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DEVELOPMENT AND EXPERIMENTAL APPLICATION OF INTERNATIONAL AFFAIRS INDICATORS

Volume B
Supportive Research
Final Report

June 1974

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RESEARCH EXPERIMENTS IN THE USE OF QUANTITATIVE INDICATORS FOR EARLY WARNING

Herbert L. Calhoun

Don R. Harris

SUMMARY

PROBLEM

The early warning intelligence function has traditionally involved the exclusive use of quantitative military analysis and qualitative political analysis as means to assess environmental threats. The present study explores the notion that quantitative political analysis is a useful and needed parallel component to military and qualitative political analyses. The central problem of this experiment is to demonstrate the value of quantitative political analysis by applying quantitative political indicators to the task of early warning.

CONCLUSIONS

General

1. The application of quantitative political indicators to two international crises demonstrates that the technology does improve the analyst's ability to sense changes in political trends. This improved ability results, in spite of the fact that the data base used is restricted to international events.

2. The exact intent of a nation to engage in hostile activities often can be inferred only from political changes manifest in the international political arena. In such cases, quantitative political indicators provide a collection of "tip-off" signals that help the analyst monitor these intents.

3. Quantitative political indicators may be used to compare and display many factors simultaneously. Quantitative indicators, however, only assist the estimator indirectly. Research is in progress to improve the uses of quantitative indicators to this end.

Results from Specific Examples of Applied Quantitative Indicators

1. Quantitative political indicators computed for interactions between India and Pakistan show a set of convergent trends toward deteriorating relations. The convergence of the trends fits a predefined pattern characteristic of imminent and developing hostilities as early as February 1971. The peak of the crisis occurred on December 3, 1971. The important indicator findings composing this pattern are given below:

- The relations between India and Pakistan showed a steep and sustained decline.
- The policy styles of the two nations were mutually negative and were becoming worse.
- The character of negative interactions exhibited by both nations was clearly dominated by verbal abuse.
- Sporadic physical conflict was present.
- Both nations experienced a narrowing of focus -- with the other at the center of that focus -- while the frequency of negative activity between them increased.
- Both nations reacted quickly and similarly to actions of the other.
- Their respective policy styles reflected a realignment among the major powers.
- A cross-over between the cooperative behavior and physical conflict curves occurred as early as February 1971.

2. In the second experiment, quantitative political indicators computed for interactions between the Soviet Union and Czechoslovakia show a similar set of convergent trends. The analysis of events that took place in April 1968, five months before the crisis peak, reveals the following pattern:

- A major deterioration in relations between Czechoslovakia and the Soviet Union was in progress prior to April 1968.
- The deterioration was accompanied in time by a substantial increase in the frequency of Czech-Soviet interactions.
- Major changes in the policy styles of the two rations took place. These changes were underscored by a discrepancy between Soviet style toward Czechoslovakia and her style toward other East European nations, and by a Czechoslovakian reversal of attitude toward the U. S. and the Soviet Union.
- Negative behavior within the East European region was increasingly dominated by Soviet and Czechoslovakian interactions.
- The Czechoslovakian change in negative behavior increased exponentially within the year preceding the crisis.
- A mutual narrowing of focus between the countries took place during the year preceding the crisis, with each country acquiring the center of the other's focus.

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INTRODUCTION: DESCRIPTION OF QUANTITATIVE INDICATORS

This paper represents the results of an experiment designed to show how quantitative political indicators may be used as an aid to the analyst involved in an early warning function. The indicators to be used in this analysis are discussed in summary form below. It is crucial that readers unfamiliar with them refer for details to other CACI publications.[1]

The five indicators to be used in the analysis are: the "relations," "policy style," "involvement," "concentration," "verbal and physical conflict" indicators and TEXSCAN descriptive statements. With the exception of the concentration measure, these indicators may be conveniently divided into two categories: those that indicate changes in the quality of interactions and those that indicate changes in quantity. The former category includes "relations" and "policy style." The latter includes "involvement" and "verbal and physical conflict."

The relations and policy style indicators are computed using the same formula. It is given below:

$$R \text{ or } S = \frac{P - N}{P + N + \frac{NE}{2}}$$

where P, N, and NE are respectively the sum of positive, negative, and neutral interactions computed between the two nations, A and B. The

[1] CACI, "Quantitative Report on International Affairs (1966-1971)" (Arlington, Va.: CACI, 1971); Theodore J. Rubin, "International Affairs Indicators for Defense Decision-making," RM 305 (Arlington, Va.: CACI, 1973); Theodore J. Rubin and Jeffrey A. Krend, "Quantitative Indicators for Selected Country Characteristics," RM 307 (Arlington, Va.: CACI, 1973).

difference between the indicators arises from their respective interpretations. The relations index is based on total interactions between two countries and is interpreted as a measure of the total status of relations between them, whereas the policy style index is based only on the interactions directed by one country to another and is interpreted as the foreign policy style of one nation toward another. Both indicators vary between +1 and -1.

The involvement index -- referred to as "participation" when associated with the policy style indicator -- is simply a frequency count of the events used in the relations and policy style computations. It can be separated into meaningful components such as the total number of verbal and physical conflict acts contained in it or the total number of political, economic, or military acts contained in it. These separate components are referred to as the verbal and physical conflict indicators or the political, military, and economic indicators respectively. The quantitative indicators represent a measure of the significance of the qualitative ones.

The concentration indicator differs from the others in that it is used to identify attention areas for countries under discussion. Most countries are attentive to only a few countries of concern to them. A quantitative indication of their preferences -- as manifested in their day-to-day interactions -- is often revealing and useful. The concentration indicator is designed to capture the direction and scope of such preferences. It is computed as:

$$C_t = \left(\sum_{i=1}^{n} e \right)^2 \Bigg/ \sum_{i=1}^{n} e^2$$

where C_t is the total number of countries a particular nation is attentive

to at time t, and e is the total number of events initiated by that nation. By observing changes in the number and kind of countries a particular nation is attentive to, an analyst may detect shifts in its focus and scope which give clues to developing activities.

The Concept of Early Warning

Conceptually, early warning implies a timely notification of a developing situation that may either threaten national security or simply be unusual enough to draw an analyst's attention.

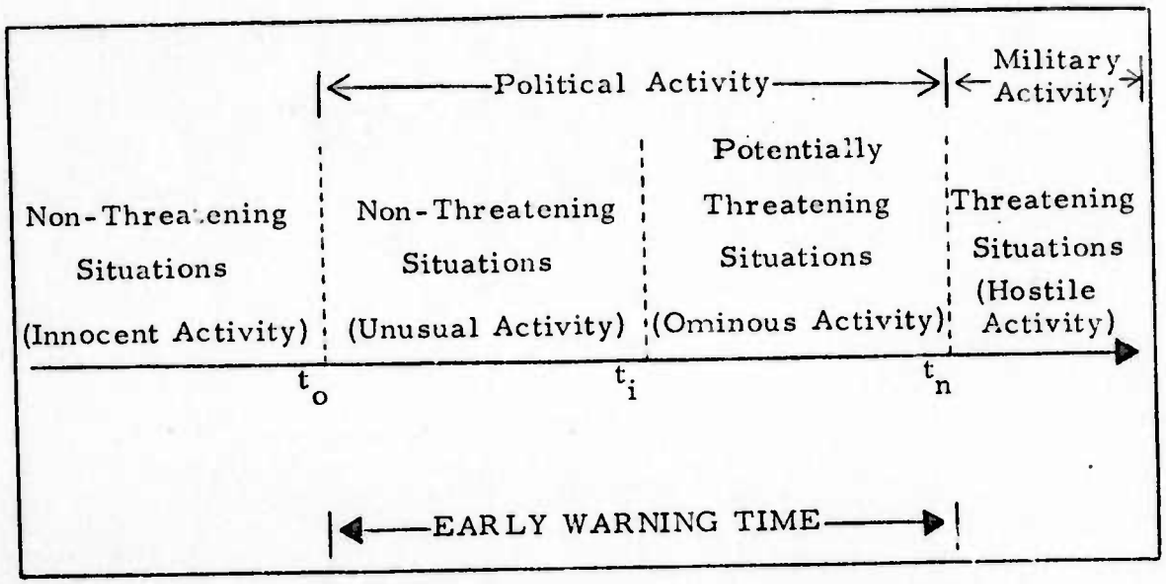


Figure 1. Early Warning Time

In the figure above, the framework for an early warning environment is depicted. The environment is partitioned into potentially threatening and non-threatening situations that contain events that may be manifested at some point in time as hostile behavior. Prior to this time, warning is possible. The content of a warning is a function of the nature of the threat, the degree of certainty in identifying the object of concern, and the amount of time available to respond to the threat. The longer the

time between notification of a perceived threat and its actual execution, the better the warning device. The wide ranging nature of the concept results in many ways of defining it. One definition is the one we have adopted and will use as a guide for this analysis: Early warning is that intelligence function that alerts U. S. policy-makers to actions or activities that may pose a threat to the Continental U. S., the international interest of the U. S., or to the security of its allies.

The time period required to act upon a perceived threat may vary from a few minutes to several years depending on the nature and character of the threat. For instance, in the case of a threat from a missile-carrying submarine, the time frame may be in the 8 to 15 minute range. In the case of a threat from a newly developed weapon, the time span may extend from the actual decision to procure such a system to its operational firing. This time frame may be in the 7 to 10 year range.

The early warning process is one of timely notification of impending threats, whether they be of the former or latter type. Thus, it is a way of describing and defining a political and/or a military environment of activity, particularly one that appears hostile, such that preventive or correctional action may be taken to eliminate the hostile elements before they are carried out. In this sense it is predictive in character.

Approaches to Early Warning

Approaches to early warning span an investigatory area bounded on one side by a "dragnet" approach where an analyst examines an environment for every piece of information that may contain a clue to unusual activity or developing hostilities, to a more modest approach of analyzing a few select, reliable, and easy to collect indicators. In either case, the output is usually a probability assessment of the potential for conflict.

The former approach is costly and unwieldly and often yields marginal results. The latter approach relies heavily on the ability of the analyst to develop the best set of indicators and to properly interpret and assess the importance of subtle changes in them. It is relatively inexpensive and often yields good results.

The Quantitative Indicators Approach: A Summary

The quantitative indicators approach is of the latter variety. Using this approach, one constructs measurable indices that are high in preserving content that may reveal threat patterns or patterns of unusual activity. The substance of the approach rests on the logical and empirical convergence of several such indices, as well as on their ability to lead to previous historical patterns that may help explain existing situations. Theoretically, it attempts to identify meaningful causal relationships by simplifying a large body of complex information. The quantitative indicators shown in Table 1 represent this simplification. The table illustrates a correspondence between the early warning problems and the indicators that analysts may use to solve them.

Indicators and Early Warning

One way to adapt indicator technology to the task of early warning is to consider it in the framework of changes in capabilities and intents. Figure 2 below illustrates this relationship.

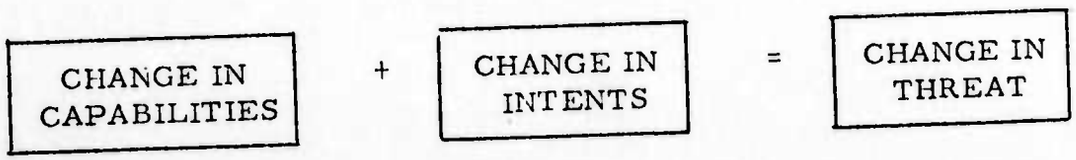
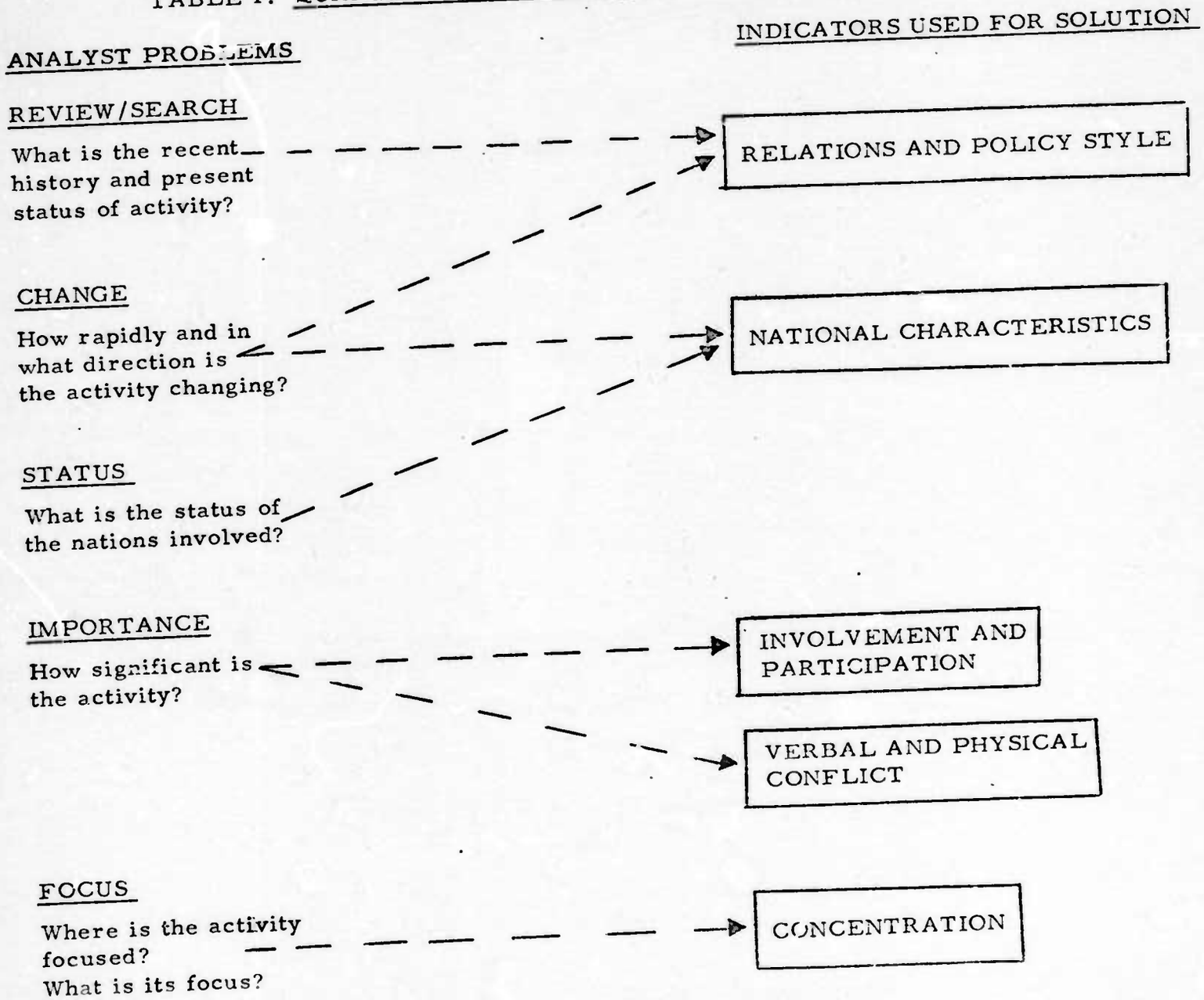


Figure 2. Change in Capabilities and Intents

TABLE 1: QUANTITATIVE INDICATORS AS AN AID TO THE ANALYST



CABLE TRAFFIC

It has long been recognized that the act of perceiving threats involves a conscious assessment of an opponent's capability to carry out a threat. That is, an analyst must know whether an opponent possesses the manpower, material, logistical support, ingenuity, managerial skills, discipline, and morale to implement a threat in a given situation and, if so, whether he also demonstrates, either overtly or covertly, the will, motivation, and desire to carry out such a threat. The pivotal connection between capability, intent, and early warning lies in the fact that normally as a nation's activity changes from innocent to unusual or ominous, so does its capability and/or intents. Thus, if we can monitor changes, we can determine whether these activities are threatening. The strength of this argument serves well as a basis for indicator construction and analysis. Thus, in the following experiments, quantitative political indicators will be used to investigate the various situations described in Figure 1.

In Table 2 below we illustrate the use of capability and intent as indicators of early warning. When observing an unusual environment of activity, an analyst may use capability and intent as concepts to probe the activity for its threat or hostility potential. If such situations contain only one of these, they are usually not classified as threatening. When they contain both they are usually classified as threatening. The crux of early warning then is to be able to separate threatening from non-threatening activity -- the signal from the noise. In the present experiment we have selected a set of indicators whose indices can make this distinction.

In Table 2 we list indicators that are either under development or have been tested and are ready for analysis, and show the function they play in monitoring and tracking capabilities and intents. Our concern in the following analysis is with intent only, and will include only behavior indices. An experiment using indicators in the other category will be presented at a later date.

TABLE 2

A LIST OF QUANTITATIVE INDICATORS FOR EARLY WARNING

INDICATORS	TYPE	DEFINITION	FORM OF PRESENTATION	POSSIBLE EW USE	CLASS OF INFORMATION
RELATIONS	Current-dyadic	(P-N)/(P+N+NE*.5)	numerical index, time-series plots	to determine the current and historical nature of the status between pairs of nations	quantitative event interaction indicator (national level) decomposable into political, economic, and military
POLICY STYLE	Current-unilateral	(same as above)	numerical index, time-series plots	to determine a nation's foreign policy posture towards another nation	(same as above)
INVOLVEMENT	Current-dyadic or	total frequency of interaction	numerical values, time-series plots	to determine the volume and level of significance of interactions for relations and policy style	frequency counts of events (national level)
VERBAL AND PHYSICAL CONFLICT	Current-unilateral	total frequency disaggregated into verbal and physical conflict	numerical values, time-series plots	to determine the composition and level of negative and positive behavior involved in a set of interactions	disaggregated frequency counts of events (national level)
CONCENTRATION	Historical multi-national	$(\Sigma e_i)^2/(\Sigma e_i^2)$	numerical index, table of rank-labels, table of time-series frequency values	for constructing a perspective of the direction, scope and focus of a nation's attention	composite quantitative indicator (international and regional level)
TEXSCAN STATEMENTS	Current-dyadic	statement retrieval	chronological verbal text	to determine the exact meaning and context of events occurring across national borders	raw observations (national level)
NATIONAL CHARACTERISTICS	Historical and current	13 different composite indexes defined separately	tables of numeric indexes, single or composite time-series plots	attribute indexes to complement event indicators	composite attribute indexes

NOTE: This list contains only external indicators; research is presently underway on internal indicators.

In the process of developing and experimenting with the quantitative political indicators discussed, we have learned to associate a number of changes in them with patterns of unusual or potentially hostile behavior. These signs and others like them are indispensable to the function of early warning analysis. Table 3 presents a summary of our findings.

TABLE 3

QUANTITATIVE SIGNS OF UNUSUAL OR OMINOUS ACTIVITY

1. Sustained decline in the relations index with an increase in involvement.

2. Mutual decline in policy style indices with an increase in participation.

3. A continuous dominance of involvement by its negative component.

4. A cross-over between the cooperative interaction curve and the verbal and/or physical conflict curves with either of the latter assuming a dominant status.

5. A telescoping of a nation's attention toward the world with an increase in the volume of activity.

6. An increase in the severity and frequency of verbal abuse over time.

7. A change from sporadic acts of physical conflict to continuous acts.

The table lists seven of the most conspicuous and easily defensible of the signs found. The analyst can, at his disgression, develop

additional signs that may recur in his analysis. The interpretation of these signs is straightforward and demonstrates the close correspondence in meaning of quantitative political indicators and commonly used concepts of international affairs. In the discussions to follow, many of these signs will be used to demonstrate how an analyst may utilize quantitative political indicators in an early warning task.

In the next sections we will conduct two experiments in the use of quantitative indicators for the task of early warning. The situations selected as subjects for the experiments are the Indo-Pakistani War of December 1971, and the Soviet-Czech crisis of August 1968. The approach to be taken in these demonstrations is to use the indicators as tools to help the analyst define and organize his materials in such a way as to provide him with the best possible inputs for later assessments. In the course of these developments many of the signs given in Table 3 will be used.

EXPERIMENT I: THE INDO-PAKISTANI WAR

A Recap of Events Leading to the War

In the March 1971 elections, Mrs. Indira Gandhi's party gained a two-thirds majority in the Lok Sabha and took office with high hopes of radically changing conditions within India. Yet, before she was able to implement her electoral promises, India's attention and energies were diverted by a civil war in Pakistan. During the same month, the Pakistani army seized control of East Pakistan and attempted to suppress the Bengali separatist movement. In the weeks that followed, hundreds of thousands of East Bengalis sought asylum in India. The influx of refugees created severe problems for India. The only solution -- a temporary one -- was to return the refugees to Bangladesh. Indian rightist political leaders, as well as the people of West Bengali, urged as an alternative solution that the Indian government intervene in the Pakistan civil war. The Indian government rejected the pressures of the proposal because of uncertainty concerning an American or Chinese response, but did provide sanctuaries for the Bangladesh guerrillas who were increasingly successful against the Pakistani army. The success of the guerrillas and the uncertainties of the response of concerned nations led Mrs. Gandhi's government to conclude that its interest rested in forcing Pakistan to a compromise with the Bangladesh insurgents through diplomatic channels. The principal effort along these lines was Mrs. Gandhi's early November visit to Washington where she conferred with President Richard Nixon. The talks led to the United States exerting some pressure on Yahya Khan to reach a settlement.

Within two weeks, however, Indian troops had become directly involved in the Pakistani civil war. Mrs. Gandhi acknowledged as much on November 24, 1971 when she attempted to defend an Indian raid against Pakistan. She claimed it had occurred in self-defense. A few days later, the Indian government announced that Indian troops would continue to attack Pakistani positions in self-defense. Beyond this point, the drift toward a military solution was irreversible. Full-scale war became a reality on December 3. After occupying the capital, Dacca, and receiving the surrender of Pakistani forces there, India ordered a cease-fire on December 16.

Our experiment is assumed to have taken place during early 1971, shortly before Mrs. Gandhi took office. The vehicle for this demonstration will be the Indo-Pakistani War of late 1971 just described. Our experiment will be based on events that occurred prior to the spring of 1971. We will assume the role of an analyst who, as early as February 5, 1971, was responsible for determining the potential for conflict between India and Pakistan. Emphasis will be placed on suggesting ways in which quantitative indicator technology may assist the early warning analyst. For this demonstration we will use materials at hand. These include the five quantitative political indicators introduced earlier and the New York Times event data, an international political data base consisting of more than 50,000 discretely coded interactions between 150 nations of the world from 1966 through 1972. The indicators will be constructed using this data set. We will trace through a sequence of steps that will result in definitive statements concerning this possibility. At every step in the sequence, we will bring quantitative political indicators into the analysis to help the analyst answer questions and create an accurate picture of the international environment.

On February 5, 1971, the New York Times reported the following events which we will treat as simulated cables (Table 4).

TABLE 4

SIMULATED CABLES

710205	750	121	770	90
IND ACCUSES PAK OF BEING COMPLETELY RESPONSIBLE FOR DESTRUCTION OF IND AIRCRAFT				
710205	750	150	770	90
IND DEMANDS COMPENSATION FOR PLANE, EXTRADITION OF HIJACKERS FROM PAK				
710205	770	121	750	90
PAK HIGH COMMISSIONER IN IND SAYS IND HAS ESCALATED THE AIRCRAFT INCIDENT				
710205	770	160	750	90
PAK HIGH COMMISSIONER IN IND WARNS IND OF CONSEQUENCES OF ANTI-PAK DEMONSTRATIONS				

There is nothing especially noteworthy about these events. They are isolated activities that involve hijackings, a rather bizarre and random kind of activity, and represent relatively mild charges originating from both sides. A reasonable argument could be made for their insignificance. Before discarding them, however, an analyst should examine the international environmental context in which they appear for clues or signs that would allow him to determine if they were indeed insignificant or part of a larger developing pattern of ominous activity. To help him decide, the analyst may pose a series of questions that would enable him to organize his facts. For example, to refresh his memory on the recent history of activity between the nations involved, he might ask

the following questions: Have the relations between India and Pakistan been on the decline recently? Or have they been stable and unchanging?

To help answer these questions, it will be assumed that the analyst has available a set of quantitative political indicators based on all the reported interactions between the countries involved. A series of steps he might take in using the indicators for this purpose are suggested below.

Step 1. First, the analyst would refer to the relations index in order to determine the general status of relations between the nations as well as to determine if shifts in attitudes were beginning to occur. Figure 3 is a plot of the relations index.

Notice the sharp downward trend of behavior between India and Pakistan on the date of review (see the slanted dotted line in the figure). This indicates that the relations between India and Pakistan were deteriorating.

At the bottom of Figure 3 is a plot of the involvement index that gives the volume of activity between the nations. The volume at the review date had begun to rise, an indication that the deteriorating state of relations was gaining momentum. These two facts alone help the analyst answer the questions posed above.

Step 2. Second, the analyst would appeal to the policy style index to determine who was responsible for the deterioration in relations. Thus, to continue the analysis let us assume, based on the information in Step 1, that the cable events are not mere random occurrences of routine events but are part of a larger pattern of developing hostilities. If indeed the two nations have embarked on a course of mutually hostile interactions, it ought to be reflected in their foreign policy styles toward

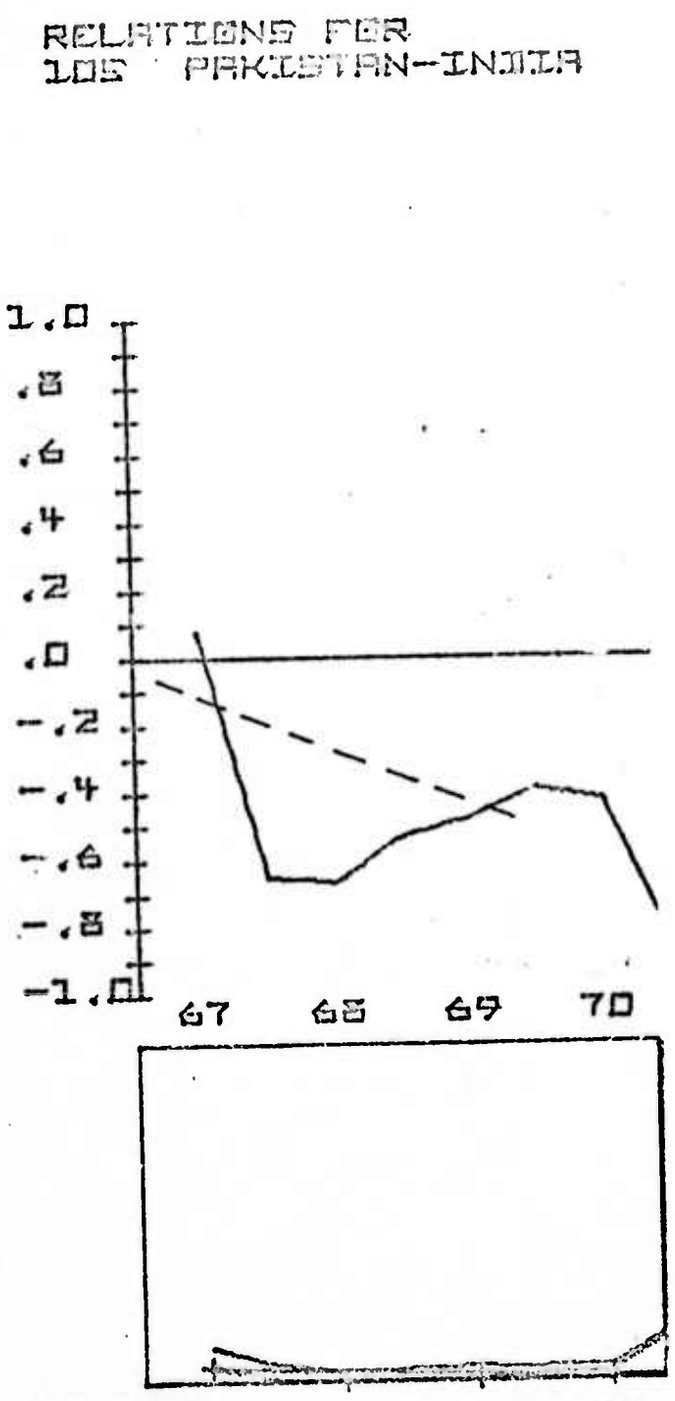

RELATIONS FOR
105 PAKISTAN-INDIA
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
67
68
69
70
INVOLVEMENT (MAX. VALUE = 72)

Figure 3.

each other as well as toward other nations mutually important to them. Thus an analyst might ask: What is the precise nature of the foreign policy posture of these nations toward each other? What are their respective policy postures toward the superpowers, or toward any interested third parties? Do they reflect new alignment postures? Again he may appeal to quantitative indicators for answers to such questions.

Figure 4 is a plot of the policy index between India and Pakistan up to the review date. As the plot shows, since December 1970 there has been a mutual hardening of attitudes by the two nations. Pakistan's attitude has hardened slightly more than India's. The similarity of the curves underscores the fact that the two nations respond quickly to actions by the other. These are important pieces of information for the early warning analyst.

Step 3. As a third step, an analyst may desire to know the policy styles of the countries under discussion toward major third parties. Figures 5 and 6 show plots of policy styles for India and Pakistan toward the three major powers: U.S., China, and the Soviet Union. If we focus our attention first on Figure 5, we will notice that each curve is annotated with a set of numbers. The numbers refer to the order in which the country names appear. Thus, the curve annotation "1" refers to the U.S., "2" refers to the USSR, etc.

An analyst cannot fail to notice recent changes in policy styles between the nations under discussion and the major powers. In particular, Indian policy toward China has been consistently negative and is presently worsening. On the other hand, her policy style toward the U.S. and the USSR has been somewhat unstable and changing. As the dotted lines indicate, India's policy style toward these two powers has changed direction in the last year. Her attitude toward the U.S. has changed

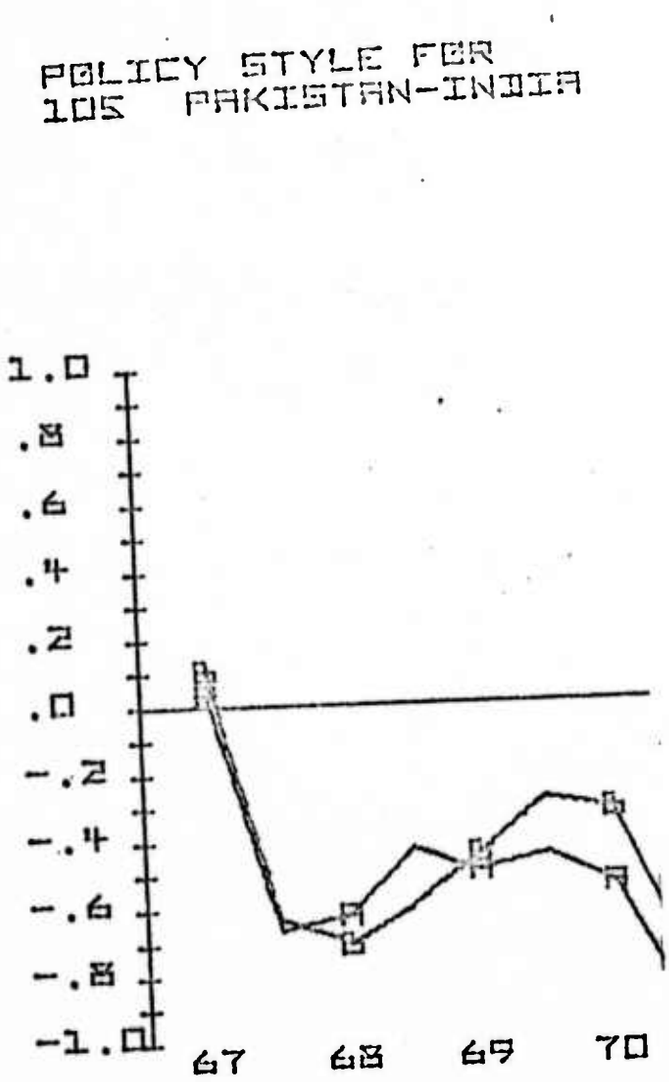

POLICY STYLE FOR
105 PAKISTAN-INDIA
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
67
68
69
70

Figure 4.

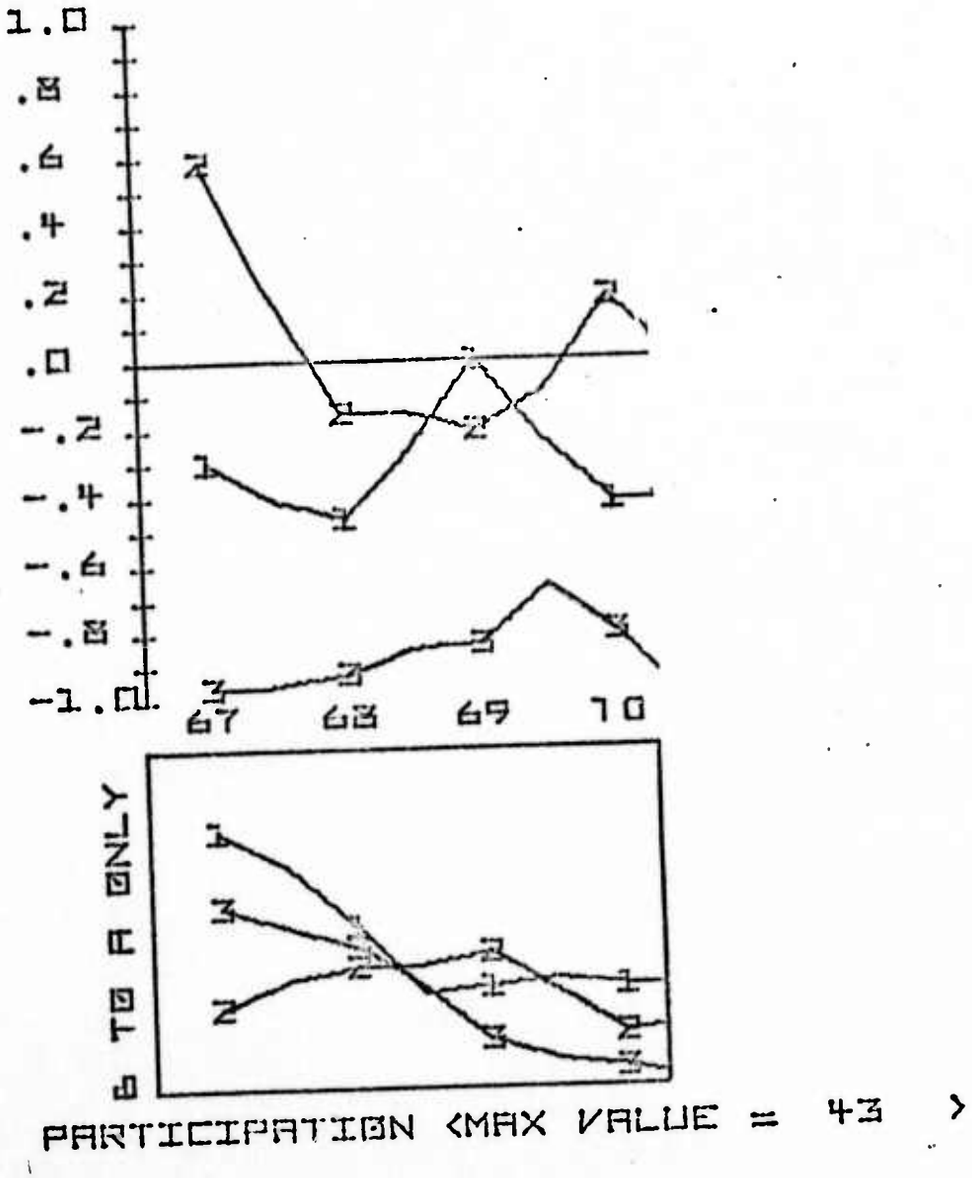

POLICY STYLE FOR
044 US-INDIA
067 USSR-INDIA
088 CPR-INDIA
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
67
68
69
70
0 TO A ONLY
PARTICIPATION <MAX VALUE = 43 >

Figure 5.

from an upward to a downward trend since December 1969, and from a downward to a upward trend for the USSR during the same period. These trends indicate that possible changes in policy alignments are taking place. Figure 6 gives Pakistan's policy style toward the major powers. The annotation is the same for this figure as for Figure 5. Notice here also that a reversal in policy style toward the U. S. occurred during early 1970. A similar reversal toward China occurred at the beginning of 1969. The Soviets, at the same time, began to show a sharp downward trend at the beginning of 1971.

A quick summary of what the analyst has found by mere inspection of the plots of three quantitative indicators is now given. He has determined that:

- The relations between India and Pakistan are in a steady decline.
- The frequency of activity between them is on the increase.
- They respond similarly and quickly to each other's actions.
- Their policy styles toward the major powers have changed in a direction that suggests a possible realignment.

The number and possible interpretations of the plots resulting from the indicators are not restricted to those given in this example alone. They are very much a function of the analyst's needs. Yet, whatever his needs, they always yield a quick, easy to read, and accurate summary of the recent history of the interactions between nations.

Step 4. As a fourth step, the analyst may utilize quantitative political indicators in a disaggregated form. The first level of disaggregation

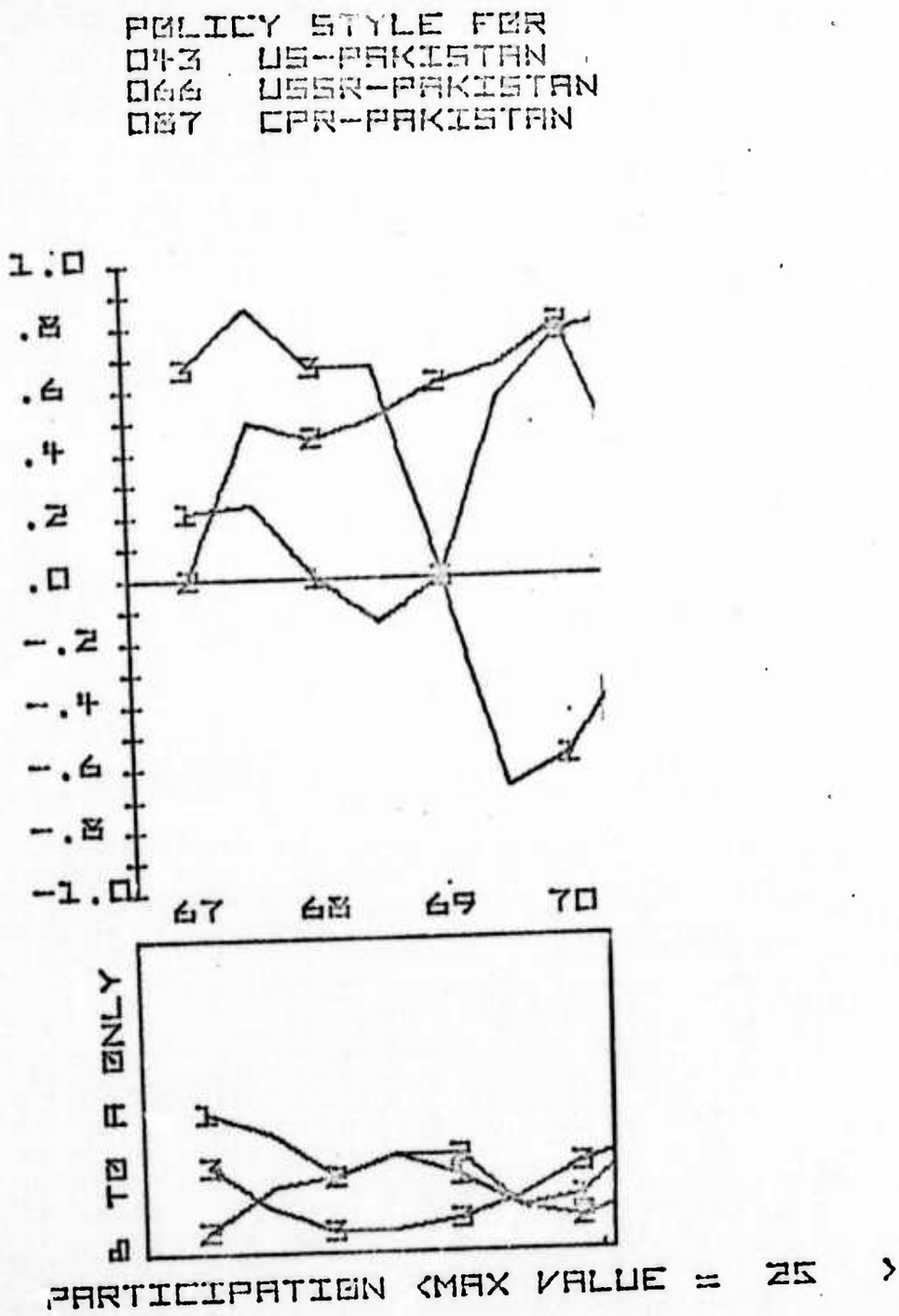

POLICY STYLE FOR
043 US-PAKISTAN
066 USSR-PAKISTAN
067 CPR-PAKISTAN
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
67
68
69
70
0 TO A ONLY
PARTICIPATION <MAX VALUE = 25 >

Figure 6.

available to the analyst is that of dividing the involvement or frequency index into its separate components. He may separate it into positive, neutral, and negative interactions as is done in Figure 7. Or he may separate it into other more meaningful aggregations such as dividing the negative behavior into verbal and physical conflict as is shown in Figures 8 and 9. Both of these disaggregations help the analyst properly assess the significance of new developments.

Figure 7 shows, for instance, that during February 1971, the primary contributor to the increase in frequency of interactions was that made by an increase in the proportion of negative interactions. It also shows a lack of neutral interactions, a signal that the nations have not been involved in normal inter-state exchanges or in negotiations. Similarly, the disaggregation shows a very low level of positive behavior between them.

Step 5. As a fifth step, the analyst may seek to determine the exact conflict content of the interactions. This involves another type of disaggregation illustrated in Figures 8 and 9. They are respectively the verbal and physical conflict plots for Pakistan to India and India to Pakistan. The most useful piece of information for the analyst here is the dominance of the verbal conflict over cooperation, and the cross-over in both cases between the physical conflict and the cooperation curve. These are unmistakable signs of ominous behavior.

Step 6. Disaggregation may occur along other dimensions as well. A sixth step might involve a disaggregation along issue dimensions. Figure 10 presents a breakdown of the relations index across 1) political, 2) military, and 3) economic issues. At the date under discussion, all three issues appear to be equally prominent and in a simultaneous

INDIA AND PAKISTAN INVOLVEMENT

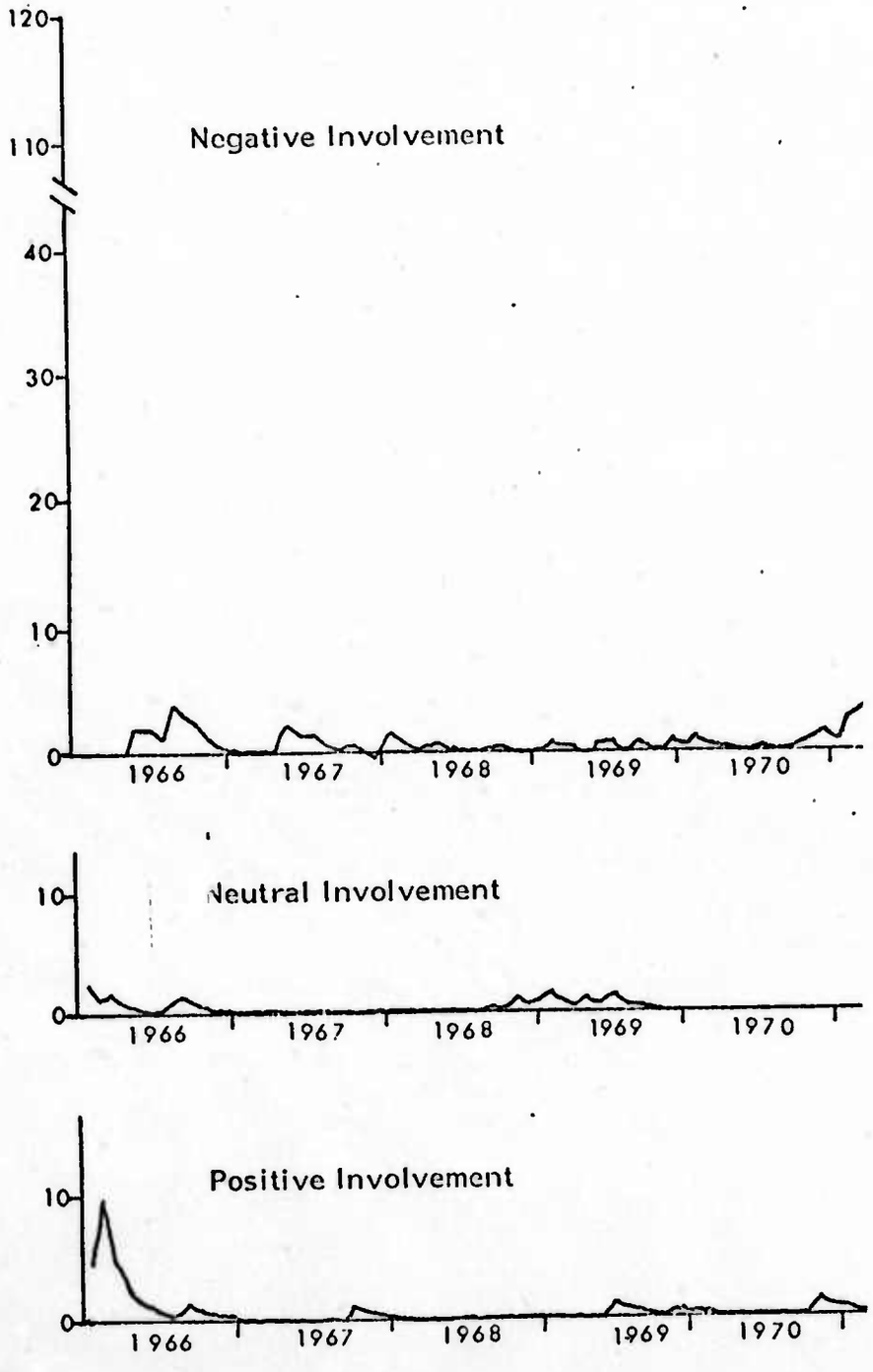


Figure 7.

PHYSICAL AND VERBAL CONFLICT

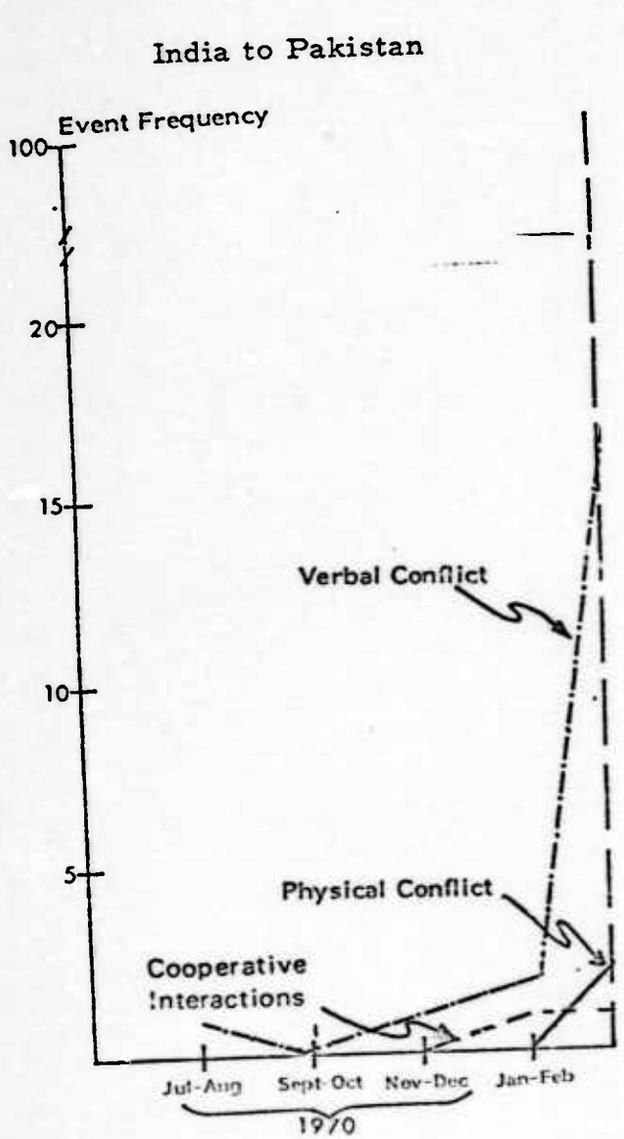


Figure 8.

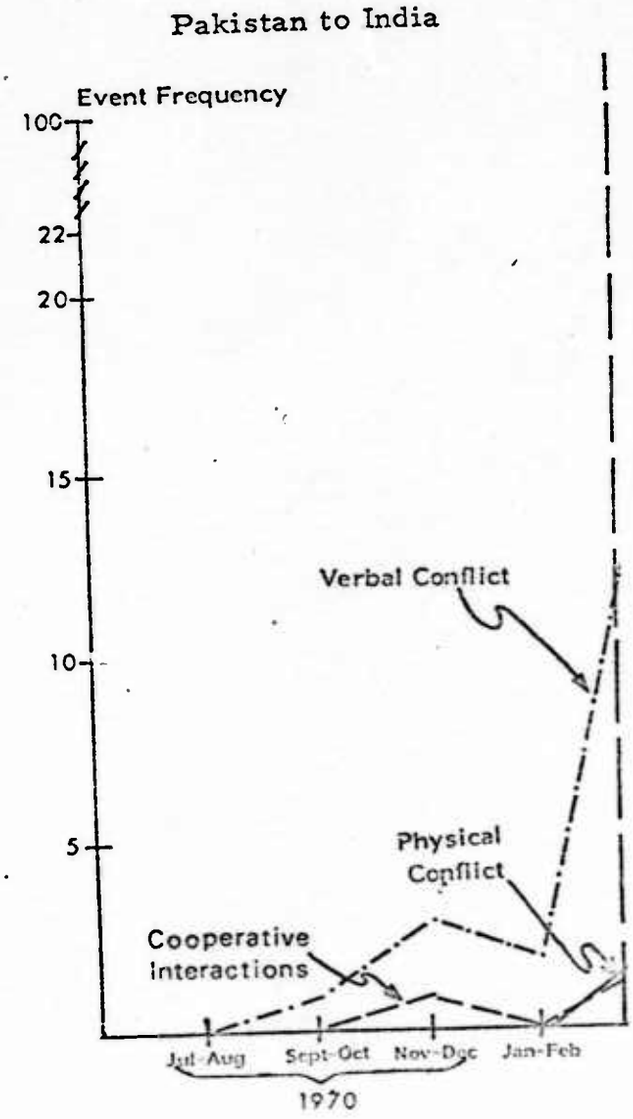


Figure 9.

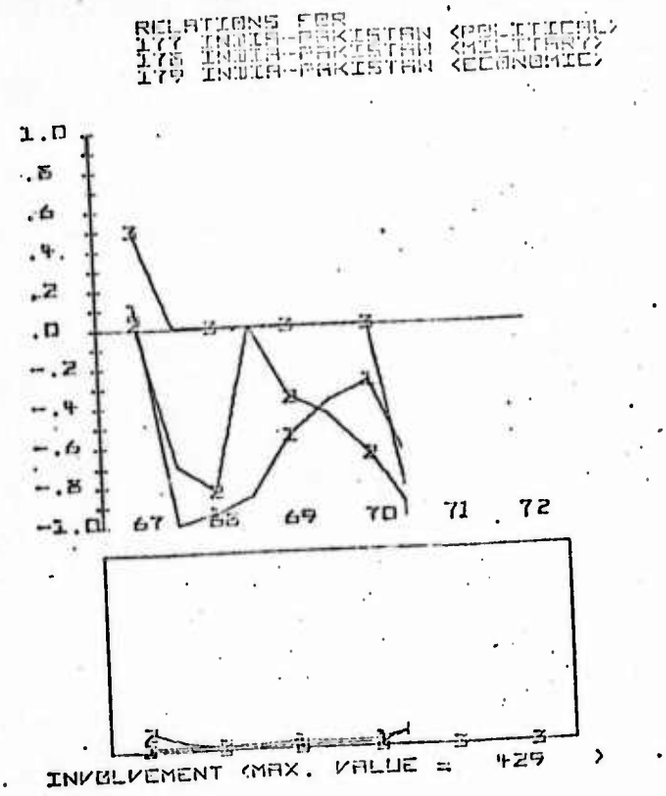


Figure 10.

plunge. The economic plunge leads and is the sharpest, followed by the military and political. In the last three years there have been wide oscillations in the political and military dimensions with the economic dimension remaining stable and neutral. The information in this case is not very useful to the analyst. However, in cases where one or another issue tends to dominate, it is easy to see how such a disaggregation would reveal valuable information to the analyst.

Step 7. The seventh step leads to the final level of disaggregation at the level of raw information. In our case, this is the level of a coded descriptive event. Table 5 below gives a list of coded events. These are identical to the list introduced to simulate cable reports. The events

TABLE 5

TEXSCAN RETRIEVAL

690712	750	102	770	90
IND FM WENT TO PAK TO MAKE FINAL ADJUSTMENT ON BORDERS OF RANN OF KUTCH				
690712	770	111	750	90
PAK FM SAID NO RAPPROCHEMENT WITH IND OVER KASHMIR AMB GANGER				
690724	750	101	770	90
IND PM GANDHI PROPOSED JOINT IND-PAK BODY TO INVESTIGATE IMPROVED RELATIONS				
701021	750	121	770	90
IND UNO REP NARENDRA SINGH SAYS PAK HAS COMMITTED AGGRESSION AGAINST IND IN KASHMIR				
701207	750	142	770	90
IND FOR MINISTRY DENIES PAK REPORTS THAT IND POLICE AND CIVILIANS KILLED 300 AND WOUNDED 700 PAK CITIZENS IN BATTRIGACH				
701207	750	131	770	90
IND PROTESTS PAK "BASELESS INSINUATION" THAT IND NATIONALS KILLED AND WOUNDED PAK NATIONALS IN BATTRIGACH				

listed in the table were reported during 1969 and 1970. They indicate that an Indian overture to rapprochement was rebuffed by Pakistan during July 1969. The rejected overture was followed in time by a series of charges and counter-charges that occurred over a rather long period. A summary of the content of these events indicates that prior to the review date -- February 5, 1971, the next date in the event list -- nothing significant was taking place between India and Pakistan, and though there are few events in this list, they do illustrate an additional tool at the analyst's disposal. He may need to review a specific time period to verify the composition of a particular sequence of events. Or he may desire a complete listing of several situations of interest. The TEXACAN retrieval provides the analyst with this tool.

Step 8. The eighth step involves use of the concentration index as an indicator of interest and intent. The exact intent of a nation involved in hostile behavior can only be inferred by observing changes in indicators which signal or "tip-off" a nation's motives. Quantitative political indicators can be quite useful in providing such clues.

In particular, the concentration measure[2] is an excellent tool for interpreting an increasingly tense international situation. Table 6 gives the result of a concentration run made for India and Pakistan. It reveals the focus of interest of these nations with respect to the most active nations in the world. The top part of the table gives a rank ordered list of the ten nations most important to them for the indicated time period. The bottom part of the table gives the frequency associated

---

[2]The concentration measure is simply an index that attempts to identify the changes in attention areas for a given nation. The index measures the number of countries a nation is attentive to at a particular point in time.

TABLE 6*

CONCENTRATION MEASURES FOR PRIMARY TARGETS

(ALL BEHAVIOR) FOR PAKISTAN

1	IND	USA	CPR	INS	BUR	MAL	KON	ISR	JOR	UAR
2	IND	USA	USR	CPR	ISR	JOR	KON	UAR	TUR	IRN
3	IND	USR	USA	IRN	ISR	TUR	CPR	KON	JOR	SYR
4	USA	IND	USR	IRN	TUR	CPR	ISR	KON	JOR	ROM
5	IND	USR	USA	IRN	CPR	ISR	TUR	INS	KON	JOR
6	IND	CPR	USA	IRN	USR	JOR	INS	TUR	KON	ISR
7	IND	CPR	USA	JOR	USR	INS	IRN	POL	ISR	TUR
8	IND	USA	CPR	USR	JOR	INS	POL	UNK	SRI	ISR
9	IND	USA	CPR	USR	JOR	UNK	BDG	POL	CAN	INS
10	IND	USA	USR	CPR	BDG	UNK	IRN	POL	GMW	CAN

1	31.	14.	8.	3.	3.	2.	2.	2.	2.	2.	2.81	69.
2	16.	11.	6.	4.	3.	3.	2.	2.	2.	2.	4.14	51.
3	9.	7.	7.	4.	3.	3.	2.	1.	1.	1.	5.11	38.
4	10.	9.	9.	5.	3.	2.	2.	1.	1.	1.	4.38	43.
5	15.	9.	8.	4.	3.	2.	2.	1.	1.	1.	3.85	46.
6	14.	5.	5.	4.	4.	3.	2.	2.	1.	1.	4.27	41.
7	13.	8.	7.	3.	3.	2.	2.	2.	1.	1.	3.85	42.
8	59.	11.	10.	7.	3.	2.	2.	2.	1.	1.	2.15	98.
9	200.	24.	12.	11.	3.	3.	2.	2.	2.	1.	1.57	260.
10	241.	30.	19.	14.	12.	6.	2.	2.	2.	2.	1.74	330.

*Time Scale:

1 Jan. 1966-Jan. 1968
2 Jul. 1966-Jul. 1968
3 Jan. 1967-Jan. 1969
4 Jul. 1967-Jul. 1969
5 Jan. 1968-Jan. 1970
6 Jul. 1968-Jul. 1970
7 Jan. 1969-Jan. 1971
8 Jul. 1969-Jul. 1971
9 Jan. 1970-Jan. 1972
10 Jul. 1970-Jul. 1972

TABLE 6 (Cont'd)*

CONCENTRATION MEASURES FOR PRIMARY TARGETS (ALL BEHAVIOR) FOR INDIA

1	USA	PAK	CPR	USR	UAR	YUG	FRN	UNK	VTN	CAN
2	USA	CPR	USR	PAK	UAR	YUG	UNK	VTN	BUR	CAN
3	USA	CPR	USR	PAK	BUR	YUG	VTN	UAR	LAO	UNK
4	USR	CPR	USA	PAK	BUR	VTN	LAO	JAP	IRN	YUG
5	USR	USA	PAK	CPR	NEP	BUR	ROM	VTN	ISR	IRN
6	USA	USR	PAK	NEP	CPR	ROM	INS	MAL	JAP	ISR
7	USA	PAK	USR	NEP	CPP	ROM	UNK	INS	CAM	JAP
8	PAK	USA	USR	NEP	UNK	ROM	INS	CAM	CPR	ISR
9	PAK	USA	JSR	UNK	CPR	BDG	INS	CAM	MAL	SRI
10	PAK	USA	BDG	USR	CPR	UNK	GME	VTS	VTN	CAM

1	49.	32.	29.	12.	5.	5.	4.	4.	3.	3.	4.73	146.
2	42.	26.	16.	14.	5.	5.	4.	3.	3.	3.	4.90	121.
3	28.	24.	19.	9.	4.	4.	3.	3.	2.	2.	4.77	98.
4	20.	17.	17.	12.	3.	2.	2.	2.	2.	2.	4.21	79.
5	22.	17.	12.	9.	6.	3½	3.	2	2.	2.	4.93	78.
6	18.	16.	10.	6.	6.	3½	2.	2.	2.	2.	4.57	67.
7	17.	15.	9.	6.	4.	3.	3.	2.	2.	2.	4.89	63.
8	40.	17.	9.	6.	4.	3.	2.	2.	2.	2.	3.07	87.
9	201.	38.	16.	5.	4.	2.	2.	2.	1.	1.	1.65	272.
10	225.	44.	18.	18.	6.	5.	2.	1.	1.	1.	1.87	321.

*Time Scale:

1 Jan. 1966-Jan. 1968
2 July. 1966-Jul. 1968
3 Jan. 1967-Jan. 1969
4 Jul. 1967-Jul. 1969
5 Jan. 1968-Jan. 1970
6 Jul. 1968-Jul. 1970
7 Jan. 1969-Jan. 1971
8 Jul. 1969-Jul. 1971
9 Jan. 1970-Jan. 1972
10 Jul. 1970-Jul. 1972

with each entry in the upper table. Thus, the U.S. was of top interest to India for the first three time periods, after which it was replaced by the USSR. During this period, the U.S. moved from the top position of attention to the third position (time period four), to second (during time period five). At the beginning of the sixth time period, the U.S. regained the top spot of Indian attention and held it throughout time period seven. It was then replaced by Pakistan. Similarly, Pakistan's primary focus was -- with a single exception -- India. In every case, except time period 4, India was the primary target of Pakistan's interest. The U.S., CPR, and USSR were the major secondary targets. The boldface solid line partitions the matrix of names into the number of nations that correspond to the index for each time period. The index for time period 1 is 4.73, which, when rounded-off, yields five nations. Time period one is thus partitioned into two groups of five countries. The first group represents, in rank order, the five countries that occupied Indian interest during time period one. They are the U.S., Pakistan, CPR, USSR, and UAR, respectively. The important information resulting from the index for the analyst in both the Indian and the Pakistani cases is the increase in frequency of interactions accompanied by a corresponding narrowing of focus in the last few time periods (see the matrix of frequencies in Tables 8 and 9). Quantitative indicator research leads one to accept this reading of the indices as a valid sign of developing hostilities.

To illuminate this point further we present Figure 11 on the following page. Figure 11 is a plot based on analysis of crisis activity. It illustrates the relationship between frequency of activity and the concentration index as the peak of crisis activity approaches. The solid line illustrates the change in frequency. The dotted lines illustrate the change in the concentration index. As the index falls, the frequency rises. The

AVERAGE CONCENTRATION FOR ALL BEHAVIOR DURING CRISIS

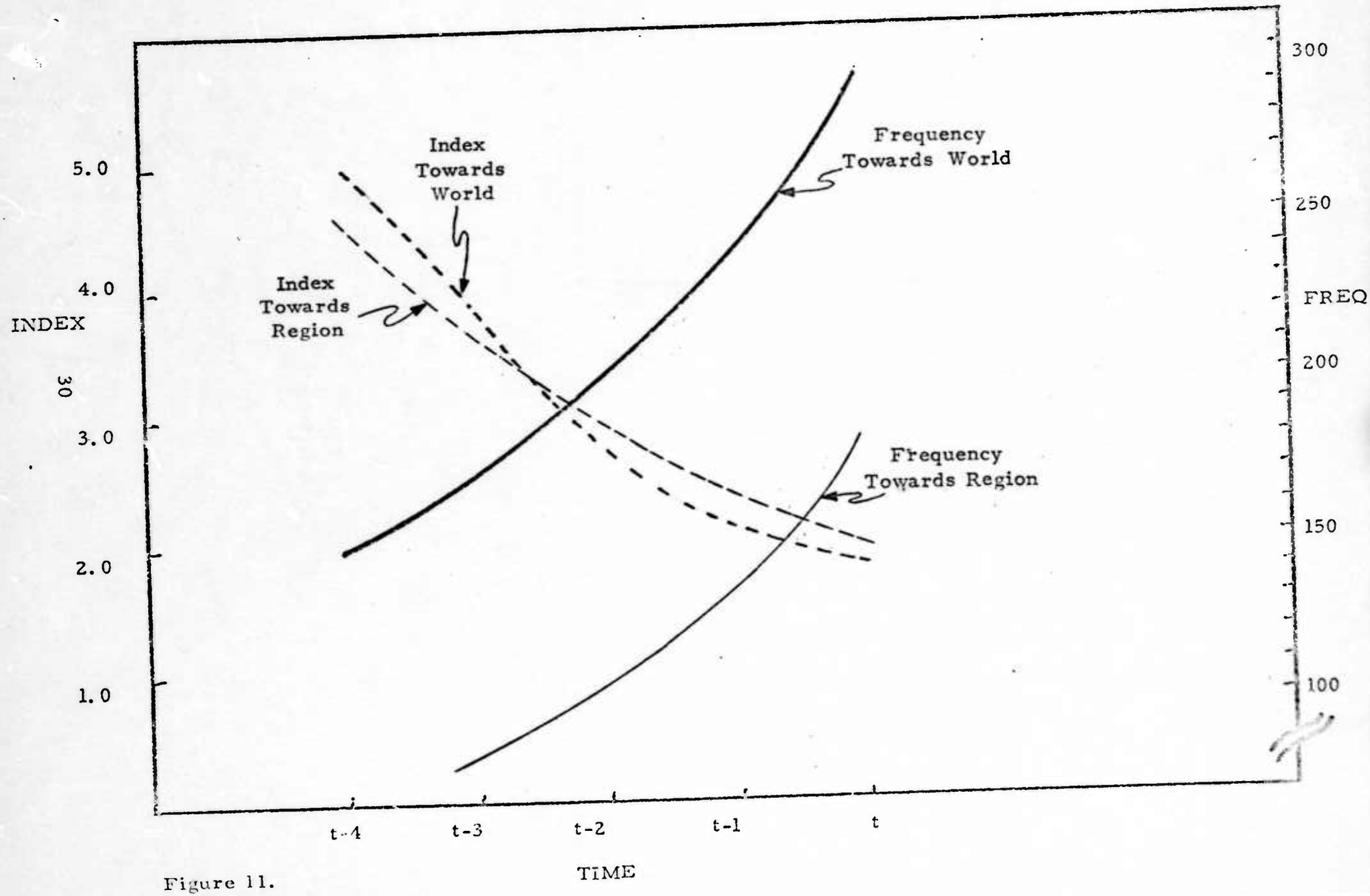


Figure 11.

index reaches a minimum value at the crisis peak while the frequency reaches a maximum there.

Figure 12 is a plot of the concentration index versus frequency for India and Pakistan prior to the Indo-Pakistani War. The vertical dotted-line indicates the approximate date for this analysis. The slopes of the curves -- even though they are exponential fits to the data -- suggest an irreversible trend toward a telescoping point similar but more pronounced than that of Figure 11.

Step 9. The concentration measures given thus far are computed across all Indian interactions. An analyst may restrict this to only negative interactions. Table 7 is such a table. It shows where Indian negative attention has been directed. China and Pakistan have been the primary recipients, with the U.S. and USSR receiving considerable secondary interest. India's negative attention has been narrowing since time period five (observe the staircase convergence of the index as illustrated by the solid line from this period to the ninth). Also, notice the parallel increase in frequency. Together these fit the prototype described in Figure 11. Thus, the analyst notes that Indian negative behavior is narrowing its focus in a fashion similar to that which occurs during crisis periods.

In order to determine what country is receiving the focus of attention, the analyst need only follow the change in Pakistan's rank positions as time passes. During the first three periods, Pakistan held a rank position of three. During time period four and five, she moved up to position two. And during time periods seven through ten, she occupied rank position one. Thus, Pakistan moved progressively up the ladder ending in the top spot as early as January 1969.

CONCENTRATION INDEX A[illegible] FREQUENCY FOR THE INDO-PAKISTAN CR[illegible]
(A LEAST SQUARES FIT)

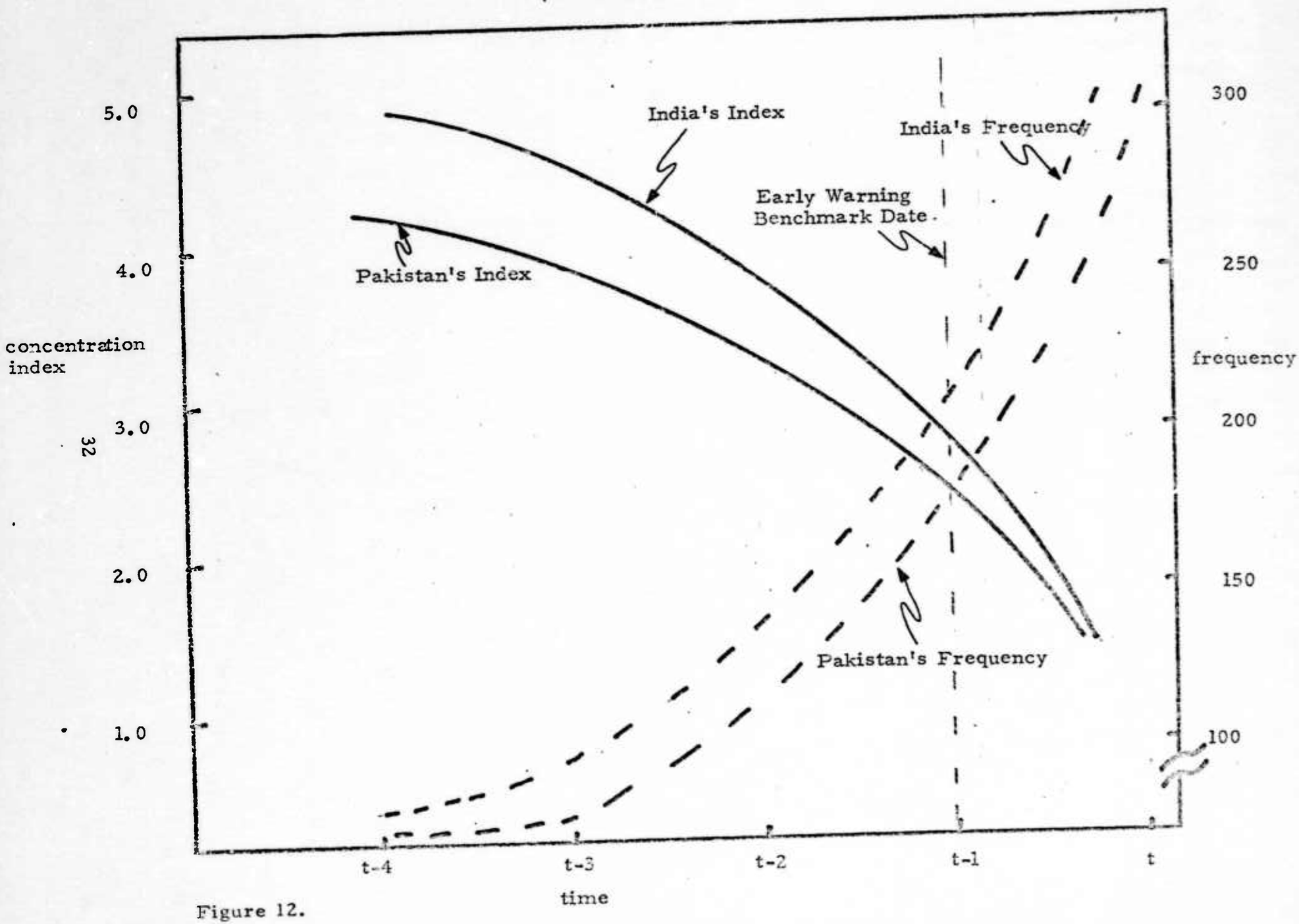


Figure 12.

TABLE 7

CONCENTRATION MEASURE FOR PRIMARY TARGETS

(NEGATIVE BEHAVIOR) FOR INDIA

1	CPR	USA	PAK	UNK	VTN	ISR	GMN	CUB	
2	CPR	USA	PAK	USR	UNK	VTN	ISR	CUB	
3	CPR	USA	PAK	USR	VTN	BUR	ISR	UNK	CUB
4	CPR	PAK	USA	USR	VTS	BUR	UNK		
5	USR	PAK	CPR	USA	NEP	ISR	VTS	BUR	JOR	MOR
6	USA	USR	NEP	PAK	CPR	ISR	INS	VTS	BUR	JOR
7	PAK	USA	NEP	UNK	CPR	ISR	INS	VTS	JOR	MOR
8	PAK	USA	NEP	UNK	ISR	INS	CPR	JOR	MOR	USR
9	PAK	USA	UNK	CPR	INS					
10	PAK	USA	UNK	CPR	BDG					

1	25.	16.	11.	2.	1.	1.	1.	1.	0.	0.	2.70	58.
2	22.	16.	10.	2.	2.	1.	1.	1.	0.	0.	2.74	55.
3	18.	12.	7.	5.	1.	1.	1.	1.	1.	0.	3.25	47.
4	11.	7.	6.	5.	1.	1.	1.	0.	0.	0.	3.64	32.
5	6.	5.	5.	4.	3.	2.	1.	1.	1.	1.	4.77	29.
6	6.	4.	3.	3.	2.	2.	1.	1.	1.	1.	3.66	24.
7	7.	7.	3.	3.	2.	2.	1.	1.	1.	1.	3.45	28.
8	31.	7.	3.	3.	2.	1.	1.	1.	1.	1.	1.88	51.
9	175.	22.	4.	2.	1.	0.	0.	0.	0.	0.	1.30	204.
10	183.	26.	4.	3.	2.	0.	0.	0.	0.	0.	1.36	218.

We cannot suppose here that this information is not easily available to the analyst. It is a certainty that it is. What we can suppose is that there are other more obscure cases in which such changes in interest are not readily apparent. In those cases, the concentration measure will be very useful to the analyst.

Table 8 shows similar results for Pakistan with the exception that Pakistani attention has been single-mindedly focused on India.

Conclusions

Up to this point we have provided the analyst with facts and figures that he may now use to assess the activity that occurred between India and Pakistan on February 5, 1971. These facts are summarized below:

- The interactions between India and Pakistan were in a steep decline.
- The policy styles of the two nations were mutually negative and were becoming worse.
- The character of negative interactions exhibited by both nations was clearly dominated by verbal abuse.
- Sporadic physical conflict was present.
- Both nations experienced a narrowing of focus -- with the other at the center of that focus -- while the frequency of negative activity between them increased.
- Both nations reacted quickly and similarly to actions of the other.
- Their respective policy styles reflected a realignment among the major powers.

Four of these findings qualify, according to research criteria discussed earlier, as signs leading to hostility. At this stage, an analyst may not

TABLE 8

CONCENTRATION MEASURE FOR PRIMARY TARGETS

(NEGATIVE BEHAVIOR) FOR PAKISTAN

1	IND	USA	ISR									
2	IND	ISR	USA									
3	IND	ISR	USA									
4	IND	USA	ISR									
5	IND	ISR	USA									
6	IND	USA	INS	ISR								
7	IND	USA	INS	ISR								
8	IND	USA	INS	ISR	UNK							
9	IND	USA	USR	UNK	INS	NTH	CAN					
10	IND	USR	UNK	USA	GMW	NTH	CAN					

1	12.	2.	1.	0.	0.	0.	0.	0.	0.	0.	1.00	15.
2	12.	2.	2.	0.	0.	0.	0.	0.	0.	0.	1.00	16.
3	6.	2.	2.	0.	0.	0.	0.	0.	0.	0.	1.00	10.
4	4.	3.	3.	0.	0.	0.	0.	0.	0.	0.	1.96	9.
5	8.	2.	2.	0.	0.	0.	0.	0.	0.	0.	1.00	12.
6	7.	2.	1.	1.	0.	0.	0.	0.	0.	0.	1.00	11.
7	8.	2.	1.	1.	0.	0.	0.	0.	0.	0.	1.00	12.
8	52.	3.	1.	1.	1.	0.	0.	0.	0.	0.	1.12	58.
9	185.	3.	2.	2.	1.	1.	1.	0.	0.	0.	1.03	195.
10	204.	3.	3.	3.	2.	1.	1.	0.	0.	0.	1.09	217.

be inclined to accept these signs as definitive in and of themselves. He will surely want to complement them with his own independent findings. But he will nevertheless pay heed to the pattern suggested by this quantitative analysis.

Experiment II uses the Soviet-Czech crisis as a basis for analysis. The nature of this crisis, however, is different from the Indo-Pakistani conflict and therefore provides several new applications of the indicators used in this section.

EXPERIMENT II: THE SOVIET-CZECHOSLOVAKIAN CRISIS

In this section we will again assume the role of an analyst in examining the events that occurred in the Soviet-Czech crisis of August 1968. In April 1968 the first inklings of possible Soviet-Czech difficulties surfaced. The following news events appeared and are listed in Table 9.

TABLE 9

SOVIET-CZECH EVENTS, APRIL 1968

680412	365	42	312	0
USR APPROVED CZE PARTY CHIEF STATEMENT THAT COMMUNIST PARTY WOULD NOT SURRENDER ITS DOMINANT POSITION IN COUNTRY				
680423	365	31	315	0
USR AMB MET CZE DUBCEK				
680423	315	31	365	0
CZE DUBCEK MET USR AMB				
680423	315	160	365	0
CZE WARNED USR TO STAY OUT OF INTERNAL AFFAIRS OR CZE WOULD NOT SEND AMB				
680428	315	121	365	0
CZE SECRET POLICE CHIEF CHARGED CZE PURGE OF 1952 WAS ORDERED BY STALIN (USR)				
680429	365	193	315	0
USR SUSPENDED WHEAT SHIPMENTS TO CZE				
680430	365	72	315	0
USR OFFERED $400 MIL CREDIT TO CZE				

The tenor of the events appeared to be of an ideological character in which the Soviets seemed concerned with continued Communist Party dominance of Czechoslovakian politics and the Czechs seemed concerned with affecting less Soviet interference into their internal affairs. The speed with which charges and counter-charges occurred began to accelerate toward the end of April. Table 9 is a TEXSCAN retrieval of the events during that period. An analyst equipped with the tools of quantitative political indicators would respond to these events by searching for clarifying facts. In this experiment, as in the last, we will assume the role of an early warning analyst in simulating a sequence of steps that might lead to the facts surrounding such events.

Step 1. The search might begin with a set of questions designed to give it guidance. The following questions are among those an analyst might be expected to ask: What has been the recent history of Soviet-Czech relations? Have they been friendly or generally hostile toward each other? Is there a difference in Soviet attitude toward the Czechs compared with other East European allies? To answer these questions an analyst would use the relations indicator. Figure 13 is a plot of the relations between the USSR and Czechoslovakia during 1967-68.

As Figure 13 indicates, relations between the USSR and Czechoslovakia had been on a steady decline while their involvement was on a steady rise. This pattern of activity, as early as December 1967, fits our prescribed pattern of possible hostile developments.

Step 2. To answer question two, the analyst may compute a relations measure between the Czechs and the Soviets and between the Soviets and all other East European nations taken separately or as a group. Figure 14 is an example of the output from such a computation. It is a plot of

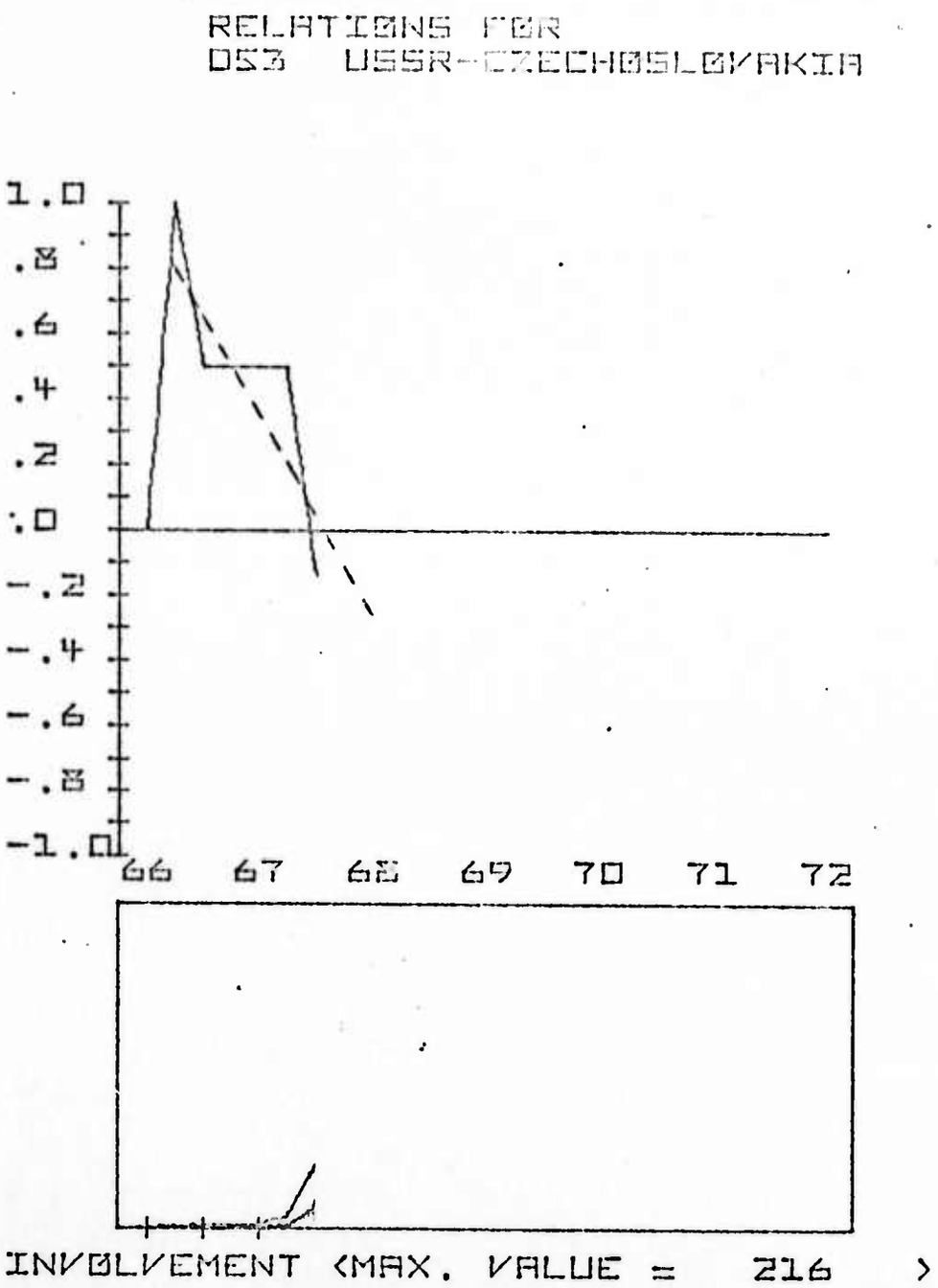

RELATIONS FOR
053 USSR-CZECHOSLOVAKIA
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
66
67
68
69
70
71
72
INVOLVEMENT (MAX. VALUE = 216)

Figure 13.

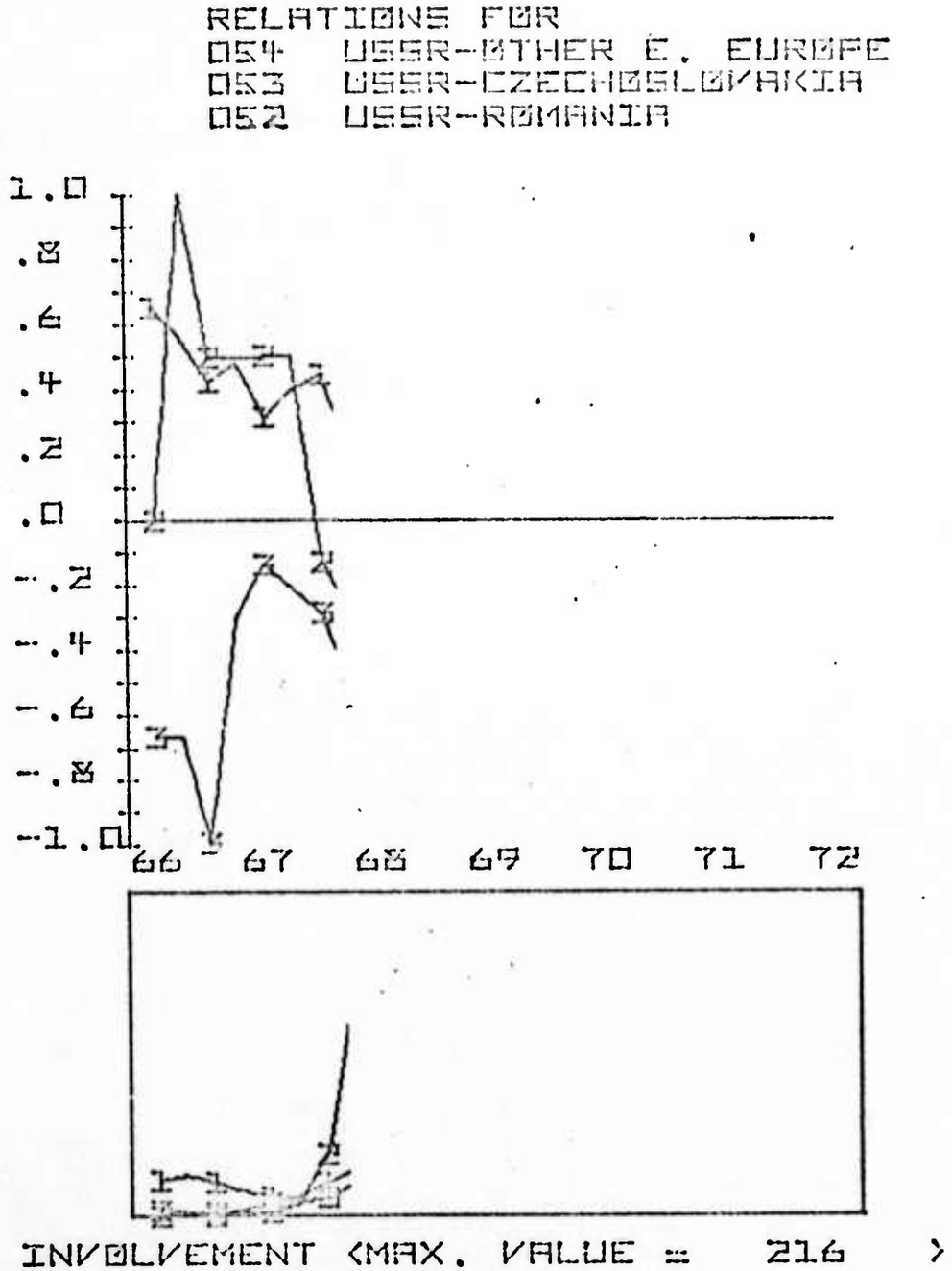

RELATIONS FOR
054 USSR-OTHER E. EUROPE
053 USSR-CZECHOSLOVAKIA
052 USSR-ROMANIA
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
66
67
68
69
70
71
72
INVOLVEMENT (MAX. VALUE = 216)

Figure 14.

the relations measure between the USSR and other East European nations (the curve labeled "1"), between the USSR and Czechoslovakia (the curve labeled "2"), and between the USSR and Romania (the remaining curve labeled "3"). The plot shows that Soviet-Czech relations are significantly more negative than the relations between the USSR and other East European allies and that they are rapidly approaching a status similar to that between the Soviets and the Romanians. Soviet-Romanian relations were the most strained among the East European nations during this period. A fact of equal importance is that indicated by the substantial increase in Soviet-Czech involvement shown in the lower portion of the figure.

Step 3. If the substance of the deteriorating relations is ideological, as the TEXSCAN statements suggest, then one of the first concerns of the analyst would be to determine if a change in the character of Czech foreign policy had occurred. The analyst may desire to know: 1) What is the present and recent history of Czech policy style toward the USSR? U.S.? 2) Does it suggest a change in Czech policies? 3) What is Soviet policy style toward the Czechs? Does it suggest a change in policies or attitudes? The policy style indicator is an indispensable aid to the analyst who desires answers to questions of this type. Figures 15 and 16 show how they provide such aid.

Figure 15 is a plot of USSR policy style toward Czechoslovakia and toward other East European nations. The general trend of both curves is downward. In the Czech case it is drastically downward. In the case of other East European countries it is down only slightly with a bend, indicating a change in direction. Thus, question three can be answered in the affirmative. Soviet policies and attitudes toward the Czechs is indeed changing for the worse. At the same time its policies and attitudes toward other East European nations are beginning to show signs of improvement.

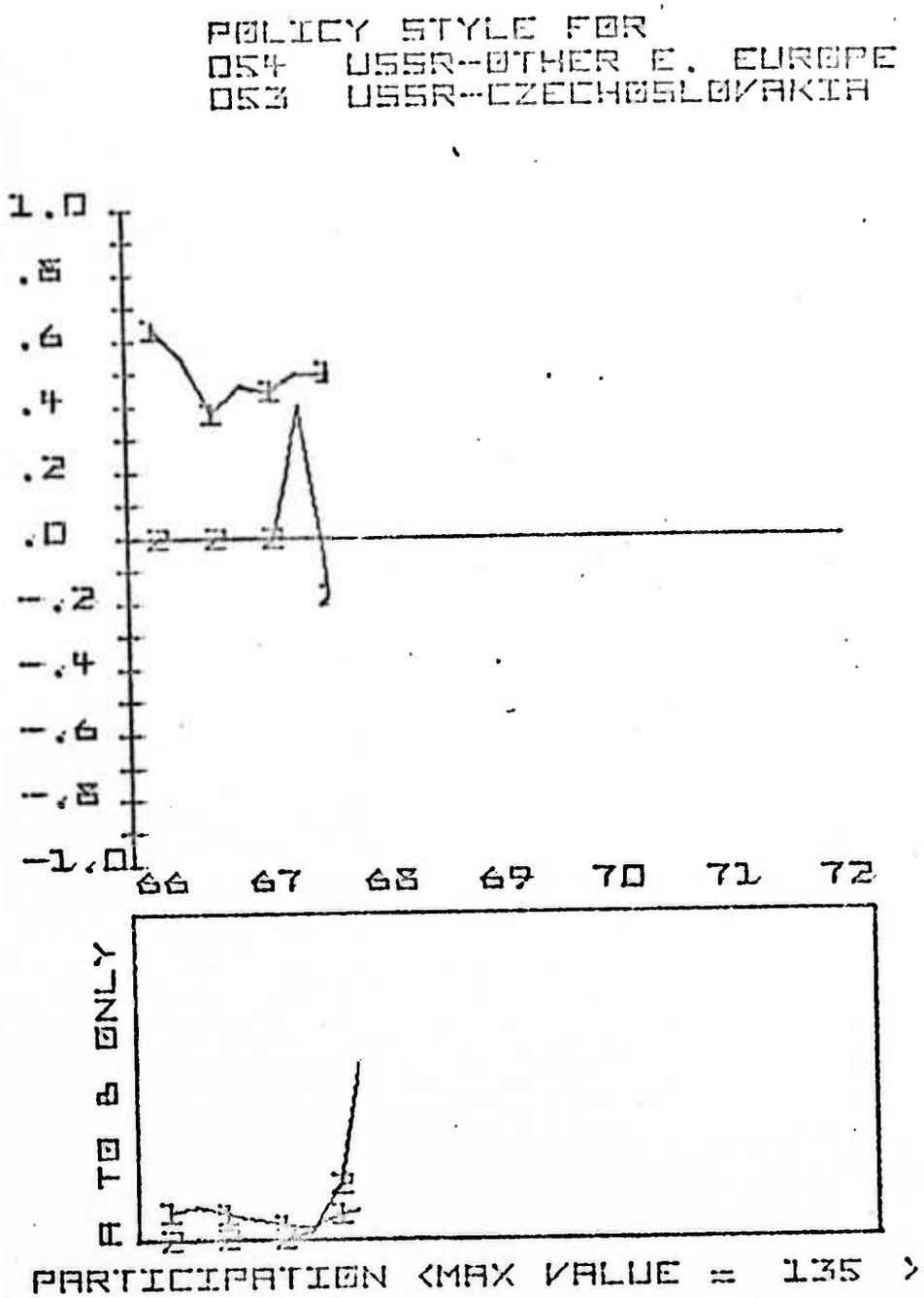

POLICY STYLE FOR
054 USSR--OTHER E. EUROPE
053 USSR--CZECHOSLOVAKIA
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
66
67
68
69
70
71
72
E TO B ONLY
PARTICIPATION <MAX VALUE = 135 >

Figure 15.

Figure 16 helps answer questions one and two. It is a plot of Czech policy style toward both the Soviets (1) and the U.S. (2). Czech policies toward the U.S. are indeed improving, while her policies toward the USSR are in a steep decline. Since April 1967 there appears to have been a major readjustment in Czech policies toward the Soviets as indicated by the steep drop in curve "2."

Step 4. The analyst's fourth step is to determine the composition of events in the event stream. The trend of political behavior within the East European bloc is by now clear to him: A sustained deterioration of relations between the Soviets and Czechs exists. There has also been a change in the respective policy styles of both countries. Precisely what types of events characterize deteriorating relations? What events suggest changes in policy? These are questions the analyst may need to answer at this stage.

The physical and verbal conflict plots in Figures 17 and 18 provide a disaggregation of the interaction stream. They show that cooperative behavior, as of April 1968, was the dominant type of behavior for both nations. No physical conflict was present. They also show an increase in verbal conflict. In fact, the slope of verbal conflict in the Soviet case (Figure 18) was steeper than that of the corresponding cooperative curve, suggesting a possible cross-over during early June 1968. (The cross-over actually occurred in May 1968.) The plots do not show a tendency toward a decline in either type of behavior, but an increase in both. This pattern of ambiguous behavior is usually characteristic of negotiations or bargaining over issues of a competing nature. This may be the case here. A final point of interest in Figures 17 and 18 is that the interaction between nations, as of November 1967, had begun to occur on a continuous basis.

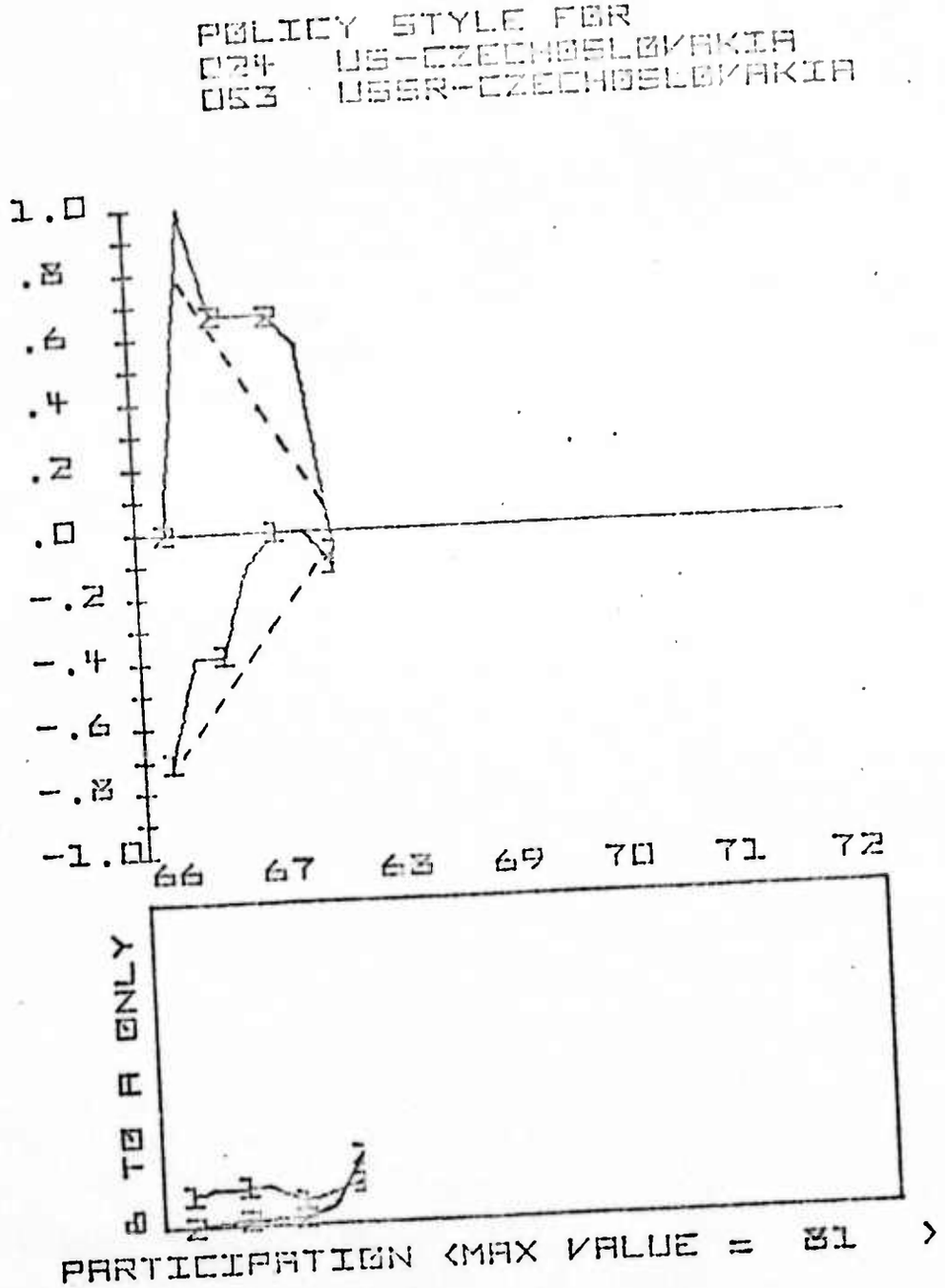

POLICY STYLE FOR
024 US-CZECHOSLOVAKIA
053 USSR-CZECHOSLOVAKIA
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
66
67
68
69
70
71
72
0 TO A ONLY
PARTICIPATION (MAX VALUE = 81)

Figure 16.

VERBAL AND PHYSICAL CONFLICT BETWEEN

THE USR AND CZECHOSLOVAKIA

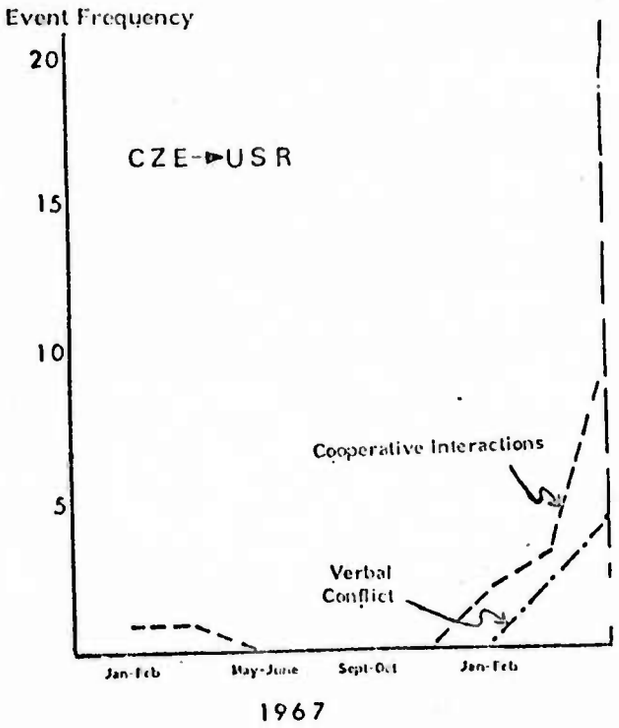


Figure 17.

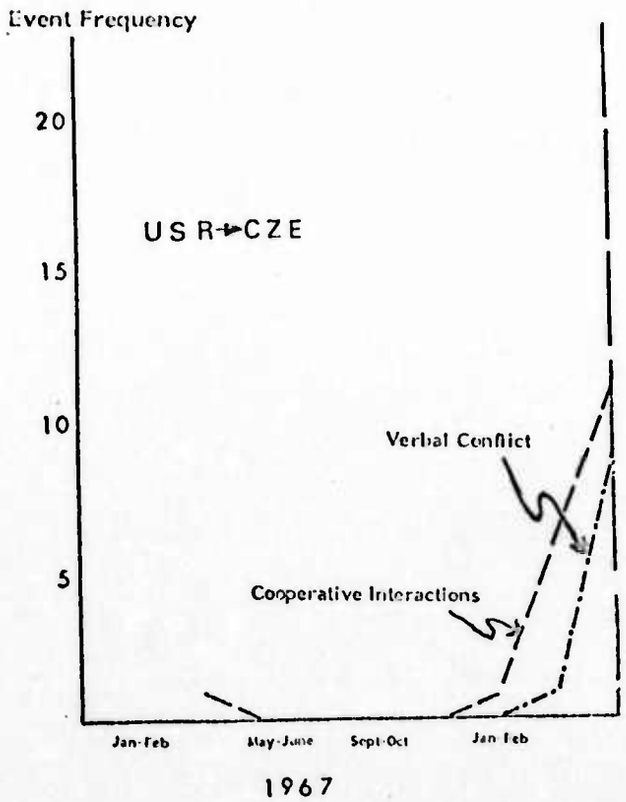


Figure 18.

At this point, the details surrounding the cable events are somewhat clearer. The Soviets and Czechs are involved in a pattern of ambiguous behavior characterized by:

- Deteriorating ideological relations.
- Major changes in policy styles toward each other.
- A discrepancy in intra-bloc attitudes with an increased hardening of attitude between the Soviets and Czechs.
- An increase in the frequency of activity dominated by cooperative behavior but closely trailed in number by verbal conflict.

Step 5. Step five involves use of the concentration indicator. At this point in the analysis, the analyst may desire a broader impression of the overall pattern of activity between the Soviets and the Czechs. Such an impression might answer questions involving possible intentions of these nations. Following this line of reasoning the analyst may be prompted to ask where the worldwide interest of these nations lies? Or where their regional interest lies? Or if the scope and character of their focus indicate a negative preoccupation with each other? The concentration indicator will aide the analyst best in searching for answers to these questions.

Table 10 is a table of rank-ordered labels reflecting Soviet interest in East Europe during the time period under consideration. Czechoslovakia has moved from rank position nine to position one in a single time period. Romania has moved up as well. The concentration index has narrowed considerably during this period, while the frequency has increased. The index has decreased from six (5.69) countries (GME, HUN, POL, ROM, YUG, and ALB) to two (1.67) countries (CZE and ROM).

TABLE 10

PRIMARY USR TARGETS WITHIN EAST EUROPE (ALL BEHAVIOR)

		Index	Freq.
1	GME HUN POL ROM YUG ALB CZE EBE	5.69	34
2	CZE POL ROM YUG HUN GME BUL ALB EBE	3.76	71
3	CZE ROM POL YUG GME HUN BUL ALB	1.72	180
4	CZE ROM GME POL YUG HUN BUL ALB	1.67	201
5	CZE ROM GME YUG POL BUL ALB HUN EBE	1.47	221

An analyst is surely compelled to conclude that Czechoslovakia has rapidly acquired the center of Soviet attention in East Europe.

In a similar fashion, as is shown in Table 11, the Soviet Union has moved from the fifth position of Czech attention to first in only three time periods, a less rapid ascension but a no less important one. The frequency of interaction here has also been on a steady rise.

The indicators suggest to the analyst that both the Soviet Union and Czechoslovakia have begun, as early as April 1968, to act out a pattern of attentiveness that suggests hostile developments.

Step 6. The final quantitative political indicator to be used in this analysis is shown in Figures 19 and 20. They are time-series plots of the frequency of negative behavior within the East European bloc and the rate of change in negative behavior within the bloc respectively. Figure 19 illustrates Soviet dominance in the frequency of negative interactions. Prior to 1968, Soviet negative behavior was sloped downward. At the beginning of 1968 this trend was reversed. A similar but less substantial reversal of trend occurred with regard to

TABLE 11

CONCENTRATION MEASURES FOR PRIMARY TARGETS

(ALL BEHAVIOR) FOR CZECHOSLOVAKIA

1	USA	GMW	CPR	SWZ	USR	CYP	POL	FRN	CUB	VTN
2	USA	USR	GMW	GME	HUN	CPR	POL	VTN	SWZ	CUB
3	USR	USA	GME	GMW	YUG	ROM	HUN	POL	CPR	BUL
4	USR	USA	GME	GMW	YUG	ROM	HUN	CPR	POL	BUL
5	USR	USA	GMW	GME	YUG	HUN	ROM	POL	AUS	CPR

1	17.	5.	4.	3.	2.	2.	2.	2.	2.	1.	2.48	40.
2	24.	22.	9.	8.	5.	4.	4.	3.	3.	3.	5.61	85.
3	85.	18.	14.	13.	8.	6.	6.	5.	4.	3.	3.24	162.
4	96.	19.	13.	13.	9.	6.	6.	5.	5.	3.	3.08	175.
5	108.	18.	16.	14.	10.	9.	6.	5.	5.	4.	2.99	195.

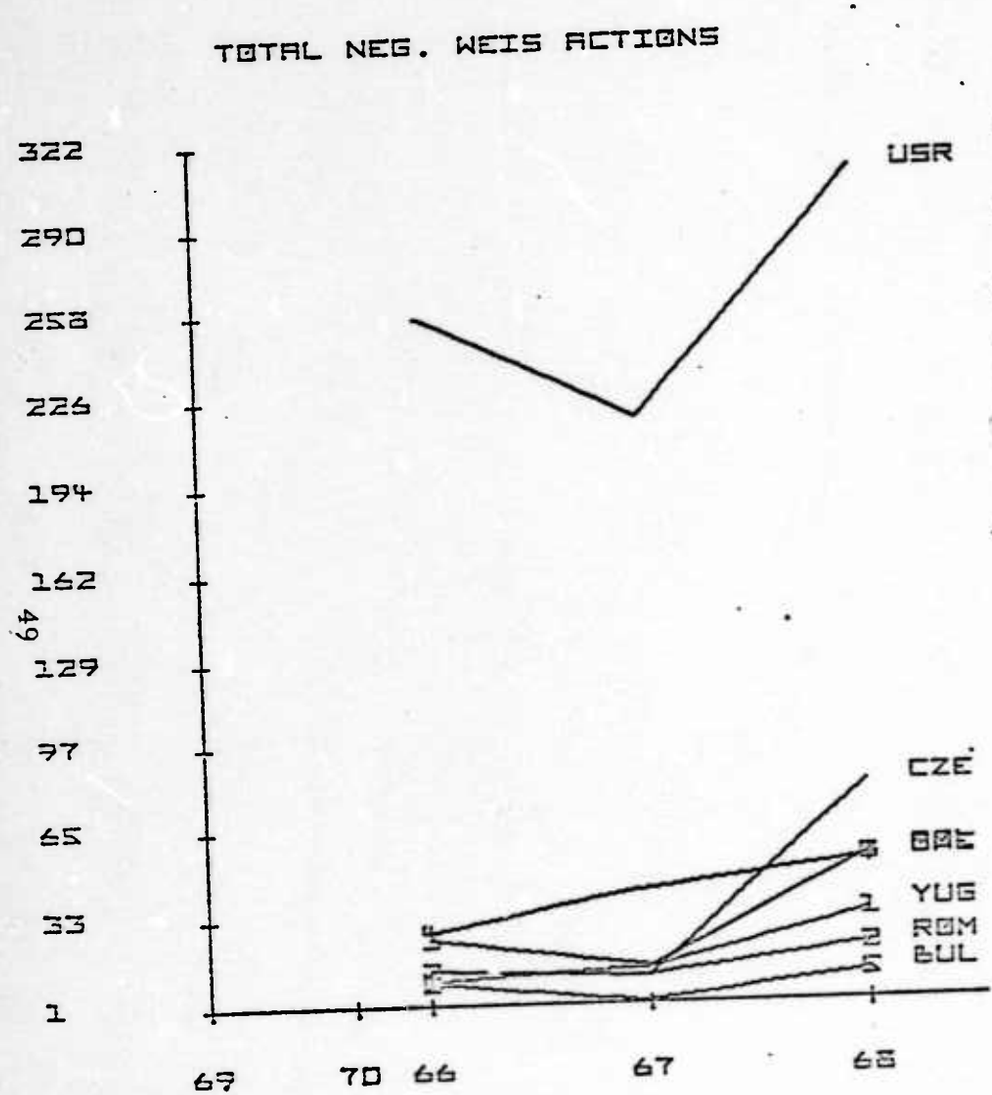


Figure 19.

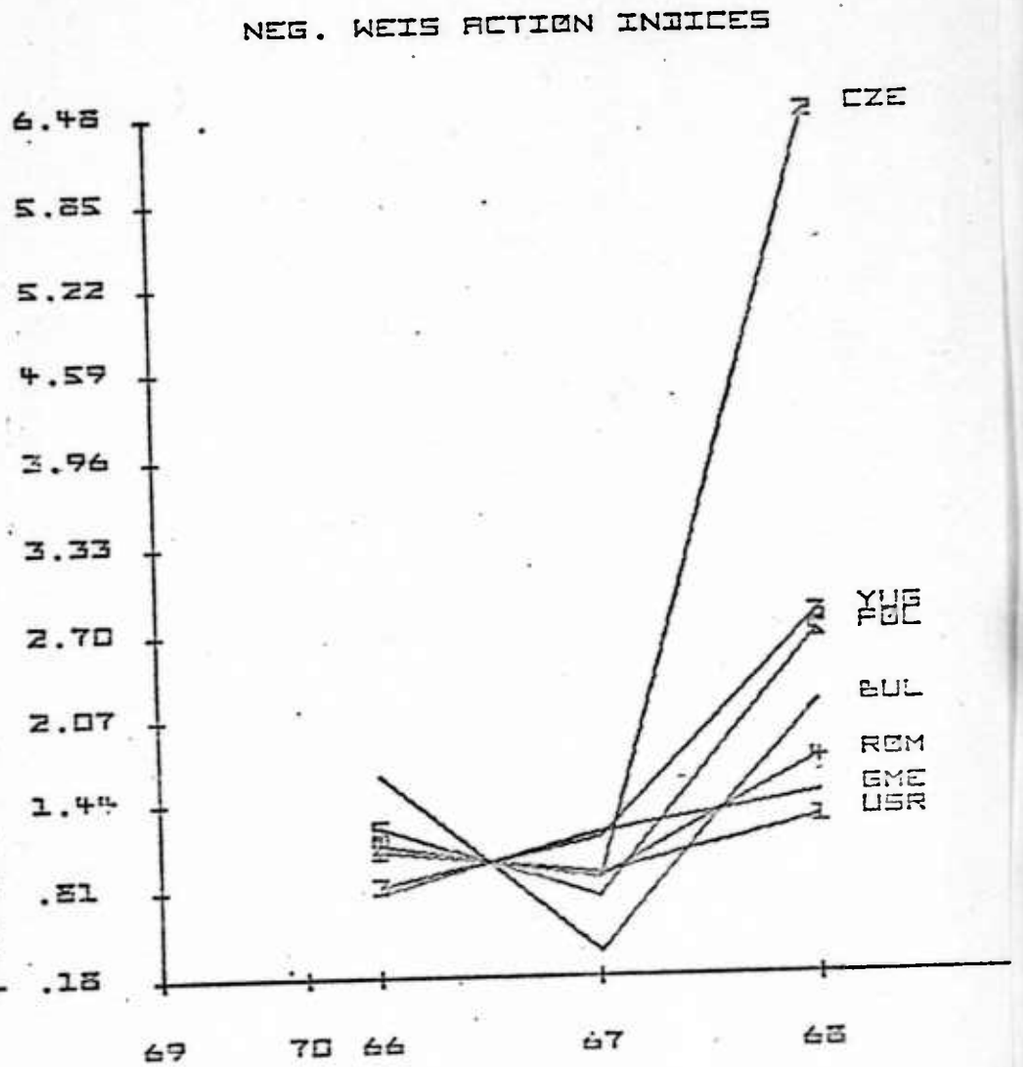


Figure 20.

Czechoslovakia during the same time period. These reversals resulted in a clear pattern, depicted in Figure 19, of Soviet-Czech dominance in the negative behavior of East Europe as early as December 1967. These facts are of obvious importance to the early warning analyst.

Another index of equal importance to the analyst is the rate of change index shown in Figure 20. The towering increase in the rate of change of Czech negative behavior can hardly be overlooked as a representation of a significant readjustment by the Czechs to developing concerns.

Conclusions

In this experiment we have attempted to demonstrate how quantitative political indicators may be successfully used to aid an early warning analyst charged with assessing the possibility of future conflict in the Soviet-Czech crisis. Our analysis, which was assumed to have taken place prior to April 1968, revealed the following facts:

- A major deterioration in relations between Czechoslovakia and the Soviet Union was in progress since the beginning of 1968.
- The deterioration was accompanied in time by a substantial increase in the frequency of Czech-Soviet interactions.
- Major changes in the policy styles of the two nations took place. These changes were underscored by a discrepancy between Soviet style toward Czechoslovakia and her style toward other East European nations, and by a Czechoslovakian reversal of attitude toward the U.S. and the Soviet Union.
- Negative behavior within the East European region was increasingly dominated by Soviet and Czechoslovakian interactions.

- The Czechoslovakian change in negative behavior had increased exponentially within the last year.

- A mutual narrowing of focus between the countries had taken place within the last year with each of them acquiring the center of the other's focus.

These conclusions result from a simulated line of questioning thought to be reasonable for an analyst to ask. The utility of the indicators is not tied in any way to the questions themselves. Other questions may demand a different selection of indicators or a different sequence of the ones used.

IMPLICATIONS OF THE EXPERIMENTS

The general implications of this analysis point to four key points they they relate to the task of early warning.

The first point has to do with the relationship between quantitative political indicators and an advancement in the art of information compression. One of the major problems for the analyst is one of how to better separate meaningful information from noise. The experiments just completed show that quantitative political indicators help illuminate aspects of the information stream which are otherwise obscured by ambiguity and noise. Thus, in addition to being easily computed, easily interpreted, and readily displayed, the indicators demonstrate an ability to track and monitor behavior changes which are often overlooked by other kinds of analysis.

The second point has to do with the relationship between quantitative political indicators and the task of cataloging changes in activity over time. Another of the major problems of the analyst is that of properly organizing available facts on changes in the political environment and putting them into historical perspective. It is easy for an analyst to know what is going on in a particular area of the world at a particular point in time. But it is not easy for him to retain an accurate image or impression of changes in events over a longer period, i.e., six months to five years. For these longer periods, he has traditionally relied on qualitative historical summaries. These, however, have often proved inadequate for assisting in the construction of needed impressions. Quantitative political indicators, on the other

hand, provide the analyst with a tool that allows him quick access to recent historical developments displayed in an easy-to-read form. One or more countries may be "called up" simultaneously to help the analyst put together a complete picture of suspected activity. An analyst may begin with a single suspicious act, and with the use of quantitative political indicators he may build a complete picture of the activities surrounding it.

In addition, quantitative indicator technology allows the analyst the ability to build a catalogue of different types of activity. These types may be "called up" as patterns to aid in future analysis or they may be used for model building on other semi-theoretical enterprises.

The third point is that quantitative political indicators can be used with confidence by the analyst. Quantitative indicator technology as practiced by CACI utilizes the technique of developing many independent indicators that monitor the same or similar activity, resulting in a convergence of divergence in results. A divergence in indicators tells the analyst very little about the activity he is studying. A convergence tells him what he needs to know about the activity under study. In the present experiment the activity studied has been restricted to international behavior. Future possibilities suggest loosening this restriction so that other types are included. Experiments are already underway in which non-event indicators and a trial set of military indicators will be used. The prospects for an integration of these appear very promising.

Finally, quantitative political indicators will not solve all of the analyst's problems. For instance, they will not serve as a substitute for his judgment, nor will they replace other quantitative or qualitative tools. However, if they are used properly, they can greatly enhance the analyst's ability to assess the military-political environment.

C.A.C.I.

WASHINGTON, D.C. OFFICES

AVAILABILITY AND UTILITY OF PRESENT MILITARY CAPABILITY INDICATORS

Dale Dean

Donald Krysakowski

I. INTRODUCTION

This paper is designed to fulfill Task B-2 of the current contract which focuses on Quantitative Indicators for Defense Analysis. Task B-2 states that "a survey shall be made of the availability and utility of military capability indicators. This survey shall commence with open source information and shall proceed sequentially to classified intelligence information. If considered useful, a sample application of such indicators shall be developed." Due to certain slippages in clearances, the research for this task was done on an unclassified basis. However, the findings have been submitted to persons who know of the availability of military indicators for classified use. Thus, the findings are believed to be general.

II. SUMMARY AND CONCLUSIONS

The survey found that most aspects of the military establishment can be measured and reported on by use of indicators. But generally, they measure a single aspect of the military capabilities, i. e., the number of a specific type aircraft, the total tonnage of a class of naval vessels, the number of ground force divisions, etc. In addition there are some more complex indicators that deal with the overall capability of a weapon system to attack the enemy, i. e., in the case of an aircraft this could include the probability of take-off, of arriving in the area of the target, of the CEP of its targeting mechanism, the probability that the weapon will explode when it strikes, etc. The survey also found that there is little or no need to construct what might be termed simple indicators. As the Tables in Appendix A indicate most aspects of the military are covered and data is available in indicator form.

One major conclusion of the survey is that few if any complex indicators have been developed to assist the planner and the intelligence analyst assess the changes in capabilities of other nations' military capabilities through time. Complex indicators have been developed for use in war gaming. In this sense, they are numerical indices representing the capabilities of one or more weapon system as affected by the environment in which the "war" is to be fought. They can encompass the effects of opposing weapon systems. They can be dynamic, being programmed to respond through time to several stages of combat. But these indicators tend to be highly discrete, developed for specific combat situations. They are not generally useful to the intelligence and planning analysts. They generally cannot be used to determine changes through time in a nation's military capability to undertake certain types of missions.

In this latter sense, military indicators could be developed to assist the planner and the intelligence analyst keep track of the impact of change in friendly and other forces. In particular, they would be available to

the intelligence analyst to assist him in estimating the intentions of potentially unfriendly nations. The military indicators could be combined with those from the political and economic areas to assess the target nation's capabilities which greatly assists in determining their intention to follow a particular course of action.

CACI recommends that further research in the development of military indicators for use by the planner and the intelligence analyst be undertaken in the next fiscal year. As indicated in the report there are avenues of approach that appear to be profitable. (See pp. 5). The objective would be to develop a bundle of complex indicators of change in military capability -- overall and in specific force missions -- that could be tested for use by the planner and the intelligence analyst.

III. REPORT

A. PRESENT MILITARY CAPABILITY INDICATORS

The sources reviewed for military capability indicators are listed in the bibliography. (See Appendix B). Because all sources could not be exhaustively reviewed, an effort was made to examine a representative range of literature which would most likely contain indicators an analyst might use to monitor and assess a state's military capabilities. Thus, the literature included surveys of military inventories, technical discussions of weapons system characteristics, and discussions of the resource base for military capabilities.

The indicators found are listed in Appendix A. They are classified by categories which seemed to recurr throughout the sources: inventory (listing equipment and manpower counts), weapons system traits and performance characteristics (listing measures for assessing military hardware), and resource bases for military capabilities (listing country resources).

The indicators reviewed appear to be used as "basic" descriptors of military capabilities. They seemed "basic" because they recurred throughout the sources reviewed. As such, they seemed likely to be used by an intelligence analyst to monitor developments of capabilities over time in order to see changes and assess the significance of those changes.

The striking feature of these indicators is their discreteness. With few exceptions, each indicator measures a very specific aspect of military capability within each general category of indicator (inventory, traits, and resources). The indicators reviewed did not combine aspects within or between general categories. For example, the agility of a ground vehicle is composed of four separate elements, each of which can be measured. But there is no combination of these elements into a composite index measuring agility. Another example is weapons inventories

which measured numbers of weapons with no expression of any trait or performance characteristic.

The resulting indicators, agility and inventories, are narrowly confined to measure single aspects. A single measure of only one aspect may not itself describe accurately the military capability an analyst is interested in. He may have to consult several indices, each measuring a separate aspect. This increases the amount of information he has to examine because he cannot get it more succinctly from one index. A more accurate indicator would facilitate the relevant comparisons an analyst could make between capabilities within one country over time and between countries.

B. SUGGESTED NEW MILITARY CAPABILITY INDICATORS

This section offers examples of the kinds of indicators that could be constructed with further research. For illustration purposes we have chosen to build indicators based on two of the general categories (inventory and weapons traits) we found in the survey.

1. Inventory Indicators

The simplest set of indicators which may be of use to the analyst are those at the inventory level. This type of indicator is simply a count of men and equipment for a nation, and can be compared against a similar count for another nation or group of nations when discussing military balances. Inventories can also be aggregated into regional or alliance comparisons.

A typical example of inventory indicators is the annual publication of the International Institute of Strategic Studies, The Military Balance. This study inventories men and weapons for nearly every country in the world and is considered to be the most authoritative and comprehensive unclassified source for such data.

These inventory indicators are not new, nor is the idea of computerization of this information. What CACI can do though is something that we feel will be of value to the military analyst. With the material coded from The Military Balance for every year since 1966 and stored in a computer, graphical and numerical comparisons can easily be obtained. With the aid of a plotter, trends in force buildups can be charted over time, compared with patterns of similar buildups, or compared within and between alliance formations. Similarly trends in military construction procurement, and force deployments could be followed and analyzed. Simple percents and ratios could be calculated and displayed to the analyst.

In addition to the plots and numerical comparisons, richer inventory measures could be available through programs stored in the computer. By focusing on some characteristics other than numerical counts it is possible to gain some insight into the relative strengths and weaknesses of different inventories. An example of this would be the use of statistical tools such as means and standard deviations to analyze changes within inventories over time. Mean tonnage could be calculated for an entire fleet of ships, showing the direction of fleet building by a rising or falling mean. The mean would indicate a larger or smaller displacement per ship while the standard deviation would measure the degree of change around that mean displacement. Also, a mean of the percentages of each ship type, i.e., destroyers, cruisers, battleships, etc. could be calculated and analyzed to discover changes of emphasis in ship construction. In a similar fashion, a mean weapons payload could be calculated for different aircraft types and with each standard deviation could be analyzed for significant variations around that mean.

The use of indicators such as mean tonnage and the standard deviation would allow the analyst to follow changes over time in the structure of an inventory. He could determine not only if an inventory is increasing in size, but whether there are changes of characteristics within the inventory.

2. Indicators of Traits and Performance Characteristics

To incorporate in a single indicator more than one aspect of capability we propose to build a series of composite indicators. By this we mean taking the relevant components of a major system, measuring each, then by adding the measured sub-systems together, creating an indicator of the capability of the whole system. The example given here is by no means exhaustive nor may it be entirely correct, but serves to exemplify how composite indicators could be constructed. By combining aspects into a single index we hope to produce indicators accurate and rich in information parsimonious in form.

a. Comparing Tanks: Agility and Firepower. In order to evaluate the comparative capabilities of a weapons systems, it is necessary to determine the most important components of that system and attempt to measure them in some rational manner. The example we will use is tank comparisons for NATO and the Warsaw Pact. But the lesson is applicable to any system. The purpose of the evaluation is to compare agility and firepower of a tank relative to other tanks. This evaluation cannot be used for direct comparisons with other equipment, for example, tanks vs. armoured personnel carriers.

A tank is usually evaluated in terms of three elements: agility, firepower, and defensive capabilities. Factors influencing agility or the ability of the tank to move over various types of terrain, include maneuverability, speed and the weight of the tank. Firepower is computed on the sustained rate of fire, effective width of burst, and the fragmentation area.[1] The tank is classified by the size of its gun and a firepower score is determined for the gun as well as any secondary armament. Defensive capability is usually equated with the thickness of armor, its slope, and the percentage of hull and turret exposed; however, for our purposes and for simplicity, defensive characteristics have not been considered. The tanks in the

[1] FM 105-5 Department of the Army Field Manual, Maneuver Control, HQ UA Army, April 1964, Unclassified, pp. 84.

example will be evaluated in terms of agility and firepower only.

1) Agility. Maximum speed is one measure of agility which hardly needs to be explained. A tank must be able to move fast enough to reach a front or to exploit any gaps in an enemies defenses. It is assumed that the faster a tank travels the better it is. However, speed is not the sole criteria. A high power to weight ratio is also important. A tank must be able to move fast quickly. A high power to weight ratio is a good indicator that a tank will be able to accelerate quickly, not respond sluggishly. A high power to weight ratio will also give a tank better performance over low power to weight ratio tanks in inclement weather conditions, especially mud or bog.

Another indicator of good tank performance in poor terrain is ground pressure. Ground pressure is the amount of weight exerted by the tank's tracks usually measured in pounds per square inch or kilograms per square centimeter. The lower this number, the better the vehicle will perform especially in sloppy conditions and off the road operations.

With these three factors, then, we can construct an index of agility. The factors which increase the agility of the tank as they get larger are placed in the numerator of the equation and the factor which increases the agility of the tank as it gets smaller are placed in the denominator so that the entire equation will increase as the factors effecting it get better. The higher the index is the better the vehicle is expected to perform. Expressed as an equation, the agility index is:

$$\text{Index} = \sqrt[3]{\frac{\text{Max. Speed (kms/hr))} \times \text{(bhp/ton)}}{\text{Ground Pressure (kg/cm}^2\text{)}}}$$

With this formula the following are the agility measurements for various tanks in use today:

TABLE 1

System	Country	Index	Index[3]
Leopard Mk. 1	W. Germany	11.6648	1587.21
M-60 A2	USA	10.2398	1073.68
T-62	USSR	9.9159	975.00
M-60 A1	USA	9.8437	953.85
T-54/55	USSR	9.5842	880.36
M-47	USA	9.2335	787.23
Chieftan	UK	9.2154	782.60
Centurion	UK	7.7159	459.36

On the whole the figures appear to have a certain amount of face validity. The Leopard appears to be the recognized leader in terms of mobility.[1] The older model tanks, M-47 and Centurion rank farther down on the list. A major criticism of the British Chieftan is its lack of agility and it is believed that this criticism has led to the development of a Mk. 5 version of the tank.[2]

2) Firepower. Rather than attempting to create our own index of firepower, we have used the ratings given (on pages 136 and 137) of a US Army Field Manual, Maneuver Control. Here tanks are rated by size of gun and secondary armaments. Several assumptions were made which may not be wholly accurate but reflect an approximation of weapons effectiveness. First, all NATO 105 mm tank guns are presumed to have the same effectiveness as a US Army 105 mm as they will all accept a standard NATO shell size. The same holds true for equating the 120 mm gun size for the Chieftan to a US 120 mm gun. Second, the data is outdated (1964 firepower scores). It is presumed firepower scores for NATO or the US have not outstripped Soviet scores, but have progressed

[1] Jane's Weapons Systems, p. 251.

[2] Ibid., p. 264.

upward, if indeed they have, at the same rate. Finally, since no unclassified scores are available for the SHILLELAGH missile/152 mm gun system used on the M-60 A2 tank, the score is simply an extrapolation based on gun size.

The firepower scores for the tanks in the example are given below:

TABLE 2

System	Country	Score
Leopard 105 mm	W. Germany	30
M-60 A2 152 mm	USA	36*
T-62 115 mm	USSR	30
M-60 A1 105 mm	USA	30
T-54/55 100 mm	USSR	29
M-47 90 mm	USA	28
Chieftan 120 mm	UK	32
Centurion 105 mm	UK	30

*Estimated

This data for agility and firepower can now be plotted against each other in order to compare various agility ratings in relation to gun sizes. That plot is given in Figure 1 below. The plot is a visual display comparing tanks in terms of their relevant elements.

3) Probability of Success. Figure 1 makes sense only if the assumption is made that a tank moving at 5 kms/hr has the same firepower as one moving 25 kms/hr. Intuitively it would appear that just the opposite would be true. For that reason a decaying factor is applied to the firepower score as the speed of the vehicle increases. The assumption is that vibration and roughness of ride would be greater resulting in less accuracy. Methods of sighting can also be included in this category because a higher probability of hitting a tank at long range with a laser

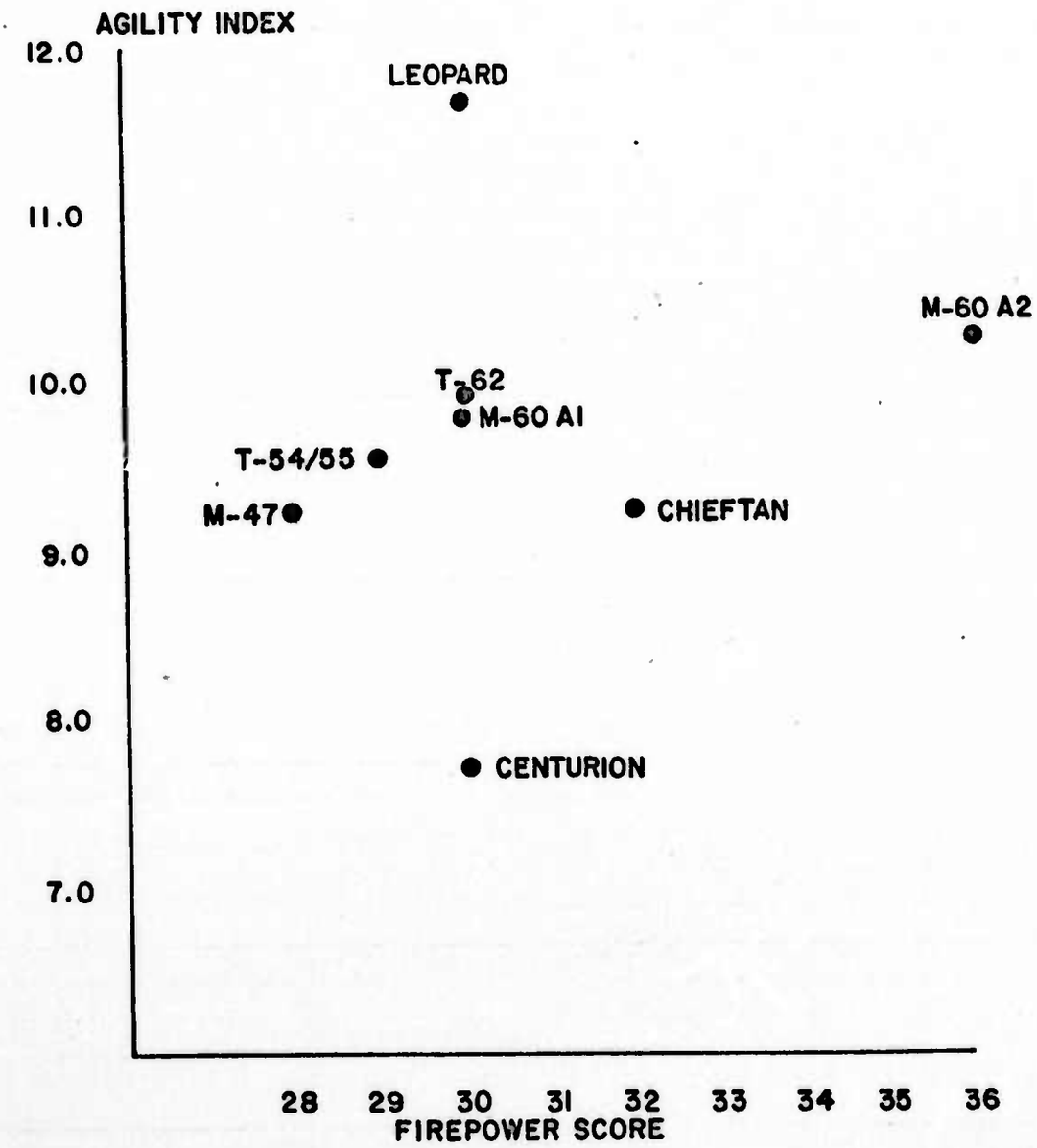

AGILITY INDEX
12.0
11.0
10.0
9.0
8.0
7.0
LEOPARD
M-60 A2
T-62
M-60 AI
T-54/55
M-47
CHIEFTAN
CENTURION
28
29
30
31
32
33
34
35
36
FIREPOWER SCORE

Figure 1.

rangefinder is higher than by the estimation and judgment of the tank commander. For the lack of empirical evidence on these matters the probability of success (POS) is formulated strictly on intuitive judgment.

4) Combining the Factors. Though we have compared the systems in terms of firepower and agility, we have yet to link agility, firepower, and POS into a single measure of tank capability. This can be done by the following formula:

$$\text{Index} = \text{Agility} + (\text{Firepower})(\text{POS})$$

In this way all the characteristics we have described are combined into a general index measure for tanks. The index figure represents potential capabilities if utilized to the fullest. However, top speed will rarely be used in combat, only in exceptional circumstances. Figure 2 below represents the tank index curves when speed is not held constant but actually increases from zero to top speed. In this manner, a tank can be compared with all other tanks at any given speed. Given equal probabilities of success at various speeds we can see by the diagram that the M-60 A1, T-62, Chieftan, and Leopard tanks are all relatively equal. The advantage of the M-60 A2 lies in the estimation of firepower of its SHILLELAGH missile/152 mm gun system. Thus, on a one for one basis all tanks in Europe, both NATO and the Warsaw Pact, can be considered equal.

3. Combining Weapons Systems and Inventories

The composite indicator model also appears to be a good method of mating technical characteristics with measures of inventories. When these characteristics are combined, a clearer picture of military capabilities begins to emerge.

Let us consider a simple air attack model. We will evaluate two separate aircraft systems and determine the maximum available deliverable

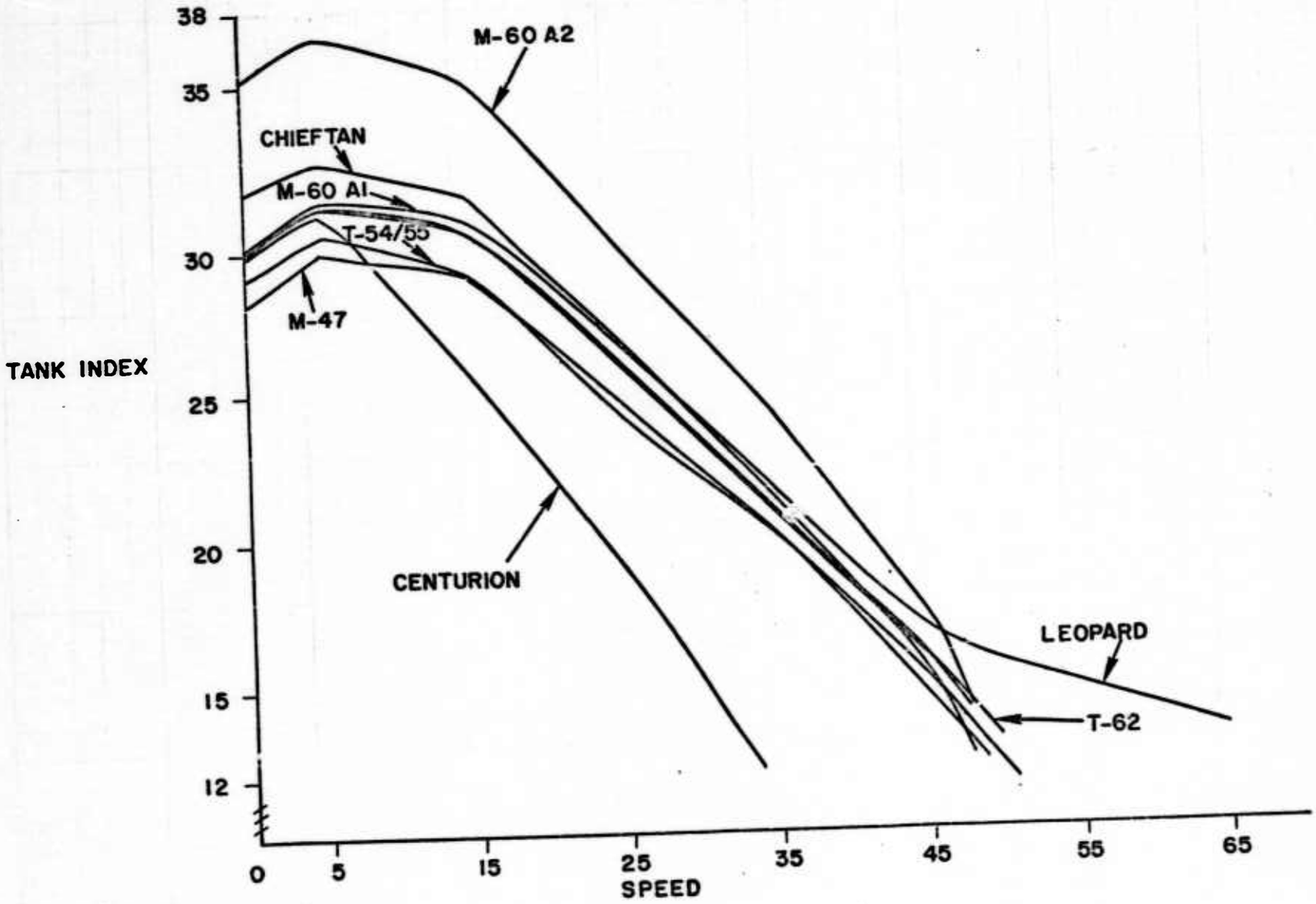

38
35
30
25
20
15
12
TANK INDEX
M-60 A2
CHIEFTAN
M-60 AI
T-54/55
M-47
CENTURION
LEOPARD
T-62
0
5
15
25
35
45
55
65
SPEED

Figure 2.

ordnance valued in tons per day. The inventory indicator would simply list the aircraft type involved and leave it to the analyst to make some intuitive judgment about bomb loads, maximum range, and number of operational aircraft. Through the use of our model, however, the analyst can be given the amount of ordnance that can be expected to be delivered up to any given range for each 24 hour period. This can be done by storing the relevant characteristics in the computer and having the model combine these characteristics into the analyst's desired format.

For example, let us consider two types of air attack aircraft (named T-1 and T-2) with the following characteristics:

Characteristic	T-1	T-2
1. Number of AC	30	20
2. Percent Operational	70	60
3. Bomb Load (lbs.)	7000	7000
4. Load Time (hours)	2	1.5
5. Unload Time (hours)	2	1.5
6. Range (miles)	200	400
7. Speed (mph)	150	300

By incorporating these characteristics into the following formula, we can determine the minimum amount of deliverable ordnance for a single 24 hour period.

$$X = \left[\#AC(r)\right]\left[\frac{24}{L + U + 2\left(\frac{d}{s}\right)}\right]\left[B\right]$$

AC on mission | # missions/ day/AC | Bomb load/ AC

Where:

AC=number of aircraft
r=percent operational on any given day
L=Load time
U=Unload time
d=Distance to target
s=Speed of aircraft
B=Bomb load
X=Bomb load

The formula contains three expressions within the brackets, each a multiplicative function. The first expression represents the number of aircraft available for the mission which is obtained by multiplying the number of aircraft available by the average daily operational percentage. In terms of aircraft type T-1 this would mean that on the average 70% of all aircraft would be operational. In fact, this figure will fluctuate daily but on the average over an extended period of time would represent the true amount of operationally ready aircraft.

The second expression calculates the number of trips per day that can be expected by the aircraft given the distance to target, the turnaround time (adding the loading and unloading time), and the maximum speed of the aircraft. These figures when added give the amount of time needed for one mission and is divided into 24 hours to give the number of missions per day.

The third expression is the bomb load per aircraft. Thus by multiplying the number of operationally ready aircraft by the number of trips expected in a twenty-four hour period by the bomb load the maximum deliverable bomb load per day can be calculated.

This is done below and by varying the range of targets we can determine the maximum deliverable ordnance for both aircraft types at each range. In addition they can be plotted as is done in Figure 3.

TABLE 3

Range of Target	T-1	T-2	T-1 & T-2
50	377.73	328.28	696.01
100	330.96	302.70	633.66
150	294.00	288.00	582.00
200	264.47	274.66	539.13
250	----	263.18	263.18
300	----	252.00	252.00
350	----	241.90	241.90
400	----	232.80	232.80

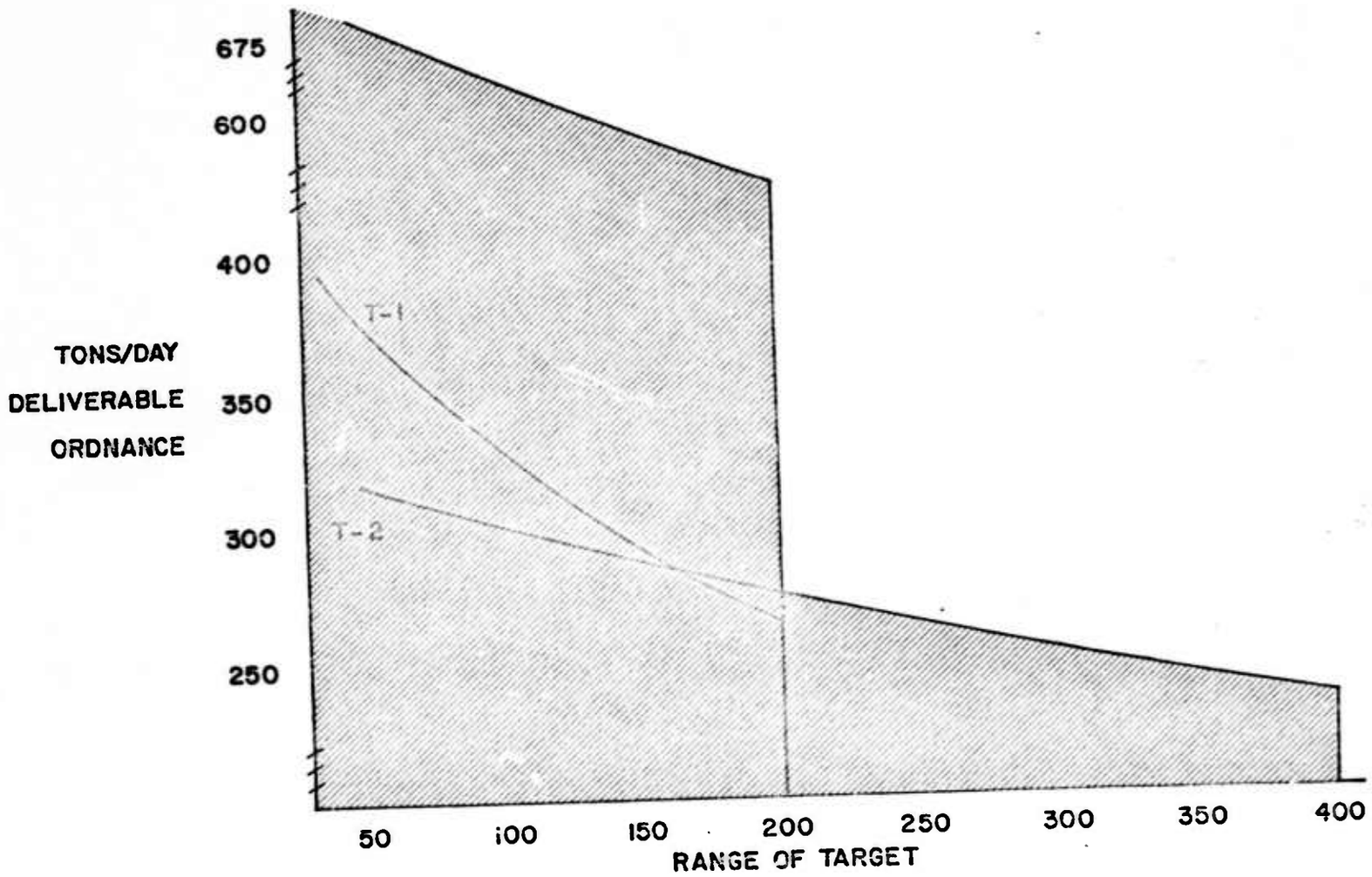


Figure 3. Maximum Deliverable Ordnance for T-1 and T-2.

By using a terminal and plotter these values can easily be called up and be displayed in graphic form. Also for any specific range the maximum deliverable ordnance values could be plotted over time to show the development of capabilities at that range.

This type of indicator is much better for the analyst because it combines the factors relevant to air attack in a meaningful way. An analyst watching a potential military confrontation can quickly assess the implications of the introduction of a new fighter-bomber in terms of both payload and range. Areas formerly out of range of an enemies aircraft could possibly become targets of an air attack. By monitoring potential threats of this nature an analyst can more easily perceive the <u>real</u> dangers of new equipment or modifications rather than the <u>apparent</u> dangers implied by less refined inventory indicators.

APPENDIX A

TABLE 1

MILITARY INVENTORY INDICATORS

MANPOWER

Numbers of Personnel:

- Total
- Regular
- Reserve
- by Service (Army, Navy, etc.)
- by Specialty (Infantry, Armor, Support, etc.)
- by Region of Deployment
- by Combat Organization (Division, etc.)

WEAPONS

Numbers of Weapons:

- by type (aircraft, ships, ground)
- by sub-type (fighters, destroyers, tanks)
- at given points in time up to present
- needing replacement
- in planned future deliveries
- produced by year by type and sub-type

Percentage of Weapons:

- type deployed by geographic region
- changes in inventory over time

Ratios of Weapons:

- deployed in one area to those deployed in another
- by type of one country to another

TABLE 2

TRAITS AND PERFORMANCE CHARACTERISTICS
OF WEAPONS SYSTEMS

General Characteristics of both Platform (aircraft, ships, tanks, etc.) and Projectiles (missiles, warheads)

- Size (length, width, beam of ship, milimeters)
- Weight (tons, pounds)
- Mean weight of given number of platforms or projectiles
- Range (in units of distance)
- Mean range of given number of platforms or projectiles
- Speed (in miles of kilometers per hour, feet per second, etc.)
- Mean speed of a given number of platforms or projectiles

Traits and Performance Characteristics of Platforms

- Age
- Number of weapons or weapons systems per platform
- Crew complement (number personnel carried or needed to operate)
- Engine horsepower
- Agility (of tank or other ground vehicle) – measured by each of the following elements: ground pressure, ground clearance, depth of trench crossing (in meters), horsepower/weight ratio, degree gradient
- Ship displacement tons
- Mean ship displacement tons
- Aircraft carrier launch cycle
- Ship refitting or maintenance period
- Gun rate of fire
- Aircraft combat radius
- Aircraft rate of climb
- Aircraft runway length required
- Aircraft turnaround time

TABLE 2 (con't.)

- Aircraft turnaround time
- Aircraft maximum number of missions flown
- Aircraft flying hours per time period
- Aircraft flight effectiveness ratio = $\frac{\text{hours flown}}{\text{hours scheduled}}$
- Aircraft loiter time
- Aircraft effectiveness at SAM suppression = $\frac{\text{\# fire units destroyed}}{\text{\# attacking aircraft}}$

Traits and Performance Characteristics of Projectiles

- Accuracy (circular error probable)
- Armor penetration capability
- Damage radius
- Yield per missile or total yield
  - in megatons
  - in equivalent megatons (EMT = ^{3} Yield in megatons^{2})
- Mean yield for given number of warheads

TABLE 3

RESOURCES APPLIED TO MILITARY CAPABILITIES

MANPOWER

- Duration of conscripted service
- Number men of military age
- Regular armed forces personnel as percent of population
- Regular armed forces as percent of men of military age

MONEY EXPENDITURES

- Annual level of defense spending
- Defense expenditure per capita
- Defense expenditure as percent of GNP
- Operating costs for equipment
- Ratio of equipment investment cost to operation cost
- Amount and percentage money spent on personnel, equipment, operations and maintenance
- Level of Research and Development spending
- Percentage change in expenditures on various types of forces
- Amounts of basic military pay
- Index (base = 100) of military pay increases and decreases
- Percent military expenditures represented by outside grants in aid

ECONOMIC CAPACITY

- Growth rate of military sector of economy
- Output of defense-related industries
- Numbers employed in defense-related industries
- Amount of surplus of GNP disposable for military sector

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NON-EVENT INDICATORS

I. INTRODUCTION

Quantitative political indicators may be conveniently divided into behavioral indicators and non-behavioral indicators. Behavioral indicators refer to overtly manifested actions carried out within the boundaries of a state which are formulated in wuch a way that they summarize the characteristics of the state's action. Such actions are commonly referred to as political events. The political indicators based on these actions are called event indicators. Non-behavioral indicators refer to attributes inherently characteristic of nation, such as its size, political system, geography etc. They are often referred to as attribute, or non-event indicators. Both groups of indicators have been widely used as measures to explain interstate relations.

CACI has focused considerable attention on the construction of and application of event indicators to various problems. The present paper is an attempt to develop a set of non-event indicators.

The criteria for construction were open-ended--bounded only by the requirement that the resulting indicators be useful both for theory building and as tools for the intelligence analyst.

Tha hope was to come up with a set of variables highly correlated with internal or external systemic or sub-systemic changes which would be useful in monitoring the magnitude and direction of changes as internal or external situations develop. Ideally the non-event indicators would serce well as complements to event indicators. The combined potential of the two sets of indicators would yield better predictions and estimates of potentially disruptive change. Having said this it is necessary to emphasize that the resulting indicators are intended to be crude working static-model analogs and are not intended to approach the explanatory power of interactive models in general. Hopefully the indices computed using the indicators will yield benchmarks for model construction.

The studies of Professor R. J. Rummel and his collegues provided us a useful index for selecting indicators satisfying these criteria. As it turns out the bounds on the criteria are not mutually exclusive about contain considerable overlap.

The domains of concern include a subset of Rummel's list (see R. J. Rummel, the Dimension of Nations, Sage Pub. 1972 pages 87-93). They include communications, agriculture, economic stability, resource base, technological pressures, science and technology, social and domestic conflict, foreign conflict, trade, military and political stability.

Th practical philosophy guiding indicator construction has been to combine th the variables in a way in which important relationships may be reflected. The indicators were designed so that taken individually or in selected clusters they reveal information on potential societal changes.

II. NON EVENT INDICATORS

COMMUNICATIONS INDICATOR

The objective of the communications indicator was to develop an indicator sensitive to improvements in or deterioration in information dissemination ability. The variables available in the literature included books, titles, literate population, circulation, number of telephones, number of radios, and number of TV's. The indicators which appear most meaningful and useful are:

(1) $$\left[\frac{\#\text{ Books published} + \#\text{ Titles published}}{\text{literate population}}\right]$$

(2) $$\frac{\sqrt{\text{news cir} \times \#\text{ papers} \times \text{press freedom factor}}}{\sqrt{\text{literate population}}}$$

(3) $$\left[\frac{.49\,(\#\text{ TV's} + \#\text{ radios}) + (.51\ \#\text{ phones})}{\text{population}}\right]$$

Indicator (1) is a gross measure of potential intellectual awareness or sophistication. The number of books published represents a response to literate demands. The number of titles yields the variety in publication and renders the index higher for nations with fewer controls on type of publications.

Indicator (2) is a measure of the potential for general awareness acquired through newspapers. It is larger for nations with fewer press controls.

Indicator (3) is a gross index of potential for rapid dissemination of information. The units are items of information potentially transmittable.

The average amount is obviously assumed equal across the three media. There is some empirical support to substantiate this assumption.[1] Sheatsley and Feldman found that five hours after President Kennedy's assasination 99.8% of U.S. citizens were aware of it. About 47% were apprised through radio and TV, another 49% by phone. The index reflects these empirical findings. Figures 1, 2 and 3 are examples of index values computed for several selected countries.

AGRICULTURE INDICATOR

The objective of an agriculture indicator was to reflect a nations capacity to sustain its food supply. Livestock and grain production appeared to be the best candidates but were not measured along comparable units. The index below was chosen as the next best possibility.

(1) $$\left[\frac{\text{(agriculture production)}}{\text{arable land}}\right]$$

The index is a measure of average yield for potentially cultivatable land. (See figure IV for examples of value ranges)

(2) (% GDP in agriculture)

Indicator (2) is simply a measure of the % economic production generated from agriculture production.

ECONOMIC INDICATOR

The economic indicators are intended to index the capacity of a nation's economy to satisfy: (1) demands for goods and services, (2) surplus product for capital investment and for specialization, (3) economic stability, (4) growth, (5) degree of specialization, and (6) overall productive potential.

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[1] See Sheatsley and Feldman, Public Opinion and Politics, pp. 323, 1970 Holt, Rhinhart and Winston.

(1) $\left[\left(\%\ \blacktriangle\ GNP_{/Pop}\right) + (\%\ \Delta\ \text{Nat'l Income})\right] \Big/ \%\ \blacktriangle\ pop$

(2) (% GDP Originating In Industry)

(3) GDC/GNP

Indicator (1) is an index of an economy's tendency to keep up with population growth and is consequently one measure of overall economic health. Indicators (2) and (3) are measures of industrial potential for satisfying demands for goods and services.

ECONOMIC STABILITY

(1) (GOLD RESERVES + BALANCE OF PAYMENTS)

(2) (% ▲ GNP + % ▲ TRADE DEFICIT)

(3) UNIT LABOR COST

Certain economic parameters are associated with stability, soundness, and degree of specilization. A careful monitoring of them may yield lead information on anticipated political and social change. The indicators selected include: (1) Gold reserves + balance of payments, which is a gross index of liquidity potential, (2) the geometric mean of steel production and oil production, an index of sustained industrial capacity and (3) the unit labor cost an index of labor productivity. The interpretation of these indicators is straight forward and has been used repeatedly and successfully by others. (See figures XI and XII are a sample of value ranges.)

RESOURCE BASE

With rapid depletion of critical natural resources, an index of consumption patterns is useful in determining how international patterns of interdependence may develop as well as in determining where important economic and social or political changes resulting from adaptation may take

place. The indicators used here are gross indexes of critical resources necessary for sustained productive capability. They are: (1) per capita energy production: an index of rate of change in energy resources as population changes, (2) the geometric mean of oil, coal and iron reserves which include resources that are critical to sustaining industrial output.

$$(2) \qquad \sqrt{\text{oil x coal x iron (reserves)}}$$

The geometric mean is a measure of the average quantity of reserves in thousands of metric tons, and (3) Hydro-electric power potential plus nuclear power potential. Hydro-electric power is a critical energy source for developing as well as undeveloped nations. Nuclear power potential is an index of new energy potential and is not used here as an index of destructive capability. Since both sources are measured in mega-watts of power they are additive. Figure V and VI are sample values computed for four selected nations.

TECHNOLOGICAL PRESSURES

Certain ill-defined pressures which contribute to national and international instability eminate from tensions produced by increasing demands on finite supplies of resources. The measure below is an indirect attempt to measure such pressure (See figure VII for sample of values):

$$\left[\frac{\blacktriangle \text{ energy consumption/capita}}{\blacktriangle \text{ pop.}} \right]$$

The effect of increased population on finite energy sources is the creation of a consumption squeeze. The rates of population change to consumption change appear to index this squeeze. Other indicators which have proved successful in indexing such pressures are (2) cost of living index (3) exchange rate (4) stock exchange index (5) re-discount rate (6) available food supply (7) unemployed/economic active pop. (8) housing starts (9) # of economic strikes and work stoppages.

HEALTH AND EDUCATION

National health and investment in educa n are important reflections of a nation's ability to sustain itself spritually and intellectully. The indicators which index this potential are:

$$(1) \quad \sqrt{\left[\frac{\text{pupils}^2}{\$ \text{ education} \times \text{teachers}}\right]}$$

$$(2) \quad \sqrt{\left(\frac{\text{proteins consumed}}{\text{proteins required}}\right) \times \frac{\text{Physicians}}{100 \text{ Population}}}$$

A measure of pupils per critical educational resource and a measure of available physicans for healthy populations--using proteins consur ed as an index of health. Figure IX and X illustrate a selected range of values.

SCIENCE AND TECHNOLOGY

A simple index of investments in research and development is (1) the fraction of national expenditures allocated to research and develop plus GNP reinvestment rates; (2) electric and nuclear energy production per capita is also a gross index since large allocations of R and D funds are required to support projects in that area.

SOCIAL AND DOMESTIC CONFLICT

Though the dynamics of social conflict are too complex to index <u>well</u> with a single indicator, several are useful as gross indexes of the potential for domestic conflict. The total number of incidents of domestic violence has been used successfully by several scholars; (2) a political polarization index--the percentage difference in opposing opinions on critical national issues--is a potentially useful index; (3) an index of salient issues reflecting national hopes, fears and desires is also a useful index; (4) an index measureing public opinion sentiments on critical issues is also a

very important measure of the frustration-satisfaction of a people. Other indicators of an internal nature will be added to this list at a later date.

FOREIGN CONFLICT

The propensity toward foreign conflict may best be indexed by a composite measure of military spending increases divided by a national tendency toward conflictive interactions. The national security index is an index which measures such a propensity. The % of negative interactions a nation emits and receives is also useful index when used alone.

TRADE

An index of trade focus is the trade concentration index computed using:

$$(1) \qquad \text{Focus} = \sum_i T_i^2 \Big/ \left(\sum_i T_i \right) 2$$

where i ranges over all trading-partners and T_i is a measure of total exports and imports to trading partner i. (2) The trade relations index is an equally useful measure. It is the relative percentage different between imports and exports of dyadic pairs of nations.

MILITARY

A single gross index of military preparedness is:

$$\left[\frac{\text{military \$}}{\sqrt{\text{GNP}}} \right] \qquad \left[\frac{\text{\# active military personnel}}{\sqrt{\text{population}}} \right]$$

It is the average expediture on active forces as a percent of population. (See figure XIII for sample of value range)

POLITICAL STABILITY

A more general index of internal stability may be that indicated by one expressing the degree of severity of governmental sanctions measured against domestic violence. An index of a regimes ability to carry out coercive compliance is given by:

$$\left[\frac{\#\text{ internal security forces}}{\#\text{ external security forces}}\right]\left[\#\text{ Acts of domestic violence}\right]$$

II. SUMMARY

The indicators in the list discussed above and shown in table form on the next page are intended to be summary in form and are intended to be useful as benchmarks for detecting changes within a nation which may suggest external changes. For the most part the indicators are new combinations of tried and tested variables which have proven themselves useful for the intended purpose.

The indicators will remain preliminary until successful validation studies have been completed. The graphs following the table of indicators are examples of indicator value ranges. They are displayed to give the reader an idea of what they look like as numerical quantities.

TABLE 1

A Preliminary List of Non-Event Indicators

Domains	Objective of Indicator	Indicator and Measures	Interpretation
Communications	Changes in communication technology suggest improvements in or derterioration in information dissemination and sophisticeation. Also indicates potential for political indoctrination and use of mass com media for proaganda and or military purposes.	(1) $\left[\frac{\text{Books + Titles}}{\text{Literate Population}}\right]$ (2) $\sqrt{\text{cir. x \# papers x Press Freedom/ literate pop.}}$ (3) $\frac{\text{\# TV's + \#radios + \# phones}}{\text{pop.}}$	(1) # Books published indicates demands from literate pop. Titles indicate variety or richness in publication (and indirect measures of press freedom). When divided by the literate pop. one gets an indicator of the free intellectual demand of a country a measure of its general intellectual level. (2) TV's, radios and phones are media of rapid information dissemination. Added together one gets the total of such dissmination potential.
Agriculture	Reflect changes in agricultural production which might effect capacity to sustain food supply.	(1) (agri.-prod.) / arable land. (2) % GDP in Agriculture.	(1) Argriculture production is reflected in both grain and livestock produced. Arable land is required for the production of both. (2) Amount of GDP generated from agriculture.
Economic Performance	The capacity of a nation's economy to satisfy (1) demands of the Pop. for goods and services, surplus product for capital investment to create further specialized capabilities	(1) (% Δ in per capita GHP + % Δ in per capita nat'l. income) / (% Δ in pop.) (2) % of GDP origination in industry. (3) GDC formation as a % of GNP	(1) Shows how well economy keeps up with pop. growth. (2) Degree of industrilization. (3) Amt. of GHP generated from within country.
Economic	Reflect nation's economic (1) stability, soundness, (2) growth, (3) degree of specialization (4) reinvestment rate, (5) overall productivity.	(1) Gold reserves + balance of payments. (2) % Δ in nat'l. income/% Δ in pop. (3) GNP growth rate + rate of increase in trade balance (5) Unit labor cost.	(1) Measure of Liquidity (2) Shows how well income keeps up with increase in pop. (3) Total % growth/year. (4) Average production in heavy industry. (5) Self explanatory.
Resource Base	Reflect resource consumption patterns and/or production patterns that may effect economy and national well-being.	(1) Per capita energy production. (million tons of coal equivalents) (2) (oil reserves x coal reserves x iron & manganese reserves) $^{1}/_{3}$ (3) Hydor-electric power potential + nuclear power potential (in mea-watts).	(1) Energy base (2) Average reserves of critical resources. (3) Non-petroleum based energy production potential.

TABLE 1 (Con't)

A Preliminary List of Non-Event Indicators

Domains	Objective of Indicator	Indicator and Measures	Interpretation
Technological	Tensions produced by increasing demands on finite supplies of resources and technological capability.	(1) $\frac{\Delta \text{Energy consumption/capita}}{\Delta \text{ pop.}}$	(1) Effect of increase pop. on energy consumption (the consumption squeeze).
		(2) Cost of living index or consumer price index.	(2) Cost of living index or consummer price index.
		(3) Exchange rate.	(3) Exchange rate.
		(4) Stock exchange rate.	(4) Stock exchange rate.
		(5) Re-discount rate.	(5) Re-discount rate.
		(6) Available food supplies.	(6) Available food supplies.
		(7) Unemployed/econo. active pop.	(7) Unemployed/econo. active pop.
		(8) Housing starts.	(8) Housing starts.
		(9) # of economic strikes and work stoppages.	(9) # of economic strikes and work stoppages, economic effects of resource squeezes.
Science and Technology	Improvements in R & D allocation and sophistication.	(1) R & D expen. /total + reinvestment rates.	(1) Total reinvestment potential.
		(2) elect. + nuclear energy prod. /pop.	(2) Non-resource energy per capita.
Education	Reflect changes in resource allocation to education as well as improvements.	(1) $\sqrt{\left(\frac{\text{Pupil}^2}{(\$\text{ educ.})\ (\text{teachers})}\right)}$	(1) Pupil per education resource.
Health	General indication of national health.	(1) $\sqrt{\left(\frac{\text{Proteins cosumed}}{\text{Proteins required}} \times \frac{\text{Physicians}}{1000 \text{ Pop.}}\right)}$	(1) Unhealthy pop. per physician measured by proteins consumed + death due to premature illness. = total unhealthy pop.
Social and Domestic Conflict	Reflect summary of effects of conflicting internal factors and its impact on the political process.	(1) Killed in domestic violence + upheavals (riots, purges, guerilla attacks, gov. strikes) x # assassination attempts.	(1) Interactive index of total incidences of domestic violence.
		(2) Political polarization index.	(2) An index of concensus on issues of internal opposing groups.
		(3) Issues index.	(3) Index of the # of Salient issues demanding attention whihin nat'l borders.
		(4) (G-B)/C+B+N	(5) Public opinion relations index on issues of nat'l scope
Foreign Conflict	Reflect a state's propensity for violence or involvement in International Conflict	(1) # neg. events/total	(1) % of negative interactions.
		(2) National Security index.	(2) Composite measure of military spending and prepardeness/# negative interactions.

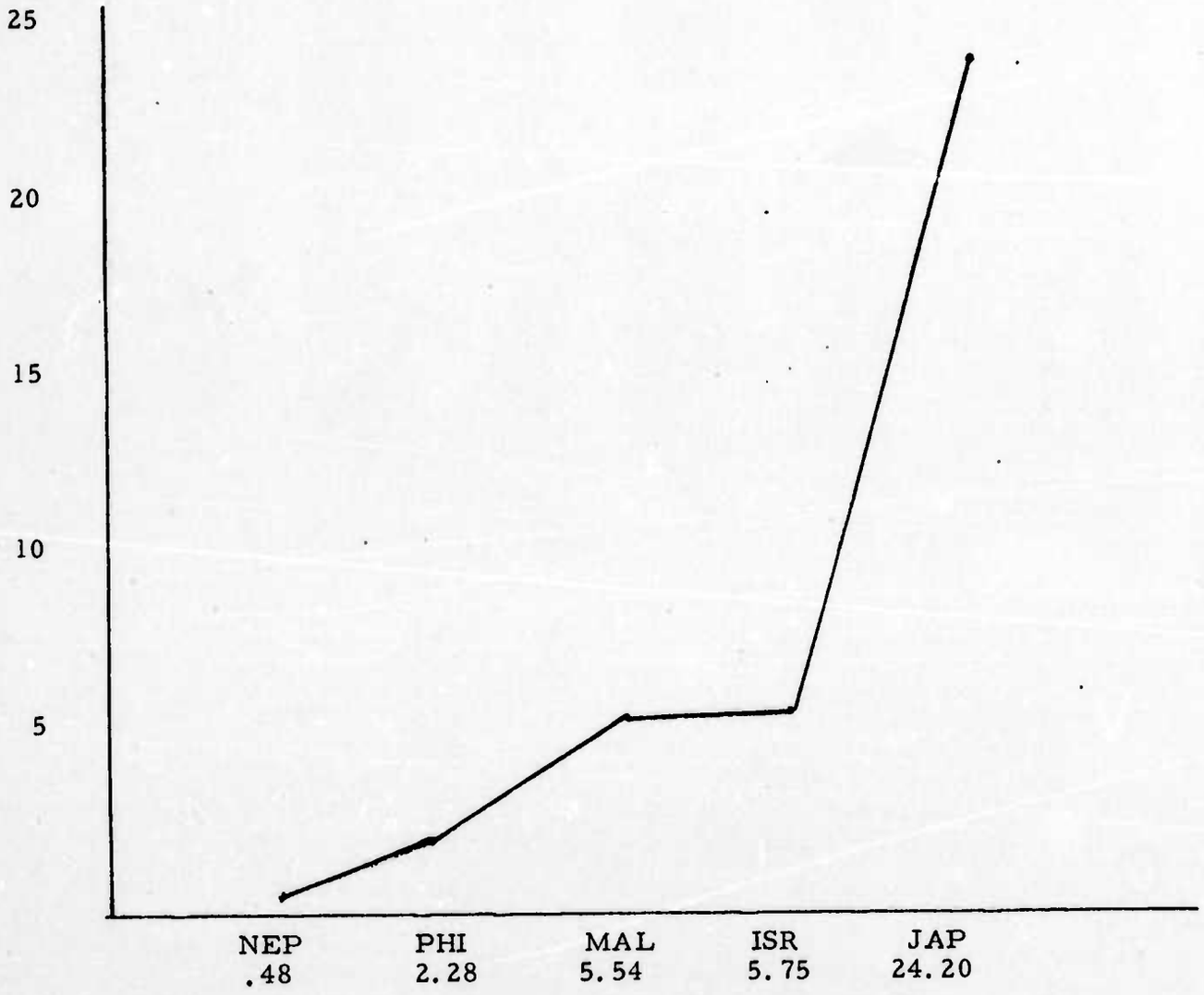
TABLE 1 (Con't)

A Preliminary List of Non-Event Indicators

Domains	Objective of Indicator	Indicator and Measure	Interpretation
Trade	Reflect focus and direction of critical trade relations.	(1) Trade Concentration Measure. (2) Trade relations measure. (3) Import of raw materials/imports (4) Trade/GHP	(1) Measure of trade focus. (2) Measure of status of trade relations. (3) Dependency factor for raw materials (4) Volume of trade index.
Military	General indicator of Prepardness.	(1) (1) $\left(\frac{\text{Mil. \$}}{\sqrt{\text{GNP}}}\right)\left(\frac{\text{\# Active Mil. Personnel}}{\sqrt{\text{pop.}}}\right)$	(1) General Military preparedness index % of funds.
Political Stability	General indicator of ability to deal with political instability and support among people.	* (1) $\left[\frac{\text{\#internal Security forces}}{\text{\#external security forces}}\right]$ $\left[\frac{\text{\# Acts of domestic violence}}{}\right]$	(1) % of security directed internally include military used for domestic purposes, etc.

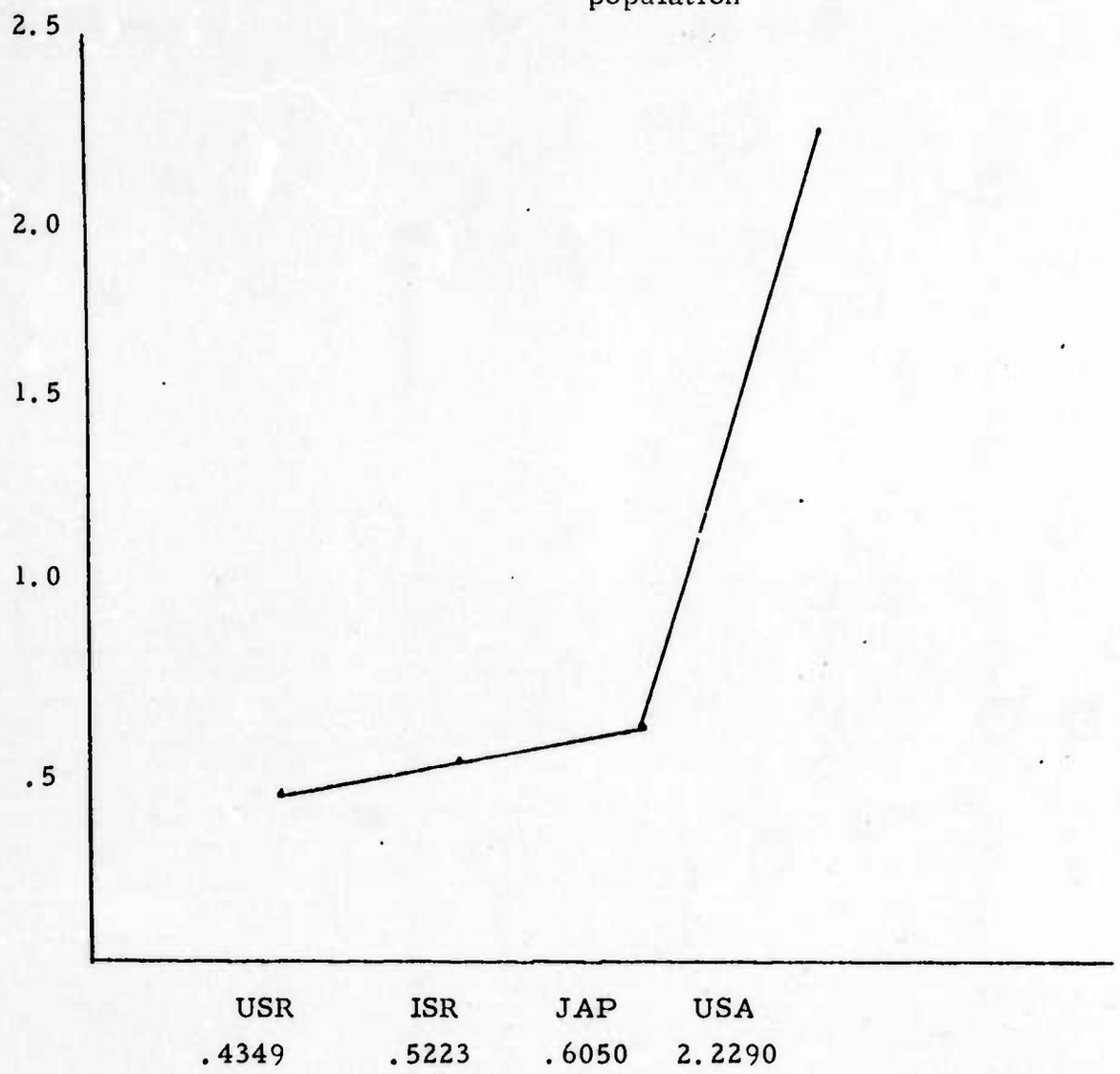
* Indicators yet to be tested.

$$\sqrt{\frac{\#\text{newspapers} \times \text{newspaper circ.} \times \text{press freedom}}{\text{literate population}}}$$



Sources: UN Statistical Yearbook
World Handbook
Cross-Polity Time-Series Data

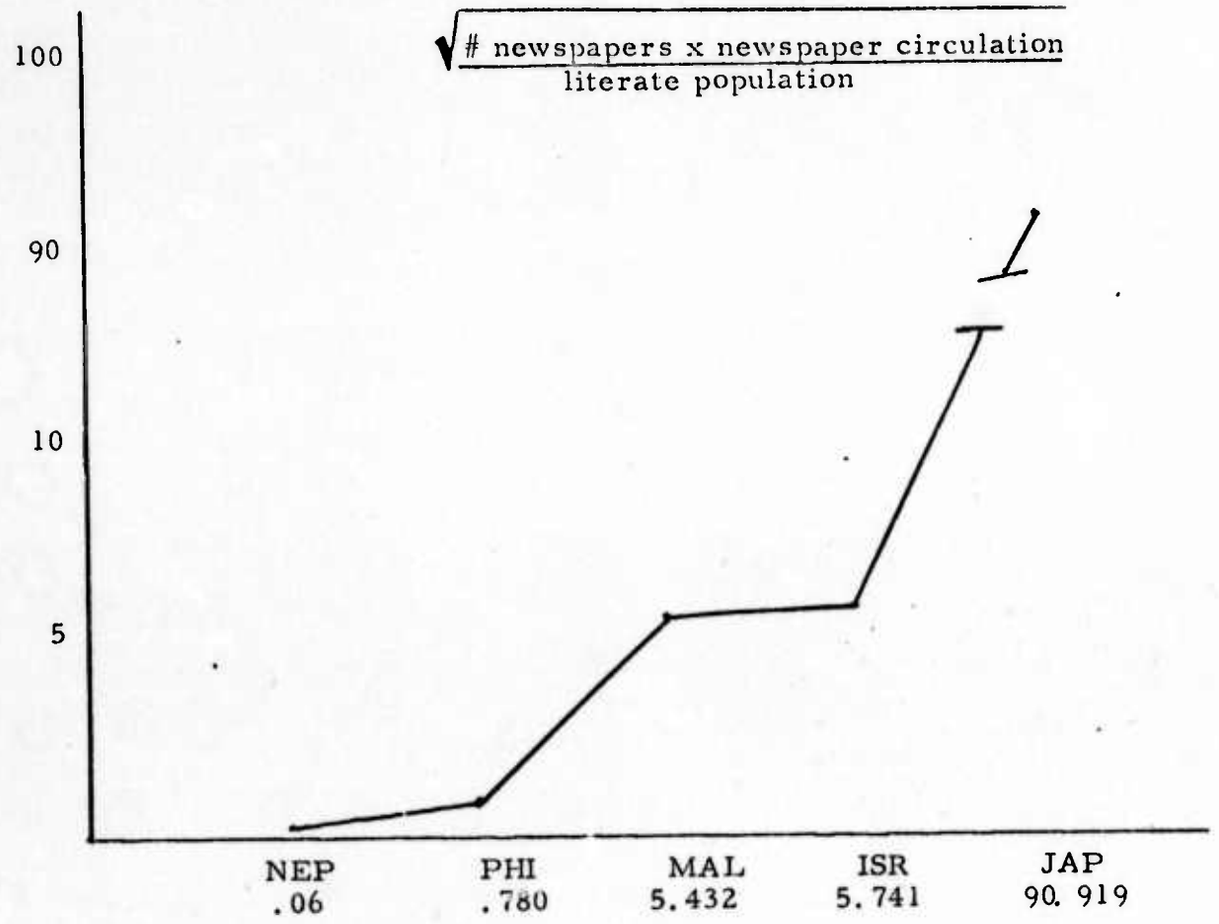
Figure 1



Sources: Cross-Polity Time-Series Data
Un Statistical Yearbook
Handbook of Soviet Social Science Data

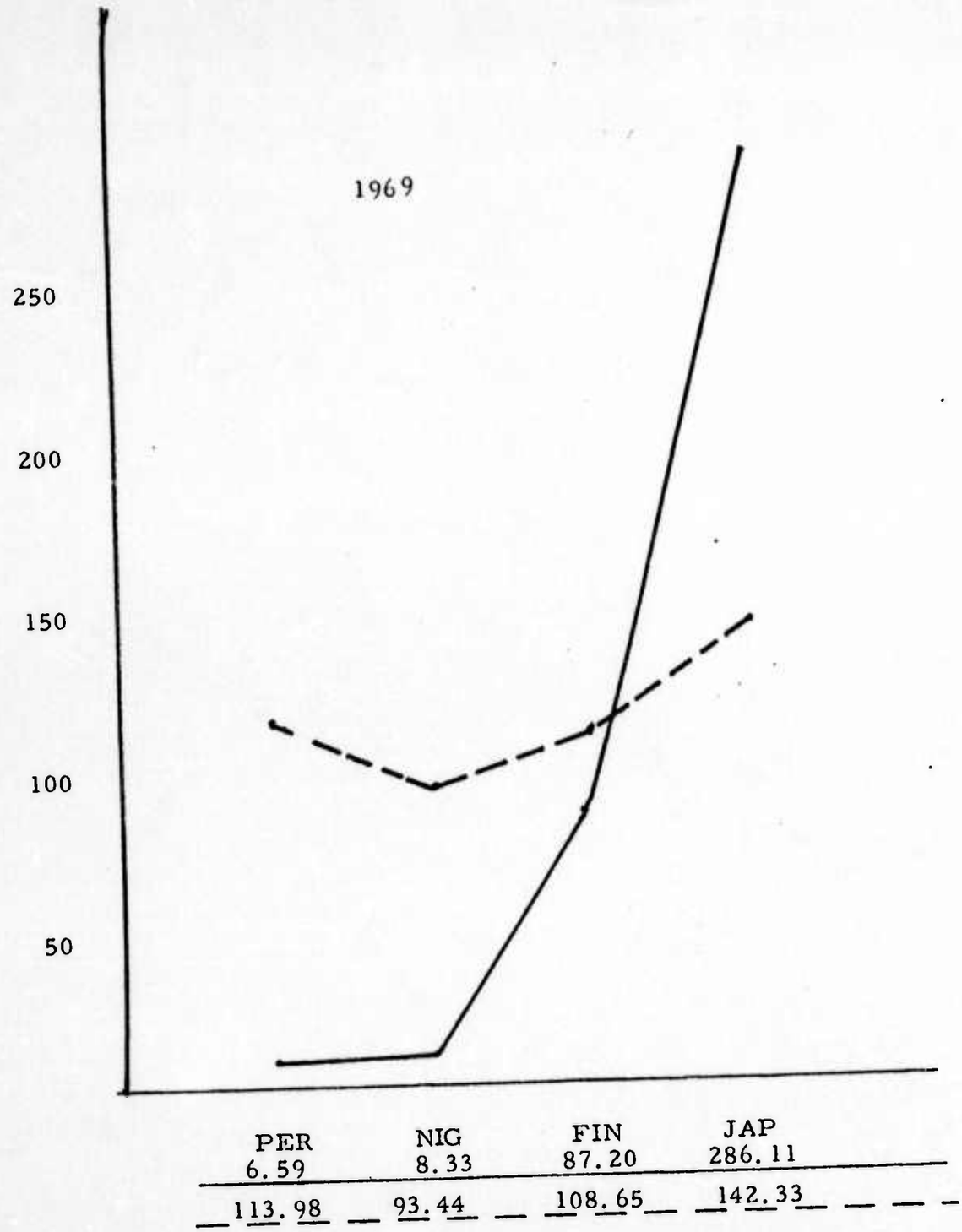
Information Please Almanal
UN Statistical Bulletin for Asia and the Far East

Figure 2



Sources: UN Statistical Yearbook
A. Banks, Cross-Polity Time-Series Data

Figure 3



Grain Production
Agricultural Area

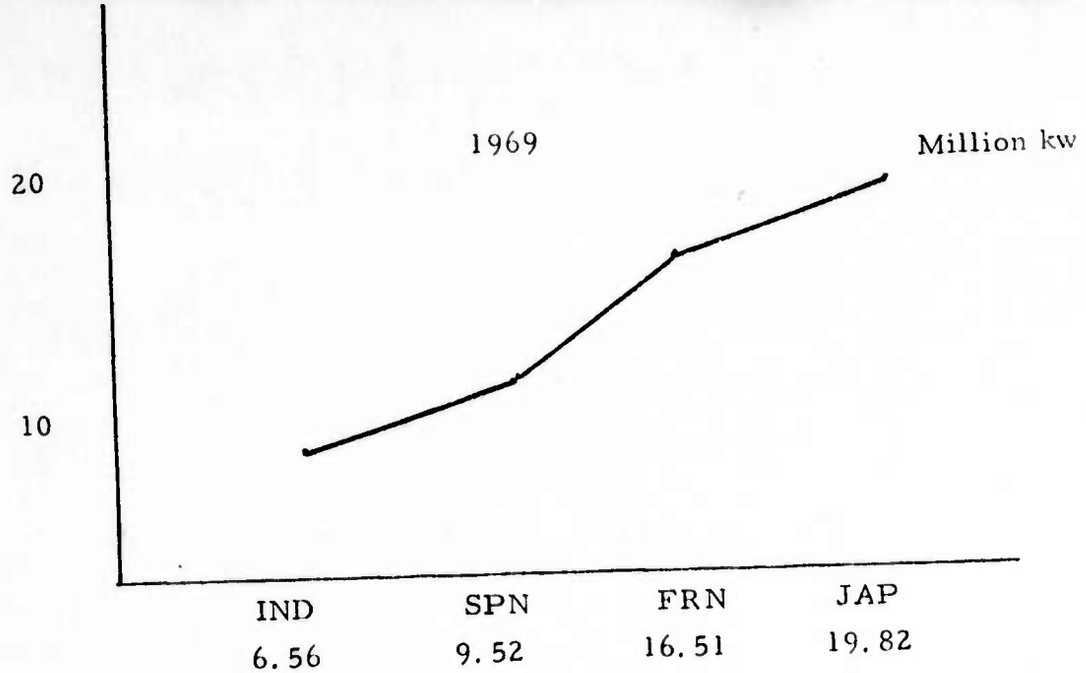
Barley
Corn
Rice
Soybeans
Wheat
Oats

Livestock Production
Agricultural Area

Cattle
Pigs
Sheep

Sources: UN Statistical Year book
A. Banks, Cross-Polity
Time-Series Data

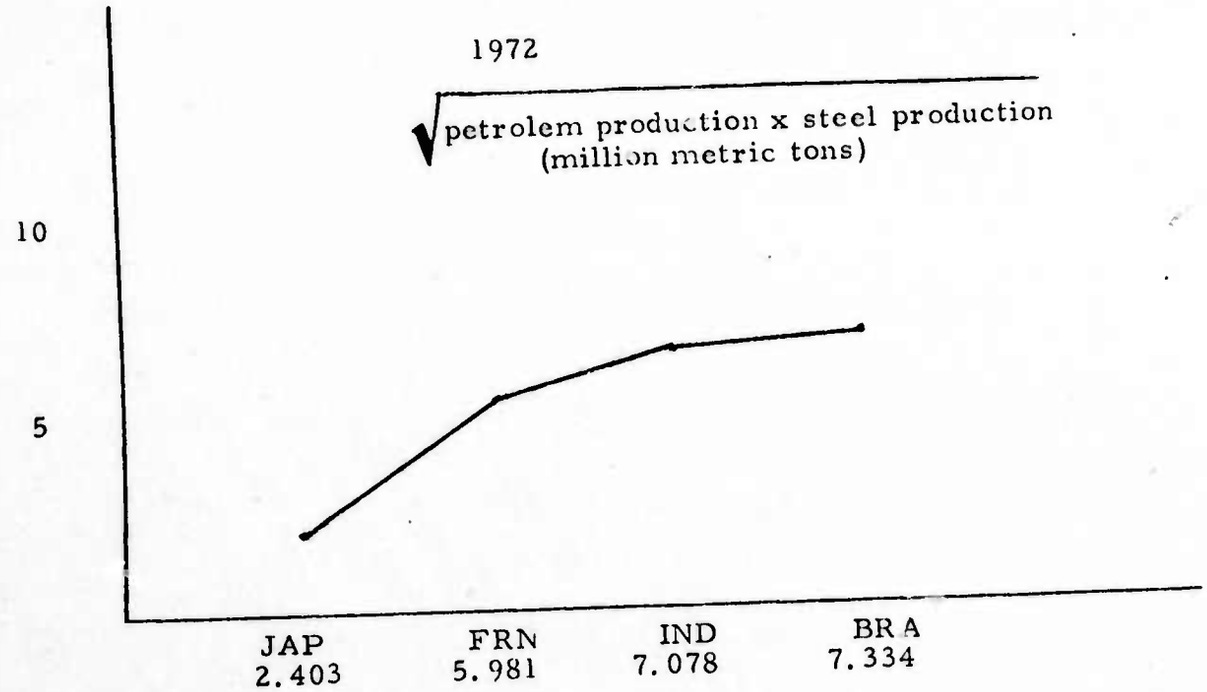
Figure 4



Installed Nuclear Hydro Electric Capacity

Source: UN Statistical Yearbook

Figure 5



Source: UN Monthly Bulletin of Statistics

Figure 6

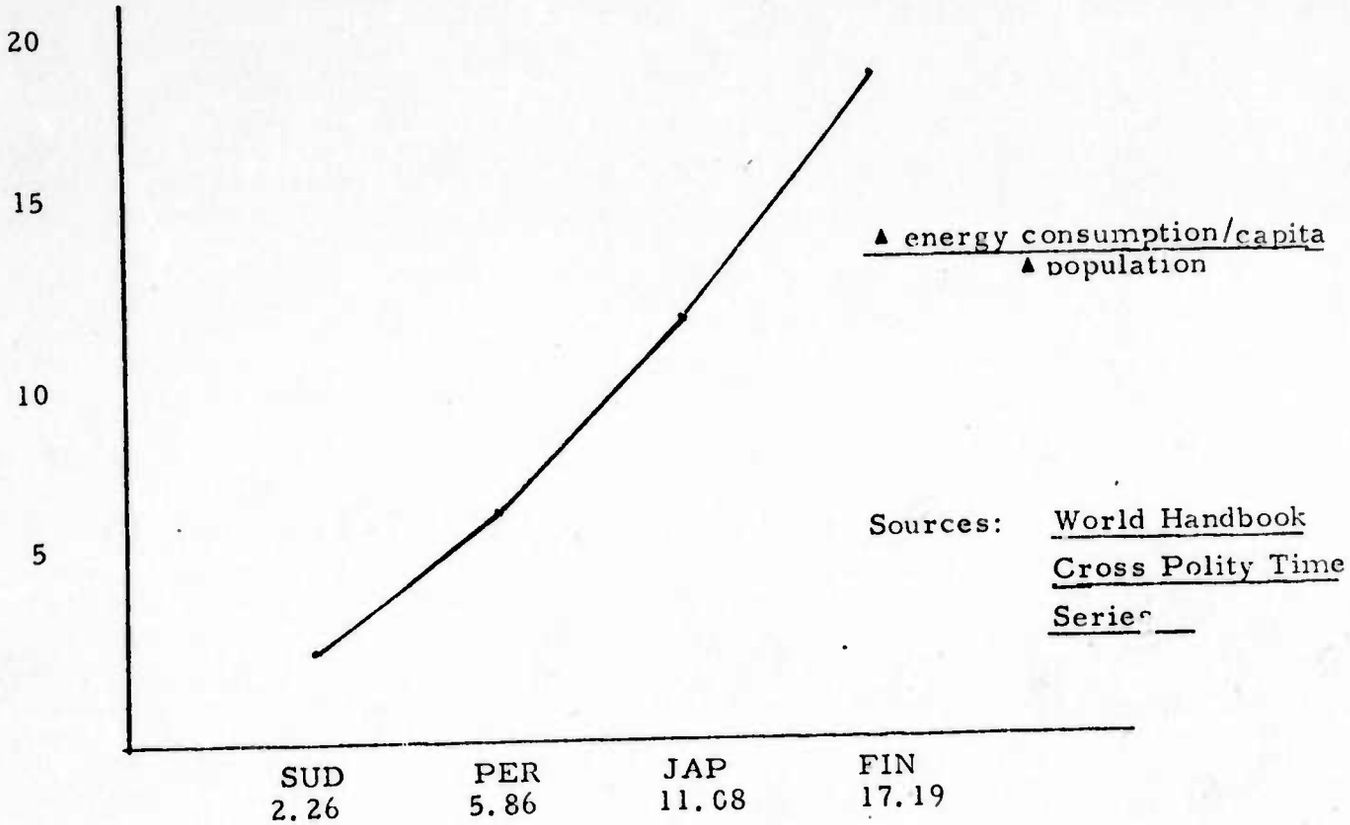


Figure 7

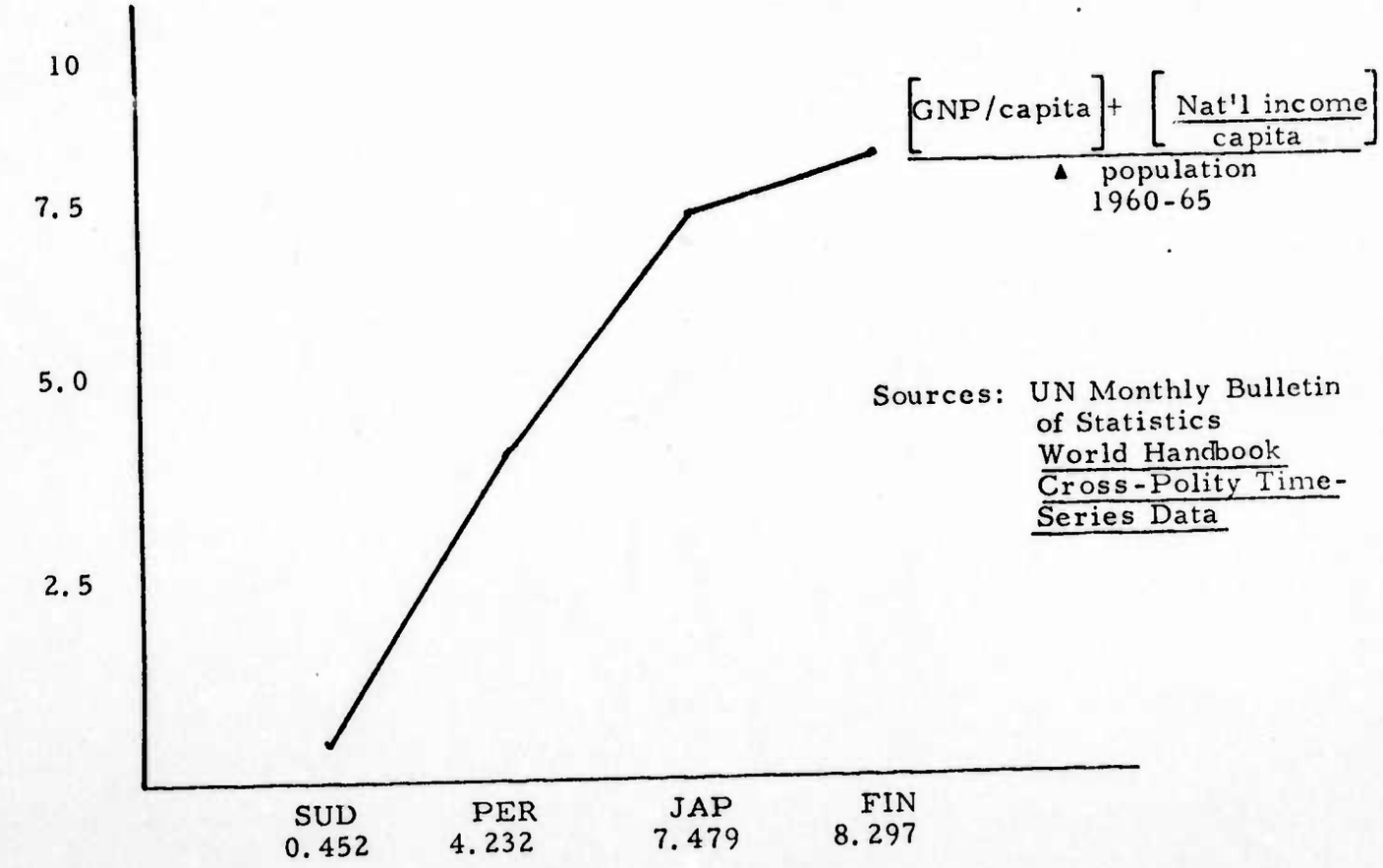
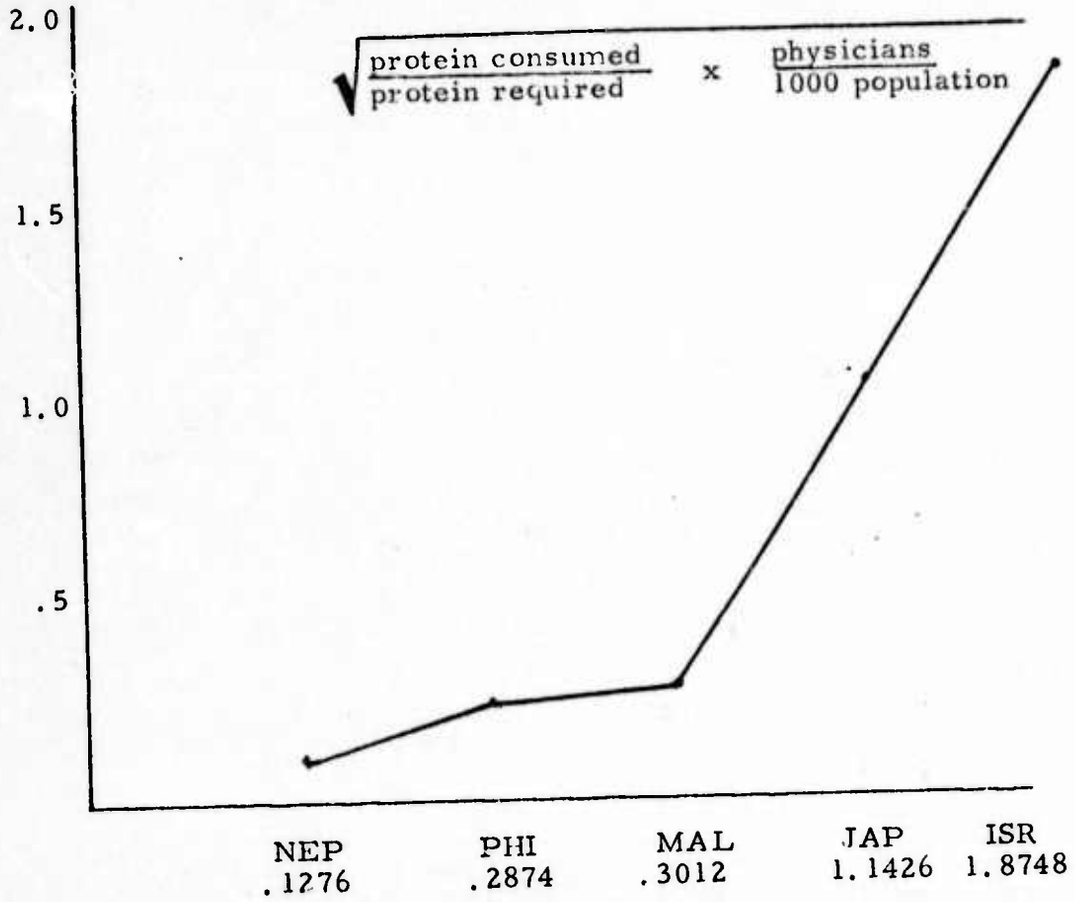
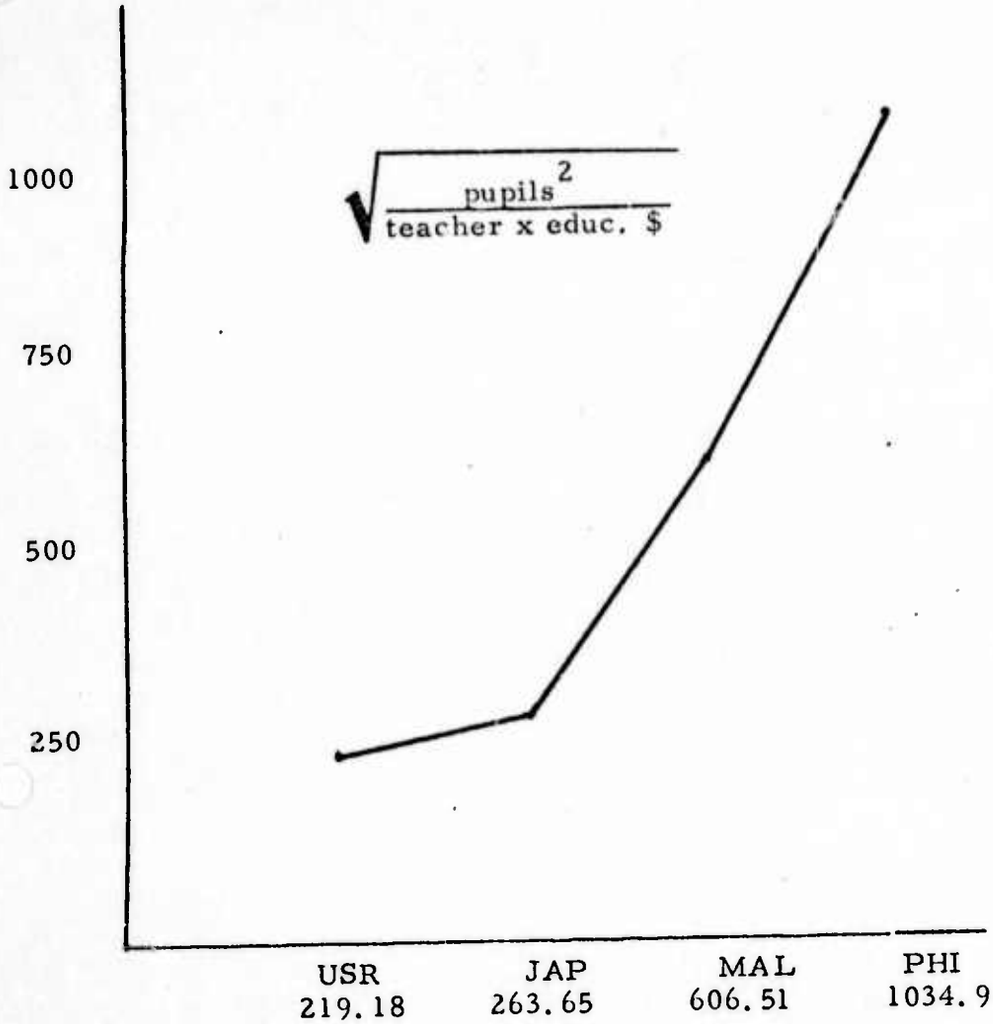


Figure 8



Source: UN Statistical Yearbook

Figure 9

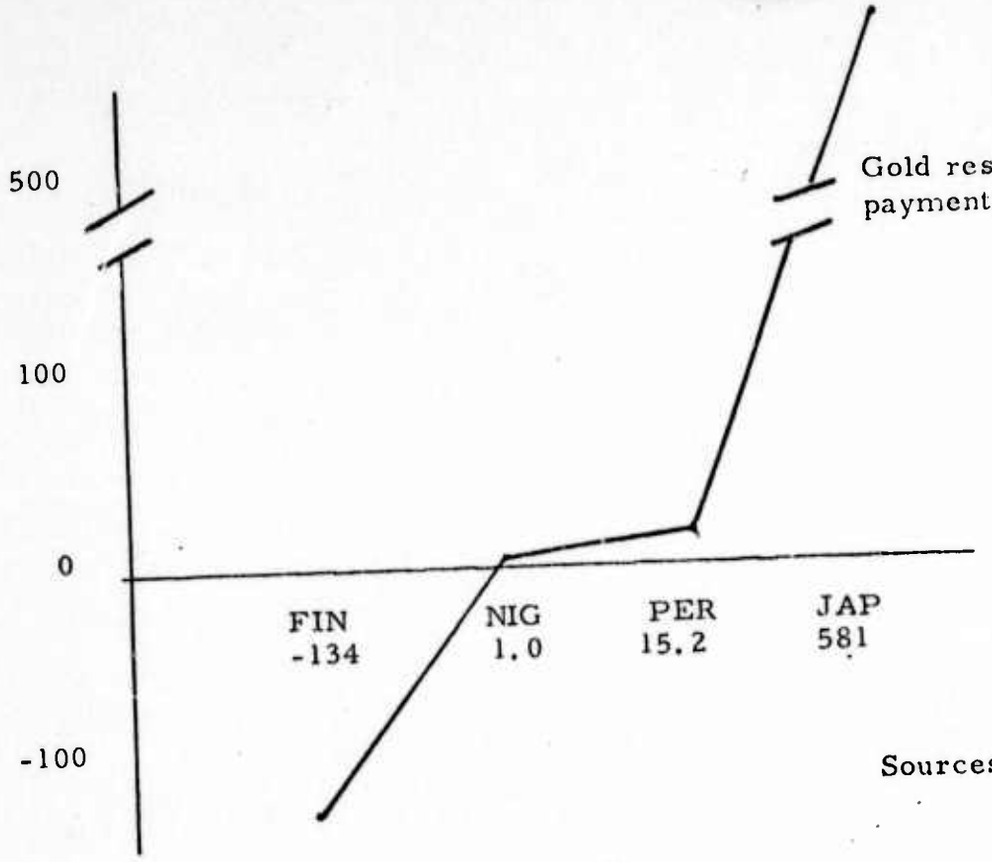


Pupils per education income

1970

Source: UN Statistical Yearbook

Figure 10



Sources: UN Monthly Bulletin of statistics
Cross-Polity Time-Series Data

Figure 11

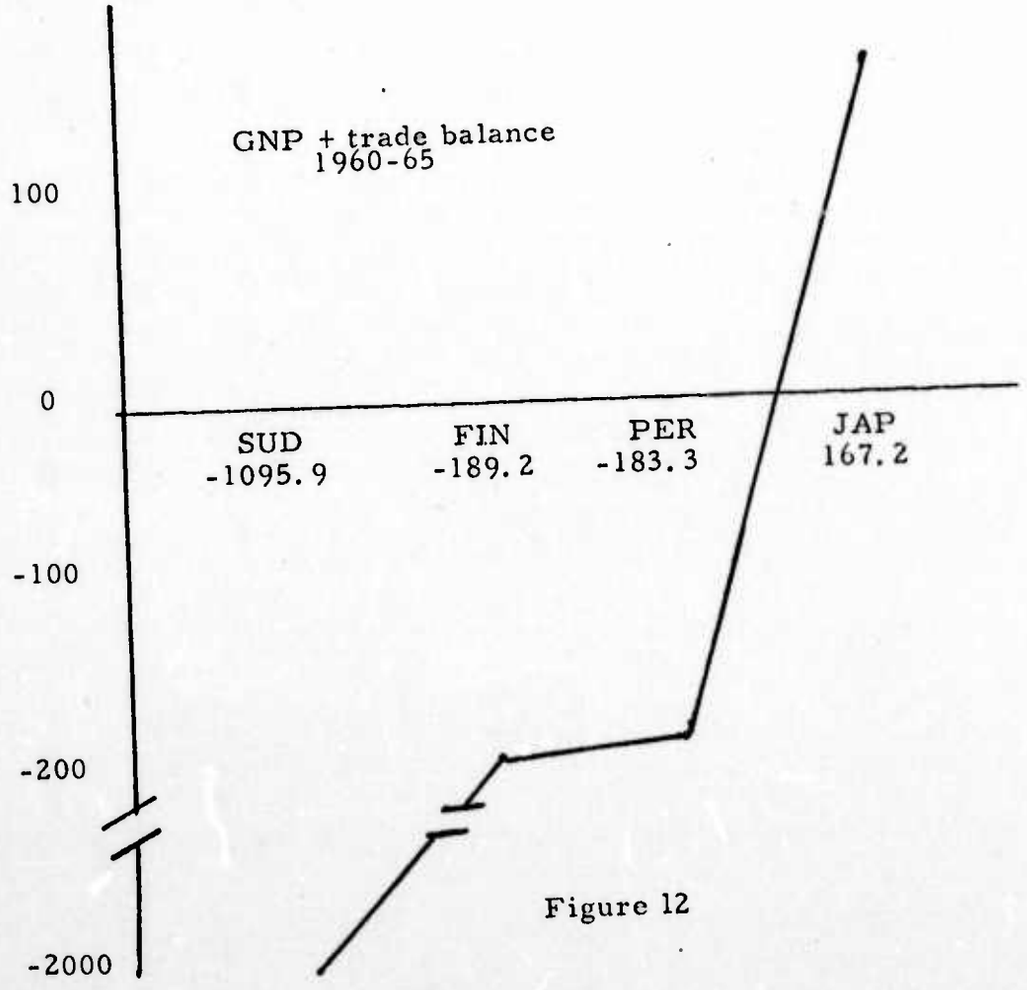
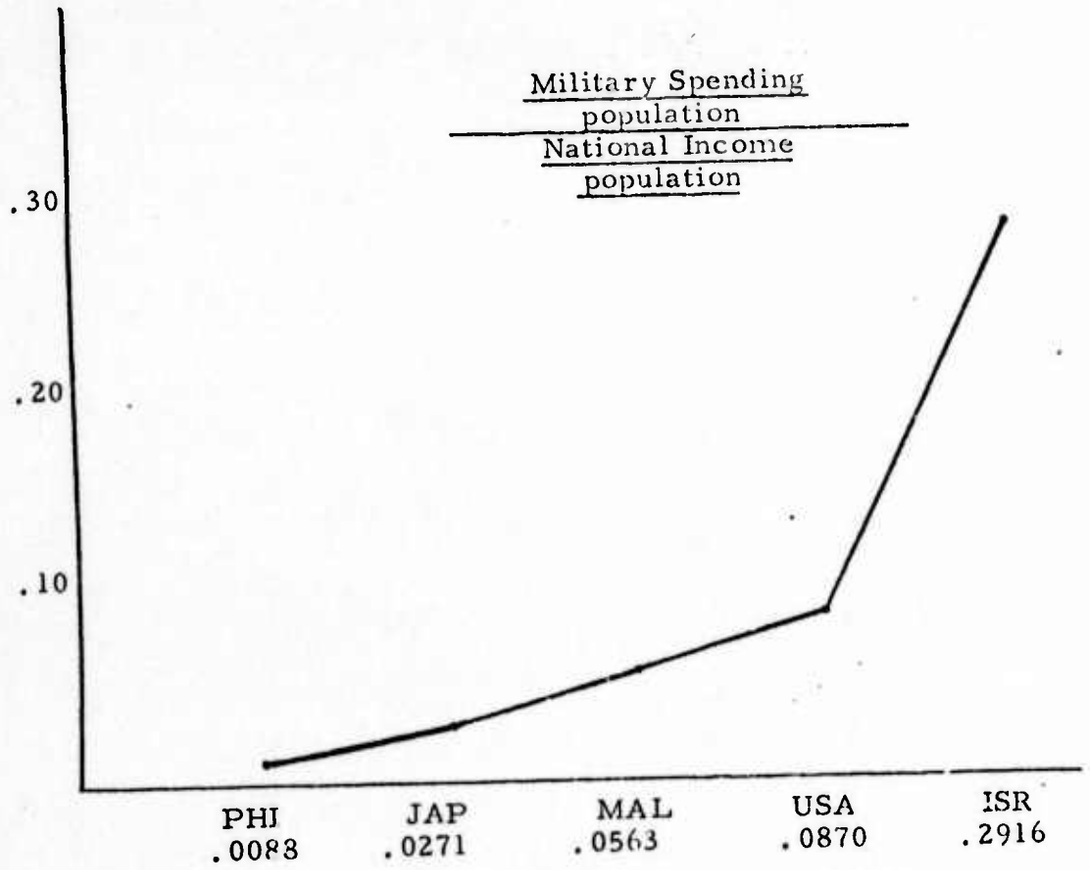


Figure 12



Sources: U.S. Arms control + Disamament Agency
World Military Expenditures
UN Montly Bulletin of Statistics

Figure 13

$$\left(\frac{\text{Mil. \$}}{\sqrt{\text{GNP}}}\right) \cdot \left[\frac{\text{\# Active Mil. Personnel}}{\sqrt{\text{pop.}}}\right]$$

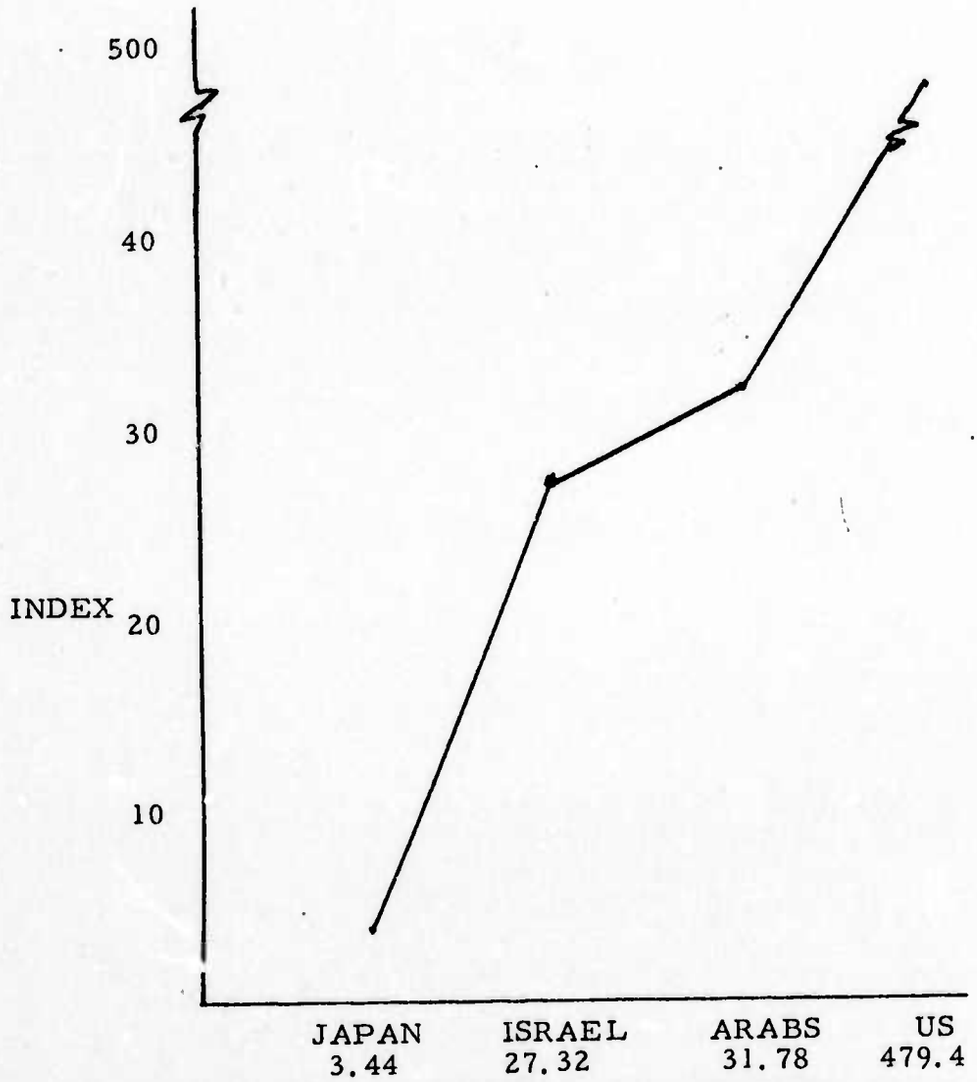
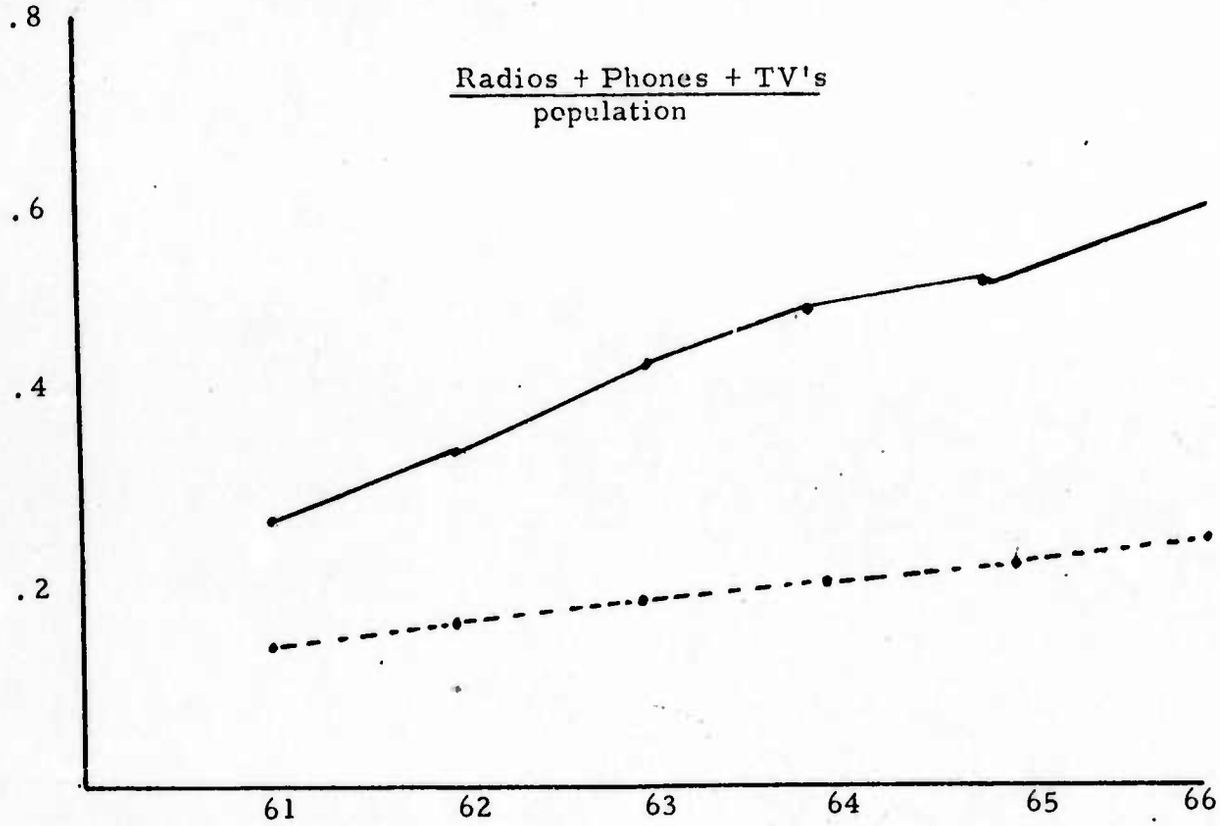
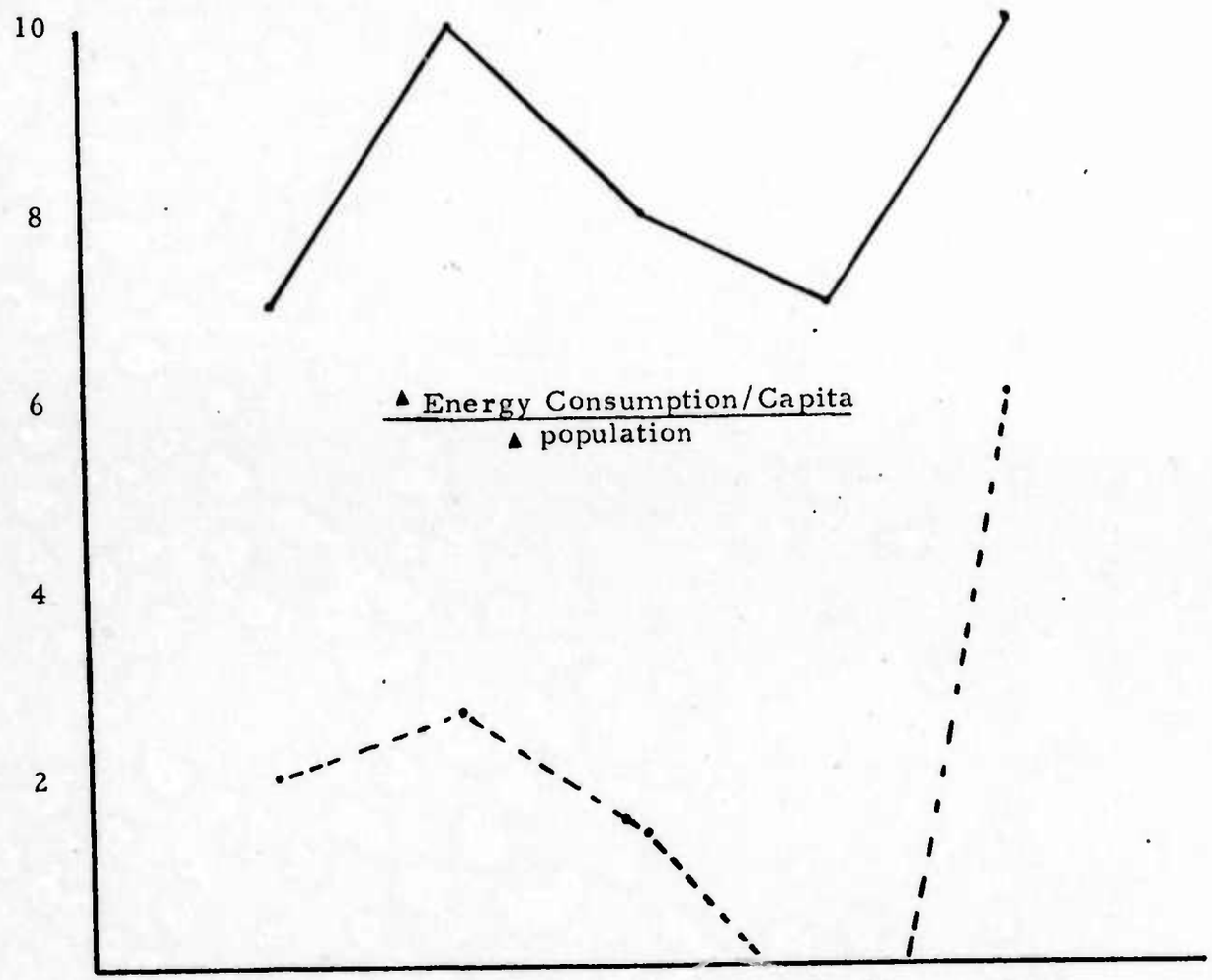


Figure 14



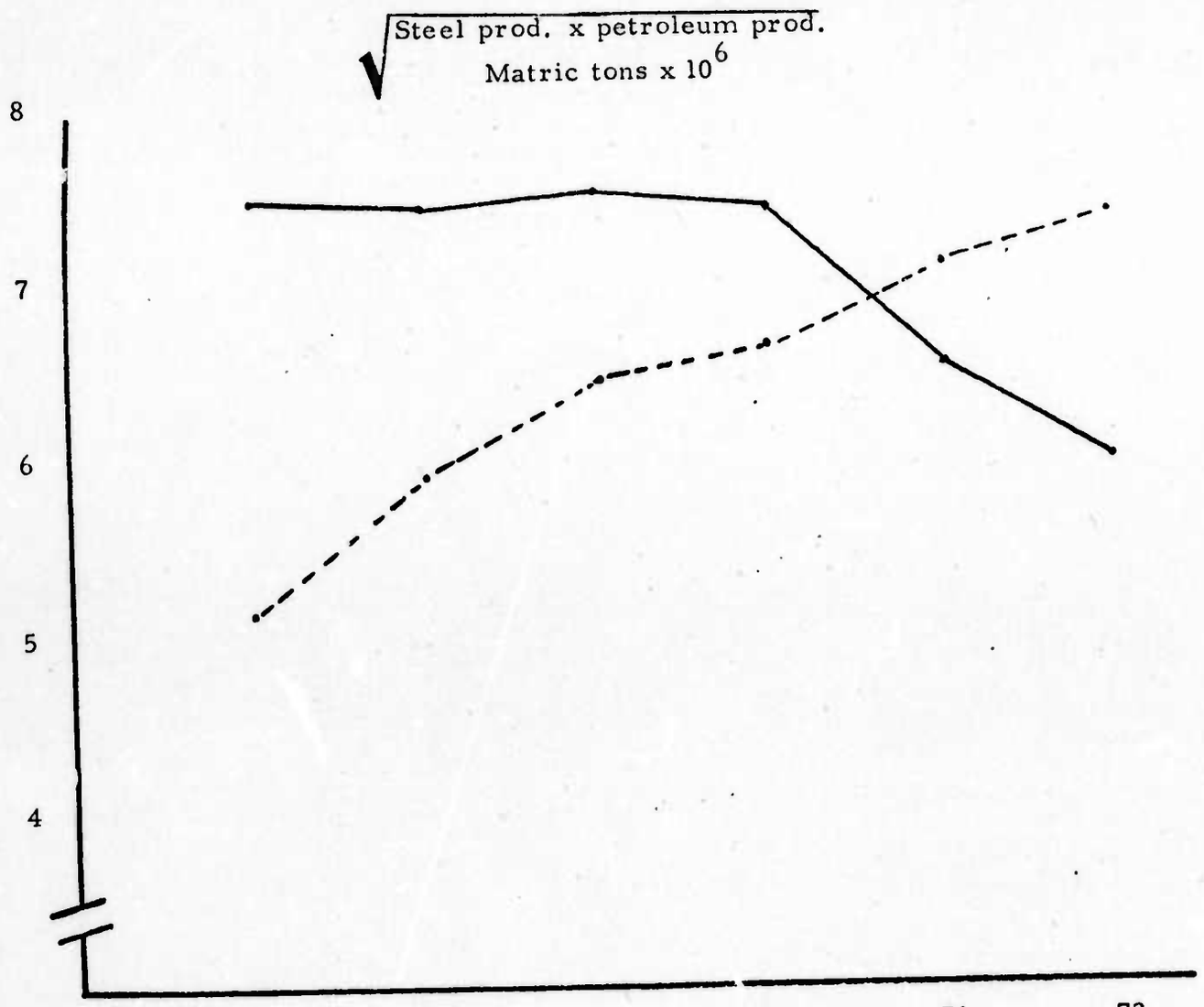
JAP	.272	.350	.441	.502	.535	.605
PER	.142	.165	.186	.205	.227	.250

Figure 15



JAP	7.0	10.0	8.0	7	10
PER	2.0	2.3	1.7	-2.0	6.0

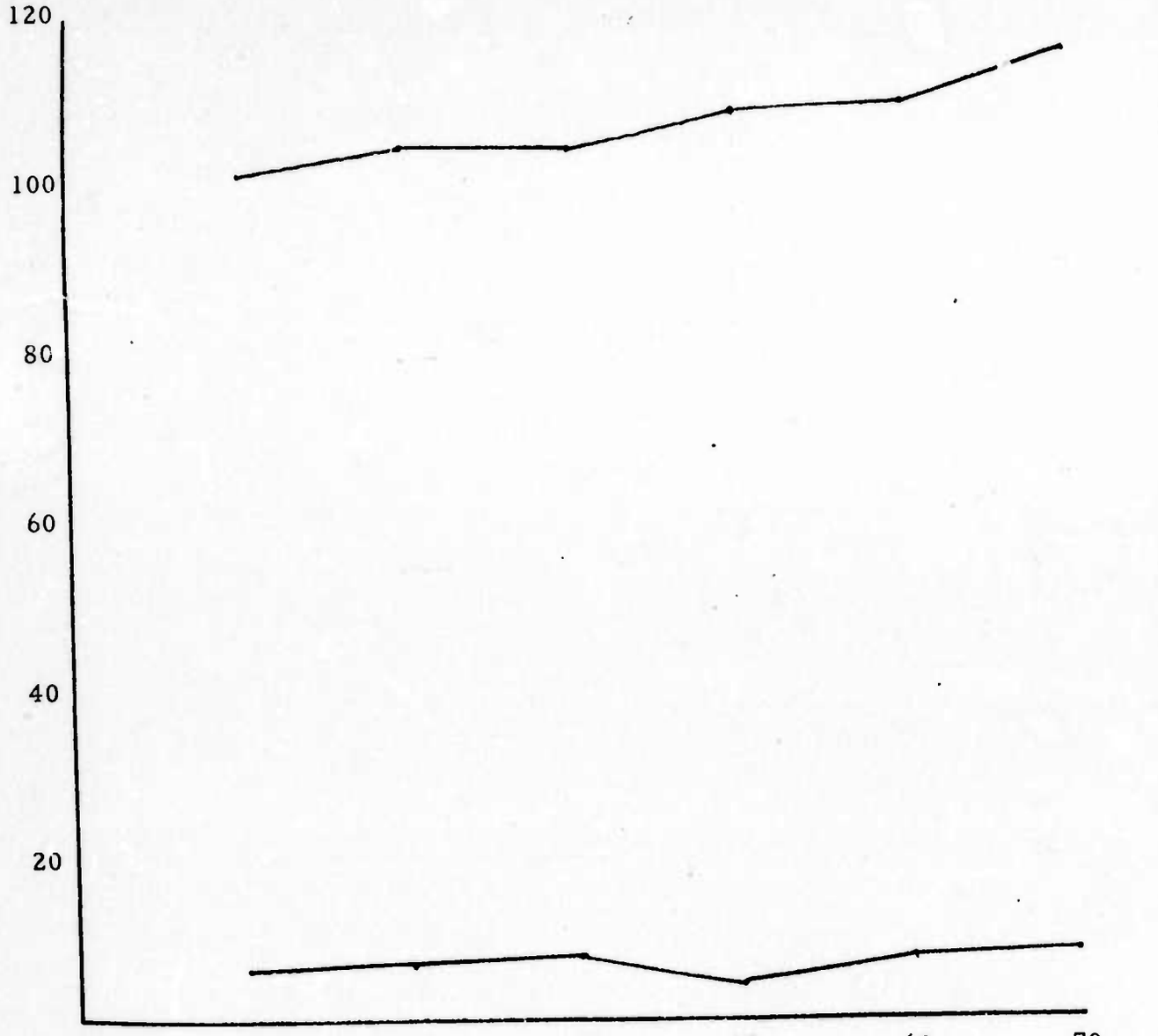
Figure 16



FRN	7.46	7.41	7.50	7.40	6.52	5.98
BRA	5.14	5.90	6.45	6.63	7.10	7.33

Figure 17

PERU



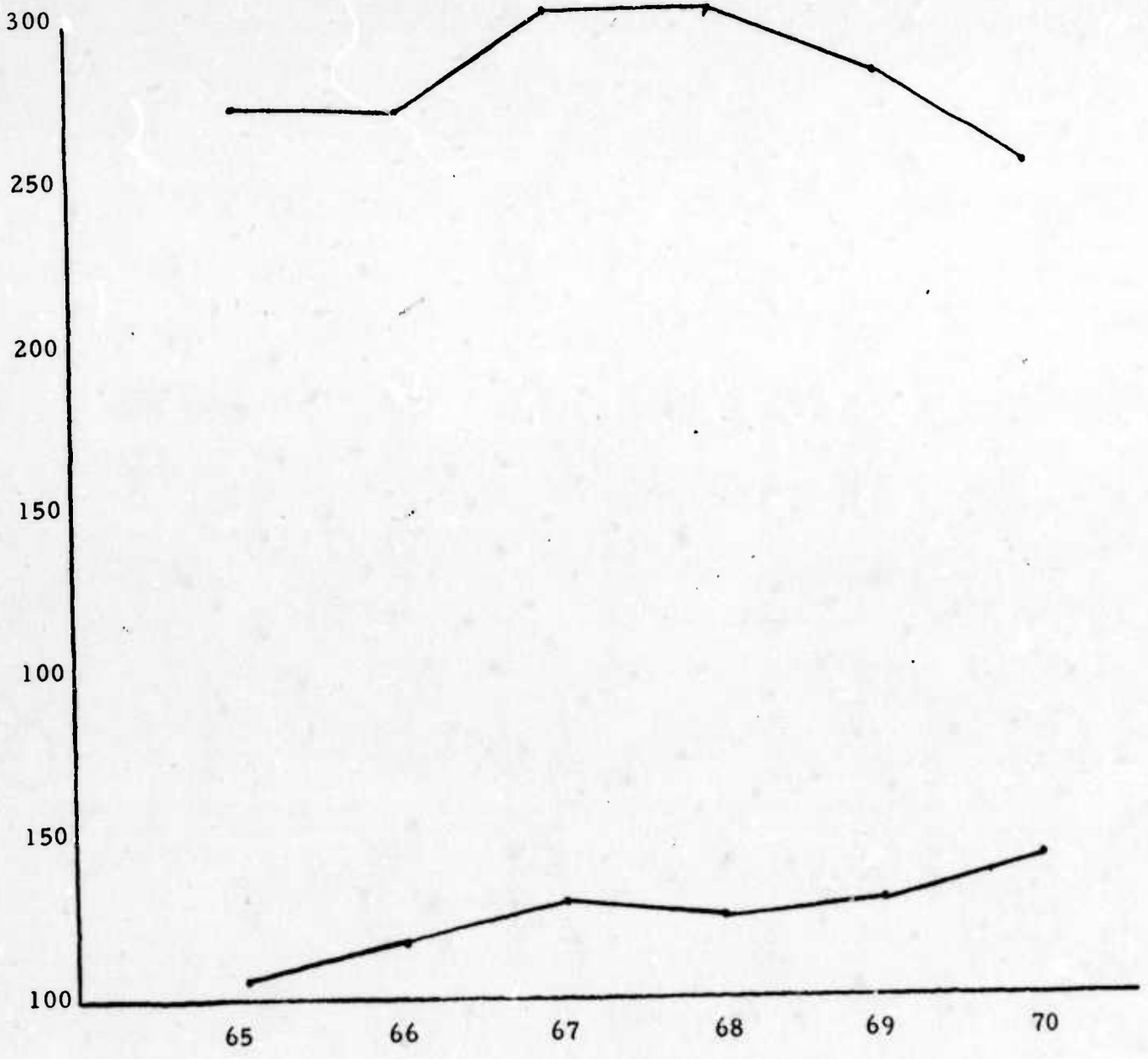
	65	66	67	68	69	70
Grain	5.8	6.2	6.8	5.4	6.6	7.4
Livestock	99.9	103.0	103.0	107.4	108.7	114.0

Grain Production
Agriculture Area

Livestock Production
Agricuture area

Figure 18

JAPAN

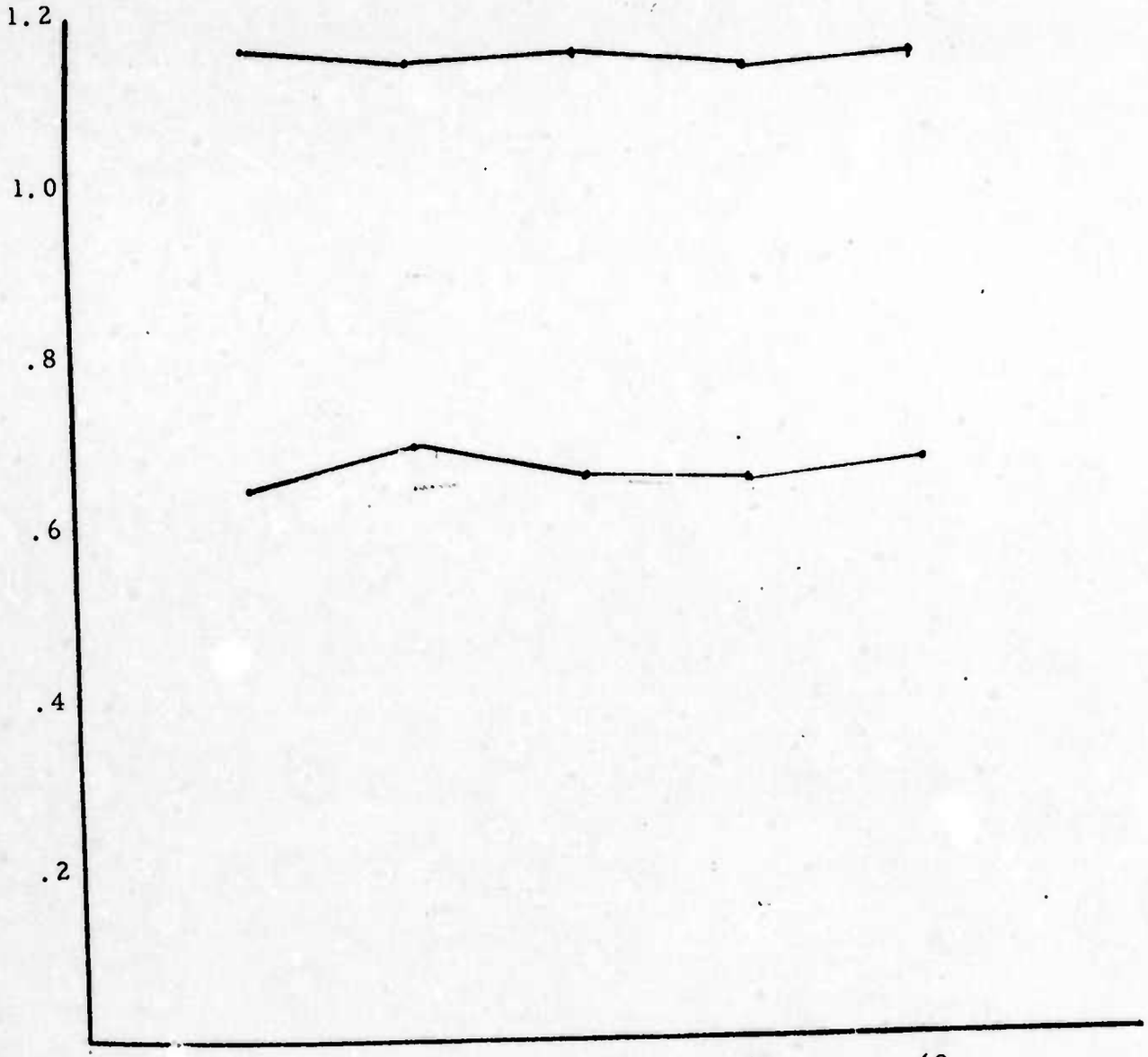


	65	66	67	68	69	70
Grain	273.0	272.4	302.6	302.1	286.1	253.9
Livestock	105.3	117.2	129.0	125.5	128.1	142.3

Grain Production / Agriculture Area

Livestock Production / Agriculture Area

Figure 19



	64	65	66	67	68
JAP	1.159	1.145	1.146	1.135	1.142
PER	.636	.682	.657	.656	.670

$$\sqrt{\frac{\text{Protein Consumed}}{\text{Protein Required}} \times \frac{\text{Physicians}}{\text{1000 population}}}$$

Figure 20

C.A.C.I.

WASHINGTON, D.C. OFFICES

PRELIMINARY INVESTIGATION OF A TECHNIQUE FOR THE SHORT-TERM FORECASTING OF SELECTED INTERNATIONAL INDICATORS

Theodore J. Rubin

INTRODUCTION

Historical analogies are frequently used as the basis for judgmental forecasts. Specifically, if a current situation is perceived to be similar in character to some previous situation, then, other things equal, the probable outcome of the former (the forecast) is assumed likely to be similar to the actual outcome of the latter. The underlying premise in forecasting by historical analogy is that behavioral sequences or patterns exist which are relatively independent of their time and place of occurrence. In this sense history is assumed to be repetitive and, therefore, predictable.

In the experiments described herein, the technique of forecasting by historical analogy is examined empirically to assess its value in the short term forecasting of international political phenomena. The two phenomena subjected to experiment are relations between countries and the policy style of one country toward another. Relations (R) is defined as the friendly to hostile quality of the interaction between two countries over time; policy style (S) is defined as the friendly to hostile quality of the actions of one country toward another over time. Both these phenomena have previously been converted to the form of quantitative indicators based on the use of public source event data. For purposes here it is sufficient to know that both R and S are measured along a scale ranging from +1.0 (most friendly R or S) to -1.0 (most hostile R or S). These measures have been calculated for a worldwide sample of country pairs from data which are continuously available since January 1966. The choice of the relations and policy style indicators for experimentation was based on three factors:

1. Confidence that these measures are reasonable quantitative approximations of the phenomena they are intended to represent.
2. Adequate time series history, i.e., sufficient data to

both detect historical patterns of interest and to observe subsequent outcomes.

3. Availability of large samples of cases (country pairs).

If the forecasting technique is shown to be promising under the above conditions, then there is no reason why it cannot be viewed as potentially applicable to a wider range of phenomena.

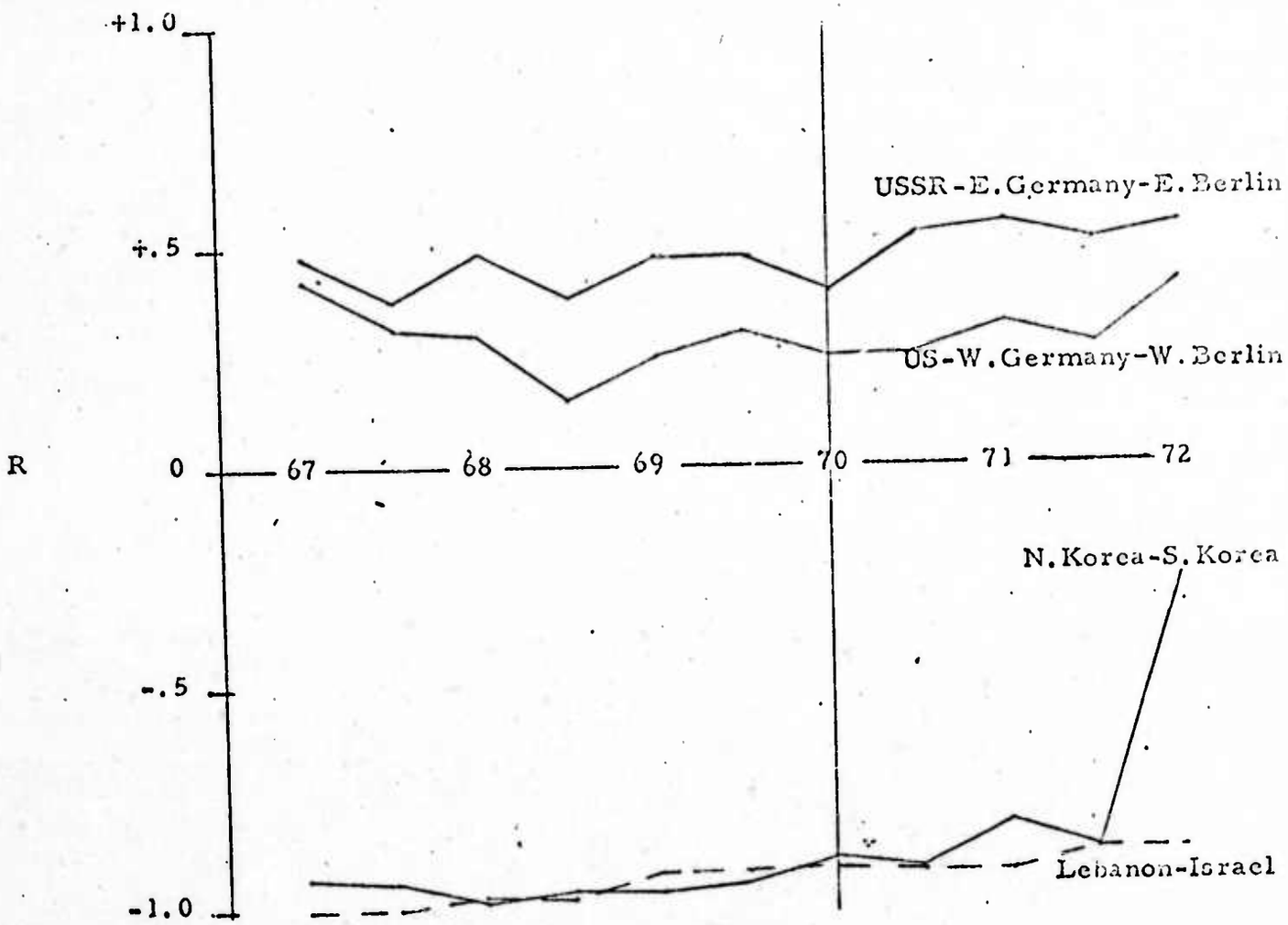
HISTORICAL PROPERTIES OF RELATIONS AND POLICY STYLE

It is reasonable to conceive of several properties which might exist in the ongoing relationships between pairs of countries. First, one can conceive of relationships which remain relatively unchanging (or stable) over extended periods of time. Many such cases can be observed in the relations sample available for experimentation. A few are presented in Figure 1.

Figure 1 displays the calculated values of the relations indicator (R) for four pairs of countries from 1966-1972. The value of R is calculated each six months for the preceeding 24 month period. This overlapping calculation provides both a smoothing function in the time series, and an adequate amount of data to ensure reliability in each calculated value. To interpret the time scale, the initial values represent the 24 month period 1966-1967, the second value represents the period mid-1966 to mid-1968, etc. The vertical line through the point representing the time period 1969-1970 represents the division which will be employed in the experiments between historical patterns (1966-1970) and subsequent outcomes (1971-1972).

The cases displayed in Figure 1 were chosen to illustrate another aspect of the forecasting technique which will be examined. Note that three of the four cases maintain their stability through the entire time series, while relations in the last case, North Korea-South Korea, change significantly subsequent to the end of the "historical" period. It is implicit that stable relationships will tend to remain stable but here we see an "exception". To account for exceptions then, we wish to express forecasts as probabilistic statements. In this instance, for example, we might say that if other cases conform to the historical patterns evidenced by stable cases, then their probable future relations would have three chances out of four (75%) of remaining stable and one chance in four (25%) of manifesting a large change. Sub-

Figure 1. Cases Manifesting Stable Relations Through 1970



stantively speaking, it seems intuitively correct that most cases which manifest stable relations over time will have a higher prospect for continuing stability than for change, other things equal.

A second property of interest is change in the characteristic quality (level) of relations between pairs of countries. Such characteristic level changes might occur as longstanding issues are resolved and countries achieve a "fresh start", or as new issues arise between countries and result in a deterioration of prior relations. Intuitively, one might expect that a level change would result in at least a temporary instability of relations at the new level until further developments of enduring consequence emerge. Figure 2 illustrates several examples of what appear to be negative level changes in relations between country pairs. Figure 3 illustrates examples of what are apparently positive level changes.

The third property of interest is random change or fluctuation in relations; that is, cases in which no apparent historical pattern exists. This class of cases, of which there are many, would seem the least susceptible to forecasting by analogy or precedent, inasmuch as the chances for future change or stability in relations seem independent of prior performance. Intuitively, however, one might expect a higher likelihood of change than stability in cases whose relations have historically manifested a tendency toward frequent change. Figure 4 displays three cases which illustrate random historical fluctuation in relations.

It is important to note that the properties classified above are only statistical in character; that is, they are independent of the substantive matters which are the basis of relations for specific pairs. Therefore, any forecasting guidance which emerges from the analogies of these statistical properties must be viewed as the best guidance available in the absence of substantive information. Clearly, analysts and estimators would want to evaluate such statistical forecasts in con-

Figure 2.

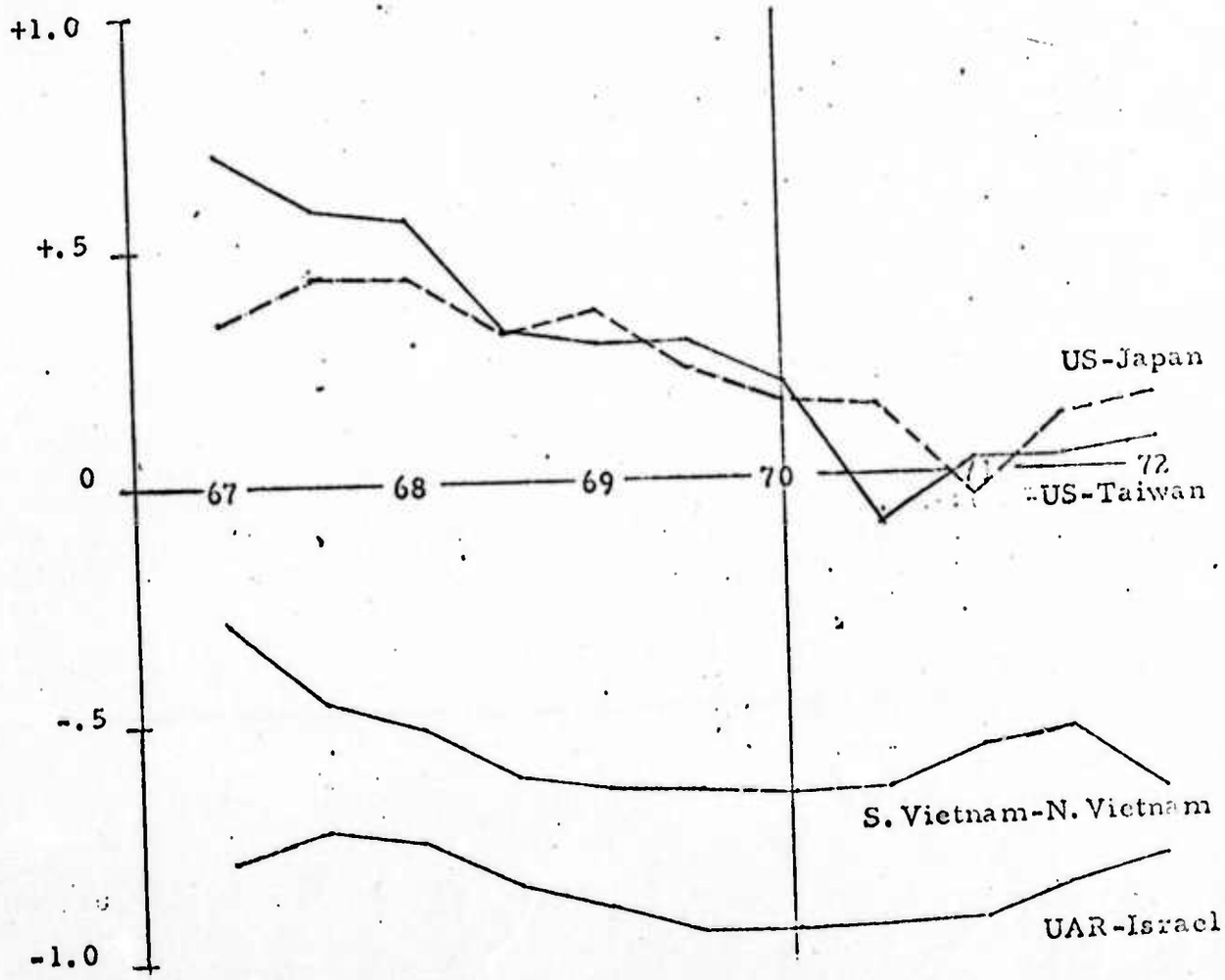

+1.0
+.5
R
0
-.5
-1.0
67
68
69
70
72
US-Japan
US-Taiwan
S. Vietnam-N. Vietnam
UAR-Israel

Figure 3.

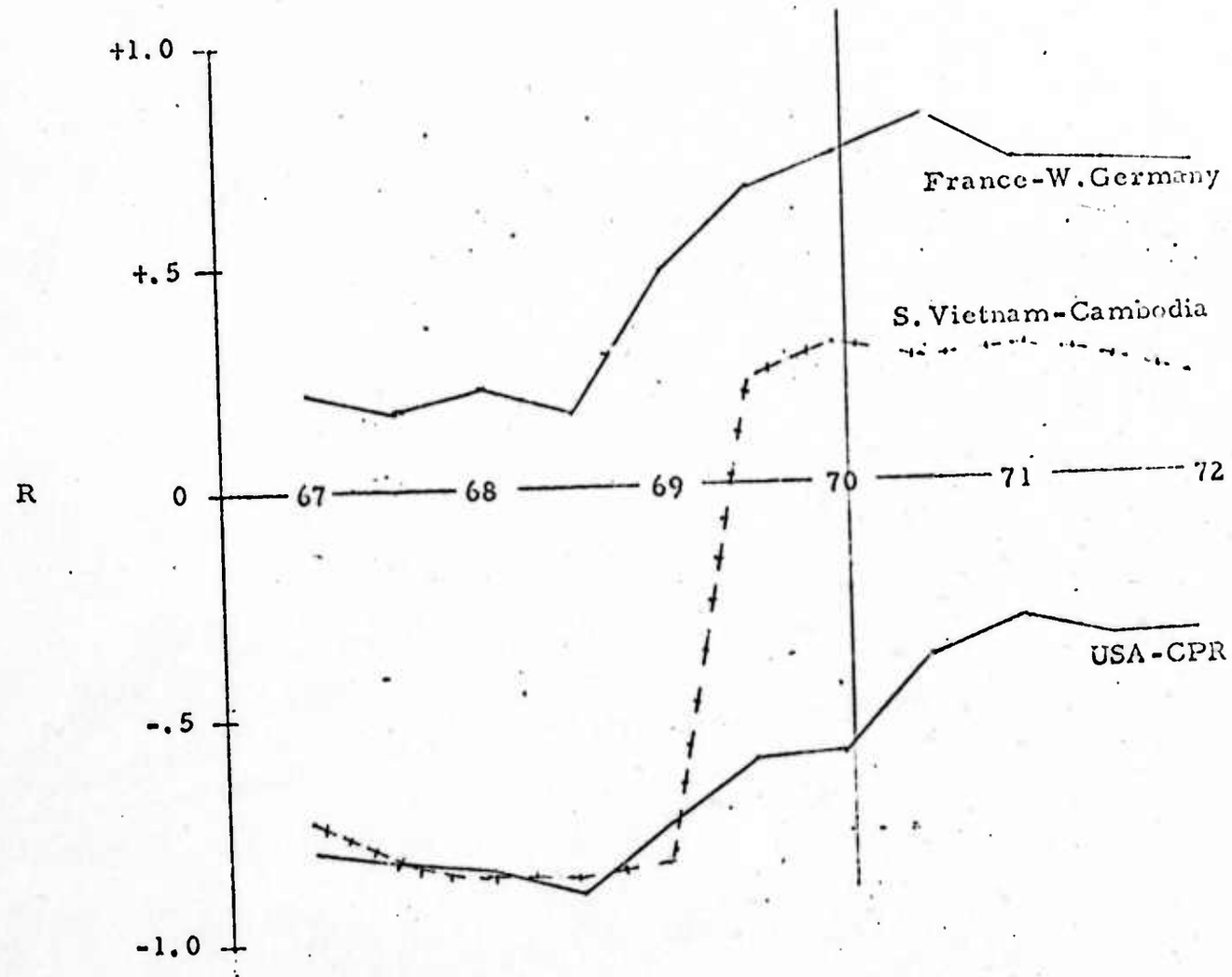
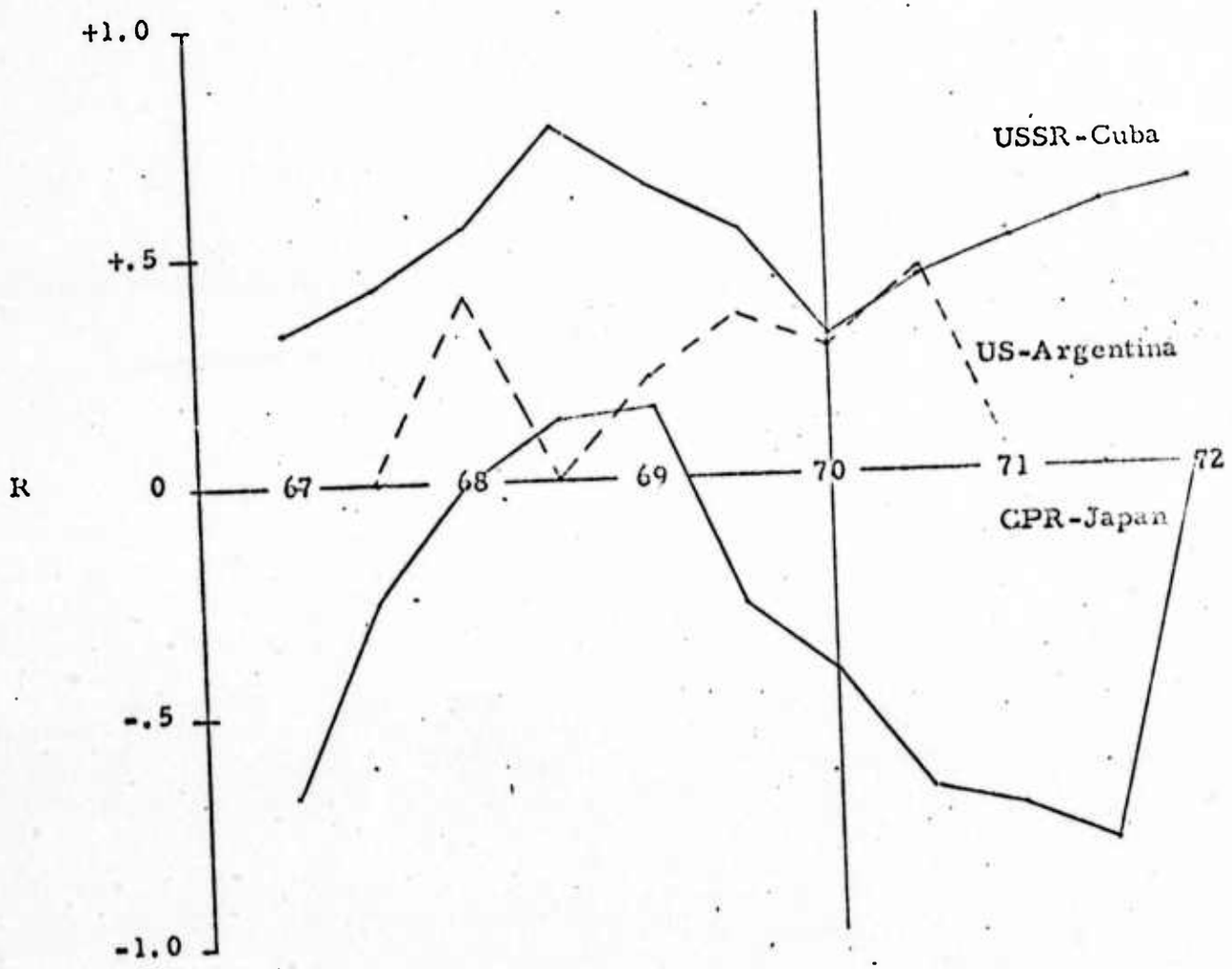

+1.0
+.5
R
0
-.5
-1.0
67
68
69
70
71
72
France-W.Germany
S.Vietnam-Cambodia
USA-CPR

Figure 4.



junction with other more substantive knowledge at their disposal.

The point here, however, is that if means can be found to isolate groups of cases of the types discussed above in a systematic manner (according to fixed statistical criteria), and if the groups so isolated evidence distributions of future performance significantly different from the total population of cases, then the identification of historical precedents relevant to forecasting will have been successful, and a means will be available for improving forecasting capabilities.

EXPERIMENTAL DESIGN AND IMPLEMENTATION

The research strategy for the experiments consisted of the following steps:

1. Develop and apply criteria for isolating groups of cases with distinctive historical patterns of relations from a large sample of cases.

2. Examine the distributions of subsequent changes in relations within each of the groups to determine the uniqueness of these distributions relative to the universe of cases.

3. Replicate the experiment with a second sample of cases, employing policy style rather than relations, to determine whether the patterning criteria and resulting "future" change distributions persist.

In the two experiments the variables employed will be derived from values of R and S, respectively, calculated over a 24 month period as previously described. The total time series from January, 1966 to December, 1972 for each country pair (case) will consist of eleven values of R or S. The period January, 1966 to December, 1970, consisting of the first seven values, will be defined as the "historical" period in each experiment. The last historical value, then, covers the 24 month period 1969-1970, and is termed the "current" value of R. The "future" period will be defined as the eleventh or last time point, 1971-1972. This point is free of any smoothing influence present in the historical data; that is, none of the data which enter into the calculation of the historical values are present in the final value of R or S. The "future" values for each case, then, reflect the true change in R or S, subsequent to the historical period. The absolute differences between R current and R future, or S current and S future, serve as the dependent variables toward which our historical patterns will predict. These will be designated ΔR and ΔS.

THE SAMPLE OF RELATIONS CASES

For other purposes data for over 150 pairs of countries and country groups had previously been assembled in a form convenient for the calculation of R and S values. From among these, 74 cases which met the following criteria were selected for inclusion in the experimental R sample:

1. Only pairs which consisted of individual countries (e.g., China-India) were included. Pairs in which one or both members were country groups (e.g., Warsaw Pact-NATO) were excluded.

2. Of pairs which met the first criterion, only those with a minimum of five data points (events) in every 24 month time interval were included to ensure the reliability of the R calculations.

MEASURING HISTORICAL RELATIONS PATTERNS

The general properties which seemed important in visually identifying the patterns denoted as stable, level change, and random fluctuations in relations (see Figures 1 through 4) included the following:

1. Stable cases show little difference in R value from the beginning to the end of the historical period, and little fluctuation between beginning and end.

2. Level change cases show a significant difference in R value from the beginning to the end of the historical period, a dominant direction of change (i.e., either improving or worsening relations), and more or less continuous movement in the dominant direction.

3. Randomly fluctuating cases may manifest either small or large changes from beginning to end, but tend to fluctuate without a dominant direction and without continuity.

To capture these patterning properties systematically the historical R values (R_1 - R_6) for each case were expressed in terms of their relationship to R_7, the last "historical" or "current" value of R. Vari-

ables V_1 - V_6 were created to serve this purpose. Each value for V represents the difference between the R value at a time point and the current value of R (i.e., $V_1 = R_1 - R_7$, $V_2 = R_2 - R_7$, etc.). V_1 - V_6, then, represent the variation from the current R value of each preceding historical value. Finally, the average of the absolute sum $\frac{\sum_{i=1}^{6} |Vi|}{6}$ represents the average fluctuation ($\bar{F}$) of the historical values around the current value of R. The seven variables, V_1 - V_6 and $\bar{F}$, are intended to summarize the shape or pattern of the historical time series of R.

Isolating Stable Cases

Table 1 contains the ranked values of $\bar{F}$ for the 74 cases in the R sample. Inspection of $\bar{F}$ suggests possible discontinuities between ranks 20 and 21 ($\bar{F}$ values .087 and .107) and between ranks 46 and 47 ($\bar{F}$ values .195 and .215). On this basis we segregate the sample of cases into three groups.

1. Group 1 consists of cases where $\bar{F} \leq .10$ (low average fluctuation).

2. Group 2 consists of cases where $.10 < \bar{F} \leq .20$ (medium average fluctuation).

3. Group 3 consists of cases whose $\bar{F} > .20$ (high average fluctuation).

The threshold criterion relative to $\bar{F}$ for Group 1 is employed to define stable cases. The distinction between Group 2 and Group 3 cases will be employed subsequently for other purposes.

Isolating Level Change Cases

Three criteria are necessary for defining level change cases. Level change cases must satisfy all three criteria in order to be so defined. First, level change cases must manifest significant change from their

TABLE 1

RANKED VALUES OF $\bar{F}$ FOR 74 CASES IN RELATIONS SAMPLE

Rank	$\bar{F}$	Rank	$\bar{F}$	Rank	$\bar{F}$
1.	.025	26.	.125	51.	.238
2.	.032	27.	.127	52.	.243
3.	.033	28.	.128	53.	.243
4.	.048	29.	.128	54.	.248
5.	.050	30.	.133	55.	.255
6.	.053	31.	.143	56.	.257
7.	.005	32.	.147	57.	.257
8.	.058	33.	.148	58.	.292
9.	.060	34.	.155	59.	.292
10.	.062	35.	.165	60.	.310
11.	.062	36.	.167	61.	.322
12.	.065	37.	.170	62.	.337
13.	.065	38.	.177	63.	.358
14.	.067	39.	.180	64.	.383
15.	.078	40.	.180	65.	.392
16.	.080	41.	.182	66.	.417
17.	.082	42.	.183	67.	.438
18.	.082	43.	.183	68.	.463
19.	.085	44.	.193	69.	.563
20.	.087	45.	.193	70.	.567
21.	.107	46.	.195	71.	.618
22.	.108	47.	.215	72.	.720
23.	.118	48.	.217	73.	.958
24.	.123	49.	.218	74.	1.042
25.	.123	50.	.220		

historical beginning to the present. Because the historical period is arbitrary relative to time (i.e., it is an artifact of the data collection which began in January, 1966), we shall define "beginning" as either the first or second time period of the seven which comprise the history. Further, we shall define "significant" change in R as change $\geq .20$. Level change cases then must first satisfy the condition that:

- $V_c \geq .20$, where V_c is the first of values V_1 or V_2 which is $\geq .20$

Second, level change cases must manifest a dominant direction of change reflecting either improving R (D_I) or worsening R (D_w). The direction of change is defined by:

- $D = V_1 \rightarrow V_7$, unless $V_1 = 0.0$, in which event $D = V_c \rightarrow V_7$

Third, level change cases must manifest general continuity of change (C) in the dominant direction. Continuity of change must meet the condition that:

- each value succeeding V_c must lie in the dominant direction, or, if not, must change direction by $< .10$ from the preceding value. This criterion permits minor opposing historical movement in level change cases. Further,
- for D_I, $V_6 \leq .10$, and for D_w, $V_6 \geq -.10$

This last condition ensures that the level change is consistent through the value, R_7.

Randomly Fluctuating Cases

All cases not meeting the requirements of stability or level change set forth above are defined as randomly fluctuating cases.

With conditions now defined for isolating cases of three major historical types (stable, level change, and randomly fluctuating relations), it now remains to be seen whether the cases so grouped exhibit non-random distributions of changes in relations from the experimental present to the experimental future (ΔR).

To simplify the analysis we shall define three ranges of magnitude for ΔR to provide a basis for measuring group distributions:

1. Low ΔR $\quad |\Delta R| \leq .20$
2. Medium ΔR $\quad .20 < |\Delta R| \leq .40$
3. High ΔR $\quad .40 < |\Delta R|$

Cases with low ΔR are those whose change from present to future $\leq \pm .2$. We have previously speculated that stable historical patterns and level change patterns would manifest a greater than expected tendency toward low change and that randomly fluctuating cases might, conversely, display a greater than expected tendency toward high change.

DISTRIBUTION OF R VALUES BY HISTORICAL PATTERN

In Table 2 the distribution of ΔR values is shown for the three historical types for the sample of 74 cases. Table 2A displays the distributions as frequencies and Table 2B displays them as percentages.

From the tables it can be seen that the stable and level change cases do, indeed, tend toward low subsequent change and, further, that most of the cases with high ΔR (12 of 17) are those which have a history of random fluctuation. As a group, however, those with a randomly fluctuating past have the most uniformly distributed frequencies of ΔR.

TABLE 2 DISTRIBUTION OF ΔR BY HISTORICAL PATTERN

(A - Frequency Distribution of ΔR)

Historical Pattern	Low	Medium	High	Total Group
Stable Group	12	4	2	18
Level Change Group	16	6	3	25
Randomly Fluctuating Group	8	11	12	31
Total R Sample	36	21	17	74

(B - Percentage Distribution of ΔR)

Historical Pattern	Low	Medium	High	Total Group
Stable Group	64	24	12	100
Level Change Group	67	22	11	100
Randomly Fluctuating Group	26	35	39	100
Total R Sample	49	28	23	100

Table 2B shows that ΔR for the total sample is distributed about 50% low and 25% each medium and high. The historical patterns represent statistical analogies and the probability distribution for the future ΔR of a test case will correspond to the distribution of ΔR for the pattern group within which its own history falls. For example, the forecast of future relations for a pair of countries whose past relations conform to the properties of a level change type would correspond to the ΔR distribution for that type. Specifically, the forecast would be that relations between countries X and Y over the next two years have a 67% probability of a low change ($\leq \pm .2$), and 22% probability of a medium change and only an 11% probability of a high change ($> \pm .4$).

REPLICATION WITH A SECOND CASE SAMPLE

In order to assess the validity of the criteria developed for isolating historical patterns and for determining if similarly derived pattern types display similar future distributions, the above experiment was replicated using a second sample. In this instance, policy style (S) was selected for analysis and in all other respects but one the experiment is an exact duplicate of the R sample experiment. The exception is in the sample size which, in this instance, consists of 85 cases; and in sample case selection where candidate cases involving policy style from the U.S. to other countries were excluded.[1]

The results of the S sample experiment are summarized in Tables 3A and 3B which are identical in format to Tables 2A and 2B. A comparison across corresponding portions of Tables 2 and 3 reveals marked similarities in the ΔR and ΔS distributions for like historical patterns.

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[1] This exclusion was effected to ensure that no real or imagined bias in the reporting of U.S. international activity would be present in the data, and to make the resulting distributions more meaningful in terms of forecasting future policy styles <u>toward</u> the U.S. rather than <u>by</u> the U.S.

TABLE 3 DISTRIBUTION OF ΔS BY HISTORICAL PATTERN

(A - Frequency Distribution of ΔS)

Historical Pattern	Low	Medium	High	Total
Stable Group	18	5	3	26
Level Change Group	16	1	2	19
Randomly Fluctuating Group	14	10	16	40
Total S Sample	48	16	21	85

(B - Percentage Distribution of ΔS)

Historical Pattern	Low	Medium	High	Total
Stable Group	69	19	12	100
Level Change Group	84	5	11	100
Randomly Fluctuating Group	35	25	40	100
Total S Sample	56	19	25	100

This successful replication is further evidence that the technique of historical analogy may well be valid and serve as a useful guide to probabilistic forecasts of political phenomena like relations and policy style.

FURTHER REFINEMENT OF PATTERNS

In the results discussed above, the variable $\overline{F}$ is employed only to segregate stable cases from all others, using the Group 1 threshold of $\overline{F} \leq .10$ to define stable cases (See p. 8). The Group 2 and 3 ranges of $\overline{F}$, however, may be employed to further discriminate among the level change and randomly fluctuating cases.

Table 4 presents the results of such an analysis for both the R and S case samples. Table 4A displays frequency distributions of ΔR and ΔS and Table 4B displays percentage distributions of ΔR and ΔS within the low, medium and high $\overline{F}$ groups. Results in Table 4 for low $\overline{F}$ correspond, of course, to stable case results previously shown in Tables 2 and 3. The other results in Table 4 show the effect of further refining the level change and randomly fluctuating historical patterns in terms of $\overline{F}$.

The most striking results in terms of discriminating power are those for medium $\overline{F}$, or Group 2. Here, virtually all of the level change cases (7 of 9 in the R sample and 13 of 13 in the S sample) manifest a low ΔR or ΔS. The randomly fluctuating cases in Group 2, on the other hand, are almost equally distributed across the three ranges of ΔR and ΔS. Within Group 2 criteria, then, the ΔR and ΔS for level change cases appear to be highly predictable, while the ΔR and ΔS for randomly fluctuating cases are unpredictable (that is, in the latter instance there is virtually an equal probability of subsequent high, meduim or low ΔR or ΔS).

TABLE 4 DISTRIBUTIONS OF ΔR AND ΔS AS A FUNCTION OF $\bar{F}$

(A - Frequency Distributions)

Historical Pattern	ΔR				ΔS			
	Low	Medium	High	Total	Low	Medium	High	Total
Low $\bar{F}$ (Group 1)								
Stable Cases	14	4	2	20	16	1	2	19
Medium $\bar{F}$ (Group 2)								
A. Level Changes	7	2	0	9	13	0	0	13
B. Random Fluctuation	5	7	5	17	6	7	5	18
High $\bar{F}$ (Group 3)								
A. Level Changes	7	4	3	14	5	5	3	13
B. Random Fluctuation	3	4	7	14	8	3	11	22
All Cases	36	21	17	74	48	16	21	85

(B - Percentage Distributions)

Historical Pattern	ΔR				ΔS			
	Low	Medium	High	Total	Low	Medium	High	Total
Low $\bar{F}$ (Group 1)								
Stable Cases	70	20	10	100	84	5	11	100
Medium $\bar{F}$ (Group 2)								
A. Level Changes	78	22	0	100	100	0	0	100
B. Random Fluctuation	30	40	30	100	33	39	28	100
High $\bar{F}$ (Group 3)								
A. Level Changes	50	29	21	100	39	39	22	100
B. Random Fluctuation	21	29	50	100	36	14	50	100
All Cases	49	28	23	100	56	19	25	100

With respect to Group 3, the results are not as definitive but do satisfy intuitive expectations of distributional bias. In Group 3, level change cases manifest ΔR and ΔS values which are predominantly low and medium (11 of 14 for ΔR and 10 of 13 for ΔS). The ΔR and ΔS values for for randomly fluctuating cases, on the other hand, are divided equally between the combined low and medium categories and the high category.

For purposes of forecasting ΔR and ΔS, it seems reasonable to employ the percentages in Table 4B as probability distributions for cases which are analogous in recent behavior to the five historical patterns represented therein.

ILLUSTRATION OF FORECASTING BY HISTORICAL ANALOGY

The premise of forecasting by historical analogy is that historical behavioral patterns exist which are relatively independent of their time and place of occurrence. A group of such historical patterns of the relations and policy styles of countries has been identified. These patterns have sufficient statistical significance to be considered relevant for forecasting purposes. To apply these patterns to forecasting the future requires only a translation forward in time. The procedure is as follows for any case[1] for which a forecast is required:

1. Compute the seven most recent values of R (S) for the test case.

2. From the R (S) values compute the values of $V_1 - V_6$ (see p. 8).

3. Analyze $V_1 - V_6$ in terms of the patterning criteria (see pp. 8, 9) to determine the group to which the history of the test case is analogous.

4. Table 4B provides the probability distribution of the forecast for ΔR and ΔS.

The nature of forecasts of this type is that, in the absence of any other information, or of more compelling information on the substantive issues present or emerging in the case, this is the best approximation of the likely future of the case based on its similarity to other past cases (analogies).

EXAMPLE FORECASTS

At present, the most recent data available for the calculation of relations

[1] Cases to be forecast must meet the same requirements as cases in the historical sample. First, they must consist of pairs of individual countries. Second, they must meet the minimum data requirement of at least five data points (events) per 24 month time period.

extend through December, 1972. Therefore, in the example forecasts in Table 5, the forecast period is the 24 month period January, 1973 - December, 1974. The forecast distributions in the table represent the probable quality of interaction (R) between the sample country pairs over that two year period. The current values of R also appear in the table for reference purposes.

The first three example forecasts in Table 5 are of relations among the U.S., USSR, and China. The forecast for US-China relations is of likely stability, i.e., a 78% probability of $\Delta R \leq \pm .2$ from the current value of R= -.35. Forecasts for the other two major power pairs are of virtually equal likelihood of low, medium or high change.

The second set of three forecasts is of relations between Japan and each of the three major powers. Here, Japan's relations with the U.S. are forecast to have a high (70%) probability of low change from the current value of R=.15. On the other hand, Japanese relations with both the USSR and China are forecast to have a 50% probability of high change ($\Delta R > \pm .40$) from current values.

Two of the above forecasts are presented graphically in Figures 5 and 6. Figure 5 depicts relations between the U.S. and Japan. The forecast intervals terminate at the time period representing January, 1973 to December, 1974. At that point, the forecast distribution may be viewed in conjunction with the entire relations history of the pair. Future relations between this pair have a 70% probability of occurring within the inner interval, which ranges from R=.35 to R=.35 to R=.05. There is only a 5% probability that relations will be more positive than R= .6, or more negative than R= -.25.

Finally, Figure 6 illustrates the historical and forecast relations for the USSR and Japan. In this case, future relations have a 50% probability of being more positive than R=.82 (a positive level which rarely occurs) or of being more negative than R=.02.

TABLE 5 EXAMPLE FORECASTS OF RELATIONS FOR THE 24 MONTH PERIOD, JANUARY, 1973 TO DECEMBER, 1974

Example Case	R Current	Probability of:		
		Low ΔR	Medium ΔR	High ΔR
US-USR	-.26	30	40	30
US-CPR	-.35	78	22	0
USR-CPR	-.79	30	40	30
US-Japan	.15	70	20	10
USR-Japan	.42	21	29	50
CPR-Japan	0.00	21	29	50

FIGURE 5 FORECAST OF RELATIONS BETWEEN THE US AND JAPAN

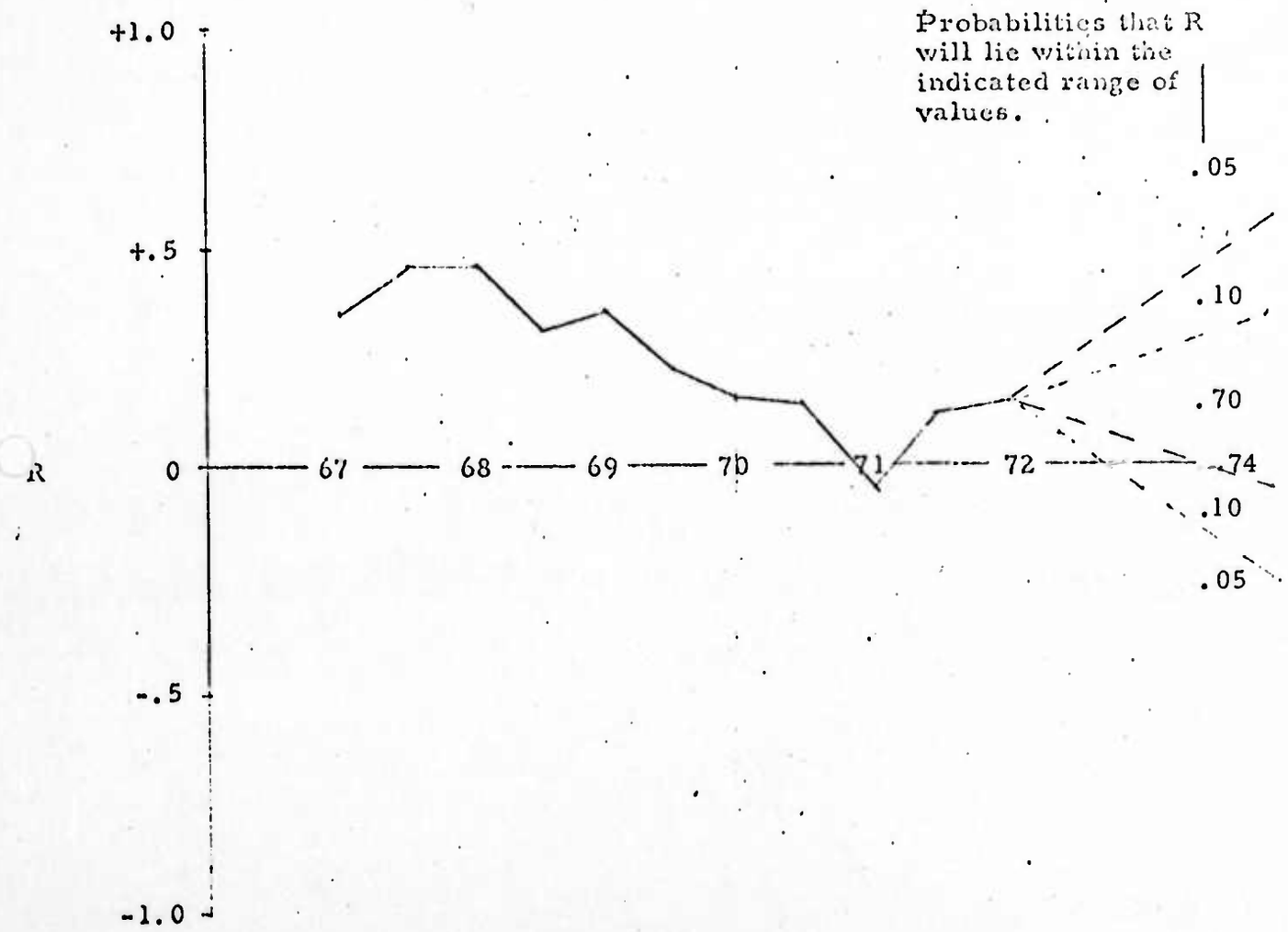
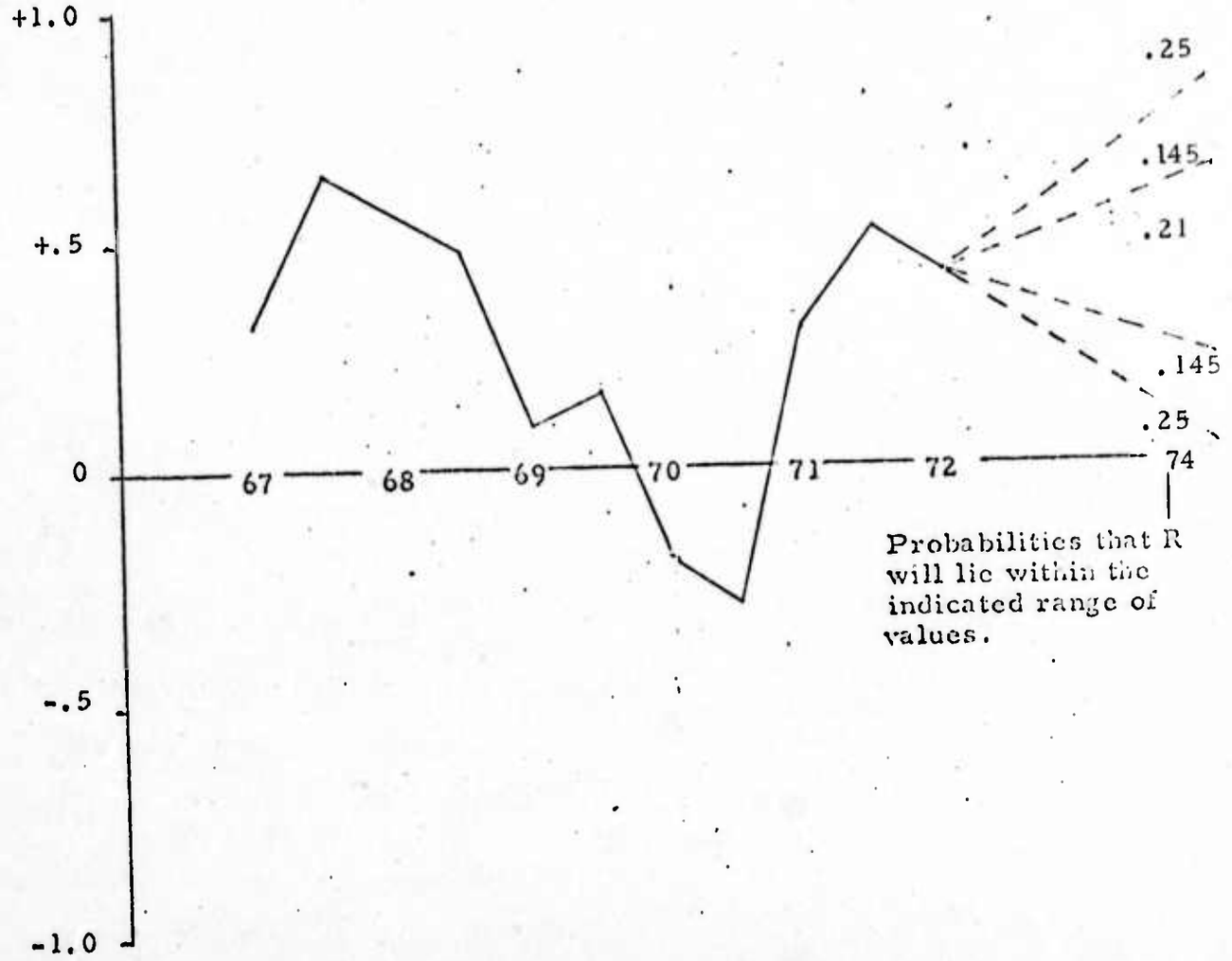


FIGURE 6 FORECAST OF RELATIONS BETWEEN THE USSR AND JAPAN



C.A.C.I.

WASHINGTON, D.C. OFFICES

NEW EVENT-BASED INDICATORS

James Moore
Dale Dean
Barbara Hughes

I. INTRODUCTION

This paper describes three procedures for measuring aspects of relations among nations. The three procedures are constructed in response to the general proposition that an analyst benefits from having available to him multiple and varied measures of the international environment. Specific characteristics of each procedure have their roots in particular goals which were set for this effort. Two most important goals were to produce measures which communicate to an analyst something about the particular types of international events occurring, and to construct indicators which may be especially helpful in making estimates of the future.

The paper is divided into four sections. Section II describes and discusses the foundation from which we begin, namely, the current CACI relations (R) measure.[1] The section discusses means of complementing and building upon the existing foundation. Section III presents a modification of the R measure. The modified R is designed to take on particular values if and only if one of a set of "extraordinary" events occur. The measure therefore reflects more precisely the types of international events that occur. Section IV demonstrates the use of Guttman scalogram analysis for the development of a scale which has two important attributes from our current perspective. First, a Guttman scale value is a description of a cumulative history of event types. A Guttman measure therefore responds to the need for indicators which give information on the particular events occurring internationally. Second, since in a Guttman scale each lower-ranked event type is conceived as a necessary (but not sufficient) condition for the occurrence of higher-ranked types, a Guttman measure may be of use in forecasting. Section V describes a method of measuring an additional attribute of a nation's behavior. The attribute, consistency in a nation's behavior, commonly is felt to be related to the nation's policy and therefore to its possible future behavior.

[1] See, for example, Theodore J. Rubin, "International Affairs Indicators for Defense Decision-Making," (Santa Barbara, Calif.: CACI RM 305, January, 1973).

II. THE RELATIONS MEASURE

The current relations (R) measure asserts that interaction between country pairs consists of positive actions (such as aid, agreement, and praise), negative actions (such as protests, threats, and sanctions), and neutral action (such as meetings, proposals, and visits). Overall relations are defined as the quality of official interaction between a country pair, where quality implies the mix of positive, negative and neutral actions of the pair toward one another. The R measure is:

$$R = \frac{p - n}{p + n + \frac{ne}{2}}, \text{ where}$$

p = total positive actions (events) between the pair

n = total negative actions (events) between the pair

ne = total neutral actions (events) between the pair

The value of R ranges between +1.0 to -1.0. A positive value of R indicates that positive actions exceed negative actions; a negative value of R indicates the opposite. The magnitude of the value of R indicates the degree to which relations are positive or negative.[1]

The R measure is a representation of the relative mix of positive and negative action between a pair of nations. The construction is parsimonious, using few terms and in simple relations, and is shown in systematic studies to correspond well to government analysts' subjective perceptions on relations among nations.[2] The measure does not, of course, perform every function which an analyst might desire from event-based quantitative indicators. In particular the measure provides no information on the specific types of negative events that occur; an

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[1] CACI, "Dissemination and Evaluation of International Affairs Indicators," July, 1972.

[2] CACI, "Quantitative Report on International Affairs (1966-1971)" contains these definitions and also a large number of example applications of the measure.

"n" is an "n" whether it consists of a rejected request or a threat of forceful action. Some analysts express dismay at such "overaggeration". Two responses to the reaction are appropriate. First, it is helpful to bear in mind that whether categories are overaggregated or not depends on the purpose of a measure. In this particular case, the purpose of R is to show the mix of positive, negative, and neutral acts. The measure is not inconsistent with its purpose. Second, the reaction of some analysts to R suggests a need for a complimentary measure designed with a different purpose in mind. The new purpose is to reflect the occurrence of types of events. Effort to achieve this purpose are described in Sections III and IV.

A subject of debate regarding R is the presence of the neutral category of action. The presence of this category asserts that some events have neither positive nor negative implications for relations. The effects of the location of neutral events in R prompt critical comment from some observers, for the following reason. The effect of neutral events is to diminish the magnitude of R (by increasing R's denominator). Thus, if R is at a value of +.8 for a country-pair at one time-point, and during the next period the very same events occur with the exception that many meetings (neutral events) occur, then R will drop in value. The objection to this effect of neutral events is that the value of R should not become less positive unless at least one of two conditions holds: more negative events occur or fewer positive events occur. One response to this criticism of R is to experiment with a measure that treats no events as neutral. Section III presents such a measure.

To reiterate a point made earlier, a critique of R may indicate a fundamental difference of purpose between the critic and the designers of R. One such criticism of R which has been voiced is that the measure, itself, does not suggest possible futures. The criticism is correct insofar as the measure by itself offers little if any information about futures. However, the measure is not intended to be an independent pointer to the future. The measure is used in conjunction with other techniques

in order to produce forecasts.[1] The demand for a more independently predictive measure is, therefore, a demand for a measure which could complement (rather than replace) R. Section IV offers an example of an approach to constructing a new measure which does have implications for the future.

The criticisms of R provide an opportunity to build upon and complement the current measure in ways that will be useful to government analysts concerned with relations among nations. The outcomes of an initial effort in this direction are described in the following sections.

[1] See, for example, CACI, "Preliminary Investigation of a Technique for The Short-Term Forecasting of Selected International Indicators."

III. MODIFIED RELATIONS MEASURE

In this section a measure is presented which incorporates two suggestions made by analysts: the measure distingishes between most negative acts and a subset preceived as extraordinarily serious, and the measure does not include a neutral category. Example empirical applications of the measure are shown.

THE MEASURE

The modified relations measure is similar in some respects to the current relations indicator. However, in the modified version certain types of action such as "military force" or "threat with force specified" are handled in a different manner than other negative actions. The result of the modified measure is that the relations indicator graph flows just as before, with relations ranging between 1.0 and -1.0, unless one or more of the extraordinary acts occur. Such an occurrence drives the measure down below the -1.0 line toward a limit of -2.0. The -2.0 limit is defined by the occurrence of only extraordinary acts in a time period, no positive or other negative acts occurring. Table 1 lists the extraordinary acts.

TABLE 1

Extraordinary Acts*	WEIS Code
Threaten with force specified	173
Threaten with negative sanctions, ultimatum	174
Armed force mobilization, blockade	182
Attempt to cause physical destruction	183
Break diplomatic relations	195

TABLE 1 (Con't)

Extraordinary Acts*	WEIS Code
Seize position or possessions	211
Intrude on territory of	213
Military injury-destruction	222
Military engagement	223

* This list constitutes one impression of extraordinarily negative events. An analyst may add or subtract event types from the list so that the resulting measure will better reflect his own understanding of what constitues extraordinarialy negative behavior.

The "neutral" classification which is used in the original relations measure has been changed as well. The events which had been called "neutral" are, in the view of many analysts, positive events in the relations of nations. It would appear that when the representatives of two nations are able to meet with each other and discuss policy matters, their relations are good. When nations urge actions, propose, explain policies, or seek information, their relations are felt by analysts to be good. It may be argued by the foreign policy practitioner that "good relations" exist when representatives are able to communicate. This does not imply that complete accord must exist, only that the lines of communications not be closed. If indeed analysts and practitioners would define "good relations" to include communicative or consultative acts, then it becomes important that such acts not be regarded as "neutral" in the measure of interstate relations.

The modified relations measure (which is symbolized by R_q) is calculated as follows:[1]

$$R_q = \left(\frac{P - N}{P + N}\right) - \left[\frac{Q}{Q} \times \left(\frac{P - N}{P + N} + 1\right)\right] - \frac{Q}{P + N + Q}$$

Where P = positive acts
N = negative acts (excluding extraordinary acts)
Q = extraordinary acts

EXAMPLES

Figures 1 and 2 show empirical examples of the modified relations measure. The modified measure is compared to the standard measure. The first example is one-way relations ("style") from the USSR toward Israel. Two points of comparison are notable. First, the modified version usually is less negative than the standard. This difference is due to the placing of "neutral" events in the "positive" category in the case of the modified measure. Second, note that the modified measure dips below -1.0 during the June War period. The dip reflects some serious threats made by the USSR against Israel. The modified measure identifies the June War as a more "negative" period in USSR—Israel behavior then existed prior or subsequent to the period.

The second example (Figure 2) is for USSR — Czechoslovakian relations, the two-way relation of the two countries. The modified measure displays far greater fluctuation in the Soviet-Czech behavior. The major change from the standard relations measure is the extreme dip into "negative relations" which occurs in the second half of 1968. The dip reflects the invasion and its tense aftermath. Once again, the modified measure graphically portrays the gravity of the two nations' relations in a period of extraordinary conflict.

[1] If a least one Q (extraordinary) event occurs, then the measure reduces to $-1 - \frac{Q}{P+N+Q}$. If no Q event occurs, then the measure reduces to $\frac{P-N}{P+N}$. In the first case, the distribution between P and N is irrelevant to the value of R_q, while in the second case the distribution is relevant.

One-Way Relations ("Style")
USR → ISRAEL

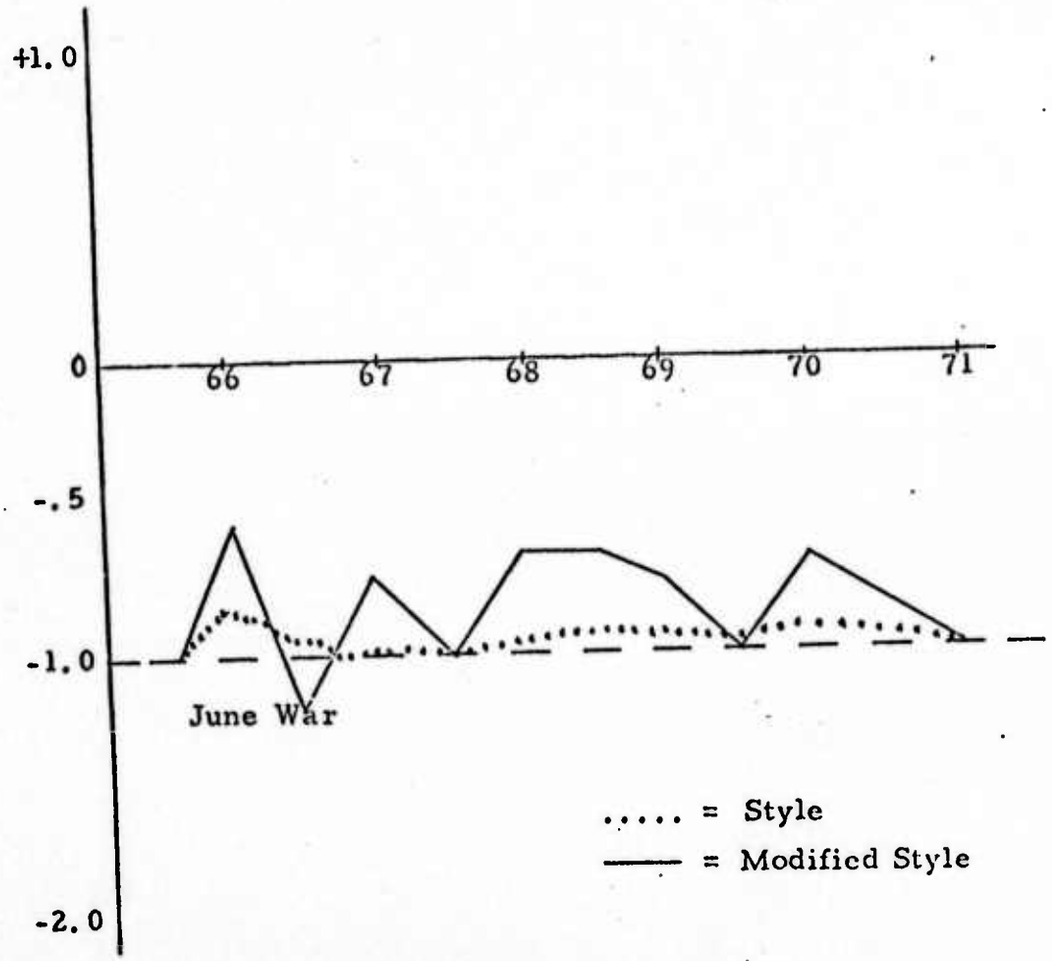


Figure 1*

*Date marks the second half of calendar year. Points preceding a date are for the first half of the year. For example, the first point is the first half of 1966; the second point is the second half of 1966.

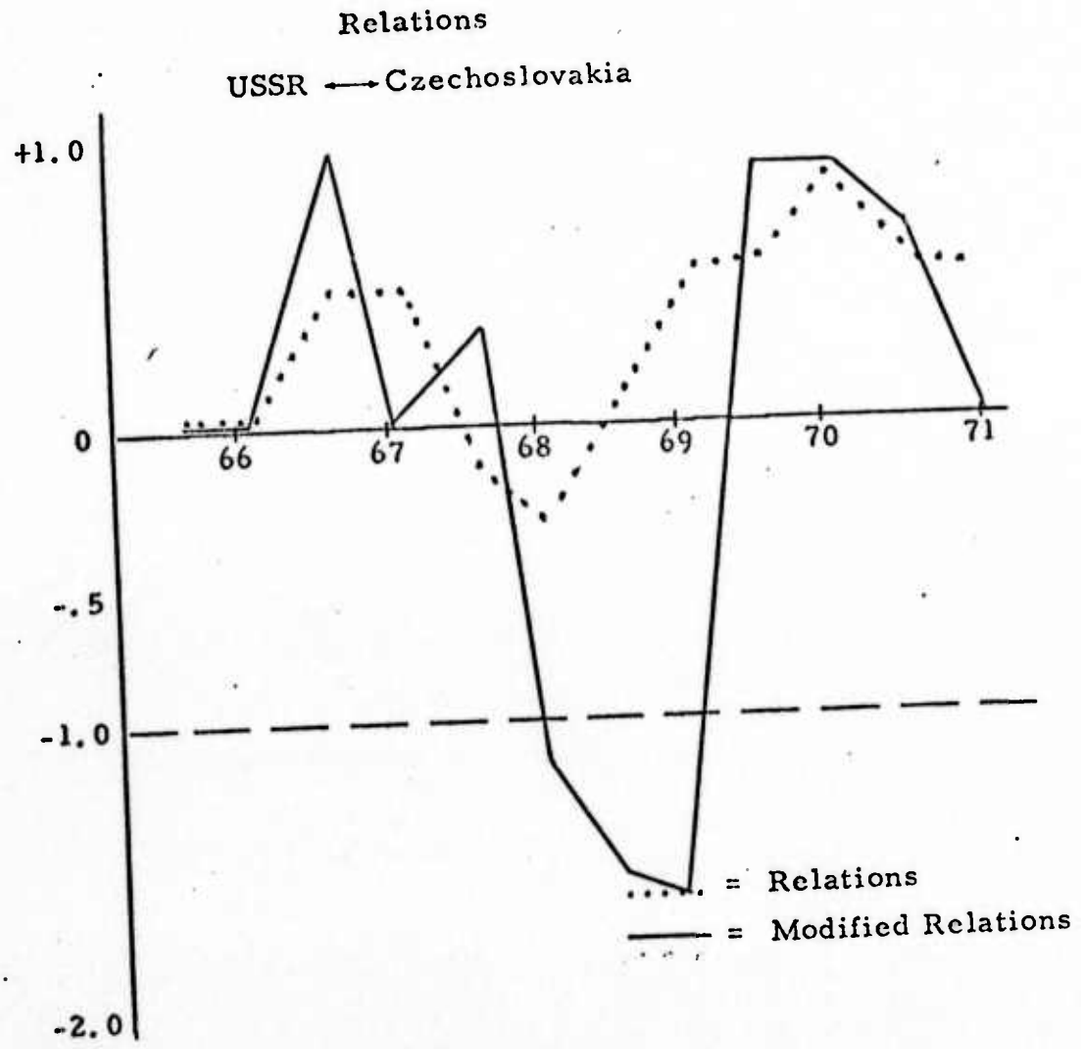


Figure 2*

*Date marks the second half of calendar year. Points preceding a date are for the first of the year. For example, the first point is the first half of 1966; the second point is the second half of 1966.

IV. A GUTTMAN SCALING APPROACH TO "RELATIONS"

The approach described in this section may produce measures which have two attributes desired by some analysts. The approach is illustrated and empirical examples are offered.

GUTTMAN SCALOGRAM ANALYSIS

The technique used to construct a scale in this section is Guttman scalogram analysis. This technique is particularly well suited to two requirements for a new measure discussed earlier, namely:

1. The measure should consistently reflect the type of action occurring
2. The measure should have characteristics which suggest possible futures.

A Guttman scale is a rank ordering of items (in our case, event types) that orders cases (dyads) in terms of degrees of some attribute.[1] Table 2 shows an example of a perfect Guttman scale. An "X" in the matrix means that the case to its left is characterized by the item above the X. A blank space in the matrix means that the case to its left is not characterized by the blank space.

Note that in the example if a case is characterized by item 5, it also is characterized by items 1-4; if it is characterized by item 3, it also has items 1-2. This attribute of the example suggests that items 1-5 form a cumulative scale. The items define some dimension and their ordering from left to right is an ordering of "less" to "more" of the dimension. For example, the items could be types of riot behavior, the cases could be cities, and the scale (1-5) could be one of riot intensity.

[1] For more extensive description than offered here, see G. David Garson, Handbook of Political Science Methods, pp. 120-128.

TABLE 2: Perfect Guttman Scale

Cases \ Items	1	2	3	4	5
1	X				
2	X	X			
3	X	X	X		
4	X	X	X	X	
5	X	X	X	X	X

A Guttman scale is capable of meeting, at least to some degree, the two current requirements. A Guttman scale:

1. Reflects the type of action occurring. A particular scale value refers to a particular type of event.
2. Scale values have implications for possible futures. Lower numbered events on a Guttman scale may be interpreted as necessary conditions for the occurrence of higher-numbered events.[1]

Guttman analysis is both a scaling criterion and a scaling method. As a criterion, Guttman analysis is used to test the hypothesis that a set of empirical observations (case-items) represents a unidimensional attribute. As a scaling method, the analysis orders items into a rank order scale. In the following example we test the hypothesis that a unidimensional scale underlies a set of observations, and also focus upon the rank order of the items (the scale) revealed by the analysis.

[1] Certain assumptions about temporal order are necessary, and may be testable.

A GUTTMAN SCALE

We conducted a scalogram analysis of a subset of WEIS data in order to determine whether a Guttman scale of events could be found.[1] The results are positive. The subset consists of 14 dyads involving the US with a European nation (or Canada). In each dyad over 100 acts occurred during 1966-1971. The subset is restricted to Europe and North America in order to minimize scale errors due to cultural/etc. heterogeniety of actors.[2] The subset is further restricted to highly active dyads in order to minimize scale errors due to spotty reporting of events in the New York Times. The analysis uses the WEIS "combevents" which generally are considered "conflictive" (types 11-22). Table 3 displays the final analysis.

An "X" in the table means that at least one event of the type shown on the horizontal axis occurred in the dyad shown on the vertical axis. There are eleven errors (e) in the distribution of X's : nine empty spaces where there should be X's and two X's where there should be blank spaces. The rank order scale derived from the analysis is shown in Table 4.

---

[1] This is an example of a method which might be applied to other spatial-temporal domains. The results indicate that further applications would be fruitful. However, there is no certainty that additional applications would be successful.

[2] Somewhat different scale patterns in different regions would not be surprising.

TABLE 3: Scalogram Analysis of Behavior in 14 Dyads Involving the USA

Items

Cases	Accuse	Reject	Protest	Reduce	Demand	Warn	Demonstrate	Sieze	Deny	Expel	Threat	Force	
US - POR	X	X											
US - RUM	X	X	X										
US - YUG	X	X	X	X									
US - GME	X	X	X	X	X								
US - CZE	X	X	X	X	X					X			
US - ITA	X	X		X	X	X	X						
US - GMW	X	X	X	X		X	X	X					
US - GRC	X	X	X	X		X	X	X	X		X		
US - CAN	X	X	X	X	X	X	X	X	X				
US - FRN	X	X	X	X	X	X	X	X	X				
US - POL	X	X	X	X	X	X	X	X	X	X			
US - SPN	X		X	X	X		X		X	X	X		
US - SWD	X	X	X			X	X	X		X	X		
US - USR	X	X	X	X	X	X	X	X	X	X	X	X	
e =	0	1	1	1	3	1	0	1	1	1	1	0	= 11
T_n =	14	13	12	11	8	8	9	7	8	9	10	13	= 122

(errors)
(total in most numerous category, x or blank)

$n = 14 \times 12 = 168$

$C_r = .93$

$C_s = .52$

TABLE 4: Rank Order Event Scale

Rank	Event Type
1	accuse
2	reject
3	protest
4	reduce relations
5	demand
6	warn
7	demonstrate
8	seize
9	deny
10	expel
11	threat
12	force

The scale earns a coefficient of reliability (C_r) of .93.[1] Guttman felt that scales having $C_r \geq .90$ could be considered adequate. The coefficient of scalability (C_s) of .52[2] is somewhat below the rule-of-thumb level of .60. The difference between .52 and .60 may be acceptable. If the difference is unacceptable, then C_s can be improved to .60 by dropping the "demand" item from the scale. In other words, the items scale satisfactorily. The rank ordering of items is in terms of conflict severity as exhibited in actual interstate behavior. A scale value for a dyad indicates its rank proximity to a severe breakdown in relations. The scale possesses the required qualities:

1. Scale values reflect types of events; e.g., a value of 6 means that at least one "warn" event occurred in the period being measured, and no other more highly scaled event occurred.

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[1] C_r equals the number of errors divided by the number of cells in the matrix.

[2] A C_s of .52 means that the number of errors in the matrix is less than half that expected by chance (precisely, 48 % of that expected by chance).

2. An inference is that lower-numbered events are necessary conditions for higher-numbered events; e.g., seizures do not occur if protests and warnings do not occur.[1]

The scale seems to approximate an important dimension of dyadic relations. The rank order correlation (r_s) with the WEIS ordering is greater than .70. The correlation with the Calhoun ordering is greater than .50.[2] The dimension ranges through three types of acts: 1) expressions of disapproval (accuse, reject, protest): 2) suggestions of changes in action or policy (demand, warn; 3) physical acts possibly designed to force a change (demonstrate, seize, expel, force). The three classes of acts seem to indicate increasing degrees of opposition. Since a central idea in the concept "conflict" is conscious opposition, the scale can be called a conflict scale.

EXAMPLES OF THE GUTTMAN MEASURES

Figure 3 compares the Guttman scale measure with the current relations measure. The measure is taken one way ("style") in the dyad Soviet Union (USR) to Israel (ISR). The style measure is at each point very low, owing to the fact that nearly all USR acts to ISR are "negative." The style measure is at rock bottom (-1.0) for periods in which the most conflictive act was an "accuse". By contrast, the Guttman measure never hits rock bottom (12) because a "force" act never occurs. The Guttman measure is at every point relatively higher than relations. In a sentence, the comparison shows this: Though nearly all USR acts are "negative" at each point (yielding very low relations scores), the maximun type of conflictive act varies considerably over the period (yielding varying scores with the Guttman measure).

---

[1] The temporal validity of such an assertion is testable and, given the good results here, is worth testing.

[2] The WEIS ordering is shown in the coding system described in Barbara Fitzsimmons et al., "World Event/Interaction Survey Handbook and Codebook." University of Southern California, 1969. The ordering of the WEIS coding system is not intended to be a scale, although event types are generally ordered from less to more conflictive. The Calhoun scale is shown in Herbert Calhoun, "The Measurement and Scaling of Event Data Using the Semantic Differential," 25th Annual Meeting of WPSA, Albuquerque, New Mexico, 1971.

Two "STYLE" Measures for USR → ISR (by Six Month Periods)

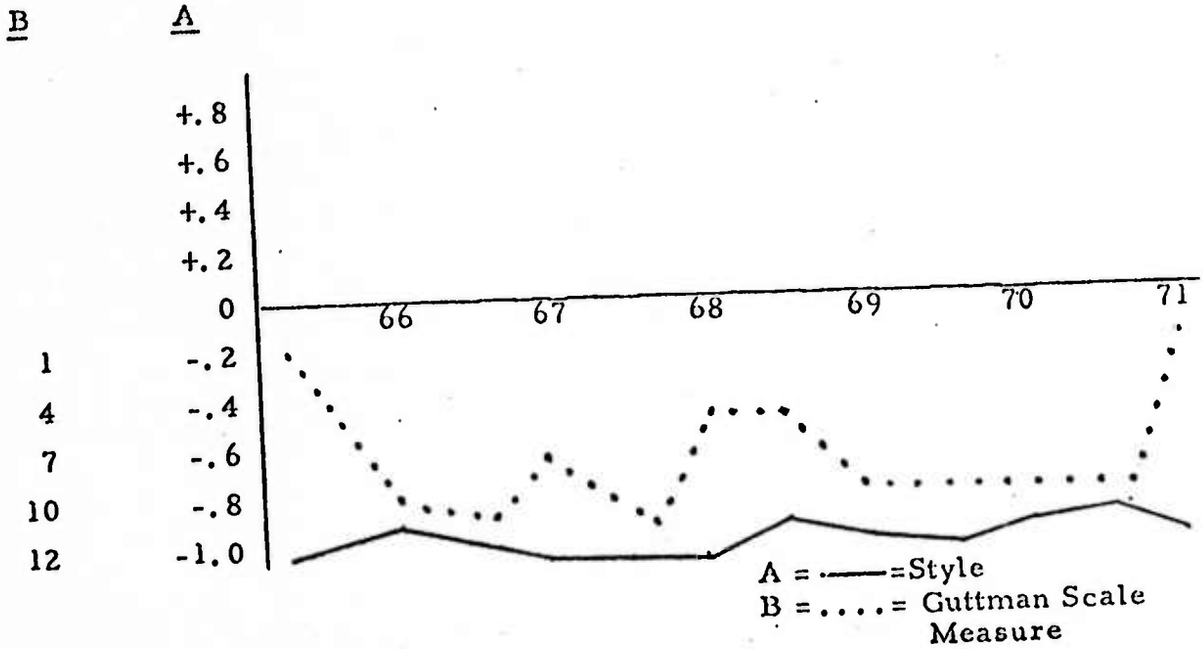


Figure 3

A second example shows that the Guttman measure goes to rock bottom for Soviet (USR) —Czechoslovakian (CZE) relations during the 1968 invasion, while the Relations measure dips but to -.3. The example is in Figure 4.

USR ⟷ CZE Relations, 1966-1972

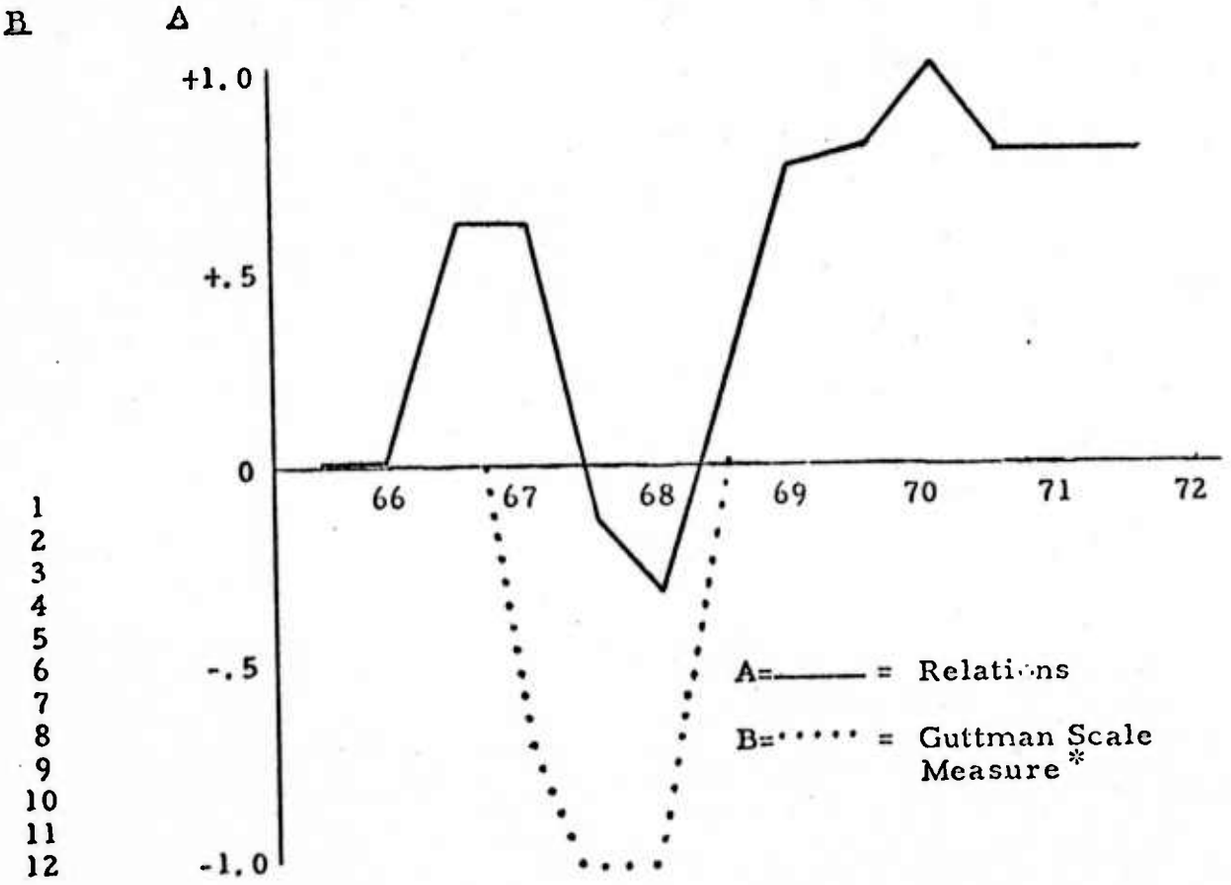


Figure 4

* Guttman measure not shown for periods in which no conflictive acts occurred.

indicate conditions which are quite relevent to estimation. For example, high variation might indicate the absence of a definite policy or an internal struggle over policy, or a low priority in this particular relationship or issue. The idea of consistency is substantively relevant and is not captured in the relations measures.

A MEASURE OF CONSISTENCY

A widely used measure of variation is the standard deviation (S).[1] The measure has been used on event-based indicators primarily to measure the differences between observation points. The suggested use here is to measure variation within observation points. Larger values of S are due to less consistency. The lower boundary of S is 0.0. The lower boundary occurs when there is no variation in behavior from subperiod to subperiod. There is no upper boundary of S.

Hypothetical data will illustrate the general use of S for the purpose described above. In the example the description of the quality of a nation's behavior is simply an average weekly number of conflictive acts, computed each month. This measure is called "monthly mean frequency." The example illustrates how the S measure might be used in conjunction with the average measure. The illustrative data are in Table 5.

The monthly mean frequency tells us the magnitude of conflictive acts averaged for a given month. We can see in Table 5 that over time the magnitude is increasing gradually. The standard deviation is a measure of how closely the raw frequency scores during a month are close to the mean value for the month. When the standard deviation figure is larger

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[1] Where X_i's are the cases, $\bar{X}$ is the mean of the X's and N is the number of cases

$$S = \sqrt{\sum_{i=1}^{N} \frac{(X_i - \bar{X})^2}{N}}$$

[2] For example, see Charles A. McCelland, et al., "The Management and analysis of International Event Data," 1971.

as it is for the first month, the conflictive act frequency tends to be sporadic or inconsistent. The January acts are not consistent; they drop from a high of 6 in the second week to only 2 in the third week, and a low of 1 in the fourth week. Though the mean value for January is 3.25, the average frequency of the acts for the first two weeks is considerably above it while that for the last two weeks is considerably below it. The variation within January is reflected in the moderately large S of 1.92. By May, however, the situation is different. Not only have the raw frequencies of the acts increased but they are consistently of the same magnitude week after week without the rises and falls we saw in January. This consistency is reflected in the lower S of 0.50. The data from Table 5 are shown graphically in Figure 5.

TABLE 5

(hypothetical data)

CONFLECTIVE EVENTS				
Month	Week #	Weekly Raw Freq.	Monthly Mean Freq.	Monthly Standard Deviation(S)
Jan	1	4		
	2	6		
	3	2		
	4	1		
			3.25	1.92
Feb	1	8		
	2	4		
	3	3		
	4	5		
			5.00	1.87
Mar	1	8		
	2	4		
	3	5		
	4	5		
			5.50	1.50

TABLE 5 (Con't)

(hypothetical data)

CONFLECTIVE EVENTS Month	Week#	Weekly Raw Freq.	Monthly Mean Freq.	Monthly Standard Deviation(s)
Apr	1	8		
	2	6		
	3	5		
	4	7		
			6.50	1.12
May	1	8		
	2	8		
	3	7		
	4	7		
			7.50	0.50

The hypothetical data describe a case in which an actor's behavior is becoming not only more conflictive overall, but also more consistently so within observation points. Such growing consistency might reflect a confidence in a policy of increasing conflictive behavior, or might indicate less felt need or desire to vary the signal being given to the target of the actions. Different meanings of decreasing variation, and S in general, might be evaluated in the context of estimation efforts.

The consistency measure may be used on the existing relations and style measures and also on the current issue position and emphasis measures. The application to relations and style has been discussed. The application to issue position (or emphasis) consists of measuring within observation points, the extent to which an aggregate measure of issue position (or emphasis) is due to a consistent position or is simply a central tendency of widely varying signals. It is substantively important to distinguish these two cases because wide variation may indicate uncertainty or unwillingness to commit to a position, while high consistency may indicate a firm decision on a position.

C.A.C.I.

WASHINGTON, D.C. OFFICES

ISSUE-LEVEL INDICATORS

James Moore
Michael Maxfield
Barbara Hughes

INTRODUCTION

PURPOSE

The current contract with ARPA calls for studies of the application of quantitative international affairs indicators for early warning, estimating and planning. In the intelligence community, warning, estimating and planning often occur with respect to fairly narrow subsets of international concerns which may be called "issues." For example, an intelligence analyst may estimate Soviet behavior with respect to a Middle East issue; a planner may advise that more or less emphasis be given to gathering intelligence about a Sino-Soviet border issue. A planner or analyst who is working in an issue context may be aided by quantitative indicators of the issue-related behavior of nations. For this reason, a system of coding issues and a set of issue-related indicators have been constructed. The coding system attaches to an event a code representing the issue to which the event pertains. The issue-related indicators produce quantitative measures of issue-related behavior.

There are theoretical as well as practical reasons for disaggregating to the issue level. In particular, there are reasons to believe that behavior patterns within issues to some extent are independent of each other. Hence, different models may be appropriate for understanding and predicting behavior in different issue contexts. Independence among issues follows from the existence of ever more specialized foreign-policy actors responsible for increasingly specific issues.[1]

[1] John R. Handelman, John A. Vasquez, Michael K. O'Leary and William D. Coplin, "Color it Morgenthau: A Data-Based Assessment of Quantitative International Relations Research." A paper prepared for delivery at the International Studies Association National Convention, 1973.

Experience as well as theory suggests some independence among issues. For example, in Mexican-US relations during 1972-73, there was a great deal of cooperation at all levels on the narcotics issue. Joint activities, coordination of enforcement, and continuous communication between officials of the two nations characterized the interaction on this issue. On the other hand, negotiations on air routes stumbled and staggered. Negotiations on the Mexicali Valley salinity issue created a great deal of tension. While officials in one office of the US Embassy in Mexico City were enjoying extremely amicable relations with their counterparts at the highest levels in the Mexican government, officials in the next office considered themselves fortunate to complete phone calls to an assistant's assistant.

FEASIBILITY OF ISSUE CODES

There are three major parts to the question of feasibility for issue coding and issue indicators. First, is it possible to define "issue" in a relatively precise and useful way? The definition offered in the next section is, we believe, satisfactory in these respects. Given the definition, issues should be fairly easily recognizable. The definition, where applied to recent history, identifies subjects which usually are thought of as issues.

Second, is it possible to provide coding rules which insure reliable coding of issues? The question of reliability cannot confidently be answered prior to test coding and analysis thereof. However, the coding rules described in subsequent sections appear to be sufficiently straightforward to suggest that major coding discrepancies are not likely. The coding rules do not require that precise discriminations be made among a large number of alternative codes. The coder is

required only to identify whether an event is related to any given issue, and if so what position[1] the event expresses, if any.

Third, are the data rich enough to sustain indicators which are at the issue level? There are a number of dimensions to this problem: is activity sufficient to provide an observation at each time-point being used by an analyst? Are the indicators based on a quantity of events sufficient to prevent small coding errors from having a major effect on the indicators? Are there adequate events at this level to disaggregate into a number of indicators based on particular types of issue-related events? To achieve an initial evaluation of these problems, Japan's behavior on four issues was coded from the New York Times collection by six-month intervals for 1966-1972. The results indicate that the Times data are not sufficiently rich to completely eliminate the problems, but that nevertheless indicators were produced which corresponded well with a prior, less systematic picture of Japanese behavior on certain issues. By all indications, the FBIS data will be far richer than the Times. For example, the Times collection contains 19 international events for Japan in January 1972; the FBIS collection contains 275 for the same period. This is cause for optimism. As a hedge against frequency-related problems such as those described above, an intermediate level of aggregation between the issue level and the completely aggregated level is introduced. The intermediate level, described below, consists of "issue-areas."

[1] The issue position code is described in a following section.

ISSUE CODING

DEFINITION OF "ISSUE"

An issue is defined as a point of contention or debate about whether some stated condition (often an act, policy, state of relations or territorial status) should exist. There are objections to this definition. In particular, the definition does not encompass areas of debate in which the alternatives are unclear. The definition applies only where some condition has been proposed to which objections may be made.[1] The coverage foregone by the definition is compensated for by the relative simplicity of constructing indicators of issue-related behavior using the definition. Examples of issues covered by the definition are: reversion to Okinawa to Japan, Japanese institution of a quota for textile exports, US withdrawal from Vietnam, and Israeli withdrawal to pre-1967 borders.

THE ISSUE CODE

Currently 37 issues involving Japan are to be coded. Japan is chosen as a test case for issue coding. The issues are shown below in Table 1 with four digit issue codes. The first digit of each code (1, 2, 3, 4, or 9) identifies the issue as falling into one of the "issue-areas" shown in

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[1] The limitation is not unique to our definition of "issue." For example, it applies to a definition of issues in terms of specific proposed "outcomes." See William D. Coplin, Stephen L. Mills, and Michael K. O'Leary, "The PRINCE Concepts and the Study of Foreign Policy, forthcoming in Patrick J. McGowan (ed.), The International Yearbook of Foreign Policy Studies, (Beverly Hills: Sage Publications, 1973).

TABLE 1*

ISSUES REGARDING JAPAN

9001	An international conference should be held to discuss the Vietnam War
3001	Japan should not provide support for U.S. troops during the Vietnam War.
1001	Japan should not continue to permit U.S. bases on her soil.
4001	Japan should establish diplomatic relations with Vietnam
4002	Japan should establish diplomatic relations with KON.
4003	Japan should recognize CHN and establish diplomatic relations.
4004	CHN should be represented in the United Nations.
4005	CHT should be excluded from the UN.
3002	Japan should increase trade with CHN.
4006	Japan should cease diplomatic relations with CHT.
9002	Cambodia should be a neutral nation.
3003	Japan should not invest in INS oil resources.
9003	Japan and the USSR should expand the air routes between the two countries.
1002	The USSR should return the Northern Territories to Japan.
3004	There should be increased trade between Japan and the USSR.

*Issues are expressed in terms of non-status quo propositions. This point is explained below. New issues will be added to the current list as they arise.

TABLE 1 (Continued)

ISSUES REGARDING JAPAN

3005	The Soviet Union should permit Japanese fisherman in the waters of the Northern Island.
3006	Japan should be involved in the development of the USSR oil and gas.
3007	Japan should be involved in the development of USSR timberlands.
1003	Okinawa should revert to Japan.
1004	The United States should not have nuclear devices on its bases in Okinawa.
1005	The United States should not have poisonous gases on its bases in Okinawa.
3009	The Japanese should finance part of the USA military which defense Japan.
1006	USA bases on Japan should not be allowed to receive ships which are nuclear-weapon carrying.
2001	Japan and the USA should not retain a security treaty for mutual defense.
3010	There should be a Japanese textile export quota.
3011	Japan should reduce import quota.
3012	The Japanese should revalue upward their currency.
3013	Japan should reduce its capital investment overseas.
3014	The US should place no limits on the export of technology to the Japanese.

TABLE 1 (Continued)

ISSUES REGARDING JAPAN

1007	The Ryuku Islands should revert to Japan.
3015	Japan should increase its investment in VTN.
3016	Japanese investment in the USA should be reduced.
3017	Japanese investment in Australia should be reduced.
9004	The Japanese should rebuild their military power beyond the "self-defense" state.
3008	Japan should not invest (financially and technologically) in the Middle East.
9005	Japan should adhere to International trade agreements (e.g. Kennedy round).

Table 2. The issue-area typology is from Rosenau[1] who argues that "the functioning of any type of political system can vary significantly from one issue-area to another." The issue-area codes provide a basis for aggregating issue data to a intermediate level between the issue level and the fully aggregated level. The intermediate level is potentially helpful in analyzing and estimating international behavior because, as Rosenau argues, processes of behavior may vary across issue-areas.

An issue belongs to a particular issue-area when the issue pertains to the allocation of the particular type of value (territorial, human resource, nonhuman resource, or status). For example, the Okinawa issue is in the territorial area because the issue pertains to the allocation of territory; the Japan textile exports issue is in the nonhuman resources area because the issue is about the allocation of material goods; any diplomatic recognition issue is in the status area. The last three digits in the issue code simply identify an issue number.

An issue code is assigned to an event when the event is unambiguously "about" the issue; i.e., when the event contains an explicit reference to the issue or to any meeting or conference in which the issue is discussed or to someone's position on the issue; or when the event constitutes the realization or negation of the condition at issue. The following non-exhaustive list is illustrative of the ways in which an event may be about an issue:

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[1] James N. Rosenau, "Pre-theories and Theories of Foreign-Policy," in R. Barry Farrel (ed.), Approaches to Comparative and International Politics, p. 71. Evanston: Northwestern University Press, 1966.

TABLE 2

ISSUE-AREAS

1.	Territorial Area
2.	Human Resources Area
3.	Nonhuman Resources Area
4.	Status Area
9.	None of above or unclear

1. It is an expression of preference or position regarding the condition at issue, e.g., preference for or against an act, policy or state of relations, or preference for territorial status.

2. It is a meeting about the issue.

3. It is a comment about issue-related meetings or negotiations.

4. It is a refusal to take a position.

5. It discusses implications, in any area, of different resolutions of the issue or of settlement in general.

6. It is an assessment of the likelihood of one or more particular resolutions, or any resolution at all.

7. It is a comment about another's position on the issue.

8. It states a requirement to bring about one or any resolution.

9. It is a statement of fact given in support of a position.

THE ISSUE POSITION CODE

The current definition of "issue" is built around the idea of a condition which, in the view of an actor, should or should not exist. Some acts express a preference for or against the condition at issue. The issue position code records such a position as either supporting (code = 1) or opposing (code = 2) the condition. As a convention, positions on the non-status quo condition will be recorded. For example, on the Okinawa issue, position is recorded in terms of opposition to or support for reversion (the non-status quo condition); on the Japan textile export quota issue, position is recorded in terms of opposition to or support for a quota (the non-status quo condition).

Each issue in Table 1 is stated in terms of a non-status quo proposition in order to facilitate issue position coding. The coder gives an issue position code of "1" if the event supports the proposition, and a code of "2" if the event opposes the proposition.

Not every issue-related event contains a position. When no position is taken, the space for the position code is coded zero. To be coded as having a position, the event must explicitly express a position. The event is regarded as explicitly expressing a position when it contains a statement of belief, request or demand that the condition should or should not exist.

Any of the indicators previously constructed (e.g., style, and relations) can be computed at the disaggregated issue level, if enough data are available at this level. Additional measures which are designed specifically for the issue level are as follows:

POSITION

Position measures the extent to which an actor's behavior supports or opposes the non-status quo contention on an issue. The measure is:

$$\text{Position} = \frac{\text{\# support acts} - \text{\# oppose acts}}{\text{\# support acts} + \text{\# oppose acts}}$$

The measure ranges between +1 and -1. A value of +1 indicates complete support. A value of -1 indicates complete opposition. As the value approaches zero the actor's position may be said to be more ambiguous.

EMPHASIS

An actor's emphasis on an issue is conceived as an expenditure of scarce behavioral resources. The total number of acts by an actor represents a measure of resource base, a certain proportion of which,

$$\text{Emphasis} = \frac{\text{\# of acts re. an issue}}{\text{total \# acts}}$$

is devoted to the issue. This proportion is a measure of issue emphasis. The measure ranges from +1 to 0.

DIRECTED EMPHASIS

Directed emphasis is the emphasis given an issue in a particular dyadic relationship:

$$\text{Directed Emphasis} = \frac{\#\text{ actions re. issue } A \rightarrow B}{\#\text{ acts total } A \rightarrow B}$$

ACTIVISM

An activist is a person who (a) takes a strong position and (b) devotes a large portion of his behavior to the issue on which he holds the strong position. Stated differently, activism is a multiplicative function of position and emphasis:

$$\text{Activism} = (\text{Position})\,(\text{Emphasis})$$

The measure ranges between +1 and -1, the sign indicating the quality of activism (the actor's position) and the value indicating the degree of activism.

DIRECTED ACTIVISM

Activism may be directed at particular actors. Directed activism is measured as activism in general, with the exception that the directed emphasis measure replaces the general emphasis measure:

$$\text{Directed Activism}_{A \rightarrow B} = (\text{Position}_{A})\,(\text{Emphasis}_{A \rightarrow B})$$

ACQUIESCENCE

On an issue, different actors have different positions, by definition. According to one model, an actor attempts to influence the positions of others in the direction of the actor's position. The concept of acquiescence has meaning in this model: An actor is acquiescent to the extent that its position changes in the direction urged by other actors. Holding constant the pressure on the actor, greater change in its position is evidence of greater acquiescence. These relationships are expressed in a measure of the acquiescence of actor A to the directed activism of an opponent B:

$$\text{Acquiescence}_{A} = \frac{\text{Position}_{A,\,t+1} - \text{Position}_{A,\,t}}{\text{Directed Activism}_{B \rightarrow A,\,t}}$$

In this measure, the directed activism of B is assumed to represent some pressure or inducement to change position in the direction of B's position, which is of the opposite sign of A's position. The measure has no upper or lower limits. A positive value for acquiescence means that actor A changed position in the direction desired by B. The larger the numerical value of acquiescence, the greater the position change relative to B's directed activism. A negative value for acquiescence means that actor A changed position in the direction opposite that desired by B—a condition called "counter action" for the present.

This acquiescence indicator must be used carefully because it assumes that actor A's changes in position are due to B's activism. Ideally, evidence regarding the validity of the assumption would come to bear on a decision of whether to use this particular indicator.

SUB-NATIONAL ACTOR

Another proposed means of characterizing issue-related events is the coding of sub-national actors associated with issues. The primary rationale for an indicator of who is acting with regard to issues is that the type of actor may systematically affect issue behavior. For example, of the six possible linear relationships between issue emphasis (E), issue position (P) and sub-national actor (A) the following are plausible:

$$A \longrightarrow P \longrightarrow E$$
$$P \longrightarrow A \longrightarrow E$$
$$P \longrightarrow E \longrightarrow A$$

These relationships, briefly, express whether or not who is acting affects issue related behavior or is affected by trends in behavior. Procedures for testing these assertions will not be discussed here but the different possible relationships should be noted since they point to the possible importance of a sub-national actor indicator for purposes of early warning and estimation.

For present purposes, sub-national actors participating in issue interactions can be coded and plotted against issues. A percentage distribution will show which types of sub-national actors are associated with specific issues. The percentages are computed as (where i = type of actors):

$$\%_i = \frac{\text{\# acts from actor type}_i \text{ on issue}}{\text{\# acts total on issue}}$$

Six categories have been selected from the current DECS codebook to include all sub-national actors that are likely to be associated with issues:

1. head of government
2. ceremonial chief of state
3. executive council or cabinet members and diplomats
4. members of legislative bodies or party congresses and business
5. military
9. other and non-specified

The most obvious ambiguity likely to arise from such a classification might be that such actors as military dictators (code 1 or 5) and governing royalty (code 1 or 2) may be assigned more than one code. It is suggested that such cases be assigned the lowest applicable code value; e.g., military dictators and governing royalty would be assigned code 1.

The potential value in coding issue-related acts according to sub-national actors lies in associating particular types of actors with changes in issue position or issue emphasis. As stated, these proposed categories assume no ranking of actor types with respect to expected effect on change in issue position or significance of issue interaction. With regard to future possibilities, if the measure of

issue emphasis, $E = \frac{\text{Issue-related interactions}}{\text{total interactions}}$, can be assumed to indicate the relative importance assigned to an issue by a national actor, rankings of sub-national actors might be empirically established by associating the five sub-national actor categories with five ranked intervals on the E indicator.

	E_1	E_2	E_3	E_4	E_5	
A_1						100%
A_2						100%
A_3						100%
A_4						100%
A_5						100%

The E_i intervals most often associated with each actor category can be identified, and the actors can thus be rank-ordered according to this distribution. The results of this procedure may be interpreted as follows: the E_i interval most strongly associated with an actor category is said to indicate the relative importance of issues with which that actor is most often associated.

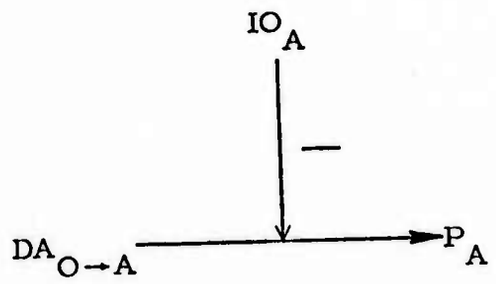
INTEREST IN OUTCOME

Each of the seven measures suggested above is designed to measure some characteristic of behavior. The advantage of focusing upon behavioral concepts rather than psychological ones is that no inference

from behavior to a psychological concept is required.[1] Any such inference depends on a theory linking behavioral and psychological concepts.[2]

The concept "interest in outcome" is psychological. It refers to the intensity of perceived "stake" in the outcome of an issue. The concept seems sufficiently important that movement toward an indicator of it should be made, despite the inherent difficulties.

Causal reasoning is helpful in dealing with this kind of measurement problem. The question is asked, "what measurable characteristics are caused by the concept of interest?" It is reasoned that a strong perceived stake in the outcome would cause an actor to be swayed little by pressure applied by others. Symbolically, where P_A is A's position and $DA_{O \rightarrow A}$ is the directed activism of all of A's opponents (those whose positions are the opposite of A's) toward A, and IO_A is A's interest in the outcome:



[1] A psychological concept requires measurement of some aspect of an actor's mind (e.g., "hostility," "intent"), whereas a behavioral concept requires measurement only of action.

[2] Hubert M. Blalock calls the problem of measurement one of "auxiliary theory" in a discussion of this point, in "The Measurement Problem: A Gap Between The Languages of Theory and Research" in Hubert M. Blalock and Ann B. Blalock (eds.), Methodology in Social Research, New York, McGraw-Hill, 1968.

The argument is that the effect of $DA_{O \rightarrow A}$ on P_A is determined by IO_A. For example, if interest in outcome is great, then the effect of pressure on A's position is slight. If $DA_{O \rightarrow A} \longrightarrow P_A$ were affected only by IO_A, then the former would be an ideal indicator of the latter. The fact that other variables affect the indicator (e.g., A's response to pressure may be due also to its relative power position and fear of various consequences) means that the indicator is an imperfect measure of the concept and that the measurement model must be expanded to control for the effects of the other variables. These are objects of future work if the idea of measuring interest in outcome is important enough.

For the present, interest in outcome is measured by the effect of opponents directed activism on whatever actor A is doing independently. The notion of "whatever actor A is doing" is important because the actor may independently be changing its position over time. The effect of external pressure is conceived, then, as the effect on the actor's position or movement in position; that is, the change in the actor's rate of change (acceleration) produced by external pressure. The term P_A is for the acceleration of A's position. The measure is:

$$IO_A = \frac{DA_{O \rightarrow A}}{P_A}$$

The measure is based on the pressure and change irrespective of direction because the relationship of direction of pressure and direction of subsequent change is irrelevant to whether or not actor A allows $DA_{O \rightarrow A}$ to affect P_A. When actor A allows a larger effect, <u>in any direction</u>, then the actor is said to have a smaller interest in the outcome.

SYSTEMIC SUPPORT

A nation holding a certain position on an issue may be opposed or supported by others. A "systemic support" indicator measures the extent to which nation A's position is shared by other nations who have positions. Where

x = # of actors sharing A's position,

y = # of actors opposing A's position,

The systemic support for A (SS_A) is:

$$SS_A = \frac{x - y}{x + y}$$

The measure indicates the extent of global support for actor A's position. Such a measure might empirically relate to the probability of different resolutions and the rate of resolution. SS_A varies between +1 (all involved actors support A) and -1 (all oppose A).

C.A.C.I.

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INTERNAL INDICATORS

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I. INTERNAL INDICATORS

During the past decade scholars of political science both within academia and outside of it have increasingly directed their attention toward developing and utilizing techniques which help to systematize and thus understand processes which occur within a nation-state that may have severe ramification within as well as outside of it. Sociologist, psychologist, anthropologist, demographer, and various genre of political scientist have devoted large amounts of research energy to this task. The body of literature—both theoretical and otherwise—devoted to topics dealing with this question is vast indeed. Consequently, we will not attempt here to cover all or most of the ground that has been covered. To be precise about it, we will only mention those areas of theory which bear directly on the concerns of developing internal indicators. Those concerns will be discussed presently.

THE CONCERN OF INTERNAL INDICATORS

At CACI the research strategy employed to understand complex phenomena is implemented by breaking the complexity into smaller, easier to handle abstractions, preserving the essential characteristics of the phenomena and proceeding immediately to the development and construction of useful indicators based on the relationships which result. To date, this strategy has resulted in several useful sets of indicators concerned with international behavioral processes as well as with nonbehavioral processes. The present concern is with developing a complimentary set of indicators which deal exclusively with internal political processes. The foci around which

the substance of this analysis will revolve are two in number. We will concern ourselves first with (1) the effects of internal social and political processes on the stability of a given socio-political system and second with (2) the effects of internal social and political processes on the external relations of nations of varying socio-political structure. These foci are broad concerns indeed and we are not so arrogant as to proceed under the assumption that we can begin to deal with more than a few of the specific topics which they subsume. Before we outline the approach to be used here, it seems instructive to mention some of the basic characteristics and functions of any political system.

THE PERFORMANCE OF POLITICAL SYSTEMS

Empirical study of what political systems actually do in their social and international environments represents something of an innovation in political theory. Plato and Aristotle dealt with the performance of political systems, just as did later political theorists, but the main stress of their treatment was on the "ought" of performance rather than on its reality. Thus, in both Plato and Aristotle distinctions were drawn between "lawful" and "unlawful" forms of political rule, according to whether kings, aristocracies, or majorities used political power for the good of the rulers or for the good of the general society. Plato discussed at great length the question of what kinds of policies good rulers ought to follow. Aristotle developed in some detail the question of how the structure of a given society, in particular the distribution of wealth, affected the structure and process of the polity and how this in turn affected the kind of public policies these political systems pursued.

Marxist theory presented the argument that the class structure of a society determined the structure and process of the political system, and its performance in society and in the international environment. Marxist theorists believed that the capitalist form of society produced a political system dominated by the bourgeoisie, acting in its own interests and following a policy of international aggression in order to maximize markets and profits.

The study of the performance of political systems enables us to deal more directly and effectively with the problem of political change. We know that the stimulus for political change can come from three sources: from the political system itself (that is to say, from its elites), from social groups in the domestic environment, and from political systems in the international environment. Usually these three sources of political change interact with one another. For example, pressures coming from the political elite which affect changes in the capabilities of the political system may produce changes in the society or in the international political system which in turn may change the pattern of demand and support. When we look at the political system at the level of interaction with its environment, our attention is drawn to changes in magnitude and content of the flow of inputs and outputs, and these changes in magnitude and content may be the stimuli of political change. Thus, if we look at the flow of demands into the political system, we can make judgments about the load on the system, whether it is beyond the capacities of the structures and processes of the political system to handle. If it is, we can make some estimate of the probability that the system will have to change its structure and process patterns and its capabilities (or both) if it is to continue carrying the load.

Similarly, if we examine the outputs of the political system to observe how they are changing the domestic social environment or the international environment, we can make some judgments about how these changes may affect the flow of inputs into the political system (whether they are likely to reduce the flow, to increase it, or to change its content).

The five primary functions of a successfully operating political system are: (1) the extractive function, (2) the regulative function, (3) the distributive function, (4) symbolic function, and (5) responsive function.

The extractive capability of a political system refers to the range of system performance in drawing material and human resources from the domestic and international environments. The capability to obtain such resources underlies the other capabilities, and limits or expands the possibilities of attaining various goals for the system and the society.

The regulative function refers to the political system's exercise of control over behavior of individuals and groups. By common definition, this is the distinguishing capability of political systems, the employment of legitimate coercion to control behavior. In characterizing regulative performance one must consider what individuals and groups are being subjected to regulation, what areas of individual and collective life are affected, and what frequency or intensity of intervention is exercised.

Regulation, like extraction, obviously underlies much of the performance of the other functions. These two functions—regulation and extraction—are themselves interdependent. A system needs

resources in order to regulate, but it is through the use of control, and of coercion or its threat, that resources are obtained.

The distributive function refers to the allocation of goods, services, honors, statuses, and opportunities of various kinds from the political system to individuals and groups in the society. It is the activity of the political system as dispenser or distributor of benefits among individuals and groups. The most relevant measurements of distributive capacity must involve the quantity and importance of the objects distributed, the areas of human life they touch, the particular sections of the population receiving various benefits, and the relationship between individual needs and governmental distribution to meet those needs.

The symbolic capability is the rate of effective symbol flow from the political system into the society and the international environment. Symbolic outputs include affirmations of values by elites; displays of flags, troops, and military ceremony; visits by royalty or high officials; and statements of policy or intent by political leaders. These may be seen, of course, as a kind of distribution, but they take on a special character since they have little immediate cost for the elites yet are highly dependent on tapping popular beliefs, attitudes, and aspirations for their effectiveness. Political events play an important role in shaping significant political symbols.

The effectiveness of symbolic outputs of this kind is difficult to measure, but political elites (and journalists and scholars) often attempt to do so by counting crowds and audiences, by recording the strength and duration of applause, or by conducting surveys of attitudes. Of course, symbolic output is not the same thing as the

symbolic function. The output of symbols may cease to be edifying, menacing, or credible, or may even stop being received. Royalty or high officials may be reviled, statues may be thrown down from high places, television and radio sets may be turned off. Or, as in the case of new nations, the symbolism may have little if any resonance. Symbolic messages may be transmitted but not received. The symbols of local authority may be the only ones granted legitimacy, while the central symbol output may have little meaning or effect. Thus, the activities of governments in making displays, building statues, and making speeches to the nation are not in themselves indicative of the symbolic function.

The significance of a high symbolic capability for a nation should not be underestimated. Through the judicious creation and exploitation of a set of powerful and popular symbols, the political elites may be able to gain acceptance of policies which they deem necessary but which are painful or unpopular. Reserves of support may be created or mobilized, as by Churchill's speeches during World War II. Symbolic capability can magnify the impact of certain governmental distributions or regulations far beyond their physical effect on individual citizens.

While extractive, regulative, distributive, and symbolic functions are ways of describing the pattern of outputs of the political system into the internal and external environments, the responsive function is a relationship between inputs and outputs. Responsiveness is of great concern for political scientists in their normative, explanatory, and predictive analyses of political systems. Certainly many of the judgments we commonly make about dictatorships and democracies

are founded on some estimate of responsiveness. Indeed, most modern political elites make elaborate claims to be giving the people "what they want," regardless of how responsive they may appear to observers. Some sort of claim to ultimate responsiveness has come to replace custom or religious belief as the legitimating grounds for polular support and obedience.

In a sense every political system is "responsive" to something. The political system must be responding to some set of internal or external pressures and demands. The more salient questions are: To whom is the system responsive? In what policy areas is it responsive? How does it manage to sustain a pattern of responsive behavior? Thus, in a bureaucratic empire the governmental activities may be at the whim of the king or emperor or of his immediate staff, with little concern to demands and pressures—if they exist—from other sources. The political elites would then constitute almost the sole source of political inputs.

In contrast, a political system with a highly developed set of interest groups and political parties to which elites are sensitive and responsive in policy making would represent a case of a highly developed responsive capability. But, of course, there is a vast range of responsiveness falling between these two extremes, and we can only suggest a few of the possibilities in this discussion.

We should be first concerned with considering what groups are engaged in making demands on the political system and what sort of responses the elites usually make to them. Thus, demands may be confined to a small group of landholders, first families, military

officers, and members of the political elite, such as has been traditionally the case in Latin America. Or there may be a broad range of demands from most groups in the society, but particular regional, ethnic, or religious groups may be excluded from the political input process. Such is the case of the Bantu in South Africa, who make up more than two thirds of the population, and such was long the case of the blacks in many parts of the United States.

Closely related to this question is the whole problem of the mechanisms and channels of demand processing. The structures and cultural attitudes underlying the performance of the internal conversion processes of the political system have great influence on the responsive capability. If certain well-organized, well-financed groups have special channels of access to the political elites, then it is likely that the system will be primarily responsive to their demands and not to those of the masses. The masses may have to become aroused to the point of violence and demonstration before an impact is made.

One final point must be made about system responsiveness. A political demand for certain needs may be met by the political system in the form of a response which not only provides certain immediate benefits, but institutionalizes the responsiveness of the system in that area. That is, the political elites concede that the political structures have the responsibility for meeting a certain kind of want or need, and set up specific political roles and structures to meet the need on a continuing basis. Subsequent response then becomes automatic.

To return to our initial concerns we might ask: What viable

abstractions will allow us to accomplish and portray these basic functions most efficiently? There are a number of candidate possibilities, some taken from sociology, others from political science. From the sociology literature we find a cluster of social process theories emanating from Parson's "The Structure of Social Action." One such theory which disclaims the Parsonian "mechanisms" but retains the structure, nevertheless, is that set forth by Duncan.[1] Duncan views the internal domestic process as being a socio-communication structure generated from an appeal to social order. According to this formulation society, its institutions—including political ones—roles, hierarchies, and relationships grow out of an appeal to social order. Thus order is used as a fundamental construct of societal processes. Relationships between "authorities" and "publics" may be determined by the degree to which communication between them is open or closed.[2] The role of government under this conception is to dramatize rules of order through actions as communication. Breakdowns in social order represent breakdown in belief systems and symbolic structures, in short break downs in communication.

Lasswell and Kaplan[3] analyze the socio-political system as a series of interactions between ruler and ruled. The stability of the system is axiomatically related to the type of processes that occur between ruler and ruled. The Lasswell Kaplan paradigm emphasizes the strength of elites and counter-elites in acquiring and maintaining ideological control. It also stresses—as does Gurr's[4]—the difference between actualization and realization of values for the masses. The

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[1] Hugh Duncan, Symbols in Society, Oxford Press, 1968.

[2] Methodological Proposition 17, Introduction, op. cit.

[3] H. Lasswell and A. Kaplan, Power and Society, Yale Press 1950.

[4] T. Gurr, Why Men Rebel, Princeton University Press 1970.

Lasswell Kaplan view is seminal and readily lends itself to operational constructions. The substance of their view may be summarized in the axiomatic propositions given below.

Moore sees society as a "tension-management system" rather than a self-equilibrating one.[5] Such a conception makes order problematic rather than assumed, and invites attention to sources of dissidence and deviation, controversy, and conflict. Moore believes that social disorder can be predicted if change inducing mechanisms are properly assessed. He suggests that the key to predicting social disorder lies in adequate knowledge of change itself. In his analyses he emphasizes the study of changes in the direction of change, changes in the rate of change, changes in change threshold values, changes in exogenous variables, and changes in the variety of change. He suggests that monitoring continuation of orderly trends, persistent components of the present, historical trends and cycles, and likeliness of innovation are most useful in predicting social order.

Easton views the political system as a dynamically interacting system in which input from the external environment serves as the basic unit for initiating a never-ending process of supports and demands. The demands are seen to flow from the citizens to the constituted authorities (see Figure 1 below). The political system emits outputs back into the environment which in turn converts them into new inputs. This continuous looping between inputs and outputs constitutes the dynamics of the system.

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[5] Wilbert Moore, "Predicting Discontinuities in Social Change," American Sociological Review 29 (1964), pp. 331-338.

AXIOMS OF INTERNAL STABILITY

(1) The stability of a rule varies directly with the intensity of the ideology of a sustaining elite. (Lasswell and Kaplan)

(2) Stability of rule varies directly with the amount of dissent expressed as an elite attempts to recruit itself. (Lasswell and Kaplan)

(3) Stability of rule varies directly with the intensity of adherence to the ideology of the ruling elite. (Lasswell and Kaplan)

(4) Stability varies directly with the degree of actualization and realization of values for the masses. (Laswell, Kaplan, and Gurr)

(5) The stability of a rule varies directly with the elites control over the instruments of violence. (Lasswell and Kaplan)

(6) The stability of rule varies inversely with the degree of organization of a counter elite. (Lasswell and Kaplan)

(7) The magnitude of political violence varies strongly with the potential for collective violence generally. (Gurr)

(8) The magnitude of political violence varies strongly and directly with the ratio of dissident coercive control to the point of equality and inversely beyond it. (Gurr)

(9) The magnitude of political violence varies strongly and directly with the ratio of dissident institutional support to regime institutional support to the point of equality and inversely beyond. (Gurr)

(10) Regime coercive control varies with the proportion of its population subject to regular surveillance and deterrence. (Gurr)

(11) Regime coercive control varies curvilinearly with size and the resources of its military and internal security forces, control being lowest when size and resources are at intermediate levels. (Gurr)

(12) Regime coercive control varies strongly with the loyalty of coercive forces to the regime. (Gurr)

(13) Regime coercive control varies strongly with consistency of regime-administered negative sanctions. (Gurr)

(14) Regime institutional support varies strongly with the number and scope of regularized channels for protest provided by regime-oriented organizations. (Gurr)

(15) Regime institutional support varies strongly with the proportion of a population belonging to regime oriented organizations and inversely with the proportion belonging to dissident-oriented organizations. (Gurr)

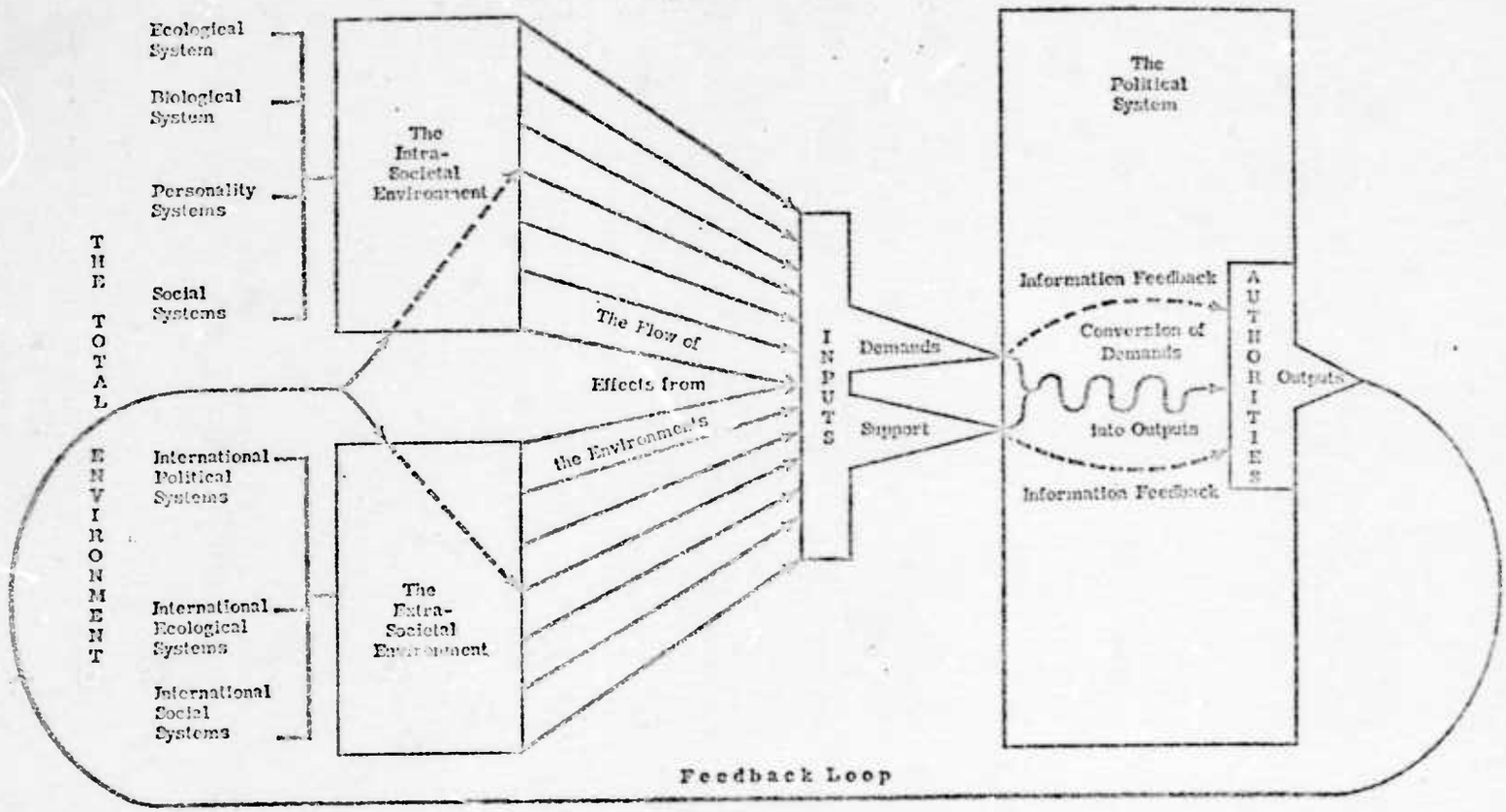


Figure 1. A Dynamic Response Model of a Political System

The Easton paradigm is very close to the one we will use but several important modifications are required before its adoption.

II. FRAMEWORK FOR ANALYSIS: INTERNAL PROCESSES—A PROPOSED MODEL

The basic strategy for dealing with these concerns will be to condense as expeditiously as we can the core theoretical findings into a processable model framework. The components of the model—its variables—will be converted into explicit statements and operationalized as indicators. The resulting indicators will remain preliminary until they are validated.

Most recent literature of sociology, psychology, and political science deal with internal processes in terms of their effect on the stability of the socio-political system.[6] This orientation based on the notion of stability has a long history extending far into the annals of western thought. Hobb's influence has, of course, been pervasive in its impact on developing such an orientation. There are other orientations which could serve as well. We will not debate the issue of which orientation is best, as we accept the stability orientation as adequate. The model to be developed will use it as a fundamental building block.

The stability orientation is best understood as a measure of the predisposition toward internal violence. The idea of measuring the predisposition toward internal violence has been the subject of many research ventures in political science, sociology, and psychology. The range of existing paradigms are wide and varied, therefore we will only mention them in passing. They are bound on one end by

[6] Such a view is similar to that proposed by David Easton in his "A Framework for Political Analysis," Prentice Hall, 1965.

the psycho-analytic paradigms of Freud, Fromm, Lorentz, and Hoffer among others, who attribute the predisposition toward violence to individual psychological survival mechanisms such as the "death instinct," and "aggressive instinct for survival," and a "passionate fear of change."[7] They are bound on the other end by the so-called "frustration-aggression" paradigms and their variants which attribute collective violence and aggression to gaps in expectations. These have been best expressed by Berkowitz, Yates, Allport, Bateson, Lasswell, and lately Gurr. One variant, that of "relative-deprivation," will deserve particular attention in later discussions as it will be used as a basis for developing indicators.

Transforming the concepts in these paradigms from the individual and group level to the nation-state level involves the development of an expression of internal political violence or a tendency towards instability. At this level, if we look at the nation state as a socio-political system in which values are created, allocated, and passed on through a process of bargaining through supports and demands between rulers and ruled, then the concept of internal stability begins to take shape.[8] In common sense terms, a state in which this process occurs with a minimum of dissent (either manifest or latent) may be loosely referred to as stable. On the other hand, a state in which this process takes place with relatively great difficulty may be said to be unstable—or to exhibit a noticeable predisposition toward instability. Quite clearly

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[7] See particularly E. Hoffer's The Ordeal of Change, Perennial Library, Harper and Row, 1963.

[8] See Dahl in "Conflict and Conciliation" from Pluralist Democracy in the US; reprinted in Kenneth Dolbeare, ed., Power and Change in the US, also S.N. Eisenstadts, Modernization, Protest and Change: "A Comparative Analysis of Situation of Breakdown and of Sustained Growth," pp. 129-147.

such a concept depends to some extent on the type of socio-political system involved as well as on or whether or not such behavior is manifest or latent.

Dahl identifies three components or sources of political change which might account for instability at the national level:

(1) The operating structure of government

(2) The policies proposed and adopted by the national government.

(3) The relative influence of different non-government groups on the policies and decisions of the national government.[9]

Eisenstadt effectively separates them into processes and structural components. According to Eisenstadt, the capacity for a state to withstand, absorb, or integrate disruption into its social and/or political system is a differential, yet crucial factor in understanding the mechanics of instability. Some countries possess more of this ability than others. For example, the remarkable quality of the U.S. social and political system is its ability to tolerate large amounts of internal disturbances. Indeed, it is a basic characteristic of the system to be able to tolerate such disturbances. Consequently, its capacity for absorption is higher than for other countries. Some would attribute such a capacity to the structural form of the system alone. Eisenstadt would consider such an attribution simplistic, if not erroneous, as there are many intervening variables which mediate between social

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[9] op. cit.

process, political structure, and internal disruption—type of political system being a single one.

Following Eisenstadt, we find that other variables of equal importance are ones such as tradition of social freedoms (freedom of speech, freedom to criticize government, freedom to organize and protest governmental policies, etc.), flexibility of social and political institutions, and level of, and rate of growth and development. Simply put, countries with similar political systems do not necessarily possess the same capacity to absorb social violence. Greece is a case in point. It is a nation which historically has been considered the prime example of stable democracy. Yet in recent decades it has yielded to one internal upheaval after another. A similar observation is true of certain non-democratic systems. Bulgaria, for instance, has remained one of the more stable of the eastern European countries while Czechoslovakia, Poland, and East Germany have periodically yielded to internal stresses. The point to be made is simply that, though political structure is an important variable in explaining and predicting internal system breakdown, it is not the only or most important one. The above considerations allow us to make several analytic distinctions which will later serve to index the points in this discussion.

STRUCTURAL ACTIVITIES AND PROCESS ACTIVITIES

One way to handle the problem of the effects of internal stress on stability is to divide them into structural and process components. Eisenstadt has done this.[10] Process activities in Eisenstadt's conception are interactive activities which are manifestations of specific ills

[10] op. cit.

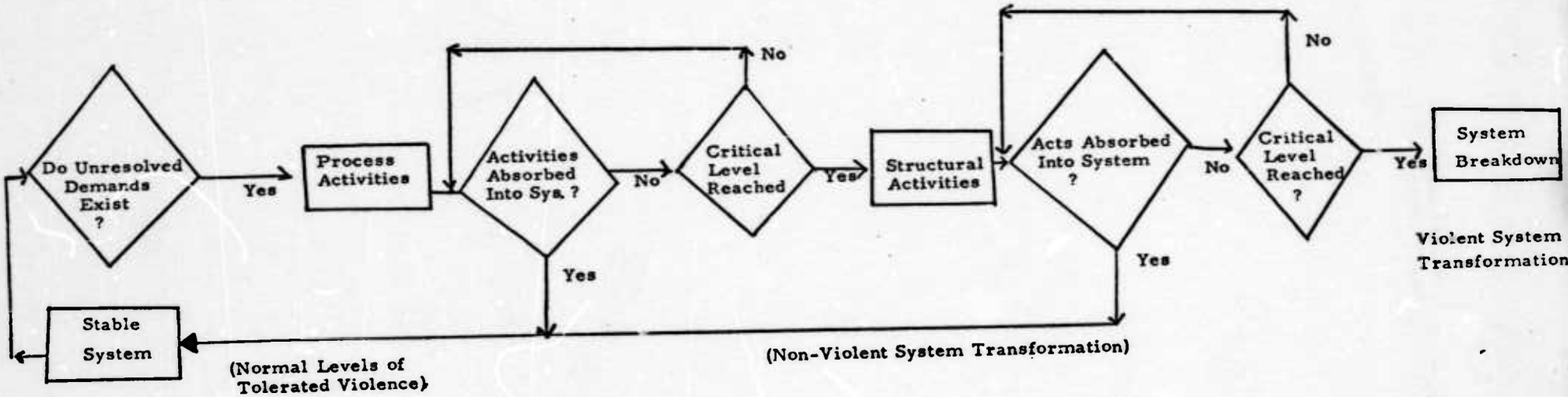
within a society. They include such activities as riots, political organizing, sporadic acts of violence, anti-government demonstrations, violent protest, etc. Process activities develop, dissipate, redevelop, are absorbed into normal channels of activity or move to a higher level of system importance. The direction they take is very much a function of all the variables discussed above as well as the scope, level, and duration of the activities. Like other non-linear complex social processes, threshold values are likely to exist as tolerance levels for nations whose capacity for a mediated response to such activities differ.

On the other hand, structural activities—those which have an immediate and direct effect on the social and/or political structure of the nation involved—differ from process activity more in degree than in kind. They include economic or political disasters, irregular changes in leadership, fundamental changes in constitutions, changes in basic freedoms, changes in national symbols, changes in ideology, assassinations of major political figures, coups, armed revolts, etc.

The distinction between the two activities of course is not perfect, as there is obviously some overlap. The overlap may be rendered tolerable by judicious operationalization of indicators. To be sure, the dynamic relationship between them is a more important concern than definitional imprecision. Quite clearly, process activities affect structural activities which in turn affect process activities. The diagram below is one possible reflection of the interplay of effects.

As is clear from the diagram, the distinction is--as was previously stated--more of degree than of kind, for at some level of magnitude and duration process activities become structural ones. Both activities are either

Figure 2. Dynamics of Process Activities and Structural Activities



constantly being absorbed back into the system or they rise to a new level. Process activities must first become structural activities and structural activities must reach a critical level before internal breakdown occurs.

Under the present conception it is possible for a socio-political system to undergo structural transformation without disruptive political violence. It is also true under this conception that a stable system is always required to respond to new demands which may develop into new activities. The extent to which they are absorbed into the system is the extent to which a particular system will tolerate internal disturbance. Once the level of tolerance is breached (magnitude, scope, and duration index this change), the structure of the system becomes affected, militia mobilizations occur, leaders are thrown out of office, armed revolts occur, political prisoners are shot, wholesale governmental sanctions are imposed, etc. Even after reaching this level the possibility of absorption is not precluded. When structural activities are absorbed into the system, an adaptive system transformation may be said to have taken place. When they are not absorbed into the system a new and final level is reached: the level of total system breakdown. During this period the system undergoes a violent non-adaptive system transformation. The results may be a new system or no system at all. The operational implications of such a model provide the basis by which a reasonable set of indicators may be constructed. The task of construction will be delayed to a later section so that we may introduce the second point of concern: the relationship between internal instability and external conflict.

INTERNAL PROCESSES AS CORRELATES TO EXTERNAL VIOLENCE

Historically scholars have attempted to formalize a long suspected fact of dom. stic behavior: that internal disturbance leads to external disturbance, and though all the facts are not in yet, the findings to date are not overwhelmingly convincing. The most plausible of the notions which link internal violence to external is the so-called "devil hypothesis" which suggests that national leaders are often willing to instigate external crises as a necessary evil to divert attention away from internal ills. In the field of international relations such noted scholars as Waltz, Hoffman, and Rosenau, among others, give credence to the devil hypothesis. Other scholars such as Gurr—the devil hypothesis aside—have found co: relations between internal and external violence to exist but to be very weak. Similarly, but in a much broader context, Rummel and Tanter have uncovered a supporting set of findings that show there is a relationship between internal and external violence but like others, they find the relationships to be weak. The scope of this task will not allow even a minimum critique of hyoptheses such as those posed and tested by these scholars. We will only mention in passing that such relationships are weak when they exist. And that, so far, little convincing evidence exists which would contradict these findings. When the arrows of the hypothesized relationships are reversed, substantiation becomes more compelling, but that particular set of relationships is not at the base of our concerns here.

Ancther point of view to take with regard to the internal-external issue is that suggested by practitioners. Simply put, it is that all external relations eminate from internal relations and thus it must be true <u>a fortiori</u> that violent internal relation must also generate external relations, some of which are violent. The implications of such logic are

not compelling. Nevertheless, there is some element of truth to this assertion. If we could focus our attention for a moment on the way in which internal activities serve to shape and mediate external actions--which they must be definition--instead of on the possible arrangements of correlations between simply manifested external outputs, then the academic and the practical conception of its effect would be more nearly congruent. The logically compelling conclusion for us to consider appears at the intersection of the two conceptions: it is indeed true that the "internal" effects the "external" but the ways in which it (the internal) effect the external are not simply in a correlational fashion. The functional relationship between internal violence and externally manifested behavior is more nearly--it may by argued--a many-to-one mapping. Internal violence may or may not manifest itself as external behavior. When it does, it may produce many kinds of external behaviors. In other words, the variables which correlate highly with external violence are many and complex ones and cannot be limited to internal violence alone. The academic's perspective is too limited and the practitioners too broad.

THE INTERNAL-EXTERNAL MODEL

The foregoing argument aside, one cannot deny that internal violence presents opportunities for external violence. It may for instance entice a waiting opponent to attack, or give a ruler an excuse to initiate hostilities with an opponent. In the scheme of the totality of hostile occurrences though, such incidents occur with predictably low probabilities. Consequently a theory built along lines with these points as its basis is likely to be marginal in its use and low in the power of

the propositions which result from it. Having said this, we propose to adopt the opposing strategy, to examine the structural and process activities within a nation in order to determine how they help to shape and structure external relations, rather than attempt to construct internal indicators which predict to external violence. The way this can be done most easily is through considerations involving domestic issues.

Domestic Issues

The notion of issues is a complex one to explicate analytically and has not been treated with much rigor in the literature of political science. What little scientific treatment it has received can be attributed to Rosenau, Key, Lowi, and Bauer.[11]

Webster defines an issue as "a point in debate on which the parties take affirmative and negative positions." Rosenau defines an issue as "any conflict over values or interests among identifiable individuals or groups."[12] The two definitions may serve as a point of departure toward developing a domestic issue taxonomy. The Webster definition is scarcely a detail in the realm of political science as it leaves no basis for delimitation. Whereas it is true that all "points of contention"

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[11] See J. N. Rosenau, "Foreign Policy as an Issue-Area" in The Scientific Study of Foreign Policy; V. O. Key, Jr., Public Opinion and American Democracy (New York: Knopf, 1961), Chapter 9; Theodore J. Lowi, At the Pleasure of the Major (New York: Free Press, 1964), Chapters 6 & 7; Raymond A. Bauer, et al., American Business and Policy: The Politics of Foreign Trade (New York: Atherton 1963). Also Robert Dahl, Who Governs? Democracy and Power in an American City (New Haven: Yale University Press, 1969).

[12] op cit., page 405.

are potential issues, the converse is not true. The Rosenau definition on the other hand makes it clear that an issue is an area of concern where points of conflict or contention may be debated. Thus it seems more accurate following the Rosenau definition to think of issues as areas of contention or areas of concern in which clusters of related topics of contention fall. For the present analysis we need a rather precise definition of issues. The foregoing discussion leads us to adopt the following as our definition of domestic issues. An issue is (1) a topic or problem of current concern (not necessarily expressible as a point of contention) which (2) generates a cluster of related topics or problems of interest related to specific and identifiable groups over a finite period of time, and which, (3) serve as generalized focal points for the topics within the cluster.

Our immediate concern is with a simple typology of issues which will allow us to identify and separate domestic issues from foreign issues; and which, more specifically, will allow us to determine which domestic issues most likely affect the environment of international polities as opposed to those which do not.

Rosenau suggests three kinds of "issue-area" typologies: (1) value typology wherein issues are clustered together on the basis of the kinds of values or interests over which controversy ensues, (2) process typology in which issues are clustered together on the basis of the kinds of processes through which they are conducted and settled, and (3) unit topology where issues are clustered together on the basis of the kinds of units in or for which they are contested. The basic typological structure leads us to adopt the following taxonomy.

ISSUE TAXONOMY

Type	Values	Process	Unit	
Domestic	Distribution of resources, regulation of the use of resources, redistribution of resources among national subgroups	Government to subnational and subnational to government	Subnational actors governmental institution	(Private citizens and groups)
Domestic—Foreign	acquisition and dissemination of resources to other nations	Subnational to government government to government	National actors	Government officials and organizations
Foreign—Domestic	acquisition and dissemination of resources from other nations	Inter-governmental	National actors	IGO's government

The point of the taxonomy is to highlight identifiable differences between strictly domestic issues and related domestic-foreign issues and foreign-domestic issues. The motives of the design are apparent: to deal with the very complex and imposing problems of the effects of internal on the external and vice versa. Rosenau has warned against the evils of viewing all policies as issue-dependent. As he puts it; [such a view] "provides a simple and effective means of cutting off any discussion of the political process." (Rosenau, op cit., page 402).

III. INDICATOR CONSTRUCTION

PRE-OPERATIONAL CONSIDERATIONS

The indicators to be constructed will be a first attempt to quantify semi-macro internal processes. As such it is not designated as a causal model, but as a series of indexes which track and monitor internal components known to be associated with internal system breakdown. The Eisenstadt, Gurr, Laswell paradigms will be integrated and operationalized at a subsystem level. The indicators will attempt to indicate or track the following systemic processes:

(1) Power struggles
(2) Social adaptation
(3) Social integration and absorption
(4) Systemic anomie
(5) Systemic participation
(6) Governmental sanctions
(7) Counter-elite control
(8) National polarization
(9) Traditions of violence
(10) External or exogenous impacts

To the extent that event-interaction data can measure these concepts of domestic processes, the task can be said to be accomplished. In some cases the operational indices are poor representative measures for the domestic processes they are designed to measure. Hopefully, future analyses of this sort will include in addition to event interaction data, public opinion poll data, and analysis of cross-cultural political

symbols. Finally, our aim is to portray quantities of instability and change for purposes of comparative analysis. To do so requires one to accept the proposition that violent events are indeed comparable and that one can sensibly add them together. Some believing a knowledge of context of events to be paramount, will reject this proposition outright. Most others, including ourselves, will accept it for certain limited purposes such as a single index of a multivariable process.

PROCESS INDICATORS

1. Index of Political Fractionalization or Cleavage

$$F = 1 - \sqrt{\frac{\sum_{i=1}^{K} \left(\frac{ni}{N}\right)^2 - 1/K}{1 - 1/K}} \qquad (1)$$

where n_i = the total number votes cast (or seats) held by the ith party

N = the total number of votes (or seats)

K = the number of groups

Rae and Taylor categorize cleavage in society into three categories: ascriptive, attitudinal, and behavioral. By ascriptive is meant such "trait" cleavages as race or caste.[13] By attitudinal is meant such "opinion" cleavages as ideology or preference. By behavioral is meant "act" cleavages as those elicited through voting and organizational membership. The index above may be used to compute cleavages of all three types. All that is required is that the necessary substitutions be made.

(a) Thus the degree of ethnic fractionalization within a given political system is given by (1) with N_i being the number member of the ith ethnic group and N being the total in all groups.

[13] Douglas W. Rae and Michael Taylor, The Analysis of Political Cleavages (New Haven: Yale University Press, 1970), page 1.

(b) The degree of fractionalization on ideological issues is also given by (1) where N_i is the member of subnational actors of interest group i supporting (or opposing) an issue stand, K the total number of interest groups, and N is the total numbers of subnational actors.

(c) Fragmentation of political participation is computed using (1) with N_i = number votes cast by political subclass i and N is the total number of votes cast by all subclasses.

2. Internal Relations Index

$$R_i = (P_i - N_i)/P_i + N_i + \frac{NE_i}{2}$$

where:

P_i = number of positive acts between government and subnational actor i

n_i = number of negative acts between government and subnational actor i

ne_i = number of neutral acts between government and subnational actor i

The relations index measures the net difference in positive and negative behavior by both government and major subnational groups. Its interpretation is the same as that for international processes.

3. Internal Style Index

$$S_i^j = (P_i - N_i)/P_i + N_i + \frac{NE_i}{2}$$

where:

P_i, N_i, and NE_i refer to the same groups as those in (2) and j refers to regime and i refers to any one of the sub-groups.

The measure gives a dyadic index of the peoples' attitude toward government and the government's attitude toward the people. The index may be computed by sub-groups or by all sub-groups as a unit. It may also be computed on an issue-by-issue basis.

The directional relationships of behavior between people and rulers resulting from the style measure is analyzed presently. The matrix below will serve as a focal point for discussion.

DIRECTIONAL RELATIONSHIP BETWEEN RULED AND RULERS
(Holding Issues Constant)

		People to government	
		+	-
Government to people	+	(Mutual satisfaction high stability)	(tension toward change low stability)
	-	(Regime contempt-low stability)	(mutual contempt-high instability)

The matrix summarizes possible dyadic attitudes between people and rulers. The matrix may be computed directly by aggregating events by polarity and assessing the differences between positive and negative totals. The result is a measure of their respective attitudes toward each other. The attitudes are often indicative of a tendency toward instability or a tendency towards change.

As is indicated by the matrix, when the governments' and peoples' attitudes are mutually positive, then high stability results. The

status-quo is secure. Everyone is happy. Demands and supports are mutually reinforcing. On the other hand, when the peoples' attitude toward the government is negative while the government's attitude is positive, the political situation may be described as unstable. It indicates that the people are dissatisfied with the government's policies functioning or structure (or all of these, issue topics can help determine which). If it is the government that has the negative attitude and the people a positive one, then the political system is said to have the potential for instability. It is an indication of regime contempt for the people. Such contempt is usually manifested as increased controls, government sanctions, increased government corruption, increased isolation from people (fewer total events with larger proportions of category 700, cancelled events, reduced relations, violation of agreement, etc.). Such a state of relations is unstable, Finally, if both the government's and the peoples' attitudes are negative, high instability results. No one is happy. The status quo received a serious challenge, change may be imminent.

4. Regime Support

$$\frac{\text{Number Pro-gov. primary subgroups - number anti-gov. primary subgroup}}{\text{Total number primary subgroups}}$$

Easton claims individuals of certain status feel efficacious enough to articulate a political position. These persons and the groups they represent exercise an important measure of control over the number of demands put into the political system. A measure of a regime's strength is directly proportional to the number of such group which supports the regime. Indicator four is an index which attempts to measure this. The pro and anti-government status is determined by

whether or not the internal style index is positive or negative. Subgroups that produce a neutral value are considered non-supporting of the regime and are counted as anti-regime. The measure ranges between +1 and -1, with positive values indicating regime support and zero or negative values indicating a lack of regime support.

5. Degree of Adherence to Ideology of Ruling Elite

$$DI = \frac{A_1P - A_2N}{A_1P + A_2N}$$

where:

A_1 = total number of groups contributing to positive interactions towards regime and A_2 = total number of groups contributing to negative interactions towards regime.

The measure is weighted against regime "coaching." If all regime support eminating from a single source it is not weighted as heavily as regime support eminating from several sources. Likewise, isolated opposition does not receive the same weight as concerned opposition. Lasswell and Kaplan stress the importance of adherence to ideology of regime as being fundamental to regime support and hence to its stability.

6. Stability and Relative Depravation

$$\frac{\text{Positive Government Deeds + Negative Symbolic Actions - (Negative Deeds + Negative Symbolic Actions)}}{\text{Subnational Demands + Government Promises}}$$

Gurr and Lasswell stress the relationship between relative depravation or gap between expectations and real political rewards. Indicator (6) is an attempt to measure this phenomenon using evemt data. The events computed into this formula may be restricted to value issues as they are more reliably related to citizen aspirations and expectations. The event categories which correspond to symbolic actions and deeds are given below:

On Value Issues

+	Words (Symbolic Actions)
671	Approve, endorse, praise, thanks
672	Promise, agree to future action, agree to meet
692	Propose
675	Give friendly warning

+	Deeds
681	Grant
682	Reward
683	Yield
674	Formal agreement

-	Words
703	Protest, complain
704	Deny

-	Deeds
711	Cancel, postpone
712	Reduce

MEASURES OF STRUCTURAL PROCESSES

(1) System Capacity for Absorption and Integration (Violence Threshold)

$$\frac{\text{Number acts of violence prior to latest irregular transfer of power (or breakdown in system.)}}{\text{Number of years since last irregular transfer (or breakdown in system) + number coups (number constitutional changes regarding order + number new institutions created to deal with order).}}$$

(2) Tradition Index

(Age of national institutions + number consecutive years with regular power transfers)/number system breakdowns since independence.

(3) Adaptation Index

Total number non-violent upheavals which resulted in major structural changes minus total number violent upheavals.

(4) Exogenous Index

(A) Impact of external on internal

Number of process activities related to external issues.

(B) Total number of subnational interactions with international actors/total subnational interactions.

(5) Governmental Response Index

$$\frac{\sum(x_i f_i)}{\sum f_i} \times \frac{\text{government sanctions}}{\text{demonstrations}}$$

where:

x_i is the score or weight assigned to selected domestic events

f_i is the frequency of each event

The scores and the general categories to which they apply are:

0 = elections

1 = executive adjustments

2 = peaceful demonstrations and non-violent sanctions

3 = violent demonstrations and violent sanctions

4 = coups and revolutions

A lower value for this component of the indicator is associated with generally peaceful domestic activity. The value increases towards its limit of 4 as domestic violence increases.

Though the ordering of the categories with reference to political unrest seems intuitively valid, the weights assigned each category are arbitrary in that they are not intended to imply, for instance, that 4 executive adjustments are equivalent to 1 revolution. The scores for each general event class may be adjusted as experience in application of the indicator dictates.

The right-hand component of the indicator is an expression of government reaction to the number of demonstrations. It may be interpreted

as the government's perception of threat from the demonstrations. A high value indicates that a government perceives a greater threat from domestic unrest than does a low value. Thus the indicator measures the interaction between the level of domestic unrest and the perceived threat from that unrest.

Table 1 lists the DECS events used in the calculation of the domestic violence index and their assigned scores.

TABLE 1

Score		DECS Event Code
0	regular power transfers	601
	regular executive transfers	602
	renewal of executive tenure	603
	elections	661, 662
1	irregular power transfers	621
	dissolution of legislature	622
	fall of cabinet	623
	resignation of significant person	612
	dismissal of significant person	613
2	political, general strikes	632, 631
	anti-government demonstration	634
	symbolic demonstration	633, 638
	ban demonstration	722
	order halt	724
	political arrest	726
	protest, complain	703
	sanctions against organization	721
3	assassinations, attempts	641, 642
	riots	644
	mutiny	645
	sabotage	646
	terrorism	647

TABLE 1 (continued)

Score		DECS Event Code
3	seize government property, personnel	636, 637
	declare martial law	725
	curtail press freedom	727
	execute	731
	attack crowd	732.
	produce injury, death	733
	symbolic suicides	643
4	attempted coup	635
	guerilla warfare	648
	civil war	649
	coup	624
	revolution	625

Table 2 lists the events used in the calculation of perceived threat.

TABLE 2

government sanctions
detain or arrest persons
deny rights, ban
demonstrations
non-military demonstrations, strikes
non-military, non-injury destructive act
non-military, injury destructive act
riot
execute or assassinate

(6) Generalized Structural Measurement of Domestic Violence

The Feierabends use as a measure of stability or internally aggressive behavior the following scale:

Feierabends Scale 1*

0 - General election

1 - Resignation, dismissal of cabinet officer, dissolution of legislative

2 - Peaceful demonstrations, strikes, declarations of martial law

3 - Riots, assassinations

4 - Large scale arrests, plots, terrorism

5 - Revolts, coups d'etat

6 - Revolution or civil war

The Feierabends generalized measure of domestic violence was constructed by ranking each country on the scale from 0 to 6 by the most unstable event to have happened during a given period. Within each category of stability (0-6) a country was rank ordered by total number of unstable events during the time period given.

The index described here will be similar to that of the Feierabends, with certain modifications. We will first divide the events by actor, i.e., government and non-government, and by the event most likely to

* A similar listing of these scaled values is given on the following pages with accompanying DECS II codes for each category.

Physical Protest - Non-Violence

631	Political, general strikes
632	Economic, other strike
633	Boycott
634	Anti-government demonstrations
636	Sigure of government property
637	Singure of government personnel
638	Symbolic demonstrations

Physical Expressions of Support

651	Pro-government demonstrations
652	Symbolic demonstrations of support

Physical Protest - Violence

641	Assasinations
642	Attempted Assasinations
643	Suicides as demonstrations
644	Riots
645	Mutiny
646	Sabotage
647	Terrorism, armed attacks
648	Guerilla warfare
649	Civil War

Government, Non-Violent

721	Sanctions against organization or group
722	Ban demonstration
723	Outlaw political group
724	Order to halt strike, boycott, protest
725	Declare Martial Law or state of emergency

Government Sanctions, Violent

731 Execute

732 Attack crowd, produce injuries or death

733 Produce injury or death to individual not in crowd

be associated with that actor, i.e., arrests and strikes, demonstrations. The scale below will be used in the same sense as that above.

0 - Elections
1 - Executive adjustments
2 - Demonstrations
3 - Riots
4 - Coups and Revolutions
2 - Non-violent sanctions (government)
3 - Violent Sanctions (government)

To compute the index we multiply the frequency of events contained in each scale value category by the scale value itself and sum the result, then divide by the total observed frequency. The resulting value ranges between 0 and 4. The index computation may be expressed as:

$$\frac{\Sigma(f\,s)}{F}$$

Where: f = frequency
s = scale value
F = total frequency

In this manner mean values for a single year of data can be compared with the mean values of the other years in order to determine if levels of violence have generally been on the increase or decrease.

For example, using the INDECS data for the United States from 1968 through 1971, the mean values can be computed and compared as on the following page.

Year	Mean Value	x (t) - x (t-1)
1968	2.46917	
1969	2.49833	(+) .02916
1970	2.29417	(-) .20416
1971	2.40833	.11416

What we can say for this is that the level of violence increased in 1969 over 1968; decreased in 1970 over 1969; and increased in 1971 over 1970.

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DYAD COVERAGE
IN THE NEW YORK TIMES

Gary A. Hill

BACKGROUND

The end of 1973 will mark the eighth year of data in the WEIS/CACI event collection. Dating from January 1, 1966 the Weis data presently consist of over 50,000 records of the official interactions between nations and other important international bodies. The data collection has provided an information base for numerous studies on international affairs and its event-based methodology has been adapted in various forms for a wide range of research purposes. Despite the time spand and size of the collection one of the first lessons apparent to its users is the extreme in the world are equally represented in the data collection. Because of these inequities, the data user should be familiar with the geographical distribution of the data prior to designing and engaging in any large scale investigation. If this preliminary task is neglected, it is highly probable that original research plans will, at best, have to be revised or, at worst, abandoned due to the scarcity or absence of data for nations included in the research design.

A number of reports have been issued which assist the user in understanding the geographical scope and range of the WEIS data. Initially the WEIS staff at USC presented yearly technical reports (the "Flow of EVENTS" reports) to summarize the information contained in the data set. More recently the C. A. C. I. staff has issued supplementary memoranda which also document the data set. Primarily the documentation has consisted of summaries of the three major elements in the WEIS coding system - Actor Event, and Target. The purpose has been to describe which actors, events, and target categories constitute the major and minor portions of the data collection. This type of information has been of partial assistance to those who use the data in their research but who require some initial guidance as to which actors and targets manifest sufficient information in the collection.

DYADIC COVERAGE

One of the drawbacks of documentation presented in the above manner is that is may distort the basic character of the information collected or mislead the researcher into false assumptions as to the quantity of data available for this analyses. Generally the most active nations are described, or the most frequently used event categories are reported. This information, however, neglects the structure of the event which is dyadic in nature, or in other words, involves actor/target pairs.

This problem becomes more apparent if one considers it in the following terms. Given approximately 160 actors and 50,000 event records, the average actor would have over 300 event records. However, the structure of an event reflects both an actor and a target. Thus each event should be considered in pairwise, or dyadic fashion. Viewed from this prespective the number of possible dyads (actor/target pairs) exceeds 13,000 or an average of only 3 to 4 events per dyad. This obviously underscores research limitations not apparent when the data are viewed monadically, i.e., as event reports associated with the total output of a single actor.

The question of averages however, is not very interesting. Rather it is the question of how the data are distributed throughout these 13,000 dyads. This paper is addressed specifically to that problem. It identifies those dyads which constitute the principal coverage of the WEIS data collection. In order to present this information in a concise manner the data re organized into a series of actor/target matrices grouped on a regional basis. The matrices, hoepfully, will provide a reference for anyone needing to quickly identify the amount of data associated with country pairs pertinent to their research interests.

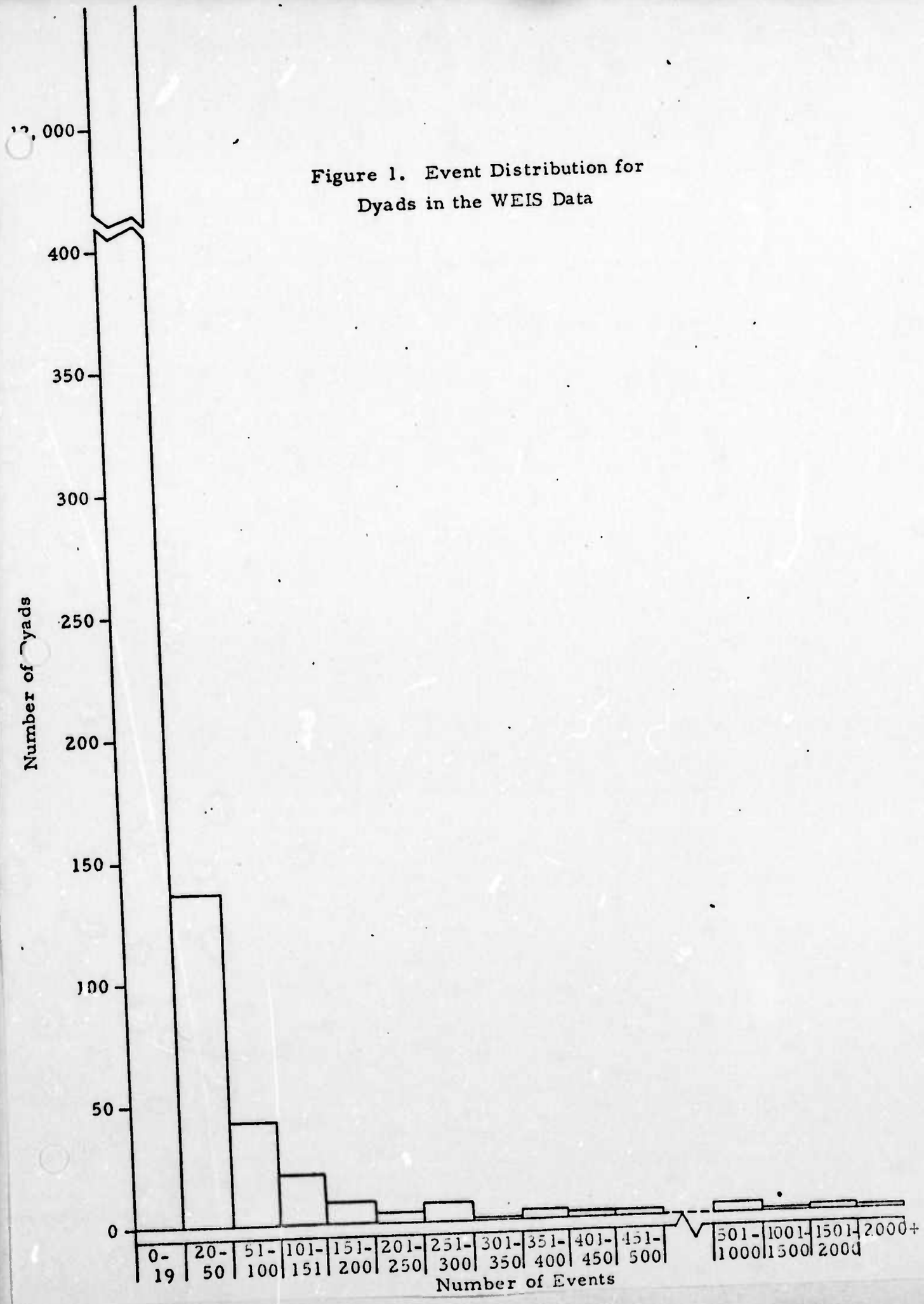
The time frame covered by these matrix summaries represents a 75-month period from January 1, 1966 through March 31, 1972. It contains 47,389 event records. To be included in a matrix, a dyad was required to contain

at least 20 interactions during this 74-month time period. An important note concerns the use of the WEIS event categories. The indicators developed at C. A. C. I. (Involvement, Relations, Style) are based on a partition of the original 63 WEIS event categories into eight groups (Groups 0-8). Group 0 event categories are not used in the indicator calculations but are included in the following summaries. Therefore the dyad totals in the matrices will not always accurately reflect the amount of information available for calculating the indicators.

An interesting preliminary view of the dyadic component of the data collection is seen in Figure 1. This figure illustrates how the data are concentrated into relatively few dyads. Of the nearly 13,000 dyads which exist in the data collection there are only 241 dyads which meet the requirement of 20 or more interactions during the 75-month period. Furthermore, these 241 dyads represent 28,693 events; in relative terms this means that approximately 2% of the dyads account for over 60% of the data. Event this percentage figure is not an accurate reflection of the concentration of coverage since the data for the multi-lateral (998) and unidentified (999) target categories are excluded from this 241 dyad set. These latter two target categories account for over 11,000 of the 47,389 events (approximately 25%) in the 75 mounths. Thus by discounting these 11,000 events the 241 dyads represent 80% of the remaining data.

We now turn to the regional summaries of actor/target matrices in order to identify these dyads and document the data concentration in the event collection. The matrices are arranged with actors in the rows and targets in the columns. Thus during the 75-month period the United States (actor) initiated 708 interactions toward the USSR (target) while the USSR (actor) initiated 872 interactions toward the United States (target). The total for the country pair is then obtained by adding these two cell entries.

Figure 1. Event Distribution for Dyads in the WEIS Data



WORLD SUMMARY-NEW Y(: TIMES INTERACTION MATRIX

	USA	USR	CPR	UNK	FRN	GMW	NAT	WAR	Europe	Latin America	ISR	Arabs	Sub-Sah. Africa	NIG/BIA	IND/PAK	KOS/KON	Indochina	JAP	Asia	UNO
USA		708	107	130	115	124	280	102	119	274	203	339	85	51	212	161	1969	135	173	281
USR	872		252	114	89	156	91	261	63	39	121	198		12	86	10	101[l]	54		116
CPR	332	279		82	15		25	20[c]	18[d]				13[i]		117		103	52	64	30
UNK	137	24	47		43	53	22		66		24	48	83	20	10					71
FRN	150	106	11	22		66	39				30	23					18[n]			40
GMW	132	108		50	75			161	10[f]		15									
NAT	263	93	23	21	?		31[a]		35											72
WAR	147	216	16[c]			268		137[b]	21[g]											
Europe	163	92	13[d]	105		10[f]	25	22[g]				15[h]	20[k]							20[e]
Latin America	354	35								71										
ISR	175	64		26	32	13						1247								138
Arabs	564	121		66	34				15[h]		1224	1219								222
Sub-Saharan Africa	62		9[i]	114					13[k]				64							22
NIG/BIA	36	9		21										165						29[j]
IND/PAK	183	81	78	11											601					63
KOS/KON	182	10														181				21
Indochina	1872	51[l]	49		18[n]												3913		14[m]	66
JAP	197	50	23																	
Asia	209		60														12[m]		139	
UNO	114	27	19	47	19		50		24[e]		234	131	31[j]	21	47	28	32			68

Footnotes to cell entries refer to country accounting for the interactions represented in the cell matrix, e.g., "m" means that Thailand and Malaysia comprise the Asia grouping which initiates and receives interactions from Indochina.

[a] GRC/TUR
[b] All w/ CZE
[c] w/ RUM
[d] w/ ALB
[e] w/ CYP
[f] YUG
[g] w/ YUG
[h] w/ YUG
[i] w/ TAZ
[j] w/ SAF
[k] BEL/COP
[l] w/ VTN
[m] TAI/MAL
[n] w/ VTN

EUROPEAN INTERACTION MATRIX

	USA	USR	CPR	UNO	NAT	CAN	UNK	NTH	BEL	FRN	POR	CMW	ITA	GRC	TUR	WAR	GME	POL	HUN	CZE	RUM	IRE	SPN	AUS	SWZ	ALB	MLT	YUG	CYP	FIN	SWD	EEC
USA		708	107	281	74	69	130		7	115	16	124	36	46	32		23	27	9	19	24		46		11			43			19	42
USR	872		252	116	19	31	114			89		156	16		25		31	20	12	174	24			14		6		17		17	9	
CPR	332	279		30		13	82	12		15											20					18						
UNO	114	27	19	68		10	47			19	17			15	8														24			
NAT	19	13								6																	10					
CAN	84	39	14	29			9			25																						
UNK	137	124	47	71		11				43		53		11								23	19				24					30
NTH			9																													
BEL	17																															
FRN	150	106	11	40	17	22	56					66																				30
POR	16			17																												
CMW	132	108					50			75							95	40		16	10							10					
ITA	44	25																														
GRC	42			13			12								14														25			
TUR	41	16		13										17																		
WAR																				14												
GME	23	26										185								34												
POL	39	24										43								28												
HUN	19	10																		12												
CZE	45	118										27				17	15	7	10									10				
RUM	21	38	16									13																11				
IRE							48																									
SPN	55						35																									
AUS		9																														
SWZ	14																															
ALB		21	13																													
MLT					10		22																									
YUG	44	33										10								11	11											
CYP				20										15																		
FIN		17																														
SWD	50	12																														
EEC	40						19			7																						32

ASIAN INTERACTION MATRIX

	USA	USR	CPR	MON	CHT	HOK	JAP	MAL	SIN	PHI	INS	AUL	NEW	KON	KOS	IND	BGD	PAK	BUR	TAI	CAM	LAO	LAP	VTN	VTS	VCG	UNK	FRN	UNO
USA					52		135		8	43	27	38	5	75	86	118	7	87		63	118	34	2	1260	303	189			
USR							54							10		51		35						101					
CPR				6	11	14	52				33					56		37	24					86		17			
MON			16																										
CHT	44		13																										
HOK			14																										
JAP	197	50	23							26	27									12									
MAL											11																		
SIN	15																												
PHI	60							23																					
INS	21		17					35	17																				
AUL	53																												21
NEW	16														82														
KON	95	10												99															
KOS	87																	16	269								11		27
IND	116	51	44														10		12										
BGD	15																283	11											36
PAK	52	30	27																										
BUR			7																		29			14					
TAI	50							14												18				366	65	116			21
CAM	149																						45	173					
LAO	29																					45							
LAP	26																			19	388	162			927	25		18	26
VTN	1159	51	43																		80			847		220			19
VTS	167																				104			16	254				
VCG	292		6																										
UNK																	10							18					
FRN															28		22		25		5			20	7				
UNO																													

MIDDLE EAST INTERACTION MATRIX

	USA	USR	CPR	UNO	ISR	ALG	LBY	SUD	IRQ	UAR	SYR	LEB	JOR	TUN	SAU	MOR	YEM	IRN	PLO	UNK	FRN	GMW	YUG	GRC	TUR
USA					203	13	12		12	127	13	12	60	8	12	14	11	24	11						32
USR					121	16			23	130	29														25
CPR																									
UNO					234					60	17	6	40			8									
ISR	175	64		138						543	135	77	280						212	26	32	13			
ALG	25	9																			19				
LBY	12							11		23	11									16					
SUD							13			22															
IRQ	25	19								18	15		14					12		12					
UAR	275	90		115	554		26	19	15		34	13	64		34		13		30	28	15		15		
SYR	39	23		15	122		10		12	31		22	43												
LEB	21			14	69					11	15								56						
JOR	57			65	252				10	41	27				9				182	10					
TUN	12																								
SAU	14									29			13												
MOR	9			13																					
YEM	13									7															
IRN	23								13																
PLO	39				227					18		67	216												
UNK					24		15		8	15			10												
FRN					30	15				8															
GMW					15																				
YUG										15															
GRC																									17
TUR	41	16																						14	

LATIN AMERICA INTERACTION MATRIX

	USA	USR	CPR	CAN	CUB	MEX	HON	ELS	PAN	COL	ECU	PER	BRA	BOL	CHL	ARG	OAS
USA				69	38	51			18	10	20	38	36	12	36	15	29
USR				31	28										11		
CPR				13													
CAN	84	39	14														
CUB	72	26													10		
MEX	45																
HON								24									
ELS							27										
PAN	24																
COL	17																
ECU	40																
PER	40																
BRA	37																
BOL	16																
CHL	41	9			10												
ARG	22																
OAS	13																11

SUB-SAHARAN AFRICA INTERACTION MATRIX

	USA	USR	CPR	NIG	BIA	COP	UGA	TAZ	ZAM	RHO	SAF	GHA	ETH	UNK	BEL	UNO
USA				24	27	18			7	16	12	16	16			
USR				12												
CPR								13								
NIG	26	9			77									21		29
BIA*	10			88												
COP	10														13	
UGA								19								
TAZ			9				16									
ZAM	16									16				30		
RHO	5								13					68		
SAF	12													16		22
GHA	9															
ETH	10															
UNK				20					11	66	6					
BEL						20										
UNO				21							31					

*No longer a state

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DISPLAY CAPABILITIES FOR INDICATOR PROGRAM DATA

Jeffrey A. Krend

INTRODUCTION

This paper is intended to provide preliminary documentation, operating instructions and sample applications for a software package designed to enable rapid calculation and display of selected data and indicators.

Scope. This package provides tabular and/or graphic display capabilities for the following general data and indicator types: (1) WEIS analytic and descriptive data; (2) indicators derived from event data, such as the "relations" and "style" measures; (3) characteristics data, such as GNP, population, military expenditures; and (4) indicators derived from characteristics data, such as "national security emphasis," "power," and "stress".

Combinations of specific data sets and indicators have been organized into six computing and display options, as follows:

1 -- TABULAR DISPLAY OF CONCENTRATION MEASURES FOR 19 MAJOR ACTOR NATIONS RELATIVE TO MORE THAN 150 POSSIBLE TARGET NATIONS.

2 -- TABLES OR PLOTS OF RELATIONS AND INVOLVEMENT INDICATORS FOR ANY OF THE 170 NATIONS-PAIRS ON FILE, PLUS ISSUE-ORIENTED RELATIONS AND INVOLVEMENT INDICATORS FOR SELECTED PARIS.

3 -- TABLES OR PLOTS OF STYLE AND PARTICIPATION INDICATORS FOR ANY OF THE 170 NATION-PAIRS ON FILE, PLUS ISSUE-ORIENTED STYLE AND PARTICIPATION INDICATORS FOR SELECTED PAIRS.

4 -- TABLES OR PLOTS OF MONTHLY SMOOTHED OR ACTUAL EVENT DATA FREQUENCIES, FOR ANY OF THE 170 NATION-PAIRS, PLUS SELECTED ISSUE-CODED PAIRS.

5 -- TEXTUAL AND NUMERICAL DESCRIPTIONS OF INDIVIDUAL EVENTS REPRESENTING A FINAL DISAGGREGATION OF EVENT DATA. ONLY 1969-1972 USA-JAPAN DATA ARE AVAILABLE FOR THIS DEMONSTRATION.

6 -- RANKS OR PLOTS OF 26 NON-EVENT MEASURES CONSIDERED RELEVANT TO THE ASSESSMENT OF NATIONAL SECURITY CHARACTERISTICS.

Concentration Measures (DEMO1). Concentration is a measure of the basic number of countries in a particular configuration of countries toward which a particular actor nation is directing most of his attention. Concentration measures have been computed for 19 major actors (Table 1) over the period January 1, 1966 through June 30, 1972. For this time period, ten data intervals were constructed consisting of 24 months of event data, where each 24 month interval overlaps the previous interval by 18 months for smoothing purposes. Thus, time period 1 dates from January 1966 through June 1968, and so on.

For most major actors, measures are available with respect to four target groups; (1) the "world" of 155 target nations at time t; (2) the ten primary target countries at time t; (3) the primary target regions (Latin America, Eastern Europe, Western Europe, South/Southeast Asia, Far East, North Africa/Middle East, and Sub-Saharan Africa); and (4) the ten primary target countries within selected regions. For each such partitioning, the user is given the option of basing the calculations on all C.A.C.I. event groups (1-7), or on negative events groups only. (Groups 1-3).

TABLE 1

MAJOR ACTORS FOR WHICH CONCENTRATION MEASURES ARE AVAILABLE

Actor	How Recognized by the Program
United States	USA
Soviet Union	USR
Chinese People's Republic	CPR
Japan	JAP
United Kingdom	UNK
France	FRN
West Germany	GMW
India	IND
Pakistan	PAK
North Vietnam	VTN
South Vietnam	VTS
Israel	ISR
United Arab Republic	UAR
North Korea	KON
South Korea	KOS
Yugoslavia	YUG
Czechoslovakia	CZE'
East Germany	GME
Cambodia	CAM

Table 2 consists of concentration measures for Japan relative to the primary targets in each of the ten time periods. Output consists of the names of the ten countries toward which Japanese activity was greatest in each time period, rank-ordered from left to right. Also presented are the event frequencies (A-to-B only) associated with the target names. The concentration measure for this "constituency" is presented in column 12 of the second table in Table 2. Participation (the smoothed, A-to-B event frequency for that constituency) is presented in column 13.

Relations and Involvement Indicators. (DEMO2). Relations and Involvement measures may be computed and displayed for any of the 170 nation-pairs currently stored on the G.E. system. In addition, 12 additional dyads are available which have been coded according to political, military, and economic issues. A complete list of the 182 dyads thus available to this demonstration package will be found in Table 3.

When the relations/involvement option is invoked (option 2), the program asks the user to make a number of choices. The format of the questions and answers is depicted in Table 4. In Table 4, the user indicated that three dyads (42, 65, 86) are to be plotted using 24-month periods with six-month moving intervals (time option 5). Calculations

TABLE 2.

Concentration Measures for Japan.

```
ENTER DEMO OPTION NUMBER (1 - 6), 0 FOR LIST, 99 TO STOP...?1

SPECIFY ACTOR COUNTRY (3-LETTER CODE)...?JAP

SPECIFY TARGET GROUP (1-4), OR TYPE ZERO FOR LIST...?0

     TARGET GROUPS CONSIST OF THE FOLLOWING:
 1 -- THE 'WORLD' OF 155 TARGET COUNTRIES IN THE DATA BASE;
 2 -- TEN MOST IMPORTANT (PRIMARY) TARGET COUNTRIES AT TIME t;
 3 -- TEN PRIMARY TARGET REGIONS AT TIME t;
 4 -- TEN PRIMARY TARGET COUNTRIES WITHIN SELECTED REGIONS AT TIME t.

SPECIFY TARGET GROUP (1-4), OR TYPE ZERO FOR LIST...?2

DO YOU WANT TO SEE MEASURES BASED ON ALL SEVEN
C. A. C. I. EVENT GROUPS, OR MEASURES BASED ON NEGA-
TIVE EVENT GROUPS ONLY (0=ALL EVENTS; 1=NEGATIVE EVENTS)...?0

 PRIMARY JAP  TARGET COUNTRIES

  1  USA USR CPR KOS ISR CAN INS PHI VTN IND
  2  USA CPR USR INS ISR VTN KOS CAN PHI IND
  3  USA USR CPR INS ISR VTN IND CHT YUG FRN
  4  USA USR CPR INS IND VTN CHT ISR YUG FRN
  5  USA USR CPR INS KOS AUL IND YUG UNK SIN
  6  USA USR CPR IND KOS AUL VTS KOM GMN SIN
  7  USA USR CPR KOS IND AUL VTS PAK KOM GMN
  8  USA USR KOS CPR AUL SIN VTS IND UNK INS
  9  USA USR CPR IND KOS CHT NOR GMN UNK CAN
 10  USA USR CPR ISR FRN PER INS TAI KOS CHI

 PRIMARY JAP  TARGET COUNTRY FREQUENCIES, CONCENTRATION

  1    29.   12.    7.    4.    3.    3.    2.    2.    2.    2.   3.15    66.
  2    33.   11.    8.    5.    4.    3.    3.    3.    2.    2.   3.65    74.
  3    45.   13.    7.    5.    3.    2.    2.    2.    2.    2.   2.34    83.
  4    52.   12.    9.    3.    3.    2.    2.    2.    2.    2.   2.12    89.
  5    66.   16.    9.    3.    3.    2.    2.    2.    2.    1.   2.05   103.
  6    65.   21.    8.    3.    3.    2.    2.    2.    2.    1.   2.11   109.
  7    64.   13.    6.    5.    3.    2.    2.    2.    2.    2.   1.91   101.
  8    62.   14.    5.    4.    3.    2.    2.    2.    2.    1.   1.89    97.
  9    82.   10.    5.    2.    2.    2.    2.    2.    2.    2.   1.37   111.
 10    94.   16.    6.    4.    3.    3.    2.    2.    2.    2.   1.73   134.

          CONCENTRATION MEASURES FOR JAP , GROUPS 1-7, TIME OPTION 3

MORE CONCENTRATION DISPLAYS (0=YES; 1=NO)...?1
```

TABLE 3

NEW YORK TIMES BASIC DATA FILE (BASDF) STRUCTURE

US-World	001	US-UK	033
USSR-World	002	US-Europe, North Atlantic	034
Rumania-World	003	US-Canada	035
Czechoslovakia-World	004	US-West Germany/W. Berlin	036
Yugoslavia-World	005	US-Turkey	037
CPR-World	006	US-Greece	038
North Vietnam-World	007	US-Laos	039
North Korea-World	008	US-South Vietnam	040
Cuba-World	009	US-Other South East Asia	041
France-World	010	US-Japan	042
Laos-World	011	US-Pakistan	043
South Vietnam-World	012	US-India	044
Japan-World	013	US-Iran	045
Pakistan-World	014	US-Israel	046
India-World	015	US-Arabs	047
Aul., New Zeal.-World	016	US-UAR	048
Iran-World	017	US-North Africa	049
Israel-World	018	US-White Colonial Africa	050
Arabs-World	019	US-Other Sub Saharan Africa	051
UAR-World	020	USSR-Romania	052
UK-World	021	USSR-Czechoslovakia	053
US-USSR	022	USSR-Other East Europe	054
US-Rumania	023	USSR-Yugoslavia	055
US-Czechoslovakia	024	USSR-CPR	056
US-Other East Europe	025	USSR-North Vietnam	057
US-Yugoslavia	026	USSR-North Korea	058
US-CPR	027	USSR-Cuba	059
US-North Vietnam	028	USSR-France	060
US-North Korea	029	USSR-UK	061
US-Cuba	030	USSR-Europe, N. Atlantic	062
US-South America	031	USSR-Laos	063
US-France	032	USSR-South Vietnam	064

USSR-Japan	065	UK-W. Germany	100
USSR-Pakistan	066	Greece-Turkey	101
USSR-India	067	Laos-N. Vietnam	102
USSR-Iran	068	Laos-S. Vietnam	103
USSR-Israel	069	S. Vietnam-Cambodia	104
USSR-Arabs	070	Pakistan-India	105
USSR-UAR	071	Israel-Arabs	106
USSR-N. Africa	072	Arabs-Other S.S. Africa	107
USSR-Other S.S. Africa	073	UAR-Israel	108
USSR-Turkey	074	N. Africa-Israel	109
USSR-W. Germany	075	Wh. Col. Africa-Other S.S. Afr.	110
USSR-Canada	076	Tot E Europe-Eur. N. Atlantic	111
CPR-Rumania	077	Tot E Europe-W. Germany	112
CPR-Other E. Europe	078	Albania-World	113
CPR-N. Vietnam	079	Warsaw-NATO	114
CPR-Taiwan	080	S.S. Africa-World	115
CPR-UK	081	US-Tot E. Europe	116
CPR-Other S S. Africa	082	US-Tot S E. Asia	117
CPR-North Korea	083	USSR-Tot E. Europe	118
CPR-Laos	084	USSR-Tot S.E. Asia	119
CPR-S. Vietnam	085	N. Vietnam-Tot S.E. Asia	120
CPR-Japan	086	US-Argentina	121
CPR-Pakistan	087	US-Brazil	122
CPR-India	088	US-Peru	123
Rumania-Other E. Europe	089	US-Mexico	124
Czech-Other E. Europe	090	US-Sweden	125
N. Vietnam-S. Vietnam	091	US-E. Ger/E. Ber.	126
N. Vietnam-Other SE Asia	092	US-Italy	127
N. Korea-S. Korea	093	US-Spain	128
Cuba-S. America	094	US-Algeria	129
Cuba-Mexico, etc.	095	US-Jordan	130
France-UK	096	US-Indonesia	131
France-Israel	097	US-Taiwan	132
France-W. Germany	098	US-Philippines	133
UK-White Col. Africa	099	US-Thailand	134

US-Cambodia	135
US-S. Korea	136
US-Australia	137
USSR-Finland	138
USSR-E. Ger/E. Ber.	139
USSR-Italy	140
USSR-Albania	141
W. Ger/W. Ber-Czech	142
W.Ger/W.Ber-Poland	143
W.Ger/W. Ber E. Ger/E. Ber	144
UK-Rhodesia	145
UK-Israel	146
UAR-Syria	147
UAR-Jordan	148
Lebanon-Israel	149
Syria-Israel	150
Jordan-Israel	151
CPR-Albania	152
CPR-Indonesia	153
Philippines-Malaysia	154
Malaysia-Indonesia	155
World-World	156
Tot E Eur-Tot E Europe	157
S. America-S. America	158
S. E. Asia-S. E. Asia	159
Arabs-Arabs	160
N. Africa-N. Africa	161
Oth SS Africa-Oth SS Afr	162
Warsaw-Warsaw	163
US-World*	164
N. Vietnam-World*	165
S. Vietnam-World*	166
US-N. Vietnam*	167
N. Vietnam-S. Vietnam*	168
N. Vietnam-Other S.E Asia*	169
N. Vietnam-Tot S.E. Asia*	170
U.S.-Japan Political	171
U.S.-Japan Military	172
U.S.-Japan Economic	173
USSR-CPR Political	174
USSR-CPR Military	175
USSR-CPR Economic	176
Ind-Pak Political	177
Ind-Pak Military	178
Ind-Pak Economic	179
USSR-Czech Political	180
USSR-Czech Military	181
USSR-Czech Economic	182

*Includes North Vietnamese events in Groups 1 and 7 coded since Oct., 1970.

TABLE 4.

Conversational Sequence -- Sample Relations Plot.

(User responses underlined.)

```
RUN DEMO

DEMO          09:52PDT     09/29/73


ENTER DEMO OPTION NUMBER (1 - 6), 0 FOR LIST, 99 TO STOP...?2

HOW MANY DYADS...?3

WHICH DYADS (1-182)...?42 65 86

TIME OPTION (1-5), OR TYPE ZERO FOR LIST...?5

START AT WHAT MONTH (1-61)...?1

DO YOU DESIRE PLOTS OR TABLES (0=PLOTS; 1=TABLES)...?0

DO YOU DESIRE ONE COMPOSITE PLOT, OR   3 SEPARATE
PLOTS (0=COMPOSITE; 1=SEPARATE)...?0
\P\\P\\P\\P\\P\\P\\P\\P\\P\\P\870      (Plotting taking place)
DO YOU DESIRE ADDITIONAL RELATIONS MEASURES (0=YES; 1=NO)...?1


ENTER DEMO OPTION NUMBER (1 - 6), 0 FOR LIST, 99 TO STOP...?99

USED     3.82 UNITS
```

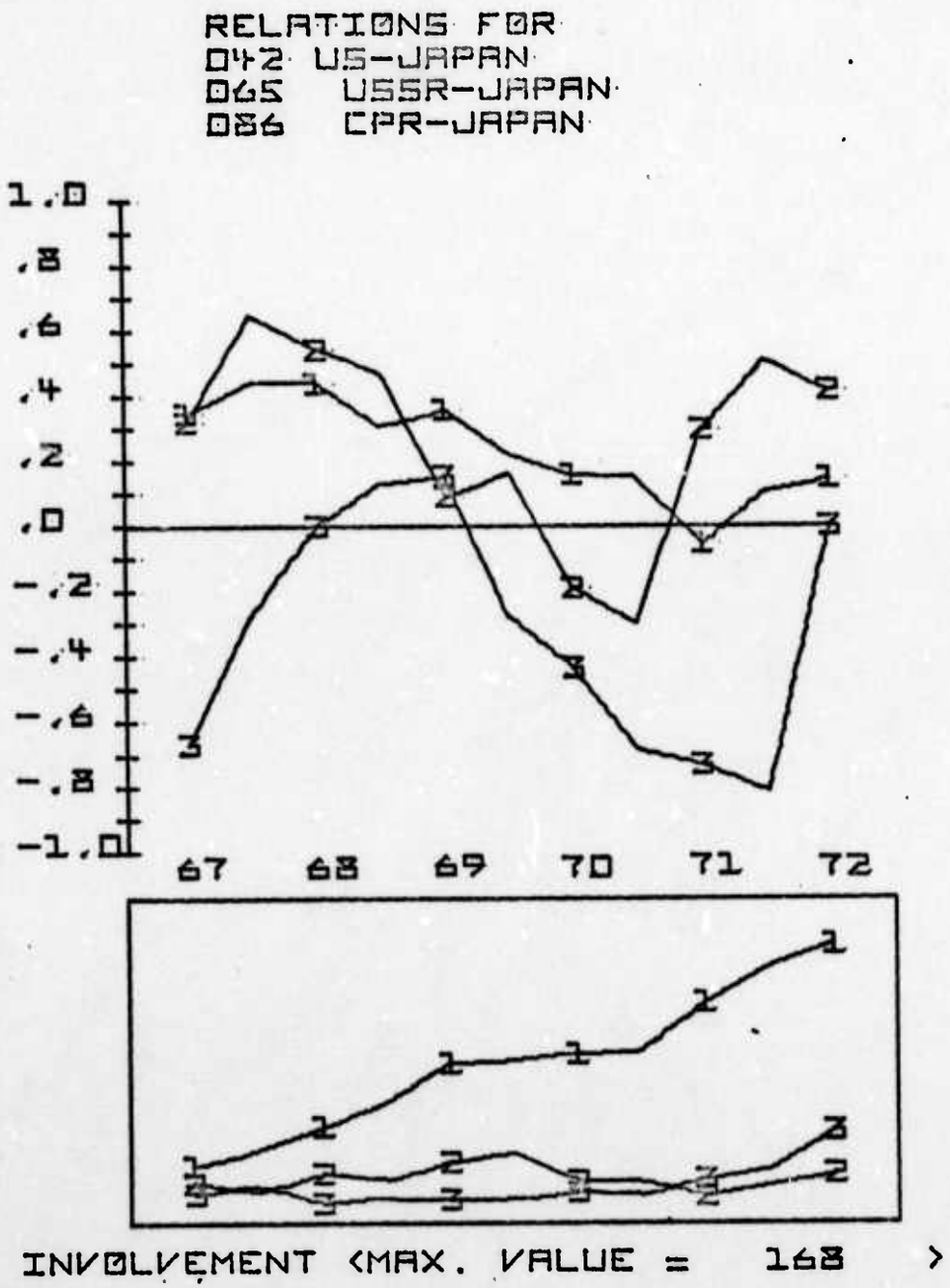
are to begin at month one (January 1966) and continue through December 1972. (The convention by which the program then progresses from the starting point through the end of the data set (December 1972) is being modified to permit the specification of "break-points" at which computing and plotting can be stopped at the user's discretion.) The program was asked to provide plots in this instance; however, if actual statistics were desired, the user would have entered the number 1 as a response to the query, "Do you desire plots or tables (0 = plots; 1= tables)...?" It should be noted that there is no reason why, after having requested and received graphic output, the user cannot request the same dyad(s), time option, and starting point in order to obtain tables. This capability is useful where interest has been expressed in the resulting plot, and the tables are desired to enhance its interpretation.

In addition, it should be noted that the Basic Data File used for these calculations is accessed in a "shared" mode by all of the programs in this package which use this file. This means that virtually simultaneous access to the file is possible; thus any attempt to use more than one terminal to produce plots and tables simultaneously should not be difficult.

The conversational question-answer sequence in Table 4 produced the plot in Table 5. When composite plots are requested, as is the case in this example, the relations measures for the period specified by the user are computed and plotted in the order that the dyads are specified. Since the user asked for dyads 42, 65 and 86, in that order, these dyads were over-plotted in that order with the plot labels proceeding from the top of the plot downward, (and with the curves) annotated with numbers at every other point for easy reference. For example, the curve annotated with the number 1 refers to dyad 42, US-Japan, the curve annotated with the number 2 refers to dyad 65, USSR-Japan, and so on. Similarly, the curves representing total involvement (small rectangle) have corresponding notations. In a composite plotting situation, only total involvement is presented as distinct from the occasions where separate plots are specified, and positive, negative, and total involvement are presented. This is to avoid the confusion which would result if three lines were presented for more than one dyad on the same set of axes. In order to construct the total involvement curves in Table 5, each of the three involvement series was scanned to determine the maximum data value, which in turn was used as the scale factor for the involvement plot. This maximum value is reported in the plot label so the user can determine the rough magnitude associated with the relations calculations, plotted directly above the involvement

TABLE 5.

Sample Plot (Relations Option)



series. A final convention: annotations for data years are centered at a point corresponding to December 31st of the year indicated.

When separate plots are requested, the formats and conventions are basically the same as for composite plotting, except that each dyad specified is plotted on a separate set of axes. Furthermore, a breakdown of total involvement into positive and negative components is provided. The positive component is annotated with "+" symbols, the lower of the two remaining curves is the negative component, while the remaining, uppermost curve is the total involvement (the sum of the positive, negative, and neutral components).

One use of the sample plot in Table 5 is to illustrate how an actor nation of interest, Japan in this case, gravitates toward each of three (or n) major powers, the United States, USSR, and CPR. Used at the beginning of a demonstration session, this plot would provide a more global perspective on the state of relations of one country of interest relative to an arbitrary number of other countries which are prominent in that actor's pattern of interaction. Numerous other examples could be constructed on the same basis by requesting plots (or tables) for an arbitrary number of nation-pairs, all having one member in common.

Using the identical call-up procedure, but working with issue-coded dyads (171-182 in Table 3), one can produce a plot which is similar in format, but which represents a disaggregation of one of the relations curves of interest in Table 5, namely, US-Japanese relations. Table 6 contains a plot of dyads 171, 172, and 173, plotted in a composite manner. The purpose of producing this plot is to demonstrate how, given the available issue-coded data, the relations measure can be broken down into its major components. From this one might determine which of the three components, political, military, or economic, have shown the most improvement or decline, and which component is having the greatest impact on the overall relations curve in Table 5. From Table 6, economic relations appear to be changing more rapidly than political or military relations, and involvement appears to be greatest on this dimension.

Style and Participation (DEMO3). The third display option in this package combines plotting and tabular capabilities for the policy style and participation measures. As reported elsewhere, style is an asymmetrical measure of the quality of actions, or policy style, directed by one actor nation toward another. Like the relations option, this option is invoked by a conversational procedure as illustrated in Table 7. In this example, an attempt was made to further disaggregate a relationship of interest into its asymmetrical, (A-to-B, B-to-A)

TABLE 6.

Sample Plot of Issue-Coded Dyads.

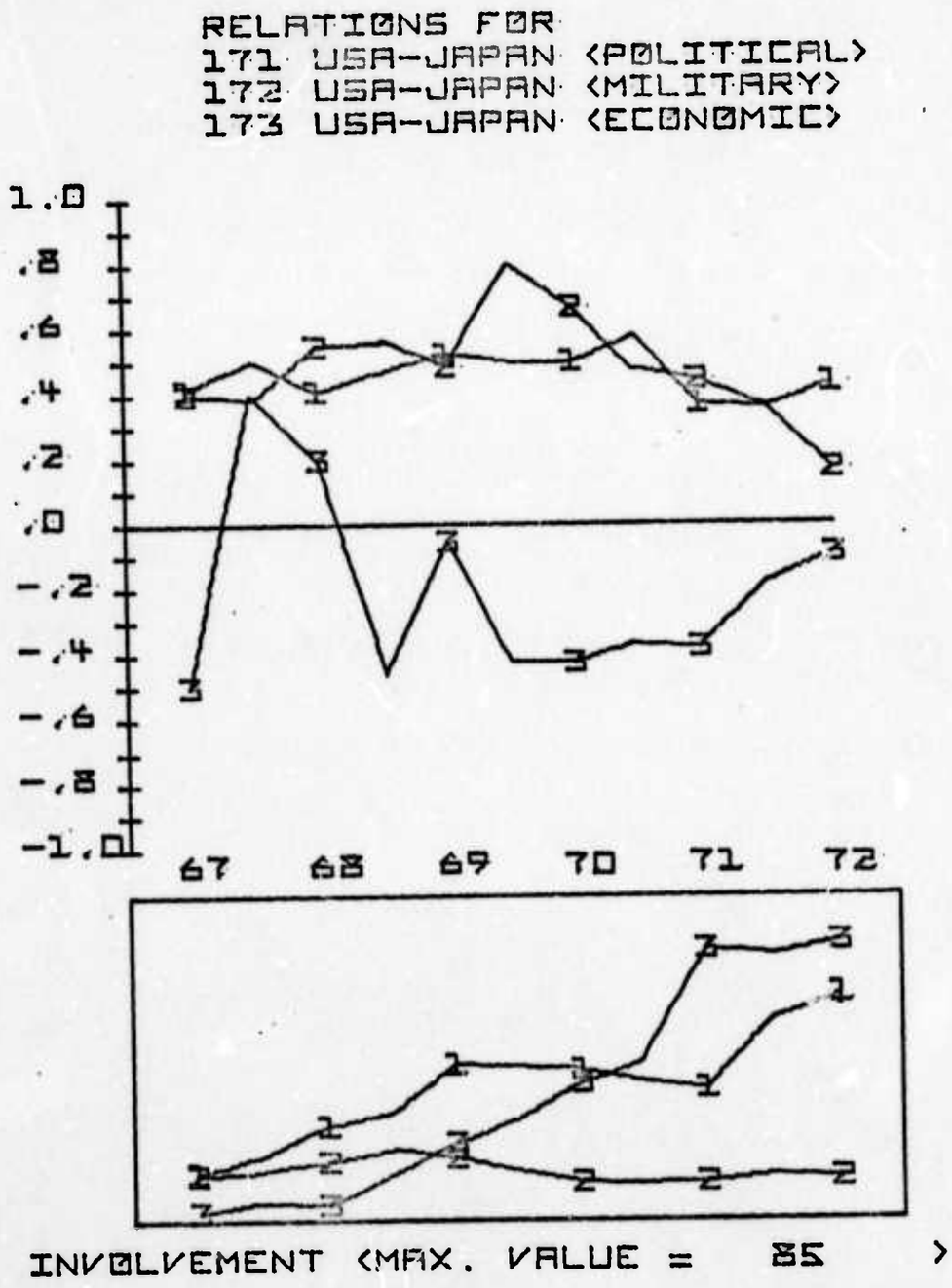


TABLE 7.

Sample Plot (Style Option).

```
U#=HKB28501,CACIDC,USER
SYSTEM- FIV
NEW OR OLD- RUN DEMO

DEMO          12:19PDT     09/29/73


ENTER DEMO OPTION NUMBER (1 - 6), 0 FOR LIST, 99 TO STOP...?3

HOW MANY DYADS...?3

WHICH DYADS (1-182)...?171 172 173

TIME OPTION (1-5), OR TYPE ZERO FOR LIST...?5

START AT WHAT MONTH (1-61)...?1

DO YOU DESIRE PLOTS OR TABLES (0=PLOTS; 1=TABLES)...?0

SHOULD PLOT(S) CONSIST OF A-TO-B STYLE, B-TO-A STYLE,
OR BOTH (TYPE 'AB', 'BA', OR 'BOTH')...?AB

DO YOU DESIRE ONE COMPOSITE PLOT, OR   3 SEPARATE
PLOTS (0=COMPOSITE; 1=SEPARATE)...?0
\P\\P\\P\
```

components. Continuing the US-Japan example, plots were requested for the US-Japan issue coded dyads (171, 172 and 173), with the A-to-B (US-Japan) policy style for the three issue coded dyads displayed first, and the B-to-A (Japan-US) component displayed in a following plot. These plots appear as Tables 8 and 9, respectively. From these plots, one might be able to compare policy styles on the various component dimensions, noting, for example, that while political and economic styles were being fairly well reciprocated at the end of 1972, both in terms of magnitude and quality, military styles exhibited some divergence. In addition, US policy styles over the three dimensions appear to exhibit the greater fluctuation over time, and, in places, the greater rate of change.

Time Series Data Display (DEMO4). This option provides the capability to retrieve, compute and display both smoothed and unsmoothed event frequencies. The actual or smoothed data can alternately be displayed as a table or as a plot or series of plots. This option should be helpful in pinpointing those months which were particularly active in terms of positive, negative, neutral or total event frequencies. An example of the conversational sequence used to invoke the program and communicate user choices is provided in Table 10. An arbitrary number of dyads may be specified to begin the procedure. The program asks the user to identify the dyads in which he is interested, to indicate whether he wishes to see smoothed or actual data, and whether the data

TABLE 8.

Sample Style Plot of Issue-Coded Dyads.
(A-to-B, US-Japan Style for Political, Military and Economic Issues.)

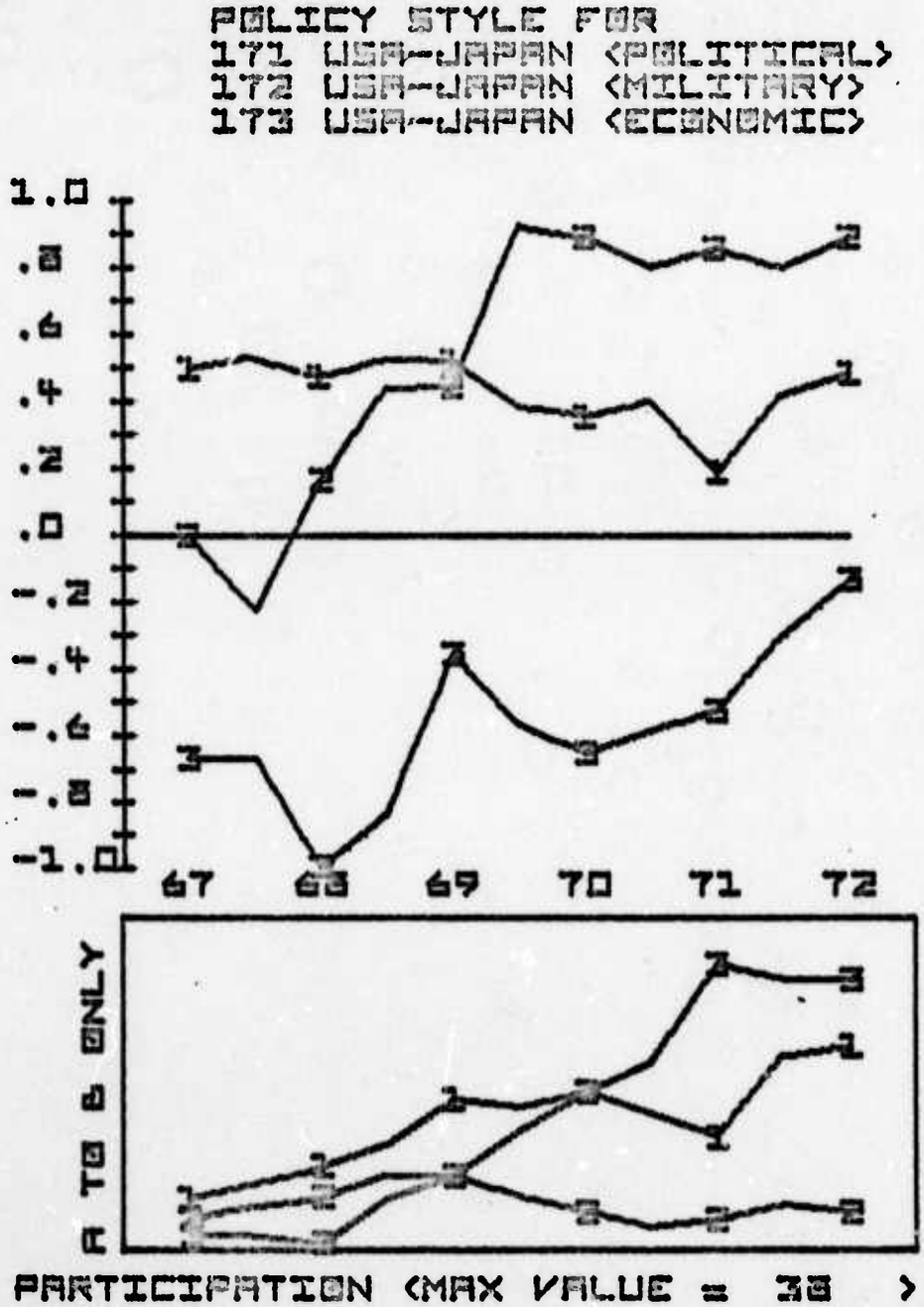
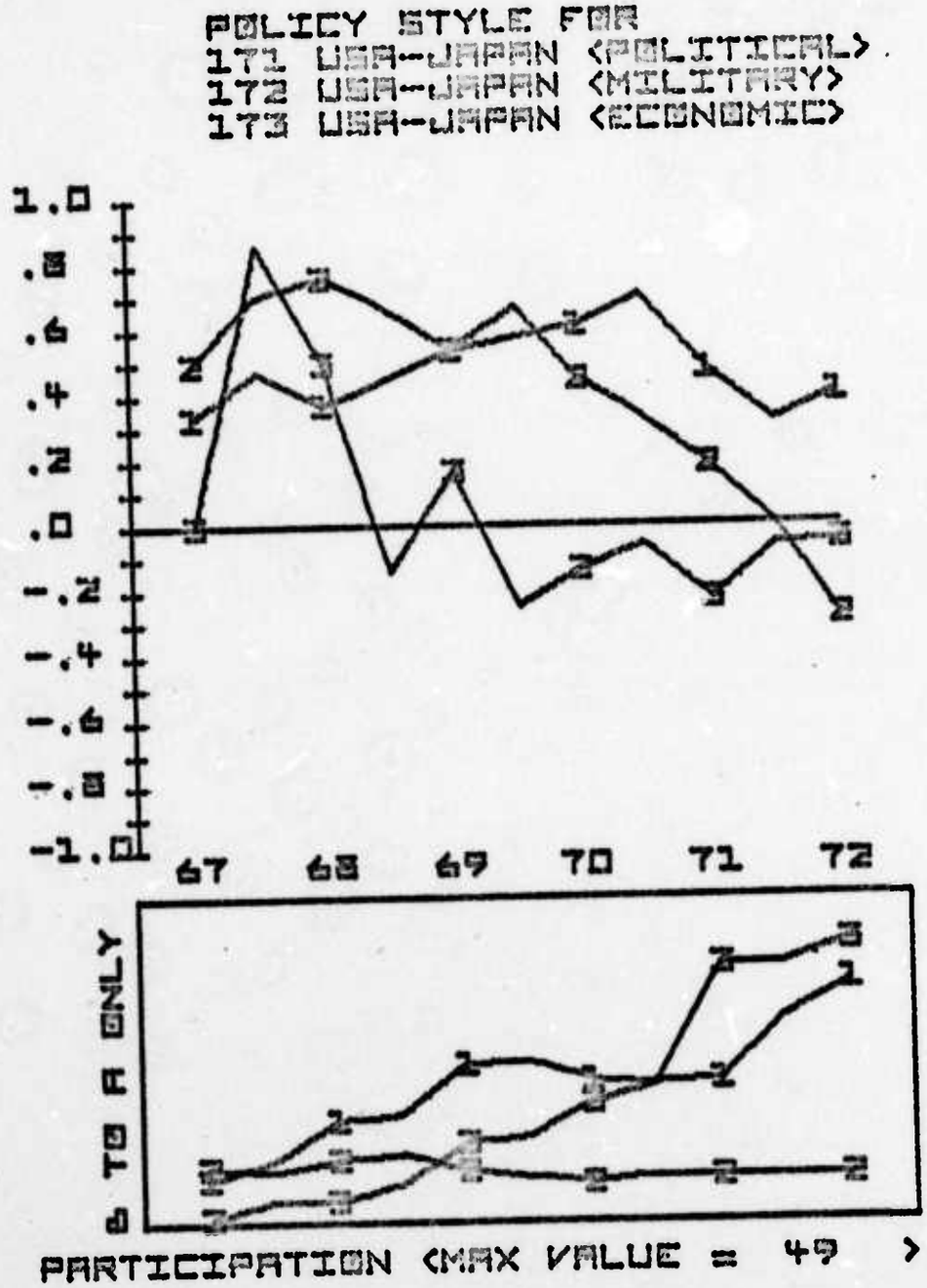


TABLE 9.

Sample Style Plot of Issue-Coded Dyads.
(B-to-A, Japan-US Style for Political,
Military and Economic Issues.)



is to be aggregated as involvement (A-to-B plus B-to-A) or as participation. If the user specifies participation, he is further asked to indicate whether A-to-B or B-to-A participation is desired.

If more than one nation-pair is requested, the program asks if separate or composite plots are desired. For multiple dyads and composite plots, the user can display only one of the following time series: (1) total events; (2) positive events; (3) negative events; or (4) neutral events. This restriction is necessary to avoid considerable confusion when multiple pairs and multiple aggregations are implied. For any number of dyads and separate plots, the user can specify any or all of the preceding time series. These time lines will appear on the same plot for that dyad, scaled to the maximum and minimum values which occur across the time line or lines requested.

The following conventions apply: first, the total event time series will be drawn as a solid line, and will always appear above any other time series when it is requested. Positive time series are annotated with "+" symbols at every 12th data point (December of each year). Negative time series are solid lines without any symbols, but where negative and total event time series appear on the same set of axes, little difficulty should be encountered distinguishing the two. Neutral event time series are annotated with the symbol "=" at every 12th data point.

TABLE 10.

Sample Conversational Sequence for Time Series Plotting.

```
ENTER DEMO OPTION NUMBER (1 - 6), 0 FOR LIST, 99 TO STOP...?4

TIME SERIES FOR HOW MANY DYADS...?1

WHICH DYADS...?173

DO YOU WANT TO SEE SMOOTHED OR ACTUAL DATA (0=SMOOTHED; 1=ACTUAL)...?0

DO YOU WISH TO SEE (1) INVOLVEMENT DATA,
OR (2) PARTICIPATION DATA (TYPE 1 OR 2)...?1

DO YOU DESIRE PLOTS OR TABLES (0=PLOTS; 1=TABLES)...?0

FOR EACH SEPARATE PLOT, YOU CAN SPECIFY ANY OR ALL
OF THE FOLLOWING TIME SERIES:
PLOT TOTAL EVENTS (0=YES; 1=NO)...?0

PLOT POSITIVE EVENTS (0=YES; 1=NO)...?1

PLOT NEGATIVE EVENTS (0=YES; 1=NO)...?0

PLOT NEUTRAL EVENTS (0=YES; 1=NO)...?1
\P\\P\870
MORE TIME SERIES DISPLAYS (0=YES; 1=NO)...?1


ENTER DEMO OPTION NUMBER (1 - 6), 0 FOR LIST, 99 TO STOP...?99
```

Frequency of events will always be plotted as the vertical, or Y-axis, while time in months will always be plotted as the horizontal, X-axis. Annotations for the x-axis include tic marks drawn for each calendar quarter, and year annotations centered at a point corresponding to December 31 of the year indicated. Finally, whenever participation is requested, a label indicating whether A-to-B data or B-to-A data is present will be drawn.

Again taking up the US-Japan example, one interpretation of the plots drawn in previous options is that the economic aspects of US-Japanese interrelationships are changing rapidly and in a direction of potential interest to both parties. As a further disaggregation of the trend lines drawn in previous options, a time series plot of US-Japan data, coded for economic issues was specified with the conversational sequence in Table 10, and plotted as shown in Table 11. In this plot, smoothed event totals are plotted with negative event totals to see both the timing of what might be termed "new" economic initiatives, and the extent to which such initiatives were coded as being primarily "helpful" or "harmful." The presence of a strong negative component relative to the total might be interpreted to mean that economic interactions are not entirely congenial. With this in mind one might turn to Option 5 in an attempt to find out why.

Texscan Junior(DEMO5). As a demonstration of disaggregation of event data to the event data level, a sample TEXSCAN-type retrieval program has been included in this package. The data base on which this subprogram operates is an actual TEXSCAN retrieval for US-Japan, for the period February 4, 1969 through December 15, 1972. The user can specify any intervening dates for which a retrieval of both descriptive and analytic WEIS data is desired. This option may be used as a final disaggregation of the indicators for US-Japan presented earlier in this memorandum. Having moved progressively through relations, style and grouped event time series, the demonstrator can point to the intervals in which particular events produced changes in the indicators and/or became noticeable as peaks or valleys in the graphs of magnitude measures. He may then elect to display individual events in textual format for intervals of particular interest. For example, having noted the beginning of an uptrend in US-Japan policy style (economic issues) near the end of 1970, (Table 8), a sample textual retrieval of analytic and descriptive events might be made for the arbitrary period November 1970 through February 1971. As indicated in Table 12, a number of agreements between the US and Japan were reached during this period which contributed to the upswing observed in plots of the style indicator. Iterative use of the sample TEXSCAN option would permit successively better isolation of events for purposes of developing satisfying interpretations of the aggregate data and indicator displays.

TABLE 11.

Sample Time Series Plot
(US-Japan Total and Negative Events with Smoothing.)

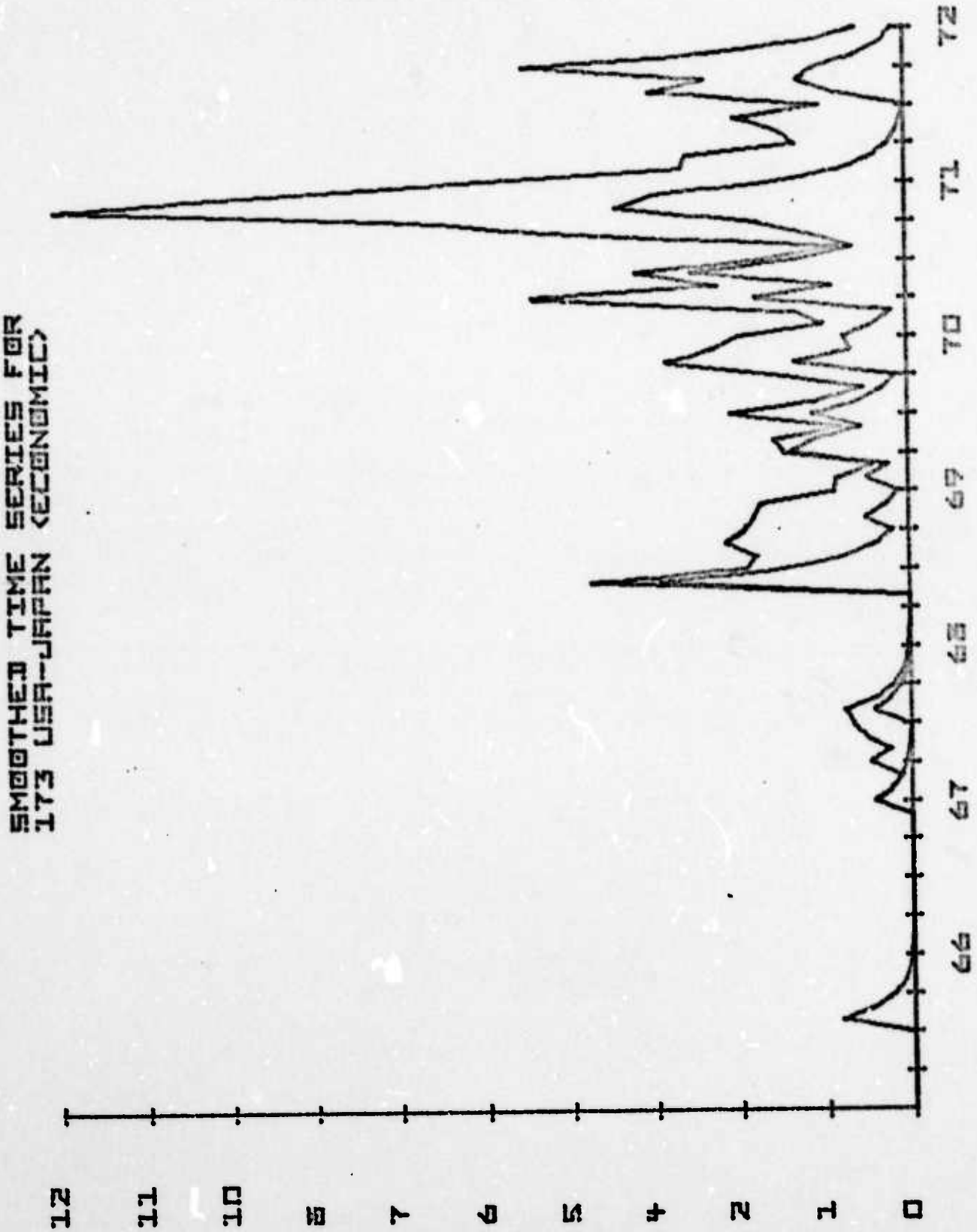


TABLE 12

Sample TEXSCAN JR. Option
(US-Japan Data Only.)

```
DEMO          14:01PDT    09/29/73


ENTER DEMO OPTION NUMBER (1 - 6), 0 FOR LIST, 99 TO STOP...?5


IN THIS SAMPLE TEXSCAN, VALID DATE BOUNDARIES ARE
'690204' TO '721215' (FEBRUARY 4, 1969 TO DECEMBER 15, 1972).


ENTER DATA BOUNDARIES (LOW,HIGH IN THE FORMAT YYMMDD),
SEPARATED WITH A BLANK...?701101 710231

 701117                                                740  31  2  0
JAP AMB USHIBA MEETS WITH USA FLANIGAN TO DISCUSS TEXTILE
ISSUE
 701117                                                  2  31  740  0
USA FLANIGAN MEETS WITH JAP AMB USHIBA TO DISCUSS TEXTILE
ISSUE
 701204                                                  2  121  740  0
USA TREASURY DEPT CRITICIZES JAP FOR DUMPING JAP TV SETS ON
USA MARKET FOR LESS THAN FAIR VALUE
 701212                                                  2  81  740  0
USA AND JAP SIGN AGREEMENTS INCLUDING ACCORD SETTLING CRAB
QUOTAS IN EAST BERING SEA
 701212                                                740  81  2  0
JAP AND USA SIGN AGREEMENTS INCLUDING ACCORD SETTLING CRAB
QUOTAS IN EAST BERING SEA
 701231                                                740  102  2  0
JAP PRM SATO URGES USA NOT TO PASS RESTRICTIVE TRADE
LEGISLATION
 710201                                                  2  81  740  0
USA AGREES WITH JAP ON EXPORT QUOTA FOR SILVERWARE
 710201                                                740  81  2  0
JAP AGREES WITH USA ON EXPORT QUOTA FOR SILVERWARE


MORE RETRIEVALS (0=YES; 1=NO)...?1

. .

ENTER DEMO OPTION NUMBER (1 - 6), 0 FOR LIST, 99 TO STOP...?99


USED      .36 UNITS
```

Characteristics Indicators (DEMO6). The characteristics data files contain 26 variables constructed using both attribute and event-type data for the period 1961 through 1970. Exceptions to the time frame covered by this collection are the variables derived from WEIS data, for which the years 1966-1970 are available. The characteristics option permits the user to rank or plot selected variables for selected countries. If the rank option is specified, the program will request a data year for which the ranking is to be performed. The user is also asked to indicate the variable(s) on which the 82 countries represented are to be ranked. For any given data year in the collection, the program will rank each case on up to 20 variables simultaneously. Under the ranking option, output will consist of (1) country names, presented in rank order, where each column of names represents the ranks of the various countries on each variable; and (2) a tabular display of the data, presented in rank order, and corresponding to the sequence of country names which precedes it. The program permits the user to construct subsets of the countries to be ranked. During the printout, the interrupt button on the communications terminal may be used to skip unwanted print-out.

For the plot option associated with this subprogram, the user is asked to specify a single variable for plotting. After the program accepts a single variable, the user is given the opportunity to create subsets of

TABLE 13

ALPHABETICAL LISTING OF 82 COUNTRIES IN THE CHARACTERISTICS DATA FILE

Number*	Country	Code	Number	Country	Code
700	Afghanistan	AFG	731	Korea/North	KON
339	Albania	ALB	732	Korea/South	KOS
615	Algeria	ALG	812	Laos	LAO
160	Argentina	ARG	660	Lebanon	LEB
900	Australia	AUL	450	Liberia	LBR
305	Austria	AUS	620	Libya	LBY
211	Belgium	BEL	820	Malaysia	MAL
145	Bolivia	BOL	070	Mexico	MEX
140	Brazil	BRA	712	Mongolia	MON
355	Bulgaria	BUL	600	Morocco	MOR
755	Burma	BUR	210	Netherlands	NTH
811	Cambodia	CAM	920	New Zealand	NEW
020	Canada	CAN	093	Nicaragua	NIC
155	Chile	CHL	385	Norway	NOR
710	China/Peoples Rep.	CPR	770	Pakistan	PAK
713	China/Republic of	CHT	095	Panama	PAN
100	Columbia	COL	150	Paraguay	PAR
094	Costa Rica	COS	135	Peru	PER
040	Cuba	CUB	840	Philippines	PHI
315	Czechoslovakia	CZE	290	Poland	POL
390	Denmark	DEN	235	Portugal	POR
042	Dominican Repub.	DOM	360	Romania	ROM
130	Ecuador	ECU	670	Saudi Arabia	SAU
530	Ethiopia	ETH	560	South Africa	SAF
375	Finland	FIN	230	Spain	SPN
220	France	FRN	625	Sudan	SUD
265	Germ. /Dem. Rep.	GME	380	Sweden	SWD
255	Germ. /Fed. Rep.	GMW	225	Switzerland	SWZ
350	Greece	GRC	652	Syria	SYR
090	Guatemala	GUA	800	Thailand	TAI
041	Haiti	HAI	616	Tunisia	TUN
310	Hungary	HUN	640	Turkey	TUR
750	India	IND	365	USSR	USR
850	Indonesia	INS	651	United Arab Rep.	UAR
630	Iran	IRN	200	United Kingdom	UNK
645	Iraq	IRQ	002	United States	USA
666	Israel	ISR	165	Uruguay	URU
325	Italy	ITA	101	Venezuela	VEN
740	Japan	JAP	816	Vietnam/North	VTN
663	Jordan	JOR	817	Vietnam/South	VTS
501	Kenya	KEN	345	Yugoslavia	YUG

*These numbers are standard code numbers developed by Bruce M. Russett, J. David Singer, and Melvin Small, "National Political Units in the Twentieth Century, A Standardized List," American Political Science Review, 62 (September 1968), pp. 932-51, and are used in the WEIS sytem.

countries for plotting. The program produces a plot, scaled to the maximum and mimimum values encountered over the five or ten year data series for the subset of cases specified. New subsets may be specified for the same variable and plotted in a separate subsequent display. At the end of this sequence, the user may terminate the subprogram or request another variable to be plotted or, alternatively, display country ranks for a given data year of interest. Table 13 contains a list of the 82 countries for which data are presently available.

Following through with the US-Japan case, it might be of interest, after having isolated specific events or event patterns, to display important non-event variables over a reasonably similar time interval. One could, for example, request plots of economic growth indices for Japan and Japan's primary targets as determined in a previous use of the concentration option. Such a plot is requested in Table 14 and plotted in Table 15.

General Considerations. It should be emphasized that the sequence in which options are exercised, the many choices of time options, starting locations, combinations of dyads are entirly up to the user. There seems to be little value in constructing a program which blindly follows a cut and dried procedure. Rather, this package is intended to be responsive to the needs of the demonstrator and to the questions of visi-

TABLE 14.

Request for Characteristics Data Plot.

```
ENTER DEMO OPTION NUMBER (1 - 6), 0 FOR LIST, 9 TO STOP...?6


DO YOU DESIRE RANKED DATA OR PLOTS (0=RANKS; 1=PLOTS)...?1

WHICH VARIABLE (ENTER NUMBER OR TYPE ZERO FOR LIST)...?

VARIABLES AVAILABLE ARE:

  1     GROSS NATIONAL PRODUCT          14    GNP CHANGE INDICES
  2     POPULATION                      15    POPULATION INDICES
  3     MILITARY EXPENDITURES           16    MIL. SPENDING INDICES
  4     ARMED FORCES (1000'S)           17    ARMED FORCES INDICES
  5     TOTAL WEIS ACTIONS              18    WEIS ACTION INDICES
  6     TOTAL NEG. WEIS ACTIONS         19    NEG. WEIS ACTION INDICES
  7     GNP PER CAPITA                  20    GNP/POPULATION INDICES
  8     MIL. SPENDING/MIL MAN           21    MIL. SPENDING/MAN INDICES
  9     NAT'L SECURITY EMPHASIS         22    SECURITY EMPHASIS INDICES
 10     POWER                           23    POWER INDICES
 11     INTERNATIONAL STRESS (1)        24    INT'L STRESS (1) INDICES
 12     INTERNATIONAL STRESS (2)        25    INT'L STRESS (2) INDICES
 13     CONFLICT RATIO                  26    CONFLICT RATIO INDICES

INDICES ARE DEFINED AS THE DATA FOR A GIVEN YEAR
DIVIDED BY THE MEAN OF THE FIRST TWO YEARS OF DATA...TO
STOP THE PROGRAM, ENTER A ZERO OR <CR> WHEN THE PROGRAM
ASKS FOR A DATA YEAR....THE <BREAK> KEY CAN BE USED
TO SKIP UNWANTED PRINT-OUT.  PROGRAM WILL BRANCH TO NEXT
OPTION...

WHICH VARIABLE (ENTER NUMBER OR TYPE ZERO FOR LIST)...?1


DO YOU DESIRE ALL 82 COUNTRIES, OR DO YOU
WANT TO CREATE A SUBSET OF COUNTRIES (TYPE -ALL- OR -SUB-)...?SUB


HOW MANY COUNTRIES IN THE SUBSET...?5

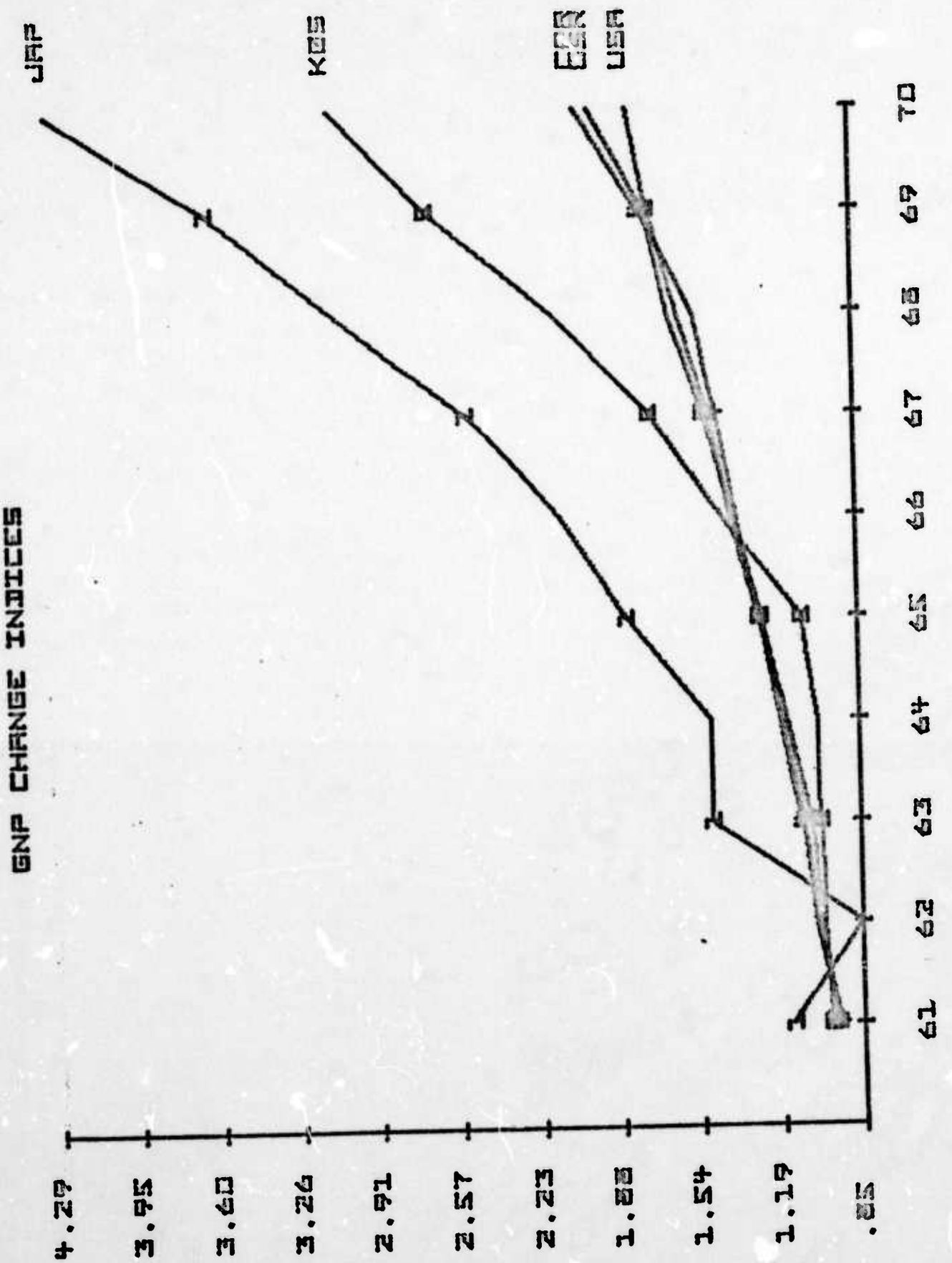
WHICH COUNTRIES (3-LETTER CODES, SEPARATED WITH BLANKS)...
?JAP USA USR CPA ROS
\P\\P\870


DO YOU WANT TO CREATE A NEW SUBSET OF COUNTRIES
FOR THE SAME DATA SELECTED EARLIER (0=YES; 1=NO)...?1

ARE YOU DONE WITH THIS PROGRAM (0=YES; 1=NO)...?1
```

TABLE 15.

Sample Plot of Characteristics Data



tors. Any demonstration session can take on a variety of substantive aspects: every aspect from the length of the presentation to combinations of plots and tables is entirely the user's prerogative.

Operating Hints. It seems appropriate to review the various steps by which people can access the host computer and run the demonstration package. These steps are as follows:

(1) Turn the plotter power switch on. This should also energize the communications terminal. If not, check the terminal power switch located at the right-rear of the terminal. A 30 Char-per-sec terminal with a wide carriage is assumed.

(2) Mount a felt pen with the color of your choice in the pen carriage. Using the north arrow button, the "pen" button, and the "fast" button on the top-front of the plotter, check to see that the pen comes down hard enough to make a sharp line, but also that it lifts off the paper cleanly. If the pen drags, it is located too close to the paper.

(3) Bring the pen to the "home" position using the fast button and the "south" arrow. "Home" is the southern most position of pen travel closest to the cluster of buttons on the top-front of the plotter. The paper can be adjusted using the "fast" button and the east-west buttons.

(4) Turn the power switch located on the acoustical coupler to "on." Set mode switch to "half duplex," set the remaining switch to "inductive."

(5) Dial the G.E. system. Numbers are 652-4445, 656-2720, or 656-1920. Place the telephone handset in the acoustical coupler with the cord oriented on the end closest to the power switch on the coupler. A successful hook-up is indicated by the illumination of a green light on the coupler.

(6) Your first input to the G.E. system should be the letter "H" followed by a carriage return. This permits the system to analyze the rate at which the terminal is sending data (should be 30 CPS). The desired response from the system is "U#", which means enter a user number. If the response is garbled, hang up and dial again.

(7) Enter the user number, password and project I.D. as follows:

HKB28501, CACIDC, USER (carriage return)

For a valid entry the response will be "SYSTEM--." Otherwise, it will ask you to re-enter the user number.

(8) To the query, "SYSTEM--," you type "FIV" (carriage return). This tells the system you want to work in FORTRAN. If it recognizes what you type, the system will then type, "NEW OR OLD--."

(9) At this point you type, "RUN DEMO" (carriage return). This will initiate the conversational sequences described above.

In general, the demonstration package asks questions in order to decide what to retrieve or calculate and how to display it. The primary decision point is where the software asks, "Enter demo option (1-6), 0 list, 99 to stop..." From this point, one of the six subprograms described above takes over. These programs ask additional questions to pinpoint the user's request. Wherever feasible, the format of the expected response (usually a number) is printed along with the question. In addition, many short tutorial explanations have been included to review the options at each stage of the program. It is crucial to remember that the program cannot act on your input until you hit the "carriage return" on the terminal. Simply typing a letter is not sufficient to produce results.

Restart and Recovery. If for any reason you wish to interrupt the terminal when it is printing, press the interrupt button. In many cases, the software will branch to the next task or decision point. This feature may be used to bypass unwanted output. If the program should terminate when this action is taken and further work with the program is required, simply type "RUN." Also, for any unexpected termination of the program, for which a restart is desired, again type "RUN" (carriage return as always). Abnormal terminations due to "bugs" should be reported to me as soon as possible.

If for any reason you wish to interrupt the plotter, quickly press the plotter power switch off and on. If you are too slow, you may lose the carrier signal, in which case you will have to dial the computer and log on again. You may want to interrupt the plotter in order to pause in the middle of a plot; it is also possible that stray signals on the phone line will cause the plotter to produce strange scribblings, and to "forget" where it was and what it was doing. Lastly, the paper may tear. Under any of these conditions, press the power switch off and on once, and quickly. This should stop the plotter immediately and reactivate the terminal. Some miscellaneous characters will be dumped to the terminal, but disregard these; the software will recover and print the message, "Restart current plot or go on to next task (0 = restart; 1 = continue)...?" Before you respond, move the paper with

the "west" and "fast" buttons and "home" the pen. Then, typing a carriage return will restart the plot at the beginning (presumably after any error has been corrected or explanation given). Entry of a "1" (CR) will move the program to the next task. This may be another plot; or it may be another decision point. The program will request further instructions in any event.

When you are finished with the package, a response of "99" to the query, "Enter demo option..." will terminate the procedure. To leave the G.E. system, type "BYE" and a carriage return. Hang up the phone, and turn off the power to the coupler. Use the "west" and " "fast" buttons to advance plotter output to the point where it can be removed. I suggest you also remove the felt pen from the pen carriage if there will be a lengthy interval between uses, otherwise the pen will dry up. Turn plotter power off, and remove any output from the terminal.

Obviously a great many examples might be constructed since the variety of combinations of options and entries and variables is fairly great. Some sample demonstrations are briefly outlined below.

Sample Demonstration 1. Several aspects of the US-Japanese relationship may be illustrated by following the sequence outlined in this memo. This sequence might be refined and summarized as follows:

(1) Use Option 2 (Relations) to produce a composite plot for US-Japan and CPR-Japan (Dyads 42, 65 and 86) of relations and involvement.

(2) If desired, print the tabular display associated with (1).

(3) Use Option 2 (Relations) to Produce a composite plot of US-Japan Military, Political and Economic relations and involvement (171, 172 and 173).

(4) If desired, print tabular displays for (3).

(5) Plot the smoothed time series for US-Japan (Economic), Dyad 173, requesting total, positive and negative involvement on the same set of axes. Use Option 4.

(6) Print TEXSCAN JR. retrievals, using Option 5, with dates circa 1969; then circa 1972.

(7) Using Option 1, display Japanese concentration to primary targets.

(8) Using the country cluster found in the last time period of the concentration output in (7), call up Option 6 to display selected characteristics variables, such as power, emphasis, stress and the change indices for these countries.

Sample Demonstration 2. Some of the questions regarding European detente and the emerging role of East Germany may be examined with the following series of displays, if desired:

(1) Use Option 2 to plot

a. Relations and involvement of NATO and the Warsaw pact (dyad 114).

b. Call for a composite plot of the relations and involvement measures for US-NATO and USSR-NATO (Dyads 34 and 62). This display shows and compares the changing patterns of interaction between the two superpowers and NATO in general.

c. Similarly, call for a composite plot of relations between US-Warsaw Pact and USSR-Warsaw Pact (Dyads 25 and 54). Here one might contrast the quality of interaction between the two great powers and the Warsaw Pact in general.

(2) Use Option 6 to plot UNK, FRN, and GMW on the Emphasis Index (variable 22); redefine the subset and plot GME, BUL, POL, CZE, ROM and HUN on the same variable.

(3) If desired, (2) can be repeated, specifying the change index for international stress (variable 24, the change in Total WEIS actions/power.)

The preceding sequence is intended to display data relevant to questions of detente. To further explore the question of the future role of East Germany in Europe, plots of GME, BUL, POL, CZE, ROM and HUN for the power index (23), and military spending/military man indices can be requested from Option 6.

Sample Demonstration 3. Changing US-CPR-USR relations might be illustrated and examined as follows:

(1) Use Option 2 to plot US-CPR relations and USSR-CPR relations in a composite manner (dyads 27, 56).

(2) Use Option 3 to plot US-CPR, USR-CPR policy style (A-to-B only) in a composite manner.

(3) Repeat (2), plotting B-to-A measures.

(4) Option 4 may be used to overplot smoothed negative events (a) A-to-B; (b) B-to-A; and (c) symmetrically over time.

C.A.C.I.

WASHINGTON, D.C. OFFICES

DEMONSTRATION
ANALYST COMPUTER STATION

Don R. Harris

PREFACE

It is often difficult to visualize how quantitative indicators can be used by an intelligence analyst in the course of his work. To give this visualization, CACI has programmed its several indicator packages to be on call at a computer console. A plotter has been attached to the console so that the computer with its printout capability can demonstrate how the analyst might call up various indicators. These indicators, used singly or in combination, help him review the past and focus on those periods in which developments occurred that are most pertinent to the current situation being assessed.

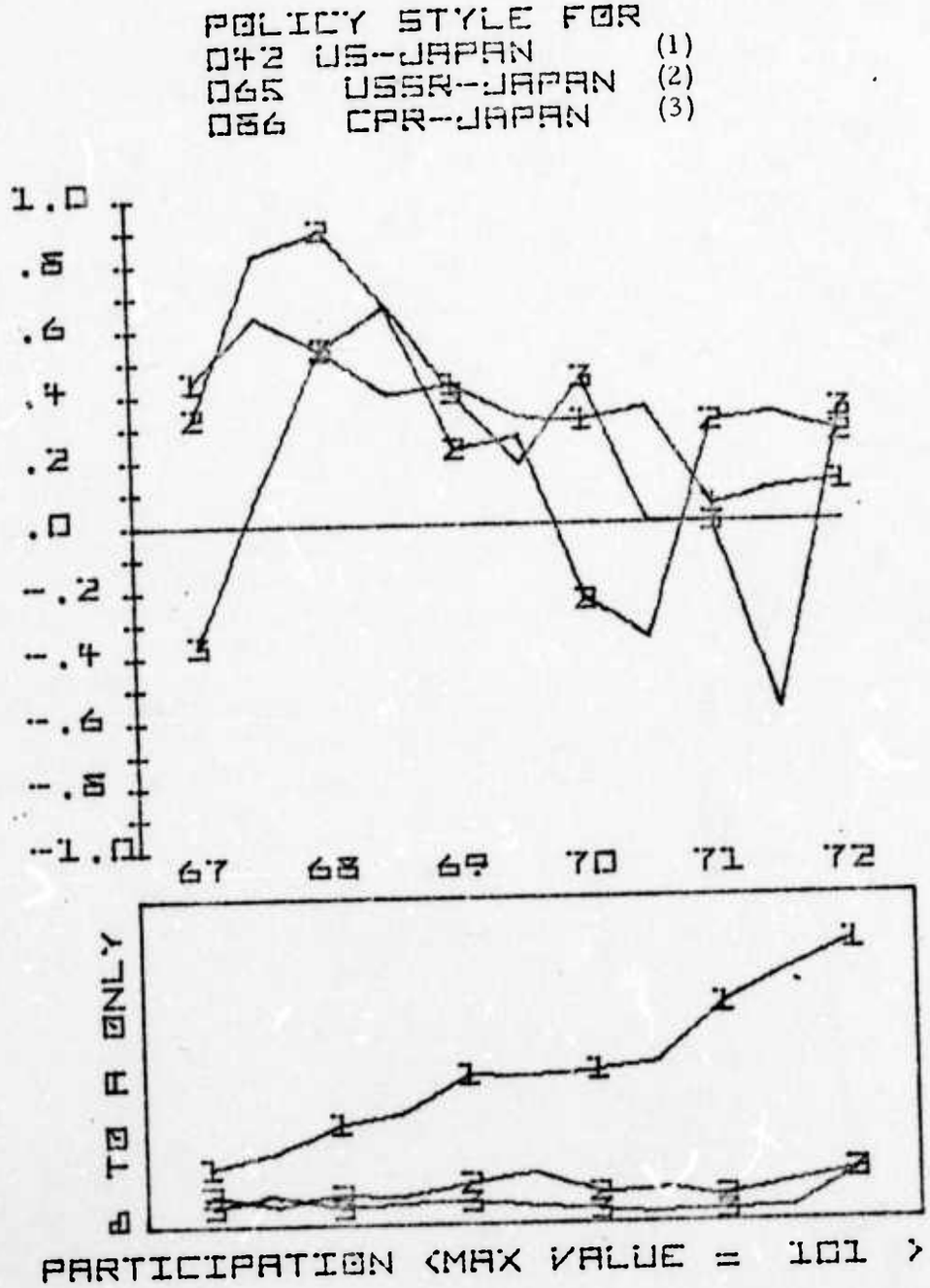
The demonstration package focuses on Japan. Japan, as a subject for U.S. intelligence, requires an analysis of nuances and political-trend shifts. Major developments such as internal civil war or external aggression appear totally out of the question in the foreseeable future. But developments in Japanese foreign policy and, especially, in its economic policy are of vital concern to the U.S. Thus, in the following pages we have reproduced a demonstration of the way an intelligence analyst might use quantitative indicators to assist him in responding to a request for an assessment of developments in Japanese policy.

We assume that the analyst has been called upon to assess Japanese foreign policy activities and attitudes toward the United States, the Soviet Union, and the Chinese People's Republic. We assume the date is December 31, 1972.

The analyst's first task would probably be to get an overview of Japanese relations with the U.S., the Soviet Union, and the CPR. He would know that the quantitative indicator graphic printout would quickly provide a historic review of Japanese relations with these countries based on a quantification of coded events. In these circumstances, the first indicator he would display would be the POLICY STYLE of Japan toward the three countries (Figure 1). This would give both the qualitative aspects of these relations over the past six years, and an indication of the number of events in the data base and their division between positive and negative events. This figure would remind the analyst that Japanese policy attitudes toward the U.S. have been generally losing their positive nature over the past five years but that there has been a fairly significant upturn during the past few months. Japan's policy toward the USSR and CPR has also improved in the last few months.

In the figures that follow, countries are identified as "A" (the first country in any pair of countries shown in a table heading and "B" (the second country shown in a heading). The direction of a policy style indicator (A B, or B A) is shown on the vertical axis of the participation box. Where a policy style curve is labeled "A" the curve shows A B style; when labeled "B", B A style is shown.

FIGURE 1


POLICY STYLE FOR
042 US-JAPAN (1)
065 USSR-JAPAN (2)
066 CPR-JAPAN (3)
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
67
68
69
70
71
72
0 TO A ONLY
PARTICIPATION (MAX VALUE = 101)

Next, the analyst might wish to review the extent to which Japanese foreign policy is focused on the three major powers, the U.S., USSR, and the CPR. Figure 2 displays the CONCENTRATION indicator which shows the focus of Japanese foreign relations. It is readily apparent from the printout that the three major powers are by far the most important in Japanese relations. Second, it is quite apparent that despite the fluctuations in Japanese policy toward the U.S., the U.S. has remained the single most important target country for Japanese foreign policy focus. The number of events (given in the last column on the second table) has substantially increased in the past year while the focus on the U.S. has also remained at a very high level. This is shown by the second to last column which refers to the number of countries accounting for 70% of the total events. Thus it can be seen that as the number of events in foreign relations has gone up, the focus on the U.S. has increased.

FIGURE 2

CONCENTRATION INDICATOR

1	USA	USR	CPR	KOS	ISR	CAN	INS	PHI	VTN	IND
2	USA	CPR	USR	INS	ISR	VTN	KOS	CAN	PHI	IND
3	USA	USR	CPR	INS	ISR	VTN	IND	CHT	YUG	FRN
4	USA	USR	CPR	INS	IND	VTN	CHT	ISR	YUG	FRN
5	USA	USR	CPR	INS	KOS	AUL	IND	YUG	UNK	SIN
6	USA	USR	CPR	IND	KOS	AUL	VTS	KOM	GRM	SIN
7	USA	USR	CPR	KOS	IND	AUL	VTS	PAK	KOM	GRM
8	USA	USR	KOS	CPR	AUL	SIN	VTS	IND	UNK	INS
9	USA	USR	CPR	IND	KOS	CHT	NOR	GRM	UNK	CAN
10	USA	USR	CPR	ISR	FRN	PER	INS	TAI	KOS	CHT

PRIMARY JAP TARGET COUNTRY FREQUENCIES, CONCENTRATION

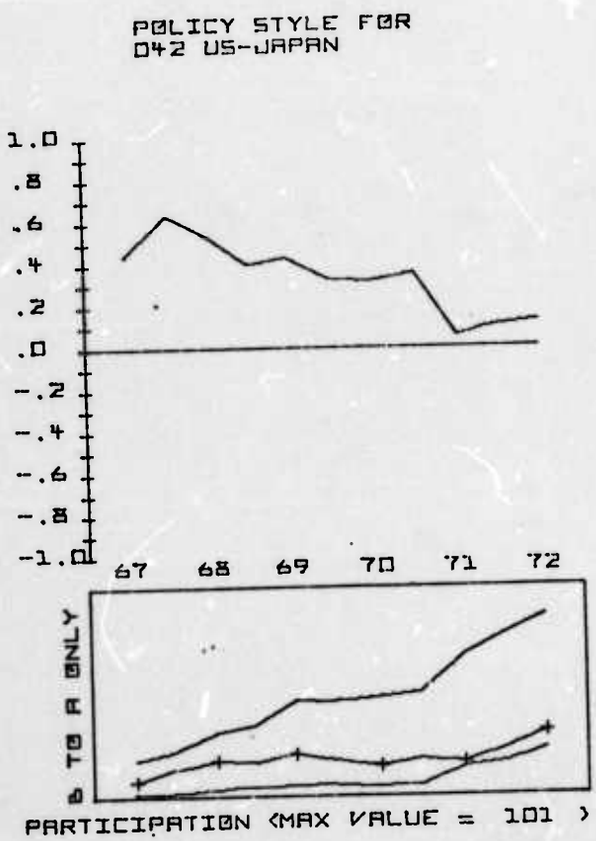
1	29.	12.	7.	4.	3.	3.	2.	2.	2.	2.	3.15	66.
2	33.	11.	6.	5.	4.	3.	3.	3.	2.	2.	3.65	74.
3	45.	13.	7.	5.	3.	2.	2.	2.	2.	2.	2.34	83.
4	52.	12.	9.	3.	3.	2.	2.	2.	2.	2.	2.12	89.
5	66.	18.	9.	3.	3.	2.	2.	2.	2.	1.	2.05	108.
6	65.	21.	6.	3.	3.	2.	2.	2.	2.	1.	2.11	109.
7	64.	13.	6.	5.	3.	2.	2.	2.	2.	2.	1.91	101.
8	62.	14.	5.	4.	3.	2.	2.	2.	2.	1.	1.89	97.
9	82.	10.	5.	2.	2.	2.	2.	2.	2.	2.	1.37	111.
10	94.	16.	6.	4.	3.	3.	2.	2.	2.	2.	1.73	134.

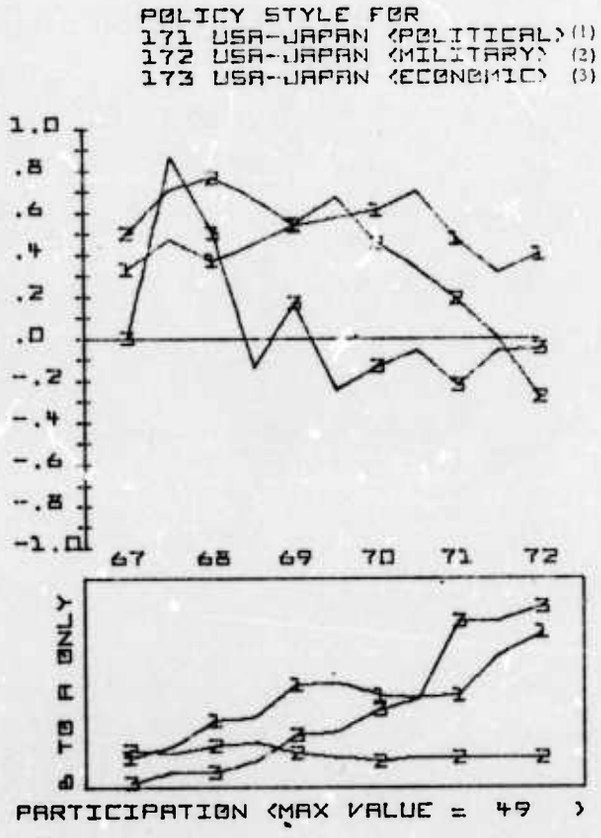
CONCENTRATION MEASURES FOR JAP , GROUPS 1-7, TIME OPTION 3

Now, the analyst might request the display that breaks down or disaggregates the POLICY STYLE indicator into three sub-groupings, namely political, military, and economic. Figure 3 gives a quick statement of Japan's policy style toward the U.S. and the relative importance of Japanese attitudes and policies in political, military, and economic areas. In particular, it emphasizes the point that the analyst would know from his normal reading of cables that the economic attitude of the Japanese toward the U.S. tended to be more negative than either the political or military attitudes. However, in the past year, the economic attitudes appear to have stabilized at or near neutral.

When the analyst reviews the PARTICIPATION index, he cannot ignore the importance of economic events between the two countries in the past few years. Economic events are proportionately greater in this period than either political or military events.

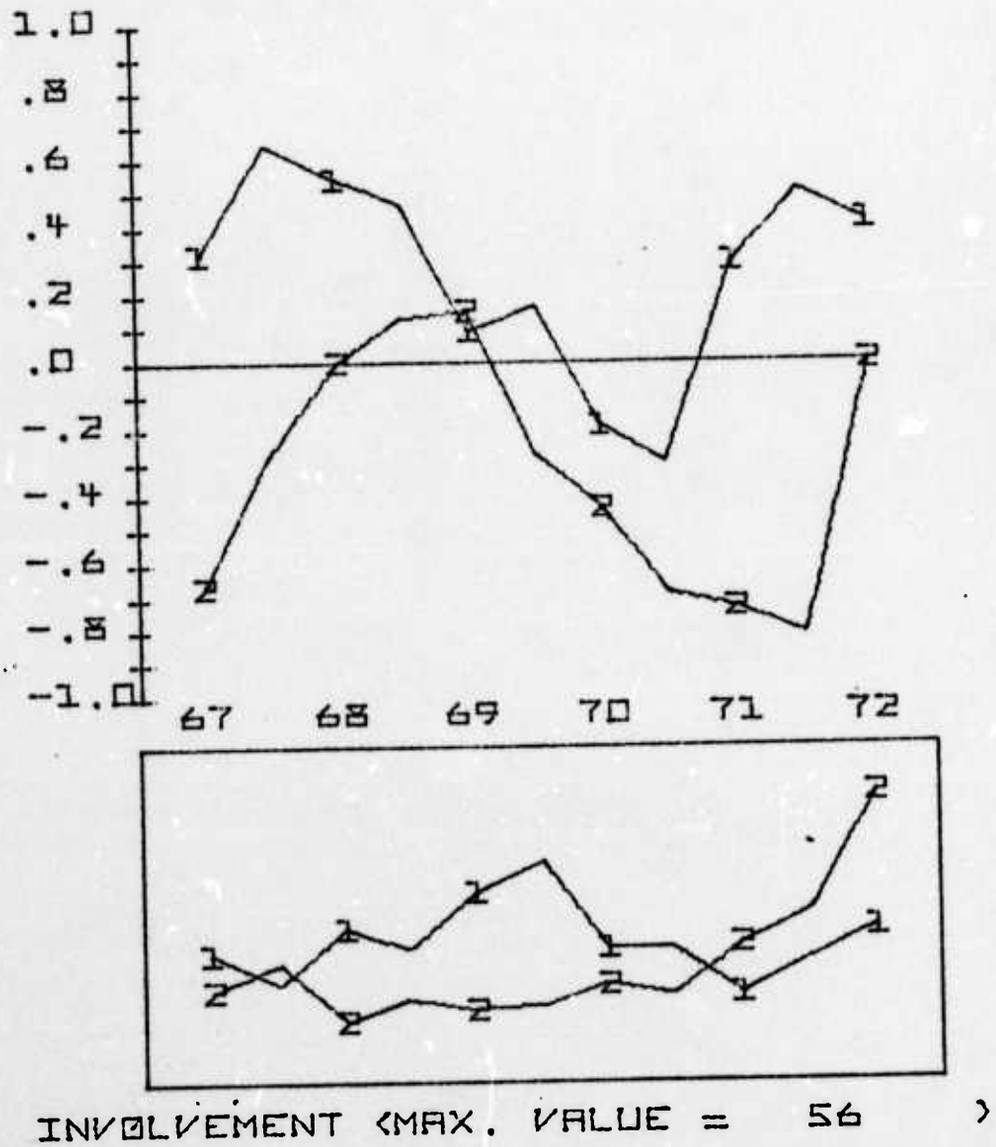
FIGURE 3


POLICY STYLE FOR
042 US-JAPAN
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
67
68
69
70
71
72
A TO B ONLY
PARTICIPATION (MAX VALUE = 101)


POLICY STYLE FOR
171 USA-JAPAN (POLITICAL) (1)
172 USA-JAPAN (MILITARY) (2)
173 USA-JAPAN (ECONOMIC) (3)
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
67
68
69
70
71
72
A TO B ONLY
PARTICIPATION (MAX VALUE = 49)

The next step the analyst might take would be to print out a graph showing the total RELATIONS of Japan with the USSR and the Chinese People's Republic (Figure 4). In refreshing his memory, the analyst would be struck by the generally favorable relations Japan and the USSR have maintained. In the case of the CPR, it is significant to note the substantial shift in their relations with each other in the past year. Not only has there been a substantial increase, as shown by the involvement index at the bottom of the page, but the quality has changed significantly from a negative to the beginning of a positive position.

FIGURE 4

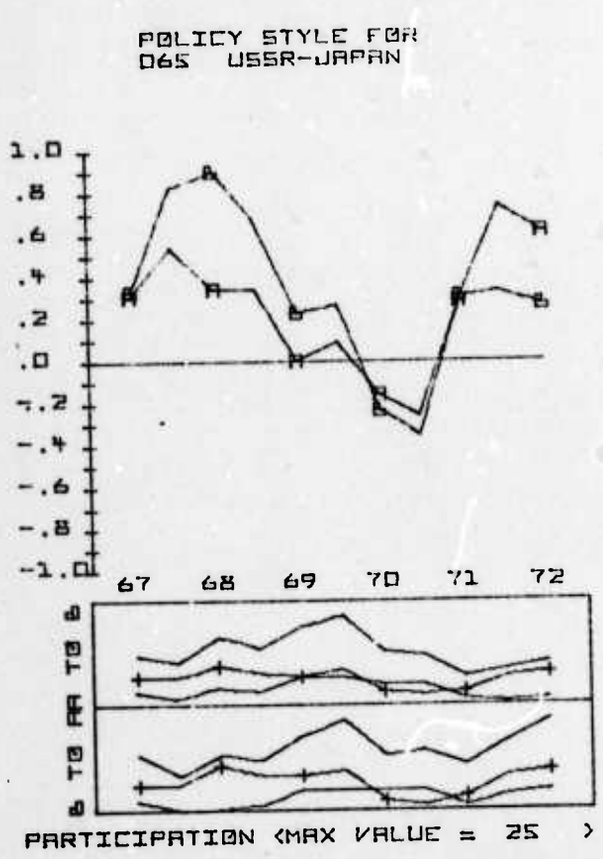

RELATIONS FOR
065 USSR-JAPAN (1)
086 CPR-JAPAN (2)
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
67
68
69
70
71
72
INVOLVEMENT (MAX. VALUE = 56)

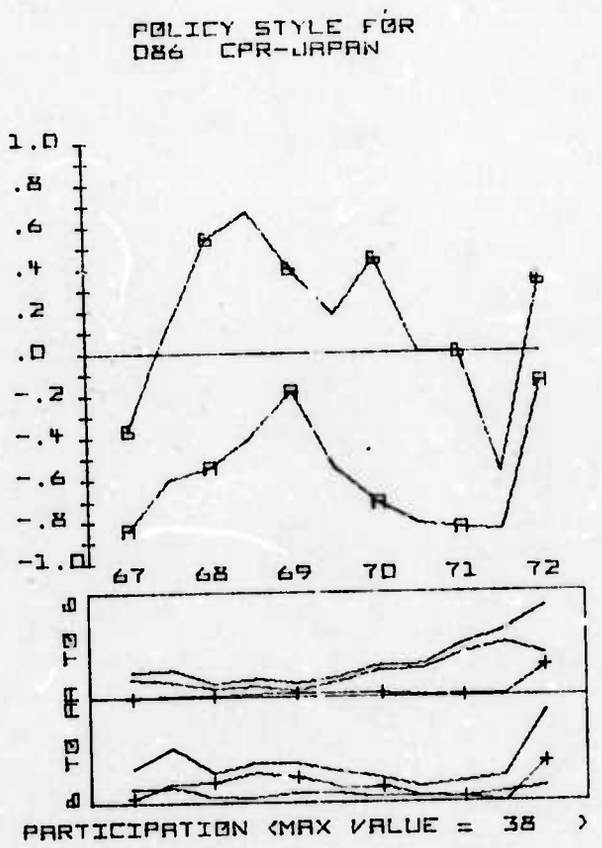
The analyst might now probe Japan's relations with the Soviet Union and the Chinese People's Republic. An easy way to do this would be to call up a printout of the POLICY STYLE of each country toward Japan and Japan's policy style toward each of these countries. Figure 5 displays the individual country's policy style and activities toward each other. The lines representing the policy styles of each country are qualitative in that they are a net position, the result of combining activities and events that are classified as positive, neutral, and negative.

The two policy styles representing USSR and Japan's policies toward each other show a fairly substantial decline, but with a current recovery. Their policy styles show a substantial similarity in movement. But there is a generally low level of events between the two countries.

The figure showing the policy styles of the CPR and Japan toward each other has the same problem as that displayed for the USSR and Japan, namely the paucity of events recorded between the two countries prior to the period 1971-1972. Again, what is notable is that as the events recorded between the two countries begin to increase in the latter part of 1970 and continue to increase through 1972, the policy style of each displays a sharp movement away from the negative. This indicates an apparent policy decision by both governments to improve their mutual relations.

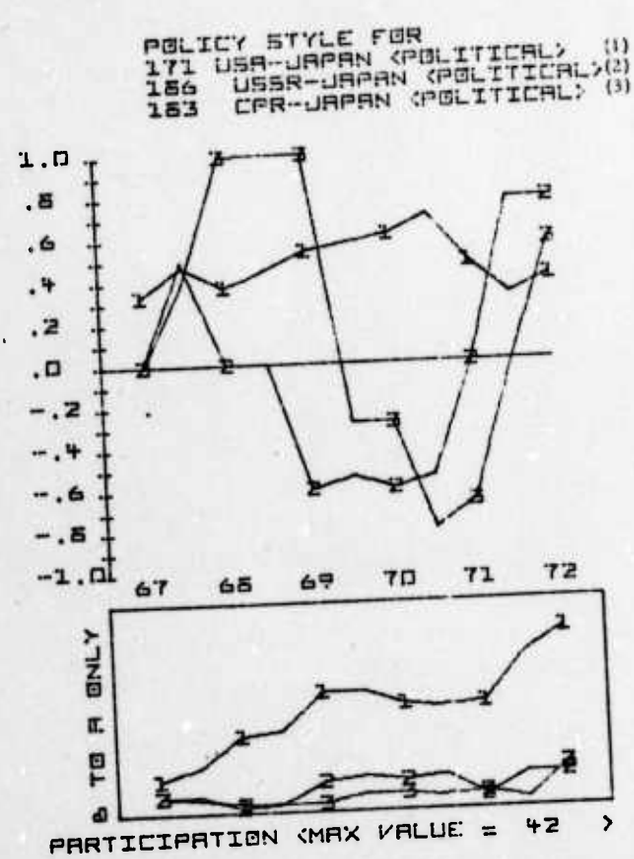
FIGURE 5

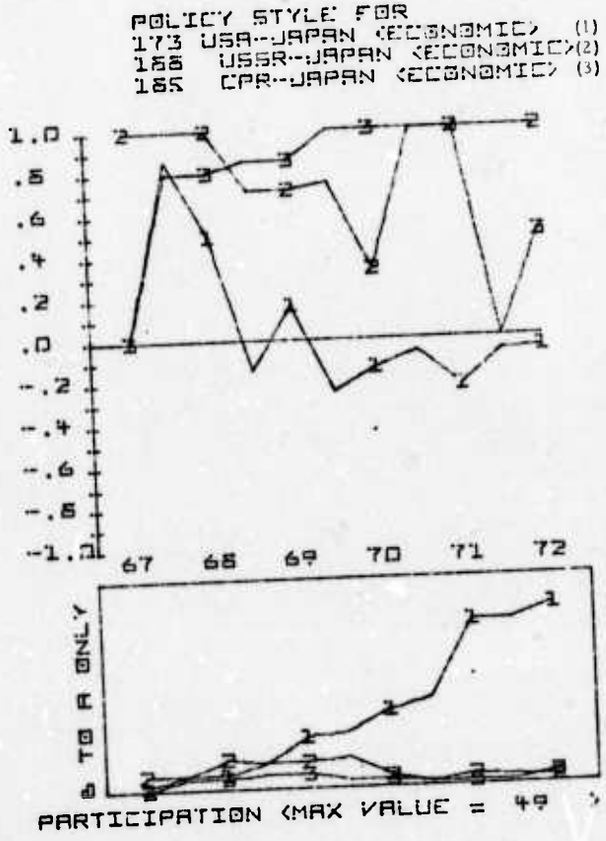

POLICY STYLE FOR
065 USSR-JAPAN
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
67
68
69
70
71
72
PARTICIPATION <MAX VALUE = 25 >


POLICY STYLE FOR
086 CPR-JAPAN
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
67
68
69
70
71
72
PARTICIPATION <MAX VALUE = 38 >

The analyst could next disaggregate the POLICY STYLES of Japan with the USSR and the CPR, respectively, and review the quality of the political and economic event contributions in each case. Figure 6 displays these indicators. The analyst would be reminded that, in general terms, the Japanese policy style toward the U.S. had been pulled down toward the negative primarily because of economic problems, but that the political interchange had been on a relatively even keel on the positive side. On the other hand, the great variation in the Soviet and CPR relations with Japan had been political rather than economic. It should be noted that the total events in these two categories were relatively thin, and that by far the bulk of the event data had to do with interchanges between the Japanese and the U.S. However, the analyst might decide to look more closely at both the Soviet and the Chinese Communist political activities since there was a substantial gain in the policy style of each toward Japan in this area.

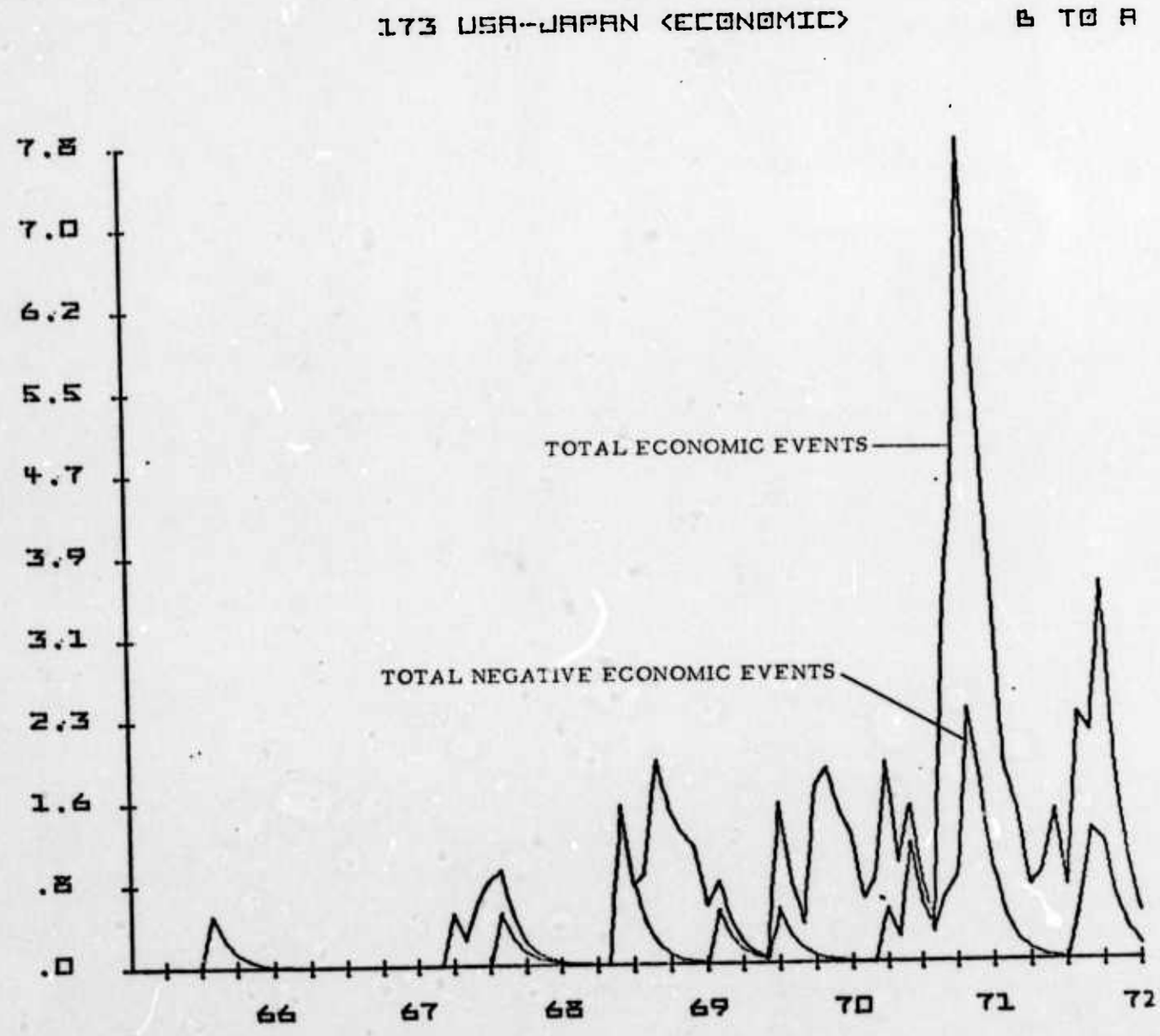
FIGURE 6


POLICY STYLE FOR
171 USA--JAPAN (POLITICAL) (1)
166 USSR--JAPAN (POLITICAL) (2)
163 CPR--JAPAN (POLITICAL) (3)
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
67
68
69
70
71
72
0 TO A ONLY
PARTICIPATION (MAX VALUE = 42)


POLICY STYLE FOR
173 USA--JAPAN (ECONOMIC) (1)
168 USSR--JAPAN (ECONOMIC) (2)
165 CPR--JAPAN (ECONOMIC) (3)
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
67
68
69
70
71
72
0 TO A ONLY
PARTICIPATION (MAX VALUE = 49)

At this point, the analyst has the option to do a quick analysis of the data base with which he is dealing. By going to the time series package, he can call forth a statement either in a figure or in a numerical table of the number of actual events recorded. In Figure 7, we have assumed that he was interested in the number of recorded events of Japanese economic activity or tatements concerning the U.S. and the extent to which these were negative. The upper line in the figure represents the total number of economic events in the various time periods and the lower line, wherever it shows, represents the negative economic events recorded. The general conclusion that can be drawn from this figure is that for the most part, the economic attitude of Japan toward the U.S. has been positive with perhaps one major exception in the period 1970 through the middle of 1971.

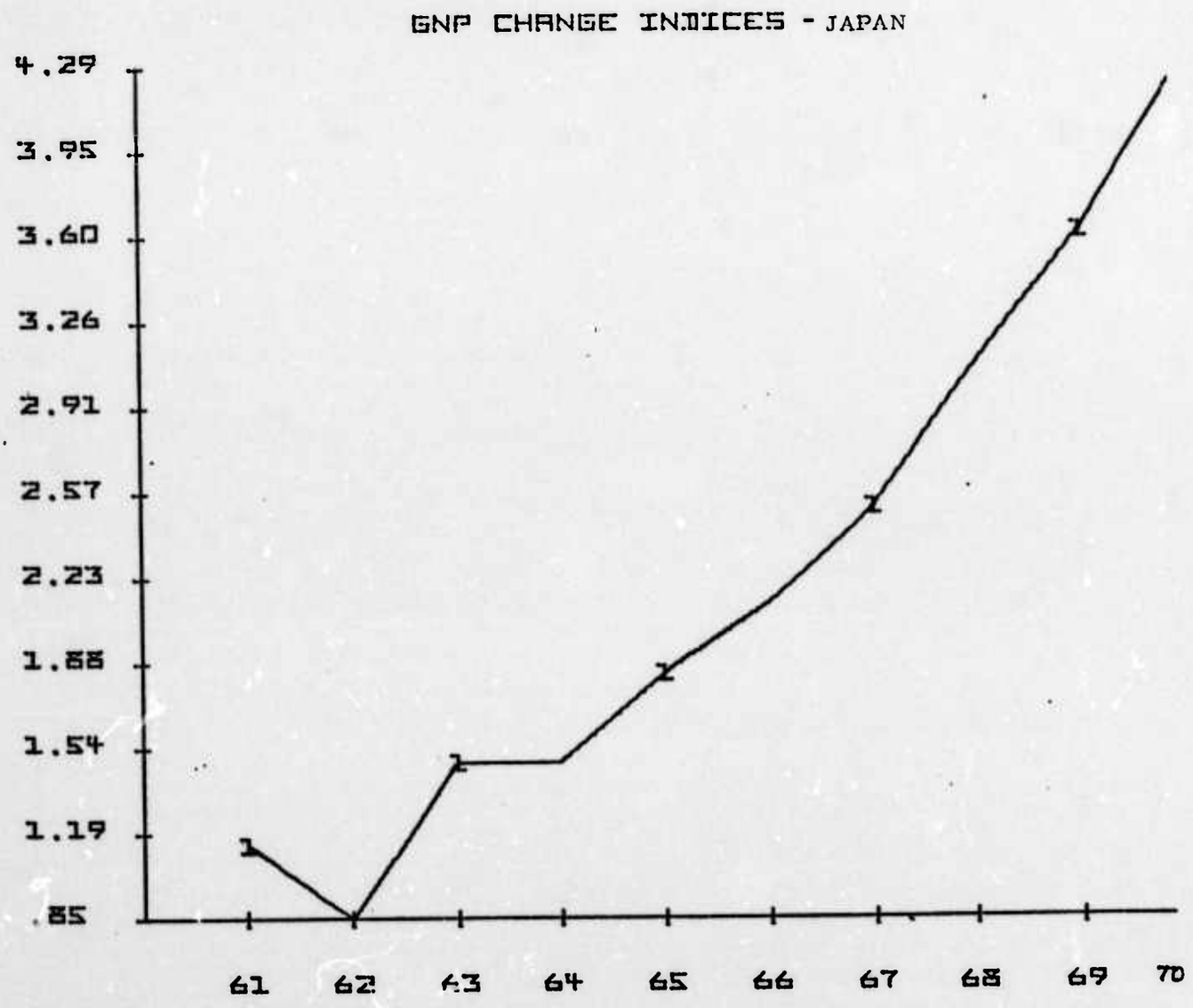
FIGURE 7


173 USA--JAPAN <ECONOMIC>
B TO A
7.8
7.0
6.2
5.5
4.7
3.9
3.1
2.3
1.6
.8
.0
TOTAL ECONOMIC EVENTS
TOTAL NEGATIVE ECONOMIC EVENTS
66
67
68
69
70
71
72

In this exercise, we have assumed that the analyst wanted a quick review of the Japanese rate of economic growth and asked for the rate of change in the GNP through the period under review. Figure 8 shows very clearly that the Japanese rate of growth has been increasing.

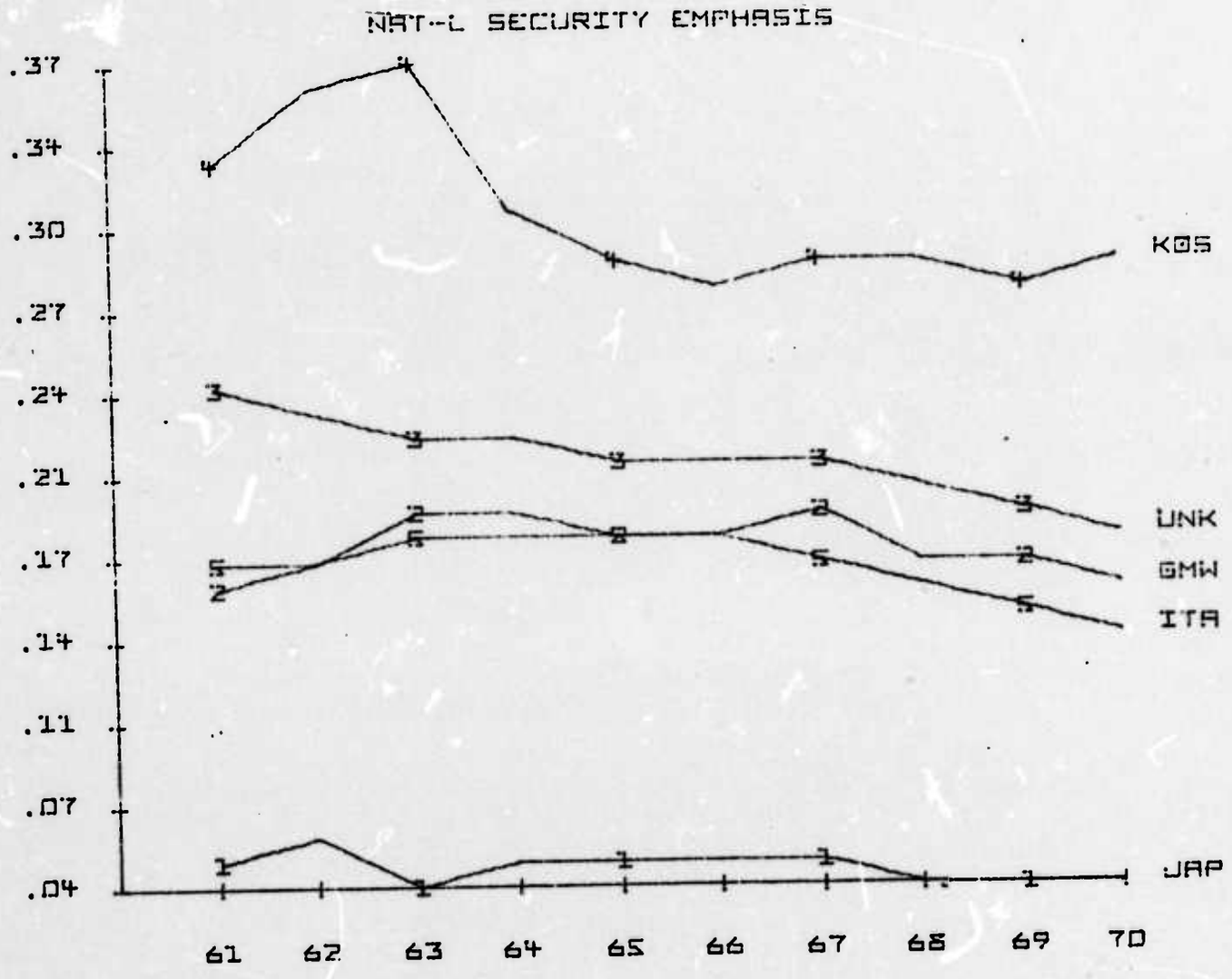
It should be noted that we are in the process of developing three bundles of additional national characteristic data sets. They are designed to represent change in the political structure and environment, in the social fabric of the country, and in the economy. Once the basic data for these sets have been accumulated, they will be put in the computer. We will use this material in subsequent demonstrations as well as in our work with Japanese estimates.

FIGURE 8


GNP CHANGE INDICES - JAPAN
4.29
3.95
3.60
3.26
2.91
2.57
2.23
1.88
1.54
1.19
.85
61
62
63
64
65
66
67
68
69
70

The analyst might also need to refresh his memory on the Japanese effort with respect to national security. This is important, from the U.S. point of view, because of the mutual defense treaty. The data presented to the analyst in Figure 9 would give him little comfort. The indicator shows that Japan is the poorest by far among the closest U.S. allies. The indicator is based on the total military effort (budget plus manpower) as it relates to GNP and population.

FIGURE 9


NAT--L SECURITY EMPHASIS
.37
.34
.30
.27
.24
.21
.17
.14
.11
.07
.04
61
62
63
64
65
66
67
68
69
70
KOS
UNK
GMW
ITA
JAP

The last figure, Figure 10, demonstrates the ability of the analyst to call forth an abstract of the actual messages from which the quantitative data had developed. This set of abstracted messages is designed solely to demonstrate this capability. It shows how the analyst can have the machine print out an abstract of all messages that have been coded during a specified time period (e.g., daily, weekly, monthly). The abstract may also be selected by subject. It should be noted that the numbers above the words on the left are the time indicators and the numerals on the right are the actual codes that are used to input this material into the quantitative data files. The final capability the analyst has is to return to the original data abstract. Use of the abstracts will simplify his search to find specific areas of interest for his particular task.

FIGURE 10

ABSTRACT

701117 740 31 2 0
JAP AMB USHIBA MEETS WITH USA FLANIGAN TO DISCUSS TEXTILE ISSUE
701117 2 31 740 0
USA FLANIGAN MEETS WITH JAP AMB USHIBA TO DISCUSS TEXTILE ISSUE
701204 2 121 740 0
USA TREASURY DEPT CRITICIZES JAP FOR DUMPING JAP TV SETS ON USA MARKET FOR LESS THAN FAIR VALUE
701212 2 81 740 0
USA AND JAP SIGN AGREEMENTS INCLUDING ACCORD SETTLING CRAB QUOTAS IN EAST BERING SEA
701212 740 81 2 0
JAP AND USA SIGN AGREEMENTS INCLUDING ACCORD SETTLING CRAB QUOTAS IN EAST BERING SEA
701231 740 102 2 0
JAP PRM SATO URGES USA NOT TO PASS RESTRICTIVE TRADE LEGISLATION
710201 2 81 740 0
USA AGREES WITH JAP ON EXPORT QUOTA FOR SILVERWARE
710201 740 81 2 0
JAP AGREES WITH USA ON EXPORT QUOTA FOR SILVERWARE

We have now completed the demonstration package. It has utilized all of the data set packages we now have in the computer. In our assumed situation, it is believed that the analyst, having reviewed these various indicators, would be in a much better position to write his assessment of Japanese relations with the U.S., USSR and CPR. In addition to the displays shown above, the analyst could have overprinted other comparisons between Japan and the three major powers. Each of their relations in other areas could have been examined and other capabilities could have been displayed. Finally, these displays could be called up in a Cathode Ray Tube (CRT).

What we have tried to show in this demonstration package (and, at the station in the CACI offices) is the contribution quantitative indicators can make to the analyst. We have restricted our comments and demonstrations to that part of the analyst's role in which he assesses what has happened and its meaning. However, we have not discussed the meaning of past developments with respect to future activities. During the second half of the current contract year, we will focus our efforts on the function of estimating.

C.A.C.I.

WASHINGTON, D.C. OFFICES

A GUIDE TO INDICATOR PROGRAM SOFTWARE

Jeffrey A. Krend

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PREFACE

This is one of a continuing series of reports describing selected aspects of the development and application of quantitative indicators for defense analysis. The objective of this research program, which is sponsored by the Defense Advanced Research Projects Agency, Human Resources Research Office, is the development of a family of quantitative indicators that will be useful for systematically recording, interpreting, and anticipating significant political phenomena related to national defense decision problems.

A description of the computer programs and procedures used in the management of data and in the calculation of selected quantitative indicators is provided herein. In addition to the author, others contributing to software development reported here include Miss Doriann Peasley, formerly of the International Affairs Center, and Professor Rodney Tomlinson, Department of Political Science, United States Naval Academy.

I. INTRODUCTION

This paper attempts to summarize the capabilities and functions of major computer programs (software) developed in the quantitative indicators for defense analysis program. A variety of indicators, derived from several different types and sources of data, have been produced in response to the program charter.

Indicator development and production under this charter depends on the computer from the initial management of the data base to the production and benchmark testing of indicator values. This paper provides a non-technical description of the programs that facilitate this translation of raw data into a viable informational shorthand.

A. MAJOR SOFTWARE CATEGORIES

It is convenient to group indicator program software into four functional categories: (1) data retrieval and display; (2) data-file building and updating; (3) indicator experimentation; and (4) indicator production.

Data retrieval and display refers to the capability for selective search of a specific data base, and for subsequent reporting or copying of relevant data to one or more smaller files for later processing. Typical of this group is the WEISUM series of programs that operate on the New York Times analytic and descriptive data files to provide the analyst with the combinations and intervals of information in which he is interested. Display programs generally have the ability to manipulate the data in various ways, as well as to retrieve it from a larger collection.

For example, programs have been developed that:

- scale and plot relations and style indicator values for pairs of countries specified by the analyst;
- rank countries simultaneously for a specified data year, on a selected set of "characteristics" indicators; and
- provide simple row and column totals and other descriptive statistics for event data that has been previously retrieved and made available for analysis.

The second category, data-file building and updating, refers to programs that recombine and manipulate data, and then create specialized files for storing the results. The resulting files typically become a permanent part of the indicator program data library. For example, the characteristics data file described below was constructed in a series of stages. The results of each stage contribute additional years of data, additional countries, an increasing number of variables in the collection, etc., to later stages. Similarly, programs exist for updating and maintaining these permanent data files on a continuing basis. The New York Times collection, for example, required software to append additional months of data as the data became available.

The third functional category, indicator experimentation, consists of a group of programs written to assist in the construction and verification stages of indicator development. Programs that allow quick appraisal of scaling and weighting parameters, for example, have been utilized in the development of the relations and style measures described below. In addition, decisions concerning the appropriateness of transformations used in the country characteristics measures were also facilitated by software in this category.

Indicator production constitutes the fourth functional category. Programs in this group are designed to compute indicator values for the countries, time periods, and indicators required by project analysts.

B. PRIMARY COMPUTING ENVIRONMENT

The computing environment in which project software operates is provided primarily by the General Electric Time Sharing System.[1] Local calls from communication terminals connect many users simultaneously with the computer center in Cleveland, Ohio. In keeping with the "interactive" character of this environment, programs in all four functional categories are designed to operate "conversationally." That is, a given program accepts specific instructions from the programmer at the time the program is run, which the program then uses to select the countries and time periods for which retrievals or computations are desired. The programs perform the required work and display the relevant data or indicators.

Considerable flexibility exists for efficient management of the output produced by these programs. When the volume of output is small, that is, when less than an hour of terminal connect time is required for reporting values, the programs display the results directly at the communications terminal. When the volume of output is large, as, for example, when relations, style, and involvement measures are calculated over

---

[1] While indicator experimentation and production software currently resides on the G. E. system, the main New York Times collection used by C.A.C.I. has, until recently, existed only on the USNA-Dartmouth Time-Sharing System at the United States Naval Academy. The cooperation of the Naval Academy in providing a facility for storage, retrieval and updating of this collection is gratefully acknowledged.

several time periods for the 170 actor-target pairs in the current data library, facilities exist for re-routing the output to a high-speed line printer. Output from the line printer is delivered to project analysts by air courier at substantially less cost than is incurred with lengthy type-outs to a terminal.

Other system features are being utilized to improve computing procedures and to minimize costs. Background computing, for example, is being used as a means of reducing data storage and retrieval costs. In the same vein, special accounting programs have been developed that permit cost breakdown by research sub-tasks.

The computing environment and software groups together establish a wide range of capabilities for data management and indicator production. Table 1 displays the individual programs arranged by functional category relative to four major data collections of interest: (1) New York Times event data, (2) specialized event data collections, (3) characteristics data, and (4) seminar experiment data. We now turn to a description of the specific software capabilities that currently exist for each collection, following the functional and substantive divisions of Table 1. For convenience, each part of the table has been identified with a letter and number to facilitate references in the text.

TABLE 1

FUNCTIONAL AND SUBSTANTIVE SUMMARY OF PROGRAM SOFTWARE

	New York Times Event Data	Specialized Event Data	Characteristics Data	Seminar Experiment Data
Data Retrieval/ Display	A1 WEISUM NEWFIL RSPLOT NEWPRG BDFCK1 BIG30 BDFCK2	A2 ARPASMRY OMEGA4	A3 RNKSALOT	A4
Data File Building/ Updating	B1 BDFCREAT BDFJK BDFJK2 UPDATE1 UPDATE2 UPDATE3 CONV1-9	B2 OMEGA1 OMEGA6 OMEGA2 OMEGA7 OMEGA3 OMEGA8 OMEGA5	B3 MAKCDF MAKCDF1 MAKCDF2 MAKCDF4 MAKCDF5 MAKCDF7 MAKCDF9 MAKCDF11	B4 RSPPG
Indicator Experimentation	C1 TSER2 TSTFRC VSCALE VWAT VWAT2	C2	C3 NEWIND	C4 EXPRMT
Indicator Production	D1 VARPB CONC1 VARPRS CONC2 VARPR CONC3 RPRIME CONC4 VARPS CONC5 SPRIME RANDS SHORTS	D2 OMEGA9 OMEGA10 OMEGA11 OMEGA12 VARPRR	D3 MAKCDF3 MAKCDF6 MAKCDF8	D4

II. CAPABILITIES FOR NEW YORK TIMES EVENT DATA

The New York Times data collection consists of numerical data representing over 50,000 international actions since January 1966. The coding technology that translates narrative accounts in the New York Times into quantitative form is based on the system developed by Charles McClelland and others at the University of Southern California.[2] The World Event/Interaction Survey (WEIS) codes identify the date an event occurred, the country initiating the action ("actor"), the country toward which the action is directed ("target"), and the type of action. In addition to the numerical data produced with this coding system, a condensed English language summary of each event has also been computerized.

A. STORAGE AND RETRIEVAL (MAIN COLLECTION)

The analytic (numerical) and descriptive (English language) data files have been placed on a magnetic tape that can be accessed through the G. E. background system. A total of 168 logical divisions, or files, were used to organize this data. The first 84 logical files on this tape contain the analytic data from the New York Times, with one month of data to a file. The remaining 84 files contain the English language descriptive data, also with one month of data to a file. Each file contains from 4,000 to 8,000 words of data. Given the large size of the collection,

---

[2] Summarized in Charles A. McClelland, et al., "The Management and Analysis of International Event Data: A Computerized System for Monitoring and Projecting Event Flows" (University of Southern California: WEIS Project, September 1971).

storage on magnetic tape is, for present project purposes, demonstrably more economical than by other means.

Data on this tape is accessed primarily by a program named WEISUM (part of category A-1 in Table 1). This program accepts and interprets instructions from the programmer regarding the appropriate actor-target-event-time combinations to be retrieved. The program performs the retrievals and saves the data in a series of scratch files. These files can subsequently be listed at the communication terminal, stored for later processing, transferred to other media such as line printer, cards, tapes, and so forth. Written in G. E. background FORTRAN, the program and its related procedures are adapted from a BASIC-language version implemented at the U. S. Naval Academy.[3]

Two other programs in category A-1, NEWFIL and NEWPRG, have been developed as experimental alternatives to the WEISUM retrieval program, and operate using a different retrieval strategy. NEWFIL identifies non-zero data locations and aggregates the existing frequencies into one of seven C.A.C.I. event groups for each month of data. At the same time, a dictionary is used to convert actor-target codes to indexes of a 145 by 145 logical matrix for each month of data. If previous non-zero cells have been encountered for a given pair, the event frequency is accumulated; if not, a random-binary record is created for the newly encountered, non-zero pair, according to the current status of each

---

[3] In the course of the WEIS project and subsequent implementation of the WEIS collection at the Naval Academy and G. E. computer center, a series of retrieval programs have been written that owe their development to the original WEISUM program at USC. Use of the name WEISUM in this report refers specifically to the current G. E. background version, with due acknowledgement of that original implementation.

cell of the logical matrix. The effect of NEWFIL is to create a smaller working collection of New York Times data analogous to the file described in the following section. NEWPRG is designed to make retrievals from the working collection created by NEWFIL. These programs were intended to reduce the number of passes through the main collection required for complex retrievals. With improvements in the WEISUM series, however, WEISUM remains the primary program for data retrieval.

B. STRUCTURE AND OPERATIONS (WORKING COLLECTION)

Programs in category B-1 of Table 1 were developed because direct computation of indicators from the full data collection is inefficient. For a variety of technical reasons, more efficient use of computer resources is possible by creating a smaller working collection, organized by pairs of countries rather than chronologically.

Accordingly, a procedure was developed in which some 300 separate WEISUM retrievals were rewritten to a single, random-binary file. This file, called the "Basic Data File" (BASDF), was prepared with programs BDFCREAT, BDFJK, and BDFJK2. These routines are characterized by various error-checking features that insure the correct placement of data in the appropriate columns and rows of each pair-oriented data matrix. A special packing subroutine in these programs compresses the final matrix from fourteen columns to five columns using modular arithmetic before the matrix is written to the working file. When the compressed record is requested by another program for checking or computing purposes, retrieval routines in these programs reverse the packing procedure and restore the original format. The packing and unpacking features of these programs reduce storage requirements of the working file by 64% over the uncompressed file size.

Appendix A summarizes the actor-target combinations that have been incorporated into this Basic Data File. As will be noted from Appendix A, actor and target pairs have been defined in some instances to represent groups of nations as well as individual countries, as dictated by substantive areas of interest. For example, the combinations "US-World" and "USSR-World" are accommodated in the same storage format as the nation-pairs "US-USSR" and "US-Chinese Peoples Republic (CPR)." These records are identical in organization, but of course differ in the distribution of event frequencies that comprise them.

Each of the 170 records in the Basic Data File consists of a record identification and an event data matrix. Organization of the event data matrix is shown in Table 2. The size of the matrix for computing purposes is currently 84 rows and 14 columns. The rows represent pairwise interaction data accumulated by months, where row one contains data for January 1966, and row 84 represents data for December 1972. The columns represent seven event groups developed by C.A.C.I. from the original 63 WEIS coding categories.[4] Two columns are required for each event group. For any one event group, events that are directed from actor A to target B occupy odd-numbered columns, while events flowing from actor B to target A are positioned in even-numbered columns. The seven event groups are defined in part C of Table 2.

When the Basic Data file was created, two simple checking programs, BDFCK1 and BDFCK2, were prepared to verify that the column totals

---

[4] Derivation of the seven C.A.C.I. event groups for purposes of data reduction and user relevance is described in Theodore J. Rubin, "Development and Experimental Application of Quantitative International Affairs Indicators," Interim Technical Report, Volume I, Summary Report (Arlington, Va.: C.A.C.I. 1972), pp. 3-10.

TABLE 2

BASIC DATA FILE (BASDF) RECORD ORGANIZATION

A.

Row Number	Data Month	
1	January	1966
2	February	1966
3	March	1966
4	April	1966
5	May	1966
6	June	1966
7	July	1966
8	August	1966
9	September	1966
10	October	1966
11	November	1966
12	December	1966
13	January	1967
.	.	
.	.	
.	.	
82	October	1972
83	November	1972
84	December	1972

B.

Column Number	Event Group
1	Group 1, A-B*
2	Group 1, B-A**
3	Group 2, A-B
4	Group 2, B-A
5	Group 3, A-B
6	Group 3, B-A
7	Group 4, A-B
8	Group 4, B-A
9	Group 5, A-B
10	Group 5, B-A
11	Group 6, A-B
12	Group 6, B-A
13	Group 7, A-B
14	Group 7, B-A

*Events directed by Actor A to Target B.

**Events directed by Actor B to Target A.

C.

Event Group	Description
1	Military Incidents
2	Coercion
3	Pressure
4	Communication/ Consultation
5	Support/Agreement
6	Reconciliation
7	Military Disengagement

as written to and retrieved from the newly created file agreed with the corresponding totals on the hard copy generated by the WEISUM program. In addition to this checking function, the programs are routinely used to prepare quick summaries of event data distribution for specific country pairs over selected time intervals.

Appendix B illustrates this summarizing capability. Underlined names and numbers in Appendix B represent input to the program from a terminal; the rest is program output. In this example, the programmer has requested two types of information. First, the program was instructed to provide column totals over the entire 84 months of data for the pairs US-World and USSR-World. Column totals, one through fourteen, are presented in ascending order from left to right, as described in Table 2. Second, the programmer has requested column totals for four country pairs, beginning with month 73 (January 1972) and ending with month 84 (December 1972). In both cases, the program was instructed to report column totals only; however, each month of data could be displayed if needed. A non-zero response to the query, "more records to check?" terminates the program.

Program BDFCK2 performs a similar function. In this case, however, the output consists of seven rather than fourteen columns of data, where A to B data has been added to B to A data for each of the seven C.A.C.I. event groups. The program writes this output to a separate file, rather than to the terminal, for additional processing. This program is useful when New York Times data for specific countries and time intervals are needed for comparison or combination with corresponding data from other sources.

Occasionally it is necessary to display A-B, B-A, and combined totals

separately over various time intervals for a relatively large number of dyads. While BDFCK1 is capable of displaying this information, BIG30 presents it in a format that permits faster comparison between selected country pairs. Appendix C contains sample output from the BIG30 program. The pairs chosen were those used in C.A.C.I. seminar experiments; the selection of dyads is controlled by a pointer system within the program that is easily modified as circumstances require. In this example, the programmer has requested column totals for the seven C.A.C.I. event groups from January 1966 to December 1972 (months 1-84).

In order to maintain the New York Times collection on a continuing basis, the UPDATE series of programs in category B-1 was developed to add new data as it becomes available. After the actual data are entered into the computer and checked, WEISUM is used to retrieve the relevant data in the usual format. The UPDATE series operates on these retrievals, manipulating the additional months of data into the 14-column matrix format described above. The old matrix for each country pair is retrieved from the old data file, and the old and new data are merged, with the latest months of data forming the last few rows of the new matrix. Matrices formed in this manner are then compressed and written to a separate, enlarged random-binary file. After extensive checking to insure the integrity of the updated collection, the old file is purged.

One additional group of programs needs to be mentioned in relation to data-file building and updating. Before the full WEIS collection became available on the G. E. system, retrievals from the WEIS data file were performed at the U. S. Naval Academy on the USNA-Dartmouth Time Sharing System. Procedures were developed by which the retrievals

were written to a magnetic tape. This tape was subsequently delivered to the G. E. computing center and "loaded" into files on that system. The CONV series of programs facilitates this transfer of data by tape or cards from the Naval Academy. These programs primarily convert the computer character codes in which the data are expressed on the tape (BCD) to the codes used by the G. E. foreground system (ASCII). The procedures are sufficiently general to accommodate future data transfers from USNA or other computing environments to the G. E. system with a minimum of difficulty.

C. EXPERIMENTATION AND PRODUCTION SOFTWARE

We now shift from data management capabilities to a description of indicator experimentation and production software, categories C-1 and D-1 in Table 1. Indicator development to date has focused on measuring concepts of international performance that are important in the subjective vocabulary of the policy community. Quantitative representations of "relations," "policy style," "involvement," and "concentration" are among those developed from, but not limited to, New York Times event data.[5] While a cursory review of each indicator is included below, the reader should consult the references for a more complete account of the derivation and application of each statistic.

1. The Relations Indicator

"Relations" emphasizes the quality of interactions between pairs of countries. Quality is derived from the relative mix of friendly, hostile, and neutral behavior between country pairs, as measured by event data

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[5] Ibid., pp. 1-35.

aggregated into the seven previously mentioned event groups. Relations values, ranging from +1 to -1, are produced by an algorithm that evaluates these groups relative to each other.

$$R = \frac{p - n}{p + n + \frac{ne}{2}}$$

where: R = relations

p = total positive actions reported between a pair (Groups 5, 6 and 7)

n = total negative actions reported between a pair (Groups 1, 2 and 3)

ne = total neutral actions reported (Group 4).

R values for selected dyads are produced by the VARPR program. With this program, R can be computed for any of the 170 country pairs in the Basic Data File. The program retrieves the data for each pair and performs the computations for that pair before continuing to the next pair. The programmer may request as many sets of calculations at a time as he wishes for any desired combination of pairs.

While the statistic itself is easily computed, considerable programming effort was required to construct various time intervals over which the R values are computed. Currently, five time-options are available for smoothing the data:

1. An annual option, where R values are computed over a full 12 months of data;

2. A semi-annual option, where R values are reported over six-month intervals;

3. A quarterly option, where R's are computed over selected calendar quarters;

4. An option to compute R over 12 months of data where R is reported at the end of each three-month interval rather than at the end of the calendar year; and

5. An option for computing R over 24 months of data reported at six-month intervals.

Appendix D contains sample output from the VARPR program. In this example, relations measures were computed for two nation-pairs, US-Japan and USSR-Japan, for all 84 months of data. Time-option five was specified, with the result that data were aggregated over eleven 24-month periods between January 1966 and December 1972. Under this option, periods are constructed such that successive periods overlap each other by 12 months for smoothing purposes. The first R is therefore computed over the interval January 1966 to December 1967; the second R calculation is based on data from July 1966 through June 1968, while the third R calculation covers January 1967 through December 1968, and so on.

The capability to compute R and other indicators over a number of different time series was provided in response to an important problem in the utilization of event data: How completely is an event captured by the arbitrary time intervals of a particular data collection? In addition to possible bias in the choice of the time interval, the problem is further complicated by such factors as reporting biases in the data source, coding conventions, short term fluctuations in the phenomena being measured, and the like. For these reasons, all C and D category programs enable the analyst to rapidly assess the differences between statistics computed over time periods of varying length.

In addition to the capability for computing various indicators over a variety of time periods, a program exists to facilitate the smoothing of

month-to-month data prior to indicator production. TSER2 combines A-B and B-A data in each event group and computes a set of smoothed data points that are analagous to each point in the unsmoothed time series. In this case, smoothing is achieved by means of a decay function that diminishes each previous value in the actual time series by a factor of one-half for each new point encountered. This procedure has the effect of "carrying over" the impact of previous events into successive time points, where the carry-over effect is reduced by half for each successive time-point as follows:

$$S_t = 1/2\ (F_t + S_{t-1})$$

where: S_t = smoothed event frequency at time t for any event group;

S_{t-1} = smoothed event frequency at the previous time-point, for any event group; and

F_t = unsmoothed, or actual event frequency at time t for any event group.

Sample output from TSER2 appears in Appendix E. Two procedures are thus available in response to the problem of arbitrary time scales:

- aggregating event frequencies for overlapping time-periods, for a variety of periods (quarters, half-year, calendar year, and 24-month intervals); and
- smoothing event frequencies using the above decay function.

At the same time that project analysts were considering alternative smoothing procedures for individual event groups, attention was also directed to determining the proper weighting of event groups relative to each other in the relations indicator. Early development of the

relations measure and subsequent experimentation with the weighting of its components were facilitated with the VSCALE, VWAT, and VWAT2 programs (Appendixes F, G). These routines permitted interactive experiments in which each of the seven event groups were assigned differential weights prior to the computation of R values. VSCALE enables the programmer to scale the event groups in the numerator of the relations measure arbitrarily, while VWAT and VWAT2 permit the weighting of components in both numerator and denominator. Judgments concerning the relative merits of various scaling and weighting combinations were supported in part by output from these programs.

One such modification of the relations algorithm, developed in the course of recent experiments in the scaling and weighting of event data,[6] is a cognate version of relations, designated as R-prime (R'). This indicator has the same interpretation as R, but here an attempt was made to compensate for certain biases in the data source. Specifically, Class 3 ("Pressure"), with the largest frequency of negative events, was scaled at 0.5 to offset a bias toward the apparent over-reporting of hostile events relative to friendly events in the New York Times. In order to produce R' values as needed for comparison with other indicators, a variation of VARPR called RPRIME was written. This program produces R' values in the same format and for the same time options as are currently available for R values. RPRIME output has the same appearance as VARPR output in Appendix D.

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[6] Theodore J. Rubin and Gary A. Hill, "Experiments in the Scaling and Weighting of International Event," RM 302 (Arlington, Va.: C.A.C.I., January 1973).

2. The Policy Style Indicator

Policy style (S), like relations, is defined as a quality rather than a magnitude measure. Also expressed as a value between +1 and -1, it is intended to represent the quality of actions directed by one country toward another (e.g., U.S. toward Japan), rather than actions flowing in both directions simultaneously. Computationally, the algorithms for style and its cognate measure, style-prime (S'), are identical with the R and R' algorithms, respectively. They differ in the composition of event data used to compute them. Whereas the relations measure combines the actions from A to B with the actions from B to A to form the seven C.A.C.I. event groups used in the computation, the style measures are based on A to B data only. Style is therefore an "asymmetric" measure that may be used to enhance the "symmetric" perspectives of the relations measures.

Programs VARPS and SPRIME produce S and S' values, respectively, for any pair of countries in the Basic Data File. The programmer's options with respect to the number and identity of pairs for which calculations are to be made, as well as for the time interval desired, are identical with VARPR and RPRIME program options. Each program requests this information at run time. Since VARPS and SPRIME have identical output formats, only VARPS is included here as Appendix H.

3. Involvement and Participation Indicators

Involvement is a magnitude concept that refers to the extent to which one country interacts with another country. It is measured by combining the event frequencies in the seven C.A.C.I. event groups into friendly, hostile, and neutral dimensions. Involvement is reported for

"symmetric" data, where A to B and B to A actions have been combined to form an event group. When A-B data is reported asymmetrically, the sum of events in the seven A-B event groups is conceptualized as "participation." These measures further enhance the relations and style indicators, respectively, by alerting the user to the number of events behind each R and S calculation. Involvement is typically reported whenever R or R' indicators are calculated, while participation is reported with S and S' values (Appendixes D, H).

A small number of special applications programs exist for computing R and S values under special circumstances. The programs SHORTS and RANDS, for example, compute these indicators from data files that differ in storage format and type from the Basic Data File. VARPRS is another special program that produces R and S values from the Basic Data File, but computes R and S over moving four-month intervals (Appendix I). TSTFRC is used to determine the dispersion of R values about a median computed from any given sample of R's. VARPB is a particularly powerful special program. It is used to compute both R and S values for large numbers of pairs at a time. This particular program is submitted to the system in such a way that the output, which tends to be considerable, is written to a disk file rather than output to the terminal. File contents are then routed to a high speed line printer and subsequently delivered to project analysts as hard copy (Appendix J).

Selected output from the VARPB program can be transferred to punch cards as well as to a line printer. Relations, style, and involvement measures for selected dyads are occasionally prepared on cards for input to a display program named RSPLOT. RSPLOT differs from all of the other programs in the library in two interesting respects. Functionally, it is a plotting program designed to drive a Cal-Comp digital

plotter. Operationally, it is implemented in batch FORTRAN for use at a CDC 6400 installation. RSPLOT reads the measures from the cards and then computes and plots a graphic display of these three indicators in 8 1/2 by 11-inch format. A sample plot created by this program appears as Appendix K. It should be noted that the lead time for computing the relevant measures, punching and delivering cards, and creating a series of plots can be as short as 24 hours.

4. The Concentration Indicator

Development work on a measure of the extent to which a particular country concentrates its international behavior has recently been completed. This "concentration" indicator assesses the distribution of event data for each country over time. The time frame analyzed to date is from January 1966 through June 1972 using New York Times data. Data were retrieved from the main collection by country rather than pair-wise and aggregated over 13 six-month intervals. Two sets of data were prepared: 13 months of data for groups 1-7, and 13 months of data for groups 1-3 (negative events) only. Procedures were developed for computing the concentration measure from both smoothed and unsmoothed time series. For each point in each time series constructed, measures were computed for each of 19 actor countries relative to three "constituencies:"

1. The "world," comprised by approximately 150 target countries retrieved from the New York Times collection for this purpose;

2. The geopolitical region (e.g., South America, Southeast Asia, Eastern Europe, etc.) to which a particular actor belongs; and

3. "Primary targets," that is, the ten countries toward

which the actor country was most active over each particular time period.

Concentration is defined in each case as the square of the sum of the event frequencies, divided by the sum of the squared event frequencies:

$$C_t = \frac{\left(\sum_{i=1}^{N} e\right)^2}{\sum_{i=1}^{N} e^2}$$

Where: C_t = Concentration at time t for any actor relative to any of three constituencies;

e = Total number of events directed from Actor A to Target B in constituency of size N;

N = Number of target countries in a given constituency.

This formulation has the effect of reducing the impact of relatively small event frequencies while amplifying the effect of relatively large frequencies. The resulting measures may then be interpreted as the basic number of countries on which a given actor is focusing his activities, relative to each of the three constituent target groups.

The software series that produces these measures is designated CONC1-5 in Category D-1 of Table 1. CONC1 computes 13 sets of concentration measures for each actor relative to each of the three constituencies over each six-mouth time slice from January 1, 1966 through June 30, 1972. CONC2 computes concentration measures for the same actor-constituency combinations, but aggregates data over 12-month periods. Each of the 12 periods overlaps the previous period by six months, so that for the 13 original time-slices, 12 sets of concentrations measures

are produced for each actor. Similarly, CONC3 computes an identical array of measures using data aggregated over 24-month periods. Ten periods are constructed by overlapping each 24-month period with the previous 18 months. Ten sets of concentration measures are produced under this option, one set per period. Physical integration of output is facilitated with programs CONC4 and CONC5, which reorganize the preliminary results into displays such as the one that appears in Appendix L.

In Appendix L, concentration measures are reported over each of 13 six-month intervals with the United States as actor nation. Concentration values for each of the seven geopolitical groups are displayed first; the column adjacent to each C value is the raw event frequency associated with that value. Concentration for the U.S. relative to the "world" of 150 target countries is reported as Group 8, along with the total actor-target frequency for each period. Primary targets for each time period are displayed next, in rank-order from left to right, where the left-most country is the country toward which most U.S. actions were directed in a given period. Finally, a table of frequencies is displayed that represents the event frequency associated with each target in the preceding table. The concentration measure for the U.S. relative to each target group appears as the twelfth column in this table.

From this display, one finds, for example, that the Soviet Union is displaced as the number one U.S. target by North Vietnam as one progresses from earlier to later time periods. It will also be noted that the "worldwide" scope of U.S. activities decreases from 27 countries to three countries (North Vietnam, USSR, and South Vietnam) during the six-year period beginning June 30, 1966 (period 1) and ending June 30, 1972 (period 13). On examining the table of target frequencies,

U.S. attention to number one targets increases from 28 events during period 1 to 362 events in period 13. One can interpret these patterns to mean that the measure has captured the increasing U.S. involvement in Vietnam, as well as some corresponding decreases in activities in other parts of the world, during the period covered by the data. This example is suggestive of the types of analysis that the measure makes possible. A research memorandum describing the application and performance of this measure is planned.[7]

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[7] Title uncertain. It should be noted that work on this measure to date is preliminary in nature, and that some changes in the measure and/or in the manner of displaying its values may be made.

III. CAPABILITIES FOR SPECIALIZED EVENT DATA COLLECTIONS

On occasion, C.A.C.I. has undertaken research projects that demanded that data be collected from non-public sources for events within nations as well as for events occurring at the international level. Neither the WEIS coding scheme nor any of the other familiar coding systems[8] were designed to accommodate both international event data and data for domestic actors and targets. In order to collect both international and subnational event data, C.A.C.I. added a number of event codes, subject codes, and subnational actor codes to a revised WEIS system. The Defense Event Coding System (DECS) was the result of this effort.[9] The purpose of this section is to describe existing software capabilities that can be used with data collections constructed with the DECS coding system.

A. STORAGE AND RETRIEVAL (MAIN COLLECTION)

Once a DECS coded data collection has been prepared, two methods of accessing the data are available to project analysts. Both methods assume that the data collection of interest exists initially on a host system other than the G. E. time sharing system. Both methods

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[8] Catalogued in Mark Wynn, "The Event Data Approach to Political Research: A Bibliography," RM 304 (Arlington, Va.: C.A.C.I., March 1973), pp. 3-4.

[9] "Defense Event Coding System (DECS) Handbook" (Arlington, Va.: C.A.C.I., forthcoming). See also Mark Wynn and Mary F. Smith, "The International and Domestic Event Coding System (INDECS)," RM 303 (Arlington, Va.: C.A.C.I., January 1973). Remarks pertaining to DECS-coded data apply to INDECS-coded event data as well.

utilize retrieval software implemented on the host system to extract the relevant portions of data to be analyzed. For example, data collections located at the U. S. Naval Academy are accessible with a BASIC-language program named ARPASMRY on the Annapolis system. ARPASMRY is analogous to the WEISUM program in design and function, but differs from WEIS in features that make it compatible with data organized according to the DECS coding scheme.

The first retrieval method is simply to run ARPASMRY directly from a remote terminal over long-distance telephone lines. Output from the program is then preserved on paper tape or magnetic tape cassette at the terminal site and subsequently loaded onto the G. E. system. OMEGA4 facilitates the conversion of this output to a suitable format on the G. E. system. For large volumes of data, however, this method is impractical when data transmission characteristics and telephone connect time are considered.

The second method, which is less direct but more appropriate for large retrievals, consists of the following steps:

1. Retrieve relevant data tables using the ARPASMRY program;
2. Transcribe the output to magnetic tape in a format that reduces redundant la ' irg and deletes unneeded blanks in the data;
3. Ship the tape to the G. E. computer center;
4. Load the contents of the tape onto G. E. disc files; and
5. Decode the BCD disc files into ASCII disc files with OMEGA1, a file-building program in category B-2 of Table 1.

B. STRUCTURE AND OPERATIONS (WORKING COLLECTION)

Unlike the New York Times collection, which is quite uniform in substantive content and organization as formatted for the G. E. system, retrievals from the specialized collections thus far analyzed by C.A.C.I. differ widely in the composition and size of the rows and columns being analyzed.

For example, in one instance the analyst may encounter data months as rows and event categories as columns, while the next data matrix may contain subnational actors on the rows and subnational targets on the columns.

To accommodate this variation, a program was devised to handle newly-received DECS data as follows. After transferring the data to the G. E. system and decoding with OMEGA1, OMEGA2 breaks up the large, sequentially organized ASCII data file produced by OMEGA1 into a large number of random binary data files, where one retrieval and its associated title and labels are written to each random-binary file. OMEGA2 makes use of the fact that part of each retrieval contains numbers that represent the size of the rows and columns of data that follow. The program reads this information from the ASCII file, then makes use of variable-dimensioning capabilities in the FORTRAN language to create and write a random-binary file of exactly the proper size for each retrieval being processed. Because each table is written to a separate file, rather than to a single, uniformly-dimensioned file as in the case of the New York Times data, OMEGA2 also writes the parameters of each file to a master index for bookkeeping purposes. Each data file is assigned a sequence number in this index, based on the order in which the file was created. OMEGA3 is used periodically

to read this index and produce from it an overview of resident DECS-type files and their dimensions.

Whenever a particular file is required for processing, the programmer simply specifies the sequence number of the data file in which he is interested. The file-building and indicator-producing routines in the OMEGA series, categories B-2 and D-2, use this number to locate the attributes of particular data files in the master index. These attributes, such as file name, row, and column sizes are then used by the program to adjust work space within the computer automatically to fit the particular data matrix being accessed.

Data is then read into memory, along with associated title, row, and column labels. Substantive computing then proceeds, depending on the exact function of the particular OMEGA program in use. This technique avoids the necessity of writing at least as many different computational programs as there are different-sized matrices in the working collection. With this strategy for organizing and accessing the data, only as many computing programs as there are distinct computing tasks need to be written.

Once the specialized data collections have been written to individual files, other software is available to combine matrices with similar substantive content as needed. Programs OMEGA5 through OMEGA8 perform various matrix-combining functions. For example, matrices with identical numbers of subnational actors and subnational targets may differ only as to the C.A.C.I. event group by which the matrix was constructed. In order to calculate relations and style measures for these entities, it is necessary to manipulate a total of seven matrices (one for each group) to obtain the desired calculations. In another instance,

it was necessary to combine event data from specialized event files with corresponding data from the New York Times file. Because the two G. E. resident collections are radically different in format, it was necessary to write programs to retrieve data from each separate collection and combine the data in a common format.

C. INDICATOR PRODUCTION SOFTWARE

Production of indicators and other displays with category D-2 OMEGA programs followed these data-manipulation tasks. OMEGA9, for example, identified actor-target pairs within certain matrices and rank-ordered these pairs according to the frequency of events occurring between them. OMEGA10 computed R and R' values for these pairs, while OMEGA11 and OMEGA12 provided S and S' computations. VARPRR produces R and R-decay, a cognate version of R with a decay function, for multiple-source data. Involvement measures were produced by all the preceding D-2 programs. A research memorandum that reports the actual calculations and assesses their substantive importance is in preparation.[10]

Thus far the discussion has centered on Indicator Program software written for managing event data and for computing indicators based on event data. We now focus attention on computing capabilities developed for other types of data.

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[10] "Experimental Analysis of Classified Event Data Sources" (Santa Barbara, Ca.: C.A.C.I., July 1973). (SECRET)

IV. CAPABILITIES FOR NATIONAL SECURITY CHARACTERISTICS DATA

Few would question the fact that concepts such as national power, size, wealth, and security emphasis are used repeatedly in analyses of foreign policy. While these concepts take on nearly as many shades of meaning as there are analysts who use them, some general agreement exists as to the utility of such concepts for differentiating countries and their capabilities. To the extent that such concepts are successfully operationalized with a recent and continuing data source, one might argue that the power to differentiate significantly increases. Recently, C.A.C.I. has selectively gathered and designed both simple and composite operational measures of these and other concepts.[11] The pragmatic thrust of this collection is to provide the policy community with useful and timely indicators of characteristics relevant to the appraisal of national security.

Table 3 displays the operational measures for each of the national security characteristics concepts that constitute this collection. These concepts fall into three analytic categories:

- national security concepts based on characteristics of the country as a whole;
- concepts based on characteristics of the national security sector; and

[11] Theodore J. Rubin and Jeffrey A. Krend, "Quantitative Indicators of Selected Country Characteristics," RM 307 (Santa Barbara, Ca.: C.A.C.I., July 1973).

TABLE 3

CONCEPTS, VARIABLES AND OPERATIONAL MEASURES OF CHARACTERISTICS INDICATORS

Concept	Component Variables		Operational Measure
	Number	Description	
Country as a Whole:			
national size	(1)	total population	people x 10^3
national product	(2)	GNP	current US dollars x 10^6
national development (technology)	(3)	GNP per capita	$\frac{\text{current US dollars}}{\text{people}}$
total international activity	(4)	total actions directed toward the world	number of actions
National Security Sector:			
military size	(5)	military manpower	people x 10^3
military product	(6)	military expenditures	current US dollars x 10^6
military development (technology)	(7)	military expenditures per military man	$\frac{\text{current US dollars}}{\text{military people}}$
Composite Characteristics:			
national power			$\sqrt[4]{(1) \times (2) \times (5) \times (6)}$
national security emphasis			$\frac{\sqrt{(5) \times (6)}}{\sqrt{(1) \times (2)}} \times 100$
international stress			$\frac{(4)}{\sqrt[4]{(1) \times (2) \times (5) \times (6)}} \times 100$

( ) designates component variable numbers

- concepts based on composite characteristics, derived from the two previous concept categories.

A. EVOLUTION OF THE CHARACTERISTICS DATA FILE

The characteristics indicators were evolved and computerized in the following manner. Having formulated the substantive purpose of the work, that is, the development of relevant measures of national security attributes, analysts conducted a search for continuing sources of data with which to operationalize the first two concept categories. As a result of this survey, two data sources were selected: World Military Expenditures, published yearly by the U. S. Arms Control and Disarmament Agency; and the New York Times event data collection, described in Section II.

The computerization of data and the formulation of composite measures then proceeded in stages. The MAKCDF series of programs, category B-3, progressively extended, sorted, and merged the collection according to the number of years covered by the data, the number of countries included, and the repertoire of indicators.

First to be computerized were the simple measures, such as GNP, population, military expenditures, armed forces personnel, total WEIS actions from each country to the world, and total negative WEIS actions from each country to the world. Initially, this collection covered only the period for which both the ACDA and WEIS data overlapped, 1966-1970.

Derivative measures were then developed experimentally from these data, including national development, national power, national security

emphasis, and international stress. Some experimentation with scaling transformations was carried out with the aid of program NEWIND, which accepts values selected by the programmer at run time to scale any desired component of any measure before the component is entered into the final calculation. Scaling experiments eliminated the inconvenience of unnecessarily small indicator values. For example, untransformed international stress indicator values are typically of the range .9 to .0003. A scaling multiplier of 100 shifts the measure to the more convenient range of 90. to .03.

The next stage consisted of experiments to determine whether, as a rule, the rank-order positions of countries on each indicator tended to remain stable over time, or whether various countries exhibited important changes from one time frame to the next. To answer this question, MAKCDF3, MAKCDF6, and MAKCDF8 were written to compute change indexes for each measure over the period for which data had already been computerized, 1966-1970. To arrive at a suitable index of change, an average of the first two years of data was divided into each individual data year. The resulting indexes ignored the absolute magnitude of particular measures, but detected any increases or decreases in each variable over the time period considered. On the basis of the results, which demonstrated the considerable extent to which countries may vary over time, two additional steps were taken:

- the collection was expanded to include data for 1961 through 1970; and
- the change indexes were made a permanent feature of the collection.

Our judgment was that a longer time series would permit more

sensitive analysis of the extent and direction of change in each indicator over time.

B. ORGANIZATION AND DISPLAY

For efficient retrieval and display of the characteristics indicator collection, the data were organized by variable, rather than by country or chronologically. In its final format on the G. E. system, each characteristics file consists of 82 countries in alphabetical order on the rows, and five years of data for each variable on the columns. Under this arrangement, three files are needed to represent one variable: one file for 1961-1965 data, a second file to accommodate 1966-1970 data, and a third to house the change indexes associated with each variable. The final organization of the collection, as summarized in Table 4, was influenced by a variety of technical factors including computing efficiency, the type of retrievals to be performed, and the desirability of listing each file directly at the terminal for checking and updating.

One of the primary software capabilities developed for this collection is the rapid, comparative display of country ranks for any desired combination of indicators. RNKSALOT, a category A-3 display program, was written expressly for this purpose. RNKSALOT is more user-oriented than most library programs in the sense that persons with little or no programming background can use it with a minimum of instruction. Complicated file-handling and output-formatting operations have been fully automated. Moreover, input requirements are simple and the output is readily interpreted. A sample run of RNKSALOT appears in Appendix M.

TABLE 4

ORGANIZATION OF CHARACTERISTICS INDICATOR FILES

A. Simple Measures

File Name	Indicator	Data Years	Data Format
VAR1.1	Gross National Product (US$M)	61-65	82 x 5
VAR1.2	Gross National Product (US$M)	66-70	82 x 5
VAR1.3	Gross National Product Indices	61-70	82 x 10
VAR2.1	Population (Millions)	61-65	82 x 5
VAR2.2	Population (Millions)	66-70	82 x 5
VAR2.3	Population Indices	61-70	82 x 10
VAR3.1	Military Expenditures (US$M)	61-65	82 x 5
VAR3.2	Military Expenditures (US$M)	66-70	82 x 5
VAR3.3	Military Expenditures Indices	61-70	82 x 10
VAR4.1	Armed Forces Personnel (1000)	61-65	82 x 5
VAR4.2	Armed Forces Personnel (1000)	66-70	82 x 5
VAR4.3	Armed Forces Indices	61-70	82 x 10
*VAR5.2	Total WEIS Actions (A to World)	66-70	82 x 5
*VAR5.3	Total WEIS Actions Indices	66-70	82 x 5
*VAR6.2	Total WEIS Negative Actions	66-70	82 x 5
*VAR6.3	Total WEIS Negative Acts Indices	66-70	82 x 5

*WEIS data available since 1966 only. Other data is from World Military Expenditures, 1968-1972 eds.

TABLE 4 (Continued)

B. Composite Measures

File Name	Indicator	Data Years	Data Format
VAR7.1	Gross National Product/Capita	61-65	82 x 5
VAR7.2	Gross National Product/Capita	66-70	82 x 5
VAR7.3	Gross National Product/Capita Indices	61-70	82 x 10
VAR8.1	Military Expenditures/Military Man	61-65	82 x 5
VAR8.2	Military Expenditures/Military Man	66-70	82 x 5
VAR8.3	Military Expenditures/Military Man Indices	61-70	82 x 10
VAR9.1	National Security Emphasis	61-65	82 x 5
VAR9.2	National Security Emphasis	66-70	82 x 5
VAR9.3	National Security Emphasis Indices	61-70	82 x 10
VAR10.1	National Power	61-65	82 x 5
VAR10.2	National Power	66-70	82 x 5
VAR10.3	National Power Indices	61-70	82 x 10
*VAR11.2	International Stress (V5/V10)	66-70	82 x 5
*VAR11.3	International Stress Indices	66-70	82 x 5
*VAR12.2	International Stress (V6/V10)	66-70	82 x 5
*VAR12.3	International Stress Indices	66-70	82 x 5
*VAR13.2	Conflict Ratio (V6/V5)	66-70	82 x 5
*VAR13.3	Conflict Ratio Indices	66-70	82 x 5

*WEIS data available since 1966 only. Other data is from World Military Expenditures, 1968-1972 eds.

In this example, the analyst has requested a rank-ordering of countries for 1970. Because the indicators are identified to the program by numbers, a list of available indicators and corresponding numbers was requested before proceeding. The program then asks for the number of indicators to be ranked in the current run, and then for the indicator identification numbers. In this example, the analyst requested rank-orders for six indicators, although the program is capable of handling all 26 indicators for any one data year. The indicators requested were GNP, population, national security emphasis, national power, international stress, and the international stress change index (1, 2, 9, 10, 11, and 24). The program permits the analyst to rank all or a portion of the 82 countries in the collection on the desired indicators. In this example, all 82 countries were included in the sort procedure.

The program next consults an internal directory to retrieve the correct columns of data from the appropriate indicator files. It stores the relevant values in working memory, and then checks to see if this array is to be written to a file for additional analysis. If the analyst desires to save the current retrieval, he enters the name of a previously created file; if not, he types "N" for no. Here the analyst has declined to save the current retrieval. If desired, the program will print out the data exactly as encountered at this point in the processing, if the user enters a zero to the query, "Echo Data?" The resulting print-out would present the data in the order in which it was stored, that is, alphabetically by country. In this case, the print-out was not requested.

The software then proceeds to rank each indicator from greatest value to smallest value, for the countries selected by the analyst. Once the

data are ranked, the program makes use of a pointer system to associate country codes with the rank position of the data elements. This array of country names is then displayed at the terminal as columns, from left to right, in the order requested. As will be noted, the U.S. and USSR rank highest on 1970 GNP (column 1), and highest on power (column 4). The People's Republic of China and India, as might be expected, score highest in the population category (column 2). South Vietnam, Israel, and Laos rank high in national security emphasis (column 3). On the international stress dimension, Cambodia, Jordan, Israel, and North Vietnam top the list, while Libya, Paraguay, Cambodia, and Laos exhibit the greatest rate of change on this dimension.

After rank position 21 was printed, the programmer used the "interrupt" button on his terminal to signal the program to move on to the next option. Without interruption, the program will provide ranks for all 82 countries on all of the indicators requested. The next option is to print the actual data in rank order. In this case, data are presented in the exact positions occupied by country names in the previous display. This option allows the user to locate major divisions within each column, and thus to decide whether the differences between rank positions are great or small. For example, this display shows that U.S. GNP was almost twice that of the Soviet Union in 1970, and more than ten times that of eight-ranked Italy. In terms of international behavior relative to national power, the stress measure (column 5) shows that Cambodia, North Vietnam, Laos, Lebanon, and Libya not only exerted themselves significantly more than most other nations in 1970, but exhibited the greatest increases in stressful behavior relative to other nations as well (column 6).

Print-out of indicator values was arbitrarily terminated after reporting

the twentieth ranking countries. A zero response to the query, "ranks for which year...?" terminated the program; however, entry of a data year (1961-1970) would have restarted the procedure. This example is illustrative of the techniques available for rapidly locating major actor nations relative to other countries on dimensions of interest to national security analysts.

V. CAPABILITIES FOR SEMINAR EXPERIMENT DATA

As part of C.A.C.I.'s responsibilities in the area of dissemination and evaluation of quantitative indicators, six seminars were conducted between March and May 1972, for members of various groups in the U.S. policy community. The purposes of the seminars were:

- To inform participants of indicator development to date;
- To elicit, through experimental techniques, quantitative estimates of relations between countries that could be compared with calculated values of R; and
- To elicit participants' subjective impressions of indicator program technology and its applications, using a questionnaire designed for that purpose.

Sixty-nine participants from six agencies participated in these seminars. Approximately half of the 69 participants were currently engaged as staff planners or analysts in their respective agencies, and about half participated in the capacity of students or faculty from educational institutions.

A. EXPERIMENTAL DESIGN

The experiment solicited participant estimates of relations for 20 pairs of countries (cases) for the past, present, and near-term future. For half of these cases, C.A.C.I. relations indicators were made available for the past and present, and withheld for the other half. Participants were advised that the use of the available relations values was

discretionary. Participants were also asked to identify cases for which their future relations estimates represented a significant change from past to present, and to explain why they anticipated significant change. Certain controls were exercised in a number of these experiments for possible case selection bias. The experiments were designed to determine how and to what extent the relations measure was used by participants in making the required estimates, and to what extent calculated R's differed from a median of the expert estimates.

B. DATA GENERATION AND ANALYSIS

Given 69 participants, the experiments generated a total of 1,380 estimates of relations (20 cases x 69 participants). Seminar responses were computerized with a program named RSPPG, category B-4. This program writes each group of seminar responses to a random-binary file for subsequent analysis.

Two types of analysis were subsequently performed on the seminar data. The first type involved the use of system-resident library programs to perform multiple regression analyses of R values relative to the median relations estimate for each pair, M. Regression analyses showed that R was used systematically in conjunction with participants' preconceived values of relations to produce estimates of past relations (1966-1967), present relations (1970-1971), and change between past and present relations. R was shown to be particularly important in arriving at estimates for the "past," illustrating its possible utility for trend recollection.

A second type of analysis determined the dispersion of R values relative to M values for various partitionings of the seminar data collection.

For any of the six seminars, EXPERMT displays the median estimate for each of the 20 pairs, the corresponding calculated relations value, the differences between R and M values, median differences, and indexes of dispersion. Appendix N contains sample output from the EXPERMT program. Among the conclusions reached with the help of this program are the following:

- R was used to an important degree by participants;
- The dispersion of individual estimates about M was smaller when R was made available than when it was withheld; and
- Neither particular seminars nor the choice of country pairs introduced significant variation in the above findings.

The experimental design, rationale, findings, and interpretations of results are reported in detail elsewhere.[12] The reader should consult this reference for additional information.

[12] "Dissemination and Evaluation of Quantitative International Affairs Indicators," Interim Technical Report 2 (Santa Barbara, Ca.: C.A.C.I., July 1972).

VI. GENERAL CONSIDERATIONS

In general, the development of interactive software capabilities for various data collections follows a rough chronology from retrieval of data from the main collection to the creation of smaller, working files, to indicator experimentation and production. In addition to the functional characteristics described above, all of the programs have been designed with the following additional criteria in mind: adequate documentation, cost-effectiveness, and generality.

All programs contain internal documentation in the form of comments to facilitate transfers of this technology within C.A.C.I. and among clients. This documentation, in most cases, explains the function of each program, its organization, and indicates where modifications must be made as specific collections are enlarged.

A decision to develop a new program or to modify an existing one usually depends on affirmative answers to the following questions. First, is the anticipated development cost and machine expense significantly less than the cost of performing the same tasks manually? Second, is there reason to believe that the program will be used more than once after it is written? These questions are intended to prevent the development of programs that are not cost-effective in terms of expected performance.

Whenever feasible, program software has been written as general as possible. Two types of generality are implied. First, an attempt has been made, in most cases, to write the program for easy adaptation

to changing computing requirements. From a programming standpoint, this refers to the use of "arguments," rather than to unchanging, specific values, so that the program can grow with the requirements of specific computing assignments. That is, some care has been taken to anticipate the addition of variables, countries, and time points in advance, so that rewriting is minimized. Also, to the extent possible, specialized computing functions are usually written as subroutines to permit a maximum degree of flexibility within a given program, and to facilitate use of the same subroutine in other programs. The same packing and unpacking subroutines, for example, are used repeatedly in programs that modify, display, or compute indicators from the New York Times file.

Second, a number of programs have been written to accommodate new data collections with little or no modification of existing programs. If, for example, data were to be collected from Nues Deutschland or the Asian Recorder using the WEIS coding system, then retrieved and organized in a format similar to the New York Times file on the G.E. system, no modification of the display, experimentation, or production software would be needed. The analyst would merely substitute the new file name at run time, and collect the output. Of course, to the extent that similar collections differ in certain respects, such as the time period encompassed, coding conventions, and so forth, additional modifications would become necessary. However, considerable power presently exists for accommodating new data collections with a minimum of program conversion.

Table 5 is an alphabetical summary of the programs described in this paper. Table 5 states the function of each program, the data file(s) on which each program operates, the number of statements, or size, of each program, and authorship. Additional technical information, including source code, is available on request.

TABLE 5

ALPHABETICAL SUMMARY OF PROGRAM SOFTWARE

Name	Function	File Used	No. State-ments	Pro-grammer
ARPASMRY	Data retrieval from major DECS/INDECS-coded data base	Varies		T
BIG30	Displays column totals for selected WEIS nation pairs; selected time periods	BASDF	80	K
BDFCK1 BDFCK2	Displays selected data months, pairs; several output formats	BASDF BASDF	110 110	K K
BDFCREAT BDFJK BDFJK2	Set up BASDF file for WEIS-coded data	BASDF BASDF BASDF	145 155 85	P,K K K
CONC1 CONC2 CONC3 CONC4 CONC5	Computes concentration measures for 19 actor nations relative to 3 constituencies; 3 time options for data smoothing	CONC17 CONC13	200 200 200 20 50	K
CONV1-9	Converts data transferred on BCD tape to GE ASCII	Varies	50@	K
EXPERMT	Calculates statistics from C.A.C.I. seminar data	RSPONS	240	P
MAKCDF1-11	Create, modify, compute national security characteristics indicators	RCDF2	550	K
NEWIND	Interactive experiments with scaling characteristics indicators	CDF	240	K
NEWFIL NEWPRG	Alternative retrieval programs for WEIS-coded data bases	Varies	190 180	P

TABLE 5 (Continued)

Name	Function	File Used	No. State-ments	Pro-grammer
OMEGA (1-12)	Create, store, retrieve, display, produce indicators from DECS/INDECS-coded working collections	Varies	850	K
RANDS	R and S calculations from irregularly formatted data	Varies	40	K
RNKSALOT	Selectively ranks countries on national security characteristics data	See Table 4	260	K
RPRIME	Calculates R' for selected pairs, intervals, smoothing options	BASDF	200	K, P
RSPLOT	Plots selected indicators for desired country pairs on CDC 6400, Cal-Comp plotter	Cards	180	K
RSPPG	Writes seminar responses to random-binary file for analysis	RSPONS	35	P
SHORTS	Computes style measures from data input as a WEISUM table	Varies	40	K
SPRIME	Calculates S' for selected pairs, intervals, smoothing options	BASDF	280	K, P
TSER2	Smoothes event frequencies with decay function; creates smoothed data set for any nation-pair	BASDF	90	P, K
TSTFRC	Calculates dispersion of R about R-median, for any set of R calculations	Varies	80	P

TABLE 5 (Continued)

Name	Function	File Used	No. State-ments	Pro-grammer
UPDATE1 UPDATE2 UPDATE3	Update Basic Data File	BASDF	300	K
VARPB	Remote batch program to calculate R, S, I indicators for large numbers of nation-pairs	BASDF	350	P
VARPR	Calculates R for selected pairs, time options, starting months	BASDF	200	P,K
VARPRR	Calculates R, R-decay for 4-month moving intervals, for any nation-pair	BASDF	100	K
VARPRS	R and S calculations for 4-month moving intervals, for any nation-pair	BASDF	90	K
VARPS	Calculates S for selected pairs, time options, starting months	BASDF	280	P,K
VSCALE VWAT VWAT2	Interactive scaling and weighting programs for R components	QFILE	130 130 110	P
WEISUM	WEIS-data-retrieval program	Varies		T,L

K = Krend C.A.C.I.
L = Leavitt C.A.C.I.
P = Peasley USNA
T = Tomlinson USNA

APPENDIX A

NEW YORK TIMES BASIC DATA FILE (BASDF) STRUCTURE

Country Pair	Record #
US-World	001
USSR-World	002
Rumania-World	003
Czechoslovakia-World	004
Yugoslavia-World	005
CPR-World	006
North Vietnam-World	007
North Korea-World	008
Cuba-World	009
France-World	010
Laos-World	011
South Vietnam-World	012
Japan-World	013
Pakistan-World	014
India-World	015
Aul., New Zeal.-World	016
Iran-World	017
Israel-World	018
Arabs-World	019
UAR-World	020
UK-World	021
US-USSR	022
US-Rumania	023
US-Czechoslovakia	024
US-Other East Europe	025
US-Yugoslavia	026
US-CPR	027
US-North Vietnam	028
US-North Korea	029
US-Cuba	030
US-South America	031
US-France	032
US-UK	033
US-Europe, North Atlantic	034
US-Canada	035
US-W. Germ./W. Berlin	036
US-Turkey	037
US-Greece	038
US-Laos	039
US-South Vietnam	040
US-Other Southeast Asia	041
US-Japan	042
US-Pakistan	043
US-India	044
US-Iran	045
US-Israel	046
US-Arabs	047
US-UAR	048
US-North Africa	049
US-White Colonial Africa	050
US-Other Sub-Saharan Africa	051
USSR-Romania	052
USSR-Czechoslovakia	053
USSR-Other East Europe	054
USSR-Yugoslavia	055
USSR-CPR	056
USSR-North Vietnam	057
USSR-North Korea	058
USSR-Cuba	059
USSR-France	060
USSR-UK	061
USSR-Europe, N. Atlantic	062
USSR-Laos	063
USSR-South Vietnam	064
USSR-Japan	065
USSR-Pakistan	066
USSR-India	067
USSR-Iran	068
USSR-Israel	069
USSR-Arabs	070
USSR-UAR	071
USSR-North Africa	072
USSR-Other Sub-Saharan Afr.	073
USSR-Turkey	074
USSR-W. Germany	075
USSR-Canada	076
CPR-Romania	077
CPR-Other East Europe	078
CPR-North Vietnam	079
CPR-Taiwan	080

CPR-UK	081	US-East Germany/E. Berlin	126
CPR-Other Sub-Sah. Afr.	082	US-Italy	127
CPR-North Korea	083	US-Spain	128
CPR-Laos	084	US-Algeria	129
CPR-South Vietnam	085	US-Jordan	130
CPR-Japan	086	US-Indonesia	131
CPR-Pakistan	087	US-Taiwan	132
CPR-India	088	US-Philippines	133
Rumania-Other E. Eur.	089	US-Thailand	134
Czech.-Other E. Europe	090	US-Cambodia	135
N. Vietnam-S. Vietnam	091	US-South Korea	136
N. Vietnam-Other SE Asia	092	US-Australia	137
N. Korea-S. Korea	093	USSR-Finland	138
Cuba-South America	094	USSR-East Germany/E. Ber.	139
Cuba-Mexico, etc.	095	USSR-Italy	140
France-UK	096	USSR-Albania	141
France-Israel	097	W. Germ./W. Ber.-Czech.	142
France-West Germany	098	W. Germ./W. Ber.-Poland	143
UK-White Colonial Africa	099	W. Germ./W. Ber.-	
UK-West Germany	100	E. Germ./E. Ber.	144
Greece-Turkey	101	UK-Rhodesia	145
Laos-North Vietnam	102	UK-Israel	146
Laos-South Vietnam	103	UAR-Syria	147
South Vietnam-Cambodia	104	UAR-Jordan	148
Pakistan-India	105	Lebanon-Israel	149
Israel-Arabs	106	Syria-Israel	150
Arabs-Other S-S Africa	107	Jordan-Israel	151
UAR-Israel	108	CPR-Albania	152
North Africa-Israel	109	CPR-Indonesia	153
Wh. Col. Afr.-Oth. S-S Afr.	110	Philippines-Malaysia	154
Tot. E. Eur.-Eur. N. Atl.	111	Malaysia-Indonesia	155
Tot. E. Eur.-W. Germany	112	World-World	156
Albania-World	113	Tot. E. Eur.-Tot. E. Eur.	157
Warsaw-NATO	114	South America-South America	158
S-S Africa-World	115	Southeast Asia-Southeast Asia	159
US-Tot. E. Europe	116	Arabs-Arabs	160
US-Tot. Southeast Asia	117	North Africa-North Africa	161
USSR- Tot. E. Europe	118	Other S-S Afr.-Other S-S Afr.	162
USSR-Tot. Southeast Asia	119	Warsaw-Warsaw	163
N. Vietnam-Tot. SE Asia	120	US-World*	164
US-Argentina	121	North Vietnam-World*	165
US-Brazil	122	South Vietnam-World*	166
US-Peru	123	US-North Vietnam	167
US-Mexico	124	N. Vietnam-S. Vietnam*	168
US-Sweden	125	N. Vietnam-Other SE Asia*	169
		N. Vietnam-Total SE Asia	179

*Includes Group 1 and Group 7 North Vietnam events (A-B and B-A) coded since October, 1970.

APPENDIX B.

SAMPLE OUTPUT FROM BDFCK1

```
INPUT FILE NAME...?basdf
HOW MANY RECORDS...?2
WHICH RECORDS...?1 2
MATRIX ORDER OR WEISUM ORDER (TYPE -1- OR -2-) ?1
STARTING ROW, ENDING ROW...?1 84
 TOTALS ONLY (0=YES; 1=NO)...?

001  USA-WORLD
COLUMN TOTALS:
  26   30  233  515  925 2217 1845 1794 1374  869  144  134   51    5

002  USSR-WORLD
COLUMN TOTALS:
   8   10  230  134  961  697  893  920  730  566   35   39    6    6
MORE RECORDS TO CHECK...?0


INPUT FILE NAME...?basdf
HOW MANY RECORDS...?4
WHICH RECORDS...?22 27 56 105
MATRIX ORDER OR WEISUM ORDER (TYPE -1- OR -2-) ?1
STARTING ROW, ENDING ROW...?73 84
 TOTALS ONLY (0=YES; 1=NO)...?0

022  US-USSR
COLUMN TOTALS:
   0    0    5   13   23   60   43   43   43   41    2    1    0    1

027  US-CPR
COLUMN TOTALS:
   0    0    1    8    7   47   11   16   10    6    2    0    0    0

056  USSR-CPR
COLUMN TOTALS:
   0    0    0    0   24   21    4    2    3    0    0    0    0    0

105  PAKISTAN-INDIA
COLUMN TOTALS:
   0    0    6    4   20   11   21   19   13   13    6    7    1    1
MORE RECORDS TO CHECK...?1
```

APPENDIX C.

SAMPLE OUTPUT FROM BIG30

STARTING MONTH, ENDING MONTH (1-84)... ?1 84

A-B TOTALS

	NAME							
022	US-USSR	0	56	193	266	157	22	3
027	US-CPR	0	4	22	38	28	15	0
056	USSR-CPR	7	24	168	33	19	1	0
038	US-GREECE	0	3	10	17	20	2	0
134	US-THAILAND	0	0	3	28	36	1	0
128	US-SPAIN	0	0	4	19	19	0	0
046	US-ISRAEL	0	6	33	100	61	4	0
069	USSR-ISRAEL	0	16	96	15	0	0	0
088	CPR-INDIA	7	13	28	2	1	1	0
057	USSR-N. VIETNAM	0	0	1	37	82	0	0
03	US-W. GERMANY BER	0			6	59	2	

B-A TOTALS

	NAME							
022	US-USSR	0	80	456	224	137	14	1
027	US-CPR	5	41	247	39	22	4	0
056	USSR-CPR	7	19	201	20	16	2	0
038	US-GREECE	0	7	8	16	10	2	0
134	US-THAILAND	0	1	6	29	18	0	0
128	US-SPAIN	0	4	7	21	17	1	0
046	US-ISRAEL	1	8	31	85	34	1	0
069	USSR-ISRAEL	0	5	49	6	1	0	0
088	CPR-INDIA	5	8	23	6	1	0	0
057	USSR-N. VIETNAM	0	1	1	34	24	0	0
03	US-W. GERMANY BER	0			70	35	3	

SYMMETRIC TOTALS

	NAME							
022	US-USSR	0	136	649	490	294	36	4
027	US-CPR	5	45	269	77	50	19	0
056	USSR-CPR	14	43	369	53	35	3	0
038	US-GREECE	0	10	18	33	30	4	0
134	US-THAILAND	0	1	9	57	54	1	0
128	US-SPAIN	0	4	11	40	36	1	0
046	US-ISRAEL	1	14	64	185	95	5	0
069	USSR-ISRAEL	0	21	145	21	1	0	0
088	CPR-INDIA	12	21	51	8	2	1	0
057	USSR-N. VIETNAM	0	1	2	71	106	0	0
03	US-W. GERMANY BER			25				2

APPENDIX D.

SAMPLE OUTPUT FROM VARPR

```
VARPR        10:15PDT    07/05/73

INPUT FILE NAME...?BASDF
HOW MANY DYADS...?2
WHICH DYADS...?42 65
TIME OPTION (1 THRU 5)...?5
START AT WHAT MONTH...?1
```

DYAD 042 US-JAPAN

24 MONTHS ENDING W/	MIL	NEGATIVE	NEUT	POSITIVE	INVOLVEMENT	RELATIONS
12/31/67	0	4	18	13	35	0.35
	0	6	16	22	44	0.44
12/31/68	0	8	21	29	58	0.44
	0	13	29	31	73	0.31
12/31/69	0	13	44	40	97	0.36
	0	18	45	35	98	0.23
12/31/70	0	18	54	30	102	0.16
	0	21	50	33	104	0.15
12/31/71	0	37	64	32	133	-0.05
	0	35	72	48	155	0.11
12/31/72	0	42	64	62	168	0.15

DYAD 065 USSR-JAPAN

24 MONTHS ENDING W/	MIL	NEGATIVE	NEUT	POSITIVE	INVOLVEMENT	RELATIONS
12/31/67	0	6	6	13	25	0.32
	0	2	4	13	19	0.65
12/31/68	0	5	5	20	30	0.55
	0	5	5	16	26	0.47
12/31/69	0	12	10	15	37	0.09
	0	12	13	18	43	0.16
12/31/70	0	10	10	6	26	-0.19
	0	10	12	4	26	-0.30
12/31/71	0	3	7	7	17	0.30
	0	4	5	15	24	0.51
12/31/72	0	6	7	17	30	0.42

```
READ A DYAD?  0=YES, 1=NO?1

PROGRAM STOP AT 1890

USED     2.80 UNITS
```

APPENDIX E.

SAMPLE OUTPUT FROM TSER2

TSER2 10:21PDT 07/05/73

FILENAME...?SASDF

TIME SERIES FOR HOW MANY DYADS...?2

WHICH DYADS...?42 65

DO YOU DESIRE WEIGHTED FREQUENCIES...?1

TIME SERIES FOR 042 US-JAPAN

	EVENT FREQUENCIES							SMOOTHED						
MO	CL1	CL2	CL3	CL4	CL5	CL6	CL7	CL1	CL2	CL3	CL4	CL5	CL6	CL7
1	0	0	0	3	0	0	0	0.	0.	0.	1.5	0.	0.	0.
2	0	0	1	2	0	0	0	0.	0.	0.5	1.7	0.	0.	0.
3	0	0	0	0	1	0	0	0.	0.	0.2	0.9	0.5	0.	0.
4	0	0	0	0	0	0	0	0.	0.	0.1	0.4	0.2	0.	0.
5	0	0	0	0	0	0	0	0.	0.	0.1	0.2	0.1	0.	0.
6	0	0	0	2	1	0	0	0.	0.	0.0	1.1	0.6	0.	0.
7	0	0	0	4	2	0	0	0.	0.	0.0	2.6	1.3	0.	0.
8	0	0	0	0	0	0	0	0.	0.	0.0	1.3	0.6	0.	0.
9	0	0	0	0	0	0	0	0.	0.	0.0	0.6	0.3	0.	0.
10	0	0	0	0	0	0	0	0.	0.	0.0	0.3	0.2	0.	0.
11	0	0	0	1	0	0	0	0.	0.	0.0	0.7	0.1	0.	0.
12	0		0	0	0			0.	0.	0.0	0.3	0.	0.	0.
13	0	1	0	1	0	0	1	0.	0.	0.0	0.7	0.	0.	0.
14		0		0		1						2.2		
1	0	0	1	2	3	0	0		0.2	1.4		2.6	0.	0.
76	0	0	0	0	0	0	0	0.	0.1	0.7	1.9	1.3	0.1	0.
77	0	0	0	0	6	1	0	0.	0.1	0.3	1.0	3.7	0.6	0.
78	0	0	1	6	5	0	0	0.	0.0	0.7	3.5	4.3	0.3	0.
79	0	1	3	3	6	0	0	0.	0.5	1.8	3.2	5.2	0.1	0.
80	0	1	1	2	0	0	0	0.	0.8	1.4	2.6	2.6	0.1	0.
81	0	0	1	6	6	0	0	0.	0.4	1.2	4.3	4.3	0.0	0.
82	0	1	0	0	2	0	0	0.	0.7	0.6	2.2	3.1	0.0	0.
83	0	0	0	0	3	0	0	0.	0.3	0.3	1.1	3.1	0.0	0.
84	0	0	1	0	0	1	0	0.	0.2	0.7	0.5	1.5	0.0	0.

TIME SERIES FOR 065 USSR-JAPAN

	EVENT FREQUENCIES							SMOOTHED						
MO	CL1	CL2	CL3	CL4	CL5	CL6	CL7	CL1	CL2	CL3	CL4	CL5	CL6	CL7
1	0	0	1	3	0	0	0	0.	0.	0.5	1.5	0.	0.	0.
2	0	1	2	1	0	0	0	0.	0.5	1.2	1.2	0.	0.	0.
3	0	0	0	0	0	0	0	0.	0.2	0.6	0.6	0.	0.	0.

APPENDIX F.

SAMPLE OUTPUT FROM VSCALE

```
VSCALE      09:44PST     12/19/72

HØW MANY DYADS? 2-DIGIT NUMBER?02

WHICH DYADS? 3-DIGIT NUMBERS?001 002

TIME INTERVALS? 4=12-MØ. MØVING CALC; 5=24-MØ. MØVING CALC.?5

GIVE SCALING FACTØRS FØR CLASSES.  FØRMAT=F4.2
  CL1  CL2  CL3  CL5  CL6  CL7?1.00 0.67 0.33 0.33 0.67 1.00
```

DYAD 1 US - GREECE

24 MØNTHS ENDING W/	1	2	3	4	5	6	7	S
12/31/67	0.	2.68	1.65	16.00	0.33	0.	0.	-0.22
	0.	3.35	2.31	13.00	0.66	1.34	0.	-0.16
12/31/68	0.	2.68	2.97	14.00	0.99	2.01	0.	-0.10
	0.	0.67	2.97	10.00	0.66	2.68	0.	-0.01
12/31/69	0.	0.67	1.65	1.00	0.66	2.68	0.	-0.03
	0.	0.	0.99	2.00	0.33	1.34	2.00	0.30
12/31/70	0.	0.	0.33	6.00	0.66	1.34	2.00	0.37
	0.	0.	0.66	10.00	1.32	0.67	2.00	0.24
12/31/71	0.	0.	0.66	16.00	2.31	0.67	2.00	0.22
TØTAL	0.	3.35	3.96	33.00	3.30	3.35	2.00	0.03

DYAD 2 US - THAILAND

24 MØNTHS ENDING W/	1	2	3	4	5	6	7	S
12/31/67	0.	0.	0.66	7.00	2.64	6.03	1.00	0.38
	0.	0.	0.66	9.00	3.30	5.36	1.00	0.35
12/31/68	0.	0.	0.66	11.00	1.98	6.03	1.00	0.36
	0.	0.	0.33	15.00	1.65	4.02	1.00	0.31
12/31/69	0.	0.	0.66	21.00	1.98	6.70	0.	0.23
	0.	0.	0.66	25.00	1.98	4.69	1.00	0.25
12/31/70	0.	0.	2.31	27.00	2.31	5.36	1.00	0.17
	0.	0.	2.31	25.00	3.30	5.36	1.00	0.19
12/31/71	0.	0.	2.31	19.00	3.63	1.34	1.00	0.12
TØTAL	0.	0.	3.63	47.00	8.25	14.07	2.00	0.25

```
READ A DYAD? 0=YES, 1=NØ?

HØW MANY DYADS? 2-DIGIT NUMBER?001

WHICH DYADS? 3-DIGIT NUMBERS?010

TIME INTERVALS? 4=12-MØ. MØVING CALC; 5=24-MØ. MØVING CALC.?4

GIVE SCALING FACTØRS FØR CLASSES.  FØRMAT=F4.2
  CL1  CL2  CL3  CL5  CL6  CL7?1.00 0.67----1.00 1.00 1.00 1.00 1.00
```

APPENDIX G.

SAMPLE OUTPUT FROM VWAT

```
VWAT          17:00PST     12/19/72

HOW MANY DYADS? 2-DIGIT NUMBER?02

WHICH DYADS? 3-DIGIT NUMBERS?001 002

TIME INTERVALS?  4=12-MO. MOVING CALC; 5=24 MO. MOVING CALC?5

GIVE WEIGHTING FACTORS FOR CLASSES.  FORMAT=F4.2
  CL1  CL2  CL3  CL4  CL5  CL6  CL7
?1.00 1.00 1.00 0.50 1.00 1.00 1.00
```

DYAD 1 US - GREECE

	WEIGHTED FREQUENCIES							
24 MONTHS ENDING W/	1	2	3	4	5	6	7	W
12/31/67	0.	4.00	5.00	8.00	1.00	0.	0.	-0.22
	0.	5.00	7.00	6.50	2.00	2.00	0.	-0.16
12/31/68	0.	4.00	9.00	7.00	3.00	3.00	0.	-0.10
	0.	1.00	9.00	5.00	2.00	4.00	0.	-0.01
12/31/69	0.	1.00	5.00	0.50	2.00	4.00	0.	0.08
	0.	0.	3.00	1.00	1.00	2.00	2.00	0.30
12/31/70	0.	0.	1.00	3.00	2.00	2.00	2.00	0.37
	0.	0.	2.00	5.00	4.00	1.00	2.00	0.24
12/31/71	0.	0.	2.00	8.00	7.00	1.00	2.00	0.22
TOTAL	0.	5.00	12.00	16.50	10.00	5.00	2.00	0.02

DYAD 2 US - THAILAND

	WEIGHTED FREQUENCIES							
24 MONTHS ENDING W/	1	2	3	4	5	6	7	W
12/31/67	0.	0.	2.00	3.50	8.00	9.00	1.00	0.38
	0.	0.	2.00	4.50	10.00	8.00	1.00	0.35
12/31/68	0.	0.	2.00	5.50	6.00	9.00	1.00	0.36
	0.	0.	1.00	7.50	5.00	6.00	1.00	0.31
12/31/69	0.	0.	2.00	10.50	6.00	10.00	0.	0.28
	0.	0.	2.00	12.50	6.00	7.00	1.00	0.25
12/31/70	0.	0.	7.00	13.50	7.00	8.00	1.00	0.17
	0.	0.	7.00	12.50	10.00	8.00	1.00	0.19
12/31/71	0.	0.	7.00	9.50	11.00	2.00	1.00	0.12
TOTAL	0.	0.	11.00	23.50	25.00	21.00	2.00	0.24

APPENDIX H.

SAMPLE OUTPUT FROM VARPS

VARPS 10:18PDT 07/05/73

INPUT FILE NAME...?BASIC

HOW MANY DYADS...?2

WHICH DYADS...?42 65

TIME OPTION (1 THRU 5)...?5

START AT WHAT MONTH...?1

DYAD 042 US(A) -JAPAN (B)

	A TO B						B TO A					
24 MONTHS ENDING W/	MIL	NEG	NEUT	POS	PART	STYLE	MIL	NEG	NEUT	POS	PART	STYLE
12/31/67	0	2	8	4	14	0.20	0	2	10	9	21	0.44
.	0	4	8	6	18	0.14	0	2	8	16	26	0.64
12/31/68	0	4	9	9	22	0.29	0	4	12	20	36	0.53
.	0	7	14	12	33	0.19	0	6	15	19	40	0.40
12/31/69	0	7	20	16	43	0.27	0	6	24	24	54	0.43
.	0	11	19	15	45	0.11	0	7	26	20	53	0.32
12/31/70	0	13	21	13	47	0.	0	5	33	17	55	0.31
.	0	15	19	12	46	-0.08	0	6	31	21	58	0.35
12/31/71	0	21	20	13	54	-0.18	0	16	44	19	79	0.05
.	0	16	26	22	64	0.12	0	19	46	26	91	0.10
12/31/72	0	16	25	26	67	0.18	0	26	39	36	101	0.12

DYAD 065 USSR(A) -JAPAN (B)

	A TO B						B TO A					
24 MONTHS ENDING W/	MIL	NEG	NEUT	POS	PART	STYLE	MIL	NEG	NEUT	POS	PART	STYLE
12/31/67	0	4	2	8	14	0.31	0	2	4	5	11	0.33
.	0	2	2	8	12	0.55	0	0	2	5	7	0.83
12/31/68	0	5	3	11	19	0.34	0	0	2	9	11	0.90
.	0	4	3	9	16	0.34	0	1	2	7	10	0.67
12/31/69	0	8	6	8	22	0.	0	4	4	7	15	0.23
.	0	8	7	10	25	0.09	0	4	6	8	18	0.27
12/31/70	0	6	5	4	15	-0.16	0	4	5	2	11	-0.24
.	0	6	5	3	14	-0.26	0	4	7	1	12	-0.33
12/31/71	0	2	2	4	8	0.29	0	1	5	3	9	0.31
.	0	1	1	8	10	0.74	0	3	4	7	14	0.33
12/31/72	0	2	1	9	12	0.61	0	4	5	8	18	0.27

READ A DYAD? 0=YES, 1=NO?1

APPENDIX I.

SAMPLE OUTPUT FROM VARPRS

```
VARPRS      09:19PDT    07/06/73
INPUT FILE NAME...?BASDF
HOW MANY DYADS...?2
WHICH DYADS...?42 27
STARTING MONTH, ENDING MONTH (1-84)...?73 84
```

DYAD 042 US-JAPAN

MONTH	PART A-B	PART B-A	INV	STYLE A-B	STYLE B-A	RELATIONS
76	10	13	23	0.50	0.09	0.26
77	10	12	22	0.59	0.36	0.46
78	12	14	26	0.74	0.50	0.60
79	14	20	34	0.48	0.44	0.46
80	14	22	36	0.48	0.30	0.36
81	16	26	42	0.43	0.18	0.27
82	10	23	33	0.40	0.15	0.22
83	8	15	23	0.77	0.16	0.37
84	9	12	21	0.62	0.40	0.50

DYAD 027 US-CPR

MONTH	PART A-B	PART B-A	INV	STYLE A-B	STYLE B-A	RELATIONS
76	14	31	45	0.48	-0.65	-0.33
77	13	35	48	0.50	-0.70	-0.40
78	11	33	44	-0.24	-0.81	-0.68
79	9	28	37	-0.27	-0.82	-0.70
80	12	25	37	-0.48	-0.80	-0.70
81	13	19	32	-0.35	-0.69	-0.53
82	8	15	23	-0.13	-0.55	-0.41
83	9	15	24	0.	-0.55	-0.35
84	5	21	26	0.89	-0.68	-0.40

```
MORE CALCULATIONS (0=YES; 1=NO)...?1

PROGRAM STOP AT 770
```

APPENDIX I.

SAMPLE OUTPUT FROM VARPB

DYAD 001 USA(A) -WORLD (B)

	A TO B						B TO A					
	NIL	NEG	NEUT	POS	PART	STYLE	NIL	NEG	NEUT	POS	PART	STYLE
YEAR												
1966	1	140	193	251	584	0.23	1	363	193	155	711	-0.34
1967	2	121	184	185	490	0.16	6	326	179	99	604	-0.44
1968	8	201	257	189	647	-0.02	11	388	250	153	791	-0.35
1969	4	158	306	185	649	0.05	9	323	298	178	799	-0.22
1970	4	171	346	252	769	0.14	1	440	325	139	904	-0.41
1971	6	196	246	254	696	0.10	2	369	237	111	737	-0.45
1972	1	197	313	253	763	0.09	0	533	312	174	1019	-0.42
TOTAL	26	1184	1845	1569	4598	0.10	30	2762	1794	1009	5565	-0.38

DYAD 001 USA-WORLD

	NIL	NEGATIVE	NEUT	POSITIVE	INVOLVEMENT	RELATIONS
YEAR						
1966	2	503	386	406	1295	-0.09
1967	8	447	363	284	1094	-0.18
1968	19	589	507	342	1438	-0.21
1969	13	481	604	363	1448	-0.10
1970	5	611	671	391	1673	-0.16
1971	8	585	483	365	1433	-0.18
1972	1	739	625	427	1792	-0.21
TOTAL	56	3946	3639	2578	10163	-0.16

APPENDIX J. VARPB OUTPUT (Continued)

DYAD 001 USA(A) -WORLD (B) 68

	A TO B						B TO A						
ENDING W/	MIL	NEG	NEUT	POS	PART	STYLE	MIL	NEG	NEUT	POS	PART	STYLE	12 MONTHS
12/31/66	1	140	193	251	584	0.23	1	363	193	155	711	-0.34	
	0	125	100	233	538	0.24	1	361	180	161	702	-0.33	
	1	148	208	217	573	0.15	4	421	199	152	772	-0.40	
	2	126	195	205	526	0.18	7	355	180	126	661	-0.40	
12/31/67	2	121	184	185	490	0.16	6	326	179	99	604	-0.44	
	3	144	201	189	534	0.10	8	357	206	99	662	-0.46	
	3	146	215	173	534	0.06	9	320	212	121	653	-0.36	
	4	167	247	183	597	0.03	8	351	243	139	733	-0.35	
12/31/68	6	201	257	189	647	-0.02	11	388	250	153	791	-0.35	
	8	210	298	185	693	-0.05	11	365	268	169	813	-0.27	
	9	200	303	193	696	-0.01	11	337	291	166	794	-0.26	
	8	175	304	184	663	0.02	11	317	295	168	780	-0.24	
12/31/69	4	158	306	185	649	0.05	9	323	298	178	799	-0.22	
	3	145	281	195	621	0.10	7	349	283	162	794	-0.29	
	2	153	272	205	630	0.11	4	355	254	159	768	-0.31	
	4	149	307	244	700	0.17	2	397	293	151	841	-0.35	
12/31/70	4	171	346	252	769	0.14	1	440	325	139	904	-0.41	
	8	215	328	261	804	0.07	1	473	296	111	882	-0.49	
	7	203	320	273	796	0.11	0	472	300	103	875	-0.51	
	4	197	264	232	693	0.06	0	411	252	106	769	-0.47	
12/31/71	6	196	246	254	696	0.10	2	389	237	111	737	-0.45	
	3	150	264	264	678	0.21	2	368	259	130	757	-0.36	
	3	171	249	239	659	0.13	2	399	247	139	785	-0.39	
	3	195	283	262	740	0.11	2	445	266	159	870	-0.39	
12/31/72	1	197	313	253	763	0.09	0	533	312	174	1019	-0.42	

APPENDIX J. VARPB OUTPUT (Continued)

DYAD 001 USA-WORLD

ENDING W/	MIL	NEGATIVE	NEUT	POSITIVE	INVOLVEMENT	RELATIONS12 MONTHS
12/31/66	2	503	386	406	1295	-0.09
	1	486	360	394	1240	-0.09
	5	569	407	369	1345	-0.18
	9	481	375	331	1187	-0.15
12/31/67	8	447	363	284	1094	-0.18
	11	501	407	288	1196	-0.21
	12	466	427	294	1187	-0.18
	12	518	490	322	1330	-0.18
12/31/68	19	589	507	342	1438	-0.21
	19	575	566	365	1506	-0.17
	20	537	594	359	1490	-0.15
	19	492	599	352	1443	-0.12
12/31/69	13	481	604	363	1448	-0.10
	10	494	564	357	1415	-0.12
	6	508	526	364	1398	-0.13
	6	546	600	395	1541	-0.12
12/31/70	5	611	671	391	1673	-0.16
	9	688	626	372	1686	-0.23
	7	675	620	376	1671	-0.22
	4	698	516	338	1462	-0.22
12/31/71	8	565	483	365	1433	-0.18
	5	518	523	394	1435	-0.11
	5	570	496	378	1444	-0.16
	5	640	549	421	1610	-0.16
12/31/72	1	730	625	427	1782	-0.21

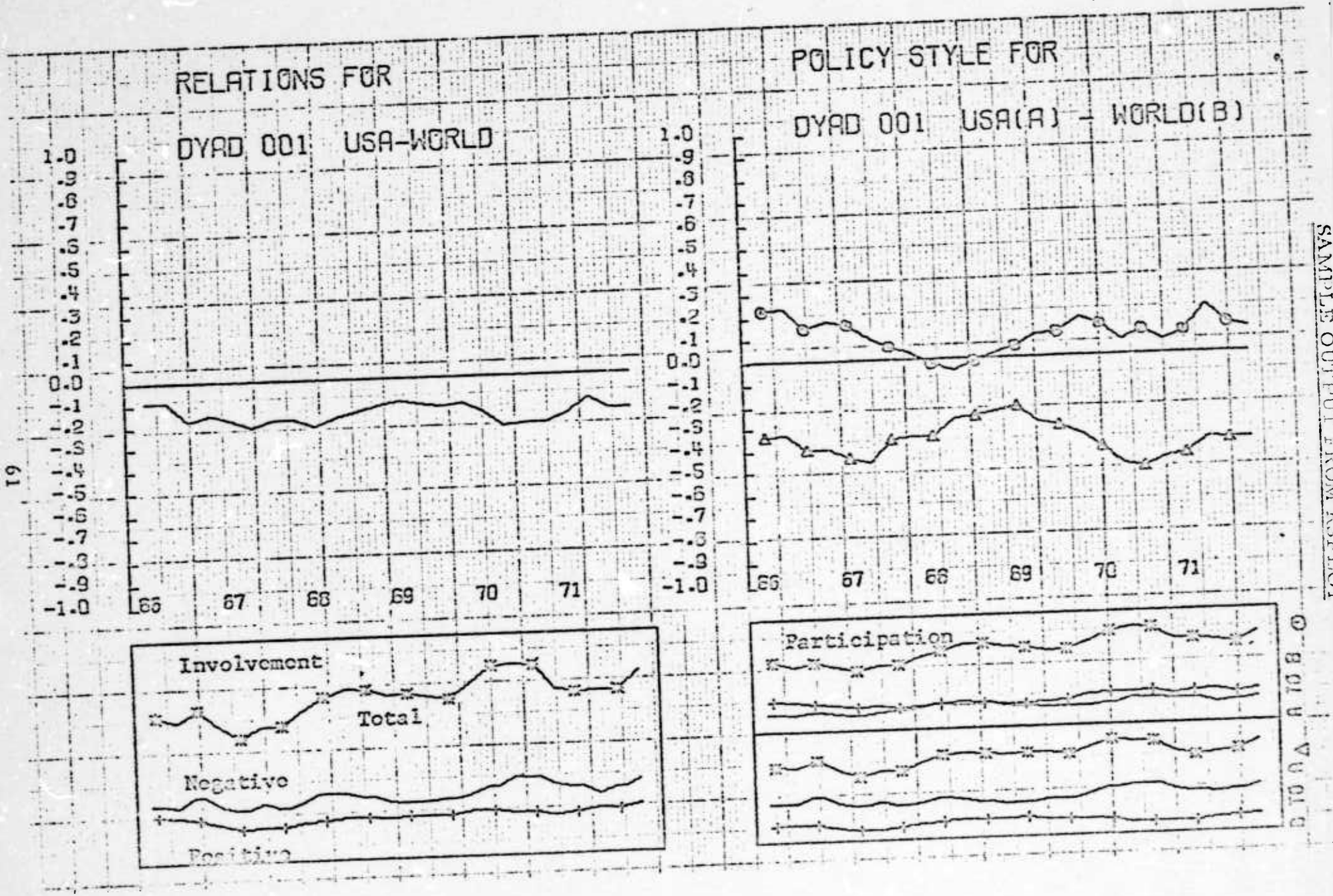
APPENDIX J. VARPB OUTPUT (Continued)

DYAD 001 USA(A) -WORLD (B)

	A TO B						B TO A					
	MIL	NEG	NEUT	POS	PART	STYLE	MIL	NEG	NEUT	POS	PART	STYLE24 MONTHS
ENDING W/												
12/31/67	3	261	377	436	1074	0.20	7	689	372	254	1315	-0.39
	4	294	423	390	1107	0.11	13	741	411	273	1425	-0.38
12/31/68	10	322	441	374	1137	0.06	17	714	429	252	1395	-0.39
	12	346	518	366	1230	0.02	20	657	503	267	1447	-0.31
12/31/69	12	359	563	374	1296	0.01	20	711	548	331	1590	-0.29
	11	353	575	398	1326	0.04	15	692	545	325	1562	-0.28
12/31/70	8	329	652	437	1416	0.10	10	763	623	317	1703	-0.32
	9	356	592	478	1426	0.11	4	827	554	262	1643	-0.41
12/31/71	10	367	592	506	1465	0.12	3	829	562	250	1641	-0.43
	10	374	569	512	1455	0.12	2	871	547	242	1660	-0.45
12/31/72	7	393	559	507	1459	0.10	2	922	549	285	1756	-0.43

DYAD 001 USA-WORLD

	MIL	NEGATIVE	NEUT	POSITIVE	INVOLVEMENT	RELATIONS24 MONTH
ENDING W/						
12/31/67	10	950	749	690	2389	-0.13
	17	1935	834	663	2532	-0.18
12/31/68	27	1036	870	626	2532	-0.20
	32	1003	1021	653	2677	-0.16
12/31/69	32	1070	1111	705	2886	-0.16
	26	1045	1120	723	2888	-0.14
12/31/70	18	1092	1275	754	3121	-0.14
	13	1183	1146	740	3069	-0.18
12/31/71	13	1196	1154	756	3106	-0.17
	12	1245	1116	754	3115	-0.19
12/31/72	9	1315	1108	792	3215	-0.20



SAMPLE OUTPUT FROM RSPLOT

APPENDIX L.

SAMPLE OUTPUT FROM CONC5*

CONCENTRATION MEASURES BASED ON CLASSES 1-7, TIME OPTION 1

CONCENTRATION MEASURES, FREQUENCIES GROUPS 1-4

		1		2		3		4	
1	USA	3.86	23	3.66	16	4.18	64	4.71	76
2	USA	2.94	10	1.00	6	3.62	51	5.52	71
3	USA	1.00	3	2.81	11	4.79	60	2.96	34
4	USA	1.00	7	1.92	10	3.41	22	4.52	44
5	USA	1.88	8	2.95	11	5.01	48	2.96	105
6	USA	3.77	18	5.52	28	5.45	26	2.21	70
7	USA	3.30	38	1.00	6	5.58	67	3.03	86
8	USA	4.32	22	0.	0	5.14	31	1.86	118
9	USA	1.95	12	0.	0	6.94	65	2.23	224
10	USA	3.56	22	1.00	8	6.08	56	1.96	248
11	USA	3.82	27	0.	0	7.52	38	1.84	317
12	USA	3.60	23	1.96	7	5.86	41	2.39	229
13	USA	2.42	16	1.00	3	4.39	26	1.43	435

CONCENTRATION MEASURES, FREQUENCIES, GROUPS 5-8

		5		6		7		8	
1	USA	3.90	21	3.90	21	2.00	6	27.08	324
2	USA	6.35	35	2.75	17	1.72	10	16.11	319
3	USA	2.53	15	3.80	51	1.88	8	19.00	297
4	USA	1.96	7	2.42	18	2.31	17	22.25	218
5	USA	2.51	58	2.22	27	1.96	7	15.94	338
6	USA	2.42	42	2.47	36	1.73	23	15.19	355
7	USA	3.76	41	3.70	27	2.66	18	16.57	411
8	USA	4.79	40	2.69	29	0.	0	11.14	335
9	USA	4.31	29	3.58	36	1.00	8	8.56	491
10	USA	3.52	31	2.86	83	1.00	3	7.78	572
11	USA	2.54	26	3.05	61	0.	0	5.49	584
12	USA	2.17	39	2.11	35	0.	0	8.21	454
13	USA	3.27	44	1.99	13	1.00	3	3.30	676

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*Geopolitical groups are: (1) Central/South America, (2) East Europe/Warsaw Pact, (3) West Europe/NATO, (4) Southeast Asia/Far East, (5) South Asia, (6) Middle East, (7) Subsaharan Africa, (8) all nations, e.g., "World".

APPENDIX L. CONC5* (Continued)

PRIMARY TARGETS

1	USR	IND	FRN	VTS	GMN	CPR	VTN	UNK	TAI	DOM
2	USR	VTN	UNK	FRN	CPR	IND	GMN	CAM	PAK	VTS
3	USR	UAR	GMN	UNK	IND	ISR	VTN	FRN	YEM	VTS
4	USR	VTS	VTN	COP	ISR	GRC	IND	MEX	IRN	UNK
5	VTN	USR	KON	VTS	ISR	UNK	CAM	KOS	GMN	FRN
6	USR	VTN	KON	ISR	VTS	BIA	JAP	POL	NIG	JOR
7	USR	VTN	VTS	PER	GMN	JAP	FRN	CAN	ISR	AUL
8	VTN	USR	VTS	ISR	JAP	GMN	UAR	MEX	CPR	TAI
9	VTN	USR	CAN	VTS	ISR	FRN	UNK	TAI	CAN	JAP
10	VTN	USR	ISR	VTS	UAR	CAN	UNK	SPN	KOS	MEX
11	VTN	USR	VTS	ISR	UAR	PAK	CPR	JAP	CAM	CHL
12	VTN	USR	VTS	IND	JAP	ISR	PAK	UNK	CHT	UAR
13	VTN	USR	VTS	CPR	JAP	PAK	CHL	KOS	UNK	IND

TARGET FREQUENCIES, CONCENTRATION

1	28.	21.	20.	20.	19.	19.	16.	13.	8.	7.	8.90
2	63.	20.	17.	15.	15.	14.	13.	11.	9.	9.	6.01
3	50.	20.	19.	15.	13.	12.	11.	10.	10.	10.	6.85
4	33.	13.	11.	10.	10.	9.	8.	7.	7.	6.	6.99
5	56.	34.	33.	17.	16.	14.	14.	13.	11.	10.	7.08
6	64.	43.	25.	21.	18.	16.	8.	7.	7.	7.	5.98
7	75.	39.	29.	18.	18.	17.	15.	12.	10.	9.	6.18
8	83.	39.	23.	14.	14.	9.	9.	7.	7.	7.	4.66
9	144.	65.	31.	25.	16.	15.	11.	11.	10.	10.	4.26
10	172.	85.	37.	33.	30.	23.	14.	11.	11.	10.	4.40
11	228.	73.	47.	26.	22.	17.	16.	13.	11.	10.	3.48
12	140.	36.	32.	29.	24.	22.	20.	10.	10.	9.	4.30
13	362.	67.	34.	26.	21.	10.	9.	9.	8.	8.	2.22

APPENDIX M.

SAMPLE OUTPUT FROM RNKSALOT

```
RNKSALOT    08:59PDT    07/03/73

RANKS FOR WHICH YEAR...?1970

(FOR HOW MANY VARIABLES...?1

WHICH VARIABLES (ENTER NUMBER OR TYPE -0- FOR LIST)...
?0


VARIABLES AVAILABLE ARE:

 1     GNP                          14    GNP INDICES
 2     POPULATION                   15    POPULATION INDICES
 3     MILITARY SPENDING            16    MIL. SPENDING INDICES
 4     ARMED FORCES (1000'S)        17    ARMED FORCES INDICES
 5     TOTAL NEIS ACTIONS           18    ACTION INDICES
 6     TOT. NEGATIVE ACTIONS        19    NEG. ACTION INDICES
 7     GNP/POPULATION               20    GNP/POPULATION INDICES
 8     VAR3/VAR4*1000.              21    VAR8 INDICES
 9     SQRT(3*4)/SQRT(1*2)          22    VAR9 INDICES
10     (1*2*3*4)^.25                23    VAR10 INDICES
11     VAR5/VAR10                   24    VAR11 INDICES
12     VAR6/VAR10                   25    VAR12 INDICES
13     VAR6/VAR5                    26    VAR13 INDICES


INDICES ARE DEFINED AS THE DATA FOR A GIVEN YEAR
DIVIDED BY THE MEAN OF THE FIRST TWO YEARS OF DATA...TO
STOP THE PROGRAM, ENTER A ZERO OR <CR> WHEN THE PROGRAM
ASKS FOR A DATA YEAR....THE <BREAK> KEY CAN BE USED
TO SKIP UNWANTED PRINT-OUT.  PROGRAM WILL BRANCH TO NEXT
OPTION...

FOR HOW MANY VARIABLES...?6

WHICH VARIABLES (ENTER NUMBER OR TYPE -0- FOR LIST)...
?1 2 9 10 11 24


ENTER FILE NAME IF VARIABLES ARE TO BE WRITTEN
TO A FILE FOR LATER ANALYSIS, -N-, IF NOT...?N

. . .

ECHO DATA (0=YES; 1=NO)... ?1

PRINT COUNTRY NAMES IN RANK ORDER (0=YES; 1=NO)... ?0
```

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APPENDIX M. RNKSALOT OUTPUT (Continued)

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COUNTRY RANKS ON  6 VARIABLES FOR     1970
      1   2   3   4   5   6
 1   USA CPR VTS USA CAM LBY
 2   USR IRD ISR USR JOR PAR
 3   JAP USR LAO CPR ISR CAM
 4   GMW USA JOP IND VTN LAO
 5   FRN PAK KON GMW LAO LEB
 6   UNK INS VTN FRN LEB VTN
 7   CPR JAP CHT UNK LBY GUA
 8   ITA BRA CAN JAP UAR VTS
 9   CAN GMN ALB ITA VTS SWZ
10   IND UNK USP POL SYR UAR
11   POL ITA SYR BRA LBR ISR
12   BRA FRN SAU PAK SUD AFG
13   MEX MEX POR SPN PAR HAI
14   AUL PHI GRC CAN KEN JOR
15   SWD TAI CUB GME TUN SUD
16   SPN TUR USA CZE BUL USA
17   GME UAR UAR INS HAI MOR
18   NTH SPN IRQ YUG TAI TAI
19   CZE POL MON ROM IRQ SWD
20   BEL KOS KOS VTS ALB GME
21   ARG IRN GME TUR ALG MOR
22   ROM

PRINT DATA IN RANK ORDER (0=YES; 1=NO)... ?0
      1           2          3        4          5        6
 1   974100.00  836000.00   1.36   83114.00   91.03    12.62
 2   497000.00  553800.00   0.86   72565.00   80.05    11.95
 3   197130.00  242500.00   0.77   41994.00   63.25     7.64
 4   156300.00  209300.00   0.73   15813.00   56.26     6.64
 5   147500.00  130200.00   0.69   13610.00   47.07     6.58
 6   121000.00  119600.00   0.67   12269.00   36.10     5.55
 7   120000.00  103400.00   0.56   11148.00   26.60     3.92
 8    93200.00   95200.00   0.55    9385.00   16.92     3.83
 9    84700.00   61700.00   0.54    8474.00   15.26     3.20
10    52920.00   55800.00   0.44    5362.00   12.71     2.36
11    39400.00   53600.00   0.40    5271.00    7.97     2.26
12    35440.00   50800.00   0.38    4741.00    6.27     1.99
13    33000.00   50700.00   0.37    4332.00    5.01     1.92
14    32990.00   38400.00   0.36    4234.00    4.94     1.89
15    32600.00   37500.00   0.36    3958.00    4.83     1.87
16    32300.00   35300.00   0.35    3488.00    4.59     1.78
17    32300.00   33300.00   0.35    3001.00    4.51     1.75
18    31200.00   33300.00   0.33    2859.00    4.44     1.74
19    30500.00   32500.00   0.29    2826.00    4.39     1.60
20    25700.00   31500.00   0.29    2825.00    4.22     1.38
21    23830.00   28700.00   0.28    2618.00
RANKS FOR WHICH YEAR...?0

PROGRAM STOP AT 590
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APPENDIX N.

SAMPLE OUTPUT FROM EXPERMT

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EXPERMT 11:57PST /27/72

[illegible]? (DYFILI ST[illegible])?DYTILE-1-1-2

WHAT HEADING??DOSOPS [illegible] ALL REP-SPONDENTS: N=13

WHICH RESPONDENTS??DO[illegible]

DOSOPS SEMINARS ALL RESP[illegible]NTS: N=13

CASE NAME	CALC T		MEDIAN B EST			DEL R 66/67-70/71	DELTA MEDIAN 66/67-70/71	70/71-75
	66/67	70/71	66/67	70/71	75			
[illegible]	-0.80	-0.[illegible]	-0.30	-0.30	0.	0.43	0.50	0.30
US-S VIET	0.49	0.[illegible]	0.50	0.40	0.20	-0.24	-0.10	-0.20
US-[illegible]	-0.36	-0.[illegible]	-0.40	-0.30	-0.10	0.06	0.20	0.10
US-TAIWAN	0.70	-0.02	0.60	0.10	0.	-0.72	-0.50	-0.10
USSR-CPR	-0.87	-0.51	-0.70	-0.40	-0.50	0.36	0.30	-0.10
CPR-INDIA	-0.94	-0.92	-0.80	-0.70	-0.60	0.02	0.10	0.10
US-SPAIN	0.29	0.41	0.30	0.40	0.40	0.12	0.10	0.00
USSR-JAPAN	0.32	[illegible]	0.30	0.20	0.30	-0.12	-0.10	0.10
USSR-W GER	-0.63	0.46	-0.40	0.20	0.40	1.09	0.60	0.20
USSR-INDIA	0.53	0.44	0.50	0.50	0.50	-0.09	0.	0.
US-W GER	0.43	0.33	0.60	0.50	0.50	-0.10	-0.10	0.
USSR-N VIET	0.90	0.[illegible]	0.50	0.55	0.45	-0.24	0.05	-0.10
USSR-CUBA	0.33	0.47	0.40	0.30	0.20	0.14	-0.10	-0.10
USSR-ISRAEL	-0.93	-0.[illegible]	-0.60	-0.40	-0.50	0.02	0.20	-0.10
US-GREECE	-0.33	0.23	0.30	0.20	0.20	0.51	-0.10	0.
US-ISRAEL	0.18	-0.02	0.70	0.70	0.60	-0.20	0.	-0.10
US-CUBA	-0.49	-0.[illegible]	-0.70	-0.60	-0.40	0.14	0.10	0.20
US-UK	0.47	0.[illegible]	0.70	0.70	0.70	-0.14	0.	0.
USSR-[illegible]	0.58	0.[illegible]	0.70	0.60	0.40	0.02	-0.10	-0.20
USSR-PAK	0.50	-0.12	-0.20	-0.40	-0.40	-0.62	-0.20	0.
US-TURKEY	0.40	0.[illegible]	0.50	0.50	0.50	0.21	0.	0.
CPR-[illegible]NDIA	0.38	0.[illegible]	0.90	0.90	0.80	0.16	0.	-0.10
US-THAILAND	0.52	[illegible]	0.55	0.45	0.40	-0.31	-0.10	-0.05
[illegible]	0.47	[illegible]	0.60	0.60	0.70	-0.21	0.	-0.10
[illegible]-W GER	0.40	0.[illegible]	0.70	0.70	0.50	-0.12	0.	-0.20
[illegible]-YU	0.[illegible]	[illegible]	0.20	0.30	0.30	0.44	0.10	0.
[illegible]-C[illegible]	-0.[illegible]	0.[illegible]	-0.40	0.50	0.30	1.24	0.90	-0.20
W GER-N CHI	-0.47	[illegible]	-0.40	-0.20	0.	0.31	0.20	0.20
US-S[illegible]	-0.40	0[illegible]	0.00	0.10	0.30	0.31	0.10	0.20
USSR-U[illegible]	0.1[illegible]	[illegible]	-0.05	0.05	0.15	-0.51	0.10	0.10

APPENDIX N. EXPERMT OUTPUT (Continued)

CASE NAME	MEDIAN DELTA		DISPERSION					R - MEDIAN		R - R
	66/67-70/71	71-75	66/67	70/71	75	66-71	71-75	66/67	70/71	66/67-70/71
US-CPR	0.40	0.30	0.06	0.09	0.09	0.08	0.11	0.06	-0.02	0.02
US-S VIET	-0.30	-0.20	0.10	0.13	0.14	0.13	0.11	-0.01	-0.15	0.14
US-USSR	0.20	0.10	0.06	0.06	0.14	0.13	0.08	0.04	-0.10	0.14
US-TAIWAN	-0.50	0.	0.13	0.14	0.15	0.14	0.10	0.10	-0.13	0.22
USSR-CPR	0.20	0.	0.14	0.15	0.20	0.14	0.17	-0.17	-0.11	0.06
CPR-INDIA	0.10	0.10	0.05	0.12	0.15	0.09	0.07	-0.14	-0.22	0.05
US-SPAIN	0.	0.	0.07	0.12	0.10	0.10	0.07	-0.01	0.01	0.02
USSR-JAPAN	0.	0.10	0.08	0.08	0.13	0.09	0.15	-0.04	0.	0.03
USSR-W GER	0.60	0.10	0.14	0.17	0.10	0.27	0.13	-0.23	0.28	0.49
USSR-INDIA	0.	0.10	0.13	0.14	0.13	0.10	0.10	0.03	-0.06	0.09
AV. W/ DATA			0.10	0.12	0.15	0.13	0.11	0.08	0.11	0.13
US-W GER	0.	0.	0.13	0.13	0.14	0.09	0.07	-0.17	-0.17	0.00
USSR-N VIET	0.	0.	0.22	0.10	0.23	0.14	0.10	0.40	0.11	0.29
USSR-CUBA	-0.10	-0.10	0.20	0.11	0.14	0.15	0.06	-0.07	0.17	0.24
USSR-ISRAEL	0.	0.	0.15	0.15	0.21	0.13	0.11	-0.33	-0.51	0.18
US-GREECE	-0.10	0.	0.20	0.13	0.13	0.17	0.03	-0.38	0.03	0.71
US-ISRAEL	-0.10	0.	0.19	0.17	0.16	0.07	0.06	-0.52	-0.72	0.20
US-CUBA	0.20	0.10	0.17	0.17	0.18	0.09	0.08	0.21	0.25	0.04
US-UK	0.	0.	0.13	0.14	0.13	0.04	0.04	-0.23	-0.37	0.14
USSR-UAR	-0.10	-0.10	0.17	0.19	0.20	0.07	0.11	-0.12	0.	0.12
USSR-PAK	-0.20	0.	0.25	0.15	0.16	0.17	0.15	0.70	0.28	0.42
AV. W/O DATA SPEC.			0.18	0.16	0.17	0.12	0.08	0.34	0.26	0.23
US-TURKEY	-0.10	0.	0.10	0.18	0.24	0.10	0.06	-0.10	0.11	0.21
CPR-ALBANIA	0.	-0.10	0.	0.	0.00	0.	0.	-0.53	-0.40	0.13
US-THAILAND	-0.10	-0.10	0.14	0.17	0.13	0.04	0.07	0.04	-0.17	0.21
US-AUSTRALIA	0.	0.	0.03	0.06	0.06	0.06	0.06	-0.13	-0.34	0.21
USSR-E GER	0.	-0.20	0.13	0.14	0.20	0.06	0.06	-0.22	-0.34	0.13
US-YUGO	0.05	0.	0.05	0.05	0.05	0.10	0.05	-0.07	0.27	0.34
US-CAMBODIA	0.70	-0.20	0.34	0.12	0.10	0.30	0.13	-0.26	0.08	0.34
W GER-E GER	0.10	0.20	0.26	0.19	0.18	0.10	0.11	-0.07	0.14	0.21
US-SWEDEN	0.10	0.25	0.40	0.	0.07	0.40	0.05	-0.40	-0.19	0.21
USSR-UK	0.10	0.10	0.20	0.15	0.15	0.08	0.05	-0.07	-0.08	0.01
AV. W/O DATA OPT			0.17	0.11	0.12	0.12	0.07	0.19	0.27	0.26
AV. W/O DATA TOT.			0.18	0.13	0.14	0.12	0.08	0.27	0.27	0.25
AV. ALL CASES			0.14	0.13	0.15	0.12	0.09	0.17	0.19	0.19

ANY MORE COMPUTATION? 0=YES, 1=NO?1

PROGRAM STOP AT 2830

USED 0.77 UNITS

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