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Efficiency in a Garbage Can: Implications for Crisis Management

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INTRODUCTION

The navy, considered at as a decision-making organization, presents us with a set of interesting and difficult parameters according to which important decisions must be and are made. These parameters are interesting because they are somewhat different from those artificially imposed on theoretical models of decision making; and they are difficult in that they (the parameters) are the result of real-world phenomena and not the simplifying assumptions so often characteristic of science. Let me identify a few of these parameters, suggest how they might be modeled and then examine whether there are any implications for decision making in the navy.

• Multiplicity of objectives: The navy wants to be ready, on the one hand, for the "big one," World War III, and at the same time be able to manage individual crises like Grenada or the Jordanian Crisis. One goal might be to set up an organization that can efficiently handle crises without impinging on its efficiency to maintain a global ready state during long periods of peacetime activity.

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- Hierarchical structure: Within the navy there is a definite chain of command; for example, lieutenant, second lieutenant, ensign and so on. Different responsibilities, different training and different objectives correspond to each level in this hierarchy.
- Mobile salience: The navy, being subject to the commander-in-chief, is not immune to the wiles of politics. In fact, at any level in the chain of command, different problems will be more salient for some leaders or executives than for others. Further, this saliency may change not only across people but over time. The political environment, the state of world affairs and the economic setting affect the degree of importance attached to a particular problem.
- Changing technology: Tactical readiness at the decision level requires up-to-date knowledge of currently available technology. However, with the present rate of change in technology, officers need to be constantly retrained just to keep abreast of currently available devices. Rapidly changing technology also means that appropriate manpower may not be available, that people will have to be retrained and that staff members will have to be moved about in order to utilize their knowledge or talents. This is especially so when relatively new or unique technologies are used in novel situations. For example, in the bid to free the hostages in Iran, the task force was forced to look to all the services to find the right kind of pilots to fly the navy's mine sweeping helicopter, the MH-53, since mine war pilots are not trained for assault missions.
- Rapid-event theaters: Escalation occurs rapidly, and the time during which a crisis can be contained is often relatively short. For example, the entire Grenada incident lasted less than a week.
- Volatile information flows: When a situation arises that has potential crisis ramifications, the information flow increases. In a relatively short time, a great deal of information comes in, and it comes in very quickly. Once the crisis is abated, the information flow basically returns to normal, the rate of incoming information decreases and the amount of information decreases.
- Incomplete information: Intelligence reports are often incomplete. For example, during the Grenada invasion, one of the problems facing the admiral was the lack of a current topological map of the island.
- Unreliable information: Not only is the information provided by intelligence reports incomplete, but it is sometimes wrong. Information can be unreliable for a variety of reasons, including human error, misrepresentation or datedness. For example, it is often claimed that unreliable information led to the Bay of Pigs incident.
- Unclear decision technology: One of the first steps in crisis management
 is often the establishment of a joint task force. Often, the members of
 this task force have not previously worked together, they have different
 backgrounds and goals, are from different military branches and so

forth. They are not an established decision team with practice making decisions together; hence, the technology of working as a team and making a decision is undefined. This lack of joint decision training forces the joint task force to face two problems: management of the crisis and team coordination.

Admittedly, these parameters do not cover all aspects that affect decisions in the navy (for example, the impact of peacetime activities and the role of leadership). Further, the interaction between the DoD, the White House, the OMB and organizational staffs is mentioned only insofar as it looks like a hierarchy; hence, many of the important nuances of this organizational structure have been left out. Nor have I spoken of the impact of investment strategies and various bureaucratic issues important during peacetime. For the nonce, however, let us consider those parameters suggested as sufficient. One further point is that not all of the parameters listed are unique to the navy; and to the extent that these parameters affect other organizations the results presented will be applicable there as well.

Let us consider now a simulation model, GARCORG, which takes into account at least some of those parameters suggested as important to naval decisions. Since GARCORG can simulate organizations with parameters like those identified for the navy, the results are potentially relevant to crisis management. This model is based on recent advances in decision theory centered around what has been referred to as garbage can models of organizations. Recall that garbage can organizations, as described by Cohen, March and Olsen (1972) are characterized as organized anarchies beset by (1) problematic information flows, (2) unclear decision technology and (3) fluid personnel flows. These characteristics are strikingly like the parameters of decision making identified for the navy, the main difference being the existence of a hierarchical chain of command in the navy, and its absence in the garbage can model. The Cohen, March and Olsen model of garbage can organizations can be combined with hierarchical models or organizational structure (Padgett, 1980) thus creating a system in which it is possible to measure organizational efficiency (see Chapter 8 in this volume).

A program for simulating organizational behavior based on such a system was developed—GARCORG. The mathematical underpinnings of this model are discussed in Chapter 8. GARCORG can be used to simulate the behavior of various types of garbage-can-like organizations and emulate their efficiency levels in both the short and the long run. GARCORG was not designed specifically with the navy in mind; rather, it was designed as a general-purpose tool for testing theories about the impact of organizational structure and information flows on organizational efficiency. However, due to the inherent flexibility in the GARCORG system, it can be used to test out ideas about organizational efficiency in the navy by simply setting the appropriate parameters to resemble those previously suggested.

Let us turn now to a description of the way in which organizations can be simulated using GARCORG. Some of the limitations and features of this

simulation program will be examined. Then, to illustrate one of the ways in which GARCORG can be used, a set of results from simulating a wide range of organizational structures using GARCORG will be presented. The results also serve as an exploratory study of the impact of organizational structure and decision flows on organizational efficiency. In turn, the results of this study have important implications for crisis management.

GARCORG is a simulation model, designed to do preliminary explorations of the relationship between various organizational features and efficiency, to study short-term effects of changing various structural and nonstructural features of the organization. Because it was hoped that this, or later expanded versions, would be used as a classroom or analytic tool, the program was written in a user-oriented, interactive, friendly fashion. The program is written in APL on an IBM 370. It allows the user to test the efficiency of organized anarchies by altering various features-for example, size and amount of incoming information. The information flow and the decision structure used for a single time period as currently implemented in GARCORG are similar to the analytic model as developed by Padgett (1980). The efficiency measures used are those discussed in Chapter 8. The organizational model used in this program departs from Padgett's in that it incorporates feedback into the system in terms of processes for transferring lower level personnel, staff members, in and out of various positions. Staff members are not expected to be always available; that is, the composition of the staff is not fixed, new staff members may be added, old ones transferred and so on.

GARCORG allows the user to model a particular organization or set of organizations and the information flows that affect decision making in this organization. The user is asked to specify various structural features of the organization and aggregate flows. Using GARCORG, the user can study the impact of various managerial solutions on the organization's efficiency level simply by testing out different sets of features.

In this paper the GARCORG simulation model is used to explore the causes of inefficiency by looking at the effects of altering various organizational features on the level of organizational efficiency. Note that this paper is not an exhaustive report on all of the capabilities of the GARCORG system, nor a critique thereof. Rather, it is an introduction to an exploratory simulation model, including an investigation of some causes of inefficiency through using this model. In the following section, the organizational structures that can be studied using the GARCORG program will be discussed. First, there will be a brief introduction to the general model used for information and decision flow. Then those features used in the GARCORG program to define an organization will be presented, as will all available options. In a way, this subsection can be thought of as a codebook for using GARCORG. In the following section, short-run organizational behavior will be looked at via computer simulation, thus illustrating some of the capabilities of the GARCORG program. That section can be viewed as an exploration of the causes of inefficiency. Note, although all of the options and features of GARCORG are presented in the second section, they are not all used in the analysis in the third section. Symbols used in analysis and in the computer code are represented by names in bold face

type; for example, the number of AEOs is referred to as AEO in the calculations. Finally, in the conclusion, the implications of these exploratory findings for crisis management will be considered.

GARCORG—AN OVERVIEW

Garbage Can Hierarchies-The General Model

We will refer to organizations as garbage can hierarchies—garbage cans because they are organized anarchies with problematic flows, and hierarchies due to the fact that the people who work in an organization are organized in a hierarchical fashion. The hierarchical form used, like that suggested by Padgett (1980) is set to four tiers. There is a chief executive officer (CEO) in charge of an organization which is composed of several divisions. In charge of each division is an assistant executive officer (AEO) who oversees numerous programs. Each program is run by its own program chief. Under each program chief are a number of staff members who analyze the information that comes in on a particular issue. The chain of command and the decision flow are illustrated in Figure 9.1.

Associated with each division is a particular set of potential issues. This set is time invariant in the short run—for example, the length of the crisis. Associated with each of these issues, in a particular program, is a particular position for a staff member whose job would be to analyze all the information that comes in on that issue. That is, under each program chief, there are as many positions available for staff members (spots) as there are potential issues. Each staff member analyzes information on only one issue, and handles only one aspect of a problem.

The decisions of concern are, for example, of the form what units should comprise the assault force or what equipment should be used to rescue hostages. Taking this latter example, the CEO in charge of the rescue operation might place a particular assistant (AEO) in charge of determining what type of equipment should be used. The AEO would have each program chief under him give him a recommendation for a particular type of equipment. Then each program chief might request a recommendation from each staff member under him.

The program chiefs make recommendations to the AEO on their programs based on the analyses of the staff members under them for only those issues to which they have access. Thus, there are as many recommendations to the AEO as there are programs. Similarly, the AEO makes one recommendation to the CEO for each of the programs under his jurisdiction based upon the recommendations of the program chiefs under him and, hence, the analyses of all the staff members for each of the programs under him. Then the CEO makes a final decision regarding each of the programs based on the recommendations of the AEOs and, hence, the analyses of all of the staff members in the entire organization.

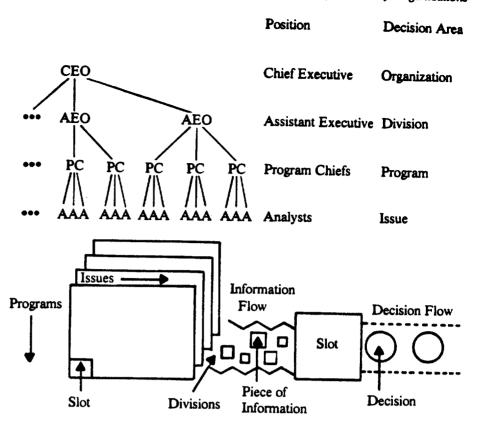


Figure 9.1 Chain of command.

Each AEO can rubber stamp program chief recommendations, thus proposing them as the final decision. Similarly, the CEO can simply rubber stamp the AEO's decision, making it the final decision.² In this paper, we will be concerned not so much with the decision-making process per se as with the process by which the staff members are transferred, and the impact of such movement on the organization's efficiency.

Aside from the hierarchical flow, the garbage can hierarchy can be uniquely described for the purposes of simulation by a limited set of features. Each of these features has several possible values that it can take on; for example, the feature program chief access structure can take on values like specialized or quasi-specialized. Each garbage can hierarchy has a level of efficiency that it is achieving, and this level is specific to the features that describe that organization. Further, there are several different ways in which efficiency can be measured, some based on structures and others based on political salience, thus allowing the researcher to use GARCORG to test various theories about the causes of inefficiency. These measures were described in Chapter 8.

Organizational Features

In the GARCORG program, the organizations are described by a set of eleven features (see Table 9.1), each of which can take on several values. By choosing a particular value for each of these features, the user can simulate a particular organization. Each of these features and their values will be described in turn.

SIZE

The size of an organization is simply the total number of people who have "jobs" or positions in that organization [TOTAL]. There are four types of "jobs," in hierarchical order the CEO, the AEOs, the program chiefs and the staff members.

With GARCORG, the user can set the initial size of the organization to be small (26 people), medium (50 people) or large (100 or 112 people). Setting the size of the organization also sets the number of divisions (equal to the number of AEOs [AEOS]), the number of programs in each division (equal to the number of program chiefs under that AEO) and the number of potential issues per program [ISSUES]. The number of staff members can change throughout the course of the simulation; however, this number for any one program chief can never exceed the number of issues. Note, the number of issues denotes the number of "spots" or positions that can be filled by staff members. It is assumed that for the period of interest this number is fixed.

DIFFERENTIATION

Differentiation refers to the width of the organizational tree, the breadth of the product line, or the range of projects. The larger the size of the organization, the greater the effect of differentiation on the overall organizational structure. At higher or executive levels in the organization a differentiated organization will have more slots available than will an undifferentiated organization; as there are more projects, there are more directors or program chiefs (see Figure 9.2). As differentiation is a relative measure, its greatest use is in distinguishing between organizations of nearly the same size.

Table 9.1: Possible Organizational Features

- 1. size
- 2. differentiation
- 3. amount of information per issue over time
- 4. content of information per issue over time
- 5. CEO salience assignment
- 6. AEO salience assignment
- 7. program chief access structure
- 8. delay or grace period
- 9. criterion for transferring staff in
- 10. criterion for transferring staff out
- 11. the personnel transfer cutoff level

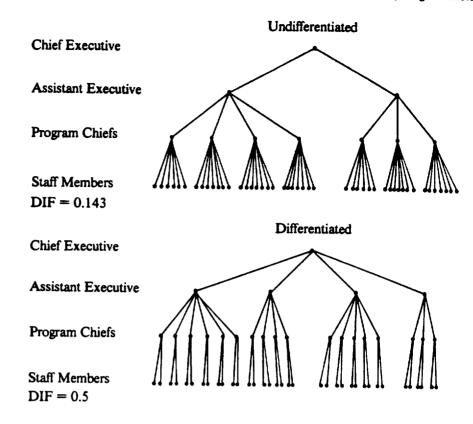


Figure 9.2 Examples of differentiation structures.

For organizations of the same size, a higher level of differentiation leads to a higher executive/staff ratio [DIF]. DIF measures the level of differentiation as the ratio of program chiefs to staff members. A DIF of 0 indicates that the organization is totally undifferentiated, all staff members are under one program chief; and a DIF of 1 indicates that there is complete differentiation, one program chief per staff member. In practice, any ratio over one-third is considered to have a high degree of differentiation. Note, the two structures displayed in Figure 9.2 have a DIF level of 0.14 and 0.5, respectively.

In GARCORG, the differentiation levels are fixed, so the organizations are distinguished as being either differentiated (YES) or undifferentiated (NO). Refer to Appendix A for the exact structures.

AMOUNT OF INFORMATION

During each time period [t], for example, a day or a week, a certain amount of information [AMOUNTINFO] is acquired by the organization on each issue known to be of potential interest to one of the programs in the organization (a potential issue). This information is acquired whether or not

there is a staff member in the organization studying that issue $[ANM_{apl} = 1 \text{ or } 0]$. That is, information comes in on a particular issue, to a particular spot, whether or not there is a staff member in that spot. The exact amount of information that comes into an organization for a particular issue at any given time is dependent on the pattern of flow chosen by the user. Regardless of the pattern of flow chosen, for a particular issue [i], for example, rescuing the students in Grenada, at a particular time [t], say June 1983, there is a particular amount of information that comes in to the organization, such as reports from intelligence operatives, orders, political objectives, availability of equipment and so forth.

In theory, there are many ways in which the amount of information that comes in on a specific issue may vary over time, and there are many different patterns possible for the flow. For example, the amount of information may stay constant over time, increase linearly, increase exponentially or decrease in some fashion. Moreover, it may be sinusoidal or have an even more complex pattern. To simplify matters, in the GARCORG program all issues, are treated as the same type of phenomena; that is, for all issues the information flow in terms of the amount of information has the same pattern over time. However, the exact amount of information that comes in on all issues is not equivalent.

Regardless of the time pattern, each issue starts out with a known amount of information, ANINT. That is, each issue has its own *initial value* for the average amount of information that came in on that issue at time (t = 0). The initial value, the initial amount of information for each issue, is chosen at random from a uniform distribution over the integers 0 to 100. The pattern for amount of information that is chosen will affect the range of the amount of information that is available during later time periods.

In GARCORG, there are four options for information flow available to the user. These options are constant, linearly increasing, exponentially increasing and random. These options allow the user to model the flow of the amount of information in two ways: as a product of a deterministic process (first three options) or as a stochastic process (last option). For a pictorial representation of these choices, see Figure 9.3.

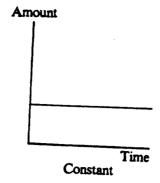
Deterministic Flow One can argue that the flow of information is deterministic, that at a specific time a certain amount of information comes in on a particular issue. All we know about this piece of information is that x amount came in. Under these circumstances, the amount of information that comes in on a specific issue at a particular time can be modeled as

[1] AMOUNTINFO = AINIT + Bt,

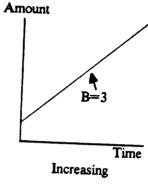
where AINIT is the initial or base rate at which information comes in, and **B** is a fixed degree of change.

When the user chooses the option constant, then $\mathbf{B} = 0$ and $\mathbf{AMOUNTINFO} = \mathbf{AINIT}$. If the option chosen is linear, then $\mathbf{B} = 3$. If the option exponential is chosen, then the amount of information that comes in is calculated as

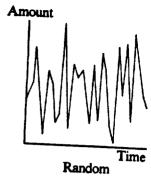
[2] AMOUNTINFO = e^{t} + AINIT



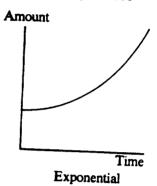
The amount of information for each issue is set to a random number, 1 to 100



The amount of information for each issue is drawn at time (T=0) as a random number, 1 to 100, and increases by 3 each time period



The amount of information for each issue is drawn each time period from a random number, 1 to 100



The amount of information for each issue is drawn at time (T=0) as a random number, 1 to 100, and increases as . (AINIT)

Figure 9.3 Information flow (amount).

Stochastic Flow As previously mentioned, another way to view this flow is as the result of a stochastic process; that is, at a certain time there is a distribution for the amount of information that may come in on a particular issue. At a particular time, the amount of information that does come in on a specific issue looks as though it has been chosen at random from a distribution that has a particular mean and variance. The mean of this distribution is allowed to vary over time. In this way, the amount of information that comes in at a particular time on any issue is stochastically determined. Here, the amount of information that comes in on a specific issue at a particular time can be modeled as

[3] AMOUNTINFO = AINIT + Bt + C(t),

where **AINIT** is the level at which the mean amount of information starts (t = 0), **B** is the rate at which the mean changes over time, and **C** is the 0-mean

distribution from which the amount of information for that particular spot is chosen for the organization.

In GARCORG, **B** is set to 0, and thus the amount of information is chosen from a distribution (**C**) with a constant mean over time (**A**); that is, the mean amount of information that comes in on that issue is constant over time. However, the actual amount of information that comes in on any issue during any particular time period is random. The constant mean (**A**) is set to 50 pieces of information, and the distribution (**C**) is uniform over the integers 0 to 100.

CONTENT OF INFORMATION

Each piece of information that comes into the organization is of some value. We can think of this value as either the degree of reliability of this piece of information or its degree of content or importance. The point here is that content serves to capture the qualitative value-oriented aspect of information, whereas amount serves to capture the quantitative aspect of information. Unlike the amount of information that comes in on any particular issue, the content for any particular issue is always assumed to be stochastic. Like amount of information, there are many ways in which the content of the information may vary with time. Content, for any particular issue, is modeled as a random variable with a known mean and variance. The mean is assumed to be a function of time, whereas the variance is not.

The quantitative/qualitative difference between the amount and the content of information is reflected in the measurement scales used. The amount of information, the number of pieces of information, can range from 0 to infinity, whereas the content of information is treated as a percentage, with numeric values ranging from 0% to 100%. A common view of content is in terms of things like value and reliability, on which bounds from 0% to 100% can be placed. For example, one might think of content in terms of the percentage amount of useful information that a particular piece of information has relative to the "ideal" piece of information. A result of this approach is that in terms of content there are end or limiting effects; for example, one sees in increasing/decreasing the average content of information over time that in the long run $(t = \infty)$, on average, the content of a particular piece of information for a particular issue will become as good or bad as it can be 100% or 0%.

The content of the information can be viewed as the result of a stochastic process; that is, at a certain time, for a particular issue, there is a distribution for the content of information that may come in on any particular piece of information. At a particular time, the content of information that does come in on a specific issue looks as though it has been chosen at random from a distribution that has a particular mean and variance. The mean of this distribution is allowed to vary over time. In this way, the content of information that comes in at a particular time on any issue is stochastically determined. Here, the content of information that comes in on a specific issue at a particular time can be modeled as

[4] CONTENT = CINIT + Bt + C(t),

where CINIT is the level that the mean amount of information starts at (t = 0), **B** is the rate at which the mean changes over time, and **C** is the 0-mean distribution from which the amount of information for that particular spot is chosen for the organization. CINIT + **Bt** is the mean of the content of that information at time **t**.

Regardless of the time pattern, each issue starts out with a known average content of information, CINIT. That is, each issue has its own *initial value* for the average content of information that came in on that issue at time (t=0). The initial value, the initial content of information for each issue, is chosen at random from a uniform distribution over the integers 0 to 100 and scaled to lie between 0 and 1. The pattern for content of information that is chosen will affect the exact range of the content of information that is available during later time periods; however, this range will never lie outside the bounds 0 to 1.

In GARCORG, the user can choose one of three ways in which to vary with time the average content of information for any particular issue: constant (time invariant), increasing, and decreasing. These are represented pictorially in Figure 9.4.

Regardless of the option chosen, C(t) is basically chosen each time period at random from a uniform distribution with a maximum range from -0.25 to +0.25. The exact range is different for each issue and is constant over time. The absolute end point of this range is set at time (t=0) by a random choice from a uniform distribution over 1 to 100, scaled to 0.0025 to 0.25.

If the user chooses the option constant, **B** is set to 0, and the mean content of that information is equal to the initial value

[5] CONTENTMEAN = CINIT.

Whereas, when the option chosen is increasing, B is set to 0.01, and

[6] CONTENTMEAN = CINIT + 0.01 t.

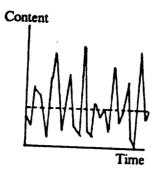
Similarly, when the option chosen is decreasing, $\bf B$ is set to -0.01, and

[7] CONTENTMEAN = CINIT - 0.01 t.

In terms of actual calculation, the following fact was utilized. All the information that arrives on a particular issue is assumed to come from the same distribution in terms of content. Therefore, the distribution of the sum of n samples, the distribution of the total content of information for that issue, has a mean that is also n times the distribution mean and a variance that is also n times as large. This simplifies calculation of content, since to determine the total incoming content we need choose only once from this summed distribution. In essence, the equations previously presented were used with the appropriate scaling by the amount of information.

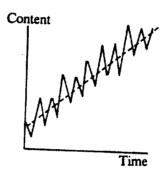
CEO SALIENCY ASSIGNMENT

For a particular issue, CEO salience (**PSALIENCE**) is simply the answer to the question "Does the CEO consider this issue to be salient to this program?" (**PSALIENCE** = 1 if the answer is yes, and **PSALIENCE** = 0 if the



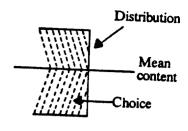
Constant Average

The mean content of information for each issue is drawn at random from a uniform distribution over 1 to 100



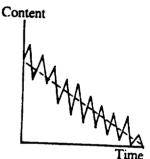
Increasing Mean

The mean content of information for each issue is drawn at time (T=O) at random from a uniform distribution and increases by 0.01 each time period



Content Distribution

The content is set by a random choice from a distribution. The mean is set by the pattern chosen. The range is set at time (T=O) to at most -0.25 to +0.25



Decreasing Mean

The mean content of information for each issue is drawn at time (T=O) at random from a uniform distribution and decreases by 0.01 from each time period

Figure 9.4 Information flow (content).

answer is no.) It is expected that the CEO will change his mind over which issues are salient. However, the mechanism behind this change, or for that matter even the pattern of change, is unclear. This makes it difficult to model saliency. To allow change over time and yet retain some user control, the following scheme was used.

Political saliency is assigned at random each time period. This is done by choosing for each spot an integer chosen at random from the uniform distribution over the integers 0 to 100. Then this number is compared against the saliency level (PSP) provided by the user. If the integer is less than the saliency

level, it is set to 1, otherwise to 0. The result of this comparison determines whether or not that issue is considered salient by the CEO (1 yes, 0 no). This process assures that, on average, the percentage of issues considered salient by the CEO will be equal to the level set by the user (PSP). That is, during each time period the CEO reevaluates the salience of each particular issue to the respective program. Over time the salience of a particular issue this appears as a random sequence of yesses and nos (1s and 0s).

The user sets the level once and it remains fixed throughout the simulation. For example, if the user sets the salience level at 0.7, then each time period 70% of the issues would be considered salient by the CEO, although exactly which 70% are decided at random. By setting the saliency level high, the user makes it less likely that a particular issue is not salient at a particular time. In effect this increases the length of a saliency assignment, whereas by setting a lower level of saliency, the user effectively increases the rapidity with which the CEO changes his mind.

AEO SALIENCY ASSIGNMENT

Salience for the AEOs is assigned in the same manner for the CEO. As the user first sets up the organization using GARCORG, he is asked for the level of AEO saliency (ASP), an integer between 0 and 100. This then sets the percentage of 1s in the AEO saliency matrix, which is redefined each time period.

THE PROGRAM CHIEF ACCESS STRUCTURE

An access structure, as one might expect, simply describes who has access to what information. In this case, we are interested in that information to which the program chiefs have access. The information is the analysis or recommendation made by the staff members who analyze issues that are relevant to the program chief's program. The decision the program chief makes is dependent on which of these analyses he has access to. Access, in this case for the program chief (PCACCESS), is simply the answer to the question "Does the program chief have access to this issue?" (PCACCESS = 1 if the answer is yes, and PCACCESS = 0 if the answer is no.)

An interesting point is that a program chief may not have access to the analyses of all the staff members working under him. For example, one of the staff members might have been told by one of the AEOs to work on project x, but the staff member's immediate superior may not have the right security clearance to look at that staff member's report. Clearly, this would be inefficient. The program chief access structure (PCACCESS) simply defines which program chief in any given division has access to which of the potential issues for that division. Thus, if the personnel transfer criterion, the job assignment criterion, does not take into account the program chief access structure, it is likely that staffs will be transferred in and put to work on issues such that the analyses are inaccessible by the staffs' immediate superior.

In GARCORG, four types of access structures for the program chiefs are available: random, specialized, quasi-specialized, and total. The access structures mentioned are illustrated in Figure 9.5.

A random access structure is one where the issues that a program chief has access to are assigned at random. There is no structural design as to which program chief, or how many of them have access to a given information.

A specialized access structure means that no two program chiefs in the same division have access to the same issue. This corresponds to a matrix of 0s with 1s along the diagonals.

A quasi-specialized access structure allows two program chiefs to have access to some of the same issues, but each program chief has some issues that are peculiar to him.

All program chiefs have access to information on all issues in the total access structure. This corresponds to a matrix of all 1s.

Each AEO is assumed to have access to all the information available to the program chiefs under his direction. Logically, this is the anding of the rows for each column. Only where the program chief access structure is total is it guaranteed that the AEO access structure will be total. Further, under

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Figure 9.5 Examples of program chief access structures.

a random access structure for the program chiefs, it is possible that there will be some issues to which no AEO has access.

PERSONNEL TRANSFERENCE CRITERIA AND CUTOFF

The personnel transference criterion is simply the answer to the question "On what criteria are staff members moved in or out of a particular position in this garbage can hierarchy?" Criteria for transferring staff members in or out of a particular "spot" can be defined separately or jointly, although identical options are available. Obviously there are many reasons why one might transfer staff members: incompetence, lack of money, lack of work, political value and so on. In GARCORG there are three criteria: amount of information available (amount), content of information available (content) and political salience (salience).

Associated with each criterion for transferring personnel is a cutoff level or threshold (TH). Should the value of the criterion for a particular issue be above or below the cutoff level (threshold) for that criterion during a certain number of consecutive time periods (R, the grace period) the staff member is transferred in or out of that spot. Recall that there is at most, at any one time, one particular staff member associated with each issue; that is, each issue defines a particular spot in the organization. Therefore, a staff member's transfer into a spot means that someone will be working on that issue; whereas a staff member's transfer out of a spot means that no one will be working on it. In GARCORG the user is asked to set the length of the grace period [R]. The grace period can be any number of time periods. The three transference criteria result in a total of 9 personnel transfer schemes. With the ability to adjust cutoff levels, and the length of the grace period, they create an environment in which the user can test a variety of managerial schemes.

Criterion Based on Amount When the criterion is amount, a staff member is transferred in or out of a position involving analysis of a particular issue because the amount of information (AMOUNTINFO) arriving over for the last R time periods on that issue is higher or lower than the established threshold (THA). If the user chooses the option amount for transfers, GAR-CORG prompts him for the cutoff level, the threshold. This can be any number between 0 and 100. Since the amount of information generally tends to stay between 0 and 100,6 the most likely value for the amount of incoming information for a particular issue is 50. In this case, if the threshold is set above 50, most of the staff will be transferred out. The project, in other words, would be aborted.

Criteria Based on Content When the criterion is content, then staff members are transferred in or out if the average content of all information arriving on that issue for the last R time periods is higher or lower than the cutoff level, the established threshold (THC) for the content of information. If the user chooses the option content for transfers, then GARCORG prompts the user for the cutoff level for content. This can be any number between 0 and 100. But where

the threshold for amount (THA) is interpreted as the number of units of information, the threshold for content (THC) is treated as a percentage. In this case, if the user specifies a content cutoff level equal to 50%, then staff members are transferred out if the average content of information arriving during each of the R time periods is less than 50%.

Criteria Based on Political Saliency Finally, when the criterion is political saliency, staff members are transferred based on whether or not the CEO, for the last R time periods, considered that issue to be salient to the program for which it was being analyzed. For example, the CEO can assign a staff member who specializes in designing assault forces to a crisis management team if he feels that having an assault force is necessary to the management of the crisis. Here there is no cutoff per se. An issue either is considered to be salient by the CEO or it is not. For example, consider when the grace period is set to 3 ($\mathbf{R} = 3$) and there is a staff member working on an issue that the CEO does not consider to be salient during this time period. If he does not consider it to be salient during the next two time periods, then that staff member will be transferred out, and vice versa for transfers.

SIMULATION ANALYSIS

The GARCORG system can be used to study the relationship between various features of garbage can hierarchies and the levels of efficiencies that these organizations achieve. In this section, GARCORG is used to study the effect of changing various organizational features on the efficiency levels of the organization in the long and short run. The following analysis is not intended to be definitive; rather, it is presented as indicative of the type of analyses that can be done using the GARCORG program. One way to view this section is as an exploration of the causes of efficiency.

Method

In GARCORG, assigning a value to each of the features discussed in the previous section uniquely identifies an organization. In this way, GARCORG can simulate as many organizations as there are combinations of these features. This allows the user to simulate 2,592 organizations without even altering the grace period (R), the AEO's saliency level (ASP) or the CEO saliency level (PSP), let alone the thresholds for personnel transfer (THA and THC).

To study efficiency by focusing on the comparison of changes in structural features and flows versus changes in managerial parameters like the personnel transfer criteria, a limited set of values was assigned to the features (see Table 9.2). This allows the simulation of 36 organizations, whose behavior is averaged for a particular type of organization to produce the "behavior" of one well-behaved organization of that type. Of these 36 organizations, half of them (18 organizations) are small and half are large, half of them are differentiated and half are undifferentiated. All the organizations have a quasi-specialized

PARAMETERS	ORG Features Used in Simulation	is
size	VALUES	NUMBE
differentiation	small large	2
amount of information	yes no	1 5
content of information	constant linear random	3
criteria for transferring in =	constant	1 1
criteria for transferring out	amount content saliency	_
content threshold	25	3
program chief access structure	0.25	1
AEO's saliency level	quasi-specialized	1
EU saliency level	50	1
race period	50	1
otal organizations	3	1

program chief access structure. Further, one-third of the organizations (12) have a constant flow for the amount of incoming information, one-third have an increasing flow, and one-third have a random flow. Finally, the criteria for transferring staff members in and out of a particular spot are set to amount in a third of the organizations, to content in another third and to salience in the final third. In these simulations the criterion for transferring staff members into a spot is the same as that for transferring a staff member out of a spot.

The total number of time periods analyzed for each of the organizations simulated was 20—TIME = 20. If we think of these time periods as months, then what is being simulated is the organization's macrobehavior over a 20month period, a year and three-quarters. All four efficiency measures were calculated for each of the simulated organizations for each of the 20 time periods. GARCORG is designed so that features of the organizations are functionally independent—that is, no feature is a function of another. Thus, the data on each organization can be thought of as independent random samples. Therefore, the data can be combined for all organizations of a particular type,⁷ time period by time period. This allows the calculation of a mean efficiency for a particular type of organization at a particular time, as well as the standard deviation and other statistics. In the following figures, the average behavior of a particular type of organization for a particular measure of efficiency is presented versus the average behavior of another type of

The statistical test to compare the effect of organizational type for a particular category of efficiency is simply the difference-of-means test (Beals, 1972). This is a two-tailed test. The significance level was set at 0.05. The null hypothesis, H_o, is that the difference between the two means is zero (0). In other words, if the two means are significantly different, we can be 95% confident in saying that the organizational type with the higher mean promotes more efficiency in a garbage can hierarchy than does the type with the lower mean, ceteris paribus.

In the following figures, each line represents the average value for that measure of efficiency of all organizations with that particular feature value. For example, in Figure 9.6, the top line is the average level of structural efficiency at the program chief level for all the small organizations simulated.

The data gathered allow comparisons over the effects of size, differentiation, amount flow and personnel transfer criteria. The effect of each of these features will be considered separately, and in some cases in pairs. For the organizations examined, structural efficiency at the AEO's level (E2) tended to behave as did structural efficiency at the program chief level (E1), as AEO's access is defined in terms of program chief access. Due to the way efficiency is measured, the organization will be inefficient at the AEO's level in the case it is inefficient at the program chief level. In the following simulations, that political efficiency at the AEO's level (E3) also tended to behave like political efficiency at the CEO level (E4). This is an artifact arising because the level of AEO saliency was set equal to the CEO saliency level. Due to these considerations, in the following subsections only the data on the measures E1 and E4 will be presented.

Efficiency Due to Size—Questionable

In Figure 9.6, the effect of size on organizational efficiency is presented. Note, small organizations are both structurally (E1) and politically (E4) more efficient than are large organizations. This difference can be explained by the bad spot syndrome. Because the measures of efficiency are based solely on the number of bad spots that are filled by staff members—positions for staff members where the issue worked on is either inaccessible by their superior or not salient to the superior—the more bad spots there are, the more inefficient the organization. This is the effect referred to as the bad spot syndrome.

Larger organizations have more spots, more positions available for staff members, than do small organizations; hence, all else being the same, large organizations have a greater potential for bad spots than do small organizations. Thus, at least in the short run, large organization will be much less efficient than small organizations, both politically and structurally. Referring to Figure 9.6, we see that this is, in fact, the case.

The bad spot syndrome should be mitigated by time. Basically, because small organizations have fewer spots, and hence fewer bad spots, they also have a greater likelihood of having staff members assigned to any particular spot, including the bad spots. This is especially true if the personnel transfer criterion does not take the value of the spot into account?—that is, if staff members are allowed to be transferred into bad spots, then over time the effect of size will be diminished. Thus, in the long run, there should be less difference between large and small organizations. The data in Figure 9.6 support this argument; although the efficiency levels for small and large organizations start out being significantly different, they rapidly converge.

Recall that none of the personnel transfer criteria take the program chiefs' access structure into account. Thus, as more staff members are transferred about, there is an increasing potential that the issues they are analyzing are not

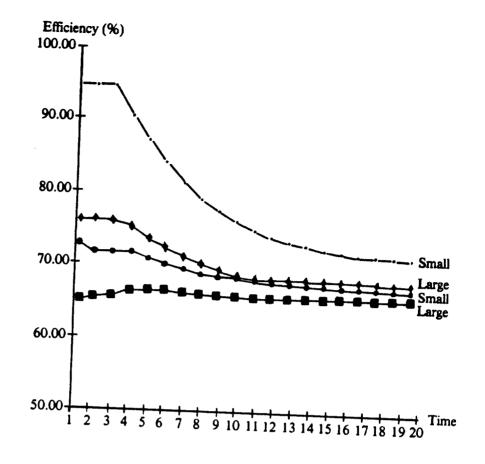


Figure 9.6 Efficiency by size.

Changes in efficiency levels over time as the size of the organization changes. Difference in means for structural efficiency is significant at the 0.05 level for only the first 8 time periods, and only for the first time period for political efficiency. Number of Organizations = 18 of each size. Structural efficiency (E1), small; structural efficiency (E1), large; political efficiency, (E4), small; political efficiency (E4), large.

those to which the program chief over them has access; therefore they are in a bad spot. Thus, one expects the level of structural efficiency to drop, as it in fact does.

The bad spot syndrome will also be mitigated by scaling. That is, to the extent that the ratios of executives to accessible issues in the case of structural efficiency, and executives to salient issues in the case of political efficiency, remain constant across size, the size of the organization will have little effect on overall efficiency. (In the organizations studied, the level of accessibility was

not held constant across size, but the level of political saliency was. Thus, we would expect a greater difference in the level of structural efficiency by size than we would in the level of political efficiency. As was expected, the difference in size is negligible with respect to the political efficiency measure (E4) during all but the first time period.)

This analysis suggests that in the short run small organizations will be more efficient than large organizations, especially structurally. However, in the long run size does not appear to have a significant effect on organizational efficiency.

Differentiated Organizations Are Most Efficient

Differentiated organizations tend to be more efficient than undifferentiated ones, both structurally (E1) and politically (E4), as shown by Figure 9.7. Note that undifferentiated organizations relative to differentiated organizations of the same size have more staff members. Hence, they have a higher likelihood of having staff members working on issues to which their superiors do not have access or which are not considered salient.

If the personnel transfer criterion does not maintain the ratio of executives to staff members (DIF), then over time the effect of differentiation should be mitigated. As the ratio of managers to staff members increases, as the organization becomes more differentiated, more potential locations for staff members open up; hence, the number of potentially bad spots both politically and structurally increases. Further, the more differentiated the organization, the more potential spots there are, and, for the same size organization, the fewer staff members. While this leads to efficiency in the short run, in the long run it means that there are more openings for staff members. Given a personnel transfer policy such that staff members are more likely to be moved in than out (as was the case for two-thirds of these simulations) the more likely it is both that staff size will increase and also that the net effect will be a decrease in the overall level of efficiency. For undifferentiated organizations, the situation starts out worse, with more staff members and fewer potential spots because of the low number of available positions, however, there are relatively few positions for new staff members, the size of the staff cannot increase as much, and therefore the efficiency level will remain unchanged or might even improve.

Structurally, this trend is exacerbated by the fact that there are fewer executives in undifferentiated organizations than in differentiated organizations, each executive has more responsibility, and has access to a wider range of issues. Thus, vis-à-vis the available positions, there are relatively fewer potentially bad spots. Note that, in the simulation results in Figure 9.7, by the 19th time period, differentiation no longer has a significant effect on the structural efficiency level. However, in terms of political efficiency, although both differentiated and undifferentiated organizations are becoming similar by time 20, it is still the case that differentiated organizations are significantly more politically efficient.

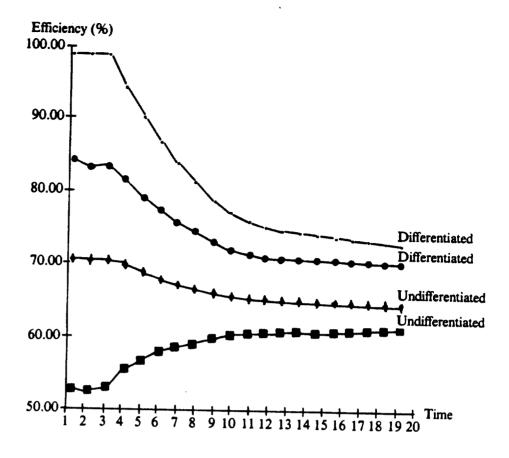


Figure 9.7 Efficiency by differentiation. Changes in efficiency levels over time as the differentiation of the organization changes. Differences in means are significant at the 0.05 level during all but the last two time periods for structural efficiency and for all time periods for political efficiency. Number of Organizations = 18 of each type. Structural efficiency (E1), differentiated; structural efficiency (E1), undifferentiated; political efficiency (E4), undifferentiated.

Information Format Has Little Effect on Efficiency

Changes in the pattern of the amount of incoming information appear to have little or no effect on either structural (E1) or political (E4) efficiency (see Figure 9.8). Admittedly, as the pattern for the amount of incoming information shifts from constant to random to increasing, the organizations become less efficient, both structurally (E1) and politically (E4). While these differences increase over time, at no time are they statistically significant.

When the amount of incoming information increases linearly over time, then if the criterion for personnel transfer has anything to do with information,

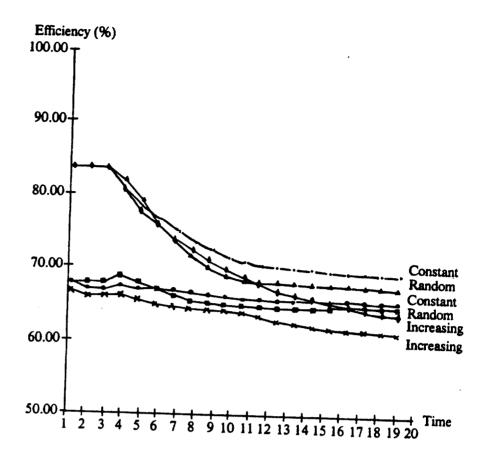


Figure 9.8 Efficiency by amount of information. Changes in efficiency levels over time as the amount of information that comes into the organization changes. Differences in means for each of the efficiency measures are not significant at the 0.05 level for any time period. Number of organizations = 12 for each amount type. Structural efficiency (E1), constant amount; structural efficiency (E1); increasing amount; political efficiency (E4); constant amount; political efficiency (E4), random amount.

more staff members will be transferred in than out. ¹⁰ The larger the number of staff members, the greater the potential for transfer into bad spots, to work on issues that are not salient to the CEO or accessible to the program chief. This would be why, given a flow of information with the amount increasing linearly over time, the organization would be less efficient. This suggests that an exponential distribution for the amount of incoming information over time would have led to even more inefficiency.

Multiple Managerial Solutions

The personnel transfer criterion utilized has a dramatic effect on the efficiency of the organization both structurally (E1) and politically (E4). As can be seen in Figure 9.9, although all the organizations tend to start out with similar levels of efficiency, they quickly disperse according to the personnel transfer scheme chosen. For the organizations simulated, this meant that those organizations where the criterion was content were the most efficient, those where the personnel transfer criterion was saliency were second, and those where the criterion was amount were the least efficient.

The important point here is not that a particular personnel transfer criterion produces a more efficient organization but that the personnel transfer criterion used has a greater effect on organizational efficiency than either the structural features—size and differentiation—or the problematic flows—amount and content of information. This means that the efficiency of the organization can be tuned by the manager by altering the way in which the staff members are transferred and that such changes will be not only easier to implement but more effective than making changes in the organization per se. Another point is that such changes will quickly alter the organization's efficiency. For example, in Figure 9.9, in roughly two full personnel transfer cycles (2R) the organizations are fairly close to their final values.

As to the exact simulated results, the high efficiency levels of organizations where the personnel transfer is based on content results from the fact that the threshold is set so high (THC = 1) that eventually all the staff members will be fired. The organizations will be efficient only because with no one working, no one can be working on an issue to which his superior does not have access or does not consider salient. Organizations with a personnel transfer criterion based on saliency are next in terms of efficiency because the particular level of saliency chosen resulted in a higher level of transfers off the staff than did the personnel transfer criteria based on amount. An interesting future study would be one where the criteria were set such that the level of transfers in or out were equivalent regardless of criteria; that is, H and F are constant across criteria. In a sense, the ČEO can only get involved in an arbitrary fashion, as his involvement is based on how salient he believes an issue to be, and this salience is time variant. The question is whether intervention in this arbitrary fashion is worse than no intervention or intervention in a controlled fashion (e.g., based on content or amount). The study proposed above would allow this question to be tested.

Another important point is that having a criterion for personnel transfer that takes into account the value of the spot does not guarantee efficiency. (In the cases where the personnel transfer criterion was based on saliency, the organizations were still not very efficient politically. The manager could do better by choosing another personnel transfer scheme.)

Value of Results

The simulated results tend to approach asymptotically the expected values calculated in Chapter 8 for the respective measures of efficiency. Therefore,

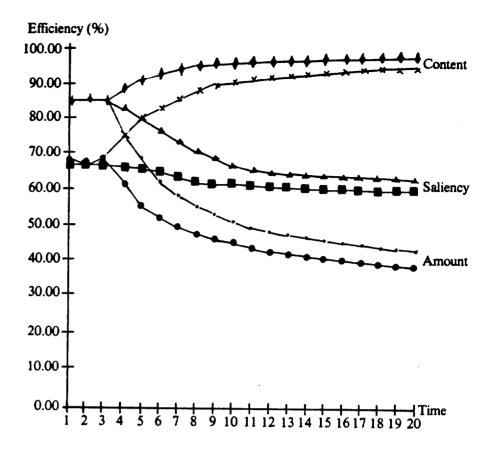


Figure 9.9 Efficiency by transfer criteria. Change in efficiency levels over time as the personnel transfer mechanism used by the organization is altered. Differences in means for both types of efficiency are significant at the 0.05 level after the third or fourth time period. Number of organizations = 12 of each type. Structural efficiency (E1), hiring/firing based on amount of information; structural efficiency (E1), hiring/firing based on saliency to CEO; political efficiency (E4), hiring/firing based on content of information; political efficiency (E4), hiring/firing based on content of information; political efficiency (E4), hiring/firing based on saliency to CEO.

the simulation model can be used to predict organizational behavior accurately in both the long and short run. As to the robustness of the results, it should be noted that multiple simulations of the same organization do produce slightly different empirical results, although they have the same quantitative behavior.

For example, in Figure 9.10 the same organization has been simulated six times, and its behavior in terms of political efficiency at the CEO level (E4) is plotted. In Figure 9.11 the structural efficiency levels (E1) for that organization

are plotted. The organization simulated was a small, undifferentiated organization where the amount of incoming information and average content of that information are constant over time. Further, the organization has a quasi-specialized program chief access structure, schemes based on amount for transferring in and out, the CEO saliency level and AEO's saliency level set to 50, the threshold to 25 and the delay period to 3.

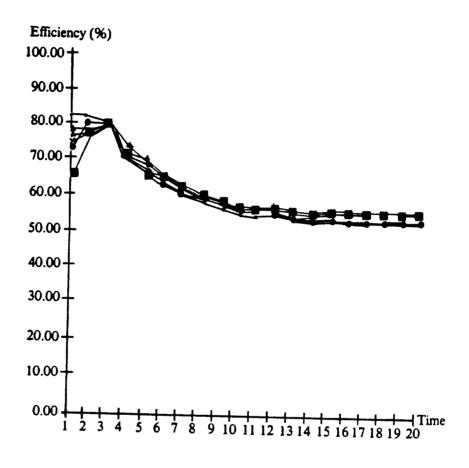


Figure 9.10 Example of political efficiency range. Changes in political efficiency at the CEO level over time for the same organization. This shows the deviation in efficiency that can occur for a small, undifferentiated organization where the amount of incoming information and the content is constant over time. The hiring/firing scheme is based on the amount of information. Six simulations are shown.

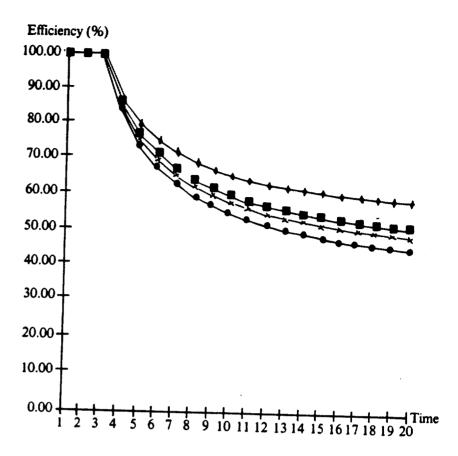


Figure 9.11 Example of structural efficiency range. Changes in structural efficiency at the program chief level over time for the same organization as in Figure 9.10. This shows the deviation in efficiency that can occur for a small, undifferentiated organization where the amount of incoming information and the content is constant over time. The hiring/firing scheme is based on the amount of information. Six simulations are shown.

Note, for political efficiency the simulated runs begin much more dispersed than they finish, moving from a 17.3-point spread to a 3-point spread. For structural efficiency, the simulations start out identical and then disperse to a 12.39-point spread. Referring back to some of the earlier figures, the reader will see that the average difference in types of organizations was often smaller than these spreads.

In the current study, the organizational behavior looked at was an average over a large number of different organizations. It is not clear that this averaged behavior is a true indicator of organizational behavior. As the above figures

indicate, the degree of difference among organizations with the same characteristics is small. However, it is still within the same range as the differences in behavior for particular types of organizations. Thus, a more thorough analysis would be one in which the effect of organizational type on efficiency level is checked against differences in efficiency level for the same organization. For example, an ANOVA could be performed to see if the deviations among simulations of the same organization are greater or lesser than deviations across types of organizations.

Short-Run versus Long-Run Efficiency

In terms of the time trends, organizations asymptotically approach equilibrium. For that matter, the equilibrium they approach is the analytically predicted value. Exactly when equilibrium is reached is dependent on the type of organization. For the organizations simulated, most have basically reached equilibrium by 20 time periods.

Short-run behavior tends to be somewhat different than long-run behavior. For example, organizations where the amount of incoming information is random or increasing are slightly more efficient in the short run but less efficient in the long run than organizations where the incoming information is constant. Undifferentiated organizations tend to become more efficient over time, especially politically. This is probably due to the transferring out of excess staff members. If the personnel transfer criterion is based on amount, then those organizations where the amount of arriving information is random are the most efficient in the short run.

The smaller the organization, the more efficient it is in the short run. However, in the long run size basically does not alter the level of efficiency achieved. Similarly, differentiated structures tend to be more efficient in the short run; but over time the behaviors converge. This suggests that to make long-term changes in efficiency levels, structural alterations are not necessary. Rather, they will only lead to short-term changes in efficiency. The problematic data flows that characterize garbage can anarchies are like the structure in which they are embedded, ineffective in terms of altering efficiency levels.

CONCLUSIONS

There are several general policy considerations that can be drawn from this analysis. First, if one is setting up an organization where the technology will be unclear (i.e., a garbage can hierarchy) then the preferred structure for minimizing overall inefficiency is a small, highly differentiated organization where the program chiefs' access structure is quasi-specialized. Moreover, the number "overlaps" in the access structure should be as high as other cost considerations allow, so as to minimize structural inefficiency relative to program chief access.

Second, if the organization is faced with problematic data flows, it will not necessarily be inefficient. If the data flows are extreme—for example, incredi-

bly high rates of information or extremely low density or reliability—the flows, in the long run, will affect the organization's efficiency levels if the criterion for transferring personnel takes these flows into account. The simulations suggest that, regardless of the flow, the manager should be able to increase overall efficiency without altering the data flows per se.

Given an existing organization, it should be possible to increase overall efficiency by changing the criterion on which the staff members are transferred, or even just the threshold used in making the changeover decision. Which scheme for transfers in and out is best for which organization, and whether or not such schemes should be mixed, is a point for further research. In the meantime, however, it should be noted that a personnel transfer scheme based on political saliency does not guarantee high levels of efficiency in terms of saliency.

Further, if the data flows are stochastic, altering the delay period can have a major effect on the efficiency levels. To begin with, the length of time that it takes to reach equilibrium is, to an extent, a function of the delay period (R). The longer the delay, the longer it will take to reach equilibrium. However, the actual effect of R is dependent on the probability of being greater than, less than or equal to the threshold for personnel transfer. Thus, the actual effect of R is, in part, dependent on the level at which the threshold is set. The threshold levels can be set as high or as low as one desires in order to achieve the desired level of efficiency. An interesting future study would be a comparison study of the effects of changing the criterion threshold versus changing the delay period.

As a final note, both the structural and the political measures of efficiency were based on "bad spots," on knowing the number of staff members working on issues to which their superiors did not have access or did not consider salient. These particular measures of efficiency have the disadvantage that organizations with no staff members are perfectly efficient, as are organizations with staff members only in the "good spots." Another notion of inefficiency would be based on knowing the number of "good" spots in which there were no staff members. It would be interesting to check the personnel transfer criteria against each other in terms of these two, in a sense, competing measures of efficiency. An important point to remember is that different personnel transfer criteria may increase or decrease different types of organizational efficiency. Thus, the way in which one defines efficiency becomes a critical factor.

Implications for Crisis Management

The movement from a general peacetime situation to a crisis situation provokes many changes in the environment that the navy, as an organization, must deal with. Let us assume that, from an organizational standpoint, the goal of the navy is to establish and maintain an organization that can deal with crises and yet maintain a global ready state during peacetime. We can view general peacetime activity and the state of being ready for World War III as being the long-run behavior of the military organization. Crisis management can be

viewed as the short-run behavior, due to the explosive nature and short time frame of crises. Thus, the dual objective of crisis management and global readiness can be met if we can create an organization that exhibits high levels of short-run efficiency without dramatically lowering its long-run efficiency levels.

As noted earlier, one of the parameters of naval decision making is the presence of volatile information flows; for example as a situation reaches crisis proportions, the information flow will change its characteristics, going perhaps from a flow that is constant or linear in both content and amount of information to a flow with perhaps very ambiguous content and extremely high amounts of information. Another parameter, unreliable information, is also exacerbated during a crisis. The information may not actually be more unreliable, but there is certainly less time to check it out, and it is therefore effectively viewed as more unreliable. Further, during a crisis situation personnel are transferred, joint task forces are established, and so forth. Thus, the personnel flows parameter becomes increasingly volatile. The technology of decision making becomes increasingly unclear. During crises, saliencies appear to shift radically. This may just be due to differences in the perceived political objective and the actual political objective, or it may be due to real changes in objectives. In either case, the point remains that saliences may be unstable during a crisis. Finally, the short time frame of a crisis often makes retraining and equipment testing unfeasible, thus increasing the impact of rapidly changing technology. Taken together, these parameter changes suggest that the movement from a peacetime situation to a crisis situation is one that thrusts the military organization from acting in a standard organizational arena to acting in a garbage can arena. From an organizational standpoint, to effectively deal with crises we want to structure the organization such that it can rapidly move from a peacetime configuration to a crisis management configuration, and the configuration chosen for crisis management should exhibit high levels of short-term efficiency regardless of what its long-term efficiency profile looks like. Assuming reconfiguration is impossible, then we want to utilize that organizational structure that is highly efficient in the long run for very steady flows, and yet highly efficient in the short run for extremely altered information flows.

In the long run, size makes little difference on efficiency; however, in the short run small organizations are more efficient than large organizations. Differentiated organizations are more efficient in the short run, and might be a little more efficient in the long run. A possible reason here is that in a highly differentiated organization the chain of responsibility has been established such that most problems are dealt with at the lowest possible level, thus reducing the number of problems that the CEO and AEOs have to deal with. Thus, if an organization is to deal with crises efficiently, it should be structured as a small, highly differentiated organization.

Recall that the impact of the information flow on organizational efficiency could be moderated by the personnel transfer criteria. While the results presented herein are only exploratory, they do suggest that if the CEO is given control over transfers, if he is allowed to adjust his staff as he sees fit, if the task

force or the navy as a whole is not locked into a particular method for moving personnel, then high efficiency levels can be maintained by simply altering the criteria for transference as the characteristics of the information flows change. This does not mean that the transference criteria should be based on saliency, how important a particular issue is to the CEO; recall from Figure 9.9 that CEO saliency does not guarantee efficiency. Rather, the point is that by promoting management flexibility by, for example, allowing the CEO to switch the criteria for transferring from one based on content of information to one based on amount of information, the navy creates an organizational structure that has the flexibility to deal efficiently with crises.

To summarize, to create an organization that is capable of dealing efficiently with crises without impairing its long-run capabilities, the navy should be structured as a flexible organization where it is possible to establish task forces rapidly. To maintain long-run efficiency, the peacetime organization should be structured as a highly differentiated unit. The task forces should be structured as small, highly differentiated units, with maximum flexibility for the CEO. The CEO should be given complete control over personnel transfers.

It is provocative to note that this is essentially the organizational structure of the joint task force that Admiral Metcalf commanded in Grenada. There are many reasons for the success of his mission, among which I would suggest is the fact that he, as CEO, had a great deal of flexibility over personnel and commandeered an organizational structure with a high short-run efficiency portfolio. Other reasons for his success seem to include an equivalence of perceived and actual political objectives, the movement of responsibility and authority to the lowest reasonable level (the decisions of "on the spot" commanders were backed up), the establishment of strong lines of communication and personal leadership. While the current GARCORG program does not have the flexibility or power to model these last two items, it can be used to model the first two. That is, the equivalence of perceived and actual political objectives can be roughly modeled as having a constant saliency matrix. Similarly, the movement of responsibility and authority to lower levels can be modeled as high levels of "rubber stamping." Hence, GARCORG could be used to model the impact of these parameters on the crisis management behavior, on the short-run efficiency of the organization.

NOTES

- 1. This can be thought of either as personnel transfers or as the actual hiring or firing of individuals.
- 2. For a more detailed description, the reader is referred to either the GARCORG program or the paper by John Padgett (1980).
- 3. For more details on the actual formalization, see Chapter 8.
- 4. Only the *linear* and *exponential* options allow the amount of information per issue per time period to exceed 100.
- 5. The grace or delay period allows the user to eliminate minor fluctuations. Note, the effect of \mathbf{R} , the delay or grace period, on organized efficiency is analyzed in Chapter 8.

- 6. This would not be true if one is using either of the *increasing* options, in which case, eventually, a staff member would be transferred into every spot.
- 7. A particular type of organization has the same value for one feature regardless of the values used for the other features. For example, all small organizations are of one type.
- 8. No tests were done to estimate whether or not some average type of organizational efficiency was different from zero, because all efficiency measures were constrained to lie between zero and one. Statistical tests on means tend to require that the distribution of the means is normal at least in the limit. For the case in hand, the central limit theorem does not apply due to the boundary conditions. Thus, the test used for differences in means cannot be considered conclusive (see Beals, 1972).
- 9. In two-thirds of the organizations simulated, the personnel transfer criterion did not take spot into account.
- 10. As the amount of information increases, then even if the average content is low per piece of information, the total incoming content will be higher. Therefore, whether the personnel transfer criterion is based on amount or content, staff size will increase. Now, if the mean of the content of the information is also increasing, even more staff members will be transferred in, whereas if the mean of the content is decreasing, then fewer staff members will be transferred in.

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APPENDIX A ORGANIZATIONAL STRUCTURES USED IN GARCORG

Structure 1-Small, Undifferentiated

 CEO
 1

 AEOs
 2

 Program Chiefs
 2
 2

 Staff
 4
 6
 6
 5

Program Chiefs

Staff

Structure 2-Medium, Undifferentiated CEO 1 **AEOs** 2 Program Chiefs 3 Staff 6778 678 Structure 3-Large, Undifferentiated CEO 1 **AEOs** 3 Program Chiefs 3 Staff 8968 8 7 8 8 10 7 6 Structure 4-Small, Differentiated CEO 1 **AEOs** 3 Program Chiefs 2 3 2 Staff 2 3 3 3 2 2 2 Structure 5-Medium, Differentiated CEO 1 **AEOs**

6

5

3

Structure 6-Large, Differentiated

СЕО

AEOs

APPENDIX B EXAMPLE SESSION WITH GARCORG

GARCORG

What is the size of the organization

The options are > small, medium, or large

Small

Is the organization differentiated, yes or no

Yes

Amount of information

The options are > constant, linear, exponential, and random.

Constant

Content of information

The options are > constant, increasing, and decreasing,

Constant

What is the hiring mechanism dependent on

The options are > amount, content, and salience.

Salience

What is the firing mechanism dependent on

The options are > amount, content, and salience.

Salience

Program chief access structure

The options are > total, specialized, quasi-specialized, and random.

Specialized

What percentage of the issues are salient to the assistant executive officer, 0 to 100

L>

30

What percentage of the issues are salient to the chief executive, 0 to 100

L>

60

How long is the grace period for hiring and firing

L>

3

Do you want just final results (y) or a time plot (n)?

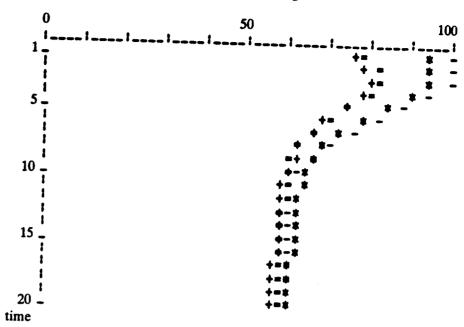
n

How many time periods do you want to run for

L>

20

efficiency — percentage



The organization's features are

size	small	26
differentiated	yes	
amount of information over time	constant	
average content of information over time	constant	
hiring mechanism is dependent on	salience	
firing mechanism is dependent on		
program chief access structure		
issues salient to CEO (percent)	•	
issues salient to AEO (percent)	30.00	
cutoff levels	tha .00 thc	.00
hiring/firing grace period		
run length is	20	
****** the results *******		• • • • • •
long-run average amount of information/issue		
long-run average content of information/issue	.19	
percentage perce rubber stamped by AEO over time	42.86	
percentage AEOrec rubber stamped by CEO over time	.00	
long-run analytic bias> efficiency	.00 var	.00
structural efficiency> program chief's access	59.91	
structural efficiency> AEO access	58.13	
political efficiency> AEO salience	56.52	
political efficiency> CEO salience		
***************************************		***end

Chap. 9



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Decision Research

with the collaboration of Pauline Ryan

Ambiguity and Command

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