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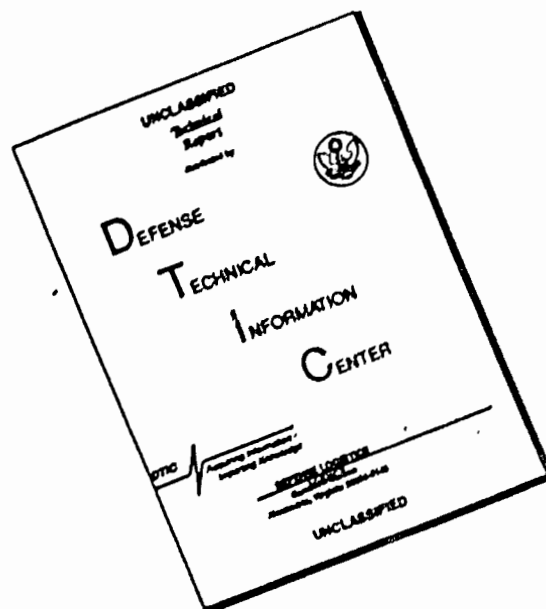
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A CONTINGENCY MODEL FOR THE
SELECTION OF DECISION STRATEGIES¹

Lee Roy Beach² and Terence R. Mitchell

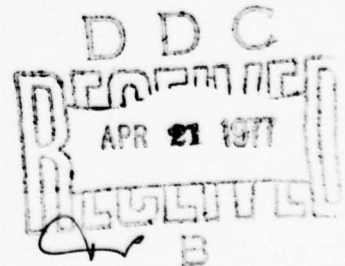
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^{cont.}
20. → promises the maximum net gain. The components of the model (repertoires, costs, benefits, etc.) are all viewed as contingent upon the characteristics of the individual decision maker and upon the characteristics of the decision task itself. A taxonomy of strategies also is presented.

19. Decision Problem Characteristics

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A Contingency Model for the Selection of Decision Strategies

People use a variety of strategies for making decisions. Sometimes these strategies resemble the optimal models from decision science but more often they do not. This fact has led some researchers to scorn human decision making, pointing out that people rather consistently make decisions in a suboptimal manner (e.g., Slovic, Fischhoff & Lichtenstein, 1976). A major result of this line of criticism has been an increase in research aimed at developing techniques (decision aids) to improve decision making effectiveness. While improved effectiveness is an important goal, we also must seek to understand human decision making as it is, not merely as it might be (Payne, 1973, 1976). The latter endeavor entails finding out why decisions are made in the ways they are and devising a framework that can accommodate the variety of strategies that introspection and observation suggest exists.

The purpose of this article is to describe a framework for examining people's selection of strategies for decision making. A decision strategy consists of (1) the set of procedures that the decision maker engages in when attempting to select among alternative courses of action and (2) a decision rule that dictates how the results of the engaged in procedures will be used to make the actual decision. For example, in the familiar Subjective Expected Utility strategy, the procedures are the computation of product sums of subjective probabilities and utilities for each alternative and the decision rule is maximization--selection of the alternative with the maximum product sum. Other strategies involve other procedures and decision rules.

The proposed framework is based on the assumption that strategy selection is contingent upon both the characteristics of the decision task and the characteristics of the decision maker. Models of this kind, called contingency models, began with Lewin's (1936) very general theory and in recent years have been developed for more limited areas such as organizational design (Woodward, 1965; Lawrence & Lorsch, 1969), participative management (Vroom & Yetton, 1973; Wood, 1973), small group behavior (Hackman & Morris, 1975) and leadership (Fiedler & Chemers, 1974; House & Mitchell, 1974). Empirical support for them has been impressive. Indeed, introduction of a contingency model sometimes has rekindled interest in areas that had become intellectually stagnant (e.g., leadership). However, with some limited exceptions (Payne, 1976; Nutt, 1976), such an approach has not been explored for decision psychology.

The development of a contingency model involves four steps which are jointly evolved as research progresses. First, the specific behavior of interest must be identified; the behavior must vary across people and across tasks, thereby implying that the characteristics of each may influence it. Second, a taxonomy of the task environment must be developed using those task characteristics that account for variance in the behavior of interest. Third, personal characteristics of the people who engage in the behavior must be identified; characteristics that account for variance in that behavior. Fourth, links must be devised to relate the task characteristics and the personal characteristics to the behavior of interest.

A Contingency Model of Decision Strategy Selection

Figure 1 represents the stages in decision making. In stage 1 the decision maker recognizes that a decision is required. In stage 2 the decision maker evaluates the demands of the decision task; evaluation is contingent upon both the characteristics of the task and the characteristics of the decision maker. In stage 3 a strategy is selected in light of how the decision task has been evaluated. In stage 4 the decision maker uses various heuristics (Kahneman & Tversky, 1972; Tversky & Kahneman, 1973, 1974) for predecision processing prior to implementing the strategy; predecision processing involves such things as information searches and evaluations, probability assessments and revisions, utility assessments, etc. Stage 5 involves the rather mechanical implementation of the strategy using the results of stage 4. Stage 6 is merely the result of strategy implementation in stage 5.

Insert Figure 1 about here

While all of the stages of this process are of potential interest, what follows is limited to stages 2 and 3. Our central interest is in the task and personal characteristics that cause the decision maker to select one kind of strategy rather than another. We will begin with an examination of some of the kinds of decision strategies that are potentially available to the decision maker. The important task and decision maker characteristics will be considered and finally, we will link these characteristics to strategy selection.

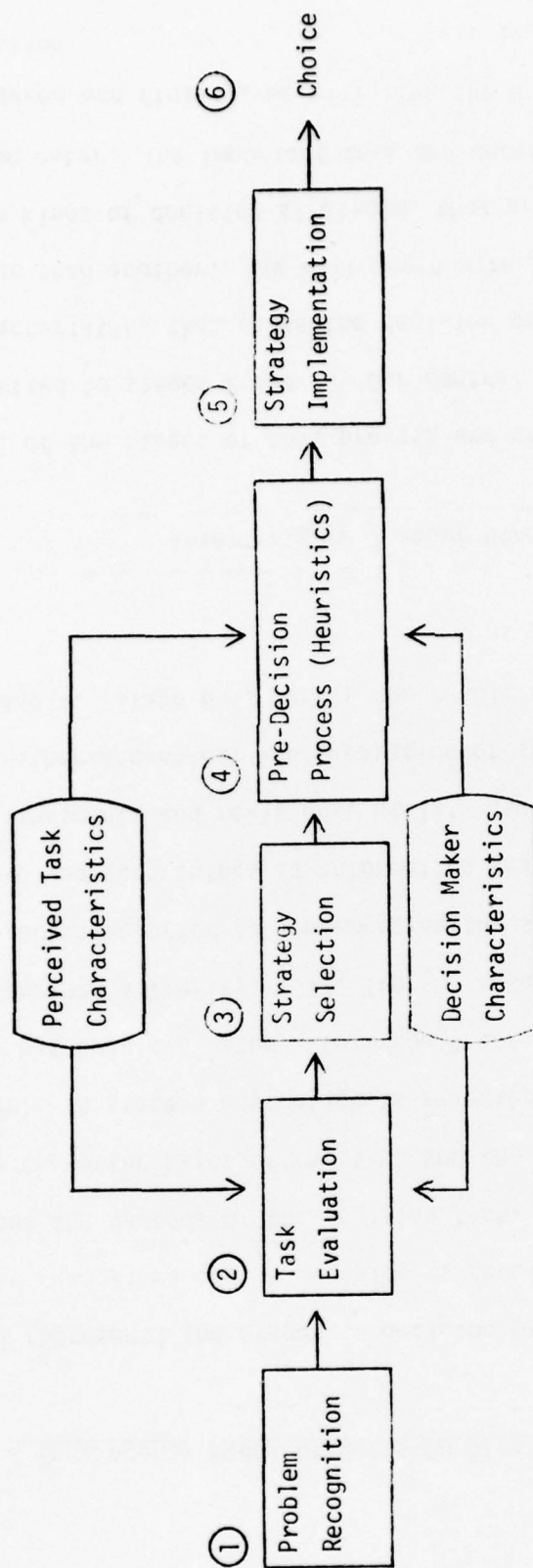


Figure 1: A diagram of the proposed model.

Decision Strategies

All of us possess repertoires of decision strategies; we have numerous ways to deal with decision problems even if they are not all equally effective. Moreover, there are characteristics that are shared by various strategies that, for the purposes of discussion, permit the division of them into categories and the ordering of them within those categories. In what follows we have chosen to use three categories: aided-analytic, unaided-analytic and nonanalytic. We will define each of these categories and give a few examples of their contents; the examples are not intended to constitute an exhaustive list, they serve merely as illustrations.

Aided-Analytic Strategies

This category contains strategies that require the decision maker to apply a prescribed procedure utilizing tools such as pencil and paper, mathematics, calculator or computer, etc., in a guided, systematic attempt to analyze the decision and evaluate its components. These strategies always require training or invention and frequently a technician is employed to help. Decision analysis (and the aid of a decision analyst) is in this category as are all normative decision models considered optimal in some sense or other in economics, statistics, operations analysis, etc. Moreover, this category contains many complex procedures that may or may not be optimal such as some that are used in siting of highways, power plants and the like (e.g., all sites that do not meet each of a set of specific criteria are eliminated and the cheapest of the remainder is selected) and similar large-scale institutional decisions. The latter are

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not necessarily optimal but they are formalized prescriptive approaches to immensely complicated and information laden decisions and are therefore within the definition of the aided-analytic category.

Some examples of rather complex decision strategies used in business environments might help. Brown, Kahr, and Peterson (1974) cite the example of DuPont having to decide on the amount of money to invest in a pilot production plant. Complex formulas were used to estimate uncertainties, the demand for the product, assessments of production costs and timing and the possible return on investment given various plant sizes and pricing policies. The same authors also describe a situation at General Electric in which all investment requests of more than \$500,000 must be supported by a complex probabilistic assessment of the rate of return and other key measures. A library of special decision analysis programs is available at General Electric to handle such problems.

Less grand, but still falling within the definition of the aided-analytic category are strategies involving the listing and evaluation of outcomes that could occur if each decision alternative were chosen. For example, the following strategy is currently being suggested to potential customers by a Seattle condominium firm: Customers are asked to rate, on a 1-5 scale, how important each of several categories of characteristics of condominiums are to them. Next they are encouraged to visit different condominiums (including the firm's, of course) and to evaluate each, on a 1-5 scale, in terms of the aforementioned categories of characteristics. Then for each condominium the evaluation ratings are to be multiplied by the importance ratings for each category and summed. The condominium with the highest sum is the recommended

purchase. This strategy is essentially maximization of weighted utilities. Of course, where appropriate, the same strategy also could incorporate subjective probability assessment.

The final example of a strategy in this category was best described by Benjamin Franklin in a letter to his grandnephew dated April 8, 1779:

"Follow your own Judgment. If you doubt, set down all the Reasons, pro and con, in opposite Columns on a Sheet of Paper, and when you have considered them two or three Days, perform an Operation similar to that in some questions of Algebra; observe what Reasons or Motives in each Column are equal in weight, one to one, one to two, two to three, or the like, and when you have struck out from both Sides all the Equalities, you will see in which Column remains the Ballance . . . This kind of Moral Algebra I have often practised in important and dubious Concerns, and tho' it cannot be mathematically exact, I have found it extreamly useful."

(Smyth, 1906, pp. 282-283, ital. Franklin's).³

While not quite as complicated as the condominium example, moral algebra still represents an aided-analytic decision strategy.

Unaided-Analytic Strategies

This category contains strategies for which an attempt is made to explore the dimensions of the problem but for which no tools are used and

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the decision maker restricts processing to the confines of his or her mind; these are the decision strategies that have been studied most by psychologists using the normative models from the aided-analytic category as comparison models.

Examples of fairly structured unaided-analytic strategies are the various approximations to SEU that decision makers perform entirely in their heads. In these strategies the decision maker attempts to think about the outcomes that could result from the available choices as well as the chances of those outcomes occurring and then chooses the alternative that seems in some rough way to offer the best potential. Grey (1975) found that third grade children's choices of arithmetic problems to solve appeared to be arrived at by this strategy and Tversky (1967), Shanteau and Anderson (1969), Shanteau (1974), Holmstrom and Beach (1973), Fiedler and Beach (1976), and many others have found that adults frequently use something quite like it too. Research stemming from expectancy models (Fishbein and Ajzen, 1975; Mitchell, 1974), which are similar in conception to the SEU model, reinforce the conclusion that people sometimes attempt strategies of this variety (e.g., Mitchell & Knudsen, 1973).

Most utility maximization strategies are compensatory in nature. That is, less of one aspect of an outcome can be compensated for by more of another aspect. This characteristic makes it quite cumbersome for the unaided decision maker because each outcome must be evaluated separately for each of its aspects and then the utility of each of those aspects must be summed to arrive at the outcome's overall utility. If many outcomes or aspects are

involved the task quickly exceeds the decision maker's information processing ability and a less taxing strategy must be sought.

One strategy that simplifies information processing without abandoning compensation is Tversky's (1969) additive difference model. Here the outcomes of two decision alternatives are compared on each of their common aspects, the differences between them are summed, and the alternative that dominates is the one selected. Payne (1976) suggests that for more than two alternatives the one preferred in the first pair can become the new standard for subsequent comparisons. This strategy simplifies the task by treating alternatives two at a time, eliminating one each time, and by reducing the comparisons on each to a sequence of single-datum differences instead of requiring retention of all of each outcome's utilities for final summation and comparison. It is a compensatory strategy in that a difference that favors one alternative can be compensated for by a difference that favors the other alternative.

The effort of information processing is reduced even more if the decision maker adopts a strategy that lacks compensation. One strategy of this kind is Simon's (1957) "satisficing" strategy: The decision maker selects the first decision alternative that exceeds some "minimum aspiration level." That is, this strategy's procedure consists of comparing the various aspects of outcomes to predetermined criteria rather than evaluating each of them, summing and then comparing the summaries; the decision rule is sufficiency rather than maximization. Related strategies have been proposed by Coombs (1964), Dawes (1964), and Einhorn (1970).

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Similar yet simpler noncompensatory strategies are the Elimination by Aspects strategy (Tversky, 1972) and the lexicographic strategy (Tversky, 1969). When using the former, the decision maker selects one aspect of the decision alternatives, eliminates all alternatives that do not possess that aspect, selects another aspect, eliminates alternatives, etc. until only one alternative remains. Tversky's formalization of this process assumes that aspects are randomly selected with a probability proportional to their importance, which seems to us more theoretically complex than necessary, but the basic notion probably describes many decisions. When using the lexicographic strategy the decision maker selects the most important aspect of the alternatives and eliminates all alternatives except the one that is superior to all the others on it; if none are superior on that aspect the decision maker drops it and moves to the next most important aspect, etc. These kinds of strategies have the advantage of reducing information processing by restricting attention to only part of the available information about the alternatives but they have the disadvantage of introducing possible irrationalities such as intransitivity of preference (Tversky, 1969).

Payne (1976) has examined some of the conditions that lead decision makers to shift from compensatory unaided-analytic strategies to noncompensatory ones. His task required participants to gather information in order to arrive at a preference among alternative apartments to rent. The results showed that as task complexity increased (i.e., as the number of decision alternatives and the amount of information about them increased) there was a shift from compensatory strategies to noncompensatory strategies that involved elimination of alternatives on the basis of a subset of the information. Moreover,

having eliminated some alternatives in this way, thus having reduced task complexity, some decision makers returned to a compensatory strategy to decide among the remaining alternatives. The importance of these findings to the present model will become apparent later.

Finally, the least formalized of the unaided-analytic strategies involves the construction of mental movies or "scripts" (Abelson, 1975) in which the decision maker imagines how things might be if this or that decision alternative were chosen and then picks the alternative for which the script turns out best. The scripts can be simple and sketchy or elaborate and detailed but the principle is the same for all of them--imagine how things would be if x or y or z were the chosen alternative and choose the one for which the imagined result is best.

Nonanalytic Strategies

This category contains fairly simple, preformulated rules that are rotely applied to decision tasks. They differ from aided- and unaided-analytic strategies in that little information is procured or processed, little time is needed, and the rules do not require that the decision be decomposed nor that its multiple aspects be considered. Examples are "Eeny, meeny, miney, mo . . . ," flipping a coin, or basing action selection such as whether to go sailing or not on "Red sky at night--sailors delight; red sky in the morning--sailors take warning." Such homiletic rules frequently are heard in organizational settings. "Better safe than sorry" or "A bird in the hand is worth two in the bush" both represent conservative strategies in contrast to the riskier strategy of "Nothing ventured, nothing gained." Of course, there is the difficulty that these rules often are quoted as

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rationalizations for decisions based on other strategies, particularly when the decision maker does not recognize or does not wish to defend his or her actual strategy. But, quite frequently simple rules do serve as decision strategies, especially when they apply to specific tasks. That is, many rules are acquired to deal with specific tasks through experience, training, or instruction. Familiar examples of the latter are the lists of helpful hints included in the instruction booklets that accompany appliances, tools, cameras or the like, or the "tips to homemakers" columns in newspapers.

More idiosyncratic rules might be such things as alternating between wearing a blue suit and brown suit from one day to the next or always going to the restaurant that one has least recently visited. Not having the same kind of meat for dinner as one had for lunch is another example.

Other nonanalytic strategies involve compliance with convention. This may be conscious (explicit) or unconscious (implicit), we each know the rules of our culture and subculture but we do not always know that we know them even though we may abide by them (Hall, 1969). Thus, for example, we may consciously elect to comply with the new conventions of word use and refer to people as "chairpersons" and we may unconsciously comply with the culture's convention of leaving a stool between ourselves and the next person at a cafe counter or maintaining rather specific speaking distances between ourselves and others of different social status or sex.

Finally, the most nonanalytic strategy of all is habit. Habit is not to be scorned merely because it is the extreme example of rote application of a rule. After all, it is efficient and it possibly may be the product of an earlier, more reasoned strategy and has become mechanical in order to realize

the economy of not having to go through the whole strategy selection process each time the decision task is encountered. Because the majority of decisions are mundane and made repeatedly, habit is a valuable strategy. Moreover, neither habit nor any of the nonanalytic strategies are completely without analytic qualities--some analysis is necessary if the decision maker is to recognize that the present decision task is sufficiently similar to previous ones for which the rule has been successful enough to warrant using it again. This is why habit and the other nonanalytic strategies are true strategies and not just decision rules; they require at least a little processing prior to actually making the decision.

In spite of the fact that we disclaimed exhaustivity in our list of examples we should point out that we have omitted what many would regard as a classic decision strategy, intuition. At first glance intuition appears to be a nonanalytic strategy that does not seem to fit the definition of that category--the rote application of simple rules. However, intuition is not particularly simple. It has distinct emotional components and it often involves very analytic processes, e.g., decisions about how to approach highly complicated mathematical proofs have been attributed to intuition as have multifaceted decisions that have influenced the entire course of the decision maker's life (Westcott, 1968). So, because no one seems to know much about intuition, we elect to assume that it is merely the unconscious application of either nonanalytic or unaided-analytic strategies. Perhaps dissatisfaction with this assumption will spur research on the role of intuition in decision making.

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Differences and Similarities

The major difference among these three categories is in the differing degrees of analysis that their constituent strategies require, and, as a result, the amount of required resources (time, effort and/or money). Aided-analytic strategies use formal procedures to lay out the problem and to decompose it into subparts for subanalyses. They often require extensive information procurement, they rely on application of often complex logical procedures, usually mathematics, to decompose the problem and to recombine it again and to provide summary statements to which a decision rule can be applied in some precise manner. All of this is done using tools and at a cost.

Unaided-analytic strategies require attempts to at least consider the different components of the decision problem. However, in part because no tools are used, the degree to which this is done systematically and thoroughly is dictated solely by the abilities and desires of the decision maker: The limits of unaided human information processing preclude complicated problems or procedures and even simpler ones require sustained hard work. Interestingly, the strategy of using scripts as a basis for decisions may be the most information-rich procedure in this category because it frequently uses both auditory and visual imagery. But, even though they are easy to use, scripts seldom are systematically composed and they run the danger of biased selection of information for inclusion (wishful thinking or "catastrophizing") thus emphasizing the trade-off between ease of use and general accuracy.

Nonanalytic strategies require very little analysis short of mere verification that the rule is applicable to the decision task at hand. How similar or dissimilar the present task has to be to past tasks before a rule is tried has been studied as transfer of training and stimulus generalization by learning psychologists. Nonanalytic strategies are quick and require little in the way of resource expenditure although the behavioral alternative decided upon may itself be quite complicated.

There are some similarities among the three categories but they are fewer than the differences. First, the strategies in all three have decision rules. This is not merely because strategies are defined that way but because no decision is possible without a decision rule. Second, all three categories involve pre-decision procedures; aided-analytic strategies tend to involve a lot and nonanalytic strategies tend to involve relatively little.

A third similarity is that within each category the strategies can be ordered from what, for want of better terms, we shall call formal to informal. That is, in the aided-analytic category strategies range from full blown decision analysis through strategies like the "condominium" evaluation scheme to "moral algebra." In the unaided-analytic category they range from approximations to subjective expected utility maximization through noncompensatory alternative-eliminating strategies to the production of mental scripts. In the nonanalytic category they range from rule-of-thumb through adherence to convention to simple habit. Within each category this range of strategies reflects differences in the amount of resources required to use them; the resource requirements generally decrease both as one goes from the aided-analytic to the unaided-analytic to the nonanalytic categories and as one

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goes from the formal to informal strategies.

So far we have suggested there are three broad categories of decision strategies (Aided-analytic, unaided-analytic, and nonanalytic). Use of the strategies require some predecision procedures and the use of a decision rule. Within the three categories the strategies may vary from formal to informal. However, across the categories there are some major differences in the degree of analysis and personal resources required to solve the problems. The question arises as to why one would choose to do more analysis and invest more time and energy. The answer lies in the characteristics of the task and the characteristics of the decision maker.

Characteristics of the Decision Task

Because strategy selection is a subjective process the influence of task characteristics on it is mediated by the decision maker's perception of those characteristics. Therefore, it is not possible to entirely disentangle task characteristics and decision maker characteristics. However, it is possible to separate them conceptually by defining task characteristics as the decision maker's interpretations of the demands and constraints of the specific task at hand and by defining decision maker characteristics as enduring aspects of the decision maker that are not task specific. Task characteristics can be further divided into two groups: those that are inherent in the decision problem itself (e.g., the number of possible alternative courses of action that must be considered) and those that describe the

decision environment (e.g., the significance of the decision). Both contribute to strategy selection.

The Decision Problem

While the number of characteristics that might differentiate specific decision problems is no doubt greater than we presently envisage, we can at least sort out some general ones that are likely to prove important.

Unfamiliarity: The degree to which the decision problem is foreign to the decision maker. Past experience with the same or similar problems can, on the one hand, provide either a specific strategy that has been used successfully before, or, on the other hand, it can rule out unsuccessful strategies. Lack of such experience means that the decision maker must be more careful in approaching the problem.

Ambiguity: The degree to which the problem is unclear to the decision maker. This includes the ambiguity of the goals, decision alternatives, constraints, etc. as well as the unavailability, unreliability, and imprecision of relevant information.

Complexity: The number of different components of the decision problem: the number of alternatives to be considered and the amount of relevant information to be considered (recall the above discussion of Payne, 1976) as well as the number of criteria on which the decision will be judged, etc. Also included in complexity is the degree to which the problem will influence future decisions; if one must choose the best alternative early on and also anticipate the consequences of these decisions on later events, the situation is clearly complex.

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Instability: The degree to which the criteria, goals and constraints of the problem change during and after the decision, particularly if those changes are difficult to predict.

The Decision Environment

Besides the specifics inherent in the decision problem there are also more general, situational, factors that influence the selection of a strategy:

Irreversibility: Most decisions are not all-or-none; the decision maker can make the decision, monitor its effects, and reverse the decision if things go poorly. But when this cannot be done, irreversibility increases the stress of making the decision by increasing pressure to be correct or having to live with the negative consequences. Some decisions are a mixture of reversibility and irreversibility: Once selected the alternative must be retained for some period of time before the decision can be reversed. The decision to join the army (or enter into any contract) is reversible at the end of the enlistment period but no matter how unpleasant the army turns out to be the decision maker usually must endure it until that period is over. These limited-reversibility decision tasks become more like irreversible tasks as the contract time increases.

Significance: The significance of the problem is determined by both the magnitudes of the outcomes involved and the breadth of the decision's ramifications for other parts of the decision maker's life, e.g., making a correct decision may be important in and of itself plus it may influence future promotions, self-esteem, etc.

Accountability: This is the degree to which the decision maker is to be accountable for the results of the decision. One kind of accountability is personally imposed and results from personal involvement with the decision and the outcomes related to it. Another kind is externally imposed and results from being accountable to others for the decision's results rather than for the quality of the procedure used to make the decision. Most frequently, the latter is associated with institutional settings although when profit or honor for the decision maker are contingent on the decision, institutional decisions also may involve a degree of personally imposed responsibility in addition to that imposed by accountability. High accountability increases the pressure to be correct.

Time and/or Money Constraints: Sometimes decision tasks allow ample time for deliberation and processing but more often there are deadlines. There are few opportunities that do not expire, few decisions that must not be resolved before things can progress, few other persons willing to tolerate prolonged indecisiveness. When such constraints are mild the other characteristics of the decision problem and the decision maker are free to determine the kind of strategy that will be used. But when time is limited an upper limit is placed on the resources that can be expended and therefore some strategies are eliminated from consideration. By the same token if there are limits on the money one is permitted to spend on information procurement and/or decision technology some strategies cannot be used.

CHARACTERISTICS OF THE DECISION MAKER

While the list certainly is not exhaustive, it seems to us that the following personal characteristics probably influence strategy selection. Note

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that we have omitted most of the "personality" variables that might be expected to be included (e.g., risk-taking and risk-aversion). This is because few solid data exist that reliably relate personality characteristics to specific decision strategies.

Knowledge: Probably the greatest influence on strategy selection is the decision maker's knowledge, or lack of it about the available strategies and their relative promise of success. Usually, aided-analytic strategies are only available through training; most of the other strategies are developed in the course of experience, which also is a source of knowledge.

With knowledge about the existence of strategies comes opinions about their appropriateness and their relative likelihoods of yielding a "correct" decision. It must be remembered that only decision scientists focus on making decisions correctly rather than on making correct decisions; most people would find little consolation in knowing that they followed the right procedure, gambled, and lost.

In general people in our culture regard the more formally analytic strategies as the ones most likely to yield correct decisions even if they seldom or never use them--the explicitness and prescriptive authoritativeness of such strategies make them defensible and give the impression of thoroughness and logical rigor. Of course, this faith is misplaced if the wrong strategy is applied to the problem, but the point here is the decision maker's perception

Ability: Knowledge of and faith in strategies is fundamental but the ability to exercise that knowledge is quite as important. For someone who lacks the ability the time and effort that must be expended in use of a particular strategy is much more than it is for someone who has the ability. In

short, the less able person must devote more of his or her personal resources of time and effort to using strategies and therefore can be expected to be less willing to select strategies with high personal resource requirements.

Three things that appear to be determinants of ability to utilize strategies with more or less personal resource expenditure are intelligence, cognitive complexity, and characteristic ways of approaching problem solving.

Intelligence is important because many strategies, especially the aided-analytic ones, require the capability of performing the operations that comprise them and these operations can be quite demanding. The same is true, of course, for some of the more formal strategies in the unaided-analytic and nonanalytic categories.

When presented with information some people appear particularly prone to break it down into small categories (differentiation) and to reassemble it into large wholes (integration); these people are called cognitively complex (Harvey, Hunt & Schroder, 1961; Schroder, Driver & Streufert, 1967; Driver & Streufert, 1969). Research suggests that the thinking of people who are not cognitively complex tends to be categorical and stereotypic, that they minimize internal conflict by using only a few principles to cover a wide range of phenomena, that they spend little time processing information and do it in simple ways, and that they consider few alternatives and acquire little information (Driver & Streufert, 1969). This would suggest that such people would tend, in general, to favor simple, easy decision strategies.

The third thing is the decision maker's characteristic approach to problem solving. Some subgroups in our culture value systematic, analytic thinking and foster it, while others value wholistic, global thinking and foster it. This social influence may be in addition to physiological

influences; there is evidence that the two hemispheres of the brain process information differently (one in a more global manner and the other more analytically) and that these differences might be reflected in individual differences in characteristic style of thinking (Ornstein, 1972). Whatever the reason, many people tend to think more readily in terms of patterns, wholistic structures, relationships and visual, pictorial schema than in verbal, mathematical, linear-sequential terms, while other people tend to do the reverse. Nonanalytic strategies and the less formal unaided-analytic strategies rely on the former way of thinking and the more formal unaided-analytic and the aided-analytic strategies require the latter, and, as a result, individual differences in strategy utilization are to be expected.

Motivation: Whatever their intelligence, cognitive complexity, or characteristic approach to problems we think that when making decisions people strive to expend the least personal resources compatible with the demands of the decision task. It is not merely that they are lazy: often there are other demands, sometimes there is a personal need to appear resolute and decisive, and often there is a tendency to avoid the emotional aspects of prolonged deliberation--what William James (1890) called "the impatience of the deliberative state." Of course, countering impetuosity is what James called "the dread of the irrevocable" (irreversibility), but unless the latter is fairly strong, the press to decide, get the matter settled and cease working on it often is a powerful motivator for selecting the fastest and easiest strategies within reason. This motivation serves as the mechanism for linking the parts of the model we have described thus far.

Linking the Parts

Table 1 contains a list of the variables that have been considered thusfar. The behavior of interest is the selection of different decision strategies which is seen as being contingent upon the characteristics of the decision problem and of the decision maker. Given this motivation to choose the strategy which requires the least investment for a satisfactory solution, different strategies will be chosen depending upon the type of problem, the surrounding environment and the personal qualities of the decision maker. The next step is to link these parts.

Insert Table 1 about here

The Decision Task. To facilitate discussion we are going to impose some oversimplifications: First, we will deal with the characteristics of the decision task only in terms of the extreme conditions (e.g., high in ambiguity, complexity, instability, and unfamiliarity or low on these dimensions). Second, we will assume that there always is ample time and money to execute whatever strategy the decision maker would prefer to use. Third, we will assume that the relationship between the felt pressure to use a more analytic technique and the task or personal characteristics is positive and linear. Increased task demands, situational demands or knowledge and ability should increase the pressure to use analytic procedures.⁴ We will discuss some of these points more thoroughly after the following examples.

Table 1
Variables Comprising the Model

The Variety of Decision Strategies	Task Characteristics	Decision Maker Characteristics
1 - Aided-Analytic	1 - Decision Problem Characteristics	1 - Knowledge
2 - Unaided-Analytic	A - Unfamiliarity	2 - Ability
3 - Nonanalytic	B - Ambiguity	3 - Motivation
	C - Complexity	
	D - Instability	
	2 - Decision Environment Characteristics	
	A - Irreversibility	
	B - Significance	
	C - Accountability	
	D - Time and/or Money Constraints	

Consider a decision task in which the problem is highly unfamiliar, highly ambiguous, highly complex, and highly unstable and the decision environment dictates high irreversibility, high significance, and high accountability (but ample time and money). Certainly, this would constitute a very uncomfortable and demanding situation and it seems to us that the decision maker would attempt to structure things and protect himself or herself by using the best strategy at his or her disposal, especially in light of the demands of the environment. For most of us this probably would mean using the most formal analytic strategy we could.

Now consider the opposite circumstances: The problem is familiar, unambiguous, simple, and stable while the environment permits reversability, dictates low significance, and imposes little accountability. This would be a comfortable, undemanding situation because the problem is familiar, simple, and clear and if the decision proves to be incorrect it can be reversed, although it does not matter much anyway because it is of little consequence and no one will hold the decision maker accountable. It seems, therefore, that for such trivial decisions the decision maker can yield to the tendency to use a quick, easy strategy because there is little to be lost if the decision turns out to be wrong and not much to be gained by investing resources in a better, more analytic strategy.

In some cases the variables might present a more complex mix. Consider a task in which the problem is unfamiliar, ambiguous, complex, and unstable but reversability exists, the decision is of little significance, and there is low accountability. The task demands would suggest an analytic procedure but the environmental demands would not. It seems that the leniency of the environment and the muddle of the problem might encourage selection of the

least analytic strategy that will result in a satisfactory answer: Since the decision is not very important, why should one spend a lot of time trying to analyze this difficult and complex problem?

Finally, consider a decision task in which the problem is familiar, unambiguous, simple and stable but the environment imposes irreversibility, high significance, and high accountability. Here the task characteristics are such that a nonanalytic or informal unaided-analytic strategy might be favored (e.g., use an old solution) but the environmental demands are sufficiently stringent to encourage caution and use of a more analytic approach.

Of course, most decision tasks would involve a range of states of their constituent characteristics and different characteristics would be in different states. But these examples may serve to convey the general idea that the choice is contingent on the characteristics of the problem and its surrounding environment.

The Decision Maker. Continuing the use of extremes and assuming no time or money constraints, consider a decision maker who is highly knowledgeable about decision strategies (perhaps even understands and has faith in decision analysis), who is highly intelligent and capable of applying his or her knowledge about strategies, who is cognitively complex and given to systematic, analytic thinking and who therefore can use analytic strategies without expending too much in the way of resources. Call this constellation an A person.

Now consider the opposite, a decision maker who has little or no knowledge of aided-analytic strategies and only a sketchy appreciation of

the more formal kinds of unaided-analytic strategies but believes they lead to greater decision accuracy than the less formal strategies, who is of moderate or low intelligence, who is cognitively noncomplex and given to wholistic, unanalytic thinking, and who therefore can use analytic strategies only with great personal resource expenditure. Call this an \bar{A} person.

Certainly all possible variations and combinations of these characteristics would exist in reality, but for simplicity let us focus on these two extremes. Clearly \bar{A} , due to lack of knowledge, will never select an aided-analytic strategy and probably will favor the less formal unaided-analytic strategies and nonanalytic strategies to conserve personal resources. On the other hand, A has access to all three categories and, because of having the ability to do so, may use the aided-analytic strategies with acceptable resource expenditure. Moreover, we would expect that when A and \bar{A} select strategies from the same category (unaided-analytic or nonanalytic) that A will tend to select more formal strategies and \bar{A} will favor less formal strategies. In part this is because \bar{A} tends not to think analytically anyway and, because of his or her lower ability, analysis takes more time and effort than it does for A, and the tendency is to avoid expenditure of such personal resources.

The Model. As can be inferred from the foregoing, strategy selection is viewed as a compromise between the press for more decision accuracy as the demands of the decision task increase and the decision maker's resistance to the expenditure of his or her personal resources. We will attempt to make this more explicit but first a caveat: We realize that the variables we are combining are not wholly independent, but we are treating them as such. We are also using an additive formulation. Both assumptions may require

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modification but as a first step may provide an approximation that can be made more precise as research proceeds.

The demand of the decision problem (D_{dp}) is the weighted (W) sum of the problem's unfamiliarity (Uf), ambiguity (Am), complexity (C), and instability (Is),

$$D_{dp} = W_{Uf}Uf + W_{Am}Am + W_C C + W_{Is}Is.$$

High D_{dp} represents a demand for a strategy that will help clarify the problem and make it tractable.

The demand of the decision environment (D_{de}) is the weighted (W) sum of the decision's irreversibility (Ir), significance (S), and the decision maker's accountability (Ac). Time constraints, while they are part of the decision environment, are not included in this equation because they play a separate role that will be described later. The equation is:

$$D_{de} = W_{Ir}Ir + W_S S + W_{Ac}Ac.$$

High D_{de} represents a demand for a strategy that will yield a correct decision.

Task demand (TD) is the weighted (W) sum of the demands of the decision problem (D_{dp}) and the decision environment (D_{de}),

$$TD = W_{dp}D_{dp} + W_{de}D_{de}.$$

The following seven statements link the task demands with other parts of the model:

- (1) The decision maker's utility for making a correct decision, U_c , is an increasing monotonic function of D_{de} .
- (2) For a given strategy, the probability of a correct decision, P_c , is a decreasing monotonic function of D_{dp} . Generally, analytic strategies are perceived as having a higher probability of yielding a correct decision, than nonanalytic strategies, and formal-informal strategies are similarly perceived.
- (3) The decision maker's disutility for personal resource expenditure, \bar{U}_e , is an increasing monotonic function of amount of expenditure.
- (4) The cost of resources (\bar{U}_e) is a positively accelerated function of the perceived probability of being correct (P_c). Use of a less analytic strategy requires, on the average, less expenditure of personal resources than does use of a more analytic strategy (i.e., the former are quicker and easier).
- (5) For a given level of D_{dp} all strategies in a decision maker's repertory can be evaluated in terms of (a) the perceived probability that they will yield a correct decision and (b) an estimate of the amount of personal resources they may require in their execution.
- (6) For a given level of utility for a correct decision associated with a given level of D_{de} , the tendency toward selecting strategies of ever increasing probability of being correct is checked by the disutility for increased resource expenditure. That is, the difference between the expected benefit ($P_c U_c$) and the expected cost (\bar{U}_e) is the expected net gain. The strategy that maximizes expected net gain is the strategy that will be selected; i.e., the strategy associated with the P_c and \bar{U}_e which determine the maximum.

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- (7) Environmentally imposed time and money constraints automatically exclude some strategies from consideration (although compensation for one constraint by increased expenditure of the other may limit the number of excluded strategies). Both constraints exclude those strategies that require a high degree of analysis and they thereby exercise their effects primarily on strategies that have a high perceived probability of success. This may force selection of a strategy that yields less than the maximum expected gain.

To summarize, strategy selection is contingent upon a compromise between the decision maker's desire to make a correct decision and his or her negative feelings about investing time and effort in the decision making process. The desire to be correct is seen as contingent upon the demands of the task environment. Environmentally imposed time and money constraints reduce the number of strategies that can be selected. The choice of a strategy also reflects the decision maker's characteristics, particularly knowledge of and faith in the various strategies as well as his or her opinion about the resources they each require for implementation. The decision maker's knowledge determines the strategies in the repertory, while faith can be seen as the decision maker's perception of the probability that each strategy could lead to a correct decision if it were selected. The estimated resource requirement is the price the decision maker thinks will have to be paid to use any particular strategy. The strategy that is perceived as yielding the maximum net gain is the one selected; one that costs more would be a bad investment of resources and one that costs less would unnecessarily increase the risk of an incorrect decision.

Obviously this is a complex model. We have also used a number of assumptions to simplify things. The next step is to empirically test the general

propositions of the model. But stimulation of research was only one of the goals of this article. The other goal was to prompt investigators to consider a general theoretical reappraisal of decision making research. Instead of the current focus on normative models and decision aids we suggest that understanding what strategies are actually used and why they are used is an equally important task.

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Footnotes

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²Reprints may be obtained from Professor Lee Roy Beach, Department of Psychology (NI-25), University of Washington, Seattle, Washington 98195.

³The next sentence in this paragraph is: "By the way, if you do not learn it, I apprehend you will never be married." To this the grandnephew replied, after stating that Franklin's system may have merit for business but not for marriage, "Before a Man is married he must fall in love and this seems to be as involuntary an act as falling into a Well which requires something more than Algebra to get out of" (Lopez & Herbert, 1975, p. 43).

⁴While this generally linear relationship is posited to hold in most circumstances it probably breaks down at extremes. For example, when the problem becomes too complex, too ambiguous, unfamiliar and unstable the individual may just give up or revert to a simpler decision strategy.

Office of Naval Research
Code 452
800 N. Quincy St.
Arlington, VA 22217

Dr. Davis B. Bobrow
University of Maryland
Dept. of Government & Politics
College Park, MD 20742

Lt. Col. Henry L. Taylor USAF
OAD(E&LS) ODDR&E
Pentagon, Rm, 3D129
Washington, D.C. 20301

Director
U.S. Naval Research Lab.
Washington, DC 20390
ATTN: Technical Information
Division

Dr. Arie Lewin
Duke University
Duke Station
Durham, NC 27706

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Washington, DC 20390

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Systems and Evaluations
232 Swanton Blvd.
Santa Cruz, CA 95060

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Science & Technology Division
Library of Congress
Washington, DC 20540

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Division of Behavioral Science
Tuskegee Institute
Tuskegee, AL 36088

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International Programs
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Psychologist
ONR Branch Office
1030 E. Green St.
Pasadena, CA 91106

Navy Personnel R & D Center
Code 01
San Diego, CA 92152

Naval Analysis Programs,
Code 431, Office of
Naval Research
800 N. Quincy Street
Arlington, VA 22217

Research Psychologist
ONR Branch Office
536 S. Clark St.
Chicago, IL 60605

Mr. Luigi Petrullo
2431 N. Edgewood St.
Arlington, VA 22207

Operations Research Program
Code 434
Office of Naval Research
800 N. Quincy Street
Arlington, VA 22217

Psychologist
ONR Branch Office
495 Summer St.
Boston, MA 02210

Dr. John J. Collins
6305 Caminito Estrellado
San Diego, CA 92120

Statistics & Probability
Program, Code 436
Office of Naval Research
800 N. Quincy Street
Arlington, VA 22217

Director
Cybernetics Technology Office
ARPA, Room 625
1400 Wilson Blvd.
Arlington, VA 22209

Commanding Officer
1 Psychological Research Unit
Chancery House
485 Bourke St.
Melbourne vic 3000 AUSTRALIA

Information Systems Program
Code 437
Office of Naval Research
800 N. Quincy Street
Arlington, VA 22217

Dr. Russell Bernard
Dept. of Sociology & Antro.
West Virginia University
Morgantown, WV 26506

Director, Engineering Psychology
Programs, Code 455
Office of Naval Research
800 North Quincy Street
Arlington, Virginia 22217

Dr. M. Bertin
Office of Naval Research
Scientific Liaison Group
American Embassy, Room A-407
APO San Francisco 96503

Naval Electronics Systems
Command, Human Factors
Engineering Branch, Code 4701
Washington, D.C. 20360

CDR Paul Nelson
Naval Medical R&D Command
Code 44, Naval Medical Center
Bethesda, MD 20014

Director, Behavioral Sciences
Department
Naval Medical Research Inst.
Bethesda, MD 20014

Dr. George Moeller, Head
Human Factors Engineering Br.
Submarine Med. Research Lab.
Naval Submarine Base
Groton, CT 06340

Bureau of Naval Personnel
Special Assistant for
Research Liaison
PERS-OR
Washington, DC 20370

Dr. Fred Muckler
Manned Systems Design, Code 311
Navy Personnel Research and
Development Center
San Diego, CA 92152

LCdr Mike O'Bar, Code 305
Navy Personnel Research and
Development Center
San Diego, CA 92152

CDR P. M. Curran
Human Factors Engineering Br.
Crew Systems Department
Naval Air Development Center
Johnsville, Warminster, PA 18974

Mr. Richard Coburn
Head, Human Factors Division
Naval Electronics Lab. Center
San Diego, CA 92152

Dr. Alfred F. Smode
Training Analysis & Evaluation
Group, Naval Training Equipment
Center, Code H-00T
Orlando, FL 32813

Mr. J. Barber
Headquarters DA
DAPE-PBR
Washington, DC 20546

Dr. Joseph Zeidner, Director
Organization & Systems Res. Lab.
U.S. Army Research Institute
1300 Wilson Boulevard
Arlington, VA 22209

Dr. Edgar M. Johnson
Organizationa & Systems Research
U.S. Army Research Lab
1300 Wilson Boulevard
Arlington, VA 22209

Technical Director
U.S. Army Human Engineering Labs
Aberdeen Proving Ground
Aberdeen, MD 21005

U.S. Air Force Office of
Scientific Research
Life Sciences Directorate, NL
Bolling Air Force Base
Washington, DC 20332

Chief, Human Engineering Div.
Aerospace Medical Research Lab
Wright-Patterson AFB
Ohio 45433

Dr. Donald A. Topmiller
Chief, Systems Effect. Branch
Human Engineering Division
Wright Patterson AFB, OH 45433

Lt. Col. Joseph A. Birt
Human Engineering Division
Aerospace Medical Research Lab.
Wright Patterson AFB, OH 45433

Lt. Col. John Courtright
Headquarters
AMD/RDH
Brooks AFB, Texas 78235

Dr. E. Weiss
Office of Science Information
National Science Foundation
1900 Pennsylvania Avenue
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Washington, DC 20036

Mr. Edward Connelly
OMNEMII, Inc.
Tyson's International Bldg.
8150 Leesburg Pike, Suite 600
Vienna, VA 22180

Dr. Victor Fields
Montgomery College
Dept. of Psychology
Rockville, MD 20850

Dr. Bruce M. Ross
Catholic University
Department of Psychology
Washington, DC 20064

Dr. Robert R. Mackie
Human Factors Research, Inc.
Santa Barbara Research Park
6780 Cortona Drive
Goleta, CA 93017

Mr. Alan J. Pesch
Eclectech Associates, Inc.
P.O. Box 179
North Stonington, CT 06359

Dr. A. I. Siegel
Applied Psychological Services
404 E. Lancaster Street
Wayne, PA 19087

Dr. W. S. Vaughan
Oceanautics, Inc.
3308 Dodge Park Road
Landover, MD 20785

Director, Human Factors Wing
Defense & Civil Institute of
Environmental Medicine
P.O. Box 2000
Downsville, Toronto, Ontario CAN

Dr. A. D. Baddeley, Director
Applied Psychology Unit
Medical Research Council
15 Chaucer Rd., Cambridge,
CB2 2EF ENGLAND

Major David Dianich
DSMS
Building 202
Fort Belvoir, VA 22060

Mr. Frank Moses
U.S. Army Research Institute
1300 Wilson Boulevard
Arlington, VA 22209

Dr. Bertram Spector
CACI, Inc. - Federal
1815 N. Fort Myer Drive
Arlington, VA 22209

Robert G. Gough, Major, USAF
Associate Professor
Dept. of Economics, Geography,
and Management
USAF Academy, Colorado 80840

Dr. C. Kelly
Decisions and Designs, Inc.
Suite 600, 7900 Westpark Dr.
McLean, VA 22101

Dr. T. Owen Jacobs
P.O. Box 3122
Ft. Leavenworth, Kansas 66027

Mr. George Pugh
General Research Corp.
7655 Old Springhouse Road
McLean, VA 22101

Dr. Gary Poock
Operations Research Department
Naval Postgraduate School
Monterey, CA 93940

Mr. Gary W. Irving
Integrated Sciences Corp.
1532 Third Street
Santa Monica, CA 90401

Dr. Jesse Orlansky
Institute for Defense Analyses
400 Army-Navy Drive
Arlington, VA 22202

Dr. Amos Freedy
Perceptronics, Inc.
6271 Variel Avenue
Woodland Hills, CA 91364

Prof. Carl Graf Hoyos
Institute for Psychology
Technical University
8000 Munich, Arcisstr 21
Federal Republic of GERMANY

Dr. Paul Slovic
Oregon Research Institute
P.O. Box 3196
Eugene, OR 97403

Dr. Arthur Blaiwes
Naval Training Equip. Center
Orlando, FL 32813

Dr. A. C. Miller III
Stanford Research Inst.
Decision Analysis Group
Menlo Park, CA 94025

Dr. William A. McClelland
Human Resources Research Office
300 N. Washington Street
Alexandria, VA 22314

Dr. R. A. Howard
Stanford University
Stanford, CA 94305

Dr. Ward Edwards, Director
Social Science Research Inst.
University of Southern Calif.
Los Angeles, CA 90007