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A SUMMARY AND ANNOTATED BIBLIOGRAPHY OF RESEARCH BY  
THE DIMENSIONALITY OF NATIONS PROJECT, 1967-1973

HAWAII UNIVERSITY

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THE DIMENSIONALITY OF NATIONS PROJECT  
Department of Political Science  
University of Hawaii

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BY THE DIMENSIONALITY OF NATIONS PROJECT,  
1967-1973

R. J. Rummel

December, 1973

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1. INTRODUCTION

In 1967 the Dimensionality of Nations Project (DON) submitted to the Advanced Research Projects Agency (ARPA), Department of Defense, a Five-Year Program of research (35).<sup>1</sup> This program was to build upon DON's previous research and had as long-range goals (1) improving our ability to forecast international relations, and (2) theoretically linking a number of diverse quantitative research approaches to international relations.

The proposed research itself involved three interrelated tasks:

Task I: Global system. The aim here was to determine the global dimensions of dyadic behavior between nations (such as the U.S. and U.S.S.R., U.S.S.R. and China, and China and the U.S.) for a number of years and the relationship -- the linkages -- of this behavior to their differences and similarities in capabilities, development, political ideology, instability, cultures and so forth. The purpose of these analyses would be to define the systematic correlates of changes in hostility, conflict and patterns of deterrence.

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<sup>1</sup>Numbers in parentheses refer to listings in the DON bibliography at the end of this report.

Through these analyses, it was argued, we would be able to define more precisely the probabilities of conflict and hostility between particular nations and the instability of deterrence.

Task II: Asian system. The Asian international system is of particular importance in world politics. It is the locus of new power relationships and a potential source of global instability. Moreover, the results found for the global system of nations may change contextually when we focus on Asia. For these reasons, it was proposed to redo the analyses outlined in Task I for the Asian system and to devote some additional resources to quantitative analyses of Asian conflict.

Task III: Computer simulation. The previous analyses would then provide the parameters and dimensions for computer simulations of international relations, such as of the future likelihood of conflicts between the U.S. and China or Japan, given projected changes in their development, ideologies and capabilities.

This five-year program was approved by ARPA in 1967 and the research was initiated under a first two-year budget, subject to subsequent annual renewals. In 1972, the five-year program was extended for an additional year (without new funding) to enable data collection to be completed. The program terminated on August 31, 1973.

The purpose of this report is to overview the accomplishments of the program's tasks to date. Now, these accomplishments are specified, detailed and elaborated in several dozen research reports, articles, books and dissertations published since the inception of the program. Accordingly, the most helpful approach to summarizing these accomplishments will be through organizing these publications and annotating them with regard to the original tasks. In this way,

specific material can be located easily, the overall research approach can be visualized, and the important findings can be given in context.

Let me underline that these publications constitute distinct studies, with a specific purpose within the overall research design guiding the five-year program. No comprehensive work has yet been produced bringing together all these separate studies in terms of the long-range goals of the program. This I am now in the process of doing through a series of volumes to be published over the next five years. I therefore can only summarize here in broad brush DON's central accomplishments and present publications, 1967-1973.<sup>2</sup>

## 2. THE DESIGN

There is no need here to present the detailed research design for the three tasks. However, a summary of the major efforts that were felt necessary to accomplish these tasks is helpful. Table 2.1 displays the three tasks and the six aspects of the research effort. The numbers in the table refer to the appropriate publications listed in the DON bibliography.

First, we needed ongoing methodological work associated with the three research concerns. Virtually all our analyses involve the computer. Accordingly, we had to develop and test computer programs and, eventually, build our own computer system. Next, we had to be sure we knew what we were doing methodologically, which entailed

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<sup>2</sup> Note that I am only annotating those publications produced since 1967. Thus, the two dozen research reports, articles, and dissertations completed or published under DON during the period 1962-1967 are not included here.

Table 2.1  
 Dyadic International Behavior,  
 Attributes, and Linkages\*

<u>Aspects</u>		<u>Task I Global System</u>	<u>Task II Asian System</u>	<u>Task III Simulation</u>
Methodology	Computer	40, 79, 88		
	Res. Design	2, 5, 12, 41		2, 12
	Data	14, 46		X
Data Collection		91, 93	91	X
Analyses	Substudies	3, 11, 13, 28, 37, 42, 43, 48, 50, 51, 52, 53, 59, 68, 72, 78, 80, 98	58, 92	
	Modules	13, 15, 70	13, 15	
	Main Line	1, 7, 9, 19, 20, 39	1, 7, 19, 20, 39	
Theory	Development	17, 49, 56, 57, 63, 73, 76, 84		
	Tests	18, 55, 69, 94	45, 61, 74, 83, 87, 90	18, 55, 69, 94, 83, 87
Policy	Theory	63, 77, 81, 85, 86, 89		
	Relevance	60, 62		
Informational		6, 8, 10, 23, 27, 30, 32, 35, 43, 45, 64, 74, 82, 100		

\*Numbers refer to the bibliography.

considerable study, exploratory analyses, and methodological "test" runs (such as testing out alternative grouping algorithms). And, of course, there were methodological issues surrounding our use of comparative and international relations data. Of particular concern was the effect of levels of measurement, missing data, and error on our findings.

The second aspect of our research comprised data collection. To determine dimensions of dyadic international behavior and their linkages, masses of data were required and this collection absorbed around seventy-five percent of our time.

Third are the analyses. In these lie the heart of our work, and as would be expected, the largest number of our publications. Our analyses worked at three levels. One comprised numerous pilot studies -- those exploring or testing a promising line of analysis. It is unwise to commit a couple of years and associated resources to a branch in our research design without obtaining some preliminary idea about what would be involved. Two, there were numerous subanalyses constituting modules in the major effort. Thus, a module of Task I was determining UN voting dimensions, which can then be incorporated in the larger analysis of the global dyadic system. Three, were the mainline analyses directly concerned with accomplishing the three tasks.

A fourth aspect of the research was theory. Empirical analysis without theory is a ship without a navigator. Theory gives understanding and direction to analyses, and for this reason a major concern of DON has been the theoretical context of the research. Two theoretical concerns were evident from the beginning of DON's efforts. One was to develop a theoretical framework which encompasses our efforts and

relates to those of others. The other one was to test out theory in the context of the two empirical tasks. If reliable, the theory could then serve to structure the Task III simulation.

Fifth, policy concerns were an integral aspect of this research. The original and overriding aim of the research was to help to rationalize foreign and defense policy decisions. In achieving this, there were two considerations of utmost importance. One was the nature of policy making; and, especially, policy questions. This has to do with policy theory. The second consideration was relevance: in what way is the DON research relevant to policy?

Finally, there is the informational aspect. The effort here is mainly to communicate to other researchers and analysts about the nature of DON's results, theory and methodology.

Such are the aspects of DON's research, 1967-1973. These give perspective on DON's accomplishments and provide organization for the subsequent annotations. In the following sections I will present the publications growing out of each aspect shown in Table 2.1, and for each aspect I will indicate its relevance to the indicated tasks.

### 3. METHODOLOGY

3.1 Computer. Considerable effort went into developing an integrated computer data storage and analysis system, enabling us to work easily between data and their analyses. Charles Wall, our programmer, prepared one report (88) growing out of this effort that describes a "job control procedure allowing users with private disks to allocate and retrieve data easily." Also emerging from this effort was a method to dynamically store in computer core the data needed for analysis,

which was published as a report (79) by Alan C. H. Kam (computer systems and programming) and Charles Wall. This particular method has saved us thousands of dollars in computer time, since through it we allocate only that core required for a particular analysis (computer rates are partially based on the amount of core used).

Aside from our computer system, to do our individual analyses, necessitated developing original computer programs. Only one of these, however, was written up as a research report (40), which was our profile program to "plot the underlying similarity of groups" developed by Dennis Hall, a research assistant. The output of this program has been included in subsequent reports, such as The Dimensions of Nations (1).

The above work is relevant to both Tasks I and II. For the simulation Task a separate program being developed will be included with a report on the simulation results.

3.2 Research Design. The methodological aspects of our research have been a continuous concern, to the point that some have felt DON to be "too methodological." Underlying our operational techniques is the use of correlational analysis, factor analysis, multiple regression, and canonical analysis. Consequently, these techniques were intensively investigated theoretically and empirically. This work began before the Five-Year Program was formally underway, but continued for the life of the program. One book, Applied Factor Analysis (2), grew out of this effort and covers the variety of multivariate techniques, with a focus on factor analysis. It also considers in detail associated questions of data collection, measurement, scaling, transformation, and so on. One article (5) was also written

to enable those unfamiliar with our methodology to interpret our technical results.

Forecasting was DON's long-range goal and some methodological consideration had to be given to alternative forecasting techniques. Therefore, a report (12) was prepared which discussed forecasting and the particular methodological problems inherent in international relations data, and in the many variables and nations required for analysis. Research was then proposed on three-mode factor analysis as a possible solution. Subsequent research showed an alternative technique method (super-P factor analysis) was better able to deal with our data. Indeed, super-P factor analysis became the basic time-series research technique.

Another design problem involved the proper approach to use in grouping nations within the space of their behavior or attributes. Accordingly, Warren Phillips, then DON's assistant director, carried out a number of grouping experiments with different techniques on data with known structure: a between city mileage matrix. The resulting report (41) suggested direct factor analysis techniques were better than hierarchical clustering approaches for defining the major clusters.

The methodological work on our research design was pertinent to both Tasks I and II. The methodological theory of factor analysis (2) and the problem of forecasting (12) applies equally to the simulation task. The simulation's structure should be built to correspond with that of the mathematical model underlying our analysis. A thorough grasp of this model was therefore required.

3.3 Data. Two major problems relevant to our analyses of the global and Asian systems concerned the error in our data and the modes by which missing data might be estimated. Analyses of the problem of data error were begun well before the five-year program and were continued through the program's first years. One publication (14) summarizes the empirical and theoretical conclusion of these studies. In brief, there are two kinds of error affecting multivariate analyses: random and systematic. Random error only weakens what empirical relationships are found. Thus, any results involving random error would be conservative. Systematic error, however, can seriously distort multivariate findings. Accordingly, controls for such error were suggested and the major sources of such error in our data were empirically delineated, which were low levels of economic development and totalitarian political regimes.

Regarding missing data, analysis of this problem involved two questions: what alternative ways were there of compensating for missing data; and if data needed to be estimated, how best could this be done? Our answer to the first question was that there are four approaches to resolving the problem of missing data: (1) eliminating nations and variables with missing data, (2) treating missing data as blanks in the analysis, (3) estimating missing data judgementally, or (4) estimating by ratings, mean values, measurement scale reduction, factor analysis, or regression analysis. The latter approach was then followed by developing a multiple regression program (MISDAT) for estimating missing data. This analysis of the problem and the computer program were presented in a DON report (46).

#### 4. DATA COLLECTION

DON's data collection under the Five-Year Program ultimately involved the following major segments:

- (a) UN voting for all nations for all General Assembly roll calls, 1950, 1955, 1960, 1963, 1965;
- (b) 24 dyadic conflict variables for the same years for all nation-dyads;
- (c) international organization co-memberships for all nations for the same years;
- (d) 94 attribute variables for all nations for the same years;
- (e) 50 dyadic behavior variables for 180 dyads for the same years;
- (f) same dyadic behavior variables for all Asian dyads for the same years;
- (g) about 40 variables for China's behavior towards all other nations for the same years;
- (h) about 40 variables for U.S. behavior towards all other nations, 1955, 1960, 1963, 1965;
- (i) about 40 variables for U.S.S.R. behavior towards all other nations, for the same years as (h).

In addition, there were numerous minor complementary data collections involved in completing the above, or relevant to a specific research report, such as (92).

The major data collections, (d) and (e) above, have been published (91, 93). The Asian collection (f) is completed, but has yet to be put in research report form. Both collections (d) and (e) as well as some of the others have been deposited with the University

of Michigan Consortium<sup>3</sup> and this will be done for the Asian behavior collection as soon as the appropriate report is finished.

Note that collection (d) published in (91) is relevant to both Tasks I and II. This is because this collection involves attribute data for all nations, regardless of region.

## 5. ANALYSES

5.1 Substudies: Global. The predominant interest of DCN has been in conflict between nations. What causes conflict? What are its correlates? How may it be forecast? How is it resolved? The whole thrust of the Five-Year Program is towards providing a basic research base for answering such questions. The three tasks comprising our research provide a systematic attack on the nature, correlates and forecasting of international conflict. Such research designs are linear and restraining, however. To get to the goal, they avoid many side questions, provocative spinoffs, or promising avenues. But investigating these byways may ultimately yield results more important than those resulting from a narrow adherence to the original design. Scientific research, as any researcher must discover, is dialectical.

Accordingly, DCN simultaneously pursued research at two levels. First, there were the research designs involving Tasks I-III. This was called the mainline research. Second, and without endangering the mainline research, a portion of our resources was devoted to

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<sup>3</sup> International Relations Archive, Inter-University Consortium for Political Research, Box 1248, Ann Arbor, Michigan 48106.

exploring the side analyses suggested by our major interests and research. Most of these analyses dealt with conflict.

To organize these studies with regard to Task I, I will divide them into dyadic foreign conflict, bynation foreign conflict, foreign conflict linkages, domestic conflict, general conflict findings, and resolving conflicts. After considering these, I will summarize our studies of international nonconflict behavior and national attributes.

#### 5.1.1 Dyadic foreign conflict.

Of interest in their own right are the dimensions of dyadic foreign conflict behavior. For years I had been collecting data on foreign conflict from my daily reading of The New York Times. These data on events occurring from the mid-1962 period through 1968, and supplemented by additional data collected for other years such as 1950, 1955, and 1960 were a mine of valuable information.

One study (13) on these data for twenty-four different kinds of conflict events delineated five patterns of dyadic foreign conflict behavior for 1963: negative communication, violence intensity, warning and defensive acts, negative sanctions, and unofficial incidence of violence. These patterns were similar to those found in the 1955 data (7) and showed that dyadic conflict has a stable structure over an eight-year period.

However, to make the similarities and differences in conflict patterns between 1955 and 1963 more precise and to treat specifically of the dynamics of conflict, another study was done (42). This quantitatively measured and mapped for individual dyads, such as the U.S. and U.S.S.R., the shifts in patterned foreign conflict behavior

from 1955 to 1963. Moreover, a taxonomy of nation pairs was developed based on the similarity in conflict behavior shifts over this period.

A question was whether these patterns found for 1955 and 1963, which were cross-sectional patterns, would be consistent with those found in a dyadic time series analysis. Warren Phillips proposed a research design (43) for doing this and subsequently completed the analysis (59) as his dissertation (95). Analyzing conflict for 267 dyads on a month-by-month basis for 1963, patterns identical to those that exist for the cross-sectional data were found. Moreover, seven groups of similarly behaving dyads were found for these months, the most important of which manifested Cold War conflict, routine military activity, crisis behavior, and third world discontent.

The above analyses were concerned with dyadic behavior, that of one nation to another. A question that can be asked is whether this behavior is in response to that of the object. That is, does a simple stimulus-response behavior model fit the conflict data? Moreover, if there are deviations from the model, what accounts for them? Phillips dealt with these questions and showed (68) that there was a high correlation between conflict behavior received and sent by nations. Moreover, deviations are accountable by national characteristics, particularly internal unrest and instability.

#### 5.1.2 Bynation foreign conflict behavior.

Dyadic conflict behavior constitutes but one level of analysis. Another involves the total behavior of a nation. We may not only ask about the dimensions in the conflict behavior of nations towards particular others, but also about the conflict behavior of nations

towards the system as a whole -- towards all other nations. Two substudies were reported bearing on this.

The first (48) described the conflict patterns of nations (not dyads as in the previous analyses) and their grouping on these patterns for 1963. The patterns, or dimensions, delineated for 107 nations and twenty-four different kinds of conflict behavior were written or oral negative communications; unofficial violence, including unofficial attacks on foreign official persons or property; negative sanctions, including boycotts and embargoes; warning and defensive acts, entailing military alerts and mobilizations; and official violence, involving clashes and discrete military acts. These dimensions are similar to those found in the dyadic conflict data, thus suggesting that they represent general patterns of foreign policy outputs.

The second study (53) was concerned with the change in patterns of conflict for 82 nations from 1955 to 1963. Plots were presented showing such changes and change profiles were determined for each nation across the conflict patterns. Nations were then grouped on these profiles to determine whether dynamic conflict types could be defined. At least five such groups of nations with similarly varying conflict were found, in which the characteristic nations for each group were Spain, Yugoslavia, United Kingdom, Cuba, and U.S.

#### 5.1.3 Foreign conflict linkages.

It is one thing to identify conflict patterns. It is quite another to determine the correlates, conditions, or causes of conflict. The latter concern is, of course, central to DON's tasks. In order to explore such conflict dependencies, a survey was made and subsequently

published (3) of all the empirical work involving foreign conflict behavior. These results, then, were evaluated systematically in terms of several hypotheses about foreign conflict, relating its occurrence positively or negatively to: a nation's economic or technological development; international communications or transactions; international cooperation; totalitarianism; power; military capabilities; psychological motivations; national values; number of borders; or the interaction among the above.

None of these hypotheses bore up under the variety of empirical evidence accumulated in the literature. The conclusion was that scholars had considered the question of conflict from the wrong perspective, which is from the point of view of the nation vis-à-vis all others. However, when the perspective is shifted to dyadic foreign conflict and differences and similarities within the dyad, then strong relationships between dyad conflict on the one hand, and power, economic and political differences on the other, emerge. And this constitutes DON's theoretical perspective.

#### 5.1.4 Domestic conflict.

Not all our studies are easily categorized. Some were meant to simultaneously satisfy a variety of research needs and objectives. Such is the study of Firestone and McCormick (50), which is an intensive investigation of the role of factor analysis in systems theory and dynamic analyses, focused empirically around the annual domestic conflict of nations, 1955 to 1966. This study thus contributes to DON's methodology and theory, as well as advancing our systematic knowledge of domestic conflict. In general, it showed the value of

the factor model in giving rigor to systems concepts and further confirmed the existence of unorganized and planned dimensions of domestic conflict. Moreover, it showed that planned violence is dynamically independent of the other dimensions of conflict through time, and indeed, has no discernible linear or nonlinear relationship to time. However, unorganized violence and the number killed in domestic conflict as separate cross-sectional dimensions do have a strong negative relationship through time. Groups of nations were then defined in terms of their similarity in over-time domestic conflict, and harmonic analyses were done within groups. It was found that the dynamic picture is then far more complex, many relationships having been lost in the aggregate. Consistent, however, was the lack of relationship between domestic conflict and time.

Another study by Firestone (52) focused entirely on whether changing needs for achievement, affiliation, or power from 1925 to 1950 have any relationship to changes in domestic conflict behavior, 1955-1966. A cyclic intensity of relationship between conflict and motivations was found, but no clear trend towards an increasing or decreasing potency of motives could be discerned in the data.

#### 5.1.5 General conflict findings.

Empirical analyses by DON and other research projects and scientists have accumulated a confusing variety of findings. Accordingly, an effort was made to bring some order into these results and focus on the generalizations on which they converge. The conclusions of this effort were published (11) and comprised the following: domestic and foreign conflict behavior are statistically independent; there are no common conditions or causes common to both domestic and foreign

conflict behavior; turmoil (or unplanned conflict) is a primary dimension of domestic conflict behavior; independent of a turmoil dimension, are patterns of revolution and subversion; foreign conflict behavior occurs along war, diplomatic, and belligerent dimensions. These generalizations were made prior to the analyses reported in Section 5.1.2, above. Those analyses now show these foreign conflict dimensions to comprise five distinct patterns, as mentioned previously.

#### 5.1.6 Resolving conflicts.

Of course, our concern with conflict derives not from a bland curiosity, but from an ardent desire to help in controlling, managing or eliminating violence. For this reason, some effort has been devoted to understanding how and why wars are resolved, once they occur. Two studies on this were done. One by Herbert Hannah (37) was a pilot exploration of the problem on available data. A second, more thorough study (98) using new data on war resolution and DON's accumulated attribute and behavior data, found that for war's occurrence: "The frequency of conflicts has not decreased during this century and the duration of conflicts is unpatterned through time, although violent conflicts have become shorter. Political system types are not much related to the occurrence or termination of conflicts, at either the national or systemic level, but recently independent states of the postwar period are very likely to become involved in frontier conflicts."

Concerning resolving or terminating 98 conflicts from 1914 to 1965, it was observed that: (1) there were five separate kinds of outcomes, which were conquest, submission-withdrawal, passive-frozen, compromise, and award; (2) settlement procedures were found

to be bilateral, multilateral, or to involve mediation, international organizations, and judicial means. When the outcomes are related to systemic attributes, conflict attributes, settlement procedures, and attribute differences (e.g., power parity), it was shown that attribute distances -- the similarities and differences -- between nations are the best predictors of conflict outcomes. The study then gives details about which distances are most related to which kinds of outcomes, showing for example, that the conquest outcome is most related to the difference in size (or capability) between nations.

#### 5.1.7 International non-conflict behavior.

One crucial aspect of international relations comprises the communications between nations. One study (72) was thereby a review of the literature on international communications concerning:

"A. The structure and content of the flow of messages . . . .  
B. The distribution of specialized skills in receiving and reacting to messages . . . . C. The process whereby political images are created and distributed . . . . These three components of communicating are equated with interaction analyses, decision-making, and public opinion studies." The study concludes "that a nation's future communication is a function of both its own momentum in dealing with a specific other nation, as well as its expectation of the response from other nations."

The central arena of international communication and interaction is the United Nations. This is the cauldron within which international issues become aggregated and defined. Three studies were done on the UN in these terms, one of which was meant as a module (15) and

will be reported in that section, below. Of the two UN studies of interest here, one was done by Jack Vincent (78) on the attitudes of delegates to the UN. He found that of the UN and international affairs, delegates generally had positive wishes and perceptions which were found highly related to the economic development and the type of political regime of their home states. Development, however, appears to have the overriding importance in delegate attitudes, a finding found centrally relevant to DON's theoretical foundations.

The second UN study, also done by Vincent (80), was an intensive analysis of voting patterns in the 23rd and 24th General Assembly sessions. Voting, he found, was highly dependent on the economic development, nature of the political regime, and relations with the U.S. of the delegate's state. Thus in the UN both attitudes and behavior (voting) have almost the same explanation.

#### 5.1.8 National attributes.

Two kinds of attributes help to explain international behavior: those defining political regimes and those concerning motives. The characteristics and correlates of political regimes were the focus of a variety of analyses published by Warren Phillips and Dennis Hall (28). They determined that the variation of nations in their governmental structure is clearly related to other national attributes, such as political ideology, Catholic culture, density and exports. The total foreign and domestic conflict of nations and their economic development appear to have little to do with governmental structure, however.

Regarding motives, Firestone and Oliva (51) reviewed research on motives and national attributes (or character) and developed a

framework for research on this relationship. Then they tested an over-time conceptualization of this relationship, particularly regarding cooperation and conflict, and explored the predictability of national attributes by motives. Their empirical analyses disconfirmed their framework, and suggested that laboratory research on motives (from which the framework was derived) may not be useful for understanding motives at the national level. However, they did find that indicators of motives are useful for over-time prediction of attributes, especially when motives are viewed as continuous variables in a multivariate setting.

5.2 Substudies: Asian. The previous substudies ranged across all nations and dyads. However, some substudies were done on Asian data alone. Tong-Whan Park (58) defined the regional groupings of 19 Asian nations in their non-conflict relations, and determined the systemic factors underlying these groups. The grouping of Asian nations was strongly bipolar, separating into communist and non-communist groups, a grouping which changed little from 1955 to 1963. The core nation of Asia was Japan; it had peaceful interactions with a wide ranging variety of Asian nations, whether communist or not.

Another more recent study, by Sang-Woo Rhee (92), was an exploratory attempt to track the changing meaning and content latent in foreign policy relevant speeches. He focused on 49 official messages concerning unification sent by North Korea to South Korea over the years 1948-1968. Thematic content analyses and factor analysis mapped the underlying nature of these messages and showed

their variation over these twenty-one years. These results especially were helpful in providing statistical background for analyzing current Korean unification talks.

5.3 Modules. Of more direct relevance to DON's mainline Tasks were those studies constituting modules within the main research design. For example, one module may comprise analyses operationalizing a subset of variables (such as UN voting distance) to be included with others in the larger design. However, these modules were often of value in their own right and therefore were reported separately.

Such a module was a study reported by Dennis Hall and R. J. Rummel (13), which presented the analysis of dyadic conflict behavior for 1963. The purpose of this analysis was to reduce 24 dyadic conflict variables to a smaller number that could then be included in the global and Asian dyadic behavior analyses. The reduced set of variables actually derived and subsequently used are the five patterns (negative communications, violence intensity, warning and defensive acts, negative sanctions, and unofficial incidence) reported in Section 5.1.1, above.

Another module, reported by Richard Pratt and R. J. Rummel (15), similarly reduced all the varied UN roll call votes to a small number of variables. To wit, we wanted a measure of the overall similarity and difference in UN voting between two nations for 1963, which could then be included in a dyadic matrix along with their trade, conflict, treaties, and so on, at both the global and Asian levels. We then first had to determine the dimensions of UN voting space, then the location between nations in this space, and finally

the distances between them. These distances constituted our voting dissimilarity index.

Analysis revealed voting dimensions "related to the settlement of international disputes and the Korea-China questions ('Cold War'), the distribution of authority and financial responsibility within the UN ('U.N. Procedures'), general discrimination and the application of sanctions to Rhodesia and South Africa ('Racial Discrimination-Sanctions'), and South African racial policies ('South Africa')." The distances between nations were analyzed to see how nations clustered into voting blocs. An interesting result was the discovery that the U.S. shows no issue alignment with any voting bloc as a result of conflicting interests.

The mainline analysis includes linking global dyadic behavior to attribute differences. This required first defining the dimensions of dyadic behavior for a wide range of variables, including those determined in the modules mentioned (13, 15). One such analysis of behavior, that for 1963, was later published (70). It showed that the 1963 dimensions of global dyadic behavior comprised deterrence, cold war, exports, students, migrants, diplomatic, military treaties aid, and UN voting. About thirty-five percent of the variation of dyads on these 1963 dimensions could have been predicted from their 1955 behavior. Those nations shifting most in their directed behavior from 1955 to 1963 were the Netherlands to UK, Indonesia to UK, USSR to Egypt, and India to US. Out of these analyses, a cooperation-conflict scale was developed, and a plot of selected dyads on it showed that the scale measures the major 1955-1963 shifts in behavior, such as that for the U.S.S.R., China, Cuba and U.S.A.

5.4 Main Line. The mainline goal was to determine the linkage between international behavior and attributes, both globally and for the Asian region. Although most of the major analyses were finished before the Five-Year Program began in 1967, the Dimensions of Nations book (1) included some studies completed after that date. Moreover, the overall results were directly relevant to our mainline research. These comprise, in part, the finding that nations are mostly distinguished by their economic development, power or size, political orientation, density, Catholic culture, foreign conflict, and domestic conflict.

The above results are also reported in (7) and (19) along with details of the research design and dyadic conflict results for 1955. Moreover, a publication (20) by Jack Sawyer goes into considerable detail about the attribute dimensions of wealth, size and politics.

An analysis of overall dyadic behavior for 1955 and the first attempt to link such behavior to attribute differences was completed (9). The analysis delineated largely the same dimensions given in (70) and discussed above. However, in addition to reporting dimensions and linkages, indicators were selected for both the dimensions of nations and of their dyadic behavior. A specification of these indicators should be useful to others doing cross-national quantitative analysis.

Our extensive analyses for 1955 taught us much about the kind and nature of the variables to include in subsequent analyses. Since we wished to analyze behavior and attributes across the years 1950-1965, relying on our 1955 results and those of others, we selected a new list of some 90 attribute variables and 50 dyadic behavior variables

for 1950 (39). This list then constituted the variable sample for all the subsequent years.

Since attribute data dimensions found for nations as a whole would also apply to the Asian region, those mainline studies (1, 7, 19, 20, 39) concerned with attributes were also relevant to Task II. Our concern with Asia was not how attributes differ, but rather how international behavior varies within the region from the global system and whether behavior links uniquely to attribute differences between Asian nations.

## 6. THEORY

6.1 Theory Development. Under the Five-Year Program, most DON research was done within a theoretical framework called field theory, which is applicable to both the global and Asian systems and to our projected simulations. The theory provides the mathematical structure and functions for the computer simulation, where the empirical results then define the initial simulation parameters and relationships.

The initial theoretical development and papers were completed before the Five-Year Program began. During the Program, however, theoretical elaboration continued parallel to the empirical analyses, data collection, and methodological studies. This elaboration comprised three facets. One, the continued development of the main field theory structure; second, the exploration of promising theoretical tangents; and third, the evaluation and critique of the main theory. The relevant DON publications will be presented under these three headings.

#### 6.1.1 Main theoretical development.

Any theoretical work should not be carried out in isolation from other theories. Accordingly, efforts were made to build bridges between DON's field theory and the most relevant theories developed by others. Two works characterize this effort. One (57) was an attempt to mathematically relate DON's field theory to the prevalent theoretical approach used by others quantitatively investigating international relations. Called attribute theory, for want of an accepted label, this approach treats the behavior of nation as a whole and as dependent on the attributes of nations, such as their development, ideology, power, density, instability and so on. Field theory, on the other hand, asserts that the behavior of one nation towards a specific other should be focused on, and that this behavior is a resultant of their differences and similarities to each other, rather than the absolute characteristics of the actor.

A mathematical relationship between both theories was shown to exist, whereby the parameters of field theory weighting the differences between nations equally for all nation actors are a simple function of the parameters of attribute theory giving the dependence of nation behavior on attributes. This relationship between both theories serves as a link through which the empirical statements of one theory can be subsumed by the other.

A second theoretical work (76) was an elaboration of field theory to encompass status theory as developed in sociology and applied to international relations. Status theory argues that international behavior is caused by status rank and disequilibrium. Both theories ground behavior on nation attributes, thus providing an avenue for subsuming status theory within field theory.

First, among the many dimensions spanning nation attributes, two -- economic development and power basis -- can be defined as status dimensions. These position nations on their relative statuses in field theory's attribute space. Second, status theory's two key concepts -- rank and status disequilibrium -- can be measured for nations by their status dimensions and, most importantly, by their status differences (distance vectors). The latter is the implement used to combine status and field theories, since, for field theory, distance vectors are the forces toward behavior. Finally, status and field theories combined imply that the dyadic cooperation and conflict behavior of economically developed nations is inversely related to their power differences; and that such behavior of economically underdeveloped nations is inversely related to their economic development differences.

The development of a status-field theory enriches both theories. Status theory is given a mathematical representation with clear functions and tests. Moreover, status-field theory explicitly considers status and status behavior as being related to other behavior and attributes. For field theory, status-field theory adds substantive richness and defines the direction of relationship between two attribute dimensions and behavior, making salient extensive sociological literature. Thus, under one umbrella are included two empirically active and systematic international relations theories.

Aside from the "bridge building," field theory itself required internal elaboration and clarification. These elaborations were usually published in conjunction with the reports on the theory's

empirical tests, as in (18, 55, 83). However, one (17) was wholly devoted to theoretical elaboration, particularly the role of time in the international field.

In social science theorizing and empirical analysis, time is treated as an absolute continuum along which events and entities existing at the same time have the same temporal status. This is true, for example, in all theoretical work in IR where the existence of an absolute calendar time is assumed. The purpose of (17) was to help alter the dependence of scholars on this singular view of time by incorporating in DON's field theory the notions of subjective (social) and multidimensional time.

In the theory developed in (17), time is treated as a set of dimensions which, along with social dimensions, describe the social space of nations. Attributes and behavior of nations have projections on these time dimensions contingent on a nation's change through calendar time; nations are then differently located on the time dimensions in terms of their relative magnitudes on the attributes related to time and their change in time on these attributes. Social time in international relations is thus represented as being dependent on the observer nation. In field theory terms, distances (for the same calendar time) between nation actor and object can be computed on the social time dimensions and treated as social forces affecting the behavior of one nation to another.

#### 6.1.2 Tangential theories.

Field theory is a philosophical, conceptual and mathematical perspective on nations. However, there are different mathematical or conceptual interpretations of the international field possible

within the same philosophical context. Accordingly, the DON staff was encouraged to develop alternative ways of interpreting mathematically or conceptually the field of behavior. Two such developments were published.

Dave McCormick (56) presented a field related theory "of across time international processes as a function of the changing attribute relationships between interacting nations (dyads). It argues that behavior is composed of two basic parts. The first is the trend of nation pairs toward relatively long-term future levels of behavior (both cooperative and conflictful). These trends may be either complex or simple. It is argued that the rate of change of the trend line on a dimension of behavior is a linear combination of the rate of changes of the socio-political-economic distances between the members of a dyad. In addition to the trends, the theory states that there exist more rapid 'temporary' changes such as occasional violations of air space or visits of ambassadors. These more rapid changes take the form of fluctuations or oscillations around the trend line. It is argued that nations which are similar to each other have clearer expectations of each other's behavior and resist deviations from these expectations more strongly than do nations which are different from each other. This resistance to deviation is hypothesized to lead to more rapid but less intense oscillations."

A different theoretical perspective, a mathematical theory of conflict dynamics, was published by Warren Phillips (65). He developed a dynamic theory "based upon the belief that behavior begets behavior -- that the behavior of one nation towards another

is a function of its previous experience with that nation. In other words, a nation's future behavior will be a function of both its own momentum in dealing with this opponent, as well as its expectations of the strategy an opponent is most likely to adopt when responding to an influence attempt."

### 6.1.3 Theoretical evaluation and critique.

No extensive theoretical development should go without outside evaluation and critique. Such have been encouraged by DON and when done have been written or duplicated into reports and disseminated.

One evaluation, by Nils Petter Gleditsch (73), critically and empirically compared rank, field, and attribute theories. For the data he was using he found some support for all three theories, but "this can largely be traced to the correlation of . . . two rank dimensions with interaction. To choose between the three theories, then, becomes a matter of theoretical preference, since all three seem to do equally well or equally poorly in accounting for international behavior in the mid-fifties."

The above was largely an empirical assessment. Subsequently, a theoretical critique of field theory was published by Jack Vincent (84). As a result of analyzing the DON research reports, Vincent pointed out that "there appears to be certain problem areas associated with the development of Social Field Theory, common to all or several research reports." He then attempts a focused critique around the topics of "(1) what is Social Field Theory? (2) interpretation of the basic formulae, (3) the dynamics of the spaces problem, (4) the time and space frame problem, (5) the basis problem, (6) Model II and the notion of theory, (7) the concept of distance and its implications,

(8) the use and interpretation of canonical correlation, and (9) the development of status-field theory."

Although explicitly neither an evaluation nor critique of DON's theory, Firestone's philosophical analysis (49) for DON of concept formation, systems analysis, and factor analysis in political science is appropriate here. DON's theoretical framework is a type of systems theory and factor analysis is employed to operationalize this theory. Firestone's relevant conclusions are "strategic ones relative to the question of what approach to take to systems analysis." He points out that major systems theory works in political science are "primarily non-quantitative or non-mathematical. To extend systems analysis further and to adapt its full potentialities to political science techniques are needed for state variable derivation and metricization and for time-series analysis. Speaking more broadly, political systems analysis needs to be concretized, and operationalized. One technique for accomplishing this transformation is Factor Analysis. The widespread use and cultivation of this and other mathematical models will be the next stage in the evolution of the systems approach to political science."

6.2 Tests (Global System). The tests discussed here and in the following subsection are attempts to define the primary linkages between nation behavior and differences in capabilities, development, ideology, culture and so on, within the context of DON's theoretical framework. These tests were of two types: those on selected and random samples of dyads; those on the behavior of a single actor towards all others.

Two reports (55, 69) tested out the linkages between dyadic behavior and nation differences for over 300 dyads. The first one (55) employed 1955 data and found that an improved model of field theory (Modell II) on the average accounted for fifty percent of the general behavior of one nation towards another for fourteen samples of thirteen nation-pairs each. Moreover, ninety-six percent of the variation in one specific behavior (which behavior depends on the actor) at least could be accounted for by the differences between nations. Three indicators emerged as potentially of value in predicting the behavior of one nation towards another: differences in energy consumption per capita (indexing economic development), in national income (indexing power capability), and in freedom of group opposition (indexing political orientation).

The second report (69) described a retest of the above results on 1963 data and "was consistent with previous findings in showing an ability to explain around fifty percent of the variation in international behavior."

Because the dyadic samples were limited in size in the above and because of our particular interest in the major powers, subsequent studies have focused on the U.S., U.S.S.R. and China. The U.S. study (18) considered American foreign relations in terms of six hypotheses based on (1) the linkage "pre-theory" of James Rosenau, (2) the social status theory of Johan Galtung, (3) the distance theory of Quincy Wright, (4) the power transition theory of A. F. K. Organski, (5) the integration-regional findings of Bruce Russett, and (6) propositions about geographic distance.

These hypotheses were linked together by the notion of a distance vector, interpreted in terms of the constructs of "attribute space," "behavior space," and "dyads," and developed within field theory's geometric framework.

To test this theory and the hypotheses subsumed by it, data on nineteen foreign relations and actions of the U.S. (ranging from tourists and treaties to negative communications and sanctions) toward 81 object nations were correlated (using canonical analysis) with the distances between the U.S. and other nations on economic development, size or power bases, political orientation, socio-cultural dimensions, and geographic distance. The general results support the "pre-theory" of Rosenau, the status theory of Galtung, and an emphasis on homogeneity in integration theory. This suggests that these theories can be synthesized in a larger framework such as field theory. Some specific results were that: (1) U.S. behavior toward other nations consists of six independent patterns: Western-European Cooperation, Anglo-American Cooperation, Aid, Cold War Behavior, Deterrence, and Negative Sanctions; (2) joint Western-European Cooperation (such as treaties, military aid, students, and conferences) and U.S. deterrence are a function of the power parity of the object nation (with a multiple correlation of .94); (3) the Western-European Cooperative behavior relative to the U.S. Deterrence of another nation is dependent on the similarity in political orientation of the two and the degree to which the other nation has a Catholic culture (with a multiple correlation of .78); (4) differences in economic development, size (or power bases), and political orientation from the object nation jointly explain about twenty-seven

percent of the variation in U.S. dyadic behavior; and (5) overall U.S. differences on attributes from the object nation explain about forty-seven percent of the variation in U.S. behavior.

The second study (94), the Ph.D. dissertation of Chang-Yoon Choi (99), was a comparative-quantitative analysis of U.S. and Soviet foreign policy. His major findings were that: (1) American behavior toward other nations for 1960 and 1965 consists of the five independent patterns of Status Behavior, Formal Diplomacy, Patronage, Indirect Aggression-I, and Indirect Aggression-II; (2) Russian behavior toward other nations for the same years comprises the five independent patterns of Status Behavior, Formal Diplomacy, Bloc Cooperation, Economic Penetration, and Indirect Aggression; and (3) Status-Field Theory was well confirmed with regard to the three propositions relating the behavior of the United States and the Soviet Union to their similarities and differences with other nations on economic development and power. Most powerfully confirmed was that the status dependent dyadic, cooperative, and conflictful behaviors of the United States and the Soviet Union are inversely related to their power differences. In general, Choi's analysis "confirmed the validity of Status-Field Theory. The theory demonstrated sufficient power to explain and predict the foreign behavior of the United States and the Soviet Union."

6.3 Tests (Asian System). Parallel to the above analyses, attempts were made to define the linkages between Asian dyadic behavior and nation differences. The first of these studies (61), more exploratory in nature than a systematic test, constituted Tong-Whan Park's dissertation (96). He first laid out the research

design for critical evaluation (45), a design involving predicting "conflict and cooperative behavior between any pair of Asian countries from a knowledge about their political orientations and similarities in power, economic development, culture and values; . . . delineat[ing] subregional groupings of Asian nations with respect to their conflict and cooperation; and . . . develop[ing] profiles distinguishing each of these groups."

Applying the above design to data on 342 Asian dyads for 1955 and 1963, he found (61) that the capability "to span the geographic distance and the degree of actor dominance predict both conflict and cooperation between two Asian nations." One-third of the "variation in unofficial violence and relative exports was dependent upon the distances between two Asian nations on such attributes as economic development and political orientation." Moreover, "slightly less than one-third of the variation in military action, negative communications, and diplomatic representation was accounted for by power parity between two nations alone."

More focused within DON's theory, the studies of Rhee elaborated the above results. He first proposed the design for his research (74), which was the dyadic behavior of China towards all other nations, and the linkages of this behavior to her differences from them. The results then provided an important contrast to the findings for U.S. foreign relations (18). The application of Rhee's design comprised his Ph.D. dissertation (97) and was subsequently published by DON (83). He found that linear "linkages between the attribute distances of . . . nations from China and China's behavior toward those nations, which was proposed by field theory, were found to exist within a

satisfactory margin of error." More specifically, "China's joint conflict behavior and trading behavior toward other nations is the function of the power distance between China and the object nation." Finally, and in general, "attribute differences between China and other nations explain about fifty-three percent of the variation in China's foreign behavior toward them."

Subsequently, Rhee repeated his analysis (87) in the light of DON's development of status-field theory (76). Taking three theorems from the theory, "the following hypotheses on China's cooperation, conflict and interaction were deduced: 1) the more economically developed and the more powerful the object nation, the more China's status dependent cooperation (cooperation hypothesis); 2) the more powerful and the less economically developed the object nation, the more China's status dependent conflict behavior (conflict hypothesis); and 3) China's status dependent interaction with other nations is a function of the power incongruence between China and the others.

"Then these three hypotheses were tested by examining China's past behavior toward all other nations with additional emphases on the United States, the Soviet Union and Japan.

"So far as China's past cooperation behavior was concerned, status-field theory provides little explanation. The first part of the conflict hypothesis (positive correlation between conflict and power statuses) was confirmed, while the latter part (negative relation to economic development status) remains unconfirmed. Test results, however, show that the actual Chinese status dependent interaction coincided almost perfectly with the expected behavior based on the interaction theorem."

The above studies were limited to cross-sectional data. Subsequent to these analyses, DON's data collection for nation attributes (91) was completed, enabling Rhee to do a time-series analysis of China's behavior, 1950-1965 (90). Using super-P factor analysis, he focused on China's cooperative and conflictful behavior towards all other nations and the linkages of this behavior to China's similarities and differences with the object nation. He found that political distance predicted to Chinese diplomatic relations, as well as substantial and administrative cooperation; and power distances explained her conflict behavior. The above relations were with multiple correlations of .85 and .76, respectively. The overall relationship of Chinese behavior to dyadic differences was relatively low, however. Only twenty-three percent of the variance was accounted for, compared to an average of fifty percent for all other tests. The reason for this will be thoroughly investigated, once our overall analyses and tests are completed.

6.4 And Simulation. No empirical theory can be tested with a computer simulation, since such simulation is only a deductive machine for working out the implications of its underlying model conjoined with certain initial conditions. However, the model comprises both a mathematical structure and a set of functions within the model. The theoretical structure guiding DON's research provides the model; the empirical tests provide the parameters. Consequently, not only the theoretical developments, but the empirical tests as well contribute to achieving DON's simulation tasks. In particular, those studies helping to provide the simulation's parameters are (18, 55, 69, 83, 87, and 94).

## 7. POLICY

7.1 Theory. Ultimately, DON's results will have to be judged pragmatically. The question must be: what useful knowledge have you produced that helps mankind resolve some of its problems? The problems of special concern here are those having to do with the peaceful conduct of international relations, consonant with the protection of human rights and maintenance of international order. These are the most profound policy problems and focus themselves in the highest decision making chambers of government. To ultimately relate these problems to DON's efforts, therefore, requires a grasp of the policy process, including the formation and execution of policy alternatives.

For this reason, a number of theoretical policy oriented studies by George Kent, research associate of DON, were supported by the project and subsequently published (77, 81, 85). The first of these (77) shows that political studies "have had little contribution to make to the management of real political problems, largely because they have been devoted more to the end of increasing understanding than to the end of formulating concrete recommendations for action. The two are not the same. At some stages, the continued pursuit of deeper understanding may distract the analyst from the work of formulating concrete action recommendations. Carefully performed, explicit policy analyses designed to develop recommendations for action dealing with real political problems can be legitimate scholarly endeavors. Methodologies and guiding principles for the conduct of such studies can be formulated, just as they have been for the conduct of empirical research. More action-oriented policy analyses need to

be done, and more effort should be devoted to cultivating the methods for doing them."

The second study (81) considers how policy makers can be helped when "confronted with difficult decisions to form wise choices. Few useful guidelines have been offered for the evaluation of action alternatives, especially in the realm of foreign policy formation. Schemes based on statements of goals or objectives or on the use of broadly applicable criteria for choosing among alternatives can be misleading, and they are frequently found to be unworkable. Rather than searching for particular rules by which wise choices should be made, it is more useful to find ways in which difficult decision problems can be decomposed into smaller questions each of which is easier to answer than the larger problem. A tabular, account-book format, described as the revised general ledger, provides a sound basis for systematically comparing and evaluating those features which significantly differentiate the action alternatives under examination. The scheme may be used as the core of an efficient approach to policy analysis described as the pair-wise evaluation strategy."

Kent's third study (85) is more specific about the procedures designed to assist "the policy analyst in systematically developing action recommendations for dealing with foreign policy problems. The procedures are designed to assist rather than to substitute for the analyst's own judgement. They are based on the principle of decomposing large, difficult questions into series of smaller, more manageable questions. The policy analysis process as a whole is divided into three major stages: describing the policy problem,

formulating action proposals, and evaluating alternatives. Each of these, in turn, is divided into component steps. The inescapable limitations on the analyst's time and other resources is fully recognized, and attention is given to the problem of allocating those resources over the different parts of the policy analysis task."

The policy environment constitutes one set of considerations underlying our attempts to relate DON results to policy problems. Another set of considerations revolves around the desired future world to which our results will be related. This is no less a set of policy questions. Two studies by George Kent tried to analyze how one might determine a most desirable future world. One (86) is a critical evaluation of the procedures used for designing the world of the 1990's by the World Order Models Project of the World Law Fund. He then proposes a new set of procedures to guide such efforts. His second study (89) is a further consideration of these procedures. "The design process begins with the specification of the functions that the proposed political structure is to perform. This is followed by the articulation of the structural design questions asking what particular arrangements are to be made. Varieties of different answers are then suggested. Since the choice that would be made for any given design question is likely to be conditional on the answers given to certain other design questions, some groups of questions interact and thus form clusters, or subsidiary design problems which are separable from other such clusters. It is helpful to separate the task of developing a variety of different proposed solutions for each design problem from the task of choosing among them. Generally, several different proposals should be developed,

with extensive efforts made to accommodate incompatible value systems. The choices among alternative designs should be based on explicitly stated reasons, with full acknowledgement of the relative advantages and disadvantages for different affected parties.

"The most difficult and demanding political design problem is that of formulating sound models for the global interrelationships of the future. If the design of world order models is to advance, it will be necessary to identify the essential structural design questions that must be posed. The design agenda needs to be set."

The above is concerned with processes, either of policy making or designing alternative futures. A more social science theoretical analysis separating policy decisions on international behavior from the effects of power, development, type of political system and so on, was made by Chadwick (63). Using mathematical analysis, Chadwick separates out of quantitative analysis the concepts of goals, drift, and system states.

7.2 Relevance. Aside from the whole question of the policy process and environment, of course, is that of the relevance of DON to policy. This question, in general terms, was the focus of one study (60), later elaborated in more detail (62). We concluded that DON informs planning about: (a) nation capabilities and intents, that is the particular configuration of attributes measuring a nation's actual and potential power, and the linkage between this power and intentions as manifested in policies and behavior; (b) behavioral regularities, that is the historical and contemporary trends in international behavior and the correlation between specific actions (such as threats and anti-foreign demonstrations);

(c) socio-economic and politico-military factors, that is, those particular characteristics of nations (such as economic development, size and political orientation) significant for understanding the goals, foreign policies, and conflict behavior of nations; and

(d) causal influences, that is, those immediate and long run causes of hostility, tension, crises, conflict, aggression and war between nations -- causes that are subject to control and whose appearances signal impending danger. Perhaps most important, however, work on DON ties this knowledge to a system oriented model by which long-range projections and forecasts eventually may be made.

## 8. INFORMATIONAL

8.1 Overview of DON's Design, Findings, or Theory. DON is a long-run accumulative project. In order to inform others about DON's progress and intermediary results, reports of purely a summary or informational value have been prepared (such as this one).

Two such reports written for the East-West Center magazine at the University of Hawaii are (6) and (9). A much more detailed presentation of our core results up to 1968 is given in (10).

The most useful overview is Hilton's review and critique of DON (100), which was partly supported by the Richardson Institute, London, England, and which is now being published by Sage Publications. Hilton concludes with a list of recommendations for improving DON; especially DON's communication with colleagues, researchers and analysts. Most of these are now being implemented, particularly as regards the following: "Without doubt the most necessary task is to tidy up, in written form, the work of the ten-year project."

8.2 Proposals. A basic source of information to others is provided in the proposals for research DON is planning to undertake. For this reason, the Five-Year Program originally proposed to ARPA in 1967 was issued as a report (35). So was an ACDA proposal (64) by Phillips to investigate the dynamic patterns of dyadic conflict, particularly in the context of the mathematical theory (65) he was developing. This was not funded.

Another proposal by Rummel (27) submitted to ONR involved the investigation of three-mode factor analysis as a forecasting technique. Although approved, funds were not available at the time for this effort.

Other proposals comprise those describing the research designs for Ph.D. dissertation research under DON. Such are the previously discussed proposals by Phillips (43), Park (45), and Rhee (74).

8.3 DON Related Research. Finally, DON occasionally published in its reprint or report series research not performed under DON, but nonetheless relevant to our efforts. Thus, we published Denton and Phillips (23) investigation into the patterns of historical violence; Kent's (30) foreign policy analysis of the Middle East, his (31) analysis of the application of peace studies, and his (82) suggestions regarding the teaching of practical policy analysis.

## 9. DON: ACCUMULATION AND MAJOR RESULTS

The above survey has dealt with the research products of DON under the Five-Year Program begun in 1967. DON's history, however, goes back to 1962. It might be useful, therefore, to tie the above program into the major results from 1962 to date, especially focusing on scientific accumulation. Over the ten years, accumulateness

has been emphasized as a central methodological goal, whether in selecting variables, doing analyses, assessing methodological questions, or developing theory. To detail this accumulation with attention to context, qualifications, and implications, then, would be to offer again the variety of DON research reports and books. But of course this accumulation can be synthesized, compressed, and the most important detailed generalizations abstracted, and I will be attempting this in a series of four or five volumes. Leaving details aside, however, I should illustrate here some specific areas of accumulation and some corresponding general findings. This task requires first unpacking the concept of accumulation.

Now, accumulation has two meanings relevant to our mutual efforts. One is to build on others' works, to "stand on the shoulders of giants." The results, theories, and ideas of others provide a base for extending knowledge another increment. Accumulation also means convergence towards reliable knowledge which is invariant across social scientists, across data sets, and across methodologies. The two meanings of accumulation are mutually independent: we may continue to build on the work of others but yet have little convergence towards reliable results, or we may have convergence towards reliable results within a scientist's idiosyncratic research program.

Regarding accumulation as building on others' works, as a rule, DON has infused each stage of data collection and analyses with the results, hypotheses, and theories of other social scientists. For example, along with the variables of specific concern to an analysis, we normally include those indexing others' relevant findings and conclusions. On this, see Table 4.3 beginning on page 194 of the

Dimensions of Nations (1), which shows how DON's first large data collection and analyses were related to the relevant literature.

Considering accumulation as convergence on stable or reliable knowledge, this, too, has been one of DON's missions. A major line of investigation is never considered to be completed unless the results are systematically compared with the relevant findings of others. Evidence of this are Chapter 10 of Dimensions of Nations (1), the article (3) in Singer's Quantitative International Politics, the comparison of all domestic conflict analyses in my General Systems Yearbook paper on field theory, and Tanter's DON supported replication of my conflict dimensions. More important, DON's ten years encompass a concerted and programmatic building on the literature, on the systematic comparison with others' results, and on our continually growing, in-house experience.

Out of all this, what can be pointed to as particular accumulated findings? These divide into those concerning methodology, data, substance and theory. Regarding methodology, consider that when DON's research began in 1962 factor analysis had never been applied to international relations or behavior, although Cattell, Berry, and Schnore had separately published applications to cross-national attributes or characteristics. There had been some scattered multiple regression analyses, but no canonical analyses, no discriminate analyses, no multidimensional scaling; although applied here and there, the correlation coefficient was still a strange animal indeed. And journals in the field wasted pages explaining the nature of the chi-square and its application to a simple four-fold table. In this context DON undertook a concerted effort to determine the usefulness

and applicability of multivariate methods and particularly factor analysis in analyzing international relations. Applied Factor Analysis (2) was one fruit of that effort.

This research on research encompassed studying the appropriate mathematics, scanning all the relevant methodological literature, experimenting with a variety of permutations of a variety of techniques on a variety of transformed and untransformed data, and so on. From this experience and the hundreds of multivariate regression analyses, factor analyses, canonical analyses, and so on, done over ten years, sufficient evidence has accumulated for the following.

First, and in broad brush, international relations as an area of research is more appropriate for multivariate methods than are sociology and psychology. Second, factor analysis, understood as a broad set of models, will be a central quantitative methodology for international relations in future decades. The latter opinion is controversial. One should realize, however, that broadly understood, factor analysis includes principal components or axes, component analysis, image analysis, similarity transformation, canonical analysis, discriminate analysis, multi-dimensional scaling (which is to component factor analysis what integration is to differentiation in calculus), multiple regression (a special case of canonical analysis) and partial correlation. In this comprehensive sense, which could be shown mathematically, factor analysis incorporates the major mathematical models being used in econometrics, psychometrics, theoretical physics and quantum physics.

Turning now to data, DON has been accumulating a core set of data whose characteristics would be well known and understood

through a variety of analyses, and would thus be most generally useful. In collecting data we have tried to insure that they were always in a form immediately usable by others. This entailed giving explicit definitions, coding rules, and so forth. These data are now all being transferred to the Michigan Consortium, and should provide a good base for others to accumulate upon. Little more need be said on this subject; if DON is known for anything, it is for data.

Moving on to substantive accumulation, as still meaning a convergence on stable and reliable findings, based on a decade of intensive, programmatic quantitative research and on continuous comparison with the results of others, we offer the following generalizations. International relations is highly structured: the treaties, trade, aid, threats, GNP per capita, defense expenditures, literacy, riots, and so forth of nations are organized into very stable and powerful patterns. No other area of human interaction seems to manifest such strong structure. To illustrate, consider that psychologists, who are noted for perceiving psychology as a systematic science involving clear relationships and structure, are comfortable with correlation coefficients between .20 and .40. They believe it phenomenal to account for forty or fifty percent of the variance in their criteria variables. And yet, in IR correlations over .9 and indeed ranging to .89 and .99, are commonplace; DON now usually does not interpret correlation coefficients below .50, because so many are above this level. For example, in one study (18) power parity between the U.S. and object nations statistically accounted for eighty-eight percent of the variation in U.S. Western European

and deterrence behaviors towards 117 nations, including such different object nations as Yemen, India, Japan, U.S.S.R., and China. Eventually, the implications of this strong IP structure will seep through the research community. The point here is that the fact of such structure is now core knowledge based on accumulated scientific research.

Now for a second generalization. We find that the major dimensions accounting for national variation in attributes concern wealth, politics and power (or size). Nations can be generally characterized as rich or poor, democratic or totalitarian, powerful or weak. Every study which has included appropriate variables has shown that wealth, politics and size are dimensions of social and political groups, whether nations, regions, provinces, cities, small groups, and so on. The stability in findings on wealth, politics, and size is so consistent that their existence can be phrased as social laws.

Moreover, the two or three dozen analyses having the relevant variables delineated Catholic culture, foreign conflict behavior, domestic conflict behavior, and density as secondary national dimensions, even though these studies involved different time frames, researchers, and designs. It therefore seems that quantitative analyses have converged on a stable and reliable set of dimensions for characterizing nations, and in which we can place confidence as empirical concepts for understanding and explaining modern international behavior.

How do these dimensions link to such behavior? Consistently through dozens of quantitative analyses, some involving all U.S. dyadic behavior (18), some involving all Chinese dyadic behavior

(83, 87, 90), some involving samples of Soviet, Brazilian, Indonesian, Indian, Japanese, Cuban, Dutch, English, Israeli, Egyptian, and Polish behavior (55, 69), some involving cross-sectional data, and some involving longitudinal data, we find that wealth, power and politics are the most important dimensions in statistically accounting for behavior. Furthermore, the degree of power parity between two nations best explains statistically their dyadic conflict behavior; cooperation is best explained statistically in relation to conflict and on the basis of wealth, politics and power distances jointly. Here I do not mean the usual social science multiple correlations between .30 and .50; I mean correlations explaining around ninety percent of the variance and with the odds of actually being zero exceeding a million to one.

Another set of substantive findings has to do with conflict behavior alone. Through DON's analyses and comparisons with others, we consistently found domestic conflict behavior for nations as a whole to involve a turmoil dimension (of riots and demonstrations) statistically independent of revolution and guerilla warfare dimensions (a finding first published in 1963 and subsequently well illustrated by American domestic turmoil). Moreover, we consistently observed (3, 11) that for all nations domestic and foreign conflict behavior are statistically independent, whether analyzing events data in isolation, whether partialing out different levels of wealth, power or density, or whether holding constant different qualities such as Catholic culture, Western-pluralistic democracy or communism. Domestic conflict does not statistically help to explain foreign conflict; neither do the other national characteristics. Generalizing

across several dozen separate studies, to account for foreign conflict quantitatively requires analyzing conflict dyadically. It requires bringing in dyadic differences in wealth, power, politics, and culture, and geographic distances.

Turning finally to theory, our results have consistently converged with those of others in establishing the explanatory and integrating value of field theory. Most find this a strange assertion and there are rumblings that field theory is an unsuccessful paradigm. But this always occurs with a new paradigm; its value is rejected out of hand, until at least evidence for it percolates through the profession, its methods become familiar, and it proves able to resolve some outstanding issues.

Regarding the evidence for field theory we now have however, this can be said. Results accumulated across perhaps fifty different and independent analyses clearly show field theory (the Model II version) can explain statistically the linkages between nation attributes and dyadic international behavior. Second, the theory synthesizes within itself such a variety of ideas and results in a variety of fields that we can see it as the general or broad gauge scientific IR theory for which many have been searching.

So much for DON's accumulation. I realize its controversial nature; and the style of their presentation here is incautious, surely dogmatic. I ask the reader to realize that a decade of work is condensed into a few generalizations. I cannot surround them here with the necessary qualifications, justifications and evidence. All this is eventually forthcoming and many details have been established in the books and reports referred to throughout.

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