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I am submitting herewith a dissertation written by Branislav Konstantinovich entitled "Expectancy Theory, Operant Conditioning, and Choice: A Comparison of Three Models." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Organizational Psychology.

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EXPECTANCY THEORY, OPERANT CONDITIONING, AND CHOICE: A COMPARISON OF THREE MODELS

A Dissertation

Presented for the

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Degree

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ABSTRACT

Despite wide recognition given the expectancy theory of work motivation, research on the model has provided only marginal support for the theory. Numerous elaborations and modifications of the basic model have not changed this situation substantially.

Recent work on the expectancy model has focused on the concept of choice as a mediator of motivated behavior. The need to investigate the expectancy model within a choice framework raises the question as to how such a formula should be conceptualized.

The purpose of this study was to examine the utility of three different formulations of the expectancy theory model. This was done by testing the predictive accuracy of two choice models against the standard expectancy theory formula. One of these models--the within-person choice model--was adapted from expectancy theory research on choice. This model makes the prediction that the force exerted on a given alternative will be equal to the original force plus the remainder after the effects of competing alternatives have been subtracted out.

The second formulation of a choice model--the within-person effort model--is an extension of the matching law equation used to predict concurrent schedule behavior in operant conditioning. This model states that the relative effort expended on a given alternative will match the relative rate of reinforcement for that alternative.

The subjects were 186 college students attending classes during the summer quarter. A questionnaire using ten outcomes typical for the

academic setting was used to collect data in the present study. Along with this list of outcomes, the questionnaire also asked the subjects to list the courses they were currently taking. For each of the courses the subjects were asked to make the following two sets of ratings: (a) ratings of effort, and (b) ratings of valence, instrumentality and expectancy.

Results indicated that all three formulations of the expectancy model variables were predictive of effort ratings. Tests of significance of the difference between the validity coefficients generated by the three models did not reach statistical significance. Some support was found for the prediction that an inverse relationship exists between predicted force for an alternative, and effort on competing alternatives. It was suggested that models of choice behavior stand to make the greater contribution in situations involving more incompatible alternatives.

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CHAPTER I

INTRODUCTION

The expectancy of instrumentality-valence theory is said to be the most widely accepted theory of work motivation among today's industrial and organizational psychologists (Wahba and House, 1974). Despite this wide recognition, research on the model has to date provided only marginal support for the theory (Lawler and Suttle, 1973; Campbell and Pritchard, 1976).

In searching for methods to improve the predictive accuracy of the model, researchers have made a substantial number of elaborations and additions to the original Vroom (1964) formulation (e.g., Galbrith and Cummings, 1967; Porter and Lawler, 1968; Campbell, Dunnette, Lawler and Weick, 1970; Lawler, 1971). This growth in complexity, however, has not led to a concomitant increase in explanatory power. In addition, Lawler and Suttle (1973) have speculated that the model is becoming so complex that it is in danger of becoming untestable, and consequently also in danger of being abandoned.

Responding to some of these issues, Mitchell (1974) urged that before abandoning the expectancy model it might be worthwhile to examine the original Vroom (1964) formulation. As Mitchell (1974) points out, the original suggestion by Vroom was that people choose from among alternative acts the one corresponding to the strongest positive force. Mitchell referred to this choice concept as a

"within-person" model to distinguish it from the "between-person" model that researchers have typically employed.

Vroom (1964) indicated the importance of the concept of choice among alternatives in the study of motivation. However, the exact manner in which the choice concept should be conceptualized was not made explicit. According to Parker and Dyer (1976), the proper approach in conceptualizing the within-person model would be to compute for each subject two or more force scores, depending on the number of alternatives, and then test the frequency with which the behavioral alternative with the highest force score corresponds to the subject's actual choice. One problem with this approach is that it becomes necessary to obtain values based on the expectancy model variables for <u>each</u> alternative included. This additional complication may account for the lack of studies of this nature.

For the purpose of this discussion, the important thing to note is the emphasis on the concept of <u>choice between alternatives</u> as a mediator of motivated behavior. Most theories of motivation recognize that the value attached to a given outcome is at least partially dependent on the value of outcomes available from alternative sources (Campbell and Pritchard, 1976). This concept is sometimes referred to as the principle of diminishing marginal utility (Starr, 1964). This principle states that even though the value for a given alternative may remain constant, increases in rewards from other sources cause the relative value for that alternative to decrease. Prior tests of the expectancy theory formula have usually failed to take

into account the possible rewards associated with alternative choices. The need to do so has been pointed out by Mitchell (1974) in his appraisal of expectancy theory research. The guidelines for constructing such a model can be found in the literature on operant conditioning--a field that is gaining increasing visibility in the Industrial/Organizational literature (Nord, 1969; Mawhinney, 1975).

The remainder of this chapter will be devoted to an overview of the expectancy theory model, and to the operant conditioning research relevant to the formulation of an appropriate model for a within-person analysis. A modified within-person effort model derived from the operant conditioning literature will be presented. Research hypotheses will be offered to compare the three formulations of the expectancy model: (a) the traditional between-person expectancy model provided by Vroom (1964), (b) a modified within-person choice model based on the work of Parker and Dyer (1976), and (c) the within-person effort model derived from operant conditioning. An additional research hypothesis will be presented to test whether or not the formula derived from operant conditioning has the characteristics of the matching law on which it is based. Although the within-person effort model represents an analog to an operant situation it should be understood that all three models are of a <u>cognitive</u> and not a behavioral nature. Consequently, the proposed research hypotheses are intended as tests of three formulations of the expectancy model and not as a comparison of expectancy theory and operant conditioning.

I. EXPECTANCY THEORY AND CHOICE

The origin of expectancy theory is generally traced to the early work of Tolman (1932, 1938) and Lewin (1938). The key element in both these lines of research is the view that individuals have certain expectancies with regard to the outcomes their behavior may lead to, and their behavior is governed by the preference they have for the various outcomes. It is interesting to note that Tolman (1938) argued that everything important in psychology could be studied by the use of a choice procedure. At the time the use of T-mazes was popular, and Tolman suggested the appropriate dependent variable should be a "behavioral ratio." This ratio is the proportion of turns made to one side of the maze over the sum of the two alternative choices possible.

Peak (1955), also working in an expectancy framework, defined motivation in terms of persistence of behavior with some intensity and some direction. She went on to say (Peak, 1955, pp. 160-161),

> Direction is also assumed to be a property of motivated behavior by all and sundry. And I believe it is fair to say that whenever we speak of direction, we imply that there is discrimination between events (stimuli, acts, habit strengths, objects, feelings) and a choice . . . the problem of the directional aspect of motivated behavior is fundamentally the problem of choice and selection.

In the earlier work done on the expectancy model, the concept of selection among alternatives was an integral part of the definition of motivation (Tolman, 1932, 1938; Peak, 1955). A review of the major work on the expectancy model indicates that the choice concept plays a major role in expectancy theory today.

An Overview of the Expectancy Model

The expectancy valence model was first introduced as a motivational model applicable to work settings by Vroom (1964). According to Vroom, the force to perform an act was a monotonically increasing function of the algebraic sum of the products of the valences of all outcomes, and the strength of the person's expectancies that the act will be followed by the attainment of these outcomes. Symbolically,

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

where,

F_i = the force on the person 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.

Expectancy is defined by Vroom as a person's belief concerning the probability that the behavior in question will be followed by the outcome of interest, and ranges in value from zero to plus one. The concept of instrumentality, implicit in the above formula, is defined as the degree to which the person perceives the outcomes in

question as leading to the attainment of other outcomes, and ranges in value from minus one to plus one. The last element in Vroom's formulation--valence--is defined conceptually as the strength of a person's positive or negative affective orientation toward an outcome.

A number of modifications and elaborations of the expectancy model have appeared in the literature since the model was first introduced by Vroom in 1964. One such change was made by Galbrith and Cummings (1967). As was stated earlier, the concept of the instrumentality was not explicitly recognized in the original effort model proposed by Vroom. The contribution of Galbrith and Cummings was to draw a clear distinction between first level outcomes (Expectancy) and second level outcomes (Instrumentality). Expectancy thus came to refer to effort-outcome relationships, while instrumentality came to be used for outcome-outcome relationships. With these modifications the expectancy model took the now familiar form of

$$F_i = E \sum_{j=1}^{n} (I_{ij} x V_j)$$

where

F_i = the force on the person to perform act i,

E = the expectancy that effort leads to performance,

I_{ij} = the instrumentality of performance for the attainment of second level outcomes,

V_j = the valence of the second level outcome,

n = the number of outcomes.

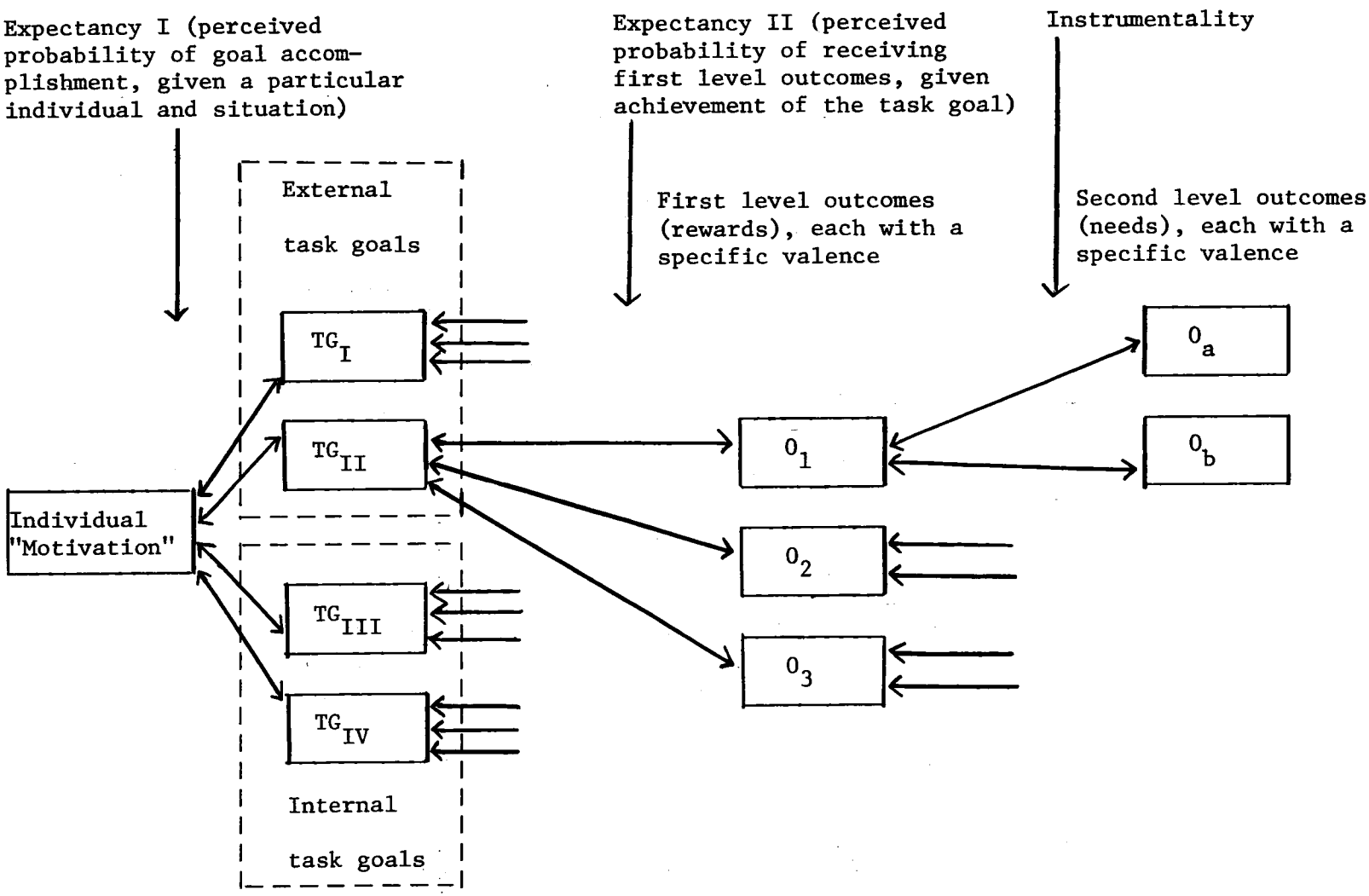
The typical procedure used in testing the between-person model has been to ask each subject to indicate, (a) the degree to which working hard was seen as leading to good performance (Expectancy), (b) the degree to which good performance was likely to lead to a set of outcomes (Instrumentality), and (c) the desirability of each outcome (Valence). These variables are then combined to give a single E (IV) score for each subject, and these scores are then correlated across subjects with some criterion variable of effort or performance (Mitchell, 1974). The between subject design, then, involves a "test" of the model by computing only <u>one</u> force score for each subject and correlating that value with measured performance across subjects.

Porter and Lawler (1968) proposed a work performance model built around the expectancy theory effort concept. According to Porter and Lawler, a person's performance is a function of the product of effort, ability and role perception of an individual. Effort in turn is said to be a function of the perceived effort-reward probability (Expectancy) and the value of rewards (Valence). Thus, the effort concept remained unchanged from the way it was initially used by Vroom (1964). The modification that Porter and Lawler made was to draw a distinction between intrinsic and extrinsic rewards, and to add two feedback loops to the model. One of these feedback loops

is between the effort-reward probability (Reinforcement History), and the other loop is between satisfaction and valence (Anticipated Value of Reward). The main effect of these modifications was to shift the conceptual focus to a more dynamic conceptualization of motivation. This change in focus however is more on a theoretical than a practical level since the model is still seldom tested using longitudinal experimental designs where factors such as reinforcement history can be taken into account.

A hybrid expectancy model was proposed by Campbell, Dunnette, Lawler and Weick (1970) as an alternative to the Vroom (1964) formulation. The Campbell et al, model is illustrated in Figure 1. In this model an important distinction is made between two types of expectancies. Expectancy I is defined as the subjective probability estimate concerning the chances of reaching a particular goal. The second expectancy (E_{II}) is defined as a subjective probability estimate that achievement of specified task goals will actually be followed by <u>first level</u> outcomes. First level outcomes are used synonymously with the term reward. Within industrial settings, some examples of first level outcomes would be pay, promotion, recognition and job security.

The definition for E_{II} comes very close to the definition of instrumentality as used by most authors. In their hybrid expectancy model, Campbell et al. (1970) use instrumentality to refer to the degree to which externally or internally mediated rewards are instrumental for obtaining <u>second level</u> outcomes such as food, housing and status. Symbolically, this model would be represented as



Aschematic representation of a hybrid expectancy model or work motivation outlining the determinants of the direction, amplitude, and persistence of individual effort.

Figure 1. Hybrid Expectancy Model (Campbell et al., 1970).

$F = E_1 E_{II}$ (IxV). However, in practice the model is usually tested using only the first level outcomes and thus reduces to the familiar F = E(IxV) formula discussed in conjunction with the Galbrith and Cummings (1967) model.

Recently, Lawler (1971, 1973) has proposed several elaborations of the Porter and Lawler (1968) model. One such elaboration was an attempt to specify the parameters that determine an individual's expectancy that effort will lead to task accomplishment (Expectancy I). The parameters that Lawler proposed are: (a) task information, (b) prior information that the person has on how they have done, and (c) the individual's self-esteem. Lawler (1971) also added a third feedback loop to the model to reflect the impact of success and failure on the individual's self-esteem and consequent performance. Another elaboration is the concept of feedback from individual performance which is also said to lead to the formation of specific expectancies that become characteristic for specific kinds of tasks.

Some attention has also been given to individual locus-of-control as a trait having an impact on the instrumentality-valence relationship (Rotter, 1966). The hypothesis is that individuals who feel that they have control over the outcomes in their environment, as opposed to luck or chance, should exhibit greater motivation. Some support has been found for this hypothesis (Broedling, 1975; Leid and Pritchard, 1976).

The two most recent reviews of the literature by Mitchell (1974) and Campbell and Pritchard (1976) are in close agreement as to the state of the art in expectancy theory research. Both reviews draw

the conclusion that studies conducted as a test of expectancy theory predictions provide general support for the model. For studies using independent ratings of effort, the obtained correlations have a median value of .25. When self ratings of effort are used as the criterion, the correlations are somewhat higher (Mitchell, 1974; Campbell and Pritchard, 1976). As Mitchell points out, the fact that self ratings produce slightly better results than independent ratings of effort is problematic in interpretation. While self ratings are naturally open to rater bias, it is also true that the model as proposed by Vroom (1964) is said to predict the force on the individual to perform and not actual performance. From this perspective, the individual is more likely to know about his/her self-effort. Separating out the true variance from the error variance, however, is an almost impossible task.

Historically, the nature of the relationship between attitudes and behavior has received wide debate (DeFleur and Westie, 1958; Doob, 1947; Fishbein, 1967; Fishbein and Ajzen, 1974; La Piere, 1934). Much of the literature has provided low empirical relationships between behavior and attitudes. Because of the general prevalence of such findings, the use of attitude measures under the assumption that they are predictive of behavior has been made suspect. More recently, Fishbein and Ajzen (1974) have suggested that while a given attitude may in fact show poor relationships with a single behavioral criterion, a relationship may exist when examined within the context of a pattern of behaviors. The essence of the argument is that while a number of

individuals may hold the same attitude, they might nevertheless express it in a variety of behaviors. This divergence in behaviors may possibly be a function of the individual's prior reinforcement history. When Fishbein and Ajzen examined the attitude-behavior relationship in this context, the obtained correlations ranged into the .60's. The suggestion then appears to be that if self-reports of attitudes are used, a number of behavioral outcomes by which such attitudes could be expressed should be used as well. A more recent finding that also relates to the issue of using self-report ratings of effort has been reported by Turney (1975). Turney found a correlation of .60 ($p < .01$) between self-reported and independent measures of effort. Thus, assuming that a behavioral criterion would be desirable in studying Vroom's model (1964), some support exists for the statement that self-ratings of effort are to an extent related to effort behavior.

Expectancy Theory Research Using a Choice Model

As Mitchell (1974) has pointed out, Vroom followed the formulation of his model with the statement that, "It is also assumed that people choose from among alternative acts, the one corresponding to the strongest positive (or the weakest negative) force" (Vroom, 1964, p. 19). However, Mitchell (1974) stated no investigation has predicted job effort in this manner. Since the review by Mitchell, several studies have appeared that test expectancy theory predictions using a choice framework. These studies will be reviewed in greater detail since they lay the groundwork for the development of the hypotheses tested here.

In a recent study, Parker and Dyer (1976) tested expectancy theory as a within-person behavioral choice model. Following the suggestion by Mitchell (1974), they took the approach of computing for each subject two force scores, one for the decision of naval officers to retire from active duty and the other for the decision to remain active. Parker and Dyer then tested the frequency with which the behavioral alternative with the higher force score corresponded to the subject's actual choice. Symbolically,

$$F_r = E \sum_{i=1}^{n} (V_{ir} \times I_{ir}$$

$$F_a = E \sum_{i=1}^{n} (V_{ia} \times I_{ia})$$

and

$$P = F_r - F_a$$

where: F_r = force to retire; E = expectancy that the effort of submitting an official retirement request will result in approval; V_{ir} = the perceived valence of the i^{th} role outcome for the retired role; I_{ir} = the perceived instrumentality of the retired role for attaining the i^{th} role outcome. And, F_a = force to remain on active duty; V_{ia} = the perceived valence of the i^{th} role outcome for the active duty role; I_{ia} = the perceived instrumentality of the active duty role for attaining the i^{th} role outcome. Once F_r and F_a are computed, F_a is subtracted from F_r to obtain the predictor score (P).

Where $P > 0$ retirement is predicted, $P < 0$ active duty is predicted; $P = 0$, no prediction is made (Parker and Dyer, 1976).

To test the accuracy of their role-choice model, Parker and Dyer first calculated the P scores for each respondent, then made their prediction about the subject's status, and finally compared these predictions with the subject's actual status (active or retired). The data were analyzed by looking at the patterns of percentages of correct and incorrect predictions, and by calculating a phi coefficient to determine the significance of the relationship between predicted and actual status. The results from the study supported the general validity of the model in that 62.8% of the cases were correctly predicted, yielding a phi coefficient of .319 which was significant beyond the .001 level.

Since the Parker and Dyer (1976) study used a dichotomous dependent variable (retire or not retire) effort for the alternatives was not calculated. The within-person model as presented by Parker and Dyer (1976) dealt only with role-choice as the dependent variable. In order to extend the Parker and Dyer (1976) model to a situation where a continuous variable is used (e.g., effort) some modifications need to be made. The need for modification becomes evident if one considers the situation where the calculated force for two alternatives (F_a and F_b) is equal, or the subject is equally motivated to perform on both alternatives. In this situation if one tried to calculate the predicted force by taking the difference between F_a and F_b, as Parker and Dyer (1976) did in their study, it would be found that the resultant

difference is zero. While a predicted value of zero may be meaningful as an indicator of preference (i.e., no-preference) in a choice context, the meaning is not as clear when one is trying to predict effort on a given alternative. The purpose of including more than one alternative is so that the effects of changes in other alternatives on the alternative of interest can be taken into account.

A logical extension of the model to the situation where a continuous variable is used would imply that the force exerted on a given alternative should be equal to the original force for that alternative plus the remainder after the effects of competing alternatives have been subtracted out, or

$$F_a^* = F_a + (F_a - [F_b])$$

where

F_a^* = the calculated force for alternative a given F_b,

F_a = the force for alternative a,

F_b = the force for alternative b,

and

F_b^* = the calculated force for alternative b given F_a,

F_b = the force for alternative b,

F_a = the force for alternative a.

Whether or not this model would be useful in predicting effort for the choice(s) made, however, is an empirical question.

Another recent study using a within-person design was done by Muchinsky (1977). This study is methodologically more similar to the approach that will be taken in the present study.

The purpose of the Muchinsky (1977) study was to compare the validity of both the within and between person models in predicting job effort. The subjects for the study were undergraduate college students, and the procedure involved asking the subjects to complete a four-part questionnaire.

The first part of the questionnaire was used to obtain a listing of the courses that the students were taking, as well as their preferences among the various courses. On the second part of the questionnaire, the subjects indicated how much effort they expended in each course. The third part of the questionniare was designed to obtain measures of valence, instrumentality and expectancy for 11 outcomes that students typically derive from taking courses (e.g., possibility of getting a high grade, feeling of accomplishment). The attractiveness of each of the outcomes (Valence) was rated on a scale from -10 to +10. The relationship between performing well in each course and attaining each of the outcomes (Instrumentality) was also measured on a scale of -10 to +10. And, the expectancy variable was measured by asking the subjects to rate (on a 0 - 9 scale) the relationship between working hard in a course and performing well. Finally, the fourth part of the questionnaire measured the same expectancy variables, but only for

the student's coursework in general; or, the coursework taken as a whole.

For the within-person analysis, a correlation was computed for each subject between the ratings of effort expended in each course, and the force for each course calculated using Vroom's model (1964). For the between-person analysis, the rating of effort expended in course-work in general (part four of the questionnaire) and the ratings of expectancy model variables for coursework in general were correlated across subjects.

Muchinsky (1977) interpreted the results from the study as being supportive of the within-person model ($\bar{r}$ = .52 versus typical between person r's of .30). In conducting his study, Muchinsky (1977) did not use the Parker and Dyer formulation of the within-person model (1976). That is, Muchinsky calculated the correlations between effort and the expectancy model variables for each of the courses separately for each subject to arrive at the within-person concept in his study. However, he did not integrate this information to make any predictions regarding the effort a subject would be expected to exert on a given course. The Parker and Dyer model tried to do this, for predicting choice, by taking the difference between the force score calculated for the two alternatives of retiring or remaining on active duty.

Thus, although the study of Muchinsky (1977) indicates a potential gain in predictive accuracy by the use of a within-person analysis, his study does not answer the question of how this information can be used to predict the level of effort for any single alternative. A

corollary issue not addressed in either the Muchinsky (1977) study or the Parker and Dyer (1976) study is the question of how a number of such competing alternatives are combined, and possibly determine the effort that is expended on any single alternative. In fact, this issue has largely been ignored in expectancy theory research. The within-person effort model to be developed from the operant conditioning literature may provide a framework for making such predictions.

In earlier work on expectancy theory, individual choice had always played a key role in conceptualizations of motivation (Tolman, 1938; Peak, 1955). Choice as a dependent variable was also recognized by Vroom (1964), but omitted in later revisions of the model by Porter and Lawler (1968). Nearly all the subsequent work has focused on force or effort as the dependent variable (Mitchell, 1974; Campbell and Pritchard, 1976). The importance of this shift in focus from a within-person to a between-person analysis is more than of passing historical interest. Besides having a strong theoretical tradition, a within-person analysis also has a substantial empirical base to commend it. Much of this research, however, is in the field of operant conditioning.

II. OPERANT CONDITIONING AND CHOICE

Current Research Comparing Operant Conditioning and Expectancy Theory

In the last few years, a number of articles have appeared contrasting predictions derived from expectancy theory with those from operant conditioning. Nord (1969) was one of the first to note that although the field of operant conditioning has enjoyed considerable

prominence within the general field of psychology, not enough attention had been given to it in the organizational literature.

Several experiments have been conducted on the differential predictions said to be made by expectancy theory and operant conditioning models (e.g., Yukle, Wexley and Seymore, 1972; Berger, Cummings and Heneman, 1975; Pritchard, Leonard, Von Bergen and Kirk, 1976). Although a number of differences are said to exist, the issue has centered on one major point. Whereas both approaches agree that rewards should be contingent on the appropriate behavior, operant research is said to predict higher rates of responding under intermittent reward schedules while expectancy theory predicts greater effort with continuous reward schedules. It should be mentioned that response rate is meaningless on CRF schedules in operant conditioning since a consumatory response is usually involved.

The design used to test these predictions typically involves the use of a continuous reinforcement schedule (CRF) and two equal variable ratio schedules (VR). One of the VR-2 schedules delivers the same amount of the reinforcer (i.e., money) as the CRF and the other provides twice the amount of money. However, since the VR-2 "pays off" only 50% of the time, the amount earned in the long run is actually the same as for the CRF. In expectancy theory terms, the higher valence acts to cancel out the lower expectancy. Different groups of subjects are then assigned to work under the three conditions, and comparisons are made between the groups in respect to the number of work units completed. The crucial comparison made to test the

two approaches is the performance of individuals on the CRF condition with the performance of those on the VR-2 schedule offering the same amount of money. The predictions made in respect to the outcome are: (a) operant-performance should be better on the VR-2, and (b) expectancy-performance should be better on the CRF. Not unexpectedly, the results from the various studies have been inconclusive.

A between-subjects design, however, is an unfortunate choice of procedure for the study of the types of manipulation of interest. As Morse (1966, pp. 78-79) points out, "In general, it appears that the rate of responding is not very sensitive to frequency of reinforcement in situations involving a single schedule . . . ," which is to say between-subject designs. Similar conclusions also seem to hold true for magnitude of reinforcement manipulations (Guttman, 1953; Keesey and Kling, 1961; Catania, 1963).

The Operant Analog to Expectancy Theory

In the operant field it has been found that the study of such variables as frequency of reinforcement is made possible under concurrent schedule responding. In this situation, the subject has the option of choosing on which of two (or in some cases more) alternative schedules on which they wish to work. By looking at the allocation of responses on the schedules provided, one can make inferences as to the relative attraction or force to perform on the alternatives.

Herrnstein (1961) used the concurrent schedules procedure to study performance on variable-interval schedules. The values of the interval schedules were systematically manipulated while the total

frequency of reinforcement per session was held constant. In expectancy theory, this could be comparable to manipulating the expectancy variable values for the two alternatives while holding valence constant. It was found that the relative frequency of responding corresponded closely to the relative frequency of reinforcement. Or,

$$\frac{\text{Resp. A}}{\text{Resp. A + Resp. B}} = \frac{\text{Reinf. A}}{\text{Reinf. A + Reinf. B}} .$$

This equation, sometimes called the matching law, says that the relative frequency of responding on the two alternatives equals, or matches, the relative frequency of reinforcement obtained on the alternatives.

Numerous follow-up studies have confirmed this finding and explored concurrent schedule behavior in greater detail (cf. Catania, 1966). Some of the relationships that have been found to hold in concurrent schedule responding are: (a) the response rate on a given schedule is not only a function of the reinforcement density for that schedule, but is also influenced by the reinforcement available on alternative schedules, (b) if the reinforcement density is increased on alternative A, while it is held constant for B, the response rate will increase on A and decrease on B, and (c) if the reinforcement density is held equal for the alternatives and increased there is a small increase in total responding.

The matching relationship found to hold for responding also seems to hold true for relative time spent on a given alternative (Rachlin, 1976). That is, the relative time spent working on a given alternative will match the relative reinforcement rate for that alternative.

An extension of the matching model for a range of alternative choices would be represented as

$$\frac{R1}{R1 + R2 + R3 + \ldots + Rn} = \frac{r1}{r1 + r2 + r3 = \ldots + rn}$$

in which R1 to Rn enumerates the response alternatives and r1 to rn the reinforcements associated with each alternative (de Villiers and Herrnstein, 1976).

One implication of the above formulation would be that the greater the relative reinforcement offered by other alternatives, the less effort the person would be expected to exert on the alternative at hand. Rachlin (1976) presents the notion of decreasing marginal utility as a parallel to this situation. The absolute value for a given alternative may remain constant but with increases in reward from other sources the relative value for that alternative decreases.

In terms of the traditional between-person expectancy theory formula, it would be quite possible for two people to provide ratings on the expectancy variables which when calculated would produce the same force score, and yet the people report different amounts of effort. This would be possible since the traditional expectancy theory formula

does not account for the relative force for alternatives other than the one under consideration.

The research on concurrent schedules shows that in order to predict the effort, or responding, for one alternative, it is necessary to know the relative force on other competing alternatives (de Villiers and Herrnstein, 1976; Rachlin, 1976; de Villiers, 1977). In operant research, the attraction of alternatives has been manipulated by varying the magnitude of reinforcement (equivalent to manipulating valence) and the frequency of reinforcement (equivalent to expectancy). The relative attraction of such alternatives has a direct impact on the effort that will be exerted on the single alternative under consideration.

A reformulation of the traditional expectancy formula that would represent an analog to the operant theory research, as well as reintroduce the concept of choice, would be

$$\frac{F1}{F1 + F2 + \ldots + F_n} = \frac{E[\Sigma(V\times I)]1}{E[\Sigma(V\times I)1 + E[\Sigma(V\times I]2 + \ldots E[\Sigma(V\times I)]n}.$$

This equation is structurally equivalent to the matching law equation, and says that the effort a person will expend across the alternatives will equal, or match, the relative calculated force for the alternatives. Also, the effort a person will exert on alternative 1 is directly proportional to the calculated force for that alternative, and inversely proportional to the total calculated force in the situation for competing alternatives. This equation will be referred to as the within-person effort model derived from operant conditioning.

Studies of Concurrent Schedule Behavior Using Human Subjects

While most of the data on concurrent schedule behavior are based on studies using nonhuman subjects (usually rats or pigeons), there are a number of studies that deal with choice behavior in humans. The question then is whether or not the behavior of humans shows similar regularities in performance, that is, follows the predictions of the matching law.

Weiner (1966) studied preference by permitting human subjects to make switching responses which controlled the programming of various two-component multiple ratio schedules. The results showed that humans prefer (switch to) components with the smaller ratio requirement. In a somewhat similar study, Striefel (1972) allowed people to choose among ten different pairs of concurrent fixed ratio schedules. Again, it was found that the people preferred the smaller ratio schedule. After this preference has been determined, timeouts (the subjects were not able to work on the schedule for a period of time) of increasing duration followed the completion of the preferred schedule. The larger the difference between the ratio requirements, the longer the timeout necessary to produce the shift to the previously non-preferred ratio.

Both of these studies are encouraging because they indicated that human subjects are sensitive to scheduling parameters and exhibit choice behavior in the same manner demonstrated by lower animals. The fact that people chose alternatives where their effort was most likely to lead to desired outcomes is also consistent with expectancy theory. A limitation common to both studies, however, is the use of fixed-ratio

schedules. With fixed-ratio schedules matching has to occur since there is a built-in relationship between responding and rewards. Under these conditions it is not possible to study the more gradual shifts in effort in proportion to the relative rates of reinforcement as predicted by the matching equation (Rachlin, 1976). This gradual shift in effort is best observed in studies using variable interval schedules to program reinforcement.

A rather elaborate study was conducted by Schroeder and Holland (1969) using variable-interval schedules to study the matching relation with human subjects. The subjects monitored four dials arranged in a square with two on the left and two on the right. The subject's job was to detect pointer deflections on the dials. A response in this study consisted of an eye movement to a dial after the subject had looked away toward the other dials. Pointer deflections were delivered by two independent variable-interval schedules. Schroeder and Holland (1969) found that all six subjects in the experiment matched relative responses (number of eye fixations per minute) on each side to the relative rates of pointer deflections to that side. The matching function was found to hold for several equal and unequal variable interval concurrent schedules.

Schroeder (1975) reported four experiments using retarded humans as subjects (IQ range = 40-70). Overall, the results showed the concurrent performances of retardates parallel those of animals and normal humans. The performance of the subjects was found to vary systematically as a function of the type of schedule, schedule value, duration and symmetry of the changeover delays.

Schmitt (1974) examined the effects of reinforcement rate and reinforcement magnitude on choice behavior of humans in a two-part study. In the first experiment each of five college students responded on four concurrent variable-interval schedules. In contrast to the studies using nonhuman organisms, Schmitt found that for his human subjects neither the relative response rate nor the relative amount of time spent responding on each side matched the relative rate of reinforcement. In the second experiment, using five different subjects, the effects of four pairs of reinforcer magnitudes were investigated using equal variable-interval schedules. As in the first experiment, a matching relationship was not found to hold. Substantial discrepancies were found between relative response rate and relative proportion of reinforcers received. The subjects responded similarly regardless of the reinforcer magnitude ratios--they failed to show matching. Schmitt concluded that the simple application of previous generalizations regarding the effects of reinforcement rate and reinforcer magnitude on choice behavior may not accurately describe human behavior in a simple laboratory situation.

Schmitt's (1974) failure to demonstrate the matching relationship for humans was somewhat surprising. In terms of the fidelity of the design the study was closer than any of the others cited in reproducing a situation as close as possible to the one used in the animal studies. The subjects responded by pressing a response key and immediate feedback was provided by counterpoints backed up with money as a reinforcer. The possibility exists, however, that the money reinforcement may not have functioned as a reinforcer. The Ss were paid approximately

$2.80 for a 90-minute session. Although, as Schmitt pointed out, the subjects were effective in obtaining nearly all the programmed reinforcements, the lack of any schedule effect raises the question as to whether the amount was sufficiently large to serve as a reinforcer in a rather tedious task. While this question cannot be answered on the basis of data reported by Schmitt, the question does serve to point out the difficulty the operant conditioning field has in defining on an a priori basis what will function as a reinforcer. In operant conditioning whether or not an event is a reinforcer is determined only by its effect on behavior.

On a broader level the difficulty lies in the fact that the term "reinforcement" embodies any number of potential variables that either singularly or in combination serve to function as a "reinforcer" (Malone, 1975). The expectancy model breaks down the components of motivation into the key variables of expectancy, instrumentality and valence. Operant conditioning theory combines all these variables under the rubric of "reinforcer." In this respect, expectancy theory stands to make a contribution to the operant field by breaking down the "reinforcer" into several components which, at least, would seem reasonable on an a priori basis.

Summary and Statement of Purpose

Based on the review of expectancy theory research, several trends would appear to characterize the state of the art. First, the studies that have been conducted using the general Vroom (1964) model have produced only modest relationships between predicted motivation

and effort. Second, modifications of the original Vroom model appear to be going in the direction of ever increasing complexity. This growth in complexity is at least partially a natural consequence of theoretical evolution and, possibly, an attempt to keep the model in tune with current research in related areas. No doubt a further contributor to the growth of motivational variables is the attempt by researchers to improve prediction by the inclusion of more factors in the expectancy equation. However, this increase in theoretical complexity has not met with a corresponding increase in predictive accuracy.

In his appraisal of expectancy theory research, Mitchell (1974) raised some fundamental questions regarding current interpretations of the Vroom (1964) model. Specifically, Mitchell pointed out that the concept of choice, though ignored in research, was an integral part of Vroom's conceptualization of a motivational model. Historically, the cognitive process models have always operated on the assumption that individuals develop expectancies regarding the consequences of engaging in alternative behaviors and that such expectancies govern the behavior of the individual (Tolman, 1932).

Following the publication of Mitchell's (1974) article several studies have appeared that examined the expectancy model within a choice framework (Parker and Dyer, 1976; Muchinsky, 1977). The results from these studies have demonstrated that a within-subject analysis can be applied to expectancy theory.

The need to investigate the expectancy model within a choice framework raises the question as to how the force scores generated for

several alternatives should be combined. The purpose of this study was to compare the utility of two models of choice for the prediction of effort.

Parker and Dyer (1976) have proposed a model that takes the difference between force scores, and makes the prediction that the alternative having the larger force score will be the one that is chosen. Muchinsky (1974) did not address the question of how force scores generated for different alternatives should be combined and proposed no method for doing so.

Although studies that have been conducted to this point that examined expectancy theory and operant conditioning have focused on possible differences between the two approaches, the two fields would seem to complement more than contradict each other. A within-person effort model, developed from the operant conditioning literature on concurrent schedule behavior, was proposed as a potentially useful formula for the study of expectancy theory within a choice framework. An advantage of this model is that it combines the force scores generated for several alternatives to make predictions about the relative motivation for a single alternative. Because the model makes predictions based on the proportional relationship between alternatives it has the additional advantage of eliminating leniency errors thus making across subject comparisons more meaningful.

III. OBJECTIVES OF THE PRESENT RESEARCH

This study will examine three formulations of the expectancy model: (a) the traditional between-person expectancy model provided by Vroom (1964) as used most frequently in the literature, (b) a within-person choice model developed by Parker and Dyer (1976), and (c) the within-person effort model derived from operant conditioning.

In the case where a student is taking two courses, the symbolic representation of the three models would be as follows:

1. The traditional between-person expectancy model,

$$F_a = E_1 \sum_{i=1}^{10} (V_{ia} \times I_{ia})$$

$$F_b = E_2 \sum_{i=1}^{10} (V_{ib} \times I_{ib})$$

where: the two force scores (F_a and F_b) are the calculated force on the person to perform in each of the courses; the two expectancies (E_1 and E_2) represent the perceived probability that working hard in each of the courses would result in performing well in each; the two valence scores (V_{ia} and V_{ib}) equal the perceived valences of the i^{th} outcomes for each of the two classes; and the two instrumentalities (I_{ia} and I_{ib}) are equal to the perceived instrumentality of good performance for attaining the i^{th} outcomes in each of the classes.

2. The within-person choice model would calculate the motivation to perform in each of the courses as,

$$F_a^* = F_a + (F_a - [F_b])$$

$$F_b^* = F_b + (F_b - [F_a])$$

where: F_a and F_b are computed according to the equations given for the traditional model (#1); the predicted force score for course A (F_a^*) is obtained by taking the difference between F_a and F_b and adding it to F_a; and the predicted force score for course B (F_b^*) is obtained by taking the difference between F_b and F_a and adding it to F_b. Or, the calculated force for a given alternative is a function of the force for that alternative plus an increment or decrement in force as a function of the other alternative.

3. The within-person effort model, derived from operant conditioning principles, would calculate the force to perform in the two courses as,

$$F_a^{**} = \frac{F_a}{F_a + F_b}$$

$$F_b^{**} = \frac{F_b}{F_b + F_a}$$

where: F_a and F_b are calculated using the equations given for the traditional model; the predicted force for course A (F_a^{**}) is obtained by dividing the combined force for the two alternatives into the force for course A; the predicted force for course B (F_b^{**}) is likewise calculated by dividing the combined force for the two alternatives into the force for course B alone.

Hypothesis

On the basis of the data presented from the field of operant research, it is hypothesized that the within-person effort model will prove to be a better predictor of effort than the traditional between-person expectancy formulation. The second comparison will be between the within-person choice model presented by Parker and Dyer (1976) and the traditional between-person expectancy formula. Based on the study conducted by Muchinsky (1977) showing the superiority of a within-person model over a between-person model, it is hypothesized that in this study the within-person model (Parker and Dyer, 1976) will also provide stronger relationships with effort ratings in comparison to the traditional between-person formula. The third comparison will be of the two within person models, the Parker and Dyer model, and the within-person effort model derived from operant research. On the basis of the operant conditioning literature, the within-person effort model is expected to show a stronger positive relationship with self-rated effort than the within-person choice model.

Another comparison to be made by the present research will be to test the within-person effort model derived from operant conditioning to see if it behaves in the manner predicted by the matching law. That is, the effort a person will exert on a given alternative will not only be a function of the force for that alternative, but will also be influenced by the magnitude of the force for other alternatives. Stated formally the hypotheses are:

Hypothesis I. The within-person effort model from operant conditioning principles will show a stronger positive relationship with self-rated effort than the traditional between-person expectancy formula.

Hypothesis II. The within-person choice model formulated by Parker and Dyer (1976) will show a stronger positive relationship with ratings of effort than the traditional between-person expectancy formulation.

Hypothesis III. The within-person effort model derived from operant conditioning principles will show a stronger positive relationship with effort than the within-person choice model of Parker and Dyer (1976).

Hypothesis IV. There will be an inverse relationship between effort in studying for a given course (course A) and the relative force offered by other alternatives (other courses). The greater the force for other alternatives, the less effort a person will report for studying in course A.

CHAPTER II

METHODOLOGY

I. SUBJECTS

The subjects were University of Tennessee-Knoxville students attending classes during the first session of the summer quarter. The courses in which the students were enrolled are: Business Policy, Production Management, Personnel Management, Industrial Psychology, Human Problems in Administration and Principles of Management. Seventy-eight percent of the students were taking junior and senior level undergraduate courses, while the others were first year graduate students. The questionnaire was distributed to a total of 215 students.

Additional data was gathered from a class attending the second quarter of the summer session enrolled in a sophomore level course in the Psychology of the Individual. Sixty-seven questionnaires were distributed to this group of students.

II. PROCEDURE

The general procedure for this study was similar to the methodology previously described for the Muchinsky (1977) study.

Ten outcomes typical for the academic setting were used in the present study. These outcomes were: high letter grade, approval from fellow students, ability to apply the material learned, ability to explain the material to others, less time for extra-curricular activities, learn important job skills, being labeled a bookworm or a

"know-it-all," feeling of accomplishment from having done well in the course, an increase in psychological stress (tension, headaches, and so forth) and developing self-discipline. Along with this list of outcomes, the questionnaire also asked the subjects to list the courses they were currently taking. For each of the courses the subjects were also asked to make the following two sets of ratings: (a) ratings of effort, and (b) ratings of valence of outcomes, instrumentality and expectancy (see Appendix A).

The questionnaire was distributed to a class approximately midway through the first session of the quarter. The questionnaire took approximately 15 minutes to complete, and was collected immediately after it was administered. It was explained that participation in the study was on a voluntary basis and that the questionnaires should be filled out anonymously. No points or credits were given for participation in the study.

Of the 215 questionnaires that were distributed, one person chose not to participate, 19 subjects were excluded because they were taking only one course and nine were excluded because they were taking more than three courses. A total of 186 subjects were thus included in the data analysis.

In order to establish the reliability of the questionnaire a test-retest procedure was used. The second administration of the questionnaire took place one week after the initial survey.

Individuals that elected to complete the questionnaire were asked to put an identifying mark (chosen by them) on the questionnaire.

It was explained that this is necessary so that a follow-up would be possible. A total of 55 subjects were included in the retest sample, 51 of which were available for the second administration.

In order to give greater support to the self-ratings of effort, a second group of subjects, attending the second session of the summer quarter, was used to gather data on the relative allocation of time across various course alternatives. The students were given a time sheet on which they were asked to indicate how much time they spent working on each of the courses they were taking outside of attending classes (see Appendix B). The students were asked to keep a record of their time for a ten day period. At the end of ten days the time sheets were collected and the questionnaire was administered to this sample of students as well. Those students who had completed the time sheet but had forgotten to bring it to class were given pre-addressed, stamped envelopes which they could use to mail the time sheets.

Of the 67 time sheets that were distributed 48 completed forms were returned (72%). From this group three subjects were excluded because they were taking only one course and one was excluded because he/she was taking more than three courses. A total of 44 subjects were thus included in the data analysis.

III. MEASURES

Expectancies

According to the expectancy model, expectancy perceptions are viewed as behavior-outcome relationships and should be measured as subjective probabilities ranging in value from zero to plus one (Vroom, 1964; Mitchell, 1974).

For the purpose of this study, subjects were asked to rate the relationship between working hard (effort) in the course and performing well. There was one such scale for each course the subject was taking. The scale ranged from zero (no chance) to ten (certainty) (see Appendix A).

Instrumentalities

According to Vroom (1964) the instrumentality variable ranges in value from -1.00 to +1.00 and reflects the relationship between good performance and outcomes. Mitchell (1974) has pointed out some of the pitfalls in measuring instrumentality in terms of a probability as well as the importance of providing a scale that has the full range of positive to negative values. In keeping with these suggestions, the instrumentality scale ranged in value from -10 (impossible) to +10 (certain). The subjects were asked to rate the relationship between performing well in the course and attaining each of the outcomes listed (e.g., high letter grade).

Valences

Vroom (1964) defined valence as the affective orientation of an individual toward a particular outcome. Theoretically valence, like instrumentality, should range from positive to negative (Miner and Dachler, 1973; Mitchell, 1974). Following these suggestions the valence measures in the present study ranged from -10 (extremely undesirable) to +10 (extremely desirable).

For each of the outcomes listed, the subjects were asked to indicate how desirable each of the outcomes was to them for the various courses. For example, "How desirable is getting a high letter grade in this course for you?"

Effort

Self-ratings of effort were obtained in two ways: (a) by asking the subjects to indicate on a scale of 0 (none) to 10 (total), the amount of effort they put into each course, and (b) by asking the subjects to rate on a scale of 0 (never) to 10 (all the time), the relative frequency with which they engage in 10 behaviors that are indicative of effort (e.g., complete assignments on time; have a disciplined study schedule).

IV. DATA ANALYSIS

The procedure for testing the first three hypotheses was to first calculate correlation coefficients between each of the expectancy equations and effort ratings. Secondly, a test of the significance of the difference between the r's using a log transformation to z was made (Ferguson, 1971, pp. 169-171).

More specifically, for the first hypothesis, the first step involved calculating the correlation between: (a) F_a and effort ratings for course a, (b) F_b and effort ratings for course b, (c) F_a^{**} and effort ratings for course a, and (d) F_b^{**} and effort ratings for course b. If a person was taking three courses, an additional correlation between predicted force and effort was calculated. The second step involved a test of significance of the difference between the correlations. The prediction was made that for each of the courses the equation derived from the operant literature would yield a higher correlation (i.e., $\rho F_a^{**} > \rho F_a$ and $\rho F_b^{**} > \rho F_b$).

For the second hypothesis, testing the within-person choice model against the traditional model, the correlation between (a) F_a^* and effort ratings for course a, and (b) F_b^* and effort ratings for course b was calculated. Again, if a person was taking three courses, an additional correlation between the force scores derived from the models and effort was calculated. The correlations between the force and effort components for the traditional model were the same as calculated in testing the first hypothesis. The comparison of the two models involved testing for significance of the difference between the correlations obtained under each model. The prediction was made that for each of the courses the within-person choice model would yield significantly higher correlation coefficients (i.e., $\rho F_a^* > \rho F_a$ and $\rho F_b^* > \rho F_b$).

The third hypothesis involved testing for differences between the correlation coefficients calculated by using the within-person choice model (i.e., equation #2) and the within-person effort model

(i.e., equation #3). The prediction was made that for each of the courses the within-person effort would yield significantly higher correlations (i.e., $\rho F_a^{**} > \rho F_a^{*}$ and $\rho F_b^{**} > \rho F_b^{*}$).

Finally, the fourth hypothesis was tested by calculating correlation coefficients between the force scores for each of the courses with the effort rating for the other courses. The prediction was made that there would be a significant inverse relationship between the force score for a given course and the effort the person would report for the other courses.

CHAPTER III

RESULTS

It was hypothesized that the within-person effort model (F_a^{**}) derived from operant conditioning would provide the strongest correlations between predicted and self-rated effort. The within-person choice model (F_a^{*}) derived from the expectancy theory literature was expected to provide the next best predictions of effort. And finally, it was predicted that the typical expectancy theory formula would prove to be the weakest of the three models. The fourth hypothesis predicted that for the within-person effort model an inverse relationship would be found between predicted effort for a given alternative and effort ratings for the other alternatives.

Test-retest reliabilities for the measures of the various components of the expectancy model as well as the two measures of effort are shown in Table 1. The stability coefficients for the instrumentality, valence and behavioral effort measures are based on the sum of the items composing each scale. The measure of expectancy and the second effort measure were each based on one item. Inspection of Table 1 shows that with the exception of the expectancy measure for course alternative C (which did not reach significance) and the effort scale for course C (significant at the .01 level) all the test-retest reliabilities of the expectancy variable measures were statistically significant at the .001 level. In conducting the analyses only the summed behavioral scale was used since it generally provided better correlations

Table 1

Test-Retest Reliabilities of the Expectancy Model Variables Including Two Different Types of Effort Ratings Across Three Course Alternatives

	Summated Instrumentality	Summated Valence	Expectancy Scale	Summated Effort	Effort Scale
Course A (N = 51)	.70***	.72***	.59***	.86***	.81***
Course B (N = 51)	.82***	.78***	.54***	.67***	.77***
Course C (N = 19)	.85***	.91***	.39*	.78***	.55**

* = significant at the .05 level.

** = significant at the .01 level.

*** = significant at the .001 level.

with predicted force under all three models as well as achieving a slightly higher level or reliability.

Test-retest reliabilities for the individual items comprising the instrumentality scale are shown in Table 2. The test-retest correlations for the individual items comprising the valence scale are shown in Table 3. The obtained test-retest value for the expectancy variable was based on one item and was previously shown in Table 1. Inspection of the tables shows that nearly all the items under each of the three scales reached a high level of statistical significance. The exception to this is the scale under course alternative C where the small sample size prohibits a good estimate of reliability and makes statistical significance more difficult to achieve. Of the ten outcomes, the one that proved to be the most reliable relative to the others across all scales was "High letter grade." Conversely, the outcome having the lowest relative reliability was "Learn important job skills."

Means and standard deviations obtained under the three formulations of the expectancy model across three course alternatives are shown in Table 4. Inspection of the table shows that there is a fair amount of variance about all three means. It can also be seen that the mean and standard deviation for the within-person effort model are far smaller in value. This is necessarily so since this formula is calculated as a proportion and the values generated indicate the relative proportion of force for a given alternative rather than an absolute magnitude.

Table 2

Test-Retest Reliabilities of the Individual Items Comprising the Instrumentality Scale Across Three Course Alternatives

Item	Course A (N = 51)	Course B (N = 51)	Course C (N = 19)
1. High letter grade	.76***	.76***	.81***
2. Approval from fellow students	.51***	.46***	.46*
3. Ability to apply the material learned	.58***	.64***	.32
4. Ability to explain the material to others	.36**	.68***	.64***
5. Less time for extracurricular activities	.48***	.58***	.51*
6. Learn important job skills	.28**	.61***	.83***
7. Being labeled a bookworm or a "know-it-all"	.51***	.42***	.70***
8. Feeling of accomplishment from having done well in the course	.42***	.59***	.68***
9. An increase in psychological stress (tension, headaches, and so forth)	.49***	.41**	.39
10. Developing self-discipline	.50***	.79***	.73***

* = significant at the .05 level.

** = significant at the .01 level.

*** = significant at the .001 level.

Table 3

Test-Retest Reliabilities of the Individual Items Comprising the Valence Scale Across Three Course Alternatives

Item	Course A (N = 51)	Course B (N = 51)	Course C (N = 19)
1. High letter grade	.69***	.83***	.28
2. Approval from fellow students	.68***	.61***	.33
3. Ability to apply the material learned	.55***	.59***	.64**
4. Ability to explain the material to others	.63***	.65***	.90***
5. Less time for extracurricular activities	.47***	.79***	.37
6. Learn important job skills	.33***	.80***	.34
7. Being labeled a bookworm or a "know-it-all"	.65***	.73***	.09
8. Feeling of accomplishment from having done well in the course	.63***	.66***	.57**
9. An increase in psychological stress (tension, headaches, and so forth)	.72***	.79***	.70***
10. Developing self-discipline	.79***	.68***	.16

* = significant at the .05 level.

** = significant at the .01 level.

*** = significant at the .001 level.

Table 4

Means and Standard Deviations Obtained Under the Three Expectancy Models Across Three Course Alternatives

	Traditional Expectancy Model		Within-Person Choice Model		Within-Person Effort Model	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Course A	2052.48	1401.81	937.23	3841.37	.27	.14
Course B	2486.84	1546.07	2533.54	4209.23	.34	.18
Course C	2960.38	1586.09	4185.38	4396.81	.39	.18

In order to establish whether or not the self-rated effort scale was related to ratings of time spent on various courses correlation coefficients were calculated using the data gathered from the second sample of subjects attending the second session of the summer quarter. The obtained intercorrelations between time spent working on different course alternatives and effort ratings for three course alternatives are shown in Table 5. Examination of the table shows that two of the three values on the diagonal, as well as one off the diagonal, reached statistical significance. The correlation between the summed effort scale on course C and time spent on course C although larger in magnitude did not reach statistical significance because of the smaller sample size.

Intercorrelations among the force scores computed for the three course alternatives using the traditional expectancy formula are shown in Table 6.

The first hypothesis predicted that the force scores calculated using the within-person effort model derived for operant conditioning principles would show stronger positive relationships with ratings of effort than the force scores generated by the traditional between-person expectancy formula. Table 7 presents the obtained correlations between the force scores generated by the two models and effort ratings for three course alternatives. Tests of significance for the difference in each pair of coefficients, based on a log transformation of r to z, are also shown. It may be seen that the obtained correlations for both formulas were significantly different from zero across each of the three course alternatives. However, not one of the three tests of

Table 5

Correlations Between Self-Rated Effort Behavior and Self-Reports of Time Spent Working on Courses Across Three Course Alternatives

	Time Course A	Time Course B	Time Course C
Summed Effort Course A	.38** (N = 44)	.44*** (N = 44)	.07 (N = 8)
Summed Effort Course B	.21 (N = 44)	.31** (N = 44)	.59 (N = 8)
Summed Effort Course C	.21 (N = 8)	.14 (N = 8)	.59 (N = 8)

* = significant at the .05 level.

** = significant at the .01 level.

*** = significant at the .001 level.

Table 6

Intercorrelations Among the Force Scores Computed by the Traditional Expectancy Formula Across the Three Course Alternatives

	Force for Course A	Force for Course B	Force for Course C
Force for Course A	———		
Force for Course B	.33*** (N = 186)	———	
Force for Course C	.37*** (N = 78)	.26* (N = 78)	———

* = significant at the .05 level.

** = significant at the .01 level.

*** = significant at the .001 level.

Table 7

Correlations Between the Force Scores Generated by the Traditional Expectancy Formula and the Within-Person Effort Model with Effort Ratings for Three Course Alternatives and Tests of Significance

	Predicted Force Within-Person Effort Model	Predicted Force Traditional Model	Significance of the Difference Between Correlations (Fisher $\overline{Z}$)
Summed Effort Course A	.21* (N = 78)	.27*** (N = 186)	- .44
Summed Effort Course B	.22* (N = 78	.38*** (N = 186)	-1.18
Summed Effort Course C	.31** (N = 78)	.35*** (N = 78)	- .27

* = significant at the .05 level.

** = significant at the .01 level.

*** = significant at the .001 level.

significance for the differences between the three pairs of correlations proved significant. The differences that did occur were all opposite to the predicted direction. The hypothesized superiority of the within-person effort model derived from operant conditioning over the traditional formulation of the expectancy model was therefore not supported.

The obtained correlations between predicted force and ratings of effort for the traditional expectancy formula and the within-person choice model, based on the expectancy theory literature, are shown in Table 8. It may be seen that the obtained correlations for the modified choice model were significantly different from zero for course alternatives B and C, but not for A. The predicted superiority of the modified within-person choice model was not supported in tests of the significance of the difference between the three pairs of correlation coefficients. The differences that did occur were opposite to the predicted direction.

The third hypothesis predicted that the force scores generated by the within-person effort model derived from operant conditioning would provide stronger relationships with ratings of effort than the predicted force scores calculated by using the within-person choice model. The obtained correlations between the force scores generated under each model and effort ratings across three alternative courses are shown in Table 9. Tests of significance for the difference in each pair of coefficients are also provided. With the exception of the correlation between effort ratings for alternative course A and predicted force for course A under the within-person choice model,

Table 8

Correlations Between the Force Scores Generated by the Within-Person Choice Model and the Traditional Expectancy Formula with Effort Ratings for Three Course Alternatives and Tests of Significance

	Predicted Force Within-Person Choice Model	Predicted Force Traditional Model	Significance of the Difference Between Correlations (Fischer $\bar{Z}$)
Summed Effort Course A	.16 (N = 78)	.27*** (N = 186)	- .79
Summed Effort Course B	.34*** (N = 78)	.38*** (N = 186)	- .27
Summed Effort Course C	.27** (N = 78)	.35*** (N = 186)	- .50

* = significant at the .05 level.

** = significant at the .01 level.

*** = significant at the .001 level.

Table 9

Correlations Between the Force Scores Generated by the Within-Person Effort Model and the Within-Person Choice Model with Effort Ratings for Three Course Alternatives and Tests of Significance

	Predicted Force Within-Person Effort Model	Predicted Force Within-Person Choice Model	Significance of the Difference Between Correlations (Fisher $\bar{Z}$)
Summed Effort Course A	.21*	.16	.28
Summed Effort Course B	.22*	.34***	-.77
Summed Effort Course C	.31**	.27**	.27

N = 78.

* = significant at the .05 level.

** = significant at the .01 level.

*** = significant at the .001 level.

all the obtained correlation coefficients were statistically significant. However, the predicted superiority of the within-person effort model over the within-person choice model was not supported. None of the tests of the significance of the difference between the three pairs of correlation coefficients were significant, although two of the three differences were in the predicted direction.

In order to determine how the results might look if the measuring instruments were made perfectly reliable a correction for attenuation was conducted. Table 10 shows estimated correlation coefficients for each of the three expectancy models when a correction for attenuation was performed on both the effort and expectancy measures. Inspection of the table shows that while the magnitude of the correlations increased the relative differences between the coefficients remained substantially the same and in some cases decreased. Tests for significance of the differences in the corrected coefficients were therefore not conducted.

Hypothesis four was concerned only with the within-person effort model derived from the operant conditioning literature on concurrent schedule behavior. The prediction made was that an inverse relationship should exist between effort ratings for a given alternative and the relative force for other competing alternatives. To test this prediction correlation coefficients were computed between effort ratings for each course and the predicted force scores generated for the two alternative courses. Inspection of the off diagonal values in Table 11 shows that while five of the six coefficients were in the predicted direction only one reached statistical significance, thus giving only partial support for the fourth hypothesis.

Table 10

Estimated Correlation Coefficients for the Three Expectancy Models When Corrected for Attenuation on the Effort and Expectancy Measures Across Three Course Alternatives

	Traditional Expectancy Model	Within-Person Effort Model	Within-Person Choice Model
Course A	.39	.34	.31
Course B	.50	.39	.48
Course C	.52	.54	.43

Table 11

Correlations Between Force Scores Generated by the Within-Person Effort Model Derived from Operant Conditioning and Effort Ratings for Three Course Alternatives

	Force for Course A	Force for Course B	Force For Course C
Summed Effort Course A	(.21)	- .11	- .09
Summed Effort Course B	.01	(.22)	- .24*
Summed Effort Course C	-.18	- .13	(.31)

N = 78.

* = significant at the .05 level.

It was mentioned earlier that while operant conditioning combines any number of potential variables that either singularly or in combination serve to function as a "reinforcer" expectancy theory breaks down the components of motivation into the variables of expectancy, valence and instrumentality. Though this study is not of a behavioral design, an important question with some implications for operant conditioning, is how important are the three components of the expectancy model in determining effort.

A multiple regression procedure was used to determine the usefulness of each of the expectancy model variables in terms of the amount that R^2 is increased by the addition of that variable. As can be seen in Table 12, the valence variable accounted for most of the criterion variance across all three course alternatives.

Table 12

Increase in R^2 Due to the Addition of Each Expectancy Theory Component and Total R^2 for the Three Course Alternatives

	Summed Effort Course A	Summed Effort Course B	Summed Effort Course C
Valence	.09	.20	.16
Instrumentality	.02	.01	.00
Expectancy	.00	.01	.00
Total R^2	.11	.22	.16

N = 78.

CHAPTER IV

DISCUSSION

The results from the test-retest analysis show that the various components of the expectancy model were being measured reliably. Averaged across the three course alternatives, the stability coefficients were: Instrumentality $\bar{r}_{xx}$ = .79; Valence $\bar{r}_{xx}$ = .80; and Expectancy $\bar{r}_{xx}$ = .51. The test-retest reliability for the total model--E (IV)--averaged to .65. These results are in line with previous estimates of the reliability of the theoretical components (Mitchell, 1974). The test-retest stability coefficients for the two effort scales were moderately high (Summed Effort $\bar{r}$ = .77 and Single Scale $\bar{r}$ = .71).

Stability coefficients for the individual items comprising the instrumentality, valence and expectancy scales, although statistically significant, showed substantial variability and achieved only moderately high values. Of the ten outcomes, "High letter grade" provided the highest relative reliability while "Learn important job skills" provided the lowest. This difference in reliabilities is probably a function of the amount of information the students have regarding the two outcomes. While students are likely to have a great deal of information regarding grades, they are far less likely to know about the importance of the job skills they may be acquiring.

The data collected from the second sample of subjects to establish the relationship between the self-ratings of effort and ratings of time

spent on the various courses indicates that there is a moderate positive relationship between the two measures. That some relationship exists between self-ratings of effort and time spent working is encouraging in that it gives greater legitimacy to the use of a non-behavioral dependent variable. However, it should be understood that all three models still are of a cognitive and not a behavioral nature.

Although not stated as a formal hypothesis, the suggestion was made that expectancy theory stood to make a contribution to the operant field if it could identify some of the component parts of the general term "reinforcer." Therefore, three multiple regressions were conducted to determine the usefulness of the expectancy model variables in accounting for variance in the effort ratings. As was shown in Table 7, page 50, the valence variable accounted for most of the variance in effort ratings across the three course alternatives. For this situation then, the major component that made the reinforcer "reinforcing" was the affective orientation of the subjects toward the outcomes, or, the value it holds for the subject.

The three formulations of the expectancy model examined were: (a) the traditional between-person expectancy model, (b) a modified version of the Parker and Dyer (1976) within-person choice model, and (c) the within-person effort model derived from operant conditioning. Force scores were calculated using each of the three models and then correlated with ratings of effort.

On the basis of the results from this study it is clearly evident that all three models can be useful in making predictions of effort

across a number of alternative conditions. With the exception of the predicted force on course alternative A under the modified Parker and Dyer (1976) model, the correlations between predicted force and self ratings of effort were all statistically significant using each of the models.

The first two hypotheses involved a comparison of the choice models with the traditional expectancy theory formula. The hypothesized superiority of the two choice models was not supported by the data. None of the tests of significance for the differences between correlations proved significant. Furthermore, the differences which did occur, although nonsignificant, favored the traditional expectancy formula rather than the choice models.

Hypothesis three made the prediction that the within-person effort model would prove superior to the modified Parker and Dyer (1976) model. Though two of the three comparisons were in the predicted direction, tests of the difference between the correlations proved to be nonsignificant.

The fourth hypothesis--involving only the within-person effort model--predicted an inverse relationship between effort ratings for a given course and force for other competing alternatives. This hypothesis was partially supported in that five of the six coefficients were in the predicted direction, one of which reached statistical significance.

In order to determine how the results might have looked had the measuring instruments been perfectly reliable, a correction for attenuation was conducted. As was shown in Table 10, page 55, while the

magnitude of the correlations increased, the relative difference between the coefficients remained essentially the same.

Before going on to discuss more general explanations of the obtained results some specific limitations on the data need to be noted first. Although the obtained stability coefficients were highly statistically significant, and, in line with previous research using similar measures, the values were not as high as might be desirable. This was especially true of the relatively low reliability of the expectancy scale and consequently the reduced reliability of the total model. This lowered reliability may in part also account for the generally low correlations that were obtained under all three models. Although the reliability of the measuring instrument possess some difficulty in terms of the accuracy of measurement of the motivational model it is not likely that the lower reliability would have a differential effect on the three models and thus the hypotheses in question. That the main effect of the unreliability was to produce a general depression in the obtained correlations was shown when a correction for attenuation was performed. Although the absolute values of the coefficients increased, their relative values remained essentially the same.

Another possible problem area relates only to the within-person effort model derived from operant conditioning. Even though this model was suggested as being only analogous, rather than equivalent, to the concurrent schedule paradigm the validity of the analog is still open to question. While the literature reviewed provided ample reason to

believe that a proportional formulation of the expectancy model should prove useful, the necessary connections between the concepts remain to be established. The possibility exists that although the two situations appear to be analogus in reality they are not.

However, the fact that the two choice models proved useful in predicting effort is encouraging for future research on the concept of choice as a mediator of motivated behavior in expectancy theory The question remains as to why the predicted superiority of the choice models over the traditional expectancy formula was not supported by the results of this study.

One possible explanation is that the subjects, having been exposed to each of the course alternatives, responded to the questions regarding the various course alternatives in a relative rather than absolute manner. Or, each of the traditional expectancy models was in fact a weighed composite. From this perspective, it would not be necessary to account for the effects of various alternatives by the use of a formula since this would be done internally by the subject. This of course is the tacit assumption that is always made when measures are taken for only one alternative.

Another possibility that may explain the lack of difference between the models can be seen by inspection of Table 2, page 44. It is clearly evident that the intercorrelations between the force scores, computed by the standard expectancy formula, for the three alternatives are all statistically significant. The implications of this fact become quickly evident when one considers that the calculations for the two

choice models were based on the force scores generated by the standard expectancy formula. In situations where significant intercorrelations exist between predicted force for a set of alternatives both choice models would make the same prediction as the standard expectancy formula. Or, there would be no differential shifts in the force for a given alternative as a function of the force for another alternative since both covary in the same manner. In this study it appears that effort on the various courses the students were taking did not represent competing alternatives. It should be remembered from the discussion on concurrent schedules that one of the main requirements for the procedure was that responding on the alternatives be incompatible. As such the possibility exists that even though the within-person effort model may represent an appropriate analog to the concurrent schedule procedure a fair test of the formula was not possible under the current procedure.

CHAPTER V

SUMMARY AND CONCLUSIONS

Despite the wide acceptance that expectancy theory has among industrial and organizational psychologists, research on the model has provided only marginal support for the theory. Modifications of the original Vroom (1964) model appear to be going in the direction of ever increasing complexity. Such increases in theoretical complexity, however, have not led to corresponding increases in predictive theory.

In a recent article Mitchell (1974) pointed out that the concept of choice, though ignored in research, was part of the original expectancy theory formulation. Historically, the concept of selection among alternatives has always been an integral part of the definition of motivation.

The need to investigate the expectancy model within a choice framework raises the question as to how the force scores generated for several alternatives should be combined. The purpose of this study was to examine the utility of two different formulations of choice for the prediction of effort, and compare these models to the traditional expectancy theory formula.

The within-person choice model is an extension of a model proposed by Parker and Dyer (1976). As formulated here, this model states that the force exerted on a given alternative should be equal to the original force for that alternative plus the remainder after the effects of competing alternatives have been subtracted out.

The second formulation of a choice model--the within-person effort model--represents an analog of the matching law formula found to hold for concurrent schedule behavior (Herrnstein, 1961). Under concurrent schedules subjects have the option of choosing on which of two or more alternatives they wish to work. In this situation the findings have been that the relative effort expended on a set of alternatives matches the relative frequency of reinforcement. This result is exactly what would be predicted from expectancy theory. It was suggested that an analogous equation might also prove useful for conceptualizing choice behavior in expectancy theory.

A questionnaire using ten outcomes typical for the academic setting was used in the present study. Along with this list of outcomes, the questionnaire also asked the subjects to list the courses they were currently taking. For each of the courses the subjects were asked to make the following two sets of ratings: (a) ratings of effort, and (b) ratings of valence, instrumentality and expectancy.

A total of 215 questionnaires were distributed to students attending the first session of the summer quarter. Of the 215 questionnaires, 186 were usable and a retest was conducted on 51 of these subjects so that estimates of reliability could be obtained.

It was hypothesized that the within-person effort model would prove to be the best predictor of effort. The within-person choice model was expected to follow next. And, the traditional expectancy theory formula was expected to provide the poorest predictions since it does not take into account the force for competing alternatives.

Based on the research on concurrent schedule behavior, the fourth hypothesis predicted that an inverse relationship would be found between predicted force for a given alternative and effort ratings for other competing alternatives.

The principal findings can be summarized as follows:

1. All three formulations of the expectancy model provided significant correlations with ratings of effort.

2. The predicted superiority of the two choice models over the standard expectancy formula was not supported by the data.

3. There was some indication that the within-person effort model was a better predictor of effort than the within-person choice model.

4. The prediction that an inverse relationship should exist between predicted force for an alternative and effort on competing alternatives received some support.

In discussing the results, it was suggested that the lack of support for the superiority of the choice models may be attributable to the non-independence of the alternatives studied. Significant inter-correlations existed between the force scores computed for the various alternatives. In the situation where the alternatives open to a person are not incompatible, the choice models would be expected to make the same predictions regarding effort as does the standard expectancy formula.

I. SUGGESTIONS FOR FUTURE RESEARCH

In considering future directions for research the next logical step is to conduct a more carefully controlled laboratory study. Such a study could take the form of the typical concurrent schedules procedure. In this case the independence of the alternatives would be assured. Such a study would also offer numerous advantages since measures of expectancy theory variables could be validated against programmed consequences.

A second possibility would be to find a field situation where the alternative behaviors, and their associated outcomes, are likely to be incompatible. The job of a first line supervisor may represent such a condition.

Still a third research question that will need to be addressed is, how many alternatives need to be taken into account, or have an impact, on the predicted force for a given alternative.

A fourth area that needs to be addressed is how the reliability of the measuring instrument could be improved. One possibility, as suggested by this study, is to include more short term outcomes on which the subject has more information and thus might make better judgments.

A fifth area for research would be to conduct a longitudinal study in order to determine whether the three models differ in their ability to predict effort among alternatives. Such a procedure might involve asking the subjects to keep a diary of their activities during different times of the day.

A sixth research possibility would be to set up a simulated work situation involving two or more tasks that are incompatible, but among which the subject could alternate. Such a design would make it possible to get more direct measures of effort and time spent on various activities as the associated expectancy, instrumentality and valence for performing the tasks are systematically varied.

In conclusion, the potential utility of two different methods for combining the expectancy theory variables in making predictions of effort for a set of alternatives has been indicated. Such models of choice behavior would stand to make the greatest contribution in circumstances involving alternatives that are to some extent incompatible.

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APPENDICES

APPENDIX A

GENERAL INSTRUCTIONS

You will be asked to express your perception of the courses you are currently taking. The questionnaire is not intended as an evaluation nor as a test and therefore there are no "right" or "wrong" answers. In answering the questions it is important that you be as honest as possible. Once you are sure of what the question is asking, your first impression will usually be the best answer. Thank you for your time.

Two basic steps are involved in completing the questionnaire. First, list all the courses you are taking at this time. Second, complete one questionnaire for each course you are taking. For example, if you list two courses: (1) management 3010; (2) psychology 2110, you would complete one questionnaire for the management course and another questionnaire for the psychology course. The questionnaires will be the same, but the courses you are answering about will be different.

What at the titles of the courses you are now taking?

1. _____

2. _____

3. _____

4. _____

Please answer the following questions about the first course you have listed. After you have finished with the first course, complete a questionnaire for the second course you listed. Continue doing this until you have completed one questionnaire for each course you have listed.

Instructions: Below are listed a number of possible outcomes which could result from your mastering the material for this course. Circle the number that represents how likely each of the following outcomes would be if you master the material for this course.

OUTCOMES	Mastery of material would make this impossible							Unrelated to mastery of material							Mastery of material would make this certain						
High letter grade:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Approval from fellow students:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Ability to apply the material learned:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Ability to explain the material to others:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Less time for extracurricular activities:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Learn important job skills:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Being labeled a bookworm or a "know-it-all":	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Feeling of accomplishment from having done well in the course:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
An increase in psychological stress (tension, headaches, etc.):	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Developing self-discipline:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10

Instructions: Please indicate how desirable each of these outcomes is to you personally in this course.

	Extremely undesirable										Neutral										Extremely desirable
High letter grade:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Approval from fellow students:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Ability to apply the material learned:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Ability to explain the material to others:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Less time for extracurricular activities:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Learn important job skills:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Being labeled a bookworm or a "know-it-all":	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Feeling of accomplishment from having done well in the course:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
An increase in psychological stress (tension, headaches, etc.):	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Developing self-discipline:	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10

Instructions: Please indicate the relative frequency with which you have engaged in the following activities in this course.

	Never					Half the time					Always
Completed asignments on time:	0	1	2	3	4	5	6	7	8	9	10
Participated in class when given the opportunity:	0	1	2	3	4	5	6	7	8	9	10
Had a disciplined study schedule:	0	1	2	3	4	5	6	7	8	9	10
Listened attentively in class:	0	1	2	3	4	5	6	7	8	9	10
Asked questions about things you did not understand:	0	1	2	3	4	5	6	7	8	9	10
Did extra work beyond what was requested:	0	1	2	3	4	5	6	7	8	9	10
Well prepared for class:	0	1	2	3	4	5	6	7	8	9	10
Read ahead on course assignments:	0	1	2	3	4	5	6	7	8	9	10
Looked up outside material relevant to the course:	0	1	2	3	4	5	6	7	8	9	10
Took notes on instructor's comments:	0	1	2	3	4	5	6	7	8	9	10
On the whole, about how much effort would you say you put into this course:	0 None	1	2	3	4	5	6	7	8	9	10 Total
Estimate the probability that if you worked hard you could master the material for this course:	0 No chance	1	2	3	4	5	6	7	8	9	10 Certainty

Instructions: Please indicate how much time you spent working on each of the courses you are now taking outside of attending classes.

	Wed.	Thurs.	Fri.	Sat.	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.
Course 1.										
Course 2.										
Course 3.										
Job										
Recreation										

Was there an exam during this period? If so, when was the exam? _____

When is the next exam? _____

VITA

Branislav Konstantinovich was born in Novo Milosevo, Jugoslavia. He received a Bachelor of Arts degree in Psychology from Queens College, City University of New York. His master's work in experimental psychology was done at C. W. Post College, Long Island University. He received his Doctorate of Philosophy majoring in Organizational Psychology from the University of Tennessee, Knoxville. He is currently employed as a research psychologist for the United States Air Force, Wright Patterson Air Force Base, Dayton, Ohio .