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Alternative Approaches to Modeling the Individual Enlistment Decision: A Literature Review

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U.S. Army

Research Institute for the Behavioral and Social Sciences

May 1987

U. S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency under the Jurisdiction of the
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FOREWORD

This report documents work completed during the first phase of a three-phase project undertaken by the Army Research Institute (ARI) in support of the Office of the Deputy Chief of Staff for Personnel and the U.S. Army Recruiting Command. ARI was commissioned by the Deputy Chief of Staff for Personnel in 1982 to identify the motives underlying the enlistment decision. ARI's initial efforts concentrated on enlistment motives of new recruits--the New Recruit Surveys (NRS). Concurrent with the advanced development of the NRS, ARI has been working on exploratory development of new quantitative instruments for measuring the factors involved in the career decision process of prospective recruits. The project was designed as a three-phase effort. In the first phase of the project, new instruments were developed and pilot tested. The second phase will involve a nationwide data collection to validate the new instruments. If the instruments prove to be predictive of enlistment behavior, they will be adapted for use as a decision aid during the third phase of the project.



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ALTERNATIVE APPROACHES TO MODELING THE INDIVIDUAL ENLISTMENT DECISION: A LITERATURE REVIEW

EXECUTIVE SUMMARY

Requirement:

To review the scientific literature pertaining to various decision models to develop new quantitative instruments for measuring the social and psychological factors influencing young adults' enlistment decisions.

Procedure:

The following decision theories/models were reviewed: Decision Theory, Social Judgment Theory, Information Integration Theory, Conjoint Measurement/Unfolding Theory, Cognitive Process Models, Affective Models, Cognitive Style Models, Conflict Decision Theory, and Expectancy Theory. In addition, the areas of career and consumer decision-making research were reviewed to assess which types of decision models have been tested and how well these models fared in two areas relevant to the individual enlistment decision.

Findings:

The extended Fishbein-Ajzen expectancy theory model was recommended for modeling the individual enlistment decision for four reasons. First, the model's explicit dependent variable is behavioral intent (and/or actual behavior), not just utility. Second, it contains a social component for explicitly determining the effect of influencers on one's decision in addition to a cognitive component for evaluating career options on specified belief attributes. Third, it incorporates affect in the form of the "evaluation" placed on each belief but, more important, its broad conceptual framework allows for the incorporation of a separate, more general affective component. And fourth, Fishbein-Ajzen's expectancy theory model facilitates a multimeasurement approach for triangulating on decision model components.

Utilization of Findings:

An extended Fishbein-Ajzen expectancy theory instrument, along with traditional demographic measures, will be developed. The instrument will be given to prospective recruits to assess how cognitive, social, and affective components influence the individual enlistment decision process. The instrument will also

be adapted for use as a decision aid that recruiters will use with individuals who are considering enlistment in the Army.

ALTERNATIVE APPROACHES TO MODELING THE INDIVIDUAL ENLISTMENT
DECISION: A LITERATURE REVIEW

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ALTERNATIVE APPROACHES TO MODELING
THE INDIVIDUAL ENLISTMENT DECISION:
A LITERATURE REVIEW

INTRODUCTION

This report summarizes the models used in previous decision making research to identify models applicable to the individual enlistment decision. An enlistment decision model must be capable of incorporating the psychological, sociological and economic factors influencing individuals deciding whether or not to enlist in the Army. The first section of this report presents the underlying theory and intended function of various decision models and discusses their applicability to the individual enlistment decision. The second section of this report reviews representative articles from the career decision making literature. This section is followed by a review of consumer decision making research. The sections pertaining to career and consumer decision making provide an opportunity to examine the application of a selection of decision making approaches to domains resembling the individual enlistment decision. Finally, the fourth section of this report provides the authors' recommendations regarding the type of model(s) that offer the most effective means for modeling the individual enlistment decision.

The present literature review focuses on potential enlistment decision models taken from applications in the psychological, occupational choice, and consumer decision literature. In evaluating decision models, emphasis is placed on their measurement requirements, functional form, and appropriateness as a model of the enlistment decision process. By appropriate we mean a model of the psychological processes involved during the making of an enlistment decision. Appropriate in this context, therefore, is not synonymous with predictive accuracy regarding eventual decision outcome. The psychological and marketing literature recognize an important distinction between modeling outcomes and modeling processes (see Dawes and Corrigan, 1974 and Carmone and Green, 1981). In the marketing literature on multi-attribute evaluations, for example, it has been well documented that

. . . false [i.e., misspecified] models often predict the pattern of overall evaluations about as well as 'true' ones. For instance, linear additive and additive part-worth models typically account for almost all of the reliable variance in overall evaluations generated by processes that include interactions among product attributes, as long as they are ordinal (noncrossover) interactions (Lynch, 1985, p.1).

If our research goal were only prediction of the enlistment decision outcome, then the observed robustness of linear models could be used to simplify specification. However, the goal is to

model the decision process, and specification cannot proceed on the basis of such a simplification. In addition, an appropriate model must be capable of incorporating potential cognitive, social, and affective influences on the enlistment decision process.

It should be noted that this focus systematically excludes from consideration an extensive body of Army enlistment research conducted by economists, sociologists, and psychologists, among others. This exclusion is made because previous analyses of Army enlistment were not oriented toward, and consequently did not use, enlistment decision models (i.e., models of the processes involved in the enlistment decision). This exclusion should not be interpreted, however, as a negative evaluation of this body of research. On the contrary, the present effort should be viewed as an extension and continuation of previous studies. These previous studies in many ways provide the context within which an enlistment decision modeling effort can be undertaken. However, a review of previous research on enlistment is beyond the scope of this report. (Note that a review of this work is currently being completed and will be published as a separate report.)

LITERATURE REVIEW OF DECISION MODELS AND THEORIES

Scope and Method of Literature Review: Specification of Criteria

The objective of this research is to develop and validate a model for the enlistment decision process that includes the economic, psychological, and sociological factors influencing individuals deciding whether or not to enlist in the Army. Towards that end, an extensive review of the scientific literature pertaining to various decision models was conducted. The models reviewed in this report include affective, social and cognitive factors that influence the decision process. Models that were considered to be likely candidates for review included Decision Theory, Social Judgment Theory, Information Integration Theory, Fundamental Measurement, Conjoint Measurement and Unfolding Theory, Cognitive Process Models, Affective Models, Conflict Decision Theory and Expectancy Theory.

Each model was subjected to the same general evaluation method. An initial review was conducted, concentrating on the critical literature reviews covering pertinent areas of interest. After this initial review of a given model and/or theory, a preliminary assessment of the applicability of the model to the enlistment decision process was made. If a model was deemed inappropriate, its literature was not reviewed further. If the model showed promise, then its literature was reviewed in greater depth, after which a final evaluation of the model was made.

Models were evaluated according to their ability to meet certain criteria based on characteristics of the individual enlistment decision. First, an adequate model would have to be able to contend with the heterogeneity of the potential enlistee population. Much decision literature reviewed pertain to members of more homogenous classes, e.g., bankers (Shapira, 1981) or nurses (Sheridan, Richards & Slocum, 1975). In contrast, potential enlistees form a nationwide population, lacking the focus of a more homogenous group. Therefore, a model reviewed would be rejected if it were so irretrievably tailored to its particular population that it could not be adapted for the purposes of this project. Thus, a model's flexibility was recognized as a key criterion.

Certain "temporal" issues are also unique to the potential enlistee population, given their special composition. The time of life in which subjects are studied imposes requirements on a model. Again, it was seen that the time of life of the prospect population radically distinguishes that population from most of those studied by previous research efforts.

Specifically, prospects are met at the beginning of their adult lives. More often than not, they are about to make the first substantive employment decision of their lives. As a result, a large branch of decision model literature is unsuitable. For example, a great deal of decision model literature focuses on employee turnover behavior. They often examine one type of employee in one company (Hsu 1970; Shapira, 1981), thereby raising the heterogeneity/homogeneity/flexibility issue. More importantly, the single focus and location of the employees afford the researchers access to them over an extended period of time. Researchers have often been able to track their subjects from start of employment through to turnover behavior (Arnold and Feldman, 1982; Mobley, Griffeth, Hand, & Meglino, 1979). In those cases, the entire decision process from start to finish can be observed.

In the study of enlistment decisions, the exact opposite is the case. Prospects are not available for extended periods of time prior to their decision. Also, many models depicting subjects in a later time of life involve issues that are of little or no concern to enlistment prospects (Mobley, et al., 1979). For example, loss of pension as a result of a career choice, or the impact of a career move on a spouse's own career, are issues that are either not considered by enlistment prospects, or, more likely, do not apply at all.

Finally, a model can be appropriate for depicting an enlistment decision only if it allows for the special "relational" issues inherent in an enlistment decision. Potential enlistees, or "prospects", are influenced by other people when making their decision to enlist. They are in relationship with others, and although these relationships vary in degree of significance, cumulatively they are a powerful factor in a prospect's life.

Thus, an adequate model would have to include the potential enlistee's network of relationships, and the role these play as sources of information, and advice (McTeigue, Kralj, Zirk, Wilson, & Adelman, 1986; Weltin, Elig, Johnson, & Hertzbach, 1984; U.S. Army Soldier Support Center, 1985).

In summary, the literature review was conducted to find a model(s) that would reflect the economic, psychological and social factors influencing individuals deciding whether or not to enlist in the Army. Special care was taken to search for models that could meet the criteria peculiar to modeling the enlistment decision process. The model would have to be adaptable to the heterogeneous population of potential enlistees. Also, the model would have to allow for the "temporal" issues discussed above, namely, that enlistment prospects, being at the outset of their adult lives, have little or no employment/economic history, and are not available for extensive pre-decision tracking. Finally, any model selected would have to allow for the strong relational influences and bonds surrounding potential enlistees. The different models are now examined, in turn.

Decision Theory

Decision Theory (DT) examines the process of choosing among alternatives with multiple attributes. According to DT, the principal parameters of the process of choosing one alternative over another are: (a) The probability of the occurrence of the alternative and (b) its utility to the decision maker. This formulation lends itself to formal, mathematical analysis, thus enabling the decision theorist to address a fundamental question: Does the decision process of one (or another) decision maker conform with the formal axioms of choice, as set forth by the logic of the mathematics of choice? Thus, DT is essentially a means for prescribing what the decision process should be, if it is to be rational.

Decision theory restricts its theoretical interest to the single-system case, which involves one person making decisions without full knowledge of the task situation and without feedback about the effects of the decision. Since decision theorists do not theorize (systematically) about psychological processes or states, the scope of DT is limited to those circumstances in which one person exercises his or her rational powers to the utmost under the guidance provided by a specialist in DT. Keeney & Raiffa (1976) emphasize the point that the aim of DT is to elaborate the logical entailments of subjective probability and utility theory and extend them to a variety of circumstances by means of mathematics. (Subjective expected utility (SEU) theory (Edwards, 1957) has the same goal as DT and is reviewed in the section describing Expectancy Theory.) The criterion for the validity of the theory is its logical, mathematical consistency. Once developed, the theory stands as a logical structure of decision making; decision makers may then use it in order to achieve the logical consistency provided by this theory. Aiding

decision makers to achieve logical consistency is, therefore, a major reason for the use of DT in the real world.

DT makes no claim that it represents or describes the cognitive activity (or information processing) of human decision makers. Indeed, it is precisely because of the presumed departure of decision making from the axioms of decision theory that decision theorists such as Keeney and Raiffa insist that people, especially policy makers, should change their decision making behavior to make it conform with the precepts of DT. Accusations, therefore, that DT does not represent the cognitive activity of any person do not deter decision theorists from developing new applications or pursuing the implications of a theorem. The emphasis is not on what decision makers do, but what they should do.

Why human decision makers deviate from the logic of DT is a matter left to psychologists. Although many decision makers remain indifferent to discrepancies between what unaided reason suggests and what logical consistency demands, an increasing number are employing decision analysts to find such discrepancies. Critics of DT argue that however satisfying DT might be from a mathematical point of view, it is not useful as a guide to decision making because human beings do not behave in accordance with the fundamental assumptions of the theory. When empirical evidence indicates that the premises of DT do not represent actual choice behavior, the validity of the postulates of DT is denied, and the validity of the behavioral entailments of the theory is denied:

One might expect decision theorists to find such criticisms to be misdirected, on the grounds that it is based on a faulty interpretation of the intended function of the theory. DT argues that (a) if one must decide or choose, then an additive or multiplicative combination of expectations and utilities is an appropriate basis for decision or choice and (b) the logic of DT, as articulated by mathematical analysis, provides the best guide for reaching defensible decisions. Decision theorists further believe that once the axioms of a particular decision are carefully explained, any reasonably intelligent person would want to change his behavior to be in accord with these axioms. As a result, if and when psychologists (or others) find behavioral violations of the axioms, decision theorists dismiss such discoveries as irrelevant to their purposes. Thus, for example,

The following example will help to illustrate how intransitivities may arise in descriptive choice behavior and why, in a prescriptive theory of choice, this type of behavior should be discouraged. In short, DT considers its axioms to be reasonable and desirable rules for decision making behavior that everyone would want to follow, once they understood them. DT thus disavows any intention to provide explanations for why

decision making takes the form others claim it does, for it has only prescriptions for improving it (Raiffa, 1968, p. 77).

The methods of DT are usually applied to a single decision maker in any one study. The emphasis is on collecting as much information from that single decision maker as is necessary to understand and structure the problem, to conduct an analysis of the various options, to construct the required probability distributions and utility functions, and to gain insights and help for the individual who must make the final decision. For a complete analysis this method may require hundreds of judgments and decisions from a single decision maker (see Keeney, 1977, for an example of an extensive interview with a single person). Across studies, DT methods have been applied to diverse substantive tasks (see Chapter 7 of Keeney & Raiffa, 1976). Finally, there is some variation of formal task properties in terms of the type of response required. For example, to test the validity of the axioms, the decision analyst may present pair comparison choices, request indifference judgments, or explain the axiom to the decision maker and ask the decision maker to evaluate its validity directly.

One assessment technique used in decision theory is the simple multi-attribute rating technique (SMART), which is a weighting technique that emphasizes ratio-paired comparisons between attributes. The SMART methodology advocates the direct weighting of variables or attributes in judgment and decision tasks rather than the rating of whole objects or schematic stimuli as in the policy capturing technique to be presented in the section describing Social Judgment Theory. Gardiner and Edwards (1975) state, for example, that the methods and procedures involved with presentation and analysis of whole objects or schematic stimuli are more complex than simply having the decision maker rank order and rate the importance of the key variables or attributes. The SMART technique depends on several assumptions, such as value independence just like other decision theoretic weighting techniques (e.g., the lottery axioms). However, just like in social judgment theory, two types of interdependence are acknowledged: (a) Value interdependence; and (b) environmental interdependence. Since values are entirely subjective and environmental facts are objectives as measured by the decision maker, a distinction is made between objective and subjective intercorrelations.

Gardiner and Edwards (1975) provide an implementation of SMART, consisting of the following ten steps for decision making, which includes modeling as a subset: (a) Identify the person whose utilities are to be maximized (e.g., the prospective Army enlistee); (b) identify the decisions to which the utilities needed are relevant (e.g., the enlistment decision); (c) identify the entities to be evaluated (e.g., recruitment packages, civilian employment opportunities, college); (d) identify the relevant dimensions of values (e.g., pay, acquisition of job skills, educational benefits); (e) rank the dimensions in order of importance; (f) rate the dimensions in importance, preserving ratios; (g) sum

the importance weights, divide each by the sum, and multiply by 100; (h) measure the location of each entity being evaluated on each dimension; (i) calculate utilities for entities using the equation:

$$U_i = \sum_{j=1}^n W_j U_{ij}$$

where U_i is the aggregate utility for the i th entity, w_j is the normalized importance weight of the j th dimension of value, and u_{ij} is the rescaled position of the i th entity on the j th dimension; and (10) decide by maximizing U_i . It should be noted that practically every technical step above has alternatives. Keeney (1977), for example, has proposed using a multiplicative-aggregation rather than an additive-aggregation rule. Multiplication and addition may also be combined for certain applications.

The lottery technique (i.e., see Keeney & Raiffa, 1976) is another weighting technique used in decision theory. It requires individuals to compare a sure thing and a gamble. The gamble always involves passing all the requirements (i.e., value dimensions) with some probability p_i and failing all the requirements with some probability $1 - p_i$. Individuals indicate the value of p_i such that they are indifferent between playing the gamble and having the sure thing.

The primary limitation in applying decision theory to modeling the individual enlistment decision is the measurement techniques it utilizes. Because both the SMART and lottery techniques involve complicated procedures, successful application requires supervision of subjects (e.g., potential Army recruits) while completing a measurement instrument. Paper and pencil measurement instruments are not recommended for these two techniques, unless close supervision is possible. For example, in a study examining five different techniques for weighting multiple attributes (including SMART), Adelman, Sticha & Donnell (1984) found that participants (a) had the least confidence in the relative weights generated by the lottery technique, and (b) that it was the most difficult technique to use. In contrast, participants had the most confidence in the weights generated by the SMART technique. Although this high participant confidence is an advantage for the SMART technique, its distinct disadvantage is the complicated procedures required for its implementation. For example, in a study comparing three measurement instruments given to unsupervised participants, Pliske & Adelman (1985) found that the SMART technique had the highest error rate. Therefore, unless potential recruits can be closely supervised when completing the measurement instrument, the SMART technique is not recommended for modeling the individual enlistment decision.

Social Judgment Theory

The function of this theory is to describe human judgment processes. Social Judgment Theory (SJT) focuses on the manner in

which the formal properties ("causal texture") of the environment create significant difficulties for human beings to learn to make accurate judgments about environmental events (multiple cue probability learning) including the behavior of other people (interpersonal learning). Interpersonal conflict arising from different judgments is also a topic to which SJT gives considerable attention. In general, SJT emphasizes the interaction between environmental and cognitive systems.

SJT states that knowledge of the environment is difficult to acquire because of the causal ambiguity--created by the probabilistic, entangled relations among environmental variables. Tolman & Brunswik (1935) emphasized the fact that the organism in its normal intercourse with its environment must cope with numerous, interdependent, multiformal relations among variables which are partly relevant and partly irrelevant to its purpose, which carry only a limited amount of dependability, and which are organized in a variety of ways. The problem for the organism, therefore, is to know its environment under these complex circumstances. In the effort to do so, the organism brings a variety of processes (generally labeled cognitive), such as learning and thinking, to bear on the problem of reducing causal ambiguity. As a part of this effort, human beings often attempt to manipulate variables (by experiments, for example) and sometimes succeed--in such a manner as to eliminate ambiguity. But when the variables in question cannot be manipulated, human beings must use their cognitive resources unaided by manipulation or experimentation (Hammond, Brehmer, Stewart & Steinmann, 1975).

In contrast to decision theory, social judgment theory attempts to create a descriptive model of an individual's decision process. Multiple regression analysis, called "policy-capturing", is used to relate judgments to value dimensions (called "cues" in SJT). The values of the cues are the values on the independent variables in the analysis, and the individual's judgment constitutes the dependent variable. The linear model fitted by this technique is:

$$Y_{ij} = b_{ik}x_{jk} + c_i + e_{ij}$$

where Y_{ij} is the judgment of individual i for profile j , b_{ik} is the raw score regression weight for individual i on cue k , x_{jk} is the value of cue k on profile j , c_i is the constant term for individual i , and e_{ij} is the residual error from the model of individual i for profile j .

Proponents of SJT specifically advocate the use of the idiographic method, whereby many responses from the same judge are observed. Therefore, the number of stimuli tend to be rather large. Because different individuals may use cues in different ways (i.e., different weights and functional relations between the cue values and the judgments) it makes no sense to average judgments across individuals or to fit one set of parameters to data from a group of individuals. Thus, in the typical study, separate

weights and function forms are estimated for each individual and a separate measure of fit (R^2) is computed for each person.

The method utilized in many SJT studies (e.g., see the review paper by Hammond, Rohrbaugh, Mumpower, & Adelman, 1977) have used schematic stimuli almost exclusively. The subject in a typical experiment judges a series of "profiles" which are descriptions (usually numeric) of an object on a number of variables or cues. These profiles may be descriptions of either real or hypothetical objects. In selecting or constructing these profiles, SJT emphasizes that, to the extent that it is possible, the set of schematic stimuli should be representative (in terms of formal properties such as means, ranges, and intercorrelations) of the real objects the subject is likely to encounter in the environment.

One application of SJT to modeling the individual enlistment decision might require various representative "profiles" for each option (e.g., Army, college, civilian job) available to potential enlistees. Due to the heterogeneity of the potential enlistee population and the variety of career options available to these prospects, the determinations of the "profiles" would prove to be a time-consuming task if the "profiles" were to be truly representative. For example, representative civilian job alternatives (e.g., cashier, bank teller, factory worker, etc.) for young adults (i.e., potential enlistees) would have to be determined, as well as the range of values of various attributes (e.g., money, job satisfaction, opportunities for personal growth) for each of the job alternatives. An alternative approach would be hypothetical cue values with, to the extent possible, realistic ranges for the cue values. For example, in a study related to the enlistment decision, Pliske & Adelman (1985) performed a pilot study utilizing SJT's policy capturing technique, a modification of the SMART technique, and the "divide-up 100 points" technique to evaluate the desirability of various hypothetical recruiting packages. Here, subjects were presented with hypothetical recruiting packages that varied in terms of six factors: Cash bonus, term of service, education money, job desirability, personal growth opportunity, and range of choice for geographic location and date for initial entry. An important finding was that fewer errors were made by the potential recruits in completing the policy capturing technique than any of the other measurement instruments.

From a modeling perspective, the policy capturing technique can permit one to test the adequacy of additive, but nonlinear models and various forms of nonadditive models of the individual's enlistment decision process. For example, it can be used to represent various noncompensatory models such as conjunctive models, where high preferences are only given to cases where all the factors have values passing a specific level, or disjunctive models where high preferences depend on passing a specific value on one or more (but not all) factors. In addition, it can be used in extreme cases, as Einhorn, Kleinmuntz, & Kleinmuntz (1979) did

for illustratory purposes, to model judgment more appropriately modeled by process tracing models.

From a policy perspective, the policy-capturing approach has two distinct advantages. First, the policy-capturing technique permits policy makers to obtain preference judgments for specific cue values. For example, Pliske & Adelman (1985) used profiles that represented actual recruitment packages, as well as those being considered or proposed for future implementation. By doing so, Army personnel planners can obtain direct feedback as the overall desirability of specific recruitment packages (or variations on a basic recruitment theme) for specific target audiences. Moreover, they can find out exactly which parts (i.e., factor values) the prospects liked and disliked.

Second, the policy-capturing technique permits policy makers to directly address economic and non-economic trade-offs because the b weights (i.e., the raw score regression weights, not beta weights) in a multiple regression equation indicate how much one unit of desirability (Y_{ij}) is worth in terms of each factor's original (not standardized) scale values. Of course, the adequacy of this worth parameter b_i depends on the predictability of the multiple regression equation; consequently, multiple regression equations with low multiple correlation coefficients (i.e., $R < 0.70$ in the judgment research literature) should not be considered for this trade-off analysis. But, assuming that the R is high (e.g., 0.90), one could directly assess how much of one factor is required to compensate for a decrease of a certain amount in another factor and still result in the same predicted desirability rating.

Suppose, for illustrative purposes, we applied a linear, multiple regression analysis to one of the potential recruits in a study examining the desirability of recruitment packages and obtain the following results for three factors:

$$Y_{ij} = .001 x_{i1} + .0086 x_{i2} - 1.6-3 x_{i3} + 5.347 \quad [1]$$

where

Y_{ij} is the predicted judgment
 x_{i1} is the cash bonus for the recruitment package i
 x_{i2} is the education money for recruitment package i
 x_{i3} is the term of service for recruitment package i
5.347 is the intercept

and the multiple correlation (R) is .95. Furthermore, we find that upon cross-validation, the multiple correlation shrinks only to .90. The multiple correlation and cross-validated multiple correlation indicate that the linear function specified provides fairly good predictions of the person's judgments. These coefficients do not mean that the person's judgment process is wholly linear or that the errors in prediction are due entirely to unsystematic, random effects. They merely indicate that function

[1] provides a fairly good description of the judgment process and also provides a way of predicting his/her judgment with fairly high accuracy.

Function [1] is a mathematical description of this person's preference function for recruitment packages. It gives us a means of estimating his preference rating for any recruitment package if we know its cash bonus, education money, and term of service. Implicit in this type of preference function are trade-offs among the factors, i.e., change in one factor can be compensated for by change in another factor. For example, if we hold term of service constant at some level, then [1] becomes:

$$Y_{ij} = .001 x_{i1} + .0086 x_{i2} + c \quad [2]$$

where c is a constant.

If Y_{ij} is fixed at some value, c' , then we have

$$\begin{aligned} c' &= .001 x_{i1} + .0086 x_{i2} + c \\ - .001 x_{i1} &= .0086 x_{i2} + c - c' \\ x_{i1} &= -8.6 x_{i2} + \frac{c - c'}{.001} \end{aligned}$$

[3]

Any pair of values (x_{i1} , x_{i2}) which satisfies Y_{ij} will result in a value of c' for predicted desirability. This means that the effect of an increase of \$8.60 in cash bonus can be offset by a decrease of \$1 in education money. In other words, \$1 in education money is worth \$8.60 in cash bonus to this person, assuming no change in term of service. Other trade-off functions are:

$$x_{i1} = 1603 x_{i3} + c$$

$$x_{i2} = 185.2 x_{i3} + c$$

These equations indicate that a one-year increase in term of service is worth \$1603 in cash bonus and \$185.2 in education money. Policy makers, and perhaps even individual recruiters, can use the trade-off information inherent in the multiple regression function, particularly when taken in conjunction with the results of economic/sociological models, to design new, more preferable recruitment packages for different target groups.

In summary, it appears that SJT offers a viable approach for modeling the individual enlistment decision. It offers measurement techniques (e.g., policy capturing technique, divide up 100 points technique) that have been successfully utilized in a variety of applications and that have been proven to be relatively easy to implement. In addition, SJT permits policy makers to obtain preference judgments for specific cue values and examine economic and non-economic trade-offs. However, a potential drawback to the use of the SJT approach is that it would not readily

lend itself to modeling the relative importance of normative and affective influences on the enlistment decision.

Information Integration Theory

Information Integration Theory (IIT) is a psychological theory that intends to discover (cognitive) psychological laws that intervene between stimulus and response and thus explain, or at least account for, the relation between Stimulus (S) and Response (R). IIT intends to describe human cognitive activity (of which decision, judgment, and attribution are merely special cases) in quantitative terms; specifically, to account for such activity in terms of "cognitive algebra" (see Anderson, 1974, p. 84). That is, IIT focuses on the organization or integration of information by describing adherence to (or departure from) various algebraic formulations such as additive equations, averaging equations, etc., that are treated as "models" of cognitive functioning. Therefore, a major part of the descriptive effort lies in discovering which model "best fits" the relation between S and R.

The information integration paradigm construes numerical ratings of overall evaluation to result from a process composed of three stages: Valuation, integration and output. In the valuation stage, the subject is assumed to evaluate the implication of each piece of information (a_i , b_j) separately, assigning scale values s_i and s_j . The scale value of a piece of information refers to the implication of that information, taken separately, for the judgment being made. (Thus, the scale values are subjective utilities.) Typically, in the integration paradigm, no a priori assumptions are made about the relationship between either quantitative or qualitative objective stimulus and subjective scale values.

In the integration stage, the scale values are assumed to be combined in a manner represented by the integration function, $I(s_i, s_j)$, to produce an integrated psychological impression, r_{ij} . For example, the part utilities of enlistment attributes may be summed to produce an implicit overall evaluation of the enlistment decision.

In the output stage, the (unobserved) integration impression, which is the individual's overall evaluation of enlisting in the Army, is transformed into a rating on a 0-100 scale (i.e., the overt response R_{ij}). This rating can be assumed to be related to the private overall equation by a monotonic (and potentially linear) output function, $R_{ij} = O(r_{ij})$.

Three psychological issues must be addressed within the integration paradigm (Birnbaum 1974): (a) Finding the scale values (part utilities), s_i and s_j , of each attribute level, (b) testing

the model, $r_{ij} = I(s_i, s_j)$, of how these scale values are integrated mentally, and (c) determining the monotonic output function, $O(r_{ij})$, that relates numerical responses, R_{ij} , to private overall evaluations, r_{ij} .

Any approach (e.g., additive, multiplicative, or multilinear) that construes some overall judgment in terms of the three stages and that explicitly considers the three issues presented above in the analysis and interpretation of the data can be said to be employing the "information integration paradigm." Perhaps the best known and most thoroughly articulated approach within the information integration paradigm is Anderson's (1970, 1974, 1976, 1982) functional measurement methodology. This methodology is characterized by: (a) A reliance on rating scale dependent measures that are presumed to be related linearly to underlying overall judgments; (b) model diagnosis by simple ANOVA techniques in cases in which the linearity is achieved (i.e., when $R_{ij} = O(r_{ij})$); (c) graphic tests that augment statistical tests of the adequacy of a hypothesized integration model, and enable the researcher to understand why a model failed when statistical tests cause one to reject it; and (d) simple techniques for scaling the independent variables when model diagnosis procedures have established the adequacy of a hypothesized integration model.

To see how functional measurement diagnoses an additive integration rule, consider the following simple two-factor A X B example. It is hypothesized that an individual's overall wanting to enlist decision, r_{ij} , is determined by the sum of wanting to achieve certain job skills (s_i) and wanting to receive educational benefits (s_j). The additive integration model ($r_{ij} = I(s_i, s_j) = s_i + s_j$) implies that the effect of variation on one attribute on r_{ij} should be independent of the level of the other attribute. If the output function relating the subjective overall evaluations, r_{ij} , and observed numerical ratings, R_{ij} , is linear (i.e., $R_{ij} = O(r_{ij}) = aR_{ij} + b$, meaning that numerical ratings comprise an interval scale of overall evaluation), this independence implies that the observed A X B interaction should be zero, except for random error. This hypothesis can be tested by simple ANOVA techniques. As an adjunct to the statistical tests of independence, one can plot the different level of job skills offered by the Army by the different levels of educational benefits offered by the Army. The parallelism of the plotted curves would indicate that: (a) A simple additive utility integration rule, $R_{ij} = s_i + s_j$, governs private overall evaluations, (b) numerical ratings of overall wanting to enlist, R_{ij} , comprise an interval scale of overall evaluations (i.e., $R_{ij} = ar_{ij} + b$), and (c) the scale value of each attribute is independent of the other information with which it is combined. The implication of this example is that if the integration function is additive, one can compare properly the difference in scale values estimated for two levels of attribute i (job skills) with the difference in scale values estimated for two levels of attribute j (educational benefits). This information could be used to decide which of two types of

recruiting packages would have a greater impact on an individual's overall evaluation of enlisting in the Army.

Other representations besides an additive integration rule can also be used. For example, the true composition function for an individual may be multiplicative or multilinear. The ability to determine the true composition rule is extremely important because different scales of the independent and dependent variables are required to best fit each composition function. Therefore, information integration theory offers great promise for examining decision making behavior. Its methods are compatible with developing trends among users of conjoint measurement and regression/ANOVA analysis procedures and it provides a direct response to a need perceived by researchers for more powerful methods for detecting and incorporating interactions and nonlinearities in preference models.

In applying information integration theory to the individual enlistment decision, each attribute (e.g., money, skill training) would be crossed with one another. Consider the following illustrative example. (See Figure 1.)

Here, each potential recruit would be shown a cell in the above matrix which corresponds to a pair of items (money--skill training) and asked to judge their attractiveness. His or her response is considered to be the resultant of the following items:

$$R_{JM_J} = W_{JT}(S_{18,000} + S_{24,000}) + W_M(S_{CA} + S_{ET})$$

where W_{JT} and W_M are the weights associated with the row (Skill Training) and column (Money) dimensions; $s_{18,000}$ and $s_{24,000}$ are the scale values of the \$18,000 and \$24,000 information items in row JT (Job Training) of dimension M (Money); and s_{CA} and s_{ET} are the scale values of combat arms training and electronic training information items in column M (Money) of dimension JT (Job Training).

The important properties of this model are that the weights are constant across levels of each dimension and that the model permits the scaling of subjective values for each item. Thus, the above equation is similar to a linear model except that subjective scale values, rather than the physical or objective values, are employed in the linear equation. It is not assumed that the objective values of the stimulus dimensions are linearly related to the responses. If, for example, the judgment task involved the rating of skill training, and salary was one of the factors, the actual salary levels would enter into a linear model as predictors of the judgments. But it is likely that the judge perceives salary in a nonlinear fashion. For example, the subjective difference between \$20,000 and \$25,000 is probably less than the difference between \$5,000 and \$10,000. Information integration theory attempts to discover these subjective scale values and to determine rules of composition based on these values.

	Salary of \$18,000	Salary of \$24,000
Combat Arms Training		
Electronic Training		

Figure 1. Information integration theory example.

One of the limitations of applying the information integration theory becomes evident as the number of dimensions increase. For example, if one wished to examine the attractiveness of five dimensions, each with three levels, this would require the subject to make 60 paired comparisons. Thus, as the number of dimensions increase, the number of required paired comparisons increases. This would have to be taken into account when determining the number of attributes and the procedures by which they would be assessed (e.g., mail-out survey, in-depth interview, etc.). In evaluating the individual enlistment decision, it should be noted that an additional factor needs to be incorporated, i.e., the type of option (e.g., Army, civilian employment, college, etc.) available to the potential recruit. Comparison of the r_{ij} for each of these options can be handled in two ways, each with its own limitations. First, the attributes for each of the options (e.g., Army, civilian employment, college) could be matched across options, i.e., each attribute would have to be applicable to each option. For example, the attribute money for education would be applicable to the Army and civilian option, however, it could not be applied to the college option, thus this attribute would either have to be dropped or worded in such a way that it could be applied to all options. This requirement of matching all attributes across all options would limit the number of applicable attributes, thereby increasing the likelihood of losing relevant information when examining the individual enlistment decision.

Another major concern in applying information integration theory is the interaction terms produced between the dimensions. Interaction terms containing more than three dimensions could be extremely difficult to interpret. Caution is required in interpreting the meaning of significant interactions when these occur. Interactions may result from cognitive configurality that is theoretically meaningful or from defects in the response scale, such as floor and ceiling effects. In some cases, a monotonic re-scaling of the judgments can be used to eliminate the interaction (Bogartz & Wackwitz, 1970). Whether or not to rescale the judgments is a delicate matter--one that depends upon the researcher's degree of confidence in the validity of the scale on which the judgments are measured.

In summary, before applying information integration theory to the individual enlistment decision, specific hypotheses about how the different dimensions (attributes) would be evaluated (i.e., their interactions) should be developed, as well as valid scale values on which the judgments are measured. Each of these requirements would necessitate extensive knowledge about the attributes comprising the various options (e.g., Army, civilian employment, college, etc.) as well as the various levels comprising each of the attributes. Thus, before the information integration theory could be reliably and validly implemented, an in-depth pilot study examining the above issues is warranted.

Cognitive Process Models

Cognitive process models attempt to model the sequence of operations or rules involved in carrying out a cognitive task by extracting such rules from verbal protocols and formalizing them in a computer algorithm (Kleinmuntz, 1975; Newell & Simon, 1961, 1972). Two approaches to cognitive process models have been developed: One focuses on the concept of "satisficing" which has been generated by Newell & Simon (1961) and the other focuses on "process tracing" which has been developed by Einhorn, et al. (1979). A short discussion of the "satisficing" cognitive process model is presented here. (Refer to the section discussing Fundamental Measurement, Conjoint Measurement and Unfolding Theory for further information).

Simon (1969) and Simon & Newell (1964) have proposed the term "bounded rationality" for decision behavior which falls short of complete selective rationality; and the concept of "satisficing" as an alternative to subjective maximization. The decision maker is assumed to have definite (but individually varying) parameters of information handling. The individual or group is also assumed to have the goal of satisficing (i.e., finding a course of action "good enough"), but may not be perfect, or optimal. Simon maintains that despite certain evidence of transitivity of preference in humans, the bulk of evidence whether from decision, perception, or learning studies speaks against man acting as a maximizing machine. Part of the problem is that determining all the potentially favorable and unfavorable consequences of all the feasible courses of action would require the decision maker to process so much information that excessive demands would be made on his or her resources and mental capabilities. Moreover, so many relevant variables may have to be taken into account that they cannot all be kept in mind at the same time. Handicapped by the shortcomings of the human mind, the decision maker's attention, asserts Simon, "shifts from one value to another with consequent shifts in preference" (Simon, 1976, p. 83).

The substitution of the concept of satisficing for maximizing opens a place for the introduction of personality, social and cultural variables. Further, whereas decision theory often assumes the invariance of preferences over time, Simon's model assumes that utilities can be altered through experience. Whenever the decision maker is looking for a choice that offers some degree of improvement over the present state of affairs, his or her evaluation is usually limited to just two alternatives: A new course of action that has been brought to their attention and the old one they have been pursuing. If neither meets their minimal requirements, they continue to look for other alternatives until they find one that does. Thus, one characteristic of the satisficing strategy is that the testing rule used to determine whether or not to adopt a new course of action specifies a small number of requirements that must be met. In addition, a decision maker using a satisficing strategy sequentially tests each alternative that comes to his or her attention since little effort is given to

examine and compare the full range of possible courses of action. There is extensive research supporting the use of satisficing strategies in personal decisions as well as organizational decisions (Etzioni, 1968; Hansen, 1972; Miller & Starr, 1967; Simon, 1976).

A simple, unweighted threshold model is typically used by a satisficing decision maker. When testing to see if an alternative meets a given requirement, the decision maker typically limits his or her inquiry to seeing whether it falls above or below a minimal cutoff point. If there is more than one requirement, the decision maker can act in one of two ways: (a) Treat each cutoff point in the same way, as equally important, and/or (b) develop multiple rules for making decisions that depend on the specific values of the requirement (or value) dimensions. This latter type of decision strategy has been referred to as a "process tracing" model by Einhorn, et al. (1979) and a "production system" model by Payne (1982). These types of decision rules differ conceptually from the linear, additive equation incorporated in the approaches discussed in previous sections in that they do not develop a single set of parameters for representing the tradeoffs inherent in individual decision processes. Instead, cognitive process models often result in multiple chains of decision rules.

The final output of a cognitive process model is a computer algorithm. This model has several attractive features: (a) It apparently captures the ongoing decision making process, because it is based on the person's own report; (b) because the verbal report is usually made on representative stimuli, the natural environment or problem space of the person is preserved; (c) the computer model is a sequential step-by-step set of rules, and because we generally seem to process information sequentially, the model has greater face validity than the other approaches discussed so far; and (d) the computer model is configural in that the patterns of information are conditional on one another.

A major aspect of the cognitive process model is the information search. That is, the order in which information is gathered, which cues are attended to, and so on, are an integral part of the model. This is a major difference from the methods previously discussed which do not handle this information search. In addition, the cognitive process model is clearly richer in detail than the methods previously discussed. Therefore, by capturing the information search aspects of the process in much of its detail, the model seems closer to the underlying process than the regression approach. This difference in starting points can account for the feeling that the process model is more firmly rooted in the observable model than in the statistical model.

The methodology of developing a cognitive process model involves verbal protocols (i.e., the decision maker must generate a verbal protocol while making a decision). Decision rules are then isolated from the verbal protocol and a computer algorithm is developed. The application of this methodology to the individual

enlistment decision would be an extremely time-consuming task. This would necessitate in-depth interviewing of a large number of potential recruits to isolate the rules governing their decision making behavior. Another limit of cognitive process models is that they have no formal means of measuring error (i.e., they have no formal error term). Therefore, it seems more appropriate to apply the cognitive process model to determine the cues to which the potential recruit is attending; protocol data is very useful for accomplishing this. Once this has been accomplished, an alternative model (e.g., a regression model) could be developed which would provide estimates of the amount of systematic and error variance in the judgment, as well as statistical tests of various kinds. Furthermore, the relative importance of a particular cue in affecting judgment is very difficult to determine from a process tracing model (i.e., no weights or cue correlations are specifically identified). Therefore, due to the limitations mentioned above, a cognitive process model does not appear to be an effective means for modeling the individual enlistment decision.

Affective Models

Contemporary psychology regards affect as postcognitive (i.e., it is elicited only after considerable processing of information has been accomplished). However, there have been numerous studies that suggest that affective judgments may be fairly independent of, and precede in time, the sorts of perceptual and cognitive operations commonly assumed to be the basis of these affective judgments (Argyle, Salter, Nicholson, Williams & Burgess, 1970; Dawes & Kramer, 1966; Kunst-Wilson & Zajonc, 1980; Scherer, Rosenthal & Koivumak 1972; Wilson, Matthews & Harvey, 1975). Zajonc (1980) has proposed a theory that separates affect and cognition, where the overall impression or attitude of the decision maker has an existence of its own, independent of the components that contribute to the decision maker's cognitive system. Research demonstrates that reliable affective discrimination (like-dislike ratings) can be made in the total absence of recognition memory (old-new judgments), thus providing evidence for the separation between affect and cognition (Bower & Karlin, 1974; Keenan & Bailett, 1980; Patterson & Baddeley, 1977; Sadalla & Loftness, 1972; Strand & Mueller, 1977)

Zajonc (1980) provides a number of distinctions between judgments based on affect and those based on perceptual and cognitive processes. For example, unlike judgments of objective stimulus properties, affective reactions are inescapable (i.e., they cannot always be voluntarily controlled (Zajonc, 1980)). Research has also shown that affect often persists after a complete invalidation of its original cognitive basis, thus affective judgments tend to be irrevocable (Ross, Lepper, & Hubbard, 1975). In addition, whereas cognitive judgments deal with qualities that reside in the stimulus, affective judgments are always about the self, that is, they identify the state of the judge in relation to the object of judgment. These differences support the view that

affect and cognition are under the control of separate and partially independent systems and that both constitute independent sources of effects in information processing.

More recently, Zajonc & Markus (1984) have proposed a representation of affect that distinguishes between hard representations of emotion and soft representations of cognition. Figure 2 illustrates diagrammatically the three components comprising affect according to this representation. One is the arousal of autonomic and visceral activity. The second is the expression of emotion, which is mainly its motor manifestation. These two forms of discharge--the internal arousal processes and the manifest expression--constitute the basis of the hard representation of emotion. The third component is the experience of emotion, which is the basis of its soft representation. The soft representation requires the mediation of the cognitive system. In the present context, the experience of emotion is simply the cognition of having one. In the extreme case, only arousal is a necessary consequence of the generation of emotion. Neither experience nor expression need be part of the emotion process because they can be voluntarily suppressed (Zajonc & Markus, 1984).

In current research, the influence of affect on cognition is examined at the level of soft representation, because it is at this level that the critical causal contact whereby affect can influence cognition is thought to occur. Emotional states (e.g., fear, happiness, etc.) have as their consequences proprioceptive and kinesthetic stimulation. This stimulation, although internal, is perceived by the individual just as external stimuli are perceived. The soft representations (associative structures) that derive from the proprioceptive and kinesthetic feedback can thus interact with the associative structures representing the exposed stimuli (Bower, 1981), implicating processes such as spreading activation. Thus when the affect-cognition interaction is viewed entirely at the soft representational level, we do not really analyze how emotion properly influences cognition, but only how one component of emotion (i.e., experience) influences cognition. Thus, the problem reduces itself to the influence of one association structure (i.e., the transformation of sensory or kinesthetic input) on another (i.e., experience). For the most part, however, no firm assertions can be made about the nature of this correspondence. But neither have images and associative structures been accessible to independent observation, manipulation, and verification. No research has, thus far, been able to generate information about the nature of soft representations. There are also doubts about whether soft representations of the form that is commonly postulated exist at all (Kolers & Smythe, 1979). Certainly, thus far, they are not available to inspection. At best, it is possible to demonstrate a correspondence between some conditions of input and some parameters of output that are consistent with some of our theories about certain types of soft representations. Thus, the "representation of affect" is inferred by observing behavior and its antecedent conditions (Zajonc & Markus, 1984).

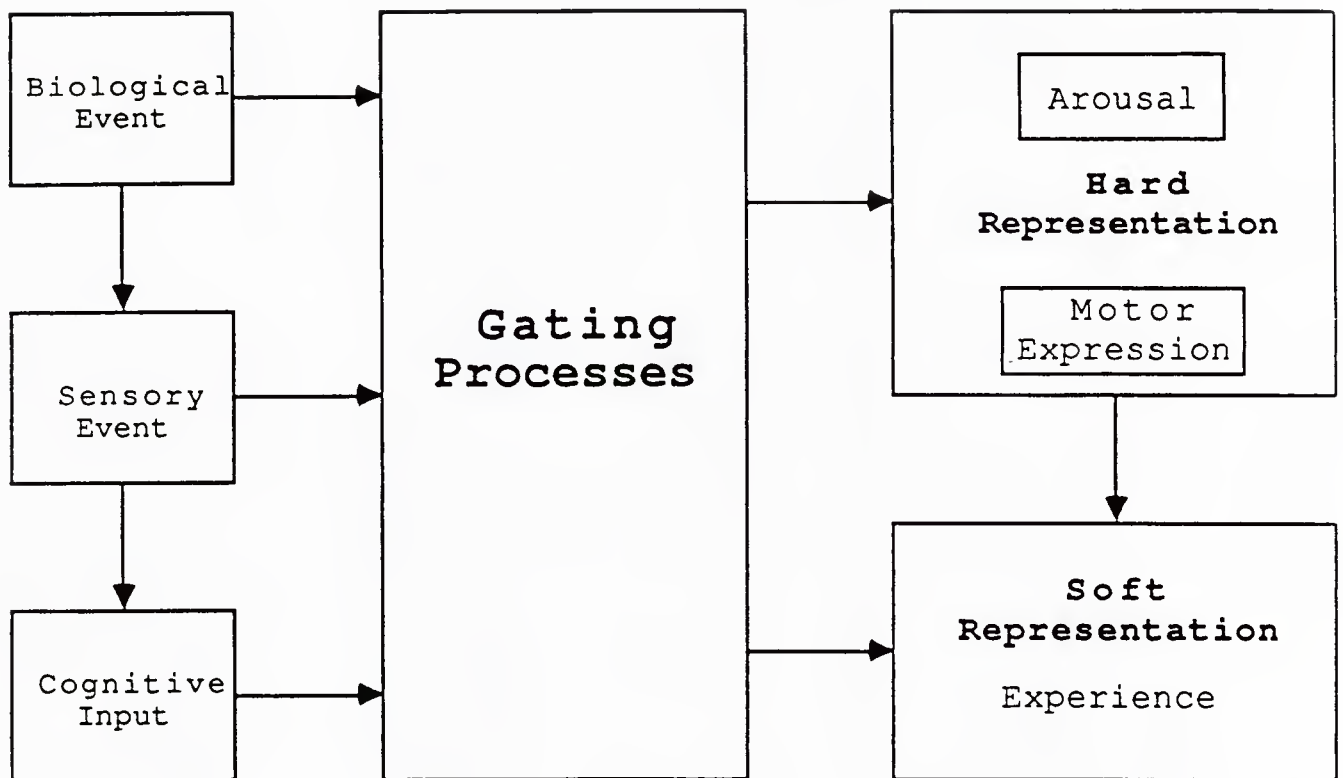


Figure 2. The representation of affect.

The above discussion on affect raises a pertinent issue relevant to modeling the individual enlistment decision. That is, it is not necessarily clear how "affect" or "cognition" can be operationally defined in an indisputable manner.

For example, an individual may decide to enlist or not enlist in the Army because they like/dislike the recruiter or because they want to escape their current situation. The emotion behind either the like/dislike statement or the motivation to escape is one of many affective representations potentially affecting behavior. The reasons given for liking/disliking the recruiter or wanting to escape from home are cognitive representations affecting behavior. From this perspective, it is possible to operationalize the cognitive representations by developing models of individuals' decision processes. The affective component of the enlistment decision process can be operationalized through the development of a measurement instrument such as the semantic differential.

The semantic differential (Osgood, Suci, & Tannenbaum, 1957) uses bipolar adjective rating scales to develop (typically) an affective measure of a given concept. That concept could be a person (e.g., Army recruiter), a group, an action (e.g., enlistment) or anything else that can be rated. The semantic differential has been extensively used in attitude research because most conceptualizations of an attitude include separate affective and cognitive components. A semantic differential is "A technique for measuring the connotative meaning of words and objects on a series of seven-point scales. The items themselves are grouped into factors known as evaluative (e.g., good-bad), potency (e.g., strong-weak), and activity (e.g., active-passive)." (Yaremko, Harari, Harrison, & Lynn, 1982, page 213). Although Fishbein & Ajzen (1975, page 79) have pointed out that the semantic differential "may be used as a direct measure of attitude," the affective connotation of the bipolar adjectives used to construct scales potentially represent a means of operationalizing the more global, immediate affective response to an object (e.g., the Army). Future modeling efforts can evaluate the value of the semantic differential as an affective measurement instrument by using it in conjunction with more cognitively-oriented models and measurement instruments, and by analyzing the obtained results for similarities and differences.

It is important to note that although some decision models may contain an affective component, they do not attempt to assess a more general, affective response, in addition to the more "cognitive" component which includes a rational or discursive process. For example, the extended Fishbein & Ajzen expectancy model (1975) contains an affective component which is defined as the evaluation of a belief; but this component does not specifically include an overall, immediate affective response. Moreover, decision models such as social judgment theory and information integration theory, which incorporate linear, additive weights or other algebraic functions to combine options' scores on individual attributes

(i.e., evaluate beliefs in the terms of the extended Fishbein-Ajzen expectancy model) would consider this combinatory process to be as much (if not more) cognitive than affective.

A formal affective model has yet to be developed. Indeed, Zajonc states that "it is too early to write a model for affect and for the various ways it interacts with cold cognitions; the important pieces of evidence are still missing" (Zajonc, 1980, p. 170). Therefore, it currently seems more feasible to incorporate an affective component into an already existing decision making model (e.g., expectancy theory models, social judgment theory models).

Cognitive Style Models

The concept of cognitive style is well-established in psychology. In a summary of research on cognitive style, Shouksmith (1970) notes that there exists over a hundred distinct cognitive differentiations, such as "semantic flexibility of closure," "spatial scanning," "associated fluency," etc. An individual's cognitive style is most apparent in relation to his/her problem-solving and decision making ability and habits. Moreover, the particular strategies an individual develops for tackling problems are an integral aspect of his or her cognitive style; in fact, theorists generally identify style through problem-solving tests.

Cognitive style is holistic in focus; it includes a molar-level notion of perception, learning, personality, intelligence and attitude. It stresses the ways in which individuals organize their experiences into "coherent models of dealing with information concerning oneself and one's environment which are, to a large degree, independent of the content of the information being handled" (Warr, 1970, p. 10). The notion of cognitive style implies preferred and consistent modes of response to problems that are partly habitual and unconscious but that also include deliberative approaches that reflect the individual's previous learning of his or her problem-solving encounters.

The focus of cognitive style research has resulted in numerous models (e.g., locus of control model, autonomy model, decisional style model, etc.) of cognitive style. To fit the immense range of capacity and responses that any capable adult demonstrates over a variety of settings into a single polarized dimension (e.g., anxiety level, self-confidence level, etc.) is inevitably to limit the applicability of the particular model in question; thus, the cognitive style model employed must be appropriate for the decision process being examined.

A large number of studies have been conducted to determine the role of personality traits in the choice process. For example, those decision makers who produce a large set of decision alternatives in open tasks are found to be characterized by such

traits as extroversion, low anxiety, and self-confidence; contrarily, small sets are produced by subjects scoring high on introversion and anxiety (Gomulski, 1972).

Another individual factor is that of the locus of control. Rotter (1966) distinguished between internals (individuals who believe that their successes and failures are primarily due to themselves) and externals (individuals who believe that their successes and failures are due to external factors over which they have no control). Internals have been found to display more enterprise in information seeking than externals. Internals are more resistant to social pressure and public persuasion than externals; and are predominantly nonconformist and their attitudes are relatively stable (Sherman, 1973).

Driver & Mock (1975) have identified two dimensions of information processing in decision making, the focus dimension and the amount of information utilized. There are two extremes of the focus dimension. At one pole are processors who view the data as suggesting a single course of action or solution, whereas at the other pole are processors who view solutions as multiple.

The amount of information used in reaching a decision also varies from decision maker to decision maker. At one extreme is the minimal data user who "satisfices" on information use, and at the other extreme is the maximal data user who processes all the available information that is perceived to be of use for the decision.

By combining these two dimensions of information processing in decision making, Driver & Mock (1975) derived four basic decision styles. The decisive style is "one in which a person habitually uses a minimal amount of information to generate one firm option. It is a style characterized by a concern for speed, efficiency and consistency" (p. 493). The flexible style "also uses minimal data, but sees it having a different meaning at different times . . . It is a style associated with speed, adaptability and intuition" (p. 493). In contrast, the hierarchic style "uses masses of carefully analyzed data to arrive at one best conclusion. It is associated with great thoroughness, precision and perfectionism" (p. 494). Similarly, the integrative style "uses masses of data, but will generate a multitude of possible solutions . . . It is a highly experimental, information-loving style--often very creative" (p. 494). Driver and colleagues have developed two main psychometric measures of decision style that have apparently predicted such behavior as decision speed, use of data, information search, and information purchase on experimental tasks. However, most, if not all, of these empirical studies, including the psychometric measures themselves, are contained in unpublished reports, which makes the quality of this research difficult to evaluate. For instance, Driver & Mack (1975) have apparently shown that some persons use one style predominantly, whereas others employ one style as often as another.

At the present time, a cognitive style model does not appear to be an effective means of modeling the individual enlistment decision. First, cognitive style models do not attempt to predict decision outcomes. That is, which alternative is selected is not modeled, only the decision process (in terms of the way that different types of people go about making a decision is modeled). Individual enlistment decision models should be capable of both modeling the decision process and predicting the decision outcome. Second, not only are there numerous types of cognitive style models, but past research results have revealed conflicting evidence for any one of these models. Therefore, rather than utilizing a cognitive style model for modeling the individual enlistment decision, it seems more appropriate to use this type of model as an adjunct to a well-established decision model (e.g., expectancy theory model). Specific hypotheses could be developed concerning the cognitive style of potential Army recruits, and a battery of measurement instruments could be administered to individuals who are also completing measurement instruments associated with a formal decision model. The primary limitation of this approach would be the time required of potential enlistees to complete this battery of measurement instruments. Additionally, it is highly unlikely that the cognitive style model alone would be able to reliably predict the individual Army enlistment decision simply because of the inconsistency among results found for past research studies. However, a cognitive style model may be capable of providing important information (e.g., anxiety level, self-confidence, decisional style, etc.) about the majority of potential Army recruits.

Conflict Decision Theory

The conflict model of decision making (Janis & Mann, 1968, 1977) is concerned with identifying factors that determine the major modes of resolving conflicts. It describes how the psychological stress of decisional conflict affects the ways in which people go about making their choices. Unlike many of the other psychological models reviewed in this report, it does not attempt to predict which choice alternative is selected.

Development of the conflict model owes a great deal to the ideas and concepts of a number of scholars who were prominent in formulating the expectancy-value approach to motivation and action. The conflict model draws on the work of Tolman (1938) who introduced the concept of cognitive expectations about consequences of action. The model has also been influenced by Lewin's (1951) pioneering studies, in particular his work on types of conflict, the concept of commitment, and the way in which positive and negative valences influence action. Both Tolman and Lewin emphasized the vital role of expectations about the consequences of an action.

Central to the conflict model is the assumption that the prospect of consequential choice is stress producing. The act of

decision making is viewed as a form of conflict resolution. Psychological stress arising from decisional conflict stems from two principal sources. First, the decision maker is concerned about the material and social losses he might suffer from whichever course of action he chooses--including the costs of failing to live up to prior commitments. Second, he recognizes that his reputation and self esteem as a competent decision maker are at stake. The distinction between the two sources of stress relates to the generalized expectation that the decision as a whole--how one goes about making it as well as its outcome--could prove to be satisfying or damaging. We see then, that the concept of expectancy is implicit in conflict theory.

The theory postulates that there are five basic patterns of coping with challenges that are capable of generating stress by posing agonizingly difficult choices. Each pattern is associated with a specific set of antecedent conditions and a characteristic level of stress. These patterns are derived from an analysis of the research literature on psychological stress bearing on how people react to health and disaster-related warnings.

The five coping patterns are:

1. Unconflicted adherence. The decision maker complacently decides to continue whatever he or she has been doing, which may involve discounting information about risk of losses.
2. Unconflicted change to a new course of action. The decision maker uncritically adopts whichever new course of action is most salient or most strongly recommended.
3. Defensive avoidance. The decision maker escapes the conflict by procrastinating, shifting responsibility to someone else, or constructing wishful rationalizations to bolster the least objectionable alternative, remaining selectively inattentive to corrective information.
4. Hypervigilance. The decision maker searches frantically for a way out of the dilemma and impulsively seizes upon a hastily contrived solution that seems to promise immediate relief. The full range of consequences of the choice is overlooked as a result of emotional excitement, perseveration, and cognitive constriction (manifested by reduction in immediate memory span and simplistic thinking). In its most extreme form, hypervigilance is known as "panic."
5. Vigilance. The decision maker searches painstakingly for relevant information, assimilates information in an unbiased manner, and appraises alternatives carefully before making a choice.

Although the first two patterns are occasionally adaptive in saving time, effort, and emotional wear and tear, especially for routine or minor decisions, they often lead to defective decision

making if the person must select a course of action that has serious consequences for himself, for his family, or for the organization whose policies he is determining. Similarly, defensive avoidance and hypervigilance may occasionally be adaptive but generally reduce the decision maker's chances of averting serious losses. Consequently, all four are regarded as defective patterns of decision making. The fifth pattern, vigilance, although occasionally maladaptive if danger is imminent and a split-second response is required, leads to decisions that meet the main criteria for high-quality decision making.

It must be emphasized that the conflict model applies only to decisions that have real consequences for the decision maker and thereby generate some discernible manifestations of psychological stress. Hence, the model is not necessarily applicable to the simulated or hypothetical decision so often investigated in the laboratory--research that may be valuable for elucidating cold cognitive processes but that seldom applies to the hot ones generated by consequential decisions. Recent experimental research on role playing and forced compliance, self-attributions, perceptual judgments, halo effects, and postdecisional re-evaluation of alternatives has converged with regard to the importance of consequentiality as a determinant of the psychological reactions evoked by the judgmental tasks imposed on subjects in the laboratory. The results of these different types of investigations show that when people are confronted with a consequential choice, they react in an entirely different way than when they are confronted with the same cognitive problem as a purely hypothetical issue or as an intellectual exercise (Collins & Hoyt, 1972; Cooper, 1971; Singer & Kornfield, 1973; Taylor, 1975).

"Consequential" decisions include those that evoke some degree of concern or anxiety in the decision maker about the possibility that he may not gain the objectives he is seeking or that he may become saddled with costs that are higher than he can afford, either for himself personally or for a group or organization with which he is affiliated. Among the possible costs of a decision are failures to obtain gains that might otherwise be obtainable if a better course of action were chosen, which are referred to as "opportunity costs" (Miller & Starr, 1967). Also included are uncertain risks, as well as known costs with regard to money, time, effort, emotional involvement, reputation, morale, or any other resource at the disposal of the decision maker or his organization.

Figure 3 provides a pictorial representation of the conflict theory model of decision making (Janis & Mann, 1977). The mediating processes specified by the model, which consist of the person's answers to the four basic questions, are anchored in observable antecedent conditions.

Communication variables are given prominence (rather than other situational or predispositional determinants) because much

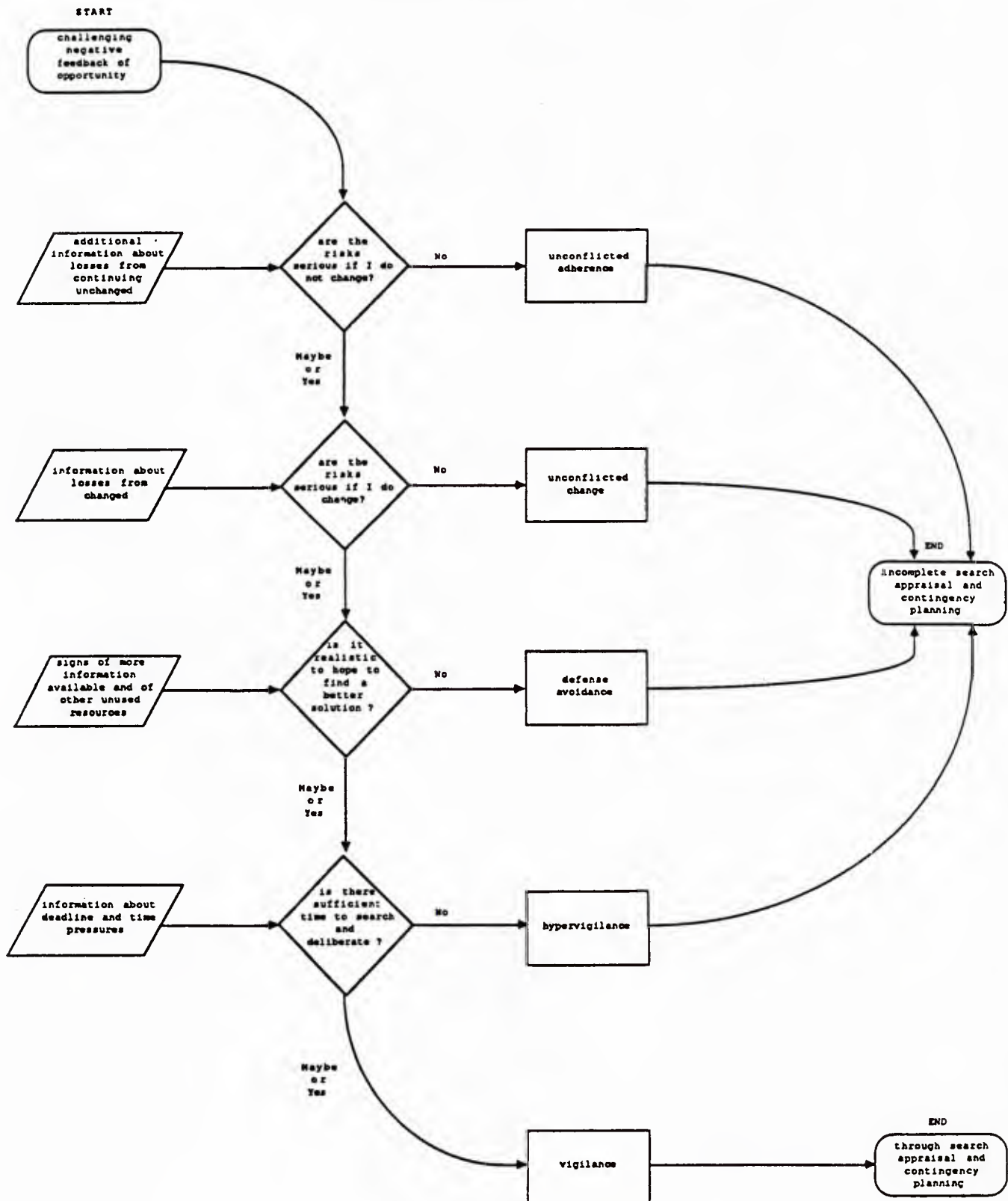


Figure 3. A conflict-theory model of decision making applicable to all consequential decisions.

of the analysis of decision making focuses directly on the influence of warnings, reassurances, and other relevant information presented to the decision maker by the mass media, representatives of reference groups (e.g., family, peers), and other communicators. But it should be recognized that many other situational factors also function as antecedent conditions. Other antecedent conditions, including personality variables and other predispositional characteristics of the decision maker, also determine sensitivity to warnings (Elms, 1972, 1976; Janis, 1974). All of these factors are likely to affect the decision maker's readiness to give positive or negative answers to the four basic questions diagrammed in Figure 3. However, knowledge about various antecedent conditions is still very primitive.

The decision making sequence shown in Figure 3 starts with signs of threat indicating that serious loss (or failure to obtain desirable gains) will result if the person adheres to his present course of action or inaction. For example, suppose an individual has decided to get a civilian job rather than enlist in the Army following graduation from high school. The threat (or opportunity) of such a decision may be conveyed by direct verbal statements (such as being told by an Army recruiter that one could receive a large cash bonus if one enlists) or by indirect signs or events (such as a dramatic increase in the civilian unemployment rate). According to this model, a person's initial response to any such challenge is to pose to himself the first basic question concerning the risks of not changing his decision to get a civilian job. A confident negative response (e.g., no, the risks are not serious if I adhere to my decision to get a civilian job following high school graduation) might come to mind if he recalls having received solid information that all new recruits in the Army will be sent to Libya. In such a case, the person will be quite indifferent to the recruiter's offers and will not bother to contemplate any alternative to his present course of action; rather he will complacently continue adhering to his decision to get a civilian job. But if his answer to the first basic question is maybe or yes, he will think about some new course of action that strikes him as a viable way to handle the challenge--such as deciding to enlist in the Army. He will then consider Question 2, concerning the risk of changing to that new policy. If his answer to Question 2 is a firm no (e.g., no, the risks are not serious if I do enlist in the Army rather than join the civilian work force), he will immediately decide to adopt that solution (e.g., enlist in the Army) and proceed to commit himself to it without giving the matter any further thought. If his answer is maybe or yes (e.g., yes, the risks are serious if I do enlist in the Army), perhaps as a result of realizing that all new recruits in the Army are sent to Libya, he will begin thinking about other alternatives such as enrolling in a vocational/technical school or college. If none of the alternatives evokes a confident negative response to the second basic question about the risks of changing, he will be in a state of high decisional conflict, wanting to change in order to avoid the serious risk of not having any career opportunities,

but, at the same time, not wanting to change in order to avoid the costs and risks of any new course of action.

A major deterrent to switching to a new course of action is the threat of violating prior commitments to the original course of action. The more committed the decision maker, the greater the stress for a better course of action. Thus, the likelihood that a decision maker will give a yes answer to the second basic question depends partly upon the degree to which he is committed to his current course of action. The more committed he is, the greater the threat of his being subjected to social disapproval and other penalties for changing.

Once decisional conflict is generated by affirmative responses to the first two basic questions, the next question pertains to optimism or pessimism about finding a better solution than the least objectionable one at hand. A person who has just graduated from high school may be unable to decide what to do in terms of a career. If he knows that the current job market for inexperienced individuals is extremely poor, that enlisting in the Army will mean that he must go to Libya, and that he doesn't have the capability to attend a vocational/technical school or college program, he feels hopeless about being able to find a satisfactory solution. When a person optimistic about finding a better solution than the objectionable ones he has been contemplating, he will display the pattern of defensive avoidance. In the employment situation, this might take the form of selectively ignoring the issue by refusing to look for a job.

If an affirmative answer to the third basic question is accompanied by a negative answer to the fourth question, concerning whether sufficient time is available to search for a better solution, the decision maker will manifest a very high level of psychological stress. He will become frantically preoccupied with the threatened losses in store for him if he believes that a rapidly approaching deadline precludes an adequate search for a better solution, knowing that one or another set of undesirable consequences will soon materialize. The predicted pattern of hypervigilance in response to deadline pressures occurs when all the available alternatives pose a threat of serious loss. A person in the hypervigilant state becomes obsessed with nightmarish fantasies about all sorts of horrible things that might happen to him, and fails to notice evidence indicating the improbability of their actual occurrence. The person is constantly aware of pressure to take prompt action to avert catastrophic losses. He superficially scans the most obvious alternatives open to him and may then resort to a crude form of satisficing, hastily choosing the first one that seems to hold the promise of escaping the worst danger. In doing so, he may overlook other serious consequences, such as drastic penalties for failing to live up to a prior commitment.

A positive response to the fourth question results in a lowering of the level of stress, because the person has confidence

about finding an adequate solution. For example, when confronted with the enlistment decision, an individual would be unlikely to act impulsively if he sees other possible alternatives such as civilian employment or college. As long as the person believes that there is sufficient time to look at other possible alternatives, the level of stress is reduced. Under these conditions of moderate stress, the person is likely to make a thorough information search and to weigh carefully whatever he discovers concerning the pros and cons of each alternative before making his choice.

All five coping patterns are in the repertoire of every decision maker. The pattern that is temporarily dominant depends upon external and internal cues that influence the answers a decision maker gives to the four basic questions. Fluctuations from one pattern to another are to be expected in any decision maker, as the determining external or internal cues alter the person's answers to the four questions. The model shown in Figure 3 represents the decision maker's state of decision conflict at any given moment and predicts the pattern of behavior that will be dominant at that particular time. So long as the answers to the basic questions remain constant, the person's coping pattern will remain constant. The model is expected to be especially useful for predicting changes in coping behavior that will ensue from new informational inputs that alter the person's responses to one or another of the four basic questions.

The current status of the conflict decision model focuses on the causes and consequences of decisional stress. Indeed, Janis & Mann (1977) state that

We do not assume that conflict theory will necessarily replace other psychological theories purporting to explain and predict decision making behavior. On the contrary, we know from experimental evidence already available that under certain conditions, attribution theory correctly predicts how new information will be assimilated, and under certain other conditions cognitive dissonance theory predicts whether or not bolstering will occur, expectancy theory predicts changes in preferences for alternatives, and so on. Ultimately, we hope that as evidence accumulates on decision making behavior, an integrated theory will emerge that will synthesize all the solid features of present-day theories. We believe that the propositions about decisional stress that we have singled out as basic assumptions for our conflict model have an excellent chance of becoming some of the key postulates in any such comprehensive theory. But the evidence now at hand is fragmentary, and we must await future research developments (Janis & Mann, 1977, p. 80).

The present version of conflict theory tends to emphasize the factors that determine whether a person will deal with his decisional conflict by withdrawing, by becoming increasingly vigilant, or by adopting other coping patterns. That is, its main use has been as a general theoretical framework for integrating diverse findings from psychological research on a wide variety of seemingly unrelated topics, all of which provide evidence on factors affecting the quality of decision making procedures. No quantitative representation or methodology has yet been established for the conflict decision model, rather this model has been used to examine the effects of selective exposure to information, uncertainty about gains and risks, threats to freedom of choice, and irrevocable commitment to a chosen course of action. Past research has manipulated each of these variables and examined whether individuals changed their previously held decisions. Thus, it has not been used to quantitatively model the decision making process; no method for operationalizing the concepts of the conflict decision theory has yet been established.

If conflict decision theory had an operationalized, quantitative model already developed, one of the primary difficulties in developing a measurement instrument would be the time at which individuals are asked to describe their decision processes. It must be remembered that the patterns of responding are temporary, that is, fluctuations from one pattern to another are expected in any one decision maker. Any new informational input can alter an individual's responses to one or another of the four basic questions. Therefore, in order for the measurement instrument to be valid, the time individuals are asked to describe their decision processes and the amount of information individuals possess when making their decision would have to be given primary consideration.

The Unfolding Theory of Preferential Choice

The unfolding theory of preferential choice is rather unlike most of the decision models considered in this literature review. With the exception of the information integrative perspective, most decision theories reviewed attempt to model decisions composed from component psychological processes such as attribute evaluations. That is, the theories articulate salient attributes involved in the decision process and then specify a functional form for their composition.

Whereas such compositional approaches attempt to model the decision process on the basis of an a priori theory of psychological processes with an eye toward predicting behavior, unfolding theory starts with behavior (i.e., choices) and attempts to infer backwards to the psychological processes underlying choice. In this way unfolding theory has some conceptual similarities with the factor analytic approach. Both begin with observations as their raw data and each attempts to infer the latent or underlying processes or factors driving observable behavior. As a result,

both factor analytic and unfolding techniques are termed decompositional (see Lynch, 1985). Each decomposes observable variation for the purpose of modeling unobserved processes. Unfolding theory, then, is both a theory or perspective for studying preferential choices and a measurement model for scaling the underlying psychological dimensions of choice. The measurement model for unfolding theory is taken from a branch of mathematics called fundamental measurement. Fundamental measurement studies the axiomatic foundations of measurement.

This section will discuss three topics in the unfolding theory of preferential choice. First, the basic theory will be presented through the use of examples. Following this, the measurement assumptions of unfolding theory will be briefly introduced. Finally, two of the more popular techniques currently used for the application of unfolding theory to actual choice behavior, multidimensional scaling and conjoint measurement, will be discussed.

Unfolding Theory

A recurrent theme in the literature on static decision theory has been a dissatisfaction with compositional models such as Edwards' SEU formulation (Coombs & Komorita, 1958). As Edwards himself acknowledges (Edwards & Tversky, 1967), such models can be criticized for failing to take into account potentially important properties of choices. Among the properties of choices most often cited as important but unmodeled are their distributional characteristics. Unfolding theory explicitly considers the distributional and order properties of choices. This change in focus from predicting choice itself to the study of the distributional properties of choices led to the articulation of unfolding theory--a theory of the distribution and scaling properties of preferences along a continuum of potential choices.

Unfolding theory starts with the recognition that individual choice behavior can be expected to vary. Even when faced with the same alternatives, people do not always choose the same course of action every time. (Though some changes in behavior can be explained by reference to learning, fatigue, etc., often changes cannot be attributed to an identifiable agent. It is the circumstance where an external cause cannot be found that interests unfolding theorists.) To explain such variations in choice, unfolding theory assumes that individuals, when presented with a set of alternatives, have an ideal preference, but that actual choice will vary about this ideal point. Further, not only is there variation about this ideal point, the variation is orderly.

An individual's preference in sweetening his coffee, for example, may be for one and one-half teaspoons of sugar. From this ideal point, increases and decreases are less and less preferred the further they deviate from one and one-half teaspoons. This is an example of a U-shaped utility function. Unfolding theory predicts that while there can be deviations in

repeated choices about an ideal point, such deviations will become monotonically less likely the further the choice is from an individual's ideal.

Unfolding theory proceeds from this assumption to articulate the manner in which both individual ideal preferences and the underlying (unobserved) utility scale common across individuals are constructed (i.e., how a common scale of preferences is unfolded from individual observed preferences). Figure 4 (adapted from McIver & Carmines, 1981) illustrates a hypothetical example of the unfolding of two individual's preferential choices regarding political candidates onto a single underlying dimension. In this example, we are presuming that individuals were asked to sort, from most to least preferred, persons associated with particular political beliefs. For the sake of argument, assume that the persons are: (a) Reverend Moon, (b) Jerry Falwell, (c) George Bush, (d) Ted Kennedy, and (e) Jessie Jackson.

Figure 4 illustrates the unfolding of individual preferences onto a single dimension underlying the choices made. (Kruskal & Wish, 1978, present examples very similar to this where nations are sorted according to similarity). Here the individual preference orderings (the I scales) are arrayed above the ideal choice as located on the horizontal scale (the J or Joint scale). The I scales are "read" from bottom to top. Individual 2's preference ordering is D, C, E, B, then A. Note that the unfolding of the I scales preserves the original rank ordering of preferences for I-1 and I-2. In this example, the psychological dimension underlying choice behavior (perceived political philosophy) was recovered by decomposing observed preferences.

Fundamental Measurement

The recovery of a scale underlying observed preference choices requires more than the assumption that the further a choice alternative is from an ideal point, the less preferred it is. As in factor analysis, a measurement model is required. The foundation of unfolding theory's measurement model is in a branch of mathematics called fundamental measurement (Krantz & Tversky, 1971).

Fundamental measurement concerns itself with the identification of conditions necessary and sufficient for asserting that a set of measurements can be meaningfully interpreted as scale values. Fundamental measurement axiomatizations are typically stated in terms of a set of qualitative order relations. Unfolding theory applies order relations taken from fundamental measurement to recover scales embedded in observed preference or similarity ratings.

Among the more important measurement constraints applied in unfolding theory are the following points:

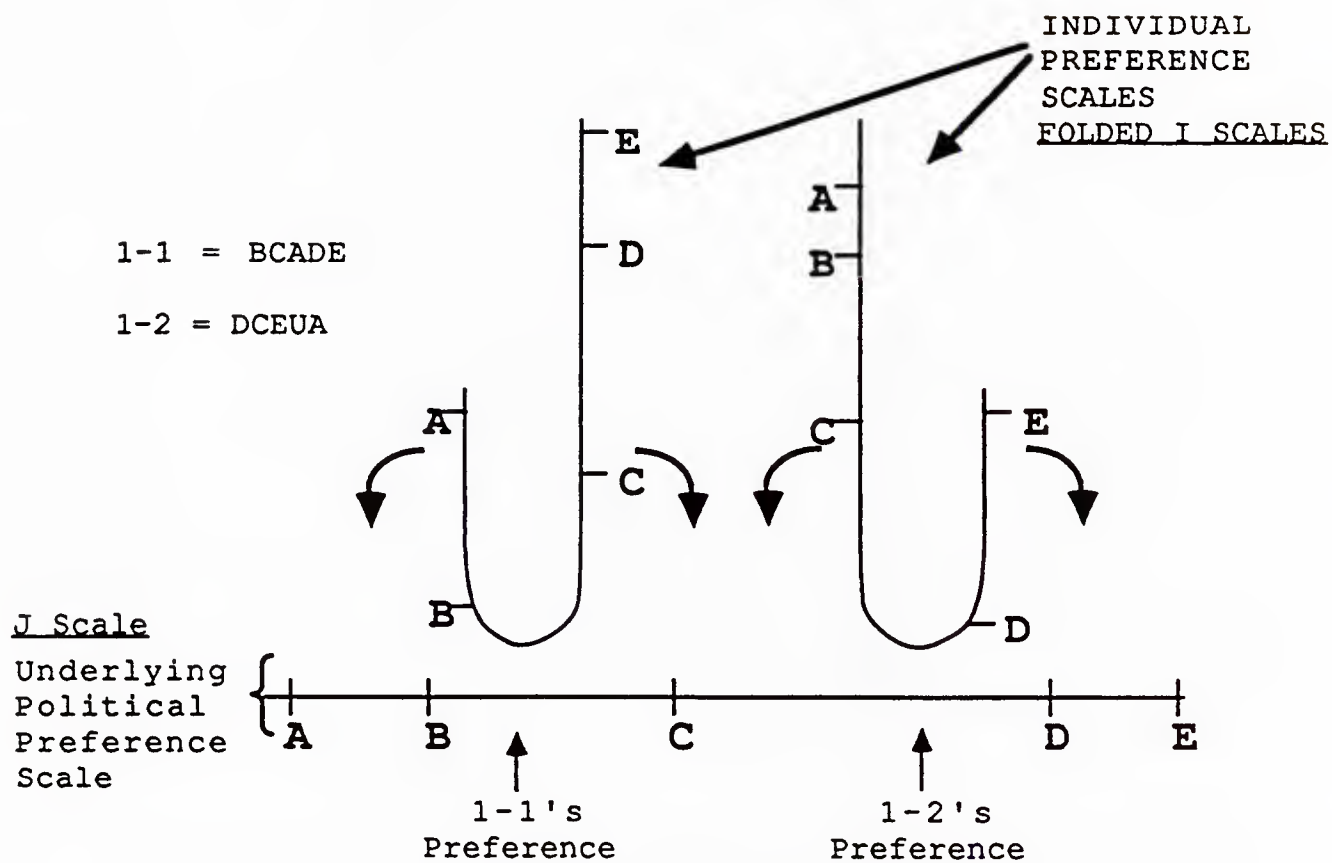


Figure 4. Unfolding of two individual preferences in single underlying dimensions.

1. One-Point Condition $s_{ii} \geq \frac{s_{ij}}{s_{ji}}$ (any object, i , must be at least as similar to itself as to any other object)
2. Two-Point Condition $s_{ij}=s_{ji}$ (Symmetry) (any object, i , must be about as similar to j , as j is to i)
3. Three-Point Condition (Triangle Condition) s_{ij} both large s_{ji} large implies s_{jk} moderately large (any two objects, j and k , that are both similar to a third object, i , must be somewhat similar)

The reader may wish to confirm for him or herself that the example presented in Figure 4 conforms to these constraints. The unfolding or recovery of a scale underlying observed preferences is dependent on the data conforming to such constraints. A weakness of this approach is that it is intolerant of error. At present there is no method for dealing with violations to the measurement model as it does not incorporate an error term. Attention will now turn to the techniques actually used to operationalize unfolding theory.

Multidimensional Scaling and Conjoint Measurement

In this section an introductory description of multidimensional scaling and conjoint measurement is presented from the limited perspective of how these techniques relate to decision processes. Each will be discussed, in turn.

Tversky (1967) and Young (1969) have demonstrated formally that virtually all of the models subsumed under the name "multidimensional scaling" can be expressed as particular cases of polynomial conjoint measurement. As they show, the primary difference between the particular and general case lie in the specific algorithms used for choosing a multi-attribute utility function from the set of feasible alternatives. Nonetheless, we will discuss the models separately so as to highlight their complementary characteristics.

Multidimensional scaling. Multidimensional scaling is a collection of techniques developed for the purpose of portraying psychological relations among stimuli as relations among points in a multidimensional space. That is, multidimensional scaling techniques transform observed individual responses to stimuli (e.g., preferences among political candidates, reported similarities among a listing of career choices, etc.) into a spatial relation among stimuli. Here, again, the conceptual relation to factor

analytic techniques is clear. Traditional factor analysis accounts for observed variation in variables in terms of a smaller number of underlying scales. Multidimensional scaling unfolds reported preferences or similarities and explains them in terms of a smaller number of underlying psychological dimensions. The axes of the spatial representation are interpreted as the underlying psychological dimensions framing choice. An example should clarify.

Kruskal & Wish (1978) submitted data on the airline distances between 10 major cities in the United States to a multidimensional scaling computer program. Figure 5 reproduces the computer solution obtained. As this figure indicates, analysis of the data produced a mapping of cities rather faithfully reproducing their physical placement in two dimensions (latitude and longitude). Knowing only the pairwise distance between cities, multidimensional scaling was able to establish the correct number of underlying dimensions and recover the simultaneous positioning of each city vis a vis all others.

Perhaps even more interesting from the standpoint of behavioral and social science applications is the map produced by Shepard (1957). Figure 6 displays a Bostonian's map of the United States. The data used to construct this map was collected by Shepard when he obtained measures of the proximities between states from a group of New England university students. From a decision modeling point of view this map is more interesting in that it shows the perceived (rather than objective) relations between states for this group of individuals. As might be expected, particular prominence is given to New England. As these figures show, multidimensional scaling takes observed similarity or preference ratings and transforms them into a coordinate map much as accomplished in factor analysis.

Multidimensional scaling can be very useful for the study of multiattribute decision making. These procedures are especially useful for psychophysical quantification of stimulus scales and the identification of choice dimensions unrecognized by researchers. Because multidimensional scaling relates, through the analysis of similarities data, the researcher's objective space to the respondent's perceived space, it is quite able to assess the fit between researcher and respondent salience.

For example, a researcher may have objective measurements on a number of incentives available to prospective Army recruits. These might include various levels of an enlistment bonus, money for college, variable enlistment terms, and basic pay. Multidimensional scaling analysis of similarity profiles for the incentives mentioned above would provide information as to the number of dimensions affecting choice. The resulting multidimensional space may not be four dimensional as some attributes may be non-salient (leading to fewer dimensions), or, on the other hand, interactions between attributes may lead to a greater dimensionality. In addition, analysis of respondent's pairwise similarity

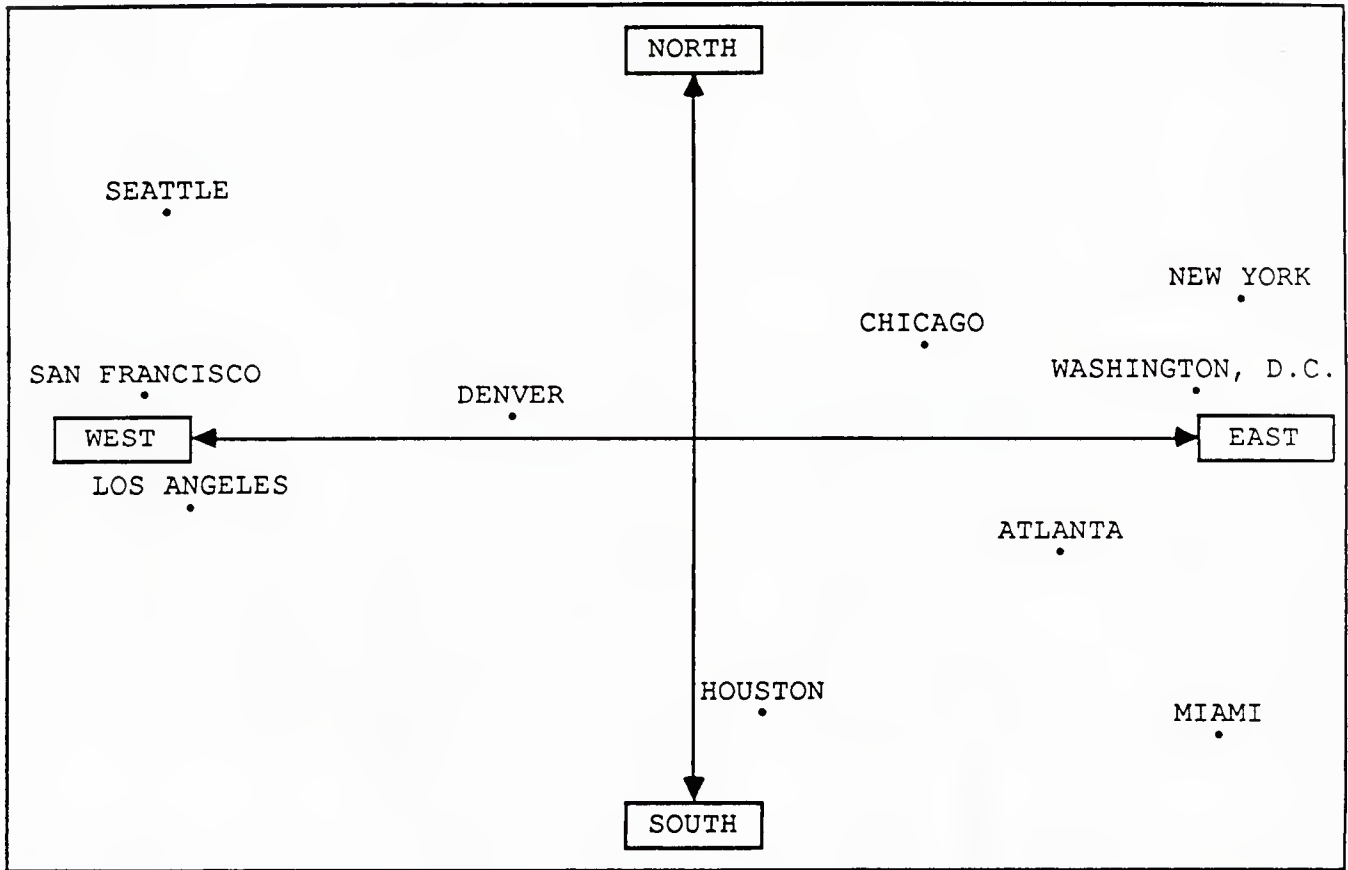
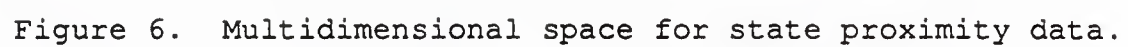


Figure 5. Multidimensional space for distance between cities.



judgments would also provide the basis for developing transformations that link objective scales to psychological scales. For example, considering the Bostonian's map of the United States, transformations could be developed that link the subjective perceptual map to the objective geographic map.

Conjoint Measurement. Conjoint measurement is a rather recent methodological development. The first formal papers on the subject were written in the early 1960's by Debrau (1960) and Luce & Tukey (1964) (it should be noted that the original conceptual work goes back considerably farther). Since these foundational works, other researchers (e.g., Fishburn, 1970; Krantz, Luce, Suppes & Tversky, 1972; Scott & Supes, 1968; Tversky, 1967) have extended analysis capabilities considerably. Beginning with an examination of the additive case, conjoint measurement principles and application algorithms have extended the original model to consideration of polynomial functions (sums, differences, and products). Presently, polynomial conjoint measurement is capable of modeling complex nonlinear psychological models of multiattribute decision making.

Conjoint measurement, like nonmetric multidimensional scaling, deals with the ordering of some response variable of interest (i.e., a decision) to the researcher. However unlike multidimensional scaling, the researcher is concerned with modeling the effect of two or more independent variables on the underlying psychological dimensions of the dependent variable. In compositional decision modeling, interest is frequently oriented toward evaluating the composition rules by which a set of independent variables can be used to predict a decision. As previous sections have shown, the decision modeling literature offers a wide variety of potential compositional rules. This poses a great difficulty for researchers wishing to comprehensively address potential specifications. In addition, most of the reviewed decision models assume interval-level measurement. As most models do not rigorously articulate conditions under which its specification may be evaluated, both the specification and measurement assumptions remain problematic in practical applications. Conjoint measurement confronts both of these issues; it attempts to solve the measurement and compositional problems by finding scales that obey the assumed compositional rule to some suitable degree of approximation.

To illustrate the approach conceptually, assume that we are attempting to establish the marginal contribution of income, opportunities for travel, physical effort, and length of work day levels to the overall evaluation of career choice attractiveness. The researcher could present pairs of attributes coded at different levels and ask which attribute and level in each pairwise case is preferred. If all attribute pairs covering a range of levels are evaluated and an additive compositional rule specified, conjoint measurement would yield model such as

$$A = 1I + 2T + 3E + 4L$$

where, [following Krantz & Tversky (1971)] 1 through 4 represent the part-worth (i.e., marginal) contributions of income, travel, physical effort, and day length, respectively, to the attractiveness (A) of career choice. Though the equation specified above may share a structural and interpretive similarity with the linear regression model, the process of model estimation and diagnosis is more extensive. For example, in this simple additive conjoint example, estimation and evaluation considers the conditions under which the proposed composition function (i.e., additive) adequately accounts for the empirical ordering observed. Not coincidentally, conjoint measurement also attempts to establish scales for the dependent and independent variables which render the composition rule valid. Unlike linear regression, which assumes the effect of independent variables on the dependent variable to be constant throughout their ranges, conjoint measurement tests for and allows for nonlinear effects over the range of the scales.

In this simple case, conjoint measurement is analogous to main-effects analysis of variance (ANOVA). ANOVA evaluates whether an additive combination of main effects can reproduce the cardinal values of the dependent variable within a specified degree of precision. In additive conjoint measurement, the attempt is to find a monotone transformation of the dependent variable and the scales of the independent variables that allow the main-effects model to hold. Note that both model input (independent) and output (dependent) terms are evaluated.

Conjoint measurement, particularly when used in conjunction with multidimensional scaling, provides a useful set of models and algorithms for dealing with multi-attribute choice behavior. As described earlier, conjoint measurement, additive or more generally polynomial, provides a variety of possible compositional functions for relating overall evaluation changes to changes in the argument of a utility function (Green & Wind, 1973, p.61).

In addition, conjoint measurement applications afford researchers the opportunity to investigate the utility functions associated with disparate sets of alternative choices. Continuing the career choice example, it may be that utility functions linking income, travel, effort, and work day to different potential careers are radically different in functional form. Conjoint measurement techniques provide a convenient method for assessing such differences.

Expectancy Theory

The fundamental principle of expectancy theory is that the strength of a tendency to perform in a given way depends on the strength of an expectancy that the act will be followed by a given consequence (or outcome) and on the value or attractiveness of

that consequence (or outcome) to the agent. Essentially, it is predicted that people choose behaviors that they think will result in the highest payoff for them.

In modeling choice behavior, classical expectancy theory uses two basic concepts: Expectancy and valence. Expectancy is defined as the assumed likelihood that an action will lead to a certain outcome or goal. Valence is the associated attractiveness of a particular outcome. This theory assumes that individuals learn expectations (i.e., probabilities that a given response will be followed by some event) either through observation or direct experience. Since the "events" can be positive or negative in nature, expectations come to be combined with an evaluation of their attractiveness (i.e., valence). Together, the combination of expectations and valence becomes the utility of an action to an individual.

Two models of classical expectancy theory are presented by Vroom (1964). The first of these models predicts the valence of outcomes, which is defined conceptually as the strength of an individual's positive or negative affective orientation toward the outcome. This model states that the valence of an outcome to a person is a monotonically increasing function of the algebraic sum of the products of the valences of all other outcomes and his/her conceptions of the specific outcome's instrumentality for the attainment of these other outcomes. Symbolically,

$$V_j = f \sum_{k=1}^n (V_k I_{jk})$$

where

V_j = the valence of outcome j

I_{jk} = the cognized instrumentality of outcome j for the attainment of outcome k

V_k = valence of outcome k

n = the number of outcomes

Cognized or perceived instrumentality is defined conceptually by Vroom as the degree to which the person sees the outcome in question as leading to the attainment of other outcomes. Instrumentality varies from minus one (meaning that the outcome in question is perceived as always not leading to the attainment of the second outcome) to plus one (meaning that the outcome is perceived as always leading to the attainment of the second outcome).

Although Vroom's model can be used to predict the valence of any outcome, it has been applied most frequently to the prediction of job satisfaction, occupational preference (as an evaluation), and the valence of good performance. In essence the model says

that the worker's satisfaction with his job or anticipated satisfaction with an occupation results from the instrumentality of the job for attaining other outcomes and the valence of those outcomes.

Vroom's second model predicts the force toward behavior. The force on a person to perform an act is conceptualized by Vroom as a monotonically increasing function of the algebraic sum of the products of the valence of all outcomes, and the strength of his/her experiences that the act is followed by the attainment of these outcomes (Vroom, 1964). Symbolically,

$$F_i = \sum_{j=1}^n (E_{ij}V_j)$$

where,

F_i = the force on the individual to perform act i

E_{ij} = the strength of the expectancy that act i will be followed by outcome j

V_j = the valence of outcome j

n = the number of outcomes

The individual's expectancy is defined by Vroom as his/her belief concerning the probability that the behavior in question is followed by the outcome of interest. An expectancy is a perceived probability and, therefore, ranges from zero to plus one. It is distinguished from instrumentality in that it is an action-outcome association, whereas instrumentality is an outcome-outcome association. Expectancies are perceived probabilities; instrumentalities are perceived correlations.

Vroom suggests that this force model can be used to predict choice of occupation (a behavior), remaining on the job, and effort. We will refer to this model as the force model and its most frequently tested example as the job effort model. Specifically, Vroom states that the force on the individual to exert a given amount of effort is a function of the algebraic sum of the products of the person's expectation that the given level of effort will lead to various outcomes and the valence of those outcomes. The individual should choose that effort level with the greatest force. It should be noted that the amount of effort, not performance, is predicted by Vroom; effort is considered to be a behavior, whereas performance would be an outcome.

Fishbein & Ajzen (1975) developed an expectancy theory that departs in some significant respects from those presented by Edwards (1957) and Vroom (1964). Their basic position regarding the specification of multi-attribute utility functions is most clearly brought out in their discussion of attitude formation.

They contend that the totality of a person's beliefs about other persons, objects, institutions, etc., serves as the information base that ultimately conditions attitudes. On the basis of outside information or direct observation, an individual comes to associate a number of attributes to objects, persons, etc. Attitude formation, however, requires more than cognition; affect must be incorporated.

Fishbein and Ajzen contend that whenever a belief is formed, an implicit evaluation (affect) becomes associated with an attribute. Individuals do not merely process information, they evaluate it as well. Together, the attributes and affect associated with objects, persons, institutions, etc., constitute a person's attitude about same. Fishbein and Ajzen's model of attitude formation can be summarized as follows:

- An individual holds many beliefs about a given object (e.g., the Army provides skill training, Army pay is low);
- Associated with each belief is an implicit evaluation (e.g., skill training is valuable, low pay is demeaning);
- Through conditioning the evaluative response becomes associated with the object;
- The conditioned responses are summative; and
- On future occasions the object will elicit this summative overall attitude.

At this point an important distinction between classical expectancy theory and the Fishbein and Ajzen formulation must be brought out. Whereas the "classical" expectancy models, such as SEU and Vroom, assume direct linkage between attitudes held (utilities) regarding an object and behavior, the Fishbein and Ajzen model does not make such a direct connection. The connection between attitudes and choice behavior can only be made through an intervening variable--behavioral intention.

Though attitudes toward an object are related to a person's intentions to perform a variety of behaviors (e.g., join the Army), the extended Fishbein and Ajzen model states that although intentions to perform a behavior are certainly a function of beliefs and evaluations, the relevant beliefs and evaluations are not those regarding the object of behavior (e.g., the Army), they are those associated with the behavior itself (e.g., joining the Army). In this way, attitudes toward the Army, for example, may be only moderately related to enlistment intentions. What is of great consequence, however, is an individual's attitudes toward the act of enlisting. As an illustration of this point, an individual may have uniformly positive attitudes toward the Army but

be completely negative regarding perceived attributes of enlisting. Although the Army is a great place, entry is an ordeal--endless testing and examinations, mass processing, hurry up and wait, haircuts, etc.

Fishbein and Ajzen made an important contribution by shifting the focus from attitude towards an object to behavioral intention. They relate overt behavior to the concept of behavioral intention that refers to the subjective probability that a person will perform some behavior (Fishbein & Ajzen, 1975). Behavioral intentions are assumed to be a function of a weighted combination of two main variables: Attitude toward performing the behavior and a subjective norm for that event. Consistent with some other related formulations (e.g., Carlson, 1956; Peak, 1955; Rosenberg, 1956; Vroom, 1964), attitude toward behavior is conceived as the sum of the beliefs or subjective probabilities that the behavior will lead to salient consequences multiplied by the evaluations of those consequences. Fishbein & Ajzen (1975) refer to this conceptualization of attitude as an "expectancy-value" model. The subjective norm aspect takes account of the influence of the social environment on behavior.

A second distinction between the Fishbein and Ajzen model and classical expectancy theory is its explicit incorporation of a normative component. Not only do individuals form beliefs about personal behavioral consequences, they form beliefs about evaluations others might have regarding such behavior. Normative beliefs are formed in the same basic manner as outlined above for attitudes. Beliefs regarding the probable evaluation of reference groups or individuals are also taken into account. Is it probable that they believe one should or should not enlist? This subjective belief is then moderated by an individual's evaluation of, or affect toward, the normative referent. What is the importance of this individual's opinion, expressed in terms of the respondent's motivation to comply with the referent's beliefs.

The general subjective norm involves the person's perception about whether reference groups or individuals whose expectations seem to be relevant in the situation would or would not support the behavior in question, and the motivation to comply with these expectations. In summary, therefore, the behavioral intention to perform a specific behavioral act under a particular set of circumstances is assumed to depend on a personal or "attitudinal" factor and a social or "normative" factor. These two components of the theory are assumed to combine additively in a weighted combination.

Algebraically the model can be expressed as follows:

$$\begin{aligned}
 B \sim BI &= (AB)w_1 + (SN)w_2 \\
 &= \left[\begin{matrix} n \\ AB = \sum_{i=1}^n B_i E_i \end{matrix} \right] w_1 + \left[\begin{matrix} 1 \\ SN = \sum_{j=1}^1 NB_j MC_j \end{matrix} \right] w_2
 \end{aligned}$$

where

B = the particular behavior
BI = the behavioral intention to perform the behavior B
AB = the attitude toward performing behavior B
SN = the subjective norm
 B_i = the belief (subjective probability) that performing the behavior will lead to consequence X_i
 E_i = the evaluation of X_i
 NB_j = the perceived expectation for Referent j
 MC_j = the motivation to comply with Referent j
n = the number of salient consequences
i = the number of salient referents, and
 w_1 and w_2 are empirically derived regression weights.

The extended Fishbein model, as depicted above, is the most explicitly inclusive of the expectancy theory models. In addition to shifting the focus to behavioral intentions, it is also significant because it introduces both social norms and motivation to comply as factors.

The Fishbein and Ajzen model can be relatively easily adapted to the enlistment decision. It provides a good approach to modeling the psychological processes involved in the enlistment decision. It is, at least in its basic configuration, unambiguous regarding measurement requirements and (most importantly) the specification of the multiattribute utility function to be used. The measurement instrument consists of simple statements/questions with rating scales which makes its implementation easy even when participants are unsupervised. Therefore, the extended Fishbein and Ajzen expectancy theory model is highly recommended as a means for modeling the individual enlistment decision.

CAREER DECISION MAKING RESEARCH

The next two sections of this report review research in two applied research areas that use decision models: Career and consumer decision making. These areas were reviewed to determine which models have been successfully applied. This section examines dominant trends in the career decision making literature. The general method used here is to review representative articles in detail, and to follow each article with comments and criticisms in light of our present objectives. The order of presentation of the articles was designed so the reader is gradually introduced to the career decision making literature, with each level adding to the sophistication of the reader's understanding of the field. Thus this section may be thought of as a "primer" to the field.

In reviewing the findings in this literature, linear models in general, and in particular, those based on the principles of Expectancy Theory, have been implemented with a high measure of success.

Basic Assumptions and Fundamental Concepts of Vocational Decision Making Models

Jepsen & Dilley (1971) present a general review of vocational decision making models. Their article is a helpful introduction to the literature, as it carefully presents the fundamental concepts, vocabulary, and assumptions operative in the field, with which one must be familiar.

One major problem in integrating decision making literature is that various theorists have not employed either the same framework or language as their predecessors. Several questions can be raised: Among the various theories, are there similarities in the basic concepts that are masked by the differences in language? Do the theories fit the same population of decision situations? Do certain theories better describe certain types of decisions? How do the theories vary in terms of decision makers and their resources?

In a major review of vocational decision making (VDM) models, Jepsen and Dilley compare and contrast various VDM models on basic assumptions and fundamental concepts. They emphasize that any VDM model employed must take a stand on the issues detailed below.

First, there are certain assumptions about the amount of information a decision maker has. Specifically, how much does the decision maker know about possible alternatives? About a given alternative? Also, what is known about the projected outcomes and the probabilities connecting alternatives to outcomes?

Second, there are assumptions concerning conditions of risk or uncertainty in VDM processes. Most models emphasize either risk or uncertainty. The risk group sees vocational decisions as among those where probabilities about future events are assigned. The risk models employ "objective" probability statements based on other persons' experiences (e.g., expectancy tables or regression equations), where available, in the VDM process.

The uncertainty group conceptualizes vocational decisions as decisions for which no generally accepted probabilities of future events can be attached. Put another way, the difference between "uncertainty" and "risk" refers to the amount of so-called "objective" data directly applied to the VDM process. The uncertainty models suggest that the probability statements about future events are filtered through the decision makers' subjective judgments before fitting into the array of information used to make a final commitment. The distinction between data (facts) and information (interpreted facts) seems to capture the essence of the different assumptions.

The root of the dispute between risk models and uncertainty models lies in the choice between beliefs about the differences found in the contemporary experiences of the decision maker and the experiences of several past decision makers. Those who prefer the risk assumption find this difference insignificant for decision purposes. In contrast, those preferring the uncertainty assumption attach considerable importance to these differences.

There are also assumptions about the strategy of decision makers. Models are classed as either classical or satisficing. The classical model attempts to select alternatives with the maximum expected utility. The classical model sees the decision maker as comparing several alternative actions and selecting the one that is "best"--usually the one with the greatest multiplicative products of values and subject probabilities summed over all outcomes, less the aggregate costs for a given occupation.

The satisficing model attempts to minimize the difference between an alternative and some preconceived standard (e.g., level of aspiration). The satisficing model assumes that the decision maker has a standard in mind that must be met. The standard is usually not fixed and fluctuates as a result of the decision makers' experiences. The alternative selected is the one that either meets or most closely approximates the standard.

In addition, one who employs a VDM must consider assumptions about the degree of precision of combining information. Simply, models are distinguished as those which require mathematical certainty and those which do not. The pivotal issue here has to do with assumed performance by the decision maker in ordering his value preferences. The range of methods addressing this issue span from a simple binary grouping of "yes" or "no" on all outcomes, to the ordering of value preferences by a constant sum method, to the complexity of indifference curves.

Finally, there are assumptions about the relationship between the subjective probability of a future state (outcome) and the evaluation of that state. Two aspects of the aforementioned relationship are involved: How much distinction a model assumes between the concepts and the direction of influence, if any, between the concepts.

Jepsen and Dilley further distinguish VDM models according to their applicability to various decision types. At the outset of Jepsen and Dilley, it was proposed that VDM models differed on assumptions about the context of the decision maker (having high or low understanding, i.e., information and and occupational skill) and his decision (having long- or short-term consequences). By imagining these two assumptions on continua and describing the extremes, four recognizable decision types appear, as Figure 7 illustrates.

In conclusion, Jepsen & Dilley (1971) assert that VDM models are similar in many ways to decision theory and to each other. Nevertheless, differences among them are substantial enough to require much care in the formulation of any generalizations about either VDM models or decision theory. They claim to have shown the various ways that VDM models are applicable to different types of decisions. Although they did not make evaluative conclusions about the various VDM models, Jepsen and Dilley did make a laudable effort to sift through the plethora of terms and isolate some of the fundamental issues that anyone studying or employing a VDM model needs to consider.

Methodological Issues in Subjective Expected Utility and Vroom's Expectancy Theory Approaches to Modeling the Career Decision

The second article considered, by Mitchell & Beach (1977), is the next logical step in developing an understanding of the career decision literature. It presents a study of the methodologies employed in modeling career decisions. The authors compare normative and descriptive approaches as found in Decision Theory and Expectancy Theory. They also present important methodological caveats while weighing the relative merits of different approaches.

Mitchell and Beach begin by clarifying and distinguishing some critical terms. "Preference" is defined as an attitude, an evaluation of attractiveness. "Choice" refers to that occupation which has actually been selected. "Attainment" refers to the occupation in which the individual currently or eventually resides. This vocabulary is used in the discussion of the primary model types under examination in this article, namely, Vroom's Expectancy Theory Models and Subjective Expected Utility Theory Models.

Mitchell and Beach identified some problems which they believe Vroom must address. First, they are concerned with how an investigator would ascertain relevant outcomes for a given subject. Obviously, when salient outcomes relevant to a particular person or particular outcome, are omitted, the predictability of the model is limited. Simply asking job candidates is inadequate because their knowledge may be limited or inaccurate. On the other hand, if the investigator uses some standard list of outcomes mentioned by a large number of people previously tested, he runs the risk of omitting an important outcome for a particular person.

Mitchell and Beach also express concern about the measurement of the theoretical components. In many cases instrumentalities are treated as expectancies, or expectancies are measured as if they were instrumentalities. The valence measures sometimes reflect importance and at other times affect. Clarification and standardization in this area are sorely needed.

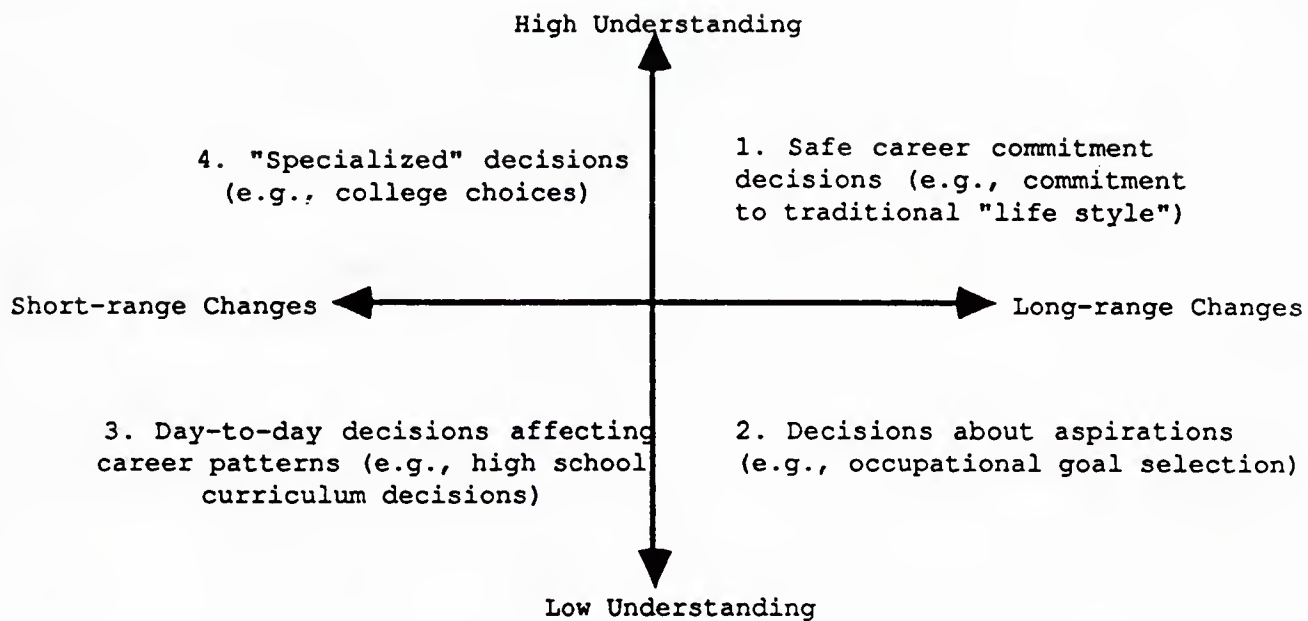


Figure 7. Theoretical vocational decision types.

Finally, there are concerns about possibly unwarranted mathematical and theoretical assumptions. Since the scales used to measure the theoretical components are ordinal at best, they cannot truly be used to reflect an underlying multiplicative relationship. Inferences about the underlying psychological properties, say Mitchell and Beach, may well be inappropriate.

Mitchell and Beach discuss Subjective Expected Utility (SEU) Theory, which is grounded upon a maximization principle. This principle states that the act with the maximum expectation (i.e., the act with the greatest sum of values of the possible outcomes and of their respective probabilities of occurrence) should be chosen.

Methodological issues for SEU are also raised, beginning with SEU's congruence with the dictates of probability theory. Mitchell and Beach claim that to assume that subjective probabilities are congruent with the rules laid down by probability theory is a "bold, perhaps brazen assumption." It requires a mathematical precision in subjective probabilities that Mitchell and Beach believe to be unlikely to exist.

Another issue raised concerns the measurement of subjective probabilities. Many studies have taken a direct approach and asked subjects for straightforward verbal assessment. These are made on scales that are labeled 0.00 to 1.00, by dividing 100 markers into stacks, by stating odds, etc. Other studies have used indirect measurement methods; the most common method involves inferring subjective probabilities from bets.

In all the studies reviewed by Mitchell and Beach, they could find no convincing claim for a "best" method. Perhaps a resolution will be found in future research.

Another area still in need of resolution is that of the additivity of utilities. The computation of SEU involves the summing of weighted utilities, where the weights are subjective probabilities. Results of studies that have examined utilities are in conflict.

In the end, Mitchell and Beach admit that there are many open questions in this area. Nevertheless, they seem to agree with the inclination of researchers who are interested in real-world applications of SEU. Mitchell and Beach characterize these inclinations as being "somewhat cavalier: Assume subjective probabilities are reasonably congruent with probability theory, use direct verbal methods to measure them (and to measure utilities), assume that utilities are additive; and if it works, use it and do not get too caught up in the subtleties" (Mitchell & Beach, 1977, p. 255).

A Comparison of Vroom's Expectancy Model and Soelberg's General Decision Process

Sheridan, et al. (1975) describe the implementation and results of an Expectancy Theory model in a career decision context. They also use Soelberg's General Decision Process to challenge Expectancy Theory's claims and to assert claims of its own.

Sheridan, et al. (1975) examined the job selection process of 49 graduating nursing students over a five-month period in which they searched for hospital jobs. Job selection involved an initial screening of job alternatives from which to select job interviews. The choice from among acceptable job candidates was implicitly made weeks before the final job acceptance. Comparative analyses were made between Vroom's Expectancy Model and Soelberg's General Decision Process (GDP).

Vroom's expectancy model of motivation suggested that an individual would select the job alternative having the highest motivational force. The motivational force to choose a particular job alternative was a multiplicative function, involving three variables: Expectancy, instrumentality, and valence. Expectancy was defined as the perceived likelihood that a given job alternative would or would not have specific end outcomes such as a high starting salary, good working conditions, and opportunity for advancement. Valence was defined as the individual's preference for attaining one outcome over another. The mathematical analogue of the perceived motivational force to select the j th job alternative was defined as:

$$MF_j = E_j \times V_j$$

where:

MF_j = motivational force to select the j th alternative

E_j = expectancy of receiving an employment offer from the j th job alternative ($0 < E_j < 1$)

V_j = perceived valence for the j th job alternative

Vroom depicted the valence of a job alternative as:

$$V_j = \sum_{k=1}^n I_{jk} \times V_k$$

where:

I_{jk} = instrumentality that the j th job alternative would or would not have the k th outcome

V_k = valence of the kth end outcome

n = number of outcomes

Vroom claimed that after a job search, there was significant correlation between expected job valence and the rated preferences for job alternatives. In response, Soelberg criticized Vroom's conclusions, suggesting that after completing the job search, the subject-reported job valence may merely represent a biased rationalization of a job decision already made. He then offered his GDP as an alternative to Vroom's approach.

In a GDP model, a decision maker screens each alternative along a number of noncompared goal dimensions. A subset of outcomes would constitute necessary conditions for acceptability. To identify a favorite candidate among the acceptable alternatives, the decision maker would evoke a few (not more than two) primary goals (i.e., desired outcomes) considered necessary and sufficient conditions for selecting a specific job.

A satisficing decision would then implicitly be made by screening each acceptable alternative according to the simple criteria of the primary goals being met on a specific job (implicit choice candidate) or not being satisfied (comparison candidate). This process is not unlike a pairwise comparison process. This implicit decision would often be made well before the decision maker formally accepted a job. Only after an implicit choice was made would the decision maker consider less important outcomes and compare job alternatives outcome by outcome.

Thus, the comparison and weighing process analogues to the formation of a cumulative motivational force function would appear only during a post decision confirmation phase, if it were to occur at all. During the confirmation phase, which could be of considerable duration, there would be a great deal of perceptual distortion in expectations and outcome values occurring in favor of the implicit choice candidate. The final job acceptance would be made explicit only after the individual had constructed a satisfactory "goal weighting function" which explained the superiority of his implicit choice candidate.

Soelberg's claims that people do not take a step-by-step approach to decision making was verified by the survey. The research also indicated, however, that those alternatives which did not coincide with a decision maker's initial prejudice were not excluded as quickly or completely as Soelberg claimed. Nonetheless, Soelberg's insight that the decision process is a little sloppier than most formulae would indicate, should be kept in mind.

Employee Turnover Behavior

The literature of employee turnover behavior is discussed in Mobley, et al. (1979). As a review article, it introduces the key

nomenclature and ideas found in the area of employee turnover literature. The authors also present their own informal model of the employee turnover process, which they claim is a synthesis of the best that this branch of the literature has to offer.

After extensively reviewing prior turnover literature, Mobley, et al., (1979) stress the importance of distinguishing between satisfaction (which is present oriented) and attraction/expected utility (which is future oriented) for both the present work role and alternative work roles. They also saw the need to consider non-work values and non-work consequences associated with turnover behavior. The authors provide some observations and explanations regarding this claim. They identify two intentions of interest, intention to search and intention to quit. The primary determinants of intentions are thought to be satisfaction, attraction/expected utility of present job, and attraction/expected utility of alternative jobs or roles.

Satisfaction is seen as the affective response to evaluation of the job. In this case, it is thought to be related to at least three other classes of variables: (a) Attraction expected utility of the present role; (b) attraction expected utility of attainable alternative roles; and (c) centrality of work values, beliefs regarding nonwork, consequences of quitting-staying, and contractual restraints.

Attraction is seen as being based on the expectancies that the present job will lead to future attainment of various positively- and negatively-valued outcomes. Attraction of alternatives is defined in terms of expectations that the alternative job/role will lead to the future attainment of various positively- and negatively-valued outcomes.

The authors also point out that to the extent that nonwork values and interests are not central to an individual's life values and interests, and to the extent that an individual associates significant nonwork consequences with quitting, the relationships among satisfaction, attraction, and turnover intentions and behavior will be attenuated.

An Application of the Paired-Comparison Model to Career Decision Making

Shapira (1981) suggests that a paired comparison trade-off model is a more accurate model than those most often found in career decision literature (viz., Expectancy Theory and Subjective Expected Utility) because it more closely parallels the actual processes of career decision makers. Although Shapira makes an appealing case for such an enterprise, he admits that there are severe limitations inherent in this model.

Classical models of rational choice assume that a job offer has combinations of attributes with the same overall utility among which meaningful trade-offs may be made, and these trade-offs are

smooth across the entire range of attributes and can be described by a linear model. In contrast, the paired-comparison model of decision making states that trade-off decisions are not made over the entire range of gains and losses. Shapira (1981) examined this trade-off process in an experiment with Israeli business executives.

The subjects were given the following instructions and graph:

Suppose you were offered a net increase of 1000 IL (Israel pounds--approximately 70 U.S. dollars). Please draw a broken line in the salary scale at 1000 IL above your current salary. Then, on each attribute, one at a time, mark the maximal amount on that attribute that you would be willing to give up to get that salary increase. Make this decision in a way that the overall value of your job to you will stay the same. Please indicate that amount by a broken line below your current job profile mark on that attribute.

You have to indicate on each attribute the amount you are willing to give up for the 1000 IL monthly salary increase, separately, disregarding the other attributes.

The first hypothesis tested was that people would not be willing to make trade-offs on the entire range of attributes. Indeed, the subjects indirectly indicated that there may be lower, as well as upper limits on attributes, beyond which no trade-offs would be made. Although instructions clearly asked for amounts to be traded, many subjects were not willing to make certain trade-offs.

Responses were considered to be "no deal" responses in the "increasing" mode if subjects were not willing to give up any of attribute *j* for an increase on attribute *i*. Recall that they were asked what would be the maximal amount they would be willing to give up on attribute *j* for an increase on attribute *i*. The maximal amount in many cases was zero. Similarly, in several cases in the "decreasing" mode subjects were not willing to consider going down on one attribute to go up on another one. The instructions in this part were to indicate the minimum amount of increase on attribute *j* that would offset the decrease on attribute *i*. Here, subjects who declined to make the trade-offs stated simply, "no deal." In several cases subjects said that "If I have to give up anything on this attribute I'd quit and leave the company." The number of people who made "no deals" in both modes are presented in Table 1.

The second hypothesis tested dealt with the asymmetrical nature of the trade-off process. It was suggested that the process is not symmetrical whereby "losses" are more important to people than gains. A first indication of this nonsymmetrical nature is captured by looking at the relative importance of the different attributes under the two procedures which were derived

TABLE 1

Number of Persons Giving "No Deal" Responses

Attributes* Traded		Increasing** Mode	Decreasing*** Mode
Salary (1000IL.) vs	Interest	51	11
	Authority	48	25
	Influence	47	23
	Status	50	15
Salary (2000IL.)	Interest	44	23
	Authority	45	28
	Influence	40	25
	Status	47	27
Interest	Salary	15	23
	Authority	25	34
	Influence	24	28
	Status	30	22
Authority	Salary	40	21
	Interest	44	10
	Influence	34	22
	Status	44	19
Influence	Salary	26	21
	Interest	36	12
	Authority	25	25
	Status	34	18
Status	Salary	23	24
	Interest	34	16
	Authority	25	29
	Influence	31	24

Note. The entrees in the table present the number of people who refused to make deals out of a total of N=56.

*The first attribute was traded for the second. An increase on the first attribute was offered in the "increasing" mode and a decrease on the first attribute was offered in the "decreasing" mode.

**These are "zero" responses, that is, the maximal amount a subject was willing to give up on the second attribute for an increase on the first attribute was zero.

***These are "no deal" as well as threats to quit responses for a decrease on the first attribute.

from each person's vector of trade-off coefficients. The median values of the trade-off coefficients across all subjects were (1.00, .912, .982, .919, .947) in the "increasing" mode and (1.000, 1.003, 1.112, 1.092, 1.012) in the "decreasing" mode. Although these coefficients were different for various people, what is important is that their order was not perfectly consistent across modes. The correlation between the two sets of trade-off coefficients (e.g., "increasing" versus "decreasing" modes) was computed for each subject.

The median correlation for the entire sample was .452 with an interquartile range of .043 to .755. No one completely reversed his preference order, but no one had a perfectly consistent preference order across the two modes, either. Thus, the change in the trading direction affected the relative importance of the attributes. To further examine the asymmetry of the trade-off process the results were described by means of indifference curves.

The results found by Shapira (1981) suggest that, in carefully constructed situations, people can make meaningful trade-off decisions. However, people may be unable and/or unwilling to make trade-offs on the entire range of attributes.

Although the paired comparison model seems to offer an effective method for examining decision making, Shapira (1981) admits that there is a serious methodological limitation to the trade-off format. When making paired comparisons between objects having K levels on each of N attributes, the total number of comparisons increases as either K or N increases. This is an obvious concern when considering implementation of the model. For example, in order to pair compare jobs with four levels on each of two attributes, 120 comparisons must be made. Related to this is subject fatigue. Shapira's pilot test showed that the level of data significance began to deteriorate dramatically after 120 pairings because of subject fatigue. These issues should be given serious consideration before applying the paired-comparison model of decision making.

Issues of Career Decision Making Models

Lohnes (1974) calls into question some of the basic assumptions of career decision making literature and suggests some novel alternatives that might be considered in future research. Lohnes (1974) asserts that the great majority of studies use linear equations, the data of which are subjected to regression analysis. These operate to transform trait assessments into predictions of career adjustments. He argues that correlation models for career development "which transform trait distributions of populations into knowledge of the antecedents of variance in careers phenomena" in the context of a sequential, structured environment can provide people with scientific attitudes and skills with which to make personal predictions, decisions, and plans.

Data analysis models are characterized by the types of questions asked of the subject. They usually take one of the following three forms:

1. Given my aptitude X, how successful in terms of criterion Y can I expect if I join population A?
2. Given my personal characteristics X, how generally suitable would membership in population A be for me?
3. Given my personal characteristics X, which of several populations of people do I resemble most?

Lohnes claims that the form of these questions contain four implicit assumptions.

1. The subjects' attention is being directed to the relevant criteria.
2. All of the crucial dimensions of a subject's personality are being assessed.
3. There is substantial intergenerational continuity in human experience.
4. A subject wants and needs a predictive rather than a retrospective study.

Lohnes criticizes each of these assumptions. As for the first assumption, he believes that the researcher really determines the criteria, not the subject. If this is actually so, he asks, should not each subject be allowed to request predictions for criteria of his own nomination? Lohnes rejects the second assumption on the grounds that the low proportion of variance explained by these models strongly suggests that relevant personality criteria are being ignored. His response to the third assumption is rather weak, being more speculation than a criticism. He asserts that it may be the case that nowadays social survey data bases become obsolete very rapidly, or at least at a rate that we are not aware of. As for the fourth assumption, Lohnes suggests that a subject may be so confused about his personal history that what he most urgently needs is an understanding of how he came to where and what he is presently, not objections of possible futures.

Although Lohnes criticizes linear models, the only alternative he offers is a vague reference to "Correlation/variance-explaining models which include the whole person." However, no models, formulas, diagrams, or data are presented in support of (or even in explanation of) his assertion.

In summary, the successful results of expectancy theory models used in career decision making literature indicate that this theory is on solid conceptual ground and is not cumbersome to

implement. However it is important to note that in the studies reviewed here, the subject populations were more homogenous (in respect to composition, location and career focus) than might be the case with a potential enlistee population. To what degree this homogeneity improved the results of these studies is not known. Nevertheless, the career decision literature reviewed here indicates that the most positive results are to be provided by the implementation of an expectancy theory model.

CONSUMER AND MARKETING DECISION MAKING RESEARCH

This section reviews two decision making models popular in the consumer and market research area. Key articles in this literature are reviewed that illustrate the major features of the models and demonstrate their applications in consumer and market research. The models discussed are the Fishbein and Ajzen expectancy theory formulation and the multidimensional scaling/conjoint measurement model.

The two most frequently utilized models in consumer and marketing decision research differ in a number of important respects. The Fishbein & Ajzen (1975) expectancy model of behavioral intention and the variants of polynomial conjoint measurement based on unfolding theory exhibit different approaches to the modeling of multiattribute decisions. As noted in an earlier section, multidimensional scaling and additive conjoint measurement can be considered special cases of polynomial conjoint measurement. The Fishbein and Ajzen model is termed compositional in that it articulates an explicit model of a consumer's thought processes leading to a purchase (see Lynch, 1985, for a discussion of compositional and decompositional consumer choice models). In contrast, the unfolding perspective of Coombs as exemplified by conjoint and multidimensional scaling approaches are termed decompositional in that they proceed from choice behavior to inferences regarding the psychological processes leading to that behavior.

Each model has generally been used in somewhat different applications. Whereas the Fishbein and Ajzen model has most often been used to study consumer attitude formation and purchase behavior, multidimensional scaling and conjoint models have been usefully employed in the mapping of consumer perceptions regarding brand attributes and the forecasting of market response to new products.

Though many theoretical aspects of these two general models and their applications differ, the two approaches are not necessarily divergent in all respects. Each approach (compositional and decompositional) has the capacity for correcting and reinforcing the other if used in tandem during the modeling of the enlistment decision.

This section begins with a review of research applications of the Fishbein and Ajzen expectancy theory model. Literature will be discussed that accentuates its development from a theory of attitude formation to one of consumer decision. Following this, marketing applications of multidimensional scaling and conjoint measurement techniques will be reviewed. This literature stresses the particular contribution a decompositional model can bring to bear during the investigation of the decision process.

The Fishbein and Ajzen Expectancy Theory Model

In the area of consumer and market research, the Fishbein and Ajzen expectancy theory model has been very influential. Indeed, Sheth (1982; p.388) acknowledged that ". . . Rosenberg and Fishbein were largely ignored by their fellow psychologists, but this certainly was not the case in consumer research. In fact, the Fishbein model, in particular, dominated published consumer research in the 1970's with the outcome that needed light has been shed on the attitude-behavior relationship." The importance of this model has continued to the present day:

As discussed in greater detail earlier, the Fishbein and Ajzen model specifies a relation between belief formation, attitudes and normative influences, behavioral intentions, and behavior (purchase behavior in the case of consumer research). The building block of this theory is belief formation. Belief formation begins with information processing. Before one can form a belief about an object, it must be recognized (i.e., its attributes ascertained). This recognition can come from many quarters--self-experience, the recounting of others, or nonpersonal information (e.g., informational sources such as books, the news, etc.). However, beliefs are not merely the recounting of observations. Surrounding each recognized attribute of an object, an evaluation is formed. Together (using a multiplicative combinatorial rule), information and its evaluation form beliefs about an object. In turn, beliefs lead to an affective response to an object--one's attitude toward the object.

Many of the first applications of Fishbein's expectancy theory of attitude formation were carried out in the area of attitude formation with regard to racial minorities. As Fishbein & Ajzen (1975) document much of the foundational work on attitude formation concerned itself with the attitudes of whites toward blacks in the United States. For example, Fishbein (1963) constructed a set of ten modal salient beliefs for his subject population by taking the ten most frequently elicited responses to the question: "What do you believe to be the characteristics of Negroes?" To provide a measure of belief strength, subjects rated the probability that blacks did, in fact, display such characteristics. In a number of trials the theoretical model of belief formation was substantiated in that a correlation of .80 or greater was obtained between model estimates and a direct measure of attitude.

In a study of attitudes toward political candidates, Feldman & Fishbein (1963) provided additional support for the expectancy theory of attitude formulation. In this study, the relation between beliefs about candidates and attitudes toward those candidates was investigated. Prior to the 1964 national election, over 600 residents of a small Midwestern community were interviewed. Eligible respondents were queried about 24 belief statements regarding Goldwater and Johnson as well as corresponding statements about personal opinion regarding such characteristics. It was found that the expectancy theory of attitude formation correlated .69 and .87 with direct measures of attitude toward Johnson and Goldwater, respectively.

Though the early work by Fishbein was well within the confines of established academic attitudinal research, he was soon to break new ground. In 1975 he published, in collaboration with Ajzen, Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research. This work (the culmination of extensive research and literature review) marked a departure for Fishbein and Ajzen from the laboratory and into the market place. A number of new issues were to be considered. In their own words:

. . . it really doesn't make a lot of difference how much a person likes a given product, or how good that product's 'brand image' is--if the consumer doesn't believe that buying a product will lead to more 'good consequences' (and fewer 'bad consequences') than buying some other product, they will tend to buy the other product. Thus, one of the factors that contributes to a person's intentions to engage in some behavior is the attitude toward engaging in that behavior . . . not the attitude toward the object of the behavior (Fishbein & Ajzen, 1975, p. 161).

Fishbein and Ajzen's extension of expectancy theory into the realm of consumer behavior required retooling of the original attitude theory. Specifically, a rethinking of the relation between behavior and attitude was needed. This was accomplished through the theoretical elaboration of concepts intermediate between attitude toward an object and behavior toward the object. One such concept was attitude toward the act. No longer was attitude alone considered the sole determinant of behavior (as in most expectancy theories). When considering behavior, the attitude formed about the behavior itself, not just the object of behavior, must be modeled as well.

Additionally, a normative component entered the model that did not exist previously. Consumer behavior was not considered totally autonomous in this new formulation. Completely free actors may be a sustainable fiction in the classroom but not in the marketplace. Fishbein and Ajzen complemented attitude formation with a normative component similarly formed. The influence of social norms is measured as an individual's believed attitude of significant others toward the act multiplied by his or her

evaluation (positive or negative) of this social influence. The total normative component of the model is obtained by summing across all salient social influences.

The final model refinement was the elaboration of the concept of behavioral intention intermediate between attitude toward the act and normative influences toward the act and behavior itself. The direct linkage between expectancy value judgments and behavior was broken. Now, such judgments directly influenced behavioral intentions but only behavioral intentions directly influenced behavior itself.

Response to this reformulation of expectancy theory was immediate. In one of the first published evaluations of the new model, Wilson, Mathews, & Harvey (1975) use this model to predict consumer choice behavior. In addition, model performance is evaluated side-by-side with the earlier model specification. In their study, 162 housewives participated in what was advertised as a shopper's opinion study. Housewives were solicited through newspaper advertisements and wall posters displayed at local shopping malls. In these advertisements housewives were informed that they would receive \$3.00 for participation.

Housewives who volunteered for the study were screened and, if qualified, were administered a survey that collected information on variables of interest for each of six brands of toothpaste. Upon completion, the survey was examined by a proctor for completeness. When finished, the housewives were paid \$2.00 and given their choice of one family-sized tube of toothpaste from a display. The latter was recorded as a measure for the study.

As the Wilson, et al., study serves as a prototype for many succeeding Fishbein and Ajzen model marketing applications, some attention should be given to model operationalization. The following quote summarizes procedures followed. "Great care was taken in operationalizing the elements of the models under examination . . . The following measures from the questionnaire are representative:

A. BI {behavioral intention} Model

1. BI--behavioral intentions. The concept "anytime that you purchase _____ toothpaste, how likely are you to purchase rated on a seven-point scale with end-points labeled "very likely" and "not very likely."
2. A_{act}--attitude toward the act (evaluation operationalization) The concept "Purchasing _____ toothpaste" was rated on the following four evaluative semantic differential scales: Foolish-wise, good-bad, harmful-beneficial, reward-punishing. The sum across these seven point scales served as an index of A_{act}.

3. NB--normative beliefs. The concepts "Most members of my family would expect me to purchase ____" and "My dentist would recommend ____" were rated on seven-point scales with end-points labeled "extremely probable" and "extremely improbable."
4. MC--motivation to comply. The concepts "I intend to follow the advice of my family" and "I intend to follow the advice of my dentist" were rated on seven-point scales with end-points labeled "true" and "false."
5. ENBMC--normative beliefs multiplied by motivation to comply, summed . . .

B. A_o {attitude} Model

1. b_i --the belief that a concept is related to the attitude object. The concept "What is the likelihood that ____ brand toothpaste has ____ (an attribute such as cavity preventative) was rated on a seven-point scale with end-points labeled "very likely" to "not very likely." . . .
2. a_i --the evaluation of the related concept. The concept "When choosing any brand of toothpaste, what is the desirability of ____ (an attribute such as competitive price)" was rated on a seven-point scale with end-points "good" and "bad".

The above-mentioned elements of both models were included in the questionnaire for each of six brands of nationally-advertised toothpastes." (Wilson, et al., 1975, pp. 40-41)

Using the data collected, analyses were conducted to determine which of the following five models best predicted behavioral intention:

$$[1] \quad BI = A_{act} + ENBMC$$

$$[2] \quad BI = A_o + ENBMC$$

$$[3] \quad BI = A_o$$

$$[4] \quad BI = A_{act}$$

$$[5] \quad BI = ENBMC$$

As expected from the theory, the Fishbein BI Model [1] was the better predictor when compared to other models, was determined to be statistically significant, and was validated using double-cross validation procedures." (Wilson, et al., 1975, p.47) The complete Fishbein and Ajzen behavioral intention model had an

average multiple R of .672 across all six equations. This model was three times better than the simple expectancy theory model [3] in explaining behavioral intention.

Interestingly, Wilson, et al., (1975) found Model [2] to be only marginally better in predictive ability than model 5 (R's of .654 and .646, respectively) but both much better predictors than 4 (average R of .501). These findings underscore the need for a normative component in the prediction of behavioral intentions. As Wilson, et al. concluded, "The present research provides correlational evidence that the BI Model can be applied in a marketing context and that A_{act} and ENBMC are both important predictors of intention" (Wilson, et al., p. 47).

Since the introduction of the Fishbein and Ajzen expectancy value model into the marketing field, "The model has been employed primarily to provide explanations about why people do or do not perform a particular behavior and to suggest strategies for changing that behavior" (Burnkrant & Page, 1982, p. 550). It has been utilized in a variety of applications from family planning decisions (Davidson & Jaccard, 1975) to assessment of strategies for initiating brand switching (Lutz, 1975) to the development of overall marketing strategies (Ajzen & Fishbein, 1980). In addition, considerable effort has been expended in the refinement of this model. Among the more innovative and critical researchers in this tradition is Bagozzi (1978, 1980, 1981a, 1981b, 1982) and Bagozzi & Burnkrant (1979). One of Bagozzi's most recent accomplishments is the articulation and testing of the hypotheses derived from Fishbein and Ajzen in the framework of the covariance structure or LISREL model (Joreskog & Sorbom, 1978).

In an analysis of attitudes toward the donation of blood, Bagozzi addresses some of the more fundamental questions facing a consumer decision model. An extended quotation should illustrate.

To explain the actions of consumers, researchers often employ a model or representation of the mental events of decision makers. In most of the models, one assumes that action is initiated with a processing of information, followed by an evaluation of the information and the development of an attitude, and ending with the emergence of a volition or intention to act prior to the performance of a particular behavior.

The purpose of this article is to examine more closely the organization of the mental events and feelings of individual consumers and to investigate how their psychological reactions influence subsequent behavior. The behavior in question is the donation of blood, and to explain this behavior several antecedents are investigated including an expectancy-value model of perceived consequences toward the act, a representation of the affect toward the act (Bagozzi, 1982, p. 562).

In other words, Bagozzi proposes a comprehensive evaluation of the Fishbein and Ajzen model.

One of the more interesting characteristics of this evaluation is Bagozzi's use of the covariance structure framework for testing (he is not alone in use of this model--Burnkrant & Page, 1982 use it also). This model constitutes a significant advance in the methodology of compositional decision modeling. Previous (most often multiple linear regression) statistical models assumed a one-to-one correspondence between the measured variables (e.g., beliefs and evaluations) and theoretical constructs (e.g., attitude). In actuality this one-to-one specification might be in error as the measurement model assumed is unyielding (Joreskog & Sorbom, 1978). Using the framework of covariance structure analysis, Bagozzi is able to specify an extended true score model (Lord & Novick, 1968) which allows more detailed tests of his hypotheses.

The expectancy theory hypotheses Bagozzi derived for testing are:

- H₁: Affect toward the act will be a function of expectancy-value judgments;
- H₂: Intentions will be direct and indirect functions of expectancy value judgments, with the indirect path occurring through affect toward the act; and
- H₃: Expectancy-value judgments and affect toward the act will influence subsequent behavior but only do so through their impact on intentions.

These hypotheses are derived from Fishbein and Ajzen and other theorists. H₁ and H₃ conform to the Fishbein and Ajzen formulation. H₂ is proposed to resolve theoretical and empirical questions in the decision making literature. Fishbein and Ajzen contend that expectancy-value judgments will effect intentions only indirectly through affect. In contrast, Triandis' (1977) model hypothesizes only a direct influence. Bagozzi, in these hypotheses, is addressing fundamental issues in the composition of behavior from judgments, affect, and intentions.

To investigate these hypotheses, students, faculty, and staff at a medium-sized eastern university were surveyed one week prior to the beginning of a blood drive (details of the data collection procedures are found in Bagozzi, 1981a). Individuals were asked about their attitudes and intentions toward giving blood, among other responses. Subsequent donation behavior was unobtrusively obtained at periods of one week and four months following the drive from Red Cross records.

Prior to initiation of the actual study, extensive instrument development was undertaken. Two pretests were performed to elicit the 13 most frequently mentioned consequences of blood donation

and select the 7 most salient consequences of the act. Hypotheses were tested, as mentioned above, using a covariance structure approach.

The results, in part, converge and, in part, diverge from findings of previous researchers. As postulated in theory (e.g., Fishbein & Ajzen 1975), the results confirm the recursive sequence of effects from expectancy-value judgments, to affect, to intentions, and finally to behavior. This is the first study to our knowledge that has tested the full theory with all the components operationalized and has used actual behavior as a criterion (Bagozzi, 1982, p.580).

Only the second hypothesis provided a contradiction of Fishbein and Ajzen expectations. Intentions were found to be both indirectly influenced by expectancy-value judgments (through affect) and directly influenced. The direct connection is not proposed by Fishbein and Ajzen. It appears, therefore, that intentions can be influenced by cognitive processes as well as through their motivational or arousing impact instead of only through affect. This suggests an additional causal path should be added to the Fishbein and Ajzen model--a path between judgment and intention.

The final finding to note is that behavior was found to be influenced directly only by intention. That is, subsequent blood donations were only directly predicted by measured intentions to donate. This is precisely the sequence postulated by Fishbein and Ajzen. With regard to prediction, Bagozzi's model found that expectancy-value judgments accounted for 56% of the variance in affect toward the act and affect and judgments together accounted for 22-28% of the variance in intentions. Finally, for the behavioral criteria, 9-22% of proximal (one week) behavior and 30-32% of distal (four month) behavior was explained by intentions.

Multidimensional Scaling and Conjoint Marketing Models

As discussed previously, modeling techniques based on the unfolding theory of preferential choice differ in several respects from those used in the application of the compositional Fishbein and Ajzen expectancy theory. Multidimensional scaling and conjoint measurement techniques are decompositional in that they proceed from observations of choice behavior to inferences regarding the psychological processes leading to such behavior. In addition, the unfolding theory measurement model (adapted from that branch of mathematics known as fundamental measurement, Krantz & Tversky, 1971) consists of a series of constraints (not compositional rules) imposed on the data so observed responses may be decomposed into underlying (and unobserved) psychological scales. By contrast, the Fishbein and Ajzen model builds up or composes psychological processes from observed responses based on an explicitly defined compositional model.

In this section we consider two related but separable unfolding techniques--multidimensional scaling and conjoint measurement. Though the multidimensional scaling and conjoint measurement applications discussed in this section could be shown to be particular forms of polynomial conjoint measurement (Tversky, 1967; Young, 1969), it is convenient to discuss them separately. Each generally contributes a slightly different perspective on the problem of multiattribute decision making. Multidimensional scaling techniques are most often used in marketing applications to obtain a spatial or perceptual map of the relevant psychological dimensions underlying consumer perceptions of commodities, and the relative placement of commodity brands vis a vis these psychological dimensions. Conjoint measurement extends this perceptual mapping function of multidimensional scaling by assessing the effects of independent variables on the psychological assessments of commodities. This technique has been found useful for determining which of a product's or service's qualities are most important to the consumer and assessing the potential attractiveness of new products and services.

Multidimensional Scaling

Multidimensional scaling as discussed in this review is the result of a very diverse developmental effort. Many individuals from several different disciplines have contributed significantly to its development. At various times it has been called facet theory, multidimensional scalogram analysis, smallest space analysis, etc. and sparked the development of a wide range of multidimensional scaling computer programs (e.g., MDPREF, MDSCAL, INDSCAL, SSA-IV, ALSCAL, etc.). We will confine our discussion here to marketing applications of the technique.

Green's 1975 article, "Marketing Applications of MDA: Assessment and Outlook," is perhaps the best beginning for a consideration of the use of multidimensional scaling in marketing. This is an article that reviews both the development of multidimensional techniques and their applications in marketing.

Green begins by considering the relatively slow development of multidimensional scaling techniques since the first theoretical papers on the subject were written in the 1930's (e.g., Eckart & Young, 1936; Richards, 1938; Young & Householder, 1938). "Aside from a few rather isolated social science applications, and the seminal work of Coombs and his colleagues, activity in multidimensional scaling remained fairly dormant until 1962" (Green, 1975, pp. 24-25). It was in this year that Shepard (1962) published the first operational procedure for nonmetric multidimensional scaling.

As Green notes, Shepard's article marked the beginning of a period of intense development for multidimensional scaling. Aided by developments in computer science, new applications appeared in rapid order. By the late 1960's the field was well developed and

the first multidimensional scaling book oriented exclusively for marketing appeared (Green & Carmone, Multidimensional Scaling and Related Techniques in Marketing Analysis, 1970). This book explains how to use multidimensional scaling for such marketing problems as segmentation analysis, life cycle analysis, and product/service evaluation.

Green goes on to cite the (then) more recent works of Pessemier & Root (1973), Shocker & Srinivasan (1974), and Urban (1973) in extending the techniques to the area of new product design. From this overview of the development of market applications of multidimensional scaling, Green turns to a consideration of methodological issue raised during the developmental period.

During the intense methodological development of the 1960's and early 1970's new applications were often claimed to be significantly different than existing applications or programs.

Despite earlier publicity that the programs were "really different," it has become quite clear that algorithms designed for pretty much the same thing have provided pretty much the same results. Comparison studies of approaches and algorithms in MDS are on the wane. The applied researcher has tended to settle on a subset of programs that fits his own tastes and experience (Green, 1975, p.25).

Though new developments are occurring in the field, Green considers the field basically mature.

Multidimensional scaling techniques in marketing are most often used for perceptual or preference mapping. That is, the technique has been applied to ". . . a wide range of product classes--beers, soft drinks, cereals, fabric softeners, transportation modes, antacid compounds, and other--often with one or more of the following questions in mind:

1. What are the major perceptual and evaluative dimensions of a product class?
2. What existing brands are perceived as similar to what other existing brands?
3. What are the major perceptual points of view among consumers?
4. What new brand possibilities are suggested by the configuration of existing brands?
5. How are respondent ideal points or preferences vectors distributed in the various perceptual spaces?

6. How compatible are various advertising messages, slogans, or other types of promotional materials with brand perceptions" (Green, 1975, p.27).

As these illustrative applications demonstrate, marketing uses of multidimensional scaling are concerned primarily with the mapping of consumer perceptions vis a vis products. This mapping may be carried out to determine the evaluative dimensions used by consumers or, more specifically, to locate products within perceptual space. In the latter application, market researchers often focus on the perceptual location of a particular product with respect to other products in the same class or in relation to the desired advertising image.

More recent marketing applications of multidimensional scaling have generally pursued issues such as those noted above (see, for example, DeSarbo & Rao, 1983; Green, Carroll, & Goldberg, 1981; Hauser & Simmie, 1981). Recent marketing applications of multidimensional scaling, however, provide indications regarding the continuing methodological work being undertaken to extend the mapping capabilities of multidimensional scaling. We will consider here, Dillon, Frederick, and Tangpanichedes' 1982 article, "A Note on Accounting for Sources of Variation in Perceptual Maps." Although this article does not provide a representative sample of all developmental work, it does provide an accurate indicator of the extension of basic methodology currently under consideration.

Dillon, Frederick, & Tangpanichedes (1982) are interested in extending decompositional models of consumer preference to include group level effects. Although market segmentation is frequently used in multidimensional scaling applications to identify different consumer groups, such segmentation does not explain the effect of group membership on perceptual space. Dillon, et al. (1982) build on a method developed by Gower (1966) and amplified by Krzanowski (1976) to specify a model that estimates group effects on perceptual maps.

Basically, the method considers n product brands evaluated on p attributes by N individuals divided into g market segments. Using a technique that can be viewed as a chaining of multivariate analysis of variance and standard multidimensional scaling, variation in perceptual maps is portioned into those portions due to brand differences and those due to group membership.

Because the approach works like a multivariate analysis of variance, it can be used to determine, among other things,

- whether a brand's position in the derived reduced (multidimensional) space representation is due primarily to brand effects, respondent effects, or the interaction of a respondent-related factor and product attribute perception and

- the degree of group homogeneity and the extent of consensus about the favorability of certain attributes (Dillon, et al., p.302).

Rather than simply determining market segments based upon differential responses to brand stimuli, Dillon, et al. outline a method for quantifying the degree of difference between obtained market segments and statistically isolating the sources of such differences. This accounting of sources of variation in perceptual maps can serve to identify the reasons for differing market segment perceptions.

The chained multivariate analysis of variance and multi-dimensional scaling methodology was utilized in a ". . . study investigating the impact of negative product-related information on consumer opinions, beliefs and purchase intentions" (Dillon, et al., 1982, p.306). During the late 1970's and early 1980's Chrysler and the Consumer Union were involved in a controversy over the handling safety of the Dodge Omni and Plymouth Horizon. To investigate the effects of both informational stimuli and market groups an independent research firm was commissioned to investigate consumer perception.

The research firm solicited the cooperation of 350 respondents using a mall intercept procedure. Each of the volunteers was randomly assigned to one of five treatment groups. Each treatment condition consisted of the viewing of a 15-minute segment of network news. Included in the presentation were five configurations of information. These were:

- T1 the full Consumers Union story;
- T2 brief introduction of Consumers Union story and Chrysler's reply;
- T3 the full Consumers Union story followed by Chrysler's reply;
- T4 two 30-second commercials, one advertising Plymouth Horizon and the other Dodge Omni; and
- T5 control (no airing of the issue).

Following treatment, subjects were asked to complete several automobile evaluation questions and provide personal background data. "To reduce demand artifacts, ratings were taken on three other subcompact automobiles in addition to the Plymouth Horizon/Omni" (Dillon, et al., 1982, p.306).

The experimental conditions constitute informational cues. If treatment were unambiguous the only main effect, treatment

groups, would have been tightly clustered and distinct in perceptual space. Although Dillon, et al. (p.309) found a significant treatment effect, ". . . its practical significance as measured by the generalized eta square measure (Wilks, 1932) is small ($n^2 = .045$).". Although cues influenced perception, they did not account for much variance.

Respondent characteristics can also influence the spatial configuration of brands. For illustrative purposes, two respondent related factors were singled out as possible sources of variation:

- Readership--whether the respondent regularly reads or subscribes to Consumer Reports . . .
- Purchase history--whether the respondent purchased an automobile in the last year (Dillon, et al. 1982).

Whereas the treatment alone accounted for a statistically significant, but practically marginal, percentage of variation in respondent perceptual maps, the inclusion of group membership (four possible groups) as a second main effect doubled the explained variance. Obviously in this application, group membership constitutes an important determinant of perception.

As mentioned above, this illustration of a recent multidimensional scaling innovation does not comprehensively cover the methodological advances achieved in the last few years. What the example does give, however, is a feel for the direction in which these techniques are going. Basically, multidimensional scaling is being developed as a more and more general method for uncovering the psychological dimensions underlying choice. Recent advances attempt to incorporate covariates in the mapping of consumer behavior.

Conjoint Measurement

Conjoint measurement techniques constitute a generalization of multidimensional scaling that extends the perceptual mapping function by assessing the effects of independent variables on the psychological evaluation of commodities. Like multidimensional scaling, conjoint measurement techniques have experienced a very diverse history. We focus, here, on marketing applications of conjoint measurement. Marketing applications of conjoint measurement techniques have proven particularly useful for determining which of a product's or service's qualities are most important to consumers and assessing the potential attractiveness of new products and services.

Early marketing applications of conjoint measurement included studies forecasting air traffic between major metropolitan areas (Davidson & Jaccard, 1975). Johnson (1974) illustrates a typical marketing use of conjoint measurement. This early application is

particularly appropriate in that it provides an example of most of the salient characteristics of such a conjoint analysis.

Johnson's introduction to his article summarizes the major steps and output from a market research conjoint analysis.

This article develops and describes a method for evaluating the value systems of consumers. The three components of this method are: (a) A technique of data collection requiring a respondent to consider "trade-offs" among desirable alternatives; (b) a computational method which derives "utilities" accounting as nearly as possible for each respondent's choice behavior; and (3) a simple market simulation model which attempts to determine those characteristics of a product which will maximize its share of preference within any particular competitive environment (Johnson, 1974, p. 121).

Most marketing research is oriented toward consumers. Specifically, considerable interest is placed in trying to find out what consumers want. It might seem relatively easy to gain this information--just ask consumers what product attributes are important to them or what constitutes an "ideal" level for specific attributes. As Johnson points out,

Neither of these traditional approaches is entirely satisfactory. For instance, judgments concerning the importance of various attributes are usually ambiguous unless great care is taken in defining attributes . . . Safety may be regarded as an overpoweringly important attribute of airlines, when considered in the abstract. Yet, if airlines are not considered to differ in degree of safety, it cannot affect a passenger's choice of airline (Johnson, 1974, p. 121).

The identification of ideal attribute levels seldom provides useful marketing information either. A consumer, for example, may ideally prefer low airline fares, but this does not provide information regarding the amenities he or she is willing to drop for a decrease in fares. Conjoint measurement techniques are able to deal with the weakness of both attribute importance and ideal level measurements. These techniques provide information about ". . . how consumers value various levels of each attribute and the extent to which they would forego a high level of one attribute to achieve a high level on another" (Johnson, 1974, p. 121).

The fundamental idea of a conjoint analysis is simple. Consumers are provided with stimuli among which they chose their preferences. From these data, conjoint techniques decompose observations in a way that allows the drawing of inferences about consumer value systems. Johnson provides an example by considering automobile purchases. For illustrative purposes, four attributes are said to be salient in the decision to buy: (a) Price,

(b) months of warranty, (c) seating capacity, and (d) top speed. Each attribute has three levels. Price is set at \$2500, \$4000, and \$6000, months of warranty at 3, 12, and 60, seating capacity at 2, 4, and 6, and top speed at 70 mph, 100 mph, and 130 mph.

In Johnson's example, data collection proceeds by giving a respondent a list of cars each differing on only two attribute levels (all others are assumed constant). Respondents then rank cars most to least preferred. Figure 8 reproduces Johnson's rankings for the crossing of price and speed. The five other pairwise attribute combinations are also ranked. This provides the data needed for conjoint measurement analysis.

A simple model of preference formation is applied to these data. In this case though, Johnson uses a multiplicative model of utility, the basic logic is the same used in the more common additive models. [Though the interpretation of utility values is more complex (as are the calculations), the logic outlined here is also applicable to polynomial conjoint models.] It is assumed that individuals have a positive utility (or preference) value for each level of each attribute and that the relative degree of preference for any particular automobile is obtained by multiplying together all of the relevant utilities for all salient attributes, we would be in a position to predict his rank order preferences among the different automobiles. In practice, modeling proceeds in a reverse direction. We know ranked preferences and wish to estimate utilities. Computer algorithms available for conjoint analysis iteratively solve for attribute utility functions that "best fit" the observed ordinal data. Utility values (also called part worths) are meaningful in a relative sense only. The derived matrix has no intrinsic interpretation.

In this example Johnson has illustrated a conjoint measurement analysis of automobile preference. This analysis provides an answer to the marketing question, "What do consumers want?" He goes on from there to investigate a production question--"What will consumers buy?" This is a second popular subject area for conjoint applications.

Product development proceeds (in the Johnson example) in the conjoint mode by first drawing a probability sample of consumers. It is important that the sample be drawn in a manner allowing eventual population or market segment projections. Various attributes and their levels would then be proposed for the new product (e.g., an automobile). Sampled respondents would then be asked to rank order possible automobile attribute combinations and supply additional demographic and purchase behavior information.

Analysis of the data proceeds using either (or both) an aggregate or market segment framework. In the aggregate, the most preferred attribute profile can be determined and total potential market shares for the product projected (given such information as income and purchase behavior, etc.).

	TOP SPEED		
PRICE	70	100	130
\$2,500	5	2	1
\$4,000	6	4	3
\$6,000	9	8	7

Figure 8. Price by speed rankings example.

If multiple product configurations were a distinct possibility (e.g., standard, sport, and luxury models), respondent utility profiles might be cluster analyzed to determine whether distinct market segments exists and if they correspond to high performances for the different product attribute configurations. If such segments are established, market shares expected, given utility profiles vis a vis existing products, may be computed.

The Johnson article is excellent in that it provides a summary of the conjoint measurement technique and its application in marketing research. A discussion of conjoint measurement (or multidimensional scaling) use in the marketing environment, however, would not be complete without acknowledging the extensive work market researchers have performed in the areas of design and measurement.

Johnson's example required the ranking of 54 product-attribute combinations (taken nine at a time). The specification of only four salient attributes each with three levels may be very conservative in some cases. If attribute numbers are raised to only five and levels from three to four, complete ranking would require the respondent to consider one hundred sixty attribute combinations. Obviously, as the products to evaluate become increasingly complex, the number of contrasts required increase at an alarming rate.

Issues concerning the number of stimuli that can be meaningfully evaluated by a respondent have a long history in market research. Fortunately, solutions to respondent burden in the conjoint case can be readily adapted from the techniques of experimental design. The problem of respondent burden (as discussed here) in some respects is not unlike the circumstances encountered in agricultural field trials. Just as all plots cannot be exposed to all treatment or exogenous factors, neither can all respondents have the same background characteristics or be asked to rate all attribute combinations (treatment).

Paul Green (1974) translates classical experimental design techniques (Cochran & Cox, 1950; Fisher, 1942; Winer, 1973) into usable measurement designs that solve the problem of respondent burden through recourse to stimuli (i.e., attribute configuration) presentation schedules having known design effects. Each respondent is asked to evaluate only a subset of all possible attribute combinations. Among the more frequently used orthogonal presentation schedules is the balanced incomplete block (BIB) design.

A second measurement issue for market researchers is how to present product options to consumers. Should they be asked to rate products where only two factors vary (a two factor evaluation--TFE) as Johnson suggested? Alternatively, should consumers be asked to evaluate products where all factors vary (a full profile technique termed multiple factor evaluation--MFE)? If data collection procedures materially affect results, the choice of procedure become critical. From a respondent burden perspective,

it is known that TFE methods are less time consuming than MFE methods and so preferred. But do they obtain data of comparable quality?

Again, contemporary researchers may profit from work done by market analysts. In the context of conjoint applications it appears that TFE and MFE methods yield comparable data. Segal (1982) empirically examines the observed variations in several measures of reliability obtained when both TFE and MFE methods are used. His findings are generally favorable from the respondent burden point of view.

One can conclude, therefore, that though statistically significant differences are noted in reliability measures, each data collection procedure supplies very reliable input preference ranks. On an overall comparative basis, the results for RW_a indicate differences between the MFE and TFE measures of reliability at the estimated parameter level. However, on an average, both the MFE and the TFE conjoint data collection procedures produce results are very reliable in the test-retest sense (no significant differences are noted in mean importance weights between test and retest phases) (Segal, 1982, p. 142).

CONCLUSIONS

In reviewing the various models and theories each was evaluated according to its ability to effectively model the individual enlistment decision. Specifically, all the models reviewed seem able to contend with the heterogeneity of the potential enlistee population (i.e., all models could be tailored to the potential enlistee population). In addition, all models seem capable of being adapted to fit the "temporal" issues unique to the potential enlistee population (i.e., the time of life in which individuals are considering enlisting in the armed services). The extended Fishbein-Ajzen expectancy theory model (Burnkrant & Page, 1982), however, appears to be superior to the others in three important ways described below and, for these reasons, is recommended here as the most promising approach for modeling the individual enlistment decision.

The first way the Fishbein-Ajzen model is superior is that its explicit dependent variable for prediction is participants' behavioral intent and, secondarily, their actual behavior. Almost all other modeling approaches focus on predicting individuals' decisions, or the subjective utility of some action, but not necessarily their behavioral intent. In these other approaches it is presumed that individuals will behave in a manner totally consistent with the results of an evaluation that focuses solely on the utility/disutility (or pros or cons) of each alternative action on the basis of explicit attributes or criteria. However,

the research by Fishbein & Ajzen (1975) and others (e.g., Baggozi, 1982; Burnkrant & Page, 1982) suggests that this is not the case, for they found that the attribute evaluation component of their model alone did not account for all the variance in participants' behavioral intent; other components, most notably social norms, were required.

Second, a model for depicting the individual enlistment decision is appropriate only if it allows for the special "relational" issues inherent in an enlistment decision. Substantial research (Weltin, et al., 1984; U.S. Army Soldier Support Center, 1985) has shown that potential enlistees are influenced by other people when making their decision to enlist. The effect of "influencers" upon the individual, therefore, is a critical factor in the enlistment decision. The Fishbein-Ajzen model was the only decision model that had a component for explicitly considering the effect of influencers on one's decision. This is accomplished via the social norms component of the model, which distinguishes between the norms or influencers that might potentially affect one's decision and one's motivation to comply with each of these influencers.

The third reason we are recommending the use of the extended Fishbein-Ajzen expectancy model is that its broad conceptual framework permits one to incorporate decision components that are not incorporated in other models. Specifically, the research by Bagozzi (1982) suggests that affect and habit have an effect on both behavioral intent and behavior. This finding, particularly for a general affect component in addition to the affect for specific attributes, is consistent with the concerns of researchers studying enlistment decision making. It is quite possible that the linear multiple regression framework of the Fishbein and Ajzen model could be expanded to include additional components for affect and perhaps even habit, although this latter component seems inappropriate in the present context given the first-time nature of the enlistment (versus re-enlistment) decision. Or it is possible that the paradigm utilized by Bagozzi would be more appropriate for representing the components of the Fishbein-Ajzen model. In any event, the extended Fishbein-Ajzen model has a broad enough conceptual framework for incorporating other potential decision components. Moreover, it can readily incorporate the results generated by alternative measurement instruments, such as a semantic differential for measuring affect.

Although the extended Fishbein & Ajzen (1975) expectancy model is our recommendation for modeling the individual enlistment decision, we emphasize that this recommendation is a tentative one at this time. The model still contains certain issues that must be dealt with before full implementation of the model. These issues and possible strategies for addressing these issues are discussed below.

First, as a linear additive model, it is important that the extended Fishbein-Ajzen expectancy model includes all the relevant pieces of information used to form an overall judgment for the

individual enlistment decision. To ensure that all relevant dimensions are included it seems appropriate to examine the results of past studies that have examined the various attributes individuals consider when deciding on whether to enlist or not, and/or pilot test various proposed attributes and then perform a factor analysis to ensure that all relevant dimensions are being accounted for. The end product of each of these options should provide a set of attributes which are relatively inclusive of all factors considered by potential recruits when making the enlistment decision.

A second major issue of the extended Fishbein-Ajzen expectancy model is that the enlistment decision process may not be additive. As a form of an expectancy model, the Fishbein-Ajzen model states that actions become more attractive as their good consequences become more appealing and more likely or as their less appealing consequences become less likely. Because the expected utilities of various possible consequences are added, low or negative utility associated with one consequence can compensate for sufficiently high utility on some consequences can compensate for low or negative utility on others. However, when attempting to model the individual enlistment decision, an additive rule may not apply. Instead, individuals may evaluate their options by noncompensatory criteria. One noncompensatory rule is the conjunctive. By the conjunctive rule, an option has to score fairly high on each consequence to be considered. For example, the enlistment option must be capable of providing reasonable monetary rewards, good benefits, suitable training, be socially acceptable by peers and family, and be personally attractive to the individual. If the enlistment option failed to pass any one of these attributes, its rating on the others would be immaterial (e.g., no amount of money will compensate for social rejection by peers and family). These minimal levels are, in a sense, non-negotiable demands. Therefore, to ensure that a linear, additive model is appropriate, noncompensatory decision rules should be pilot tested.

Other nonadditive rules also may apply to the individual enlistment decision. For example, consequences may not be evaluated independently. Literal use of an expectancy model requires one to evaluate each consequence attribute of each option by itself and then combine the results. In some situations, however, the individual might want to evaluate a particular consequence differently depending on the value of other consequences. For example, one might like either receiving a high level of discipline or a high level of responsibility for his/her position while in the Army. However, both a high level of discipline and responsibility may be undesirable for certain individuals because they only like a high level of responsibility when given a great amount of flexibility in performing their duties (i.e., a low level of discipline). In other words, behavioral intent may be an interactive function of the attributes. Therefore, an alternative model, such as one developed from multidimensional scaling should

be used to triangulate the findings of the extended Fishbein-Ajzen expectancy model to ensure the correctness of the integration of information.

A third major criticism of the extended Fishbein-Ajzen expectancy model is that the weights on the two major components, the attitudinal component and the normative component, used to determine behavioral intentions, are not individual weights but group weights. Because the purpose of this research is to model the individual enlistment decision, the utilization of group weights may be problematic. Therefore, it is proposed that a multi-attribute utility assessment (MAUA) technique be pilot tested to determine whether it is possible to obtain individual weights on the two major components comprising Fishbein-Ajzen's behavioral intentions model. The application of MAUA would involve having individuals weight the attribute they had weighted most heavily for the attitudinal component in relation to the attribute they had weighted most heavily for the normative component. These weights would then be the individual weights for each of the two components in the model.

Another major concern in using the Fishbein-Ajzen model for the explanation of behavior is the adequacy and validity of the measures used to represent the principle constructs of the model. In the absence of both an adequate conceptual basis for and operational separation of attitudinal and normative influences, multicollinearity between the two predictor variables would make the estimation and interpretation of the B coefficients difficult (Green, 1978). Tests used to assess the significance of B coefficients are sensitive to the degree of multicollinearity among the predictors: Higher degrees of multicollinearity lower the likelihood of rejecting the null hypothesis (i.e., that B equals zero). This can be a particularly serious problem when attempting to infer "causation" because a potentially important predictor variable may appear to be insignificant. Conversely, predictors that are not related to the criterion may appear important as reflected by a significant beta coefficient. Suppose for example, that both attitudinal and normative factors are, in fact, important for a given behavior. To the extent that the model does not adequately separate these two sources of influence, an insignificant B weight might result for, say, the normative component, and one might erroneously conclude that normative factors were unimportant in generating the behavior. Research using this model is replete with interpretations of component importance based upon statistical significance (or lack of it) of the two B coefficients, and statements concerning the relative importance of attitudinal and normative influences require testing the null hypothesis that the Bs are equal (Draper & Smith, 1966). But the likelihood of rejecting this hypothesis decreases as multicollinearity increases, and under such conditions that result would be an unduly conservative test. Therefore, to the extent that there is a lack of a clear conceptual separation between attitudinal and normative influences and that this is carried

through to the operational level, our ability to assess their relative importance will be greatly impaired.

In response to this criticism, it should be acknowledged that Fishbein has never explicitly claimed that the components were independent, and informally at least has questioned both the practicality and necessity of such a separation. It is our contention that the conceptual basis underlying Fishbein and Ajzen's separation of attitudinal from normative influences is only inadequate if these are to be interpreted as separate sources of influence on behavioral intentions. Indeed, Fishbein and Ajzen do not dispute the fact that information or advice from others may be reflected in both the normative and the attitudinal component, assuming that the information is believed. Data from Ajzen & Fishbein (1972) suggest that the informational influence of others was reflected in both components. In their study, statements about other's expectations of the potential risk involved in a variety of behaviors were manipulated in a role-playing setting. These variations were found to alter not only one's normative beliefs significantly, but one's attitude toward the behavior, as well. A similar finding was reported by Ajzen & Fishbein (1974), where a measure of a referent's perceived expertise correlated significantly with both attitudinal and normative measures.

The separation of attitudinal from normative influences may, in fact, be impossible. Again, it must be emphasized that as long as the two components are not interpreted as entirely separate sources of influence on behavioral intentions for an individual, this model seems entirely appropriate for modeling the individual enlistment decision. Indeed, the Fishbein-Ajzen model is the only one thus far that has incorporated two basic social psychological concepts that have traditionally been treated independently, i.e., attitudes and social norms. Psychologists and sociologists interested in individual behavior have frequently made use of the attitude concept whereas theorists dealing with groups and societies have often relied on the concept of social norms. By including an attitudinal and a normative component, the Fishbein-Ajzen model is the only one that emphasizes the importance of both concepts and provides a bridge between the two approaches to the study of human behavior. It also permits the focus on behavior and the incorporation of other potential decision components such as affect, which are clearly of concern to researchers' studying individual enlistment decision making. In short, no other decision model appears to have the broad conceptual framework and measurement techniques available for modeling the individual decision process.

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