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DETERMINANTS OF THE EFFECTIVENESS OF SITUATION ESTIMATION

by

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Determinants of the Effectiveness of Situation Estimation

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ABSTRACT

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I. INTRODUCTION

A. OVERVIEW

Success in military operations depends on many factors, including the ability to respond appropriately in a given situation. Determining an effective response is a result of analyzing the situation and deciding on an appropriate course of action. The procedure developed by the United States Army for this purpose is the estimate of the situation.

A difficulty in situation estimation is understanding the state of all variables in the environment. Uncertainty in warfare is the norm. As stated by Clausewitz, the renowned 19th-century military philosopher,

> ...the great uncertainty of all data in War is a peculiar difficulty, because all action must, to a certain extent, be planned in a mere twilight, which in addition not unfrequently—like the effect of a fog or moonshine—gives to things exaggerated dimensions and an unnatural appearance. [Ref. 1: p. 189]

Uncertainty is a major consideration when designing and evaluating organizations. Effective organizations develop methods to reduce the uncertainty which exists in a given situation. The estimate of the situation is one decision-making strategy which enables decision making to occur when uncertainty exists.

The estimate of the situation process is a time-consuming planning method which can be used by military staffs. The time available for an operation may not permit a complete estimate. Additionally, in cases where the situation is very certain, the estimate process may not be needed. Staffs can use simpler, less time-consuming processes. The

appropriate decision-making process depends on the situation which the staff faces.

Many variables occur in a situation which causes uncertainty. An analysis of the situational factors can help determine the amount of information processing required to reduce uncertainty. Once these requirements are understood, the organization can design its processing capabilities to match the needs.

The situational variables should be considered when evaluating a staff involved in situation estimation. Two similar organizations operating with different amounts of uncertainty and available preparation time should not necessarily operate the same way. An evaluation of the staffs could consider the situational factors in order to provide the most accurate assessment of each staff's decision-making ability.

Different levels of decision making exist in an organization. Individuals make decisions. Groups or staffs are composed of individuals who collectively make decisions. Organizations or units are composed of groups which interact with each other and their environment while making decisions. All levels of decision making contribute to the effectiveness of an unit.

B. SCOPE

The first portion of this thesis provides background on decision making and the different levels of decision making in an organization. Chapter II explains the current problems which exist with the estimate of the situation and introduces the concepts of military decision making. The role of the individual as a decision maker is discussed in Chapter III.

In Chapter IV, groups are defined and the ways groups can organize to make decisions are considered. Chapter V describes organizational concerns and how uncertainty affects the whole structure of an organization. A model for information processing in an organization is also presented in Chapter V.

The remaining chapters incorporate the concepts discussed in the first five chapters into the model for information processing and evaluation presented in Chapter V. In Chapter VI, the model is applied to understanding a situation in a military context. Situational factors are shown to require certain organizational structures and decision-making methods to allow a staff to effectively make decisions. Chapter VII presents a technique to use when evaluating staff processes. The importance of incorporating situational factors in an evaluation is discussed. Chapter VIII provides a summary and concluding remarks.

II. NATURE OF THE PROBLEM

A. MISMATCH BETWEEN DOCTRINE AND EXECUTION

The estimate of the situation is the procedure used by the Army to analyze a problem and to develop a solution to the problem. One would expect that schools would teach what is to be used. Army doctrine states explicitly how the estimate is to be done, but actual practice shows units ignoring or making incomplete estimates. [Ref. 2:p. 3]

The basic concept of the estimate is to consider the facts about the current situation and make recommendations on courses of action to be taken. Several courses of action are to be developed and the attributes and shortcomings of each are to be specified. The procedure is taught at various levels in the Army education system, and all officers and many senior noncommissioned officers learn it as the method for staff planning.

Studies have shown that in exercises, staffs do not follow the prescribed doctrinal format. Usually, only one course of action is developed. Often, when more options are considered, the first option is heavily weighted and the others are only used to meet the requirement to have more courses of action. Observations from the Battle Command Training Program (BCTP) show this [Ref. 2:p. 3]. BCTP is a program to train division and corps staffs in command post exercises driven by computer simulations.

To understand the process a commander and staff must execute, a model is useful. Several models of a decision process exist. For the purposes of this study, two different military decision-making models are discussed: the command decision process and the military decision-making procedure.

B. COMMAND DECISION PROCESS

The command decision process is a model of the sequence of events followed by a commander in confronting a decision. This model is used as a method to list the steps a Naval Battle Group Commander uses to react to a situation [Ref. 3:p. 42]. The process is also useful in discussing what a commander in the Army does. Levels from company command through Army command must follow the steps in varying degrees of depth.

1. Recognition

Recognition of an event which requires action is the initiating step in a decision process. The recognition may come from direct observation of an environmental stimulus, such as an enemy's action. Alternatively, the impetus may come from a higher headquarters' directive. Regardless of the source, the decision process is started by the recognition that some action must be taken.

2. Command Determination

Once an event requiring action is recognized, the person who must act is designated and notified. The commander may decide the action requires response from certain of his subordinates. The

subordinate is advised to be prepared to respond—the advice possibly received as a warning order.

The appropriate response and subordinate may be determined by standard operating procedures (SOP). Even if dictated by SOP, this step warrants careful consideration because no situation will be anticipated completely.

3. Definition

After notifying the responsible commander, the decision maker must further define the situation by clarifying and developing the course of action. The clarification may be as simple as determining that the unit must execute preplanned orders. Alternatively, a full-fledged operation order may have to be developed, to include developing several possible courses of action.

4. Decision and Authorization

With several courses of action to pursue, the decision maker will decide which to use and will authorize the appropriate action to subordinates. The courses of action will define the options available. The commander may decide not to take any action or may take one of the given options. If the commander has the proper authority, he will authorize the chosen option and the process will proceed. If he does not have the authority, the commander will request approval while simultaneously proceeding.

5. Preparation

Once the general course of action is defined, the appropriate functional areas can plan accordingly. The commander's staff acts as a

decision aid to the commander in planning the mission. The various staff officers in their various functional areas will plan for the approved course of action. If a preplanned order is executed, this step may already have been completed. If previously completed, the staff will review the planning to ensure that no changes are necessary.

6. Command

With preparation complete, subordinate units are notified regarding their responsibility. The command step includes the notification of the units involved. The subordinate unit may have to execute its own iteration of the Recognition through Preparation steps.

7. Conduct and Direction

After the various iterations of the action selection process are conducted, the persons who conduct the action direct the appropriate responses. As the action occurs, the information obtained is fed back to the appropriate command level. If all parts of the plan are executed as directed, the objective is obtained. If not, the command will begin the command decision process again and decide whether another course of action is appropriate. The process will continue until all parts are successfully completed.

C. MILITARY DECISION-MAKING PROCESS

Other models of decision making include the military decision-making process [Ref. 4:p. 5-6] and troop-leading procedures [Ref. 5:pp. 2-6 through 2-15]. The troop-leading procedures incorporate the military decision-making process as part of the decision sequence. The actions associated with the troop-leading procedures are directly applicable at

battalion level and below, whereas the military decision-making process applies to any level with a staff. For the purposes of this work, the military decision-making process is most applicable.

1. Mission Received

The mission is either assigned by a higher headquarters or is determined by the decision maker. This step initiates the process. With a mission, the unit must take action to accomplish it and begins planning.

2. Information to Commander/Staff

The commander/decision maker and his staff receive all pertinent information on the mission. Information about the mission is obtained from the higher headquarters plan. Other information is obtained about the situation from intelligence sources and friendly unit data.

3. Mission Analysis

The mission analysis is the process used to develop an understanding of the mission. The mission is determined from higher headquarters' directives and the commander gives his restated version of the mission. The staff aids the commander in ascertaining the tasks that must be performed. The most important task is obtaining an understanding of the purpose to be achieved through completing the assigned tasks. The staff must also help in deciding any constraints on the unit.

4. Staff Estimates

With the commander's planning guidance, the staff members works in their functional areas to develop estimates of the situation. The staff works as a decision aid for the commander, recommending courses

of action and listing the advantages and disadvantages of each. Each of the staff members must coordinate his functional area with that of the others.

5. Commander's Estimate

After receiving the staff estimates, the commander gives his estimate, which results in a decision and the commander's concept. During this step, the commander analyzes the courses of action previously determined by the staff. Based on his personal experience and the staff input, the commander will either choose one of the staff's courses of action, choose a course and modify it, or use a new course. The commander completes this step by deciding on a course of action and giving his concept.

6. Preparation of Plans/Orders

Once the commander has stated his concept of the operation, the staff members again work in their functional areas to produce a plan to execute the mission. The commander's concept should have given enough information so that the staff can complete its part of the plan without further guidance. Plans are written to ensure that staff and subordinates understand the mission. Fragmentary orders may be issued later to modify orders as the situation changes.

7. Approval of Plans/Orders

The completed plans are reviewed by the commander. If the staff has understood the commander concept correctly and the situation has not changed, the commander will approve the plan. If there are no changes, the plan is disseminated.

8. Issuance of Plans/Orders

The appropriate units are issued the plan. The commander may have a formal briefing, with each staff officer briefing on his part of the plan. Alternately, the commander may issue written orders and distribute the orders to the units. The commander may also choose to use a combination of the methods.

9. Supervision

After the proper orders are issued, the mission is executed and the role of the commander is to supervise. In supervising, changes to the plan may be determined. This feedback may drive a whole new planning process. The decision-making process may recycle several times. The changes may require only small modifications to the plan, distributed in an fragmentary order. Supervision of the execution is continued until the mission is accomplished.

10. Mission Accomplishment

The final step indicates the accomplishment of the mission. If all the tasks in the mission are accomplished, the process is completed. If not, or if the situation has changed, the process is repeated.

Two questions arise in discussing situational estimation. The first question is: What information does the commander need to evaluate a situation? How the information is obtained is also a concern. The second question stems from the requirement to have multiple options. The value of multiple options in obtaining a better decision is widely accepted, but the basis for using the multiple options needs investigation.

D. INFORMATION

1. Information Categories

Information is essential for a decision maker. This information may be divided into categories. While many different categories are possible, for this work the categories will be as follows: [Ref. 3:pp. 53-55]

- Tactical Data– specific information about the status of units (both friendly and enemy), to include strength, location, and missions.
- Background Data– information obtained from reference documents, strategic intelligence collection, enemy tactics and capabilities, and friendly force capabilities. This information does not change rapidly.
- Interpretation– evaluations and recommendations from staff, based on their experience, perception of background data, and other information.
- Coordination– information obtained from adjacent or subordinate units or allied sources. This would include adjacent or subordinate commanders' intentions, capabilities, and missions.
- Doctrine– how the commander is expected to fight. This information includes what is taught in schools and the commander's experience.
- Analysis– information that needs evaluation, such as the time required to move a certain-sized unit a required distance.

2. Information Needed

The information needed by the commander is obtained from a variety of sources [Ref. 3:pp. 53-55]. These sources include the following:

- Communication Equipment– information is acquired through monitoring radios, data links, and telephone systems.
- Personnel– information received from immediate staff and directly subordinate commanders.
- Documents– operation orders, reference manuals on friendly and enemy capabilities.
- Sensors– strategic as well as tactical collection devices.

- Decision Aids– current or future decision aids can fuse raw data and present the data as usable information.
- Personal Knowledge– the commander can gain knowledge from direct observation or his own personal experience.

The information received by the commander is processed to decide the appropriate course of action. The staff acts as a decision aid to help organize and evaluate. The estimate of the situation procedure is used to organize the information and present logical responses.

E. MULTIPLE OPTIONS

The concept of producing multiple options for an operation is commonly accepted as the correct procedure. Considering available alternatives and picking one is intuitively appealing. However, rational thinking requires that empirical data be considered to validate the need for more than one course of action.

An experiment using teams of military officers playing a war game on the JANUS simulation tested the hypothesis that a plan with multiple options or alternatives is superior to a single option plan. The measures of effectiveness consisted of two components: (1) the result of the war game, and (2) the process used to achieve the outcome. The outcomes were evaluated based on movement and attrition data collected from the results of the simulation. The process data consisted of frequency counts of information exchanges and requests and counts of numbers of orders. In addition, subjective ratings of the quality of performance were derived using the subjective workload evaluation assessment tool. [Ref. 6:pp. i-ii]

The conclusion drawn from this experiment was that the headquarters using a multiple option plan were more effective. The results indicated that the headquarters were most effective when a multiple-option plan was used and the battle workload was low. A similar conclusion about multiple options was not confirmed in the high-battle workload condition. [Ref. 6:pp. i–ii]

The results of the multiple-option experiment support the use of the estimate of the situation process. The process taught by the Army calls for the use of multiple options. These multiple options aid the commander in making a decision.

F. THE ESTIMATE OF THE SITUATION

The estimate of the situation is designed to be a guide to aid in planning military operations. This procedure is one step in the larger military decision-making process discussed previously. The estimate process is taught to help in developing thought patterns for staff officers and commanders.

> The intent is to present logical and detailed system that, if used repetitively, will be internalized and thus will facilitate rigorous planning and flexible execution during combat operations. [Ref. 7:p. i]

1. Origin

The estimate of the situation was first written in the 1909 publication of Captain Roger S. Fitch's *Estimating Tactical Situations and Publishing Field Orders*. In 1910, Fitch's estimate of the situation was published in the Army's *Field Service Regulations*. The doctrine gave a procedure which began with mission receipt, considered relevant factors,

and chose the best course of action to complete the given mission. Once the course of action was selected, orders were written to execute it. [Ref. 8:p. 14]

2. Current Usage

The estimate process is described to students at the Command and General Staff College as a system to develop a thought pattern. The techniques taught are placed in a logical sequence to develop courses of action, ultimately arriving at a decision [Ref. 9:p. i]. The intent is to use the process repetitively in a classroom environment so that in a stressful combat situation the estimate process is automatic.

The command estimate is a version of the estimate of the situation which builds on the classic "estimate of the situation" defined in FM 101-5, *Staff Organization and Operations*. The command estimate (referred to hereafter as the estimate or the estimate of the situation) emphasizes the information needed by the commander and his staff to quickly plan and respond. Each staff section (personnel, logistics, intelligence, operations, etc.) conducts its own estimate process. The steps of the military decision-making process are included the command estimate. The differences between the two estimate procedures are shown in Table 1 [Ref. 9:p. 1-2]. The estimate procedure is a way for planners to quickly analyze information and develop responses.

To be effective, the estimate must be a rapid mental process which allows the commander to act more quickly than his enemy [Ref. 10:p. 22]. The purpose in having a process to evaluate and respond to a

TABLE 1

COMPARISON OF THE COMMAND ESTIMATE AND THE ESTIMATE OF THE SITUATION

Command Estimate	Estimate of the Situation
Mission Mission Analysis Commander's Guidance Facts Assumptions	Mission
Development of Courses of Action	The Situation and Courses of Action
Analysis of Courses of Action	Analysis of Courses of Action and Comparison of Courses of Action
Decision Actions and Orders Supervision	Decision (Recommendation)

situation is to organize a method which everyone can use. If each individual commander and staff confronted with a decision develops his own method, some will have faster, more effective methods than others. The goal of the process is to develop a course of action which will defeat an enemy.

The estimate process works well for long-range planning, where time is not critical. The estimate process is admittedly a very thorough and time-consuming procedure [Ref. 9:p. 6-1]. ST 100-9, the *Student Text for the Command Estimate*, describes both the complete estimate and an abbreviated version which has only the most critical elements.

The critical elements are: mission, situation/develop courses of action, analyze courses of action, comparison, decision, and execution. The restated mission is derived from the missions of commanders, both one and two levels higher, and includes both planning guidance and intent. A graphic situation depicting probable enemy courses of action aids in developing friendly courses of action. The friendly courses of action are analyzed by war gaming to identify advantages and disadvantages. The identified advantages and disadvantages are compared to determine the one most likely to succeed. The commander decides which course of action is best and gives his guidance to execute the plan. [Ref. 9:pp. 6-1 through 6-2]

3. Alternative Model

An alternative model for time-critical situations was proposed by Major W. Edward Shirron. Searching for a time-efficient but thorough method, Shirron used the factors of mission, enemy, terrain (and weather), troops, and time available (METT-T). METT-T is an easy-to-remember acronym which covers all the needed considerations for a planner. Normally applied at a tactical level, the factors can be used at any level. [Ref. 8:pp. 85–89]

a. Mission

The commander first considers the mission or intent. He must understand what he is expected to accomplish. His requirements are taken from the mission of his superior and the mission he is directly given.

b. Enemy

The enemy capabilities and expected actions, both present and future, are critical to the commander. The commander must consider what actions the enemy is expected to take. By anticipating the enemy's moves, appropriate counter-actions are planned.

c. Terrain and Weather

Terrain and weather conditions are evaluated from both friendly and enemy perspectives. A quick assessment of any effect these elements will have on the unit's mission is made. The time to move a certain-sized unit through a given area is determined.

d. Troops

The troops available to the friendly commander will drive his ability to execute a mission. The ability to concentrate firepower at decisive points is often crucial to success. Concentration of firepower depends on both mobility and the logistical resources available.

e. Time

The amount of time available is often crucial. The commander must assess time in terms of both enemy and friendly forces. To win, he must use time better than the enemy.

The criticality of time is a recurring theme in decision-making models. A difficulty arises in determining how much time is truly available. The available time often is dictated in an order, but the true available time is dependent on the actions of an enemy.

The problem of time criticality illustrates a shortcoming in the decision-making processes. The definition of the total environment in

which a decision maker or commander operates is not always clear. The uncertainties of the enemy, time, terrain and weather, and even the friendly situation require further investigation of the entire decision-making environment.

III. DECISION MAKING BY INDIVIDUALS

Decision making by an individual is the basic element in a study of the process of situation estimation. In a typical staff estimate, many individuals make decisions. The process each of these individuals goes through in making his particular decision affects the result of the procedure. The quality of each individual decision contributes to the overall effectiveness of the staff.

A. EFFECTIVE DECISION MAKING

An effective decision maker is one who makes decisions which enable accomplishment of organizational goals. If a group or organization accomplishes its mission or goals, then effective decisions are made. How the effective decision maker works needs to be examined.

Different explanations of how an effective decision maker uses available information exist. Nickerson and Fecher describe effective decision makers as ones who are able to organize large amounts of information and quickly extract pertinent data. Goldin and Hayes-Roth contend that effective decision makers adopt strategies which elaborate available information to a finer level of detail than those by less-effective decision makers. The critical difference between the two definitions is whether a decision maker quickly completes effective decisions or uses a more time-consuming, detailed analysis. [Ref. 11:p. 16]

Both explanations of decision makers' methods described above may be correct. If, as Dreyfus argues, the mental processes which form the

decision-making process change based on experience, then both definitions may be appropriate at different learning stages for a decision maker [Ref. 11:p. 16]. The common thread is that information is understood and used to create results. Two decision makers may operate using completely different methods and achieve equally effective results.

Strategies used in problem solving depend in large part on the subject's knowledge base for the task to be solved. An expert not only has more knowledge but his knowledge may be more interconnected. Each piece of knowledge may be known as related to other pieces of knowledge, creating interconnections. An expert does not necessarily think further ahead, have a better memory, or examine more options. Using his highly interconnected knowledge base, the expert may recognize the appropriate response based on multiple inputs. [Ref. 11:p. 16]

B. COGNITIVE STRATEGIES

Cognitive strategies used by decision makers vary. A cognitive strategy is the mental process to develop a response in a situation. Different people may use a different strategy in a similar situation.

1. Recognitional Decision Making

Recognitional decision making involves retrieving information from experience about past situations which are similar. An experienced decision maker may recognize cues which key him to react in a way he knows will work. This reaction is not just a blind response. The decision maker considers potential problems, and if none are significant, he will implement his solution. [Ref. 12:pp. 58-64]

Studies by Klein show that decision makers may not even realize a decision is made. They react under instinct. Klein studied urban fire commanders and wildland fireground commanders. Klein interviewed one commander who said he did not make any decisions. The commander meant he did not develop multiple solutions and analyze each to find the best one. The commander actually did make decisions continuously. Klein found in his research that, in studying over 150 experienced decision makers in situation assessment, the recognitional approach is typical of those with many years of experience. [Ref. 12:p. 58]

The strengths of the recognitional decision-making strategy include the ease of application and intuitive appeal. It does not call for calculations and research to create multiple solutions. The decision maker can analyze the situation and compare it to similar past experiences, using the relevant parts to respond. People tend to be comfortable with judgments based on personal experience. [Ref. 13:p. 12]

Recognitional decision making also has weaknesses. Experience may not apply. Rarely will a decision maker foresee every possible situation. Almost any situation, as it develops, will have slight differences which require changes to the solution.

The success of the recognitional decision-making approach relies on the ability to distinguish things that apply to the present problem from those merely similar. Almost any combat situation will have similarities with another, but the similarity seen may not matter in the current problem. If a decision maker is unable to distinguish the critical cues, he is not likely to succeed using this approach. [Ref. 13:p. 13]

2. Schema Theory

Schema theory, a variant of recognitional decision making, assumes information processing for situation assessment happens by comparing an observed situation with memory reference models for different situation types and matching the one that has the most factors in common with what is observed. Schemas are memory structures used for information processing. A person can use his experience to recognize and analyze a new situation. From this analysis, proper decisions are made. A model of information processing proposed by Noble allows the flexibility to have inexact matches between observed and previous situations [Ref. 14:p. 4].

Data are developed for later recall and are stored in a network of schema [Ref. 14:pp. 5-13]. Each of the schemas in the network (see Figure 1) [Ref. 14:p. 7] consists of three layers: slot, criteria, and inference and action. The layers are related to steps in a decision-making mechanism.

The slot layer is the problem formulation step. The criteria layer relates to problem analysis. Alternative selection is represented in the inference and action layer. The slot layer specifies slots or positions which aid in identifying features of a given situation. The physical and functional assets of possible situations are specified in each slot. A schema for an armored battle might contain a slot for many tanks and an additional slot for multiple axes of advance.

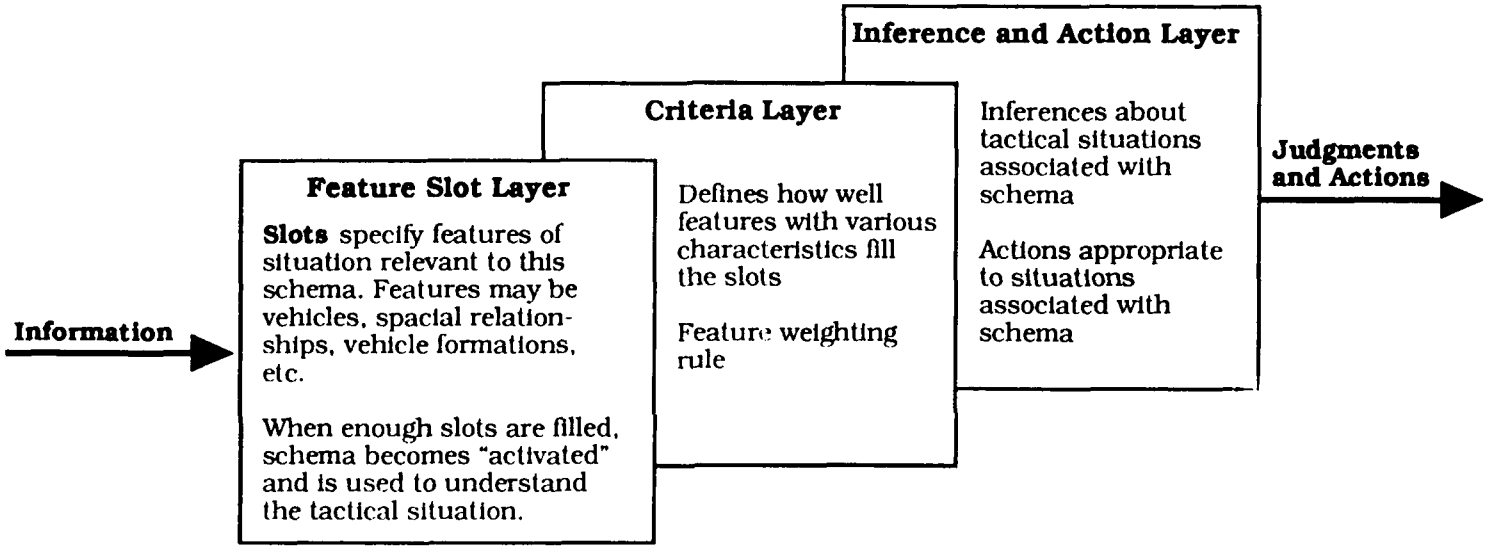

Figure 1. **A Single Schema**

The feature assessment layer includes criteria curves and weighting rules. The curves convert viewed data, such as combat vehicle numbers and distances, into usable information, such as "many tanks" or formation types. Weights can also be assigned to specific features according to their relative importance. For example, the location of engineer vehicles may weigh heavily in identifying the main attack.

The inference and action layer describes the responses and conclusions to be made with appropriate situations. The actions result from a table look-up with a particular input. The action may be to reinforce artillery in a certain sector.

To summarize the schema process, consider the identification of an enemy attack. Using the slot layer, vehicles are identified as different combat vehicles in a specific formation. In the criteria layer, the numbers and types of vehicles and their separation distances are converted to usable information, such as enemy motorized rifle regiment in a hasty attack formation. Different explanations for the formations can be weighed against each other in the criteria layer. For example, whether the attack is a motorized rifle regiment or an armored regiment can be considered. In the final layer, inference and action, the decision to counterattack or defend is made. Additional factors, such as fire artillery at a reference point, can also be decided.

A person using a schema may use a model which incorporates information-processing steps. Information is processed and referred to data that is obtained through training. The steps relate to the different layers of the schema and are shown in Figure 2. [Ref. 14:pp. 10-13]

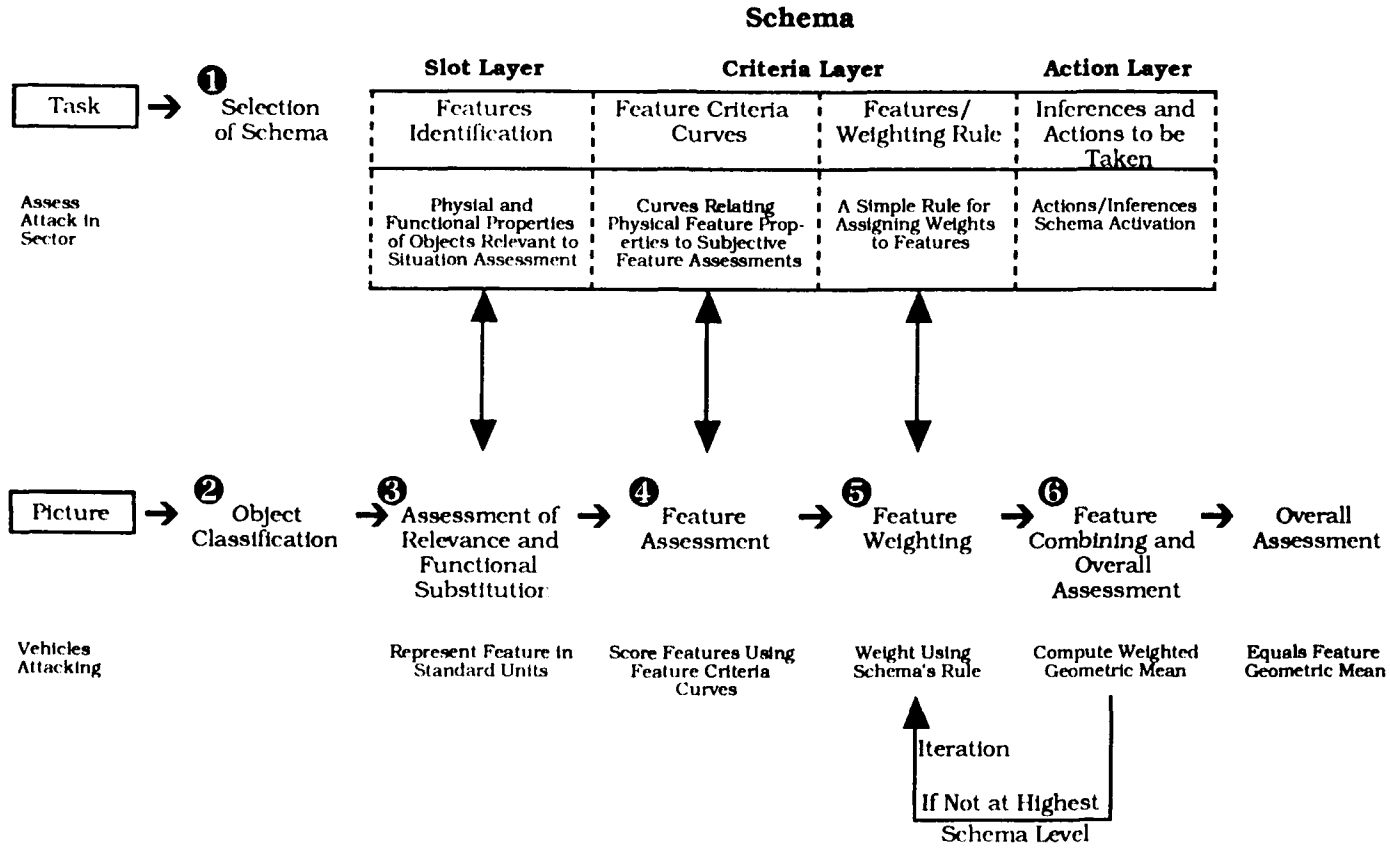

Figure 2. **Use of Schema for Situation Assessment**

- Step 1—Initial selection of schema. A situation or task will cause a particular schema to be chosen.
- Step 2—Object classification. Familiar objects seen are classified as specific items. For example, an observer viewing a satellite picture of vehicle movement would distinguish tanks from extraneous vehicles.
- Step 3—Assessment of feature relevance and functional substitution. In this step, the objects identified in step 2 are examined, including the relationships between objects. Relevant features are converted into standard physical units, such as type of vehicle and unit formations.
- Step 4—Feature assessment. The physical units are translated into specific assessment scores for each schema. For example, engineer bridging equipment will weigh heavily for locating a main attack. This step and steps 5 and 6 use the data stored in the criteria layer.
- Step 5—Feature weighting. In this step, the scored features are assigned the weight determined by the schema weight assignment rule.
- Step 6—Feature combining. Assessed and scored features are combined using a weighting scheme (e.g , a geometric mean).
- Step 7—Iteration of 5 and 6 at higher levels. In step 7, the different features assessed in the situation are combined and analyzed. For example, ground attack, air attack, and radio traffic can be combined to produce a complete assessment of a battle.

3. Analysis of Problem-Specific Information

A second cognitive strategy (given that schema theory is a variant of recognitional decision making) is to analyze the specific information for the problem. In this strategy, future conditions are determined analytically from the observed situation. For example, an enemy unit observed moving at a certain rate and direction can be used to calculate arrival times at specific locations. [Ref. 13:pp. 15–16]

The strength of the analysis of problem-specific information is that assumptions from which conclusions are drawn can be made

external and explicit. One does not have to rely on memory. In addition, conclusions can be independently verified by someone other than the main decision maker.

A weakness of this strategy includes the probability of not having all information because the other side may try to conceal or deceive. Also, the relative effectiveness of different analytical procedures varies. An analytical procedure may be highly reliable, but if it is based on poor assumptions it will not provide accurate results. For example, if a unit is moving along a specific route but later changes to an alternate route, the expected arrival location may be changed. Another weakness is that the ability to apply a procedure depends on the ability to detect what is important. If several related conditions are critical to the situation and only portions are observed, critical information may be missed.

4. Mental Simulation

Mental simulation is a third cognitive strategy. Future conditions can be projected by determining all conditions where a particular action would happen. Simulating mentally, by stepping through the action and accounting for all the movement, required resources, and various side effects, the future state can be hypothesized. Additionally, the strategy provides a method to test future plans. [Ref. 13:pp. 17-19]

A strength of this strategy is that it encourages identifying conditions, effects, side effects, and other conditions that a decision maker might otherwise overlook. In addition, the decision maker must make assumptions and expectations plain. These assumptions and expectations are exposed to scrutiny, possibly identifying any mistakes.

One weaknesses of mental simulation is that the validity of a conclusion depends on the quality of simulation. Assessing the quality of simulation is tough, especially in terms of its accuracy and completeness. The ability of people to conduct quality mental simulation is questionable. More complex tasks make simulation increasingly difficult. The simulation strategy effect may cause overconfidence by the user. A believable simulation based on false assumption or false procedure may cause a false conclusion. [Ref. 13:pp. 17-19]

C. DECOMPOSITION

Decomposition of tasks is a method to compensate for weaknesses in cognitive strategies. Breaking the problem into smaller pieces allows each piece to be analyzed more easily. The pieces are separately analyzed and then analyzed as a whole. [Ref. 15:pp. 6-7]

A commander's staff works with tasks decomposed into functional areas. The typical division into operations, intelligence, logistics, and personnel areas is made because missions are too large for one area. By separating into separate staff areas, each section can concentrate on its particular part of the problem. Within the military decision-making process, the staff members coordinate in tasks which overlap in function to complete the plan.

D. COGNITIVE BIAS

Cognitive biases are systematic discrepancies between a correct answer and a judged answer. The biases show intellectual limits, and

overcoming them improves the quality of the thought process. [Ref. 16:pp. 226–277] One common cognitive bias is the confirmation bias.

A confirmation bias occur when a decision maker fails to change a decision or recommendation despite receiving new, conflicting information. Decision makers generally have a tendency to stick with the initial estimate. If conflicting data are received, the data may be interpreted to confirm the original hypothesis or be completely ignored.

An experiment to investigate the confirmation bias in a military context was conducted using Army intelligence analysts [Ref. 17:pp. i–24]. The analysts were given a realistic battlefield scenario and asked to decide on the most likely enemy avenue of approach. They subsequently were given updated intelligence reports which included some information which confirmed and other information which contradicted previous reports. The analysts were asked to reconsider their decisions and rate each piece of information as to whether it supported or contradicted their individual hypothesis. Confirming evidence was weighted more heavily than contradictory. Contradictory information was recognized but given a low or neutral weight. The analysts appeared to have picked a course of action based on the early information and then explained new information in terms of the original course of action.

A second experiment with a similar situation and group was conducted. The participants this time were given a description of typical decision biases and graphic aids to assist in analyzing the uncertainties. [Ref. 18:p. ii] The results of this second experiment showed the analysts became more sensitive to new data and less influenced by their initial

estimates. The analysts were less likely to over-weigh confirming evidence, but this tendency was not eliminated.

The indication from these experiments is that, to reduce confirmation biases, training is helpful. The simple explanation about the tendency to have a confirmation bias had an effect. If decision makers are trained with this concept, it may help reduce the bias. [Ref. 18:pp. 29–32]

E. COGNITIVE STYLE

Cognitive style is the consistent method an individual uses in perception and intellectual functioning. Cognitive style differs from cognitive strategy in that the style is an attempt to define an individual's way of functioning as opposed to defining methods individuals can use. Additionally, cognitive style is more dependent on perception. [Ref. 19:p. 11]

Little evidence exists to show there is any effect of cognitive style on the quality of a decision [Ref. 19:p. 11]. The same decision can be reached by different people using different strategies. A decision maker or analyst will gain more by considering the strategy in making a decision than by considering the style. The purpose of mentioning cognitive style in this paper is to eliminate it as a way to model decisions.

The individual decision-making strategies discussed in this section are used by staff officers and commanders in the estimate process. Many use the different processes without realizing that they are using a decision strategy. Understanding individual, group, and organizational processes will help improve decision quality.

IV. GROUP DECISION MAKING

A. DEFINITION AND TYPES OF GROUPS

Groups and their behavior play an important role in the estimate of the situation. Each staff section involved in making an estimate comprises a group. The processes that affect the staff section affect the outcome of the estimate.

1. Definition

Many different definitions of a group exist. These definitions are usually related to a researcher's particular area of study. For the purposes of this study, the following definition will be used:

> A collection of two or more individuals who are interdependent and interact with one another for the purpose of performing to attain a common goal or objective. [Ref. 20:p. 182]

This definition includes the need for common goals, interaction, and performance, all which are necessary in a study of an organization. Groups are distinguished from crowds at a movie or other collections of people. Different types of groups can exist.

2. Types of Groups

Various methods exist to distinguish different types of groups. The groups prevalent in an organization are: functional, task or project, and interest or friendship. Groups can also be classified as formal or informal. Formal groups are those whose main purpose is attaining organizational goals. Informal groups are formed naturally by member interaction and do not necessarily have any relationship with the

organization's mission [Ref. 20:pp. 183-184]. Each of these groups can and often does exist in a commander's staff.

Functional groups are those established by the organizational structure. Designated staff sections are the usual formal groups on a military staff. Within a staff section, more groups may exist. For example, the operations staff may be divided into plans, operations, and training.

Task or project groups are groups established on an *ad hoc* basis. If a particular project involves coordination between various action officers, a task group may be created by the commander or his designated representative. If an unique mission is given which involves only a part of the unit, a special task group may be formed. For example, a division-sized unit may form an advance party with representatives from various staff sections. The advance party precedes the division on a deployment and functions as the divisional staff, a group, until the main body of the division arrives.

Interest or friendship groups are informal groups developed on a basis of a common interest, belief, or characteristic. For example, groups of officers with common backgrounds or acquaintances from previous assignments may become informal groups. The informal group may create contacts which would not occur in the normal decision-making process. For instance, an officer in the operations staff may have past experience on a logistics staff and have friends in the logistics section. Through his friends, the operations officer might informally offer his thoughts as input to the logistics estimate.

3. Group Structure

All groups will have a structure which includes in some form the following: members, differentiation of parts, communication, rules, and regulations. The membership in the group may or may not be strictly defined. The different roles or positions of group members must have unique characteristics. These positions may be permanent or may be in transition. The group members will communicate in some form. The frequency of communication may vary from seldom to continuous. Individuals in the group must follow some system of rules to enable the group to operate. In a military group, the leader or commander often holds the power which enforces regulation. [Ref. 21:p. 149]

4. Why Groups Form

Groups form for two major reasons: goal attainment and/or satisfaction of personal needs. Goal attainment is the reason groups are designated in an organization. As personal needs arise, they may cause other groups to form. [Ref. 20:pp. 195–196]

A primary purpose of formal groups in an organization is accomplishment of tasks or goals. The operations staff is organized to aid the commander in planning and conducting operations. Other staff sections also exist to accomplish their particular functions. [Ref. 20:p. 195]

The purpose of a short-term task force or a committee is formal problem solving. This need may be met by formal groups on a recurring basis. Short-term groups are used for specific, one-time problems. [Ref. 20:p. 195]

Groups may form because of proximity and attraction [Ref. 20:p. 195]. Operations and intelligence staff officers may group together to solve problems because their tasks are interrelated. Similarly, a task or mission may need the input of different project officers from different staff sections.

To meet individual needs, groups may form for socio-psychological reasons [Ref. 20:p. 195]. Particularly in a combat situation, different staff sections may organize together for safety and security. Furthermore, groups may form socially because of common interests.

Groups may form for reasons other than those previously discussed, but the ones already mentioned are the primary causes. Most military staffs are formed based on authorization documents. Anyone developing documents must consider the tasks the groups must accomplish.

4. Role of Task

The specific tasks that confront groups should drive the design of the group. The group's task drives the need for information and, consequently, the communication methods used. Each task will have unique characteristics. These can be broken into three categories: generation, choosing, and negotiating. [Ref. 22:p. 600]

A group that generates ideas is involved in planning tasks and creativity tasks. Planning tasks involve the development of plans. Creativity tasks involve generation of new ideas. A group involved in development and creativity tasks needs to organize to allow members of the group to input ideas and quickly evaluate them. Procedures and facilities

can be established to improve performance. For example, standard methods to complete a routine plan can improve effectiveness. Facility aids, such as a blackboard on which to record ideas generated, will aid in task completion. [Ref. 22:pp. 600–601]

Choosing alternatives includes intellective and preference skills. Intellective skills are used to select the correct alternative. Selecting an alternative with no objective measure of effectiveness is a preference skill. War-gaming alternatives is an example of this task in the estimate of the situation process. A staff that is involved in choosing alternatives can establish standard procedures to war-game different courses of action. By making procedures routine, the output of the staff improves. [Ref. 22:p. 601]

Cognitive-conflict and mixed-motive tasks are used in negotiating solutions. Cognitive-conflict tasks involve settling conflicts in points of view. Mixed-motive tasks are those used in resolving differences in conflicting motives or interests. In a staff structure, these tasks can be resolved by the commander or his chief of staff. Resolving differences is a reason to establish a group commander or leader. [Ref. 22:p. 601]

Staffs encounter each of the various types of tasks. The staff may organize itself differently to handle each of these tasks most effectively. How well a staff organizes affects its effectiveness.

E. GROUP EFFECTIVENESS

Various factors help or detract from the effectiveness of a group. A group's effectiveness is defined as the success of the group in achieving its goals or meeting the needs of its members. The factors that contribute

to the group's effectiveness include the members, the organization and its past performance, and the environment. [Ref. 21:p. 153]

1. Group Members

A group is only as strong as its members. Despite the form of the group's structure, individuals must make and implement group decisions. If individuals in the group do not execute their parts of a task, or do so poorly, the overall group task performance will suffer. Furthermore, the loss of a key person in the group can adversely affect the group's performance. For example, if the person lost was a leader with superb organizing and executing skills, the group will perform at a lower level until the loss is replaced or overcome. [Ref. 21:p. 153]

2. Group Organization and Performance

A group's effectiveness is influenced by how the group is organized and its past performance. The organization of the group compared to its task or mission and the appropriateness of the type of leadership used will enhance or detract from the effectiveness. The past performance of the group will influence the morale and current capabilities, which will also have an impact on the group's effectiveness. [Ref. 21:p. 153]

The size of a group and the proximity of its members influence the design of the group. A small group whose members are located near each other may work well in a conference room. A large, dispersed group could not. Some form of electronic conferencing device (a radio, if nothing else) is more appropriate for the larger, dispersed group. [Ref. 22:p. 598]

3. Environmental Conditions

The environment in which a group exists will affect the effectiveness of the group. The environment includes not only the physical elements (e.g., weather and terrain) but also other groups in the organization. Each of these will affect the group. [Ref. 21:p. 153]

The group resources must suit the conditions of the physical environment. A staff must have facilities appropriate for work in the particular external conditions in which they are assigned. For instance, combat conditions will create security requirements which must be met to allow the staff to continue operations. The staff may have to plan for a variety of conditions. Successful staff preparations will assist in a successful operation. [Ref. 21:p. 153]

Intergroup relations affect the effectiveness of all the groups involved. The performance of a lower-level staff will depend, in part, on the quality of the higher-level staff which directs the mission. Coordination between staff sections is also crucial for success. Competition between staff sections may encourage quality performance, but if not controlled it may adversely affect results. [Ref. 21:p. 153]

C. DEFICIENCIES IN GROUP PERFORMANCE

Deficiencies in the performance of a group will adversely affect its ability to accomplish a mission. The deficiencies may result from interaction in the group or from the group's design. Systemic deficiencies may be examined to avoid problems. Specific group deficiencies include group-think, social loafing, and various barriers to decision making.

1. Group-Think

Group-think is the term used to refer to a tendency for close-knit groups to become unanimous in outlook. This condition may result from seemingly positive aspects of group interaction, such as group cohesiveness. The goal of group cohesion is paramount to decision making. However, with a highly cohesive group, members may be reluctant to disagree on an issue and violate the cohesive relationships in the group. Other members of a group may pressure a disagreeing member into conforming. [Ref. 23:p. 12]

A group may overestimate its power and morality. By believing the group is invulnerable, the members may become overly optimistic and take extreme risks. Also, believing the group is fundamentally moral, the ethical or moral consequences of a decision may be overlooked. [Ref. 24:pp.10-15]

A closed-minded outlook can cause symptoms of group-think. Rationalization by the group of information that conflicts with its own view may prevent logical consideration of alternatives. Classifying other groups or other group leaders as not being in conformance with its own views may negate proper interaction. [Ref. 23:p. 12]

2. Social Loafing

Social loafing refers to the phenomenon of individuals performing at a lower level in a group than when they act individually. Experiments tested the ability of groups of people to pull on a rope. Each member of the group was also tested individually. Results showed that individuals exerted less pull in a group. Individuals seem particularly

prone to social loafing when their individual effort in the overall group effort cannot be identified. [Ref. 25:pp. 36-38]

Experiments involving the performance of swimmers measured their times in individual races versus their time as part of a relay team. The relay times, although for the same distance, were consistently faster. The result was attributed to the identifiability of each swimmer's contribution to the relay. Also, at each lap turn teammates shouted times. Hearing their teammates reinforced the idea that other members of the team depend on each person. [Ref. 25:pp. 36-38]

3. Barriers to Proper Decision Making

Decision making in a group or team creates problems in situation assessment and process management. Klein, in his study of team decision making in command and control organizations, has identified seven barriers to effective decision making [Ref. 26:pp. 242-245]. These barriers inhibit optimal effectiveness.

One barrier is that the key decision maker or commander in a group may have a distorted perception of the situation caused by having to rely on reports of others. A modern battlefield in which a commander has a full view of his entire unit is rare, if not inconceivable. The commander must rely on reports made by subordinates or other sources to determine the current situation. An individual may report what he believes to be true. For some cases, this is actually just a misperception. Compounded misperceptions can cause a decision based on erroneous information. [Ref. 26:p. 242]

Transferring situation assessment from one shift to the next, as a result of multiple shifts in a command post or group, can cause problems. This is the second barrier.

If a relief shift receives an inadequate or confusing shift-change briefing, the efforts of the new shift can be misdirected. Complete updates are essential. [Ref. 26:p. 242]

A third barrier is the communication of goals in terms of the commander's intent. In the operation order, the staff must clearly communicate the goals of the commander. Misunderstanding by subordinates can result in the commander's mission not being performed. [Ref. 26:p. 242]

Undirected attention is the fourth barrier. Staff sections or groups whose actions are closely related do not always respond identically to similar events. For example, the intelligence section may assign key assets to concentrate on specific enemy actions, while the operations section may need the same assets to be allocated differently. [Ref. 26:p. 242]

Missing expectation is the fifth barrier. Any situation assessment is based on assumptions or expectations. Checking these expectations is often overlooked because no one is assigned the responsibility to check for violations of the assumptions. [Ref. 26:p. 242]

The sixth barrier is the lack of improvisation, caused by the inability to visualize the end result when the plan's original assumptions begin to fail. A plan rarely remains unchanged from start to finish. When

the plan is no longer feasible, success can be gained by improvising. [Ref. 26:p. 243]

The final barrier is the high failure of synchronization in an operation. Synchronizing the various elements of the combined arms force so that force is maximized at the critical point and time is difficult. Not synchronizing can result in failure. [Ref. 26:p. 243]

These barriers can be overcome. Effective staffs can devise ways to correct deficiencies. If they do not correct their problems, the staffs will not be effective.

D. CORRECTION OF DEFICIENCIES

Correction of deficiencies is a prime concern in groups. Prior knowledge of potential problems can aid in prevention. Organizing to avoid problems may aid in group performance. Systemic problems, such as group-think, can be avoided by prior planning. Studying how effective groups perform may provide insight into how to have similar results. Techniques in group planning can improve performance, as can organizing ideas into a structured format. Decision support systems are a technology-aided way to compensate for deficiencies.

1. Ways to Avoid Group-Think

The symptoms of group-think can be avoided by careful planning. Different ways to organize a group are helpful. Examples include: dividing policy groups into subgroups, inviting outside experts to observe, and using a devil's advocate. Techniques of doing tasks also may aid in preventing group-think. Techniques such as developing alternative scenarios and holding a second meeting to allow further

contemplation of the issues can reduce the tendency to group-think. [Ref. 24:pp. 10-17]

Dividing policy-making groups into subgroups allows them to work on the same issue separately. The subgroups can each independently determine a solution, each under its own leader. The results of these separate groups will probably differ somewhat, allowing a better evaluation with more options. [Ref. 23:p. 15]

Outside experts who are not part of the group should be asked to evaluate the decisions. An outside expert can provide an objective view on the quality of the decision. An objective assessment by a trusted individual can improve group performance. [Ref. 24:pp. 10-17]

One member of the group should be assigned the role of devil's advocate. Considering the negative effect of any decision may avoid oversights. Errors or omissions can be determined. [Ref. 23:p. 15]

When the decision making involves a rival or enemy organization, alternative scenarios should be developed. A decision by the group may hinge upon an estimated enemy situation. Depending on how the enemy acts, the original course of action may or may not be appropriate. The alternative scenario will allow the group to provide continuity of action. [Ref. 23:p. 15]

After an initial group consensus is reached, the group should hold a second meeting where additional input is solicited. A second meeting may not be possible in a time-constrained environment, but if it is possible, the meeting may be useful. After additional thought, members

will have a chance to voice lingering doubts or doubts that arose from new information. [Ref. 24:pp. 10-17]

2. Effective Versus Ineffective Groups

The way in which effective groups interact, versus the way in which ineffective groups interact, can account for differences in the quality of group decisions. For example, internal communication is a key ingredient in any group process. In a study of groups of college students making the same decisions, several characteristics were found to distinguish effective from ineffective groups. The decisions made were determined effective or ineffective based on an independent judgment by experts in the subject of the decision. [Ref. 27:pp. 363-369]

The quality of a group's decision may stem from the manner in which the group examined opinions and the assumptions advanced by group members. Effective groups made less assumptions and carefully scrutinized those few made. Ineffective groups tended to gloss over opinions and assumptions without considering their validity. [Ref. 27:pp. 376-377]

The manner in which the groups evaluated choices may have affected the decision quality. Both types of groups developed alternatives and evaluated the choices by pre-established criteria. However, the effective groups carefully tested each choice against the pre-established criteria. They considered the consequences of the various recommendations. Ineffective groups appeared to "go through the motions" [Ref. 27:p. 371] when deciding which course of action to choose.

The quality of a group's decision may be affected by the nature of premises which served as a basis for the group's decisions. Effective groups appeared to decide based on presented facts and logical assumptions. Assumptions used by ineffective groups sometimes appeared questionable. The ineffective groups' assumptions did not correlate with the facts of a situation. [Ref. 27:pp. 378-379]

The nature of influence of the most influential members of group can affect the quality of the decision. The effective groups had members who supplied a positive influence. The dominant members helped guide their groups to effective decisions by asking appropriate questions, noting important information, and avoiding digressions. The ineffective groups had members who tended to exert a negative or restrictive influence. Making erroneous assumptions, misinterpreting information, and leading the group on tangents were some of the mistakes made by ineffective groups. [Ref. 27:p. 379]

The four propositions presented are useful in improving a group's performance. The members of the group can avoid the pitfalls of the groups in the study. Avoiding others' mistakes can improve planning and other tasks the group performs.

3. Planning as a Group Activity

Planning with a group is advanced by applying three points. First, workers should be direct participants in the planning process. Workers are more comfortable with the plan if they are allowed to to help develop it. Second, the planning should be a continuous process. As situations change, the plan should change. Third, planning should be

conducted so that all units at the same level can plan simultaneously and interdependently. Simultaneous planning will encourage communication, which will improve coordination. [Ref. 28:p. 257]

4. Idea Structuring

Organizing ideas into a structured manner can greatly improve the effectiveness of the group. A group with such a technique has a method to follow and will not have to spend time deciding how to proceed. Various techniques are available and include the estimate of the situation process. Two others are presented as examples.

a. PERT/CPM

Project Evaluation Review Technique (PERT) and Critical Path Method (CPM) are two project-scheduling techniques developed independently in the late 1950s [Ref. 29:p. 4]. Both PERT and CPM involve the concept of identifying all tasks and task interactions in a project. The tasks are ordered in the sequence in which they must be executed. Tasks that can be completed simultaneously are identified. The entire project is analyzed to determine whether effort can be realigned to optimize time, money, and manpower spent. The effect of a delay in one task on the whole project can be shown by both PERT and CPM.

b. Consensus Mapping

Consensus mapping is a technique used to aid in idea generation. A group working on a particular problem generates a list of ideas and conducts a preliminary evaluation of the ideas. The ideas are placed into clusters and categories. If possible, different subgroups are used to create more concepts. Next, members of the group try to identify

organizing frameworks for the various idea clusters. Each of the proposed frameworks is evaluated and a consensus determined. This process can involve multiple refining steps in determining clusters and the overall framework. When completed, the consensus framework has helped identify the key dimensions of the overall problem. [Ref. 30:pp. 587-591]

5. Group Decision Support Systems

A group decision support system (GDSS) can combine techniques from communication, computing, and decision support technology to help a group of people formulate and solve problems. Aids can be as simple as a checklist of possible courses of action to prevent neglecting an option. They can be as complex as a distributed teleconferencing system with computer-assisted analysis. [Ref. 31:pp. 67-68]

Computers, with their ability to process large amounts of information quickly, can improve time use. War-gaming potential courses of action on a computer gives the commander a look at possible outcomes. The courses of action can be altered slightly and the effect of the changes can be seen. If properly designed, simulations can provide a reasonable, descriptive view of a situation.

Decision aids are exactly that. They aid the decision maker but do not replace the need for humans in the process. Using aids to improve human performance has great promise if applied wisely.

Groups play a critical part in a decision. However, groups are part of organizations. The group must operate in an organization, and the organization must properly align the groups to better its

effectiveness. Groups can improve their own performance, but they may rely on other groups for information, guidance, or support. If other groups do not perform effectively, all the groups and the organization may suffer.

V. ORGANIZATIONAL DECISION MAKING

A. PURPOSE

Understanding the purpose of an organization is important in determining how the organization works. Different descriptions of organizational purpose are possible. A basic premise is that organizations must process information because of the uncertainty which they face [Ref. 32:p. 614].

1. Uncertainty

Organizations are systems designed to deal with uncertainty. The uncertainty for an organization is created when information is needed but not known. Both internal and external causes of uncertainty affect an organization. A critical task used in dealing with this uncertainty is gathering information to approach a more certain state. [Ref. 32:p. 614]

2. Information-Processing Systems

Organizations can be described as information-processing systems. One of the main purposes of an organization's structure is to create the best arrangement and interconnections for subunits to aid in the collection, processing, and distribution of information [Ref. 32:p. 614]. The information gathered by a military staff varies from friendly unit status on many factors to enemy status on similar factors.

Limited capacity is available to process information [Ref. 33:p. 555]. Regardless of the technical sophistication of a unit, information

processing in the unit has a certain limit. This limit may be created by human or technical reasons. Because of this limit, not all desired information can necessarily be absorbed. Information priorities may have to be established. The challenge is to have a structure which manages the uncertainty and processes to the required limit.

Information processing by an organization is more than just individual effort. Sharing of analysis by people is common. In an organization, decisions are often made by a group, so a consensus occurs. Decisions made should reflect disagreements and include more than just individual opinions. [Ref. 33:pp. 555–556]

Organization-level information processing is influenced by the organization's division of labor. Organizations are divided into subgroups or sections. For good performance, each of the various sections must do well and coordinate effectively. [Ref. 33:p. 556]

3. Groups of Groups

Organizations can be seen as a group of groups or composed of subunits. As mentioned before, various subunits specialize in specific tasks. The subunits may be competing for the same scarce resources and coordination between subunits is critical. The subunit structure must be carefully aligned to deal with uncertainty. [Ref. 32:p. 615]

B. UNCERTAINTY, CAUSES, AND RESULTS

The causes and related effects of uncertainty are important factors in determining the success of an organization. Uncertainty comes from several sources. Subunits within the organization face uncertainty in problem solving and coordination which is related to their different tasks.

The environment, defined as the world outside the organization, is potentially variable and unstable, which causes uncertainty. The uncertainty from sources creates a need for information to overcome the uncertainty and enable the organization to function.

1. Uncertainty Sources

As the subunits complete their tasks, they face uncertainty from different sources. Uncertainty is the difference between what is known and what is needed to complete the given task. Three factors which jointly influence subunit uncertainty are task characteristics, task environment, and task interdependence. [Ref. 33:pp. 615-616]

Tasks vary in degree of uncertainty. The complexity of tasks and subunit interdependence affect the amount of certainty or uncertainty [Ref. 33:p. 615]. For example, an administrative staff with a routine garrison mission will face less-complex tasks than a combat headquarters. An administrative staff will have fewer information-processing requirements than a staff planning and conducting combat operations.

The environment of a task is usually seen as a source of uncertainty. More information is needed proportionally as the operational environment increases in uncertainty or becomes more dynamic [Ref. 33:p. 616]. In a stable environment, standard operating procedures (SOPs) are applicable. If the environment is unstable, SOPs may not work.

Tasks that require a large amount of interdependence between subunits call for a large amount of coordination. A subunit with an independent task may need little information from other subunits. The more complex the interactions between subunits, the more complex the

coordination effort [Ref. 33:p. 616]. The difficulties encountered in coordinating joint (multi-service) operations in Grenada showed that interactions are complex.

2. Result of Uncertainty

As work-related uncertainty increases, so does the need for information and information-processing capability. A task low in uncertainty will need little additional information, whereas a task with high uncertainty may require much additional information. The uncertain situation will call for constantly updated information to allow adjustments in plans. Additional information will require more processing capability so use can be made of the information. [Ref. 33:p. 616].

C. INFORMATION PROCESSING

Information processing is important to consider because organizations are designed to process information. A basic purpose for organizations is to act as information-processing systems, as discussed previously. A major reason to process information is to reduce uncertainty in a situation. Filtering and pigeon-holing are factors that can affect improper information processing. An organization's capacity for information processing can control its effectiveness.

1. Uncertainty and Equivocality

Organizations process information to reduce uncertainty and equivocality. Equivocality is similar to uncertainty but includes the possibility of multiple interpretations of the same information. Organizations use information to clarify a situation and come to a consensus about how to react. [Ref. 32:pp. 554-555]

2. Filtering and Pigeon Holing

Organizational structure can cause excessive filtering and pigeon-holing. Individuals may receive more information than they can handle. Some pieces of information will get more emphasis than others. An individual may attempt to emphasize particular information based on what is assumed to be the correct interpretation. This emphasis, be it intentional or not, will cause a filtering of incoming information. A second effect is called "pigeon-holing." Pigeon-holing uses learned categories to define incoming information into compartments. [Ref. 34:p. 126]

The effects of filtering and pigeon-holing can be reduced by using the following: favored information channels, specialized vocabularies, communication checkpoints, and standard operating procedures [Ref. 34:p. 126]. Favored information channels can emphasize particular pieces of information as more important than others. Specialized vocabularies can clarify uncertain information. Communication checkpoints create additional checks on communication flow. Individual mistakes can be lessened by strict adherence to standard operating procedures. These four techniques will force information to be used as intended. Any filtering or pigeon-holing which does occur will restrict information in the way the organization desires and not by individual preference.

3. Information Capacity

Different organizational structures have different capacities for effective information processing. Organizations are more effective when a match exists between the information processing needed and the information-processing capability of its structure. The primary components of

organizations which affect information processing are the unit structure and the integrating mechanisms between the subunits. [Ref. 33:pp. 617-619]

The unit structure has a considerable effect on the ability to process information. The relationship between unit structure and information-processing capability is based on the degrees of organic or mechanistic factors in the structure. The terms "organic" and "mechanistic" are based on four structural variables: formalization, specialization, centralization, and impersonality. "Formalization" refers to the extent that rules, procedures, and instructions are made explicit. An organization with explicit standard operating procedures is highly formalized. "Specialization" is the amount that official responsibilities are spread among several positions. A highly specialized organization is one that that has many different divisions or sections. "Centralization" is the degree of control by an authority to make critical decisions. A single leader who must approve all decisions has a centralized organization. "Impersonality" is the proportion of interpersonal relations that are formal or restrained by the unit. An organization whose personnel interact only in ways prescribed by organizational protocol is highly impersonal. [Ref. 35:p. 6]

A mechanistic structure is high in formalization, low in specialization, high in centralization, and high in impersonality. An organic structure tends to be the opposite of a mechanistic. An organic structure is low in formalization, high in specialization, low in centralization, and low in impersonality. The more organic an organization is, the greater is

its information-processing capability. Figure 3 illustrates this relationship between mechanistic and organic structures and the effect on information-processing capabilities. [Ref. 35:p. 6]

The structures established to link subunits or integrating mechanisms affects the information-processing capability of an organization. Information-processing capability increases with the complexity of the integrating structure. A mechanism using a standard operating procedure tends to be less complex. Planning using schedules is toward the middle of the complexity scale. More complex structures involve feedback to allow changes as a result of updated information. The integrating mechanisms and their effect on information processing are shown in Figure 4. [Ref. 35:p. 6]

D. INFORMATION-PROCESSING REQUIREMENTS

Information processing requirements can be organized into frameworks to aid in analysis. The frameworks can identify the current state of the organization, aiding the proper design. The frameworks are composed of three factors which lead to uncertainty and equivocality. The factors are technology, inter-unit relations, and the environment. [Ref. 33:pp. 563-567]

1. Technology

"Technology" is the knowledge, devices, and procedures used to change input into organizational output. Task variety and task analyzability are task characteristics which define the proper use of technology. "Task variety" is the instances of unanticipated events happening in the

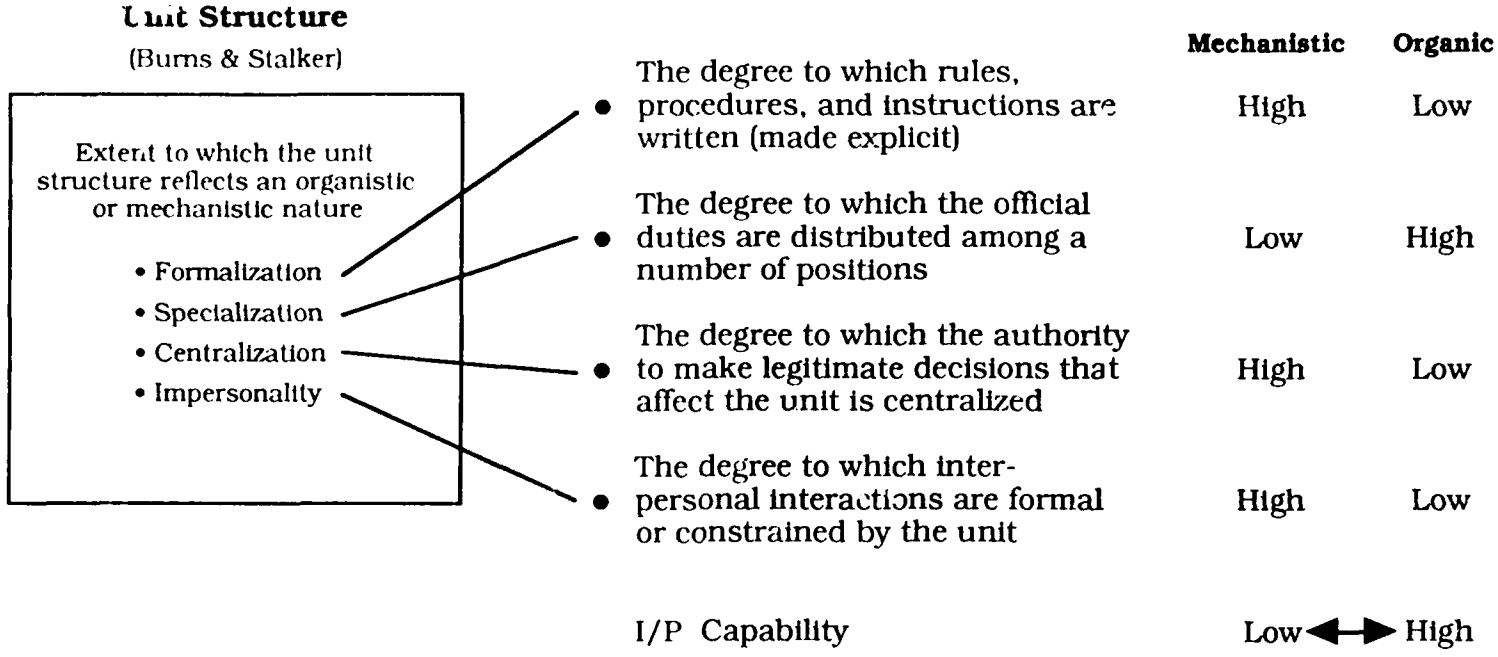

Figure 3. **Unit Structure**

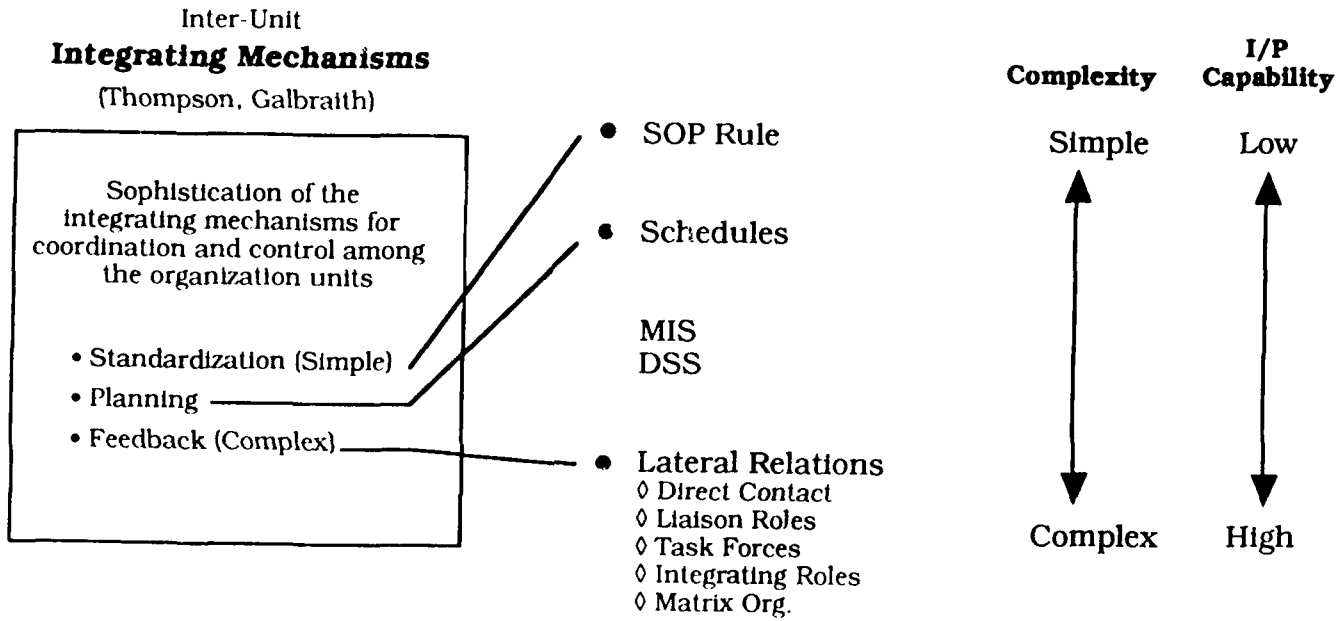

Figure 4. **Unit's Information-Processing (I/P) Capabilities**

transformation process. Task analyzability refers to the procedure used to complete a task. The more analyzable a task is, the more workers will follow a computational or objective procedure. Developing tasks for the less analyzable tasks is difficult, and experience drives the operation [Ref. 33:pp. 563-564]. Figure 5 illustrates the relationships between task variety and analyzability and the appropriate technology and information-processing requirements. [Ref. 35:p. 3]

Different types of information processing are appropriate for the different states of technology. For the routine technology of cell 1 in Figure 5, reports with quantitative data are the primary sources of information exchange. In craft technology (cell 2), more information is needed and face-to-face meetings are more common. Uncertainty increases as cell numbers increase, reaching the highest degree in cell 4, non-routine technology. Uncertainty about the technology is high, requiring more interaction within the organization. [Ref. 35:p. 3]

2. Inter-Unit Dependence

Inter-unit dependence (discussed in part in task interdependence) is the amount a subunit is dependent on other subunits for task accomplishment. Uncertainty increases with increasing interdependence between groups in an organization. Greater uncertainty creates a greater need for better information flow and communication. The effect of inter-unit relations on information processing requirements is shown in Figure 6. [Ref. 35:p. 5]

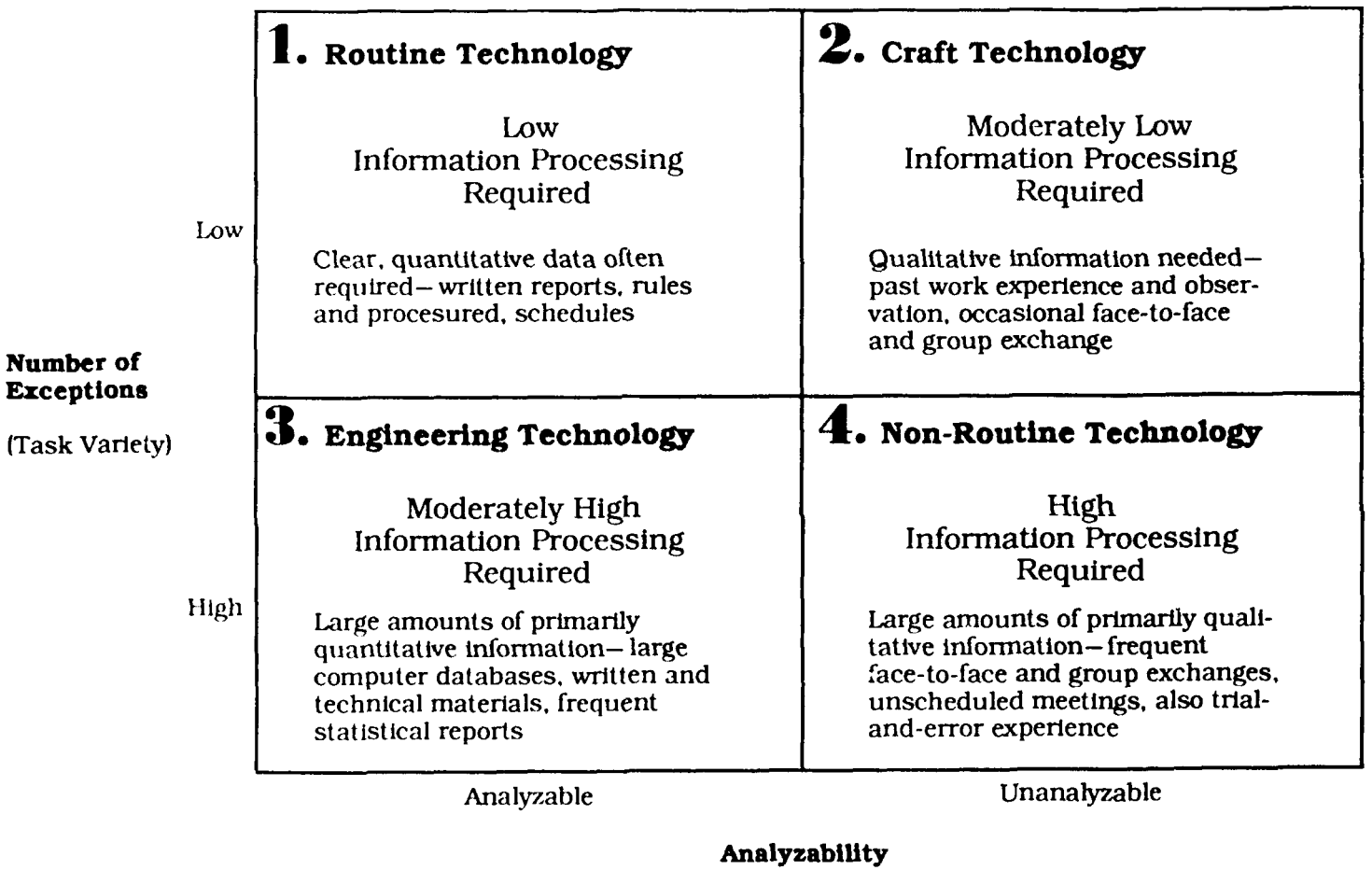

Figure 5. **Technology**

Inter-Unit Dependence

(The degree to which a unit is dependent on other units to perform its task)

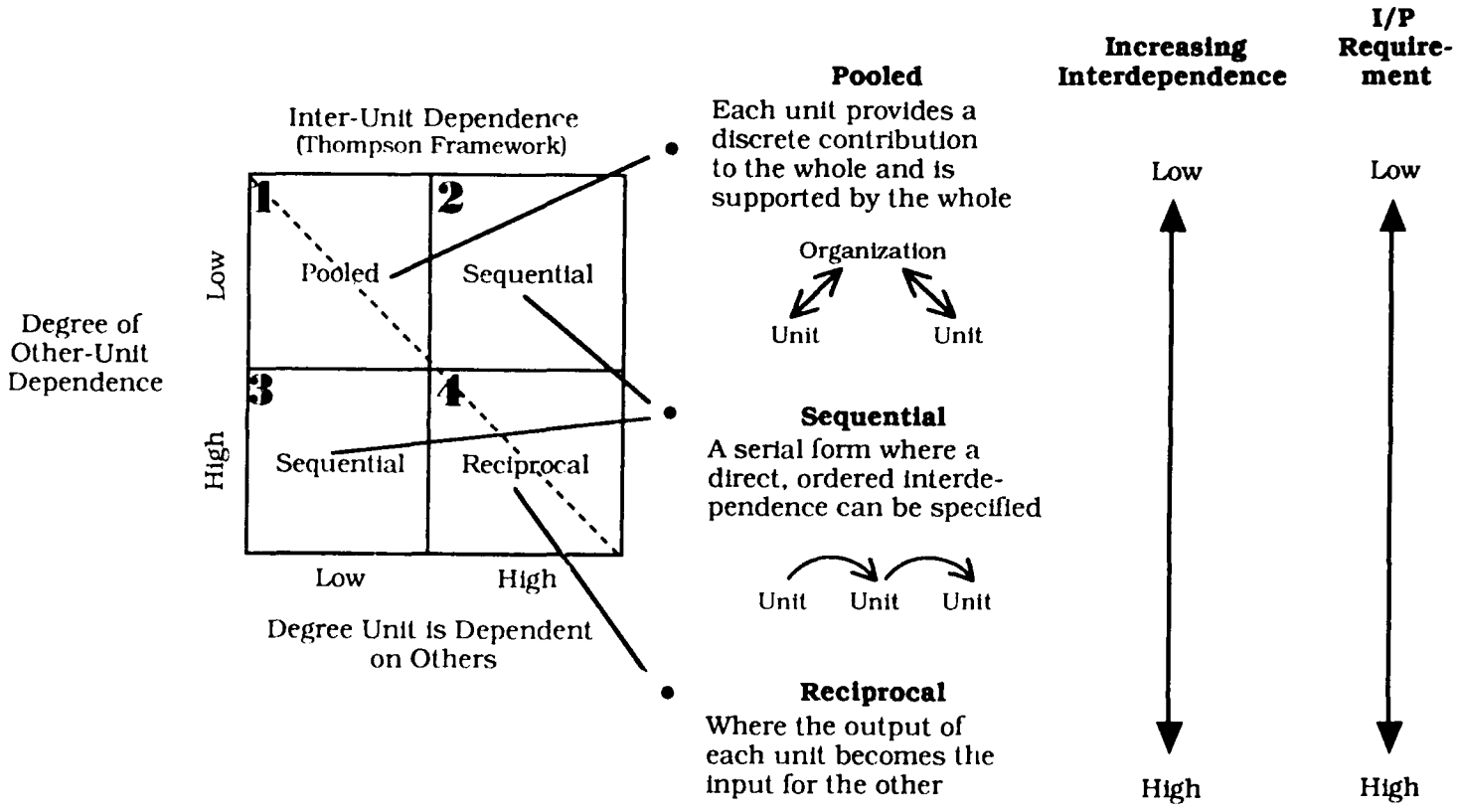

Figure 6. **Inter-Unit Dependence**

As shown in Figure 6, information-processing needs increase with interdependence, culminating in a reciprocal structure for an organization. Information-processing requirements are at a minimum in a pooled structure in which each subunit inputs directly into a central location. Information-processing demand increases in a sequential structure as more exchanges between subunits are needed. The sequential structure requires a serial flow of information. In reciprocal structures, it is necessary for subunits to exchange information to complete tasks. A subunit cannot start its task until another subunit completes a prerequisite task, placing a high requirement on effective information flow. [Ref. 35:p. 5]

3. Environmental Uncertainty

The uncertainty in the environment is a major influence on organizational information processing. One major factor which contributes to the environment's effect on an organization is the environmental complexity. If the relationship between what happened in an event and what caused the event to happen is subject to multiple interpretations, the need for information processing is high. The second environmental factor which influences organization information processing is the amount of change in the environment. A dynamic environment will cause more uncertainty, whereas a static environment can be very predictable and certain. Figure 7 represents the relationships of the environmental characteristics and the influence on information processing. [Ref. 35:p. 4]

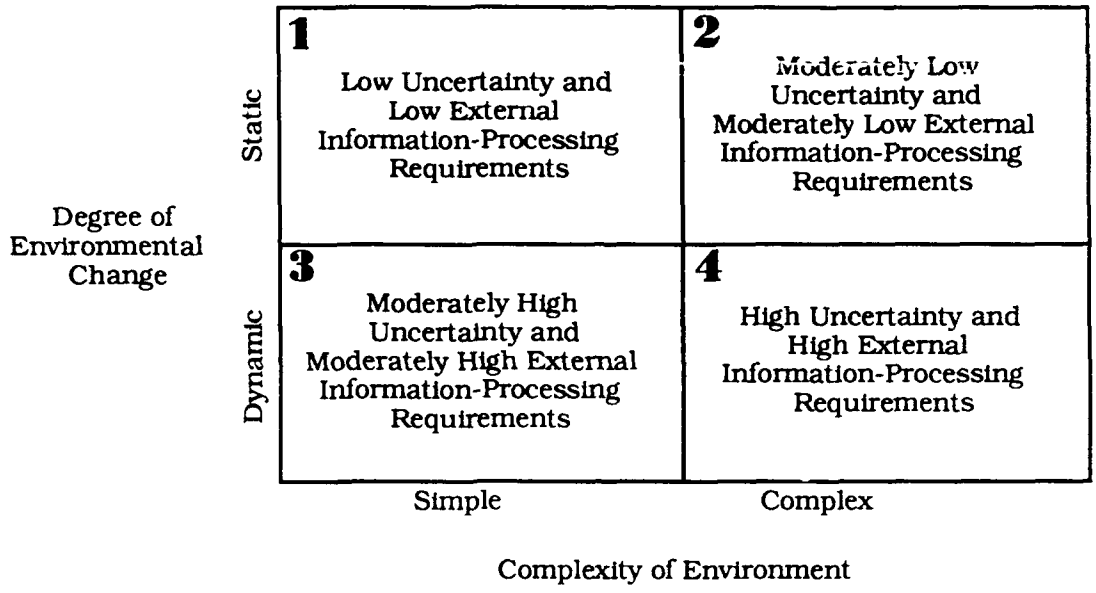

Figure 7. **Perceived Environmental Uncertainty**

Information-processing requirements in an organization increase as the uncertainty in the environment increases. A static, simple environment causes few information-processing requirements. Uncertainty will increase in a dynamic, complex environment, demanding more information processing. [Ref. 35:p. 4]

The situational factors of technology, inter-unit dependence, and environment have a combined effect on uncertainty in an organization. This combined uncertainty creates the amount of information processing required. The requirements compared against the organizational capabilities can form a model of information processing.

E. INFORMATION-PROCESSING MODEL

The effectiveness of an organization can be examined in an information-processing model in Figure 8. [Ref. 35:p. 8] On the left-hand side of Figure 8, the three situational frameworks are combined to show the information-processing requirements of an organization. On the right-hand side of the figure, the integrating mechanisms and the unit structure are combined to show what the organization can process. When the requirements are compared to the capabilities, the amount of difference between them is indicative of the effectiveness of the organization. A match between requirements and capabilities means the organization is properly designed for its mission.

The information-processing model is commonly applied to civilian organizations [Ref. 33:pp. 567-568]. This model can easily be used to design an appropriate structure for a military organization. Evaluating current organizations and their procedures against the model will provide a measure of each organization's effectiveness.

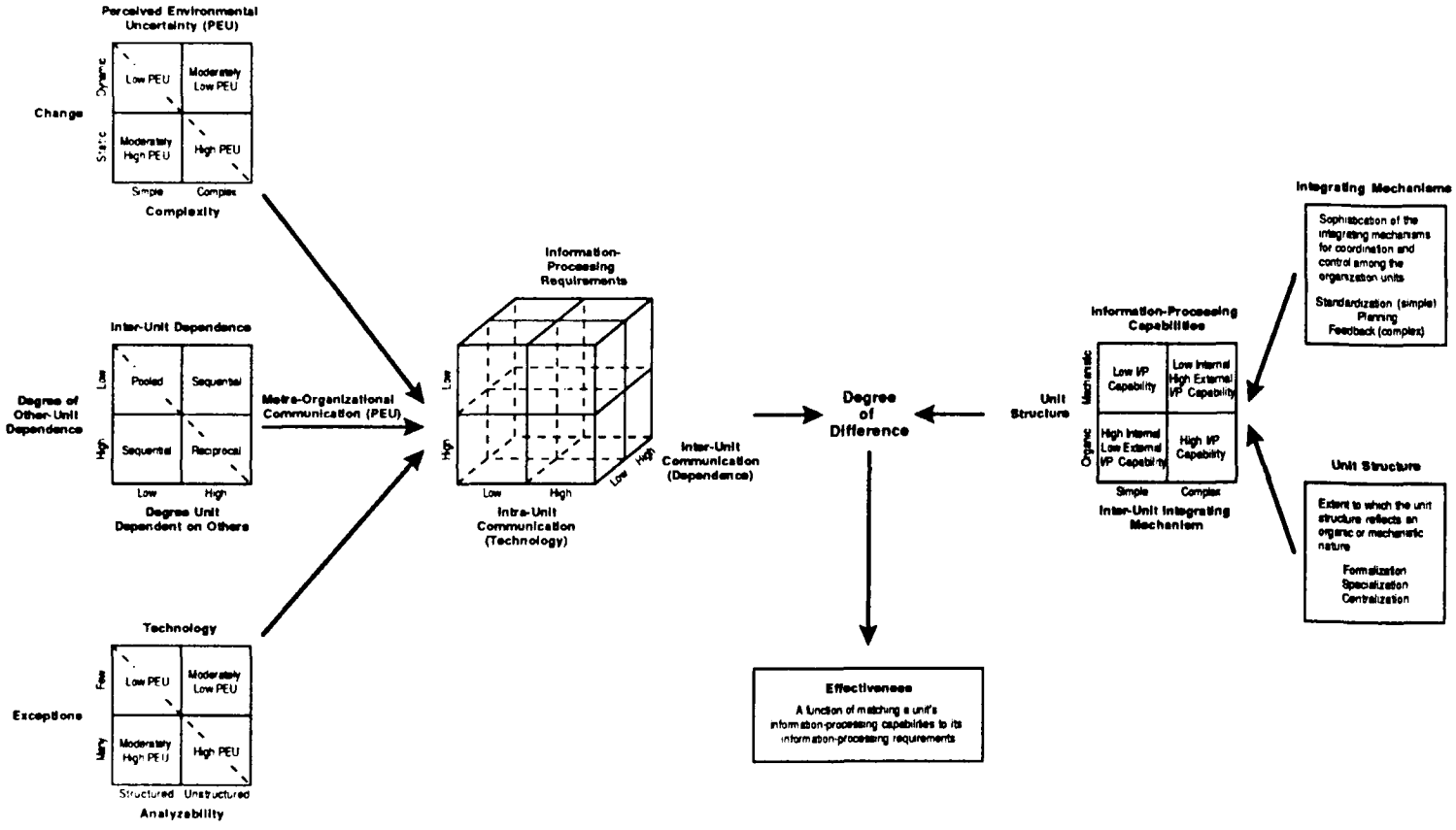

Figure 8. **Information-Processing Model**

VI. SITUATION ASSESSMENT FRAMEWORK

The estimate of the situation is a procedure staffs use to develop a plan with available information. Information is processed by staff members to plan a response to their environment. As the information-processing capabilities of the staff approach a match of the information-processing requirements, the effectiveness of the staff can increase.

A. INFORMATION-PROCESSING REQUIREMENTS

The information-processing requirements of a staff include the following: the mission, facts about the environment, friendly and enemy situation, assumptions about the environment and the friendly and enemy situation, and development and analysis of possible courses of action [Ref. 9:p. 1-4]. The amount of uncertainty in each of the requirements can vary depending on the particular situation. An effective staff will thoroughly process information for each of the requirements.

1. Mission

The mission of a unit is either assigned or determined from current operations [Ref. 9:p. 2-1]. In either case, mission analysis is done by the staff. Each staff section determines the tasks which must be completed and the assets available for use in a response. Once the staff understands what it must do, the staff sections analyze the current situation.

2. Facts

The facts of the current situation are used to develop a plan. The various staff sections gather information appropriate to their functional area. The information can fall into any of the categories listed in Table 2. [Ref. 9:p. 3-1]

TABLE 2

FACTS FOR ESTIMATE OF THE SITUATION

- Terrain/Weather
- Known Enemy Information
- Time
- Status of Own Forces/Known Friendly Information

The intelligence staff prepares information about terrain, weather, and known enemy information. Known information is data collected and determined to be correct. All the staff sections input information about time required and current friendly forces. The facts are assembled in the proper section of each different staff section's estimates. [Ref. 9:p. 3-1]

3. Assumptions

For information which is needed but not available, assumptions are made. Assumptions may also be made to account for facts that can change based on the time between mission preparation and execution. Assumptions come from the categories listed in Table 3. [Ref. 9:p. 3-3]

TABLE 3

ASSUMPTIONS FOR ESTIMATE OF THE SITUATION

- Terrain/Weather
- Enemy Forces (Templating)
- Enemy Courses of Action
- Friendly Unit Status
- Time

The intelligence section plays the primary role in developing assumptions. The assumptions regarding terrain, weather, enemy forces, and courses of action are the responsibility of the intelligence staff. As with the facts, friendly unit status and time required is input from each staff section. [Ref. 9:p. 3-3]

4. Development of Courses of Action

Once all the facts are assembled and necessary assumptions made, the development of courses of action begins. As taught at the Army Command and General Staff School (Fort Leavenworth, Kansas), several feasible courses of action are developed for each possible enemy course of action [Ref. 9:p. 3-5]. However, as discussed in Chapter II, the requirement for multiple courses of action is frequently ignored. The steps taken to develop a course of action are shown in Table 4. [Ref. 9:p. 3-5]

The development of courses of action is primarily the responsibility of the operations section, although the facts and assumptions from

TABLE 4

COURSE-OF-ACTION DEVELOPMENT

- Analyze Relative Combat Power
- Array Initial Forces
- Develop the Scheme of Maneuver
- Determine Command and Control Means and Maneuver Control Measures
- Prepare Course-of-Action Statements and Sketches

the other sections are used. The operations staff conducts a comparison of friendly and enemy force strengths and weaknesses. By comparing the forces, the operations staff can then develop feasible courses of action. The staff makes a tentative plan with sketches and mission statements for each course of action. The tentative plans are then analyzed and the best course of action for the given mission and resources is determined. [Ref. 9:p. 3-5]

5. Analysis of Courses of Action

The courses of action that the staff has developed are analyzed to determine which is the best for the commander to use in accomplishing the mission. Different methods can be used to conduct the analysis, just as different mental strategies can be used by an individual decision maker to make decisions. The most accepted method to use when analyzing each course of action is war-gaming.

The steps to follow when war-gaming are listed in Table 5. [Ref. 9:p. 4-1].

TABLE 5

ANALYSIS OF COURSES OF ACTION

- War-Game Courses of Action
- Compare War Game Results
- Develop Branches/Sequels for Each Course of Action

War-gaming is similar to the cognitive strategy of mental simulation (discussed in Chapter III). In war-gaming, the known and assumed information gathered by the staff is used to prepare a possible scenario. The possible outcome for each course of action is then determined by stepping through the likely events. The course of action producing the most favorable outcome is chosen and the corresponding plan implemented.

When conducting the estimate of the situation, the staff uses decision-making strategies to develop the best plan based on known or assumed information. The information-processing requirements for an estimate are determined by the uncertainty of a situation. Uncertainty is the basis for the situational frameworks.

B. INFORMATION-PROCESSING FRAMEWORKS

The information needed by the staff can be compared with the information-processing frameworks developed in Chapter V. Each of the situational factors (technology, inter-unit dependence, and the environment) may vary from one circumstance to another. Many situations may not fit exactly into in any one category, having attributes from each block

of a framework. The common trends for situations are useful as a basis from which to examine the required information.

1. Technology

The technology used by a staff has traits of each of the four blocks in the technology framework shown in Figure 5. In examining the technology used, it is important to focus on the functions of the staff rather than the unit as a whole. The staff's tasks have a large amount of variety, considering the many different types of combat operations they may face. Specific tasks of individual staff officers (e.g., determining the number of personnel) are easily analyzed but the general tasks of the staff are not. Analyzing the proper development of a course of action is not a simple matter. The steps are listed above, but developing the output for each step takes skill and experience. The tendency in the staff estimate is for technology to remain in block 4 of Figure 5 and produce a need for a high level of information processing.

If technology is in the non-routine block, certain methods of information processing work better than others. The information will be qualitative instead of quantitative. Face-to-face exchanges are a prime means of information transfer. An example of a face-to-face exchange is a commander meeting with his staff to develop and then analyze courses of action.

In situations where the task variety is reduced, other methods of processing information may work effectively. Task variety is the frequency of unexpected events. Task variety can be reduced by the experience or skill of the decision maker. If events are expected because of

experience or foresight, variety is reduced. With a lower level of task variety, information processing moves toward block 2 of Figure 5, craft technology. Craft technology also calls for more qualitative information and relies on past work experience to solve problems. A low-task-variety situation is one in which recognitional decision making (discussed in Chapter III) is very applicable.

2. Inter-Unit Dependence

The inter-unit dependence of the staff is frequently in the reciprocal form shown in block 4 of Figure 6. The output of each staff section is input into another staff section's estimate. Reciprocal dependence creates a need for a high amount of information processing.

A highly trained staff can reduce information processing requirements arising from inter-unit dependence. A sequential form of dependence can be developed if each member of the staff completes his or her part of the estimate in a specified order and time. Training to sequence the order can reduce information-processing requirements and increase effectiveness.

3. Environment

The environmental cell position will vary with the situation. The complexity of the environment can vary from simple to complex, and the degree of change can vary from static to dynamic. In an area with a fluctuating political situation, environmental change is dynamic. In this situation, the environment will probably be complex. As events approach high uncertainty in block 4 of Figure 7, more information processing is needed. To develop a plan in an uncertain environment, the use of the

estimate of the situation procedure (analyzing multiple courses of action for each potential enemy action) may produce more effective results than a recognitional approach.

An environment may be very static and simple, making information-processing requirements relatively few. The experience of the commander and staff play a large role in deciding a course of action. Recognitional decision making may work well in a static, simple environment.

The various situational factors drive the number of requirements for information processing. Fewer requirements may allow a decision-making strategy which calls for a less-structured process. A greater amount of information-processing requirements needs a more attentive course-of-action development and analysis. The ability of the staff to process the needed information determines the effectiveness of the staff, regardless of which method is used.

C. INFORMATION-PROCESSING CAPABILITIES

The information-processing capabilities of a staff will vary according to individual personalities. Individuals are members of a staff, and their abilities contribute to the effectiveness of the whole staff. The integrating mechanisms and the unit structure are what allow the individuals to interact successfully.

1. Unit Structure

The unit structure changes with different personalities and possibly with different situations. A staff which is more mechanistic in structure (shown in Figure 3) has less information-processing capability.

If the environment is very dynamic and complex, a mechanistic-structured staff may be forced to change more toward an organic structure. Changing the structure to organic allows more information to be processed.

2. Integrating Mechanisms

The integrating mechanisms of a staff are a component of the information-processing capabilities. A staff that operates simply using a set of rules or SOPs may have difficulty dealing with new problems because there may be no prescribed solution. A staff with the capability to handle feedback can learn and improve with new inputs. The greater the ability to use liaisons and feedback mechanisms, the greater is the staff's information-processing capability.

D. INFORMATION-PROCESSING FIT

The approach to information processing should fit the current situation. As depicted in Figure 8 in Chapter V, the three situational factors range from cell 1 to cell 4. If the situation fits in cell 1 (the northwest corner), the recognitional decision making method may fit best. If the situation fits in cell 4 (southeast corner), a more exacting procedure (such as the estimate of the situation) may improve effectiveness. Situations between the two extremes may need a hybrid method consisting of both the recognitional method and the estimate of the situation.

1. Northwest Corner

In the northwest corners (cells 1) of the situation frameworks, the three situational factors are in a position to require a small amount of information processing. The environment is in a simple, certain state,

creating little uncertainty. The inter-unit dependence approaches a pooled condition. Although staffs will likely remain in a sequential inter-unit dependence, the closer the inter-unit dependence is to the northwest corner, the lesser the amount of uncertainty present. In terms of technology, a low level of task variety and analyzability will have limited uncertainty. The low level of uncertainty in each of the factors will require little information processing.

A low level of required information processing will match a fit of a mechanistic unit structure and a simple inter-unit integrating mechanism in the northwest corner of the capabilities framework. The characteristics of recognitional decision making also fit into the northwest corner of the information-processing capabilities. A low level of information processing is needed because the staff and decision maker can recognize the situation and react.

The recognitional approach will likely fail if the situational factors all tend to the southeast corners of their frameworks.

2. Southeast Corner

In the southeast corner (cell 4) of each situational framework, a high level of information processing is needed to create a fit for the situational factors. A dynamic, complex environment has a great amount of uncertainty. A reciprocal inter-unit dependence creates a high level of internal uncertainty. A tendency to high task variety and unanalyzability causes much uncertainty. If all three situation factors are in the southeast corner, a high level of information processing is needed to eliminate the high level of uncertainty.

Better results can be achieved with a high level of uncertainty in situational factors, if a multiple course of action development and analysis is conducted. An organic structure and complex integrating mechanisms provide a staff with more information-processing capabilities. When followed, the estimate process forces a staff to consciously use more information than does the recognitional approach.

Many situations cause the situational factors to fall between the two extremes of the northwest corner and the southeast corner. The decision-making method may include portions from both the estimate of the situation and the recognitional approach. The abbreviated command estimate using the critical factors discussed in Chapter II may prove useful. An important determinant for the appropriate decision-making method is locating where the staff is positioned in relation to the situational factors.

3. Recognizing Situation Location

A staff can change its operating structure if the locations of the situation factors in their frameworks is recognized. Recognizing in what location each factor is may or may not be feasible. An inexperienced staff will likely need higher amounts of information because the environment appears dynamic and complex. Experience in a staff may allow a reduction of uncertainty and permit a staff to move to a recognitional approach. Determining when a move to recognitional decision is appropriate deserves careful consideration.

In summary, the information-processing framework can be described as a series of if-then statements. For example, if technology is

routine, and if inter-unit dependence approaches a pooled state, and if the perceived environmental uncertainty is low, then information-processing capabilities must be low to match (possibly recognition decision making). Alternatively, if technology is non-routine, and if inter-unit dependence is reciprocal, and if the perceived environmental uncertainty is high, then information-processing capabilities must be high to create a match (possibly estimate-of-the-situation format). All of the various combinations of situational factors can be mapped to appropriate information-processing capabilities states.

Fitting the decision-making process to the situation can produce a more effective output. The concept may be simple, but determining the position of all the situational factors may prove difficult. Any effort to evaluate the effectiveness of a staff should consider the fit of information-processing capabilities to information-processing requirements.

VII. EVALUATION OF DECISION MAKING

Evaluations of decision making take into consideration what makes effective staffs. Before establishing a method to evaluate a staff, effectiveness criteria are needed to form a common standard. The degree to which the goals or mission of a staff are achieved provides a measure of both unit and staff effectiveness. However, if effectiveness is based only on outcomes, there is a possibility that poor staff work can still produce good outcomes.

Outcome evaluation will not provide the needed evaluation of the staff process itself. To evaluate how effective a staff is, one must overcome the problem of quantifying qualitative skills. Skills such as developing courses of action are not easily evaluated in quantitative terms. The context or situation in which the staff operates is also difficult to quantify. Measures of performance needed for a staff evaluation are included in the Army Command and Control Evaluation System (ACCES).

A. ACCES

ACCES was developed by the Army Research Institute to evaluate Army division and corps headquarters. ACCES is a tailored version of the Headquarters Effectiveness Assessment Tool (HEAT). HEAT was developed by Alphatech Inc. under contract to the Defense Communication Agency. [Ref. 36:p. 8]

ACCES measures overall effectiveness and provides diagnostic scores for how well each process of the staff is performed. The processes

include monitoring, understanding the situation, estimating the situation, planning, coordinating, and the network configuration. Measures of performance, called part-task measures, capture the efforts of the staff for the processes. [Ref. 37:pp. 5-7]

An example of a part-task measure is "understanding quality." "Understanding quality" is defined as the number of situation perceptions held by a staff section—in effect the quality of understanding the situation. "Understanding quality" is scored as percentage correct, not incorrect, or incorrect. The measure of performance for the part-task is scored by periodically comparing the situation as perceived by the staff with the actual situation during an exercise. A list of part-task measures is shown in Table 6. [Ref. 37:p. 6]

By using part-task measures, specific problems with a staff are identified. The individual strengths and weaknesses of the staff are not lost in a consolidated assessment of unit headquarters' performance. ACCES considers specific tasks. To understand organizational performance in a situational perspective, the competing-values approach is used.

B. COMPETING VALUES

The competing-values approach to organizational effectiveness combines different values into a single model. Diverse indicators of performance are used by managers and researchers. The different "values" of the competing-values approach combine the diverse indicators to form a single model of effectiveness [Ref. 32:p. 106]. These values are further refined into perspectives for decision-making groups.

TABLE 6

PART-TASK PERFORMANCE MEASURES

Measure	Definition
Understanding Quality	The number of perceptions of the situation held by the staff section, scored as percentage correct, not incorrect, or incorrect.
Options	The number of alternative courses of action considered for the future most likely to occur.
Planners	The number of staff members participating in the development of alternative courses of action.
Queries Required	Was additional (or more complete, timely, or accurate) data required to complete the planning process?
Queries Accomplished	Was additional (or more complete, timely, or accurate) data requested?
Plan Time Less Than Understanding Time	Was the plan time less than the understanding time? Plan Time: Median time from the making of an estimate to the end of the time covered by the associated predictions of the intended futures. Understanding Time: Median time from the expression of an understanding to the end of the period which the understanding covers.
Option Rejection Commander	Was the recommended course of action rejected by the commander?
Option Rejection Other	Was the recommended course of action rejected by other than the commander?
Lead Time Adequacy	Was the planning lead time provided to subordinates adequate? Adequacy of lead time was defined by the command (twice the senior headquarters' planning time).

1. Empirical Perspective

The empirical perspective stresses the importance of facts in a decision-making process. Emphasis is on gathering all relevant information and creating a database. This perspective stresses the need for an accountable decision-making process which is thoroughly documented. [Ref. 38:p. 260]

2. Rational Perspective

The rational perspective maintains that logic is of prime importance in decision making. The decision-making process should directly flow from the objectives or goals of the organization. Decision-making methods should emphasize support of improving productivity. [Ref. 38:p. 260]

3. Political Perspective

The political perspective considers the power resources obtained with a decision. The important factors in a decision are not the results but rather what is achieved with the results. Decision making should be flexible and adaptable to insure decisions are accepted as legitimate by external parties. [Ref. 38:pp. 260-261]

4. Consensual Perspective

The consensual perspective recognizes as important the individual feelings and opinions of the individuals in a decision-making team. The best decision comes from the collective views of the members of the group. The internal support for the decision is expected to be high. [Ref. 38:p. 261]

5. Framework for Competing Values

A framework for the competing values approach to decision making is shown in Figure 9 [Ref. 38:p. 262]. The perspectives each have two criteria for evaluating decision processes. Each criterion is important in a decision-making process, but personal values and situations will compel emphasis of different perspectives. Both the political and rational

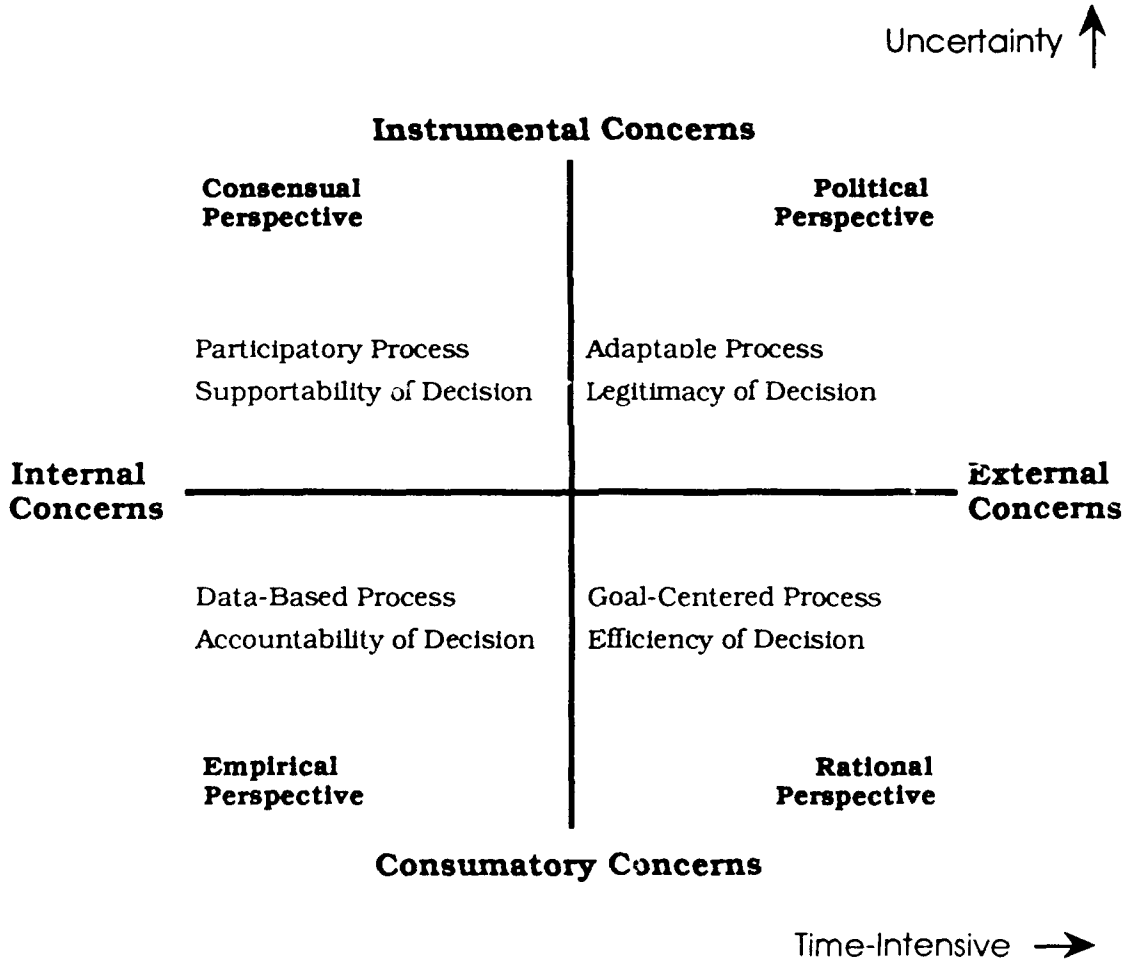

Figure 9. **Framework for the Competing-Values Approach to Decision-Making Effectiveness**

perspectives (right side) focus primarily on external concerns, with more emphasis on effect and speed and less emphasis on information. The consensual and empirical perspectives (left side) focus more on internal factors, which are concerned more with information use and the appropriateness of the decision-making method. The consensual and political perspectives (top half) favor flexible, intuitive, and implicit decision strategies. The empirical and rational perspectives (bottom half) favor regulated, analytical, and explicit decision making. [Ref. 38:p. 262]

Values are not the only factors in choosing a perspective. Time and uncertainty also contribute to perspective selection. Time-pressured situations will probably emphasize rational and political (right side) approaches. Flexibility and efficiency are stressed under time constraints. Situations without a time pressure can allow more concern for the participation and accountability found in the consensual and empirical perspectives. Situations with high uncertainty are more likely to de-emphasize the regulated, analytical methods and associate with the political and consensual perspectives (top half). The empirical and rational perspectives may be more applicable to situations with certainty. [Ref. 38:p. 262]

In the competing-values approach to evaluating decision making, different criteria are used to evaluate different environments. Values, time constraints, and uncertainty should all be considered in establishing an evaluation technique. The competing-values approach, combined with a method such as ACCES, may be useful in evaluating military staffs working in different situations.

C. EVALUATION OF SITUATION ESTIMATION

The evaluation of situation estimation should consider situational factors in addition to specific performance of a staff when completing a task. A staff with limited available time may not produce as thorough an estimate as a staff with unlimited time. Also, a situation with a high degree of uncertainty may call for the use of decision processes different from those used in a more certain environment.

1. Time

According to the competing-values framework, a time-intensive situation leads to the staff placing emphasis on the political and rational perspective in its decision processes [Ref. 38:p. 262]. If a staff follows one of these approaches, it are expected to base decisions on an adaptable process, decision legitimacy, unit goals, and decision efficiency. In other words, the plans should stress the following factors: (1) flexibility, (2) military doctrine, (3) commander's intent, and (4) simplicity. An evaluation of an unit with a time-pressured situation should concentrate on the four factors listed above. An evaluation technique (such as ACCES) could be tailored for an evaluation based on the time factor.

A situation without time pressure would more likely call for a group to use the consensual and empirical approaches. A data-based process, decision accountability, decision supportability, and a participatory process are the emphasized criteria [Ref. 38:p. 262]. In terms of actions a military staff would take in its decision-making process, the criteria include: (1) considering all available information (possibly seeking more information), (2) establishing a logical decision method, and (3)

thoroughly rehearsing plans with (4) all units involved. The rehearsals may vary from a simulation to an actual walk-through on the ground. The rehearsal would help validate the plan. An evaluation of a staff with no time constraints could be designed to emphasize the values of the consensual and empirical perspective.

The amount of time which is considered critical may depend on the level of the staff and its experience. Given the same amount of time from conception to execution of a mission, a staff nearer to the operating force may need less time than a higher-level staff. The higher-level staff has more units through which it must pass orders and it therefore consumes time in the process. A more experienced staff may be able to complete the same task more quickly than an inexperienced staff. The critical amount of time deserves special attention.

2. Uncertainty in the Environment

A highly uncertain environment may lead to an emphasis of the political and consensual perspectives in a group's decision-making process. Decision supportability, a participatory process, an adaptable process, and decision legitimacy are the criteria chosen [Ref. 38:p. 262]. The criteria in military terms are: (1) thorough rehearsals with (2) all units involved, (3) flexibility, and (4) adherence to military doctrine. An evaluation of a staff in an uncertain environment should concentrate on the criteria of the political and consensual perspectives.

A staff with a more-certain environment is more likely to use the empirical and rational perspectives in their decision-making process. The critical criteria are: a data-based process, decision accountability, unit

goals, and decision efficiency [Ref. 38:p. 262]. In military terms, the criteria include: (1) evaluating all available information, (2) strictly following the estimate-of-the-situation process, and emphasizing (3) commander's intent and (4) simplicity. The procedure used to evaluate a staff in a certain environment should consider the empirical and rational perspectives' criteria.

The level of uncertainty may be as difficult to determine as the amount of time which is critical. Experienced staffs may recognize effective decisions using little information because events are familiar to them. An evaluation of an experienced staff should measure uncertainty levels differently than an evaluation of a new staff. Measuring or quantifying uncertainty may prove difficult.

Evaluating a staff's estimate of the situation deserves thorough consideration. The environment and the staff's experience level can influence effectiveness. If the goal of the evaluation is to train staffs to become more effective, it is this author's opinion that the evaluation must consider all the situational factors (technology, environment, and inter-unit dependence).

VIII. CONCLUSION

Many factors contribute to effective situation assessment. Individual, group, and organizational decision making all play key roles in the decision-making process. The environment or situation in which an organization operates is also crucial to its decision-making process.

Individuals use various processes or strategies to make decisions. Recognitional decision making is one strategy used effectively by individuals. Other processes include mental simulation and analyzing problem-specific information. Analyzing problem-specific information is the technique used by military staffs in the estimate of the situation.

Groups can make decisions in a military organization. The commander's staff is such a group, and the staff has subgroups in its various sections. Groups can improve the process or impede effective decision making. The design of the group and the role of the group in an organization define the group's effectiveness.

Organizations can be described as information-processing systems. An organization will encounter uncertainty while making decisions. To help overcome uncertainty, an organization processes information about situational factors. Matching the unit structure and integrating mechanisms with the amount of uncertainty creates a fit which should increase effectiveness.

Situation estimation includes determining what the current situation is and deciding what response will achieve organizational goals.

Establishing the state of an organization calls for examining the factors of the situation. Situational factors with a high level of uncertainty require a high level of information-processing capability to maximize unit effectiveness.

The perceived environment, technology, and inter-unit dependence are the situational factors used to define the state of the situation. Different decision-making strategies are appropriate, depending on the state of the situation. A recognitional decision-making strategy may be most applicable when the situational factors tend to have a large amount of associated certainty. A more exacting procedure (such as the estimate of the situation) is most appropriate in a highly uncertain situation. A situation with an amount of uncertainty between the two extremes may call for an abbreviated estimate of the situation or a compromise between recognitional decision making and a complete estimate of the situation.

Information-processing capabilities include unit structure and integrating mechanisms. A unit structure can vary from mechanistic to organic. The mechanistic (or more rigid) structure has less information-processing capability than the organic. An organic structure allows more participation from members and thus has an increased information-processing capability. The unit integrating mechanisms vary from a simplistic standardization to the more complex feedback procedure. The feedback procedure involves more information processing.

The effectiveness of an organization can be determined by comparing its information-processing requirements and the information-processing capabilities. A match between requirements and capabilities implies the

organization is effective. As the requirements change, the organization must change its capabilities to met the new requirements.

An evaluation of situation assessment should consider the situational factors in which a unit operates. A unit with a time-constrained situation is not operating under the same conditions as a unit without time constraints. Different results from the two units are understandable. Similarly, the level of uncertainty varies the perspective of the unit. A unit operating in a highly uncertain environment should assess the situation differentiy than when operating a certain environment. Adjusting the evaluation to the situational factors can provide a more accurate assessment of the effectiveness of a staff. With the more accurate assessment, the staff can focus its training on overcoming the specific problems that have reduced its effectiveness.

The issues concerning situation estimation are not nearly resolved. Issues other than those addressed in this paper should be investigated in order to better understand of the estimate-of-the-situation process. A major concern is how to recognize the state of the situational factors. For example, at what perceived environmental uncertainty level is recognitional decision making appropriate? If a unit can readily determine the state of each situational factor, it can more readily adjust the unit structure and integrating mechanisms to compensate for the situational factor states.

A need exists for a headquarters evaluation which includes situational factors. A situational perspective on a staff's effort allows a better description of the staff's abilities. An accurate assessment of the staff's

abilities will help identify adjustments needed to improve the staff's effectiveness.

Improving performance and capabilities is a goal common in military units. Improving the ability of the staffs that make decisions about how to fight can result in a major improvement in military performance and capability. Studying the decision-making processes can lead to an increase in a military staff's effectiveness and, by extension, increase the effectiveness of the military.

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