NATIONS AT THE BRINK

A Computer Simulation of Governmental Behavior During Serious Disputes

RICHARD J. STOLL

Rice University

During the period 1816-1975, major powers engaged in approximately 225 serious disputes (situations in which military force was threatened or actually used), but only about 12% of these disputes ended in war (Singer, 1979). What model can explain the governmental decision-making that goes on during disputes and account for the rather small percentage of these situations that end in large scale violence? The purpose of this article is to build and test a computer simulation of basic calculations made by governments during serious disputes, and to predict the individual threats and uses of force that they will undertake, including the ultimate act of going to war. To test the simulation, the actions of both Russia and Japan during a series of disputes from 1895 to 1904 will be predicted. I begin by discussing the concept and operationalizations of the serious dispute and then turn to a description of the simulation. Finally, the disputes themselves, the model's predictions, and the fit of these predictions to the observed actions of the Russian and Japanese governments will be considered.

THE SERIOUS DISPUTE: ITS PLACE IN A CONFLICT FRAMEWORK

In this article the word "conflict" will serve as a shorthand for interstate conflict of interest—a disagreement between the govern-

ments of two or more nation states over one or more issues. A conflict can be in any one of four stages, each of which is delineated by the predominant type of activity involved.

Latent Conflict of Interest

An interstate conflict of interest is *latent* whenever the preference orderings of the involved governments cannot simultaneously be satisfied. At this point in time, the governments are not even aware that a problem exists; their preferences are unrevealed. This condition may well be typical of relations between governments most of the time; the interests at stake can range from the overthrow of a leader to the outcome of a World Cup soccer match.

Overt Conflict of Interest

For the conflict to enter the next stage, the governments must become aware that an incompatibility of preferences exists; some sort of communication from one to the other is required. Once in this stage, a government has a number of choices. It could, for example, ignore the problem, or it could give in to the other side. But if the government wishes to obtain an outcome high on its list of preferences, it must consider various means to influence the other involved parties (Singer, 1963).

If an influence attempt is to be made, a wide variety of options can be considered. For example, a government could seek the aid of third parties. Alternatively, it could rely on its own tools, such as diplomatic and economic measures, to alter the preference orderings of the other side.

The Serious Dispute

If the government uses a military instrument, the conflict becomes a serious dispute. Use of such an instrument admits the possibility of war as the "final solution." But note that military tools used during a dispute have a dual purpose: to facilitate any

eventual sustained military actions and to communicate a message of hostile intent to the other involved governments. War, however, may still be avoided.

War

If the use of military instruments (and possible sporadic combat with low level casualties) turns to continuous combat, the main purpose of which is to hurt the opponent nation state, then the dispute becomes a war. During a war, the bargaining and communication that were part and parcel of the activities in the dispute stage take a back seat to purely military objectives; the game has become a fight (Rapoport, 1960). War is the most hostile stage of behavior between nation states; and at its conclusion the conflict may revert to any of the previous stages.

THE SERIOUS DISPUTE STAGE IN DEPTH

As noted above, in the serious dispute stage of an interstate conflict of interest, military instruments are used as a method of communication between nation states. But there is more than one form of such communication. Several types of military instruments are available to governments in a serious dispute; and in this article they are divided into a series of classes. The basis for distinguishing among these classes of military instrument is the propensity of each to involve combat and possible casualties. The more likely the military instrument is to produce these effects, the higher its hostility and, hence, its class.

The lowest level of hostility conveyed with a military instrument is a *threat of force*. Threats of force are statements made by official representatives of a government, directed at one or more target nation states, that raise the possibility of future military action.

The next level of hostility is *display of force*. Displays of force are activities undertaken by the military of a nation state, with the approval of its government, that do not involve placing military units into combat situations with the military, citizens, or terri-

tory of the target nation state. These activities are military demonstrations in which the sword is displayed inside its scabbard.

The highest level of hostility in a serious dispute is *use of force*. Uses of force are operations undertaken by the military of a nation state, with approval of its government, that involve placing military units into close proximity and/or combat with the military, citizens, or territory of the target state.

These three forms of action are the heart of the serious dispute and, along with no action and going to war (discussed below), are the five policy choices available to a government in the simulation.

THE DATA SET: OPERATIONAL DEFINITIONS

The data used in this article were taken from a data set collected by the Correlates of War Project at the University of Michigan (Gochman, forthcoming). It consists of all major power interstate serious disputes from 1816 to 1975 (i.e., all disputes involving at least one major power against at least one member of the interstate system).

Operationally, a serious dispute is identified from the presence of the threats, displays, and uses of force that it produces. Thirteen types of threat, display, and use of force are coded in the data set, and twelve of these are used in this article. Table 1 displays each event-type and the level of hostility assigned to it.

As mentioned above, in addition to the three categories of military instruments defined in Table 1, the simulation allows for two additional policy choices. The highest level of hostility is generated by the action of going to war. To go to war is to initiate sustained military combat against the armed forces of the target nation state(s). The immediate objective of this action is to extract an admission of defeat from the opposition government. Operationally, war is defined as continuous combat producing a total of 1000 or more battle deaths among the participating nation states (Singer and Small, 1972).

TABLE 1
Types of Events and Serious Dispute Phases
Used in the Simulation Model

Phase of Serious Dispute	Event Type	Definition
THREAT OF FORCE	Threat to Blockade	Threat to seal off target state's territory
	Threat to Declare War	Threat to issue formal statement of start of combat ops.
	Threat to Seize or Occupy Territory	Threat to use military means to seize or occupy target state's territory
	Threat to Use Other Type of Military Force	Threat to use regular forces to fire at forces of target or to move into its territory
DISPLAY OF FORCE	Alert	Increase readiness of active military forces
	Mobilization	Activate inactive military units
	Show of Force	Demonstration of military without combat operations
USE OF FORCE	Blockade	Sealing off of target's territory
	Other Use of Military Force	Use of regular forces to fire at target's forces or move into its territory
	Seizure of Personnel, Material	Seizure of target's personnel or material by forces for 24 hours
	Seizure of Territory	Seize or occupy target's territory
not used	Clash	Combat lasting less than 24 hours having no clear initiator

It is also possible for a government to take an action that has a level of hostility lower than that of threat of force. In this simulation, such responses are treated as a category of "no action." I stress that this policy choice can cover a range of governmental behavior, but given the thrust of the simulation, I believe that the catch-all nature of the label is sufficient.

By and large, the definitions and assignments of event-types to levels of hostility are fairly obvious, but a few explanatory comments are in order. The "other use of military force" category is used to identify formal military operations directed at a target nation state whose nature is not covered by the other, more explicit, categories, such as blockade or seizure of territory. The "go to war" category of event is either the start of military operations involving sustained combat or a declaration of war when followed immediately by the onset of military operations.

Finally, the "decision to ignore the clash" category should be explained. By their very nature, clashes are events over which governments have little control, e.g., small firefights that occur when opposing units stumble together. Since individual government behavior is the object of study in this article, and since a clash cannot be attributed to either side in a dispute, it was excluded from the simulation.

THE SIMULATION MODEL

The description of the simulation begins with an outline of the model's basic components and the general flow of the program. The simulation, written in FORTRAN IV, is programmed to respond to actions taken by various other nations involved in the dispute. That is, when an event occurs in the dispute, the simulation generates a prediction of future action by the government. This prediction is then compared to the historically observed behavior of that government during the dispute. This cycle is repeated for each appropriate action in the dispute.

For purposes of identification, the nation state whose actions are being predicted is called nation state X, and the nation state on the other side of the dispute (toward which nation X is directing its behavior) is called nation state Y.

The model of governmental decision-making embodied in the simulation consists of four groups of decision rules arranged in an hierarchical structure (see Table 2). At the bottom level are three groups of rules, each focusing on a particular part of the environment. All three process information about the environment and pass on their evaluations to a fourth set of rules, which simulates the final decision of the government as to what action is to be taken. Each set of rules is tagged with an organizational name, but note that this name serves primarily as a shorthand for the nature of the calculations being performed therein.

The three sets of decision rules that evaluate the environment are the military command (the military balance between X and

TABLE 2
Building Blocks of Simulation Model

Central Decision Making Unit		
Diplomatic Service	Military Command	Intelligence Service

Y), the diplomatic service (the past relationship between X and Y), and the intelligence service (total capability balance between X and Y). The fourth set of rules, called the central decision-making unit, takes the three evaluations and generates the predicted action. Note that the central decision-making unit (CDU) must deal with the information as processed by the other sets of decision rules and has no direct access to the environment. The information may be accepted or rejected, but not reevaluated or replaced.¹

THE MODEL AS SIMULATION: FOUR KEY ROUTINES

With the overview of the building blocks in mind, I now turn to a description of the decision rules within each of the four substantive modules. The computer program consists of these four routines, plus four additional utility routines that will not be discussed here.

Given an action that requires a prediction, the CDU routine is called, and it in turn calls the other three routines. In this discussion, let me first describe the three routines that deal directly with the environment (Diplo, Mil, and Intel), and then indicate how the CDU routine integrates the information it receives and makes a policy choice.

Diplo

The Diplo routine considers factors that bear on the past relationship between X and Y. The more discordant the relationship between them, the more hostile is the level of action that is passed to the CDU as a recommendation. If there has been a war between the states in the last 25 years, the initial recommendation is for an action one level higher in hostility than that of the stimulus incident (i.e., if the incoming incident was a display of force, the initial recommendation is for a use of force). If, in addition, there has been at least one serious dispute between the two nations in the past ten years, the recommendation is increased to the next level. If there was no previous war, but there was a previous dispute, the initial recommendation is for an action of the same level as the incoming incident. This level is *increased* by one if there are no diplomatic relations between X and Y. Finally, the recommendation is *reduced* by one level if X and Y share a formal military alliance bond at the time of the dispute. The final recommended level of action is passed to the CDU routine.

Mil

The military evaluation routine has as its focus the immediate military balance between X and Y at the site of the dispute. This includes not only the military capabilities available to X and Y, but also their recent war performance. The first component of the estimate is the current military expenditure ratio of X to Y. Both nations' expenditures are discounted by their contiguity to the site of the dispute. If the state is contiguous to the dispute area, the full military expenditure figure is used. If the dispute is in the same geographic region as the state but is not contiguous to it, two-thirds of the current expenditure figure is used. If the dispute is outside the geographic region of the state and it has a significant naval capability, one-third of the expenditure figure is used. If the dispute occurs outside the geographic region of the state and it has no naval capability, its current military expenditure figure is

multiplied by .01. (Even without a naval capability, most major powers retain the ability to project small forces at a distance; this also avoids the possibility of dividing by zero.) The resulting two figures are placed in a ratio—X's adjusted expenditure figure over Y's.

Given this ratio, the effect of previous wars is now considered. If X has lost a war recently, but not to Y, 1 is subtracted from the ratio. If Y has lost a war recently (within the last 25 years), but not to X, 1 is added to the military capability ratio. If Y's war loss was to X, then 2 is added to the ratio instead of 1. If X's recent war loss was to Y, no change is made to the ratio.

The reasoning behind the war adjustments deserves some comment. As a general matter, a recent war loss indicates that the current military expenditures overestimates the military capability of a nation state. A loss by Y to X supplies even more compelling evidence on this point. On the other hand, organizations are likely to believe that any recent failures on their part have caused the appropriate lessons to be learned, so no change is made to the ratio if X had lost to Y.²

The final adjusted expenditure ratio is used to determine what level of action should be undertaken. If the final adjusted ratio is less than 1:3 (i.e., if Y is calculated as having greater than a 3:1 superiority over X), a recommendation for no action is passed to the CDU. If the ratio is greater than 1:3 but no greater than 1:1, the recommendation is for an action one level higher than the action that led to the prediction. If the ratio is greater than 1:1 (i.e., X has the advantage), the recommendation to the CDU is for a one-step increase in the level of hostility. A final adjustment occurs if the site of the dispute is contiguous to or inside the metropole of X: all recommendations of no action are replaced by recommendations of threatened force.

A better calculation would replace the military expenditure and contiguity adjustment with a more direct measurement of the amount of military might both sides could commit to the dispute site within a short period of time (e.g., 30 days). Unfortunately, such estimates are not available in any systematic fashion for the

disputes analyzed in this article. The crude calculations used here serve as a surrogate for that measure.

Note that the transformation of the final ratio into a recommended level of hostility will tend to produce an "aggressive" action; only if the current military balance is viewed as being extremely unfavorable will a recommendation of escalation be avoided.

Intel

The final routine called from the CDU is concerned with a long-run view of the situation. As used for the Russo-Japanese disputes examined in this article, the long-run view is interpreted as the total mobilizable capability available to X and Y. The total capability estimate for X and Y is based on the following six quantities: military personnel, military expenditures, steel production, commercial energy consumption, total population, and urban population. The total capability ratio between X and Y is simply the average of the six ratios formed by dividing X's value on an indicator by Y's value. Unlike the military expenditure calculations in the Mil routine, no adjustment is made for contiguity; in the long run, I assume that both sides could totally mobilize their resources and commit them to resolving the issue(s) by means of war.

CDUEV

The CDU routine receives three pieces of information: the recommendations from Diplo and Mil, and the total capability ratio from Intel. If the two recommendations are for the same level of hostility, then that level is the predicted action. If the two recommended levels of hostility differ, then the total capability estimate from the Intel routine is used. If the total capability ratio is less than 1:1, the lower level recommendation becomes the predicted action; if the ratio is 1:1 or greater, the higher level of hostility is predicted.

DETERMINING OBSERVED INCIDENTS

Since the matching of predicted and observed actions is not a trivial task, a digression about the manner in which this is done is necessary. As the reader will recall, a dispute action (one of the individual threats, displays, or uses of force) is input to the simulation, and a predicted response by government X is made. This prediction is compared to the observed action by the government, and the degree of fit is noted.

When a prediction is made, the dispute is scanned from the action that led to the prediction to determine if X did initiate an action. If X initiates an action before one of several limiting conditions occurs, this "observed" action is compared to the prediction to determine the following:

- (a) Did the action occur within 30 days of the initiating action? If the action exceeds this time limit, then an observed action of "no action" is coded.
- (b) Has this X-initiated action already been coded as the observed action of another prediction? If so, more actions in the dispute are scanned, as long as they do not exceed the 30-day time limit.

There are two limiting conditions. If the dispute ends without another X-initiated action or if another action to which X must respond is encountered, an observed incident of "no action" is coded.

In assessing the fit of the simulation's predictions, I assume that if X does initiate an action that meets all the criteria noted above, this is indeed the response to the action that activated the prediction. Thus, if the model predicts that X will display force against Y, and if shortly thereafter, X displays force against Y, this is counted as a correct prediction. It is possible, of course, that the X-initiated action was not in response to Y's previous action, but was undertaken for completely different reasons. To guard against this possibility, one can only check the available narratives to see if the program's assessment of fit corresponds to the

judgment of historians and political scientists who have studied these events intensively. Such a judgment is admittedly subjective but, nevertheless, has value. After examining a variety of sources, I am convinced that the predicted actions that are calculated as correct by the program are indeed correct in the eyes of the historians. Of course, there is always room for disagreement on this matter.

Once the observed X-initiated actions are identified, they are matched with the predicted actions in a 5-by-5 table. In this article only the summary tables representing the predicted versus observed actions for the entire group of disputes are displayed; the program itself produces one such table for each dispute. I have verbally summarized the simulation's prediction for each dispute after a brief synopsis of its context and actions.

One additional point concerning observed actions should be noted. After the program is finished with prediction for a dispute, it scans back through all the actions to see if any X-initiated actions are unpredicted. If any such actions are encountered, a prediction of "no action" is generated. The only exception to this occurs if the first incident in the dispute is initiated by X. Since the program only predicts responses, this first incident is beyond its capabilities and is not counted as an incorrect prediction.

RUSSIA AND JAPAN IN THE FAR EAST, 1895-1904

The series of disputes I subjected to analysis involved Russia and Japan during the years 1895-1904. The disputes were stimulated by the growing rivalry of these two nation states for influence in the Far East following Japan's defeat of China (and its subsequent entry into the "great power club") in 1895. The governments of both states were engaged in political, military, and economic expansion in China (specifically, the Manchurian Peninsula) and Korea. The model was used to predict the dispute actions of both major powers. For each dispute, I will give a brief description of the background and flow of events, followed by a

comment on the model's ability to predict the actions of each major power. A final summary table of the predictions for each nation state across the full set of disputes is also included.

THE TRIPLE INTERVENTION, 1895

The first dispute in the series was a direct outgrowth of the Japanese victory in the Sino-Japanese War. The immediate issue was the peace treaty that the Japanese government was seeking to impose on China after the war. The concessions Japan demanded were so extensive that the governments of Germany, France, and Russia banded together in an ad hoc coalition to pressure the Japanese into changing the terms. The three powers together threatened Japan, and Russia staged an additional military demonstration with a naval squadron. The Japanese backed down and moderated their demands (including one for the occupation of Port Arthur at the tip of the Liaotung Peninsula).

For this analysis, two actions are included: the three-nation threat against Japan and the display of force by Russia. The joint threat was handled by aggregating the traits of all three major powers together; in essence, creating a "superpower." The dispute actions of Japan are accurately predicted. The capability disparities, both military and total, are calculated to be so large as to rule out any counteraction by Japan. This seems to be an accurate reflection of the view of the Japanese government at the time. They had just emerged from a war, and although victorious, they were not ready to take on three major powers.

The Russian government is predicted as following the joint threat with another threat, as opposed to the display of force that actually occurred. This underprediction is due to my decision about the contiguity weight to be applied to the Russian military expenditures. Although many of the disputes in this series are contiguous to Asian Russia, I chose to treat them as if they occurred in a different geographic region from the metropole; consequently, the contiguity discount I applied to Russian expenditures was one-third, not two-thirds. I made this decision for several reasons. First, the seat of Russian government was far

away from the dispute site. Second, the vast size of Russian territory required the maintenance of two separate military establishments: one in Europe and one in the Far East. This informal partition of military resources was finally officially acknowledged in 1929 (Mackintosh, 1956), and it persists to this day. Thus, the military expenditure figure for Russia greatly overestimates Russian military capabilities in this region, and led to my application of the out-of-region discount. At the same time, I set the contiguity weight for the Japanese to 1. This reflects not only the closeness of the Japanese homeland to the dispute sites, but also the fact that the Japanese designed their military to project capability beyond their home islands. Note that during the Russo-Japanese War (the climax of this series of disputes), virtually their entire army and navy were committed to the combat theater.

KOREAN FINANCIAL ADVISOR, 1897

The second dispute in the series included England, as well as Russia and Japan. Earlier in the year, Germany had obtained (seized) a naval base at Kiao-chow. Although many European powers had coveted anchorages in the area, the German government was the first to change the status quo and obtain one. The Russian government, in preparation for exercising more influence in the area, attempted to have a Russian named Alexiev appointed as a government "advisor" to the Korean treasury, and chief superintendent of customs. The position was held at that time by M'Leavy Brown, who refused to be removed. In late December, to back up British protests over the matter, a joint Anglo-Japanese naval squadron appeared at Chemulpo—a demonstration directed at both the Russian and Korean governments. The Russians backed down, and Brown was retained in his position.

For both governments, the predictions of the model are reasonable. The military calculation shows a slight advantage for the Japanese (1.2 to 1), so the recommendation for the Japanese is to increase the level of the British action by 1, to a use of force. The model should have a more sophisticated calculation for joint actions such as this Anglo-Japanese naval demonstration, to allow either for support of the other party (by taking the same

level of action), or to take no action. As for the Russians, the combination of British and Japanese capability is just too much to lead to a prediction of any action. Considering that the Russians backed down and did not press their claim for Alexiev's appointment, the model fits their behavior well.

MASAMPO, 1900

The third dispute in this series also took place in Korea. The Russian government feared that action by the Japanese could cut the sea link between their naval base in Port Arthur (acquired in March, 1898, much to the chagrin of the Japanese government), and Vladivostok. To protect this sea link, a Russian naval squadron sailed to Chemulpo on March 16, 1900, as a demonstration to back up their demand for a lease at the port of Masampo on the southern coast of the Korean Peninsula (midway between their two current bases). The lease was granted, and the Japanese reacted by placing part of their army, and all of their navy, on alert. Despite the fact that this dispute provides only a single incident for prediction on each side, I included it because of its importance to the overall situation.

It is not predicted as well as the previous two disputes. First, a Japanese display of force (an alert) is underpredicted, due to the intelligence calculation (unfavorable toward Japan—a ratio of 1 to 4); this leads the CDU routine to accept the lower level of hostility recommended by the Diplo routine. On the Russian side, their government is predicted as responding to the Japanese alert with a further action. This does not happen. However, the Japanese do back down and the Russians retain their gain, so this misprediction strikes me as being consonant with the course of the dispute. Inaction in the dispute data set does not always imply deescalation by a government.

RUSSO-JAPANESE WAR, 1903

The climax of the Japanese-Russian rivalry in the Far East during this period was the Russo-Japanese War that began in 1904; the dispute that preceded the war began a year earlier. Several events after the Masampo dispute helped to set the stage

for this final confrontation. Clearly, at some point between Masampo and the onset of the dispute, both governments became convinced that a war was inevitable. One of the specific events that increased tensions between the two governments occurred in the wake of the Boxer Rebellion (1900): Russia occupied Manchuria. In an extended series of negotiations with the Japanese (supported by several other major powers), the Russian government agreed to withdraw from Manchuria in 1902, but this was never fully carried out. At the same time, the Russians and the Japanese were negotiating about spheres of influence in the region. In broad terms, Russia was to have a free hand in Manchuria, while Japan was to have a similar status in Korea. This agreement was never implemented. A third set of negotiations was implemented. In January 1902 an Anglo-Japanese alliance was announced.

The dispute itself started in April 1903, when the Russians added nineteen vessels to their Far Eastern Fleet. The Russian government initiates a number of other actions in the dispute, but the Japanese are inactive for most of the dispute; the first action they initiate is in December 1903, and their only other incident occurs just two days before the outbreak of the war. The lack of the familiar action-reaction pattern to the dispute leads to a considerable number of mispredictions, with a Japanese follow-up being predicted to all Russian actions.

OVERALL FIT OF THE MODEL

Tables 3 and 4 display the fit of the model across all disputes for the Japanese and Russian governments. Readers may judge for themselves how good the fits are (and should bear in mind that some disputes fit better than others). For my part, I find the results encouraging. The simulation was developed to cover a wide variety of nations and situations (groups of disputes ranging from the Italian Unification to the Cold War have been examined with it), with little attention paid to the specifics of this particular set of cases. A model tailored to the peculiarities of this rivalry undoubtedly would have done a better job. In the remaining

TABLE 3
 Russo-Japanese Disputes, 1895-1904; Predicted Versus Observed
 Incidents; Japanese Actions (Four Disputes Total)

		PREDICTED ACT					TOTAL
		NOACT	THT	DISPLY	USE	WAR	
A	NOACT	2	0	3	0	0	5
C							
T	THT	0	0	0	0	0	0
U							
A	DISPLY	0	1	1	2	0	4
L							
	USE	0	0	1	0	0	1
A							
C	WAR	0	0	0	1	0	1
T							
TOTAL		2	1	5	3	0	11

$$\text{TAU } 3 = .50 \text{ GAMMA} = .67$$

sections of this article I discuss the worth of this approach to understanding international conflict, and the particular improvements that I believe should be made to the model.

WHY SIMULATE? THE VALUE OF THE MODEL

Let me point out the deficiencies of this effort. The simulation is somewhat cumbersome to operate; at the same time, the underlying model of governmental behavior that drives it may be too simple to ultimately satisfactorily explain government actions in disputes. Finally, the fit is not outstanding.

Having said all that, I still believe that it has value. First, consider the perspective of governmental decision-making presented in the model: Governments monitor only selected portions of their environment, conduct their analysis of even this restricted domain in a crude fashion, and choose from a limited menu of policy options. Such a description is hardly new; part or all of it occupies a prominent place in a variety of accounts of crisis behavior. But these accounts rarely state their underlying pre-

TABLE 4
 Russo-Japanese Disputes, 1895-1904; Predicted Versus
 Observed Incidents; Russian Actions (Four Disputes Total)

		PREDICTED ACT					TOTAL
		NOACT	THT	DISPLY	USE	WAR	
A	NOACT	2	0	3	1	0	6
C							
T	THT	0	0	0	0	0	0
U							
A	DISPLY	0	1	3	0	0	4
L							
	USE	0	0	0	0	0	0
A							
C	WAR	0	0	0	0	1	1
T							
TOTAL		2	1	6	1	1	11

$$TAJ \beta = .30 \text{ GAMMA} = .44$$

mises in a manner rigorous enough to be tested across a large set of cases. This simulation model does not have that limitation; it can be applied to a wide variety of cases.

When we do turn to that portion of the literature that builds and tests explicit, generalizable models of crisis behavior, we find that the most commonly used tools are a variety of statistical methods or formal mathematical models. A recent annotated bibliography of conflict research does not even include computer simulation as one of the analytic approaches to the subject (Intriligator, 1982). Herein lies a problem. If the description of governmental behavior that drives this simulation is accurate and, therefore, worthy of future study, translating it into a statistical or formal mathematical representation may prove to be very difficult. Even the simple model used here would result in a high level of complexity if formulated as a multivariate statistical model. Computer simulation is a far superior method of representing the succession of conditional decision rules that make up this type of model.

Finally, although the fit of this model leaves something to be desired, it is no worse (and in some cases, better) than other

quantitative efforts to predict the occurrence of specific types of events during a crisis.

IMPROVEMENTS OF THE MODEL

With the benefit of hindsight, some specific improvements of the model can be suggested. A useful feature would be to integrate a "look ahead" function to the program. That is, aside from recommendations, one or more of the modules could use the same logic to explicitly predict the level of response to its action by the opponent government. This prediction should be compared to the opponent's actual behavior, and any discrepancy used to modify future recommendations in the same dispute.

Another change, along these same lines, would be to add a "memory" of prior dispute performance to the CDU. This would allow the CDU to deal with contending recommendations in a more sophisticated fashion. For example, greater weight could be given to the recommendation from the unit that was most correct (and/or most successful) in previous disputes.

Finally, some provision to handle the impact of allies is necessary. Their presence would affect the military and total capability calculations. Some of the important considerations here would be the strength of these allies, their location vis-a-vis the dispute site, and their previous record of aiding allies in disputes. All of these changes would undoubtedly improve the fit of the model by providing the simulated government with a wider range of assessment capabilities.

SUMMARY

The main purpose of this article was to take a particular view of governmental behavior, as modeled in a computer simulation, and see if it could account for the major actions undertaken by governments during serious disputes. The simulation model was built around two basic premises:

- (1) To model and understand the foreign policy behavior of governments, it is often necessary to tap the process of decision-making within them.
- (2) This process of decision-making is conducted by human beings operating as individuals, within groups, and/or within large organizations. It is subject to a wide variety of constraints that can have a dramatic effect on the final policy choice of a government. In particular, numerous shortcuts and simplifications are usually taken.

The simulated government contained four modules, each representing a different viewpoint of function of a government during a serious dispute. All of the modules take a severely proscribed portion of the environment and, through a series of crude calculations, reach a "conclusion" that culminates in the prediction of a specific level of hostility to be taken by the government in the dispute. This model was put to the test by predicting the actions of two major-power governments across a series of disputes in the Far East from 1895 to 1904. The performance of the model was adequate, although several improvements to the model could be made. I believe that the exercise was successful, both as a demonstration of the usefulness of an underutilized approach to the study of international conflict, and as a working hypothesis about the roots of governmental behavior during crisis situations that may culminate in war.

NOTES

1. The limitations on the ability of upper-level units within organizations, such as governments, to deal directly with the environment, and the effects of this are captured by March and Simon's (1958: 165) notion of uncertainty absorption:

[This] takes place when inferences are drawn from a body of evidence and the inferences instead of the evidence itself, are communicated . . . The "facts" [the organizations communicate] can be disbelieved, but they can only rarely be checked.

2. Since the disputes analyzed in this article took place far from Europe, calculations involving the major power allies of Japan and Russia were ignored. A more general version of the simulation takes these allies into account in the military and long-run calculations.

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