies that future crises will be much different from past ones and that the most useful methodology is the speculative one.

2.1.4 Behavior during crisis. The area of crisis behavior which has received the most attention is the behavior of decision-makers and other actors during crisis. Studies have been made of the perceptions of decision-makers, the expressions of hostility by leaders, the physical effect of crisis on leaders, and the process of decision-making during crisis. Research on U.S. crisis decision-making has been discussed in Candela (194), for example.

Early research concerning perceptions of decision-makers were descriptive in nature. They addressed decision-maker's perceptions of time pressures and alternatives of action and hostility. Holsti (87) and Holsti, Brody, and North (91) use the concept of perception to examine the events preceding hostilities in 1914 and the Cuban Missile Crisis. They report that misperception of adversaries' intention was high in 1914 but quite low in 1962. Using content analysis and financial indicators to measure perception of conflict, Holsti (25, 89) studies time pressures, perceptions of alternatives, perceptions of hostility, and definitions of the situation to describe differences between the 1914 and Cuban crises. The Holsti research provides the basic groundwork for subsequent explanatory work.

Rigorous attempts to use perceptions to explain behavior can be found in Zinnes (185), Zinnes, Zinnes, and McClure (187), Hilton (83), Holsti, North, and Brody (92), and Schwartz (145). Zinnes uses the 1914 crisis to test the hypothesis that perceptions of hostility lead to expressions of hostility. Zinnes, Zinnes, and McClure, in an attempt to refute the idea that decision-makers perceive or react differently in crisis situations than in non-crisis situations, try to show that decision-makers express hostility in response to perceived hostility (and that decision-makers perceive hostility fairly accurately). Hilton, however, reports that expressions of hostility are not related to perceptions of hostility but are rather more closely related to the expressions of hostility in the previous time period. Holsti, North, and Brody, show that this connection between perceptions of hostility and action exists only for situations of high intensity. Using data from eight major

post-World-War-II crises, Schwartz attempts to test the same hypothesis as the Zinnes and Hilton studies. A very promising study was conducted by McCormick and Champion (217). They examine 12 international crises in order to develop procedures for measuring national leaders' perceptions and use these measures to explain and predict leaders' behavior in the 1967 and 1973 Middle East crises. The research is promising in its attempt to be comparative and its use of more objective data (events) to validate the content analysis of perceptions.

In an attempt to explain behavior during a crisis, a great deal of work has been conducted on the decision-making process and on the behavior of decision-makers, as in the studies of Brecher (59) and Stein and Brecher (162), for examples. One of the best-known studies, of course, is Allison's (50). He uses three models, the Rational Policy Model, the Organizational Process Model, and the Bureaucratic Politics Model, to explain behavior during the Cuban Missile Crisis. Snyder (157) and Wagner (171) both examine crisis decision-making in terms of a rational-actor model. Snyder describes a preliminary bargaining model of crisis decision-making by using the assignment of utilities, costs, and risks to various outcomes and actions, and discusses how these variables can be manipulated by the actors. Wagner develops a rational-policy model of the Middle East and discusses how quantitative values could be assigned to each variable.

Paige (34, 129) extends Snyder's research to the Korean and Cuban crises. An attempt to test Allison's Organizational Process Model rigorously is found in McCormick and Champion's study (217). Wiegele (176) attempts to use Allison's Bureaucratic Politics Model (Model III) of decision-making after adding biological factors such as health, fatigue, and age, and the concept of stress. In a later paper, Wiegele (177) explains how non-obtrusive physiological measures of decision-maker's stress could be used to examine crisis decision-making. Although he never goes beyond illustrations and case study, Wiegele implies that the use of biological and physiological variables could be extended to the general study of crisis. A discussion of propositions which concern individual and organizational decision-making behavior in crisis can be found in Shapiro and Gilbert (227).

As mentioned above, most of the research on crisis has been descriptive in nature. Indeed, some of the best quantitative research is purposely descriptive and makes little attempt to be explanatory. McClelland, et al. (215), for example, first used measures of the quantity and variety of events to describe the activity

during the Quemoy and Tachens crises. In a later article, McClelland (110) uses the same measures to describe the beginning and abatement of the Berlin and Taiwan crises. In this and another article (106), he uses the measures of volume and variety to define the Berlin crisis periods.

Another attempt to describe a crisis quantitatively is Smoker (157). Smoker examines the Sino-Indian conflict of 1959-1964 by using events data to generate measures of freedom of decision, interaction (response to the other side's action within a short period of time), and reaction (response to the other side's action after a longer time lag). Azar (53) uses the 1956 Suez crisis to test some descriptive hypotheses concerning signaling during a crisis. Using scaled data (events) to test these hypotheses, he reports that hostile interactions were symmetrical during escalation but not during de-escalation and that the time distance between hostile actions did not decrease significantly as the conflict increased. These studies, while not necessarily contributing to the explanatory understanding of crisis, indicate how quantitative measures of the behavior of nations can be used to describe particular crises and represent systematic and insightful methods of dealing with large amounts of information.

2.1.5 Crisis management and resolution. The study of crisis management and crisis resolution involves two goals: one is largely descriptive, the other prescriptive. For an analysis of this distinction, see Tanter (167). In attempts to describe crisis resolution, Azar (53), McClelland (110), and Spanier (309) have examined the abatement of international crises. Many others, however, have written how conflicts can and should be manipulated or "managed." In this vein, Milburn (120), Tanter (42, 228), Kupperman, Wilcox, and Smith (100), and Bloomfield and Beattie (57) discuss the information needs of conflict managers. They all agree that conflict managers need to know when and why crises erupt and how the effects of crises can be minimized. Thus, conflict managers need to have systematic knowledge about crises and conflicts and must have a model (Tanter, 42), theory, or simply tested propositions about crisis initiation, escalation, continuation and abatement as well as a set of predictive indicators. Specific areas of research needed to provide this knowledge are elucidated in Hermann (204). Attempts to provide this information by analyzing decision-making processes during crisis (and showing how to utilize this knowledge to manage crises) can be found in Shapiro and Gilbert (227). Bloomfield and Beattie (57), Tanter (42) and Kupperman, Wilcox, and Smith (100) discuss information systems which would satisfy the above needs of conflict and crisis managers. Bloomfield

and Beattie's description of a computer-aided system for handling information on local conflicts (CASCON) shows how a computerized system of information on conflicts might be organized. Tanter discusses CACIS, an information system which would include information on most conflicts including conflicts involving more than one major power. These studies show the need for better research on crisis and how this research could be used by policymakers and analysts.

Most of the research on actual crisis management has been methodologically traditional. Ferguson (75), Snyder (157), Morse (122), Perlmutter (132), and Bloomfield and Leiss (5) present qualitative discussions of the actions of crisis managers. Ferguson uses a rational-actor model to examine tactics during potential crises involving the U.S. and the Soviet Union, and how these tactics might be used to secure advantage for one side or to reduce the intensity of the conflict. Snyder, too, uses a rational-actor model in viewing crisis management as a bargaining situation. He discusses the management of the outcomes of crisis through the manipulation of utilities, costs, and action risks. Morse, in a discussion mainly about economic crises, examines the rising economic interdependence of nations and how this leads to the use of economic tools as manipulables in crisis situations. Perlmutter describes recent crisis management attempts in the Middle East, while Bloomfield and Leiss examine crisis management from the U.S. perspective. These studies, along with those of Kahn (27) and Young (48) provide substantive insight into the management of crises.

One of the very few studies on crisis management which is quantitative and explanatory is Butterworth's (8). He examines crises and crisis management efforts since 1945 in order to determine if these efforts have had any real effect on crisis abatement, restraint, cessation, isolation, and settlement. He found that national, international, and global efforts at crisis management have been quite successful despite their inability to avert or reduce crises. Another quantitative study of crisis management is that of Hazelwood and Hayes (201). They examined 41 crises in order to identify patterns of crisis management problems. These patterns, in turn, are suggested for use in forecasting to anticipate crisis management problems in future crises.

2.2 Forecasting Research

The understanding of forecasting techniques is as important to the crisis forecaster as the general understanding

of crises and crisis behavior. The study of forecasting and forecasting methods has received a great deal of attention from business and economics but only limited attention from political scientists and international relations scholars. Only recently have political scientists begun to explore the methods and uses of forecasting. For a discussion of needed applied research on forecasting, see Tidwell et al. (302). In this section, we shall examine the forecasting literature from several perspectives. In particular, we shall look at literature on the epistemology of forecasting in social science, on general methods of forecasting, on application of forecasting methods to international relations, and on applied forecasting in international relations.

2.2.1 Epistemology of international relations forecasting. Much of the literature on forecasting in international relations is directed at the epistemology of social science forecasting, that is, if and how successful forecasting can be performed on social science data. Chapman (257) argues that international relations forecasting cannot be scientific and is best conceived as an art. He argues that the international environment is too complex and fluid to yield the discovery of trends and regularities. Friedlander (267) also feels that political phenomena do not exhibit the regularities which are required for statistical study. Others, however, believe that political phenomena can be forecasted by using statistical methods in much the same manner as business, economic, and technological phenomena. Rothstein (246) states that those who oppose using sophisticated scientific forecasting methods in international relations fail to appreciate the regularities of political behavior and overestimate those associated with physical phenomena. He also states that many people mistakenly equate prediction and forecasting with explanation and the use of "laws" of behavior (see Bell, 253). When no laws of international behavior are found, such people argue that there can therefore be no predictions or forecasts of international behavior. Of course, Rothstein (246) and Tanter (290) are convinced that prediction does not require laws of behavior. Rather, they believe that there are many forms of prediction and forecasting which can be used without the use of "laws."

The non-necessity of laws in forecasting does not mean, of course, that theory is unnecessary or undesirable. Choucri (260), Singer (284), and Tanter (290) believe that theory is necessary in international relations forecasting. For such analysts, theory is necessary in the selection of relevant indicators, in the selection of methods, and in providing the criteria for evaluating the performance of

forecasts (see McClelland, 274). More explicit requirements for forecasting in international relations can be found in Bobrow (255), Choucri (260), and Tidwell, Candela, and McCormick (302).

The topic of planning is relevant to international relations forecasting. Sometimes termed "strategic forecasting," forecasting coupled with planning yields a normative perspective. Wilcox (336), Rothstein (246), Phillips (276), and Porter (277) argue that forecasting and planning are inseparable in practice. Wilcox discusses how forecasts can be integrated with the planning process. Porter examines the difficulties and opportunities of strategic forecasting and planning in large organizations. Both Rothstein and Phillips discuss the use of forecasting in the planning process in the U.S. Defense and State Departments.

2.2.2 General methods of forecasting. Discussions of general forecasting methods abound, especially in the areas of technological and business forecasting. Jantsch (242) discusses intuitive methods such as the Delphi technique, exploratory methods such as time-series analysis, and normative methods such as systems and decision theory. Ayres (231) discusses morphological analysis, trend extrapolation, heuristic models, and intuitive methods of forecasting. Franco et al. (297) give brief descriptions of many forecasting techniques relevant to long-range forecasting. More in-depth analysis of the various methods appear in Nelson (244), Hill and Ebrahimi (298), and Box and Jenkins (235). Choucri (260) discusses econometric methods, Rummel (280) a three-mode factor analysis, and Dressler (266) more subjective methods. Critical evaluations of these methods appear in Johnston (272), Singer (284), Choucri (260), and Harrison (240).

2.2.3 Applications of forecasting to international relations. Among the time-series studies are Moore and Young's (301) and Rubin's (343). Moore and Young use time-series methods to predict the foreign policy output of selected nations. They find that the use of median frequencies rather than regression produces better predictions. Rubin also predicts changes in certain indicators by using simple time-series methods.

Much more sophisticated techniques, such as econometric modeling, have been attempted by Choucri (260), Choucri and North (237), Choucri and Blousfield (262), and Franco et al. (296). Choucri, and Choucri and North develop a model of international conflict by using such independent

variables as population, national income, trade, military expenditures, and allies. This analysis uses time-lagged variables, dummy variables for non-interval data, and tests for error and significance. Choucri and Blousfield develop a model of foreign expansion by using population, resources, economic indicators, military indicators, and lateral pressure as independent variables. Franco et al. use econometric methods to develop a model of international conflict. They use economic power base, military power base, internal instability, international trade, and international alignment as predictors of long-range (to 1995) international conflict for 26 European countries. These studies demonstrate that econometric models can be useful for longer-range forecasting in international relations.

The use of simple correlation and regression along with multiple correlation and regression has also grown in international relations research. Cannizzo (256) uses regression to predict losses during conflict, duration of the conflict and the victor in the conflict from the relative capabilities of the opponents in the conflict. Haas (19) uses a large number of independent variables such as instability, cleavage, conflict, diversity, and alienation to predict the degree of national aggressiveness. O'Leary and Coplin (308) use regression techniques to predict political instability in Africa. A problem with regression studies, however, is that they sometimes fail to forecast in advance the conflict or other dependent variables which they are trying to predict. This problem involves the distinction between prediction and forecasting. Prediction utilizes "if-then" statements about future events; for example, if Country X develops rapidly, then Country X and Country Y will engage in conflict. A forecast tries to determine if Country X will actually develop rapidly. Most regression studies are largely cross-sectional (rather than time-series based) and thus predict rather than forecast.

Another forecasting method used in international relations research is the taxonomy. Young (248) uses taxonomies of states based on foreign policy output and situations to generate better forecasts of national behavior. O'Leary and Coplin (308) use a classification of states based on the number of past coups to predict future coups. On the basis of factor analysis, Rummel (280) suggests using types of nations to forecast international behavior. While this technique seems rather limited, it may provide a simple way of predicting general behavior.

Finally, there are forecasts in international relations based on more subjective methods. O'Leary and

Coplin (308) use predictive surveys and expert-generated data for forecasting purposes. They use the survey to tap expert opinions of future events and conditions, and to forecast the results of elections in three European countries. The authors maintain that the method allows them to make fairly accurate forecasts quickly and at little cost. They also use expert-generated data to forecast the resolution of issues in North-South Korean bargaining situations. Brinsley and Wickstrom (338) use similar methods to generate expert assessments of future (post-1990) levels of conflict, possible U.S. military involvement, and probable military roles for selected international issues. Such studies indicate that methods which are less than "objective" yet quantitative may be used to generate useful forecasts in international relations.

2.3 Crisis Forecasting

In this section, attention will be given to research on the forecasting of crises as well as to two areas of research closely related to the forecasting of crises: forecasting of conflict and the forecasting of international violence.

2.3.1 Forecasting conflict. Perhaps the most ambitious attempts to forecast levels of conflict are those of Weil (335) and Franco et al. (296). Using a set of 12 equations, with such variables as national power base, domestic unrest, dyadic trade, and international alignment, they generate forecasts of levels of international conflict for selected European nations for each year from 1971 to 1990. While yearly forecasts cannot be considered "early warning," they may well serve to alert us to possible areas of increased conflict.

Sigler (149) also attempts to predict long-term trends in levels of conflict between the U.S., the Soviet Union, and the People's Republic of China. Using a variation of the 22 World Event Interaction Survey (WEIS) event categories, Sigler is unable to find trends in conflict between the three nations under study and is thus unable to forecast any meaningful levels of conflict. Sigler suggests that perceptual variables may be more useful than interaction variables in providing early warning. This idea is echoed by McCormick and Champion (216), who use perceptions of threat to predict the outbreak of conflict and conclude that conflict can be predicted as much as five days prior to outbreak. McCormick and Champion use regression with lagged variables (and leading indicators) to forecast conflict for a specific time period (1 day). In addition, the main indicator, threat perception, is linked to explicit theories

of conflict escalation and decision-making. While the implication is that such an indicator can be used to forecast for all country-pairs, the analysis itself is limited to the Middle East.

Azar, Bennett, and Sloan (316), Azar (314), and O'Leary and Coplin (308) also attempt to forecast international conflict. Azar, Bennett, and Sloan use individual time-series analyses (country-pair, specific) to produce short-range (one month) as well as middle-range (six to 24 months) forecasts of conflict and cooperation between five countries. Using Richardson's Arms Race Model as a theoretical basis, they generate forecasts by means of indicators of reaction. Azar uses scaled event data and stepwise regression to generate monthly forecasts of maximum, minimum, and relative hostile activities for 2 dyads over a 36-month period. Comparing predicted to observed hostilities, Azar finds that the model works quite well in accurately forecasting hostilities. O'Leary and Coplin use changes in the frequency of violent acts and changes in the symmetry of conflict to forecast levels of violence in the Middle East. They report that the use of their indicators would have produced clear signals of the 1967 war several weeks in advance.

2.3.2 Forecasting war. The analysis of war is also relevant to forecasting crises. Leng and Goodsell (322) attempt to develop a predictive model of war-proneness by using indicators of symmetry of conflict, conflict lock-in, and threat of military violence. Among other findings is that the threat of military action is a turning point in a conflict. The authors imply that if one monitors such turning points, one can forecast increases in violent conflict. Newcombe, (328) and Newcombe and Wert (329) develop indicators of the likelihood of a nation's going to war within five years. They use tension ratios and defense burden and schedule critical values of these indicators to formulate a Distant Early Warning System which would predict which nations are most likely to go to war. Their models, which predict the likelihood of war, are based on causal theories of war. In this sense, the indicators become variables and thus contribute to prediction as it is commonly understood in social science (see Rothstein, 246).

Another model which attempts to predict the outbreak of war has been developed by Brown et al. (339). They use a decision-analytic model to determine U.S. readiness for a Warsaw Pact attack and employ subjective methods for eliciting estimates of the probability of attack and the utility of various responses and outcomes from expert

analysts. The analysis is both quantitative and rigorous, utilizing leading indicators (which are not based on an explicit theory) and quantitative assessment and aggregation of individual estimates.

2.3.3 Forecasting crises. More closely related to crisis forecasting is the work of Alcock (310). He uses military expenditures as a percent of GNP and GNP per capita to predict international conflict over a four-year period. Although the data he uses are ordinal (rank orders), the forecasts themselves are nominal (conflict/no conflict, or crisis/no crisis). The results of this study show that conflict (or crisis) can be predicted by using the variables.

A rigorous attempt at crisis forecasting is that conducted by Rubin (343). Rubin uses a regression analysis of lagged variables to predict crisis for four dyadic relationships. He uses two methods of defining crisis: nominal crisis/non-crisis distinction and an interval definition of crisis (increases in threatening and violent acts). The main findings of the study are that certain event indicators by themselves are inadequate for crisis forecasting, that dyad-specific forecasts are very important, and that short-term predictors work much better than longer-term ones.

Other important work on crisis forecasting has come from McClelland's Threat Recognition and Analysis Project. In several papers, McClelland (117, 325, 327) shows how crises can be forecast by using events data. He tests the method by examining crisis and non-crisis periods for false alarms and claims that the method forecasts crisis with about 80% accuracy. In another paper, McClelland (325) shows how the Indo-Pakistani crisis of 1971-72 could have been forecast by using the percentage of events taken up by a single pair of countries for two-day periods as an indicator of crisis. While these studies are preliminary in nature and limited in scope, they form the basis for more rigorous studies of crisis forecasting. McClelland (326) explains, in the context of international systems theory, the use of his indicators. He also develops more fully the indicators he uses for forecasting. He uses indicators based on volume and variety of events in the international system as a whole (EFI) and on the percentage of events generated by a single nation (ROZ). These indicators are tested by using nine cases measured weekly. Although McClelland suspects that the international system has changed and that the indicators may not be so useful or so reliable as in the past, the indicators seem to work quite well in the test cases.

The work by McClelland is extremely important since it combines the use of country-specific forecasts (by using tested, leading indicators) with systemic theory. Rather than assuming that crisis behavior remains regular across time, McClelland attempts to make short-term forecasts because he recognizes that the system (and thus the indicators) has the capacity for change. This argument is also made by Azar, Bennett, and Sloan (316) in examining parameter changes of forecasting equations across time.

Another attempt at forecasting crises at the systemic level is put forth by Laszlo (321), who assumes that the main source of crises is the attempt of nations to satisfy needs without regard for the needs of other nations. In order to forecast crisis, Laszlo proposes that Resources/Needs Development Charts (RND Charts) be constructed for each nation and for the world. Such charts would map the needs and resources, both present and future, of nations and the world. By examining trends, the analyst could forecast which nations might be inclined to initiate conflict or a crisis in order to satisfy its needs.

3.0 EVALUATION

The above sections certainly illustrate that a great deal of diverse international crisis research exists or is currently in progress. While most of the research in its own way contributes to our understanding of crisis, it is not all relevant to our desire to design, develop, validate, and install an integrated user-oriented crisis warning system. Accordingly, this section evaluates existing on-going research and pinpoints critical research gaps, with specific regard to the above research goal.

3.1 Crisis Research

In order to develop reliable and verifiable crisis warning systems, relevant research should be quantitative and comparative, and should yield empirical, verifiable generalizations.

Much of the previous work on crises has been non-quantitative and of a case-study nature. The work on perceptions by Zinnes (185), Zinnes, Zinnes, and McClure (187), Hilton (83), Holsti, North, and Brody (92), and Schwartz (145), however, is largely quantitative and provided sufficient generalizations about crisis behavior to be used for practical crisis forecasting by McCormick and Champion (217).

The work by McClelland (106, 108, 110), McClelland et al. (215), Azar (53), Smoker (156), and Sigler (149) on interactions is quantitative (although based on case studies) and yields empirical generalizations about the behavior of nations, generalizations which are later used by McClelland (327, 328) to forecast international crises.

As was mentioned above in Section 2.1.5, work on crisis management has been largely non-quantitative and has not produced usable generalizations about crisis behavior. More recently, the works of Butterworth (8) and Hazelwood and Hayes (201) attempt to use quantitative and comparative analysis of crisis management situations to yield empirical generalizations. These efforts have not, however, provided generalizations which are usable by those who forecast crises.

Overall, then, crisis research has been of use to applied crises forecasting. The recent surge in quantitative studies yielding operational generalizations gives impetus to the belief that crisis research will continue to be more useful in the future.

3.2 Forecasting Research

To be of use to crisis forecasting, general forecasting research should--most importantly--generate methods compatible with available crisis forecasting data.

Crisis forecasting data is usually of an ordinal or interval nature. Such data are normally time-series and objectively derived. Most of the forecasting methods reviewed in Section 2.2.2 (regression, taxonomies, trend-extrapolation) are well suited to this kind of data. More ambitious methods such as econometric modeling seem less well suited for use with relatively less sophisticated data. Subjective methods, such as Bayesian and Delphi ones, seem ill-suited for crisis forecasting because of the difficulty of obtaining expert-generated data. Work by O'Leary and Coplin (308) and Brown et al. (339), however, indicates that such methods may be useful to crisis forecasting if data can be more easily obtained and if one can place a great deal of confidence in one's experts.

3.3 Crisis Forecasting

Crisis forecasting research should have a specific country focus (dyadic, monadic, limited multi-actor) and be conducted in the context of specific time frames. Almost all of the works reviewed in Section 2.3 meet this criterion. Most attempts at forecasting crises or conflict do so for specific countries or groups of countries, although McClelland (326) tries to forecast crisis in the system as a whole. These attempts usually make their forecasts for the next time period or within a specified period of time rather than forecast that a crisis will occur "sometime in the future." The work on crisis forecasting, although limited, is thus particularly well done with regard to the above criteria.

4.0 SUGGESTIONS FOR FUTURE RESEARCH

Despite the large number of existing and on-going studies, there are many areas in crisis research, forecasting and crisis forecasting requiring additional research. In the area of crisis research, such subjects as practical theory development, like work by Edwards (14), McClelland (325), and Brecher (61), typologies of crisis, and measurement of crisis need to be expanded and refined. In addition, since in most of the research examined above, case studies rather than comparative analyses were used, more attention must be given to comparative analysis of crisis behavior.

In the area of forecasting in international relations, emphasis must be put on refining techniques and adapting them to international relations problems and exploring newer techniques, particularly those of a more subjective yet quantitative nature. Greater contact between crisis researchers and forecasters in other areas such as economics, business, and technology assessment might facilitate this. Research must also be initiated into combining forecasting techniques, both objective and subjective, into a unified forecasting capability, as in studies by Andriole (311) and Andriole and Young (312).

There are also gaps in crisis forecasting research. Wider ranges of indicators must be developed. More varied political indicators, military and economic indicators, both international and domestic, also need to be developed and tested. An effort should be made to attach probabilities of crisis to forecasts. Two examples of such work are those of Belden (317) and Andriole and Young (312). Rather than being expressed either as a dichotomy between crisis and no crisis or as a level of future conflict, forecasts should be expressed in the form of probabilities. These allow a margin of error to be specified for each forecast and allow the analyst to observe increases or decreases in the probability or likelihood of a crisis. The forecasting of crises must also be extended beyond international political crises only, to different kinds of crises. Domestic crises, whether political or economic, and international economic crises all have important implications for international politics and must be examined and forecasted.

An effort should be made to develop a generalized crisis forecasting capability which would monitor and forecast crises in all parts of the world on a real-time basis. This effort would result in a kind of a global or regional monitoring system such as a non-prescriptive

version of that envisioned by Snyder, Hermann, and Lasswell (286), Rummel (330), McClelland (326), and Andriole and Young (312). Such a system would enable analysts and policy-makers to monitor large parts of the international arena yet make very country-specific forecasts about the likelihood of crisis.

Finally, crisis and crisis forecasting research must be examined for the purpose of merging findings into international relations theory and into practical use. Research should strive to indicate how crisis and crisis forecasting research is comparable with other areas of research in international relations and how the results might be used in actual practice. In this way, such research would serve both the scholar and the practitioner.

APPENDIX

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Crisis Research

- General Research,
- Conceptual and Theoretical Research,
- Beginning of Crises,
- Crisis Behavior, and
- Crisis Management and Resolution;

Forecasting Research

- Epistemology of Forecasting,
- General Forecasting Methods, and
- Application of Forecasting to International Relations Problems; and

Crisis Forecasting

- Forecasting Conflict,
- Forecasting War, and
- Forecasting Crises.

After the literature in each area was examined, critical evaluation was conducted with the following conclusions: - - -

- (a) Crisis research has been of use to applied crisis forecasting by providing useful generalizations about behavior;
- (b) Forecasting methods are well suited to crisis forecasting data although much work needs to be done before sophisticated techniques such as econometrics and subjective methods can be used; and
- (c) Crisis forecasting research has been specific in country focus and conducted in the context of specific time frames and is thus useful to future applied crisis forecasting.

The following suggestions for future research are made:

Crisis Research

- Practical theories of crisis must be developed,
- Typologies of crisis need to be expanded and refined, and
- More comparative crisis analysis is needed;

Forecasting Research

- Present techniques must be refined and adapted,
- New techniques (particularly subjective techniques) must be explored,
- Greater contact between crisis researchers and forecasters in other fields needs to be initiated, and
- A unified forecasting capability needs to be developed; and

Crisis Forecasting Research

- More political, economic, and military crisis indicators need to be developed and tested,
- Internal crisis indicators need to be developed,
- Crisis probabilities need to be developed,
- Domestic, global, and economic crises need to be examined and forecasted,
- A generalized, real-time crisis forecasting capability needs to be developed, and
- Findings of crisis research should be merged into general theories of international political behavior and into practical use.