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The Ohio State University, Ph.D., 1976
Psychology, industrial

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AN EXPERIMENTAL ANALYSIS OF THE DIFFERING PREDICTIONS
OF INDIVIDUAL WORK BEHAVIOR FROM OPERANT
AND EXPECTANCY MODELS

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the
Degree of Doctor of Philosophy in the Graduate
School of The Ohio State University

by

Thomas C. Mawhinney, B.A., M.S.

* * * * * * *

The Ohio State University
1976

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Science
ACKNOWLEDGMENTS

A number of individuals have contributed to this research effort either directly or indirectly at one point or another in my academic career. The most direct contribution to this work came from Professor Orlando Behling who suggested some time ago that I attempt to juxtapose cognitive and acognitive models of man to see if there existed any significant differences between them in terms of behavior predictions. He has been my conscience on the issue ever since. Professor James P. McNaul then required a research proposal as part of the requirements for a course I took with him in research design. His critical comments on the question of significance of changes in behavior sharpened the criteria used in this work for change determination and indirectly lead to my interest in statistical methods for single subject research. Professors Randy Bobbitt and Steve Kerr read the several drafts of the dissertation and provided valued comments. In addition Steve helped to point up several aspects of the task design which could be and were troublesome. The Bureau of Business Research provided funding without which the research could never have been accomplished. Randall Stotts assisted as the second experimenter and contributed effort in greater supply than would be expected for the nominal remuneration he received.

Others have contributed to this work less directly including my wife Renee, my cousin Professor V. Thomas Mawhinney, and Professor Darrel Bostow who are jointly and severally responsible for my current
behavioristic philosophy of science. Professors Alton C. Bartlett and Dorothy Harlow both provided the support and encouragement during my masters work to continue on in my academic pursuits beyond the masters level. And last, but by no means least, I have benefited to a degree beyond measure from the interactions I have had with my fellow students in the doctoral program at Ohio State: Jeff Ford, Jean Bish, Vijay Sathe, Chet and Jan Schriesheim, and Jim Tolliver.
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INTRODUCTION

Numerous psychological theories have been used to explain individual work motivation and behavior in work environments. Mitchell's (1974) recent review of the literature on Vroom's (1964) expectancy theory and subsequent extensions and refinements of the theory (Behling, Schriesheim, & Tolliver, 1974; House, Shapiro, & Wahba, 1974) suggest that it is the dominant contender for the attention of industrial/organizational psychologists at this point in time. At the same time, reviews of the growing body of literature based upon Skinner's (1938, 1953, 1957, 1969, 1974) operant conditioning paradigm (Mawhinney, 1975; Schneier, 1974) suggest that expectancy theory will have substantial competition from this paradigm.

As Mawhinney and Behling (1973) have observed, the operant paradigm and expectancy theory represent "Two diametrically opposed views of man—one expectancy theory picturing him as an autonomous being directing his life through conscious choices; the other as an entity responding to contingencies in his environment in ways readily explicable without reference to 'thinking' or 'choice'..." (p. 383). While the issue of cognitive versus acognitive accounts of human behavior is a recent phenomenon in the literature of organizational behavior (Behling et al., 1974; Berger, Cummings, & Heneman, 1975; Mawhinney & Behling, 1973; Yukl, Wexley, & Seymore, 1972), it has been debated among psychologists for many years according to Wertheimer (1972)
(Cf Watson & MacDougall, 1929). Hitt (1969) has identified ten issues which discriminate between respectively contemporary behavioristic psychologies like that of B. F. Skinner and phenomenological psychologies like that of Carl Rogers. The ten issues are in essence the major presuppositions held by the opposing forces of phenomenology and behaviorism. The presuppositions in tabular form (based on Hitt, 1969) are:

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<th>Behavioristic Presuppositions</th>
<th>Phenomenological Presuppositions</th>
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<tr>
<td>1. Man can be described meaningfully in terms of his behavior;</td>
<td>or man can be described meaningfully in terms of his consciousness.</td>
</tr>
<tr>
<td>2. Man is predictable;</td>
<td>or man is unpredictable.</td>
</tr>
<tr>
<td>3. Man is an information transmitter;</td>
<td>or man is an information generator.</td>
</tr>
<tr>
<td>4. Man lives in an objective world;</td>
<td>or man lives in a subjective world.</td>
</tr>
<tr>
<td>5. Man is a rational being;</td>
<td>or man is an arational being.</td>
</tr>
<tr>
<td>6. One man is like other men;</td>
<td>or each man is unique.</td>
</tr>
<tr>
<td>7. Man can be described meaningfully in absolute terms;</td>
<td>or man can be described meaningfully in relative terms.</td>
</tr>
<tr>
<td>8. Human characteristics can be investigated independently of one another;</td>
<td>or man must be studied as a whole.</td>
</tr>
<tr>
<td>9. Man is a reality;</td>
<td>or man is a potentiality.</td>
</tr>
<tr>
<td>10. Man is knowable in scientific terms;</td>
<td>or man is more than we can ever know about him (p.652).</td>
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Each set of ten presuppositions provides the foundations for a model of man. In reality, of course, we don't find many psychologies or psychologists representing either of the pure types; most psychologists
agree that the environment to which a person is exposed has some degree of influence on the person's behavior, behaviorists more so than phenomenologists. Hitt's (1969) brief review of the evidence for the two models does not show one or the other to be superior; there is evidence to support both models. But one very important conclusion was indicated based on the evidence reviewed by Hitt (1969):

1. The acceptance of either the behavioristic model or a phenomenological model has important implications in the everyday world. The choice of one versus the other could greatly influence human activities (either behavior or awareness) in such areas as education, psychiatry, theology, advertising, and even parenthood. Thus this ongoing debate is not just an academic exercise (p. 657).

Phenomenologists tend to look inside man for the determinants of his behavior while the behaviorists tend to look outside to his environment for the determinants of man's behavior. Cognitive accounts of behavior are located inside the person and behavioral accounts are located outside the person for the same reason. And Hitt's (1969) conclusion regarding the significance of taking either approach to the exclusion of the other is verified by recent developments in the areas of clinical psychology, pedagogy, and penology. In presenting the issues in these areas the term cognitive expectancy is used to refer to inside accounts of behavior and treatments aimed at changing the inside workings (cognitions) of a person while the term acognitive operant is used to refer to outside accounts of behavior and treatments which are aimed at changing behavior directly (i.e., without reference to any cognitive activities inside the person) by changing the environment in which the behavior occurs.
Traditional cognitive expectancy approaches to psychotherapy are based on an "assortment of hypothesized psychic forces inside the individual, including drives, needs, motives, and personality traits." (p. 2) according to Kazdin (1975) and may be contrasted with the acognitive operant approach which "departs from the traditional conception of behavior by rejecting inferred motives, hypothesized needs, impulses, and drives which supposedly explain behavior" (p. 11). Treatments according to the cognitive expectancy approach, must focus on the hypothetical internal states of the individual's psyche since abnormal behavior is considered a mere symptom of a disease or dysfunction of some internal process or psychic force. Abnormal behavior, classified in various ways, is the behavior targeted for treatment by these psychologists and psychiatrists. Treatment of behavior per se is contraindicated since, as a mere symptom of an internal disorder, it will be replaced by some other symptomatic behavior unless the underlying psychic "cause" is diagnosed and treated. Failure to get at the underlying internal disorder responsible for the abnormal behavior will, in other words, result in symptom substitution (i.e., some other aberrant behavior results from treatment of a behavioral symptom if its internal cause is not also treated). The acognitive operant behaviorists' treatments (termed behavior modification) are based upon the assumption that most behavior is a function of classical conditioning, operant conditioning, and the observation of behavior exhibited by other people (or observational learning).
Since behavior is believed to be instigated and maintained by events in the individual's past and current environments, diagnosis is aimed at determining what aspects of a given environment or history in a given environment produced and maintains an undesired behavior. Contradictory hypotheses regarding the treatment of problem behaviors thus emerge from treating behavior per se and symptom substitution (with the possibility of even worse substitute symptoms) is considered a probable consequence of such treatments. The acognitive operant approach, on the other hand, holds that desired behaviors may be established and undesired ones eliminated by manipulating environmental variables which control behavior. Current evidence on the relative effectiveness of the two approaches favors the operant approach (Bandura, 1969; Kazdin, 1975). The symptom substitution hypothesis is not only unsupported by recent evidence, to the contrary, modification of a single problem behavior has been observed to produce positive changes in similar problem behaviors (see Kazdin, 1975, pp. 19-20 for details). Thus whether one focuses on internal expectancies and other cognitive processes in the treatment of problem behaviors or on the behavior per se and its environmental determinants makes a significant difference in both the selection of treatment strategies and results.

**Issues in Pedagogy**

Differing hypotheses regarding the role of the teacher in the learning process follow from cognitive expectancy (Piaget, 1970) versus acognitive operant (Skinner, 1968) theories of learning and development. Piaget (as reviewed by Hilgard and Bower, 1975)
hypothesizes cognitive structures or stages of intellectual growth which must occur as a specific sequence of insights on the part of the learner or student. Skinner (1968), on the other hand, views such insights as a function of interaction of subject and environment; thus specific rates of development can be hastened by particular environmental arrangements. Clearly, these two differing hypotheses regarding the determinants of rate of learning or intellectual growth indicate different roles for the teacher. Piaget's hypothesis as applied to teaching may be seen in what is termed discovery learning: "the subject finds out something for himself, especially some generalization or principle, without its having been explained initially to him by someone else" (Hilgard & Bower, 1975, p. 345). The teacher's role is to provide an environment rich in objects etc. which allow the child to make such discoveries. Even then the specific sequence of discoveries must occur before one is fully matured in terms of intellect. If correct, Piaget's theory leaves little room for the teacher to teach, given Skinner's (1968) definition of teaching:

> teaching is simply the arrangement of the contingencies of reinforcement. Left to himself in a given environment a student will learn, but he will not necessarily have been taught. The school of experience is no school at all, not because no one learns in it, but because no one teaches. Teaching is the expediting of learning; a person who is taught learns more quickly than one who is not. Teaching is most important, of course, when the behavior would not otherwise arise. (Everything which is now taught must have been learned at least once by someone who was not taught, but thanks to education we no longer need to wait for these rare events.) (p. 5).

According to Skinner (1968), the discoveries of the type referred to by Piaget can be hastened by reinforcement procedures.
While there is support for each of these competing hypotheses (Hilgard & Bower, 1975), Cronback (1966) provides several arguments against reliance on discovery learning alone: "(a) that one of the roles of education is the transmission of culture, and this cannot be wholly a matter of free discovery, and (b) that maybe a little discovery goes a long way, and would be inefficient if it had to carry all of the burden" (in Hilgard & Bower, 1975, p. 345). Except in terms of efficiency of resource utilization and rate of learning, the differing hypotheses do no lead to grossly different prescriptions for education in general but a significant difference in the role of the teacher is clearly indicated by the two approaches. Skinner's (1968) suggestions have been given a good deal more attention than have Piaget's, though this may be changing according to Hilgard and Bower (1975). And most of the prescriptions suggested by Skinner (1968) have been implemented and found to be sound (Johnston & Pennypacker, 1971; Journal of Applied Behavior Analysis, 1968 to present) while Piaget's ideas have yet to be fully evaluated in practical settings. But significant differences in the prescriptions for teachers activities vis-a-vis the student are indicated depending upon whether one chooses to follow the cognitive or acognitive model of man (or child in this case).

Issues in Penology

The traditional conception of the determinants of criminal behavior clearly place them within the individual wrongdoer. A person committed criminal acts because of evil thoughts and expectations that
evil deeds would lead to desired outcomes. The cure for such behavior was restoration of "right mindedness." Thus prison was a place of confinement where an individual who had broken the law was to do penance, to reflect on his/her errors to prepare to return to work upon release, i.e., to develop the correct set of expectations about what one ought to do upon release (Killinger & Cromwell, 1973). A form of behaviorism termed "corrections" or "rehabilitation" has influenced penologists since about 1925 according to Killinger and Cromwell (1973). The criminal's behavior is hypothesized to be learned via the three forms of conditioning (classical, operant, and imitation) referred to in reference to clinical psychology (Burgess & Akers, 1969). If criminal behavior is considered a form of behavior learned in a given environment, then long periods of penance and reflection in a prison are not likely to be effective modes of treatment for the criminal. Treatments must address both the criminal and the environment which produced his/her behavior. But sentencing agents continue to administer prison sentences based upon the hypothesis that even though a term in prison may not alter criminal's behavior directly, it alters the expectations that potential criminals hold regarding the chances (risks) of capture and sentence to prison. The sentences they mete out then, according to this cognitive expectancy hypothesis, tend to alter the expected gains and costs to the criminal for engaging in unlawful behaviors. The role of the prison sentence is to reduce the ratio of expected benefits to costs of criminal behavior even if the criminal tendencies for any given offender remain unchanged by the actual experience of imprisonment (Orland & Tyler, 1974). For the expectancy strategy to be effective,
however, the criminal must match his expectations of the probabilities of capture and sentence with the objective probabilities of these events. And as many sentencing agents agree, the probabilities may be in the favor of the criminal (Orland & Tyler, 1974). The treatments suggested by the acognitive operant approach, on the other hand, are aimed at changing the behavior of the criminal by operating on his behavior in the environment in which it was learned and thus take the criminal out of the normal environments for as little time as possible (Serri & Selo, 1974). Thus expectancy adherents advocate the use of prison terms to change cognitive evaluations of the benefits of crime on the part of would be criminals while the operant adherents advocate the use of community based treatment programs where criminals can learn to adapt to the standards of acceptable behavior held by the local society (Killinger & Cromwell, 1973). Once again, differing prescriptions regarding the solution of a behavioral problem result from the cognitive expectancy and acognitive operant approaches to the analysis and treatment of human behavior problems.

Issues in Industrial/Organizational Psychology

The position one takes regarding the two models of man in general (Hitt, 1969) and the position one takes regarding the cognitive expectancy versus acognitive operant issue in particular has significant bearing on the prescriptions and proscriptions one accepts with respect to problems of mental health, education, and crime control, as the above review indicates. Significantly different approaches to the management of human behavior in work organizations result from differing positions
taken on the cognitive-acognitive issues beginning to emerge in industrial/organizational psychology (Cummings et al., 1975).

Traditionally theories of work motivation have been implicitly or explicitly cognitive (Vroom & Deci, 1972). Though Opsahl and Dunnette's 1966 review of theories relating pay, work effort, and performance included Skinner's (1953) acognitive view of money as a conditioned generalized reinforcer, Skinner's theory was given little attention by industrial/organizational psychologists until Nord (1969) suggested that prescriptions and proscriptions for managers' behavior vis-a-vis subordinates could be derived from the theories of Maslow (1965), McGregor (1966), and Skinner (1953). But interest in the Maslow-McGregor type theories among industrial/organizational psychologists was already waning at the time of Nord's (1969) writing and Herzberg's (1966) two factor theory was also being questioned (Opsahl & Dunnette, 1966). At the same time Vroom's (1964) cognitive expectancy theory of work motivation, based in large part on Tolman's (1959) theory, was receiving increased attention from researchers in the industrial/organizational psychology tradition (Heneman & Schwab, 1972; Mitchell & Biglan, 1971). Unlike the comparison between the Maslow-McGregor type theories and Skinner's theory, at least one differing prediction was derived from a comparison of Vroom (1964) and Skinner (1953) conducted by Yukl, Wexley, and Seymour (1972). Mawhinney and Behling (1973) subsequently detailed the requirements for comparing the cognitive theory and the acognitive paradigm (operant conditioning is currently considered more a technology than a theory, i.e., it is a collection of laws and principles and not a set of hypotheses). They identified a number of areas where differences
in predictions might be expected. Additionally, the papers comprising a recent seminar at the 34th annual Academy of Management meetings (Cummings et al., 1975) contain all of the elements of a classic paradigm conflict as defined by Kuhn (1970).

Paradigm conflicts, according to Kuhn (1970), are not always settled by recourse to experimental data since each group takes a side on the issue and argues from differing premises like those presented by Hitt (1969). Thus such a conflict cannot be resolved to the satisfaction of all parties no matter how good the data generated by advocates of either position. At the same time it remains important to determine which account is correct if it makes a practical difference in the conduct of our everyday activities. The significance of theoretical differences is therefore to be found in the impact such differences may have for the conduct of practical affairs. And where there are significantly different prescriptions and proscriptions which may be derived from competing theories the question regarding which theory is correct must be answered at both the theoretical and practical levels of analysis.

While some industrial/organizational psychologists are still agnostic (Behling, 1975; Berger et al., 1975) others have not hesitated to endorse the cognitive expectancy theory (Lawler, 1971, 1973) or the acognitive operant paradigm (Luthans & Kreitner, 1975) as guides to the practice of management. Yet neither the theory nor the paradigm are extensively supported by evidence with human subjects (Mawhinney, 1975; Mitchell, 1974; Schneier, 1974). Thus it is imperative to clarify the issues which separate the two paradigms and to determine their adequacy for providing valuable and accurate directions for those charged with
management of the behavior of individuals in organizations.

**Purpose of the Research**

The purpose of this research is to test the practical and theoretical significance of differing predictions of work behavior from the cognitive expectancy theory and the acognitive operant paradigm of individual human behavior. The major evidence extant on the issue of differing predictions was performed with animal subjects (Ferster & Skinner, 1957; Hendry & Dillow, 1966; Nevin, Cummings, & Berryman, 1963), institutionalized human subjects (Bijou & Orlando, 1961; Orlando & Bijou, 1960), and noninstitutionalized preschool children as subjects (Staats, Finley, Minke, & Wolf, 1964). The two attempts to investigate the differing predictions with adult human subjects under controlled laboratory conditions in simulated work settings have significant methodological limitations which make it impossible to draw unambiguous conclusions about the relative superiority of either the cognitive expectancy theory or the acognitive operant paradigm at either the theoretical or practical levels of analysis (Mawhinney, 1975).

In the following chapters the nature of the cognitive expectancy theory and acognitive operant paradigm are reviewed in terms of their historical origins in Psychology proper, translations into Industrial/Organizational Psychology, differences between the two approaches, and major evidence in support of each position or theory. After reviewing the problems associated with previous attempts to test the differing predictions, the requirements for properly
drawing hypotheses and testing them are enumerated. Finally the methods used and the results of what is believed to be a rather rigorous test of the practical and theoretical significance of differing predictions are presented.
CHAPTER I
THEORETICAL ISSUES: POSITIONS AND EVIDENCE

Introduction

The terms, concepts, and methods which characterize theoretical and experimental paradigms in Psychology are frequently adopted, in whole or in part, by industrial/organizational psychologists in the development and tests of motivation theories of work behavior. The theories of McGregor (1965) and Herzberg (1966), for example, clearly derive much from Maslow's (1965) theory of needs. Using a similar, but more eclectic tactic, Vroom's (1964) cognitive theory of the work-effort decision reflects elements of pure cognitive psychological theory (Lewin, 1935, 1938), cognitive learning theory (Tolman, 1932, 1959), attitude theory (Peak, 1955), and decision theory (Davidson, Suppes, & Siegel, 1957; Edwards, 1954; Luce, 1962). Skinner's (1969) acognitive operant paradigm, on the other hand, a predominantly data based description of the connection between behavior per se and its environmental determinants, has been adopted relatively intact by individuals concerned with the practical problems of managing behavior in organizations (Brethower, 1972; Luthans & Kreitner, 1975). To fully appreciate the issue of differing predictions between the two approaches in the literature of industrial/organizational psychology then requires an understanding of the differences in Psychology proper and the nature of the evidence supporting each position.
The Cognitive Position

Cognitive theorists presuppose that in order to fully account for the behavior of either infrahuman or human subjects a minimum of three classes of variables must be considered: 1) environmental stimuli (either past, present, or future), 2) the responses of subjects to such stimuli, and 3) the cognitive process or processes which relate 1 and 2 in some lawful way.

Cognitive Positions in Psychology Proper

Since our focus is on Vroom's (1964) cognitive theory of work motivation and its subsequent extensions and refinements, concern here is with the basic psychological literature which appears to have influenced his work. Though Vroom's (1964) introduction of the cognitive expectancy model of work motivation includes a large number of references to psychological literature, the work of Lewin (1935, 1938), Tolman (1932, 1959), Peak (1955), and various decision theorists (Davidson, Suppes, & Siegel, 1957; Edwards, 1954; Luce, 1962) appear to be fundamental sources. Therefore we review the positions of these theorists before considering Vroom's (1964) adaptations of their work to industrial psychology.

Lewin (1931) on Psychological Laws

Lewin (1931) observed that Aristotelian and Galilean modes
of thought differ in terms of temporal and relational loci of explanations of phenomena. He contended that Aristotelian modes of conceptualization and notions of time order of causation led scientists to focus upon the characteristics of objects as opposed to relationships among objects (e.g., to focus on personal attributes of people rather than their environments) and to search for historic as opposed to contemporaneous laws to relate independent and dependent variables. Lewin contended that the major advances in the physical sciences were the result of the adoption of the Galilean modes of thought for the description of physical phenomena. He reasoned that the successes of the physical sciences might be replicated by behavioral sciences if a similar approach were taken. Not surprisingly then, Lewin (1935) was one of the few psychologists to devise a system for the ahistoric explanation of human behavior.

Lewin's Cognitive-Ahistoric Theory of Individual Human Behavior

Lewin's work is summarized well in two places: 1) in Psychology: A Study of A Science by Cartwright (1959) and 2) in The Handbook of Social Psychology by Duetsch (1968). The review which follows relies heavily upon the chapter by Duetsch (1968) in the handbook.

Lewin's approach to the explanation of individual behavior was psychological, i.e., the "approach assumes that it is scientifically respectable to describe the phenomena in which psychologists are interested in terms not reducible or equivalent to the terms of physics or
physiology" (Deutsch, 1968, p. 415). Thus many hypothetical-constructs as defined by MacCorquodale and Meehl (1948) comprise Lewin's system. The fundamental assumption made by Lewin was that the psychology of individual behavior must focus upon "the individual's behavioral transactions with his internal and external environments" (Deutsch, 1968, p. 415).

According to Lewin, the Aristotelian mode of conceptualization had led psychologists to search for historical explanations of behavior and explanations of behavior in terms of attributes of the individual, e.g., instincts, heredity, and needs, which fail to relate the individual to his current situation. An adequate account of individual human behavior would require both knowledge of the person (his past experiences, his present attitudes, and his capabilities) and a knowledge of his immediate situation. In order for some factor to influence behavior in the "here and now," that factor must operate on the person in the "here and now" or in the current situation. Thus a person's past experience influences behavior in the present only if carried forward in time as an enduring quality of the person's psychological structures. Which is to say that current behavior is a function of the current situation and the person's psychological make-up.

Lewin's concepts have been described as constructive as opposed to classificatory or relations oriented as opposed to content oriented, which is as he had intended (Cartwright, 1959; Deutsch, 1968). He also emphasized the dynamic interrelatedness of man as a psychological system as opposed to a collection of mechanisms. According to Lewin, one must focus on more than a simple stimulus and response connection,
for a given stimulus or response may have broad repercussions for the total psychological system. This view of humans as interrelated wholes rather than collections of psychological mechanisms reflects his bias for the Gestalt perspectives elaborated by Hitt (1969) and Wertheimer (1972).

Lewin's theory or system of terms is expressed in the following equation:

\[ B = f(LS) = f(P,E) \]

where:

- **Behavior** \((B)\) refers to any change in the life space \((LS)\) subject to description via psychological laws.
- **Life Space** \((LS)\) is the fundamental concept which refers to the manifold of coexisting facts which determine the behavior of an individual at a given moment.
- **Person** \((P)\), though used in several ways by Lewin, is a term which refers to the person's needs, beliefs, perceptions and motoric system.
- **Environment** \((E)\) refers to both the objective and psychological environment (which is the environment as perceived by the person).

The life space is dimensionalized as time (past, present, future), and **reality-irreality**, which refers to the extent to which a person's perceptions of an environment may correspond to a given set of objective facts. Or the person may explore a situation by fantasy; locomotion in such an environment (clearly psychological) is supposed to be much easier because it is detached from reality.
The structural concepts in Lewin's theory are topological and refer to the qualitative relationships of connections and relative positions of regions in the psychological environment. *Region* is a distinguishable part of the life space or person and areas of the psychological environment. Various activities are located in various regions so that a person has at any given time a position (i.e., is located at some point in the physical or primarily the psychological life space or environment). And any change in position in the life space is termed locomotion. Regions have boundaries so that locomotion involves moving across these boundaries to another region; such movement occurs over a path. "The distinguished path between any two regions is the path along which the individual expects that he will locomote if he chooses to proceed from one region to another" (Deutsch, 1968, p. 429) or the psychologically best path. *Cognitive structure* refers to the sequence of steps required to move from one region to another or the means-end sequence required to obtain the goal of locomotion. Such structures are not likely to be present when an individual faces a totally novel situation. Because development of such structures results from experience in a given situation, more parsimonious behavior is predicted to occur with increased exposure of the individual to the situation. Locomotion between two regions, say A and B or among various regions may be any of four types:

1. **Direction toward**: any locomotion from one region to another which increases the force toward or decreases the distance from the terminal focus of locomotion, or goal region.
2. Direction away: any locomotion from one region to another which decreases the force toward or increases the distance from the terminal focus of locomotion

3. Opposite direction: Two paths have opposite directions if the distinguished path for locomotion toward one goal region corresponds with the most unfavorable path for locomotion toward the other goal region.

4. Direction at "right angles": A path is at right angles to another if locomotion along it does not change the strength of force toward the terminal focus of the other path, or if locomotion along it does not change the distance to the terminal focus of the other path. (Adapted from Leeper's (1943) modifications of Lewin and reported in Deutsch, 1968, p. 430).

The term overlapping path situations has been utilized to characterize situations in which a person can be on more than one path at the same time. The following five aspects of overlapping situations, outlined by Barker, Wright, and Gonick (1946) were presented by Deutsch (1968):

1. Consonance: The extent to which the overlapping situations require activity that is more or less congruent is called their consonance. Overlapping situations can vary from situations leading to identical behaviors, in which paths have the same direction, to situations requiring completely antagonistic behavior, in which paths have opposite directions.

2. Potency: The influence of one situation relative to all simultaneously acting situations is called the relative potency of the situation. A person in the overlapping situations of "reading the paper" and "conversing with wife," in which the latter situation is of relatively higher potency, will predominantly converse with his wife, with perhaps an occasional glance at the headlines or a slight feeling of annoyance.
3. Valence: This characteristic is an index of the relative desirability of overlapping situations.

4. Barriers: The nature of the perceived barriers or obstacles in each of the overlapping situations is an important characteristic.

5. Extent of common parts: This characteristic refers to the extent of the parts common to the overlapping regions.

Lewin's dynamic concepts are basically motivational. Three concepts, tension, valence, and force are important aspects of the dynamics of psychological environments. Tension is the basic element of activation in Lewin's scheme. It sets up the occasion for behavior that will reduce or eliminate it. The construct force refers to the direction and tendency to change in a given life space. A combination of such forces at a point in time is termed resultant force. Valence refers to the degree of attractiveness or repulsiveness of a given region. These concepts were incorporated directly in Vroom's (1964) theory of work motivation as may be noted in subsequent discussions of that theory.

Tolman's (1959) Principles of Purposive Behavior

While Lewin's system was designed for and applied specifically to humans, Tolman (1932) worked primarily with animal subjects. He contended, however, that both infrahuman and human subjects respond to cognitive representations of their environments. For that reason, he considered the study of intervening cognitive processes appropriate for animal as well as human psychologists. He was concerned with the source of cognitions and placed them temporally in the history of the organism-environment interaction. While he considered the environment
at the moment of a given response the cause of the response, the type and direction of a response was considered a product of cognitions which were developed by prior interaction with the environment. For that reason one would be required to either control or determine subject history to predict future behavior in a given situation.

Though he allocated his variables among three categories of causal order: 1) independent (environmental stimuli), 2) intervening (cognitive means-end readiness and cognitive expectancies, perceptions, and valences), and 3) dependent responses (at the molar level, like maze running), Tolman (1959) characterized his cognitive variables as hypothetical-constructs as defined MacCorquodale and Meehl (1948). Independent variables include those termed past and present. Past independent variables are the experiences of a subject with respect, for example, to running a given maze a certain number of times under a certain condition of deprivation and receiving or not receiving the element (food, water, etc.) of deprivation upon completion of the running response. These past experiences are hypothesized to affect directly the intervening variable "means-end readiness" of the subject; with means-end readiness considered an "acquired cognitive disposition resulting directly from preceding trials or from other, related, previous training" (Tolman, 1959, p. 105). There are two present independent variables in the system,"$S^*_{1}$ and $D_{H1}$. They are to be conceived as the characters and magnitudes of the alley stimulus $S_{1}$ and the drive-stimulation $D_{H1}$ which is similar to level of deprivation in most paradigms specifically present on a given trial" (Tolman, 1959, p. 107). The intervening variables "perception," "expectancies," "representations," and
"valences" are all functions of all of the preceding variables (i.e., past present independent and intervening means-end readiness).

Perception refers to the discrimination of $S_1^*$ and $D_{H1}^*$. Expectancies refer to the "represented" consequences of going down the alley and not going down the alley, i.e., an action-outcome expectation. Representations refer to the cognitive counterparts of actual environmental stimuli both current and expected. The hungry organism will, for example, experience a representation of the stimuli which will satisfy hunger, such stimuli will become positively valenced for the organism and it will then have representations of the actions which will lead to the achievement of a hunger satisfying outcome or stimulus. Thus valence in Tolman's (1959) scheme refers to the anticipated value of a given stimulus rather than its objective value since the valence of the outcome is based on its cognitive representation rather than its actual value once received.

A necessary condition for motivation according to Tolman (1959) is that the subject be energized which is to say that some $D_1$ or drive-stimulation exists for the subject. Prediction of a given instance of approach, escape, or avoidance responses and magnitudes, however, requires some summary relationship among the variables of the system. The relationship hypothesized by Tolman (1959) follows:

$$P_v = f_x(D_1, \text{Exp}_{s2}, V_{s2}) - f_y(D_w, \text{Exp}_w, V_w)$$

where:

- $P_v$ = performance vector which indicates both direction and magnitude of a performance,
- $D_1$ = the magnitude of the initiating drive-stimulation,
Exp_{s2} = the symbol for the expectancy that in the presence of S_1 (a particular alley) R_1 (a response of traversing S_1) will be followed by S_2 (a goal object like food, water, etc.) which is valenced, V_2 = a symbol used to represent the strength of the valence (positive or negative, primary or conditioned).

The f_x function is the attraction or avoidance function and the f_y function is for the work involved in approaching or escaping. The terms in the second part of the equation are the same as those in the first except that they refer to the work of movement in a given direction with a given magnitude of effort. Thus the first function relates to a tendency to exhibit some action and the second is an inhibiting factor. Tolman (1959) commented as follows on the way the variables interact and the results:

... I shall not now attempt to make any assumption as to the exact ways in which my variables ... interact, other than to assume that, in general, increases in any one of their respective magnitudes will tend to increase the magnitude of P. Further, it is to be noted that, since a valence V_{s2} is for me either positive or negative, the resultant P may be either positive or negative. That is, the resultant performance tendency may be either one of doing R or one of not doing R(R). The latter occurs in the case of avoidance. (p. 134-135)

Tolman (1959) closed his discussion of the theory by stating his position on axiomatization and quantification of the theory: 1) "I have not the type of mind that can remember which were my axioms and which were my deductions." (p. 150) and 2) "Psychology today seems to me to be suffering from a flight into too high-powered a statistics and into over-mathematized a fitting of curves" (p. 97). But his earlier
work had already been reduced to a number of postulates by MacCorquodale and Meehl a summary of which is found in Hilgard and Bower (1975). While his earlier work was well supported, Tolman's 1959 summary has generated little research in recent years according to Hilgard and Bowers (1975). At the same time, they (Hilgard & Bowers, 1975) see an indirect connection between recent developments in "cognitive psychology" under the general rubric "information processing" (see for example Chomsky, 1957; Newell & Simon, 1972; Miller, Galanter, & Pribram, 1960) and Tolman's work. The connection between his recent work and Vroom's (1964) cognitive expectancy theory of work motivation is, of course, quite direct as noted in the subsequent review of Vroom's work.

Peak (1955) Attitudes and Motivation

Peak (1955) recognized the fact that human behavior is determined by a dynamic system of variables, but contended that in most cases science progresses by taking smaller parts of a system for study at any given time. She therefore considered the study of attitudes per se a valid endeavor. Noting that the concept of attitude had once found favor among psychologists (Allport, 1936; Thomas & Znaniecki, 1918) and lost it in recent times (Doob, 1947), Peak (1955) suggested that the problems with the concept were related to the lack of theory to guide psychologists in the tasks of isolating and refining knowledge about attitude acquisition and change. She clearly considered attitudes as both dependent and independent variables, but cautioned against demanding too much of the concept as an independent variable in terms of motivation since an
attitude is but one of many components in the structure of motivation. Before an attitude can even be considered as an independent variable, however, it must exist. Thus Peak (1955) began her theoretical work by developing a theory of attitude acquisition and change, i.e., attitudes as a dependent variable.

Peak (1955) defined attitude in these terms:

We are using the term very broadly to refer to a hypothetical construct which involves organization around a conceptual or perceptual nucleus and which has affective properties. To put this in other words, attitudes have referents; i.e., they are always attitudes towards something (friends, tobacco, or bread), and they are affective reactions to that referent. By this I mean they involve preferences: liking and disliking, favoring or not favoring and so on. (p.67)

Her conception of attitude is clearly a relational one. Therefore the question of attitude structure might also be relational which is precisely how Peak (1955) conceived it. Her question was "what relationship between a person and objects or other people might determine one's attitude toward the object or person?" And the answer suggested was "that an attitude toward any object or situation is related to the ends which the object serves, i.e., to its consequences" (Peak, 1955, p.67); such relationships were termed instrumental relationships by Peak. For example "Susie learns that screaming gets attention and she likes attention, screaming has an instrumental relation to a valued end and acquires positive affect thereby" (Peak, 1955, p. 67). Such relations can be generalized in the sense that similar situations will have the same affect or engender similar attitudes. Thus attitudes
are a function of how many positive or negative outcomes the object, person, etc. represents. Attitudes change with changing instrumental relations, a hypothesis supported by the work of Rosenberg (1953).

One may scale peoples' affective orientation toward an object or outcome and then modify it by its judged instrumentality as utilities are modified by probabilities in utility theory (Rosenberg, 1953). Thus one's attitude toward an outcome may be considered the sum of the values attached to it and the degree to which the values are believed to result from the outcome to derive the affective loading (Peak, 1955).

Decision Making Theory

Decision theory is basically concerned with the way that two intervening variables, 1) the value oriented variable utility and 2) the likelihood variable probability, interact to determine individuals' choices among alternative courses of action or choice behavior. These variables can be used to address the following questions according to Edwards and Tversky (1967):

1. How do men make judgments of the utility or attractiveness of various things that might happen to them, and how can these utilities be measured?
2. How do men judge the probabilities of events that control what happens to them, and how can these judgements of probability be measured?
3. How are judged probabilities changed by the arrival of new information?
4. How are probabilities and utilities combined to control decisions?
5. How should psychologists account for, or think about, the fact that the same man, put in the same situation twice, will often not make the same decision? (p. 7).
Whether or not utility and probability are truly intervening variables or hypothetical-constructs (MacCorquodale & Meehl, 1948), of course, depends upon the operational methods used to infer their values. If purely descriptive terms are used to refer to these variables based entirely on operational measures then they are intervening variables while reference to beliefs by the decision maker (without objective verification) tends to provide the excess meaning characteristic of hypothetical-constructs like those of Tolman (1959). As the review by Edwards and Tversky (1967) indicates, decision theorists have used both approaches depending upon the purpose of the particular decision theorist.

Decision theorists tend to share Lewin's perspective on the temporal locus of causality in decision behavior. Edwards and Tversky (1967) note that:

Decision theory differs in strategy from many more familiar approaches to psychological theorizing. Perhaps the most important difference is that decision theorists look to the current situation, rather than to past experiences of the decider, for the variables that control the decision. Kurt Lewin (influenced by an early series of lectures given by John von Neumann) sharply distinguished between historical and ahistorical explanations of behavior. Historical explanations, like learning theories usually invoked the law of effect or some similar principle to link the occurrence of a response with the results of past occurrences of that same response. (p. 8).

Like Lewin's theories, decision theory is typically ahistoric in terms of the laws the theorists attempt to isolate. While the mathematics of decision theory can be used to describe behavior, "Decision theorists tend to use mathematical ideas for a different purpose: to specify what an organism should do, rather than describing what it does do"
(Edwards & Tversky, 1967, p. 8). But when the stakes are high, what the organism should do and does do tend to coincide, suggesting that decision theories can be descriptive as well as prescriptive or normative. Edwards suggests that the decision paradigm be considered an analysis of the organism-environment interaction, and that it, combined with certain assumptions about what the organism brings to the setting may yield descriptions of the interaction. The basic requirement, of course, is that peoples' behavior conform to the axioms and postulates used to describe their behavior. Such assumptions need not be satisfied for the theories which do not hypothesize that the decision maker actually accomplishes the mathematical operations mentally but uses mathematics simply to summarize the organism-environment interactions. Many decision theories are of the former type (see Behling & Starke, 1973 for a review of these requirements of descriptive decision theory). While the most recent developments in the area of cognitive decision making theory involve computer simulations of hypothesized human methods of information processing (Hilgard & Bower, 1975) "motivation" decision making theory has drawn upon the classical notions of subjective expected utility (SEU) theory (Behling, Schriesheim, & Tolliver, 1975).

SEU theory is comprised of value and probability, a set of axioms and postulates from mathematics and a hypothetical function for combining the two variables. Basically every alternative has a number of outcomes which accrue to the individual if the alternative is selected from among an array of such alternatives. Each of these outcomes has some value for the individual. One cannot, however, be
certain that the valued outcome will necessarily follow if the alternative is selected. Thus the individual must make some probability estimate for each outcome assuming that the alternative is selected. The value one attaches to an outcome is termed the utility for the outcome, and the probability one assigns to the choice alternative-outcome is termed the subjective expectation that selection of the alternative will result in the outcome. Thus for every alternative an individual expects a number of desirable outcomes to follow each with some probability. To find the expected utility for any given alternative then requires one to sum in the following fashion:

\[
SEU = \sum_{i=1}^{n} P_i \times U_i \text{ (n=1, 2, ...,n) \ (P_1 + P_2 + ... + P_n = 1.00)},
\]

Where: \( P \) = subjective probability and \( U \) = utility, value, or valence of an outcome for an individual.

People are assumed to attempt to maximize SEU in their choices: Thus given the choice among several alternatives a person would select the one with the highest SEU. Since \( U \) need not correspond to objective values of the outcomes, individuals may have other than linear relationships between objective values of \( U \). The same is true of \( P \). But here mathematical description requires more correspondence, i.e., they must sum to one. One must also restrict subjective probabilities to this limitation if mathematics is to be used in describing behavior. Numerous variations of this theory have been applied to either describe or to predict economic, business, and motivational decisions (Behling & Schriesheim, 1976; Edwards, 1954; Vroom, 1964).
Cognitive Positions in Industrial/Organizational Psychology

Though there are a variety of cognitive theories in the literature of organizational behavior (Behling & Schriesheim, 1976), we are concerned primarily with Vroom's (1964) consolidation of theories from psychology for application to industrial psychological problems and the subsequent extensions and refinements of that theory (Behling, et al., 1974). For that reason the basic terms of Vroom's theory are reviewed and then the various modifications which represent the theory as currently applied by industrial/organizational psychologists are considered.

Vroom's (1964) Basic Expectancy Model

Vroom (1964) characterized the central problem of motivational theorists as the "explanation of choices made by organisms among different voluntary responses" (p. 9). By voluntary responses he meant those under the control of the central nervous system as opposed to reflexes, tropisms, etc. With direct references to Lewin's works (1935, 1938) and those of Tolman (1932, 1959), Vroom (1964) contended that an adequate account of the motivational process as related to voluntary behavior would require an account of its determinants as a cognitive environmental representation at the moment of response. That is to say that the relationship between environment and responses to the environment is not direct but mediated by the individual's cognitive representations of the environment-response relationship. He contended that the differences in levels of activity and response
amplitude might be explained with concepts similar to those of Lewin, Tolman, Peak, and the decision theorists. Vroom (1964) therefore proposed a theory of choice to explain variations in work effort which was cognitive, ahistoric, and comprised a system of hypothetical-constructs similar to those of Lewin (1938) and Tolman (1959). The constructs of valence (the equivalent of utility) and expectancy (the equivalent of subjective probability) were combined using the decision theorists' maximization postulate to predict choice of levels of work effort. He added the concept of instrumentality from Peak (1955), i.e., the outcome of work effort might be related to other outcomes via their instrumentalities. Combining all of the concepts once operationalized was force (see page 36 for the actual formula), a term similar to Tolman's (1959) performance vector. Thus Vroom integrated four concepts in his theory of work effort choice: 1) valence, 2) instrumentality, 3) expectancy, and 4) force. When operationalized and combined according to the function Vroom hypothesized to exist among the first three variables to determine force, work effort levels were to be predicted from the levels of force which resulted from the combination. To fully appreciate Vroom's system one must consider the way in which he adapted these psychological concepts to the particular task of explaining the work effort decision. Each is therefore considered in turn.

Valence

It is assumed that an individual either prefers or is indifferent to a pair of outcomes x and y. Preference then represents a person's desire for or attraction toward outcomes. Valence is similarly
defined as "affective orientations toward particular outcomes" 

Vroom (1964, p. 15). Valence may be positive, negative, or zero; positive indicating attraction, negative indicating aversion, and zero indicating the individual's indifference to the outcome. In terms of two alternative outcomes, an individual may either prefer one or the other, or be indifferent to them. Vroom (1964) distinguished between the valence of an outcome and its value to a person:

An individual may desire an object but derive little satisfaction from its attainment—or he may strive to avoid an object which he later finds to be quite satisfying. At any given time there may be a substantial discrepancy between the anticipated satisfaction from an outcome (i.e., its valence) and the actual satisfaction that it provides (i.e., its value) (p. 15).

Instrumentality

Some outcomes are neither positively nor negatively valent in their own right. Yet they may become valent (positively or negatively) through their perceived relationship to other outcomes. If an outcome is expected to facilitate the achievement of a desired outcome or the avoidance of an aversive outcome its instrumentality is positive. Instrumentality intervenes between two outcomes, i.e., outcomes become attractive or aversive by virtue of the fact that they are means to other ends which may be positively or negatively valent for a person.

Valence and Instrumentality

Valence and instrumentality, when related to a particular set of circumstances, e.g., those related to the choice of level of effort
to apply in working, determine the valence of a work effort level as instrumental to the attainment of other outcomes such as money and subsequently other outcomes like those achieved through the spending of money. Various performance levels may have no value to a person as an outcome of work effort. But the outcome performance may become valenced via its instrumentality for the attainment of other outcomes such as pay, promotion, security, etc. etc.

**Expectancy**

The achievement of specific outcomes for an individual depends upon his choices and upon the munificence of his environment (March & Simon, 1960). The degree to which an individual's environment facilitates or retards his successes is subject to variations which may be relatively predictable, or involve some amount of risk and uncertainty. In most decision-making situations there exists an element of risk. The individual's view of this variation, risk, or chance, is related to the concept of expectancy; "An expectancy is defined as a momentary belief concerning the likelihood that a particular act will be followed by a particular outcome" (Vroom, 1964, p. 17). The strength of an expectancy is then the degree of certainty related to it, e.g., the strength of \( E = .80 \) is greater than that of \( E = .70 \) (where \( E \) is expectancy); it follows from the above that maximal strength is represented by \( E = 1.00 \).
Force

Force is the dependent variable in the model and is therefore determined by all of the other variables. The way in which these variables are combined to determine force is predicated upon the assumption of subjective rationality of the individual decision-maker. As a concept it reflects the Lewinian directional concept of force, i.e., behavior is the result of a field of force having both direction and magnitude.

The Model

Two propositions and equations serve to relate all of the variables of the model with the end product being force to perform some act. The proposition and equations appear below as presented in Vroom's *Work and Motivation* (1964, pp. 17-18):

Proposition 1. The valence of an outcome to a person is a monotonically increasing function of the algebraic sum of the products of the valences of all other outcomes and his conceptions of its instrumentality for the attainment of these other outcomes. In equation form the same proposition reads as follows:

\[
V_j = f_j \left\{ \sum_{k=1}^{n} (V_k I_{jk}) \right\} \quad (j=1, \ldots, n)
\]

\[
f_j' > 0; \quad I_{jj} = 0
\]

Where \(V_j\) = the valence of outcome \(j\)

\(I_{jk}\) = The cognized instrumentality

\((-1 \leq I_{jk} \leq 1)\) of outcome \(j\) for the attainment of outcome \(k\)
Proposition 2. The force on a person to perform an act is a monotonically increasing function of the algebraic sum of the products of the valences of all outcomes and the strength of his expectancies that the act will be followed by the attainment of these outcomes.

We can express this proposition in the form of the following equation:

\[ F_i = f_i \left\{ \sum_{j=1}^{m} (E_{ij} V_j) \right\} \quad (i=n+1, \ldots, m) \]

\[ f_i' > 0; \quad i \cap j = \emptyset, \emptyset \text{ is the null set} \]

where \( F_i \) = the force to perform act \( i \)

\( E_{ij} \) = the strength of the expectancy \( (0 \leq E_{ij} \leq 1) \)

that act \( i \) will be followed by outcome \( j \)

\( V_j \) = The valence of outcome \( j \)

The fundamental assumption is that individuals attempt to maximize positively valent outcomes and minimize negatively valent outcomes. Therefore when making a decision between two alternative acts, it is predicted that the individual will choose the one with the greatest force.

Extensions and Refinements of Vroom's Model

Mitchell and Biglan (1971) note that considerable confusion appears in expectancy theory research concerning the nature of instrumentalities; some researchers operationalized them as a correlation (as Vroom intended) while others operationalized them as the probability of outcome \( j \) producing outcome \( k \). This relationship and others have been
reconciled in the numerous revisions of the theory which have served to extend and refine it (Behling et al., 1974; House et al., 1974). The revised versions of the model involve making distinctions between first and second level outcomes (i.e., outcomes j and k) (Galbraith & Cummings, 1967; Graen, 1969; House, 1971; Porter & Lawler, 1968; Sodano, Shapiro, & Wahba, 1973), identification of intrinsic sources of valences (Galbraith & Cummings, 1967; House, 1971), and clarification of instrumentality by differentiating between Expectancy I and Expectancy II (beliefs that effort leads to performance or first level outcomes and beliefs that first level outcomes lead to extrinsic rewards or second level outcomes respectively) (House et al., 1974). The revised formulations contain essentially the same variables (with instrumentality conceptualized as a probability rather than a correlation). Two alternative forms of combining the variables have, however, emerged, additive and multiplicative. House et al. (1974) provide the following multiplicative model with variables and definitions:

\[
MF = f(IV_{bi} + EI_{i}(IV_{ai} + (EII_{j} \cdot V_{j})))
\]

Where 
\(i = 1, \ldots, m\)
\(j = 1, \ldots, n\)

\(MF\) = Motivation to work
\(IV_{bi}\) = Intrinsic valences associated with task behavior or performance,
\(IV_{ai}\) = Intrinsic valences associated with task accomplishment,
\(V_{j}\) = Extrinsic valences associated with task or goal accomplishment,
\(EI_{i}\) = Expectancy I \(\overline{E_{1}}\), the subject's probability estimate that his effort will lead to first level outcomes,
\(EII_{j}\) = Expectancy II \(\overline{E_{2}}\) the subject's probability estimate that first level outcome will lead to extrinsic rewards (second level outcomes) (pp. 484-485).
The intrinsic valences related to task behavior derive from the individual's affective reaction to the kinds of behaviors which the job requires \( (IV_{b1}) \) while the valences for task accomplishment are a function of the individual's affective reaction to accomplishment of a task or task goal \( (IV_{a1}) \) (Galbraith & Cummings, 1967). The extrinsic valences refer to variables such as pay, promotion, and other valued outcomes from "good performance" \( (V_j) \). Thus they are second level outcomes; first level outcomes are related to task accomplishment per se. The logic of the division between the two expectancies should now be clear; each is associated with one of the two forms of valent outcomes. Lawler (1971) provides a concise description of the two expectancies by noting that one, \( EI \), is an effort to performance \( (E + P) \) expectation, the other a performance to desired outcome \( (P + O) \) expectation.

Simpler additive combinations of the variables have been suggested by Grean (1969), Hackman and Porter (1968), Lawler and Porter (1967), and Pritchard and Sanders (1972). Schmidt (1973) has demonstrated empirically that highly artificial correlations may result from the use of multiplicative terms unless the level of measure in the data provides a ratio scale (which appears to be a dubious assumption in the case of most measures of valences at least). When less than ratio scaled data are used, correlations fluctuate widely using the multiplicative model and remain relatively stable when the additive model is used to combine the same data (Schmidt, 1973). The additive model takes the following form using the same variables as in the previous model:

\[
MF = f(IV_{b} + IV_{a} + EI + EII + V)
\]
The fundamental hedonistic hypothesis relating force and behavior, of course, has been retained over the successive transformations of the theory. This final model provides the basis for the subsequent generation of hypotheses since it is the one used in the only other test of differing predictions from the two theories which tapped these perceptions (Berger et al., 1975).

These various formulations of expectancy theory have been termed the **expectancy core** by Behling et al. (1975). While the expectancy core of one form or another may be used to predict motivation, Vroom (1964) hypothesized that actual performances would be dependent upon the ability of the person as well as motivation and that the relationship between the two, motivation and ability, was interactive: \( P = f(\text{Ability } \times \text{Motivation}) \). Specifically individuals higher in ability would benefit more from increases in motivation where performance is concerned than would those lower in ability according to Vroom (1964). While the incremental effects of differing levels of motivation as determined by some expectancy core model on performance might be more or less depending on ability, the direction of changes would be expected to be the same. And if ability is somehow controlled, for example, when a subject is used as his/her own control motivation should be the only determinant of incremental changes in performance. With the additional consideration of ability then the expectancy theory of work motivation and performance is complete.
Evidence on the Cognitive Expectancy Theory

Mitchell's (1974) review of the literature on expectancy tests by industrial/organizational psychologists is perhaps the most comprehensive analysis of the evidence on the theory extant 1974. Thus, his analysis of the state of the theory and evidence is summarized here rather than reviewing each of the more than thirty field and laboratory tests considered by Mitchell (1974).

Mitchell (1974) divided his review according to the type of model tested, Vroom's (1964) occupational preference model or the $V_j$s for various occupations, the work and job satisfaction models again the $V_j$s, and finally the model of interest here, the work effort model or sum of $E_{ij}V_j$s for various levels of work effort. He found strong correlations between the job preference models and subjects' reported occupational preferences with correlations of from .69 to .82, the highest correlation based upon a within-subjects survey format. The correlations between the valence ($V_j$) model and job satisfaction ranged from a low of .03 to a high of .57. All of these correlations were computed from between-subjects data. Mitchell (1974) concluded that both of these models were relatively well supported by the evidence he reviewed. He found the evidence on the work effort model more complicated, however.
The Behavior Choice Model and Job Performance

Mitchell (1974) noted that many variations on the basic expectancy model have been used to test the theory but the highest correlation between any of the models and any type of performance measure was for the E(ΣIV) model and "self rated effort" of .64 reported by Mitchell and Albright (1972). While the self report of effort is an appealing means of measuring effort according to Mitchell (1974) he also recognized that it was not acceptable for other reasons: "self-ratings are subject to rater bias and halo effects in a manner that may not be so serious for supervisor ratings." (p. 1060). The correlations between supervisor ratings of performance and effort and components of the work effort model ranged from .03 to .52. The more important correlations between objective measures of performance and the work effort models range from -.15 to .39. While these results provide some support for the model they are not strong in that at most sixteen percent of the variance is explained in objective measures of performance by the expectancy models. But as Mitchell (1974) pointed out, all of these results were obtained by computing the correlations across as opposed to within-subjects.

An important finding in the review of evidence by Mitchell (1974) was that in many cases the simple addition of instrumentalities provided stronger correlations than did the weighting of $I_{jk}s$ by $V_k$s and $E_{ij}s$. This result should come as no surprise in view of the contention and evidence provided by Schmidt (1973) which showed that this
was a potential result for correlations based on interval and ordinal as opposed to ratio data.

Mitchell (1974) did not suggest that the expectancy model be abandoned because of the low correlations between objective performance and expectancy theory components because as he indicated, the theory was stated in terms of individual behavior and none of these correlations were computed within-subjects. In addition, the use of an additive model as opposed to a multiplicative one was indicated, not because the basic relationship was additive but because of the problems of scaling, i.e., our measures are at best interval and probably only ordinal. Thus the theory remains to be tested in a rigorous manner.

The Acognitive Position

Both theoretical and applied psychologists who work in the acognitive tradition grant the possible existence of cognitive processes as mediators of the relations between environment and behavior but hold that they are at best the product of previous experience with the environment (Behling, 1975) and can therefore be described in terms of environmental history (Skinner, 1974). They argue that if behavior is a function of such a process the cognitive terms are inferred from overt behavior, redundant, and may be excluded by the criterion of Occam's Razor. Because industrial/organizational psychologists have typically been cognitively oriented their interpretations of the cognitive paradigm are often affected by such historical perspectives resulting in less than perfect representations of the paradigm in theory.
and practice (Mawhinney, 1975).

**Acognitive Positions in Psychology Proper**

The acognitive theories in psychology are in large part the learning theories. While there are numerous acognitive learning theories only Skinner's (1938, 1953, 1957) theory of operant conditioning has been utilized by industrial/organizational psychologists and its applications have been rather limited compared to cognitive theories which have appeared in this same literature. And it is with this paradigm that previous industrial/organizational psychologists have compared cognitive theories (Behling et al., 1975; Berger et al., 1975; Mawhinney, 1975; Mawhinney & Behling, 1973; Schneier, 1974; Yukl et al., 1972), and interpreted organizational concepts (Adams & Romney, 1959; Mawhinney & Ford, Note 1). It is recognized as the only real acognitive competitor, in terms of motivation theories, with the current cognitive theory (Cummings et al., 1975). Since all of the various learning theorists are in agreement with the facts of this paradigm, even though differing interpretations abound (Hilgard & Bower, 1975), our focus is on the operant paradigm.

**Skinner's Model of the Behavior of Organisms**

In contrast to the cognitive theorists in Psychology, Skinner (1938) contends that the development of hypothetical-constructs to represent internal cognitive processes is redundant and behavior scientists
would do better to maintain a system of terms defined and measured outside the subject. The "inside story" as Skinner (1975) calls the cognitive mediation phenomena will eventually be reduced to biology and chemistry, and until then we had best learn the "outside story."

Ergo Skinner (1938) focused on meticulous description of the behavior of organisms in terms of their interactions with the environment without reference to mediating cognitive processes. The object of his 1938 work was to develop and test bases of a science of behavior in the natural sciences tradition. Like many of Lewin's Galilean relational concepts, Skinner's terms were defined in terms of organism-environment interactions but confined to the level of data, as opposed to Lewin's frequent references to hypothetical entities. While the system might result in ahistoric laws when applied, Skinner's perspective, as noted shortly, is historic with respect to the determinants of behavior and his concepts reflect such a bias. Most of the behavior principles thus far isolated by application of the paradigm have in fact been historic in character.

Skinner's (1938) system represents a formalization and extension of Thorndike's (1932) law of effect which stated that:

Of several responses made to the same situation those which are accompanied or closely followed by satisfaction to the animal will, other things being equal, be more firmly connected with the situation, so that when it recurs, they will be more likely to recur; those which are accompanied or closely followed by discomfort to the animal will, other things being equal, have their connections with the situation weakened, so that when it recurs, they will be less likely to occur (p. 276).
Fundamentally Skinner's theory explains the behavior of organisms in terms of its consequences both phylogenetic and ontogenetic (Skinner, 1969). His formulation of the connection between behavior and the environment was contained in the following formula:

\[ R = f(S, A) \]

where:

- \( R \) = dependent response
- \( S \) = environmental stimuli
- \( A \) = history of the organism (Skinner, 1931).

The fundamental conceptual unit of Skinner's (1969) theory at present is the contingency of reinforcement which includes the dependent response, the stimuli present when the response is observed, and the stimuli produced in the organism's environment by the response. The purpose of behavior is found in the history of a response, in terms of what it has produced for the organism in its environment according to Skinner (1974). Conceptually the dependent variable in his system may be either rate of response or the future probability of response which is inferred from its past rate in a given set of environmental circumstances. Theoretically, with a sufficient amount of information on the history of environment-response interaction of an organism and its current state of deprivation or satiation with respect to environmental stimulation, one may predict the behavior of an organism. A highly specialized system of terms, concepts, and methods have evolved from Skinner's (1938) initial elaboration of his paradigm which is now termed the experimental analysis of behavior. A review of the paradigm is found in subsequent paragraphs.
Respondent and Operant Behavior

Behavior can be classified as "respondent" or "operant" on the basis of its responsiveness to elicitation by environmental stimulation. Respondent behavior is that which may be correlated with eliciting stimuli \( S \rightarrow R \) as a speck of sand in one's eye is correlated with an eye blink response. Behavior which cannot be so correlated, but whose probability correlates with its stimulus consequences \( R \rightarrow S \) according to the law of effect is termed operant behavior, i.e., the rate or probability of response \( R \) is controlled by the environmental stimulus it produces or \( S \). Since most human behavior is of the operant type it is the focus here. Operant behavior can be identified by systematically manipulating the consequences \( (S) \) of a response \( (R) \) and observing the effects of the manipulation on the rate of response \( R \). Environmental stimulus consequences (those stimuli the occurrence of which depend on response \( R \)) are defined in terms of their effects on the rate of \( R \).

Reinforcers, Punishers, and Neutral Stimuli

"Reinforcers," "punishers," and "neutral" stimuli are functional tautologies used to classify environmental stimuli by virtue of their effects on the rate of \( R \) when made contingent on its occurrence. Reinforcers \( (S^+ \)s) are stimuli which when made contingent on \( R \) increase
the rate of R. **Punishers** (S⁻s) are stimuli which when made contingent on R reduce the rate of R. **Neutral stimuli** (S⁰s) are stimuli which have no effect on the rate of R when made contingent upon its occurrence. The following shorthand is used to indicate that a stimulus is contingent on a response and the type of stimulus is indicated by the superscript according to the above classification scheme: R → S⁺, S⁻, S⁰.

Effects on the rate of R are also implied in the notation since it increases when reinforcers are contingent, decreases when punishers are contingent and remains constant in terms of rate when neutral stimuli are made contingent.

Positive and Negative Reinforcers

The processes of increasing and decreasing the rate of R are respectively "reinforcement," and "extinction" and "punishment." **Reinforcement** is the systematic arrangement of S⁺s to increase or to maintain the rate of R. **Extinction** is the reduction of the rate of R by arranging an environment so that there are no S⁺s to maintain its rate or the elimination of known S⁺s from the environment of R to reduce its rate. **Punishment** is the systematic arrangement of S⁻s so that the result is a reduction of the rate of R. In the case of reinforcement and punishment arrangement means making S⁺ and S⁻ contingent on R in some fashion, and in the case of extinction (Ext.) making sure that there is no contingency between R and some S⁺. In terms of contingency between a response and its consequences there are two alternatives; stimuli may be presented as a consequence of R or removed from an environment as a consequence of R. If we associate "positive" with any presentation of
a stimulus contingent on R and "negative" with the removal of a stimulus contingent on R the result is a further differentiation of the stimuli $S^+$ and $S^-$. That is $S^+$ may have the effect of increasing the rate of R by virtue of being contingently presented or withdrawn from the environment of R (i.e., impinging on the organism emitting R). If reinforcement results from the presentation of $S^+$, $S^+$ is termed a positive reinforcer and the process of increasing R is termed positive reinforcement. If reinforcement is the result of the contingent removal of $S^+$, $S^+$ is termed a negative reinforcer and the process of increasing the rate of R in this manner is termed negative reinforcement. Positive and negative punishers, and positive and negative punishment are similarly defined and all of the relationships are represented in Figure 1.

Primary and Conditioned Reinforcers

Reinforcers can be further refined in terms of classification by virtue of how they become reinforcing. Kelleher (1966) provides the following distinctions between primary and conditioned reinforcers:

A primary reinforcer is a stimulus whose reinforcing properties do not depend upon a history of conditioning; it will be a reinforcer for most members of a given species. Food and water, for example, are primary reinforcers. A conditioned reinforcer is a stimulus whose reinforcing properties are established by conditioning; it will be a reinforcer for only those members of a species who have been exposed to a specific conditioning procedure. (p. 162).

Money is a conditioned reinforcer for many behaviors because of its association with the attainment of many primary reinforcers such as food, shelter, entertainment, etc. But, of course, in the primitive
Figure 1

Effect of Stimulus Consequence When Made Contingent on the Dependent Response

<table>
<thead>
<tr>
<th>Manipulation of the Stimulus Consequence</th>
<th>Increase in rate of Response (+) R</th>
<th>Decrease in rate of Response (-) R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present Contingent on R (+)</td>
<td>+ +</td>
<td>+ -</td>
</tr>
<tr>
<td></td>
<td>Positive Reinforcer or Reinforcement</td>
<td>Positive Punisher or Punishment</td>
</tr>
<tr>
<td>Withdrawn Contingent on R (-)</td>
<td>- +</td>
<td>- -</td>
</tr>
<tr>
<td></td>
<td>Negative Reinforcer or Reinforcement</td>
<td>Negative Punisher or Punishment</td>
</tr>
<tr>
<td>Nothing Contingent on R (0) or Neutral Stimuli Contingent</td>
<td>EXTINCTION SCHEDULE</td>
<td></td>
</tr>
</tbody>
</table>

Taxonomy of Stimulus Consequences for Behaviors
cultures money may have no meaning, with its place being taken by shells or beads and the like. In our culture, however, money is associated with so many other reinforcing stimuli that Skinner (1953) has termed it a conditioned generalized reinforcer, i.e., it is almost universally reinforcing for most behaviors and most people.

**Schedules of Reinforcement**

Schedules of reinforcement, unlike reinforcers and punishers, are defined independently of their effects on behavior rates. They specify either a temporal or quantitative relationship between responses and response consequences in terms of reinforcers. Response rates and patterns of response rates have been shown to be highly correlated with specific schedules in the experimental analysis of behavior with both infrahuman and human subjects (Bijou & Orlando, 1961; Catania & Cutts, 1963; Ellis, Barnett, & Pryer, 1960; Ferster & Skinner, 1957; Hutchinson & Azrin, 1961; Laties & Weiss, 1960, 1963; Long, 1962, 1963; Orlando & Bijou, 1960; Staats, Finley, Minke, & Wolf, 1964; Weiner, 1963). While a large number of schedules are identified by Ferster and Skinner (1957) the research described here requires understanding of only five schedules and one related procedure: 1) continuous reinforcement (CRF), 2) extinction (Ext), 3) fixed ratio (FR), 4) variable ratio (VR), 5) schedule chains (e.g., FR, VR; CRF, VR; etc.) and the procedure of "stretching."

Schedules of reinforcement can be divided into those which are continuous and those which are intermittent. Both CRF and Ext
schedules are continuous. In the case of CRF every response is followed by a reinforcer being presented or withdrawn respectively for positive and negative reinforcement. In the case of Ext the response is always correlated with no reinforcing or punishing stimuli. The FR and VR schedules are intermittent with a reinforcement occurring after every N-th response on the FR-N schedule and approximately one reinforcement occurring for every N responses on average for the VR-N schedule. The N here stands for the ratio of responses to reinforcement on the schedules so when N=1 for the FR-N schedule it is the same as the CRF schedule. The variable ratio schedule or VR-N schedule is similar to the FR except that the N stands for an average ratio since the ratio varies about a mean ratio N in a random series; the series is bounded by a set of arbitrary values one greater than and one less than the mean N. On the chained (chain) schedule a single reinforcement is contingent on the completion of two or more schedule requirements, e.g., FR-10 and then some other requirement, with some stimulus being correlated with the change in schedules. Responses as well as schedules may be chained, e.g., \( R_1 \) must first be emitted and satisfy an FR-10 schedule which permits or signals the fact that \( R_2 \) may then begin on an FR-5 schedule which when satisfied results in the single reinforcement being delivered (Findley, 1962). The second response can become a conditioned reinforcer for the first since it ultimately results in the final (at least in animal studies) primary reinforcer (Kelleher, 1966). Stretching is a procedure whereby a response initially conditioned on a dense
schedule, e.g., CRF, is reinforced or maintained in terms of rate on schedules with successively larger ratio requirements, i.e., N is systematically increased, e.g., from CRF to VR-2, to VR-4, and so on. A frequent result of increasing N too rapidly is termed schedule strain which is a decrease in the rate of R as the schedule loses control of the response. Thus stretching is the process of increasing N in such a manner that the rate of R remains near the same or even increases as N is increased.

Descriminative Stimuli and Rule Governed Behavior

A discriminative stimulus (or S^D) is a stimulus in the presence of which a response is consistently reinforced and in the absence of which goes unreinforced. It may be contrasted with the S-delta (or S^A), a stimulus in the presence of which a response is punished or consistently goes unreinforced (Skinner, 1957, 1969). Such stimuli differ from the eliciting stimuli of the S - R paradigm in that they are a function of their correlation with the R + S^+;−;0 relationship and therefore conditioned like a conditioned reinforcer. When an S^D is consistently correlated with a schedule of reinforcement for a person, that person is likely to behave as though the schedule were in effect whenever the S^D or possibly a certain constellation of S^D's so correlated are present in the person's immediate environment (Cross & Lane, 1962; Long, 1962, 1963; Schmitt & Marwell, 1968). Once an individual has been conditioned to the various stimuli in a particular environment those stimuli serve to control his behavior via their relationship to R + S^+;−;0, whether or not he/she is able to verbally describe their effects. With the addition of these
terms, we have completed the three term contingency of reinforcement referred to by Skinner (1969), i.e., stimuli present on the occasion of a response or discriminative stimuli, the response per se, and the consequences generated by the response in the environment of the organism. The dynamics of a contingency of reinforcement are presented in Figure 2.

![Figure 2](attachment:image.png)

**Figure 2**

\[ S^D, A \rightarrow R \rightarrow S^+, -, o \]

The Three Term Contingency

It should be clear from Figure 2 that the effects of \( S^D \) depend upon their correlation with the response reinforcement contingency. This being true, a person exposed to a novel environment may not be conditioned to the \( S^D \)s in it and thus the environment has no meaning in the sense of providing cues regarding the consequences of responses in that environment. Once having gained experience in the environment, however, and thereby come under the control (i.e., responsive to cues in it) of \( S^D, A \)s in that environment, the relationships are said to be "known" to the person.

Because people are capable of verbal behavior, they may communicate with one another regarding the stimulus properties of the environments with which they have had experience in terms of \( S^D \)s and \( S^A \)s which comprise them. Skinner (1957) has termed such verbal behavior
Tacting (the description of environmental variables to which one knows one is responding). Individuals who have come to know an environment in the sense that for them it is enacted may communicate the stimulus properties of the environment to others who have no such experience; we may instruct another as to how the other should behave in order to be reinforced or avoid punishment in that setting. Behavior of the person so instructed is termed rule governed if that person tries to follow the prescriptions of another more experienced person whereas the behavior of his instructor is termed contingency shaped, since the latter's behavior is presumed to be a product of the objective contingencies of reinforcement in the setting. These and other complex operant terms have been neglected by most industrial/organizational psychologists (Mawhinney, 1975).

Acognitive Positions in Organizational Behavior

Interpretations of the acognitive operant paradigm in the industrial/organizational psychology literature are few indeed. Skinner's (1957) concept of the "mand" was used to interpret the concept of authority by Adams and Romney (1959) but has had little appeal for researchers in the area. Mawhinney and Ford (Note 1) have attempted to interpret House's (1971) path-goal theory of leader effectiveness using the complex operant concepts of tacting, manding, enacting, and rule governed behavior. But no coherent research program has resulted from their work to date. Most theoretical work in industrial/organizational psychology and organizational behavior has been concerned with the points where the facts of the operant paradigm depart from "common
sense" and the predictions one might derive from various expectancy theory formulations (Berger et al., 1975; Yukl et al., 1972). As an applied science the facts and procedures derived from the experimental analysis of behavior or operant paradigm provide a technology for the analysis and control of human behavior. Two books have been written specifically in this tradition of applied technology (Brethower, 1972; Luthans & Krietner, 1975) and several field interventions purporting to be based on the paradigm have recently appeared in the literature (Adam, 1975; Pedalino & Gamboa, 1974). London (1972) found much of the literature purporting to be applied operant principles in the area of psychotherapy represents little more than loose analogies to operant principles. He contends that in many cases existing procedures which have had some success are subsequently couched in operant terms even though the origination of the procedure had nothing to do with operant technology. This observation no doubt applies equally well to the current fare of literature in industrial/organizational psychology which is currently described as applied operant principles.

Growing interest among organizational behaviorists is reflected in recent reviews and seminars on the topic (Schneier, 1974; Cummings et al., 1975) as well. Since the operant paradigm has provided a technology and language for the description of individual behavior in the laboratory, application is primarily a matter of translation of these terms and methods to more complex environments. Mawhinney (1975) has reviewed the numerous difficulties which have been experienced by industrial/organizational psychologists and organizational behaviorists in such efforts. The problems of interpretation which
are pertinent to the current work are considered subsequently. At this point, suffice it to say that translation of terms and methods from Psychology to Industrial/Organizational Psychology and finally to Organizational Behavior should maintain some isomorphism which has frequently been lost and the complex operant terms and concepts like discriminative stimuli, tacting, and rule governed behavior have rarely been applied to the description of human behavior in these fields.

The prescriptions for the management of human behavior in organizations derived from the acognitive model start from the basic premise that most behavior in organizations is operant and therefore the behavior observed is being maintained by some contingency of reinforcement. Desired behavior which is not observed, on the other hand, must not be producing reinforcement (Brethower, 1972). Luthans and Kreitner (1975) use the term "O B Mod" to refer to organization behavior modification or applications of the facts of operant conditioning to the control of human behavior in organizations. They present a paradigm for the analysis of existing reinforcement contingencies which includes antecedent (A) or discriminative stimuli in the organizational setting, the behavior to be altered, instated, or maintained (B) (an operant response of some kind), and the existing consequences (C) the organization administers for the behavior when it occurs. A careful quantitative analysis of this contingency should, in the estimation of Luthans and Kreitner (1975), suggest what should be done with A and C as organizational variables (e.g., pay systems, leader behavior, etc.) to alter B. Prescriptions such as increased feedback on performance, additional contingent incentives, etc. are typical results of such analyses. Brethower,
(1972) has noted the similarity between the prescriptions one may derive from the operant literature and MBO, "zero defects" type programs, and goal setting programs. They all include specification of the desired response in terms of observable behavior and the consequences which one may expect to follow from exhibiting the proper response, goal achievement, etc. His paradigm for contingency analysis is termed a total performance system and is composed of inputs to a processing unit, which may be a person, department, or total organization, outputs from it with a feedback loop for quality and other characteristics of output, a receiving system which takes off the output and feedback from the receiving system to the processing system. Problem behavior can be identified by the internal system or by the receiving system, e.g., other department, customers, and the like. The basic presumption is of course, that the determinants of behavior are to be found in the environment of the behaving individual and one need not analyze cognitions to identify and alter problem behavior or to motivate good behavior in organizational terms.

Evidence on the Acognitive Operant Theory

As previous researchers in the organizational behavior tradition have observed, most of the current evidence on response rates resulting from various schedules of reinforcement has been collected from infrahumans, institutionalized humans, and children (Berger, et al., 1975). And Lounsbury, Arvey, and Malone (Note 2) have suggested that organizational behaviorists who have hypothesized a higher response
rate from application of VR reinforcement schedules compared to CRF have provided no references to operant paradigm literature to support their contentions. But they too miss the basic issue which is not schedules per se, but the effects of stretching schedules on response rates. Higher response rates have been observed to result from schedule stretching. Many operant analyses involve schedule stretching even though the focus of a researcher's attention may be on some other behavioral phenomenon. Thus, several of the studies subsequently reviewed in terms of stretching did not have stretching as the primary object of the reported research. Our references are then to the aspect of each study which did involve stretching in some fashion. The studies are considered according to whether they were characterized by use of infrahuman, institutionalized human, or noninstitutionalized human children as subjects.

**Infrahuman Response Rates on VR Stretching**

Our concern is specifically for experimental work in which the organism is exposed to the CRF and VR schedule in some contiguous fashion; in particular the CRF should precede the VR in order for the stretching to be accomplished. With some experience on both types of schedules, however, the VR response rate may even be reproducible without reverting to the CRF to VR sequence but this need not happen to support the contention that higher response rates can be achieved with a VR than with a CRF schedule which has been of prime concern among organizational behaviorists for some time now (Yukl et al., 1972). An example of higher response rate on VR following CRF is reported by
Ferster and Skinner (1957). During transition from CRF to VR-40 and finally to VR-100 an increase from 1.75 to 3 responses per second was observed. A study by Hendry and Dillow (1966) was designed to study response and schedule chains, but a by-product of the experiment was some comparative data on the CRF versus VR question with an observing response. Here at least one treatment involved a change from CRF to VR-2, the schedule most studied by industrial/organizational psychologists (Yukl et al., 1972) and organizational behaviorists (Berger et al., 1975). The result was the characteristic increase in response rate observed by Ferster and Skinner (1957). Other data from the experiment were not independent of several other treatments involved in this complex experiment. Nevin, Cumming, and Berryman (1963) investigated the accuracy of matching to sample (correct matching of a sample stimulus by indicating its corresponding color etc., a type of discrimination) under various FR-N schedules and one VR-3 schedule compared to CRF (operationally an FR-1). In two out of three cases the VR produced superior response accuracy immediately after reinforcement and superior accuracy for all three as the number of trials after reinforcement increased. Though not as direct as we would like, these data support the notion of "better" responses under VR than CRF scheduling. But these studies were all with infrahuman subjects in simple environments doing simple kinds of behavior.

**Institutionalized Humans' Response Rates on Stretching**

Bijou and Orlando have replicated many of the experiments conducted by Ferster and Skinner (1957) with pigeons using institutionalized
human retardates as subjects (Bijou & Orlando, 1961; Orlando & Bijou, 1960). Using candy as reinforcers, the response rates of the retardates were examined under conditions of CRF, FR, and VR schedules. The VR schedules produced very high sustained rates of response but no direct comparison of CRF and VR was made within-subjects in terms of stretching. But the cumulative records of four subjects, all classified as high in ability, suggest that higher response rates were produced by the VR than by the CRF schedules. So these data are weak in the sense of having been taken from atypical humans and making between-subjects comparisons of response rates on VR and CRF schedules.

**Noninstitutionalized Human's Response Rates on Stretching**

Staats et al. (1964) provide some excellent data on the CRF to VR question in a complex setting with a normal child engaged in a reading response in order to obtain marbles (conditioned reinforcers) differing numbers of which could be used to obtain different toys. The similarity of this setup to the payment of money for work, which money is eventually used for other purposes should be clear. After initial conditioning on a CRF schedule an attempt was made to stretch the schedule to a VR-6, which resulted in extinction or loss of schedule control of the operant. After then returning to a VR-2 and more slowly stretching the schedules from VR-2, to VR-4, etc., a VR-6 was eventually used to maintain the response with higher response rate on the VR than on the CRF schedule.
While the conclusion regarding the adequacy of the cognitive theory was related to problems of measurement and adequacy of various methods used to test the theory, the only question regarding the operant findings is related to the generality of the findings in terms of people and environments. It may be, for example, that higher response rates on VR than on CRF are restricted to animals and children and not applicable to normal adult humans working at a typical job. It is also possible that people who differ significantly with respect to histories of reinforcement may differentially respond to the CRF and VR schedules. Thus, it remains to be seen whether adult humans working at a normal task for pay as opposed to some other potential reinforcer behave like infrahumans and human children under conditions of CRF and VR schedules of reinforcement.

Nature of Differences in Psychology and Organizational Behavior

In Psychology both Skinner and Tolman are classified as learning theorists (Hilgard & Bower, 1975) and as we note subsequently there is a great deal of similarity in their systems. The major differences have to do with the theoretical locations of causality and degree of emphasis on inferred cognitive structures as explanations of observed behavior. Methodological differences result from these theoretical differences. But as Hilgard and Bower (1975) have pointed out, in Psychology there is little dispute over the facts. The small number of disagreements over facts actually result from the differing methods employed to investigate similar phenomena according to Dunham
(1968). Since Skinner (1938) and Tolman (1932) represent the theorists who best typify the differences between the acognitive and cognitive paradigms in the same area of Psychology they are used for purposes of comparing the two paradigms. In the organizational literature we find that there are again no disagreements with the facts from Psychology, but if the facts of Psychology are compared to the predictions from the quantified interpretations of psychological cognitive theories (i.e., Vroom's theory and its extensions) in this literature, obviously different predictions result (Mawhinney & Behling, 1973). It is necessary therefore to review the nature of these similarities and differences in both areas.

Nature of Cognitive-Acognitive Differences in Psychology

The fundamental differences among Lewin (1938), Tolman (1932, 1959), and Skinner (1938, 1969) in terms of their respective psychologies have to do with the differing concepts each had of the behavior to be explained and the locus (i.e., inside versus outside the organism) of the explanatory system each sought to devise. Lewin (1938) attempted to devise a system for the measurement of changes in peoples' cognitive structures as purely psychological phenomena arising from interactions with their environments. Thus he was more concerned with mental behavior than overt behavior. Eventually, however, overt behavior was to be explained by mental events occurring at the moment of behavior or response. Tolman's (1938, 1959) concept of behavior was large units of behavior in terms of direction and intensity, e.g., the turns right or left of a rat at a choice point in a runway and its speed.
Though he used operational measures of cognitive states of his subjects, Tolman (1938, 1959), as did Lewin, clearly considered the psychological mental reactions of his subjects to their environmental experience the ultimate source for explaining their behavior. The organism's expectations about the consequences of a given response based on past history of response-environment interaction according to Tolman (1959) provided an explanation of current behavior in cognitive terms. Skinner (1938) was concerned with explaining the probability of a response with a response being restricted only to those which might be operationalized in terms of rate or number of responses over time. Thus, in the Skinnerian system choices and intensity of responses might also be studied in terms of response rates. These differences, of course, led to differences in methodology. Skinner's (1938, 1969) conception about the locus of behavioral explanation constrasts sharply with both Lewin and Tolman; Skinner argued that consideration of what occurs or does not occur within the subject is redundant if its behavior can be lawfully related to environmental stimuli without reference to internal cognitive structures. Again methodological differences arose from these conceptual differences.

If one seeks to explain the direction and intensity of responses then one must consider some sort of spacial arrangement for the study of directional hypotheses and use of space which permits an estimate of direction and intensity, such as right or left turn and how fast a certain distance was covered. If one seeks to explain probability of response on the other hand one needs only to count responses and the time period over which the responses occur. For these reasons the
cognitive animal psychologists have typically utilized experimental spaces characterized by alleys, runways, T-mazes, and the like. The acognitive psychologists have tended to use only a small box-like experimental space with a bar to be pressed by rats or a disc to be pecked by pigeons with bar presses and disc pecks being recorded over time on a cumulative record (Skinner, 1969). The cognitivist dealing with human subjects has the additional problem of questioning his subjects regarding their cognitive states whereas animal psychologists must simply infer these states from outside data. While methods other than direct questioning may be used (Edwards & Tversky, 1967) the use of direct questioning appears to be more characteristic of current psychologists in the Lewinian tradition. Thus, Lewin and his followers have relied heavily upon the post experimental questionnaire to obtain information about cognitive states since this is essentially the only real source of such information, i.e., if one does not know one's cognitions then we must question whether one had them at all. If one cannot trust one's subjects, of course, a theory may be drawn up which permits the use of the hypothetico-deductive method (Salmon, 1973) to derive and test the observational predictions of what people would do if they did in fact have certain types of cognitions. Decision theorists have utilized this method extensively (Edwards & Tversky, 1967) while Lewin's followers have used it and the questionnaire method (Deutsch, 1968).

The cognitivists have tended to focus on the acquisition of behavior while the acognitivists investigated both acquisition and maintenance of behavior. Since a response is typically acquired only once,
the same subject cannot be used more than once to study a particular instance of acquisition. For this, and other reasons, the cognitivists have tended to utilize between-subjects designs and aggregated data across subjects for analyses. Sidman (1960) has argued that such methods of treatment and data analysis "destroys, confounds, or omits significant data of moment to moment rate changes in a single organism's behavior" (quoted in Krantz, 1971, p. 62). The effects of schedule stretching, for example, cannot be investigated with a between group design since each subject must act as the starting point of the treatments and receive treatments successively in a certain order. And data aggregation over subjects would obscure instances of extinction from stretching the schedule too rapidly. While the two groups still agree with the major findings in both areas, it has recently been recognized that differences in facts can be attributed to this difference in method, i.e., between versus within-subjects research designs (Dunham, 1968).

Hilgard and Bower (1975 maintain that the major difference between the camps is that one has a penchant for theorizing while the other has an antipathy for it. Clearly the cognitive position demands the use of theory since the phenomena cannot be observed directly and the acognitive position may or may not use theory since the facts of interest to the acognitivists are readily observable. The following characterization of the current stance of the two camps by Hilgard and Bower (1975) tends to sum up the essence of the confrontation in Psychology proper and the potential for at least a methodological reconciliation:

It may be noted that the split between the two
Methodologies depend on the focus of interest—in particular, whether transitional (and transitory) behavior is of primary concern, as when the animal is acquiring new skill or extinguishing an old habit; or whether asymptotic steady-state behavior is of central concern. The older learning theories tended to concentrate on acquisition and its rate, whereas operant conditioners are much more concerned with the steady-state maintained by given contingencies. Their methodology rather resembles that of the psychophysicist who tests a single subject repeatedly. Similar designs are now common in studies of human memory (e.g., Atkinson & Shiffrin, 1965) and information processing (e.g., Sternberg, 1969). Therefore, there is really no reason for methodological segregation of these fields any longer. The main division thus remains theoretical preference—or, rather, a preference for theorizing on one side versus an active antipathy to theorizing within the operant conditioning group. This comes down to the matter of deciding what are the proper goals of a scientific psychology. And here we come again upon the empiricism-rationalism schism of antiquity. There is a fundamental opposition between scientists who believe that progress is to be made only by rigorous examination of the actual behavior of organisms and those who believe that behavioral observations are interesting only insofar as they reveal to us hidden underlying laws of the mind that are only partially revealed in behavior. Is psychology to be the science of the mind, or the science of behavior? Is physics the science of physical things, or the science of meter readings? Do behaviorists confuse the subject matter of the field with the evidence available for drawing inferences about this subject matter? Skinner opts for behavior as the subject matter; cognitive psychologists who form the current opposition (e.g., Neisser, 1967) suppose that one uses behavior as evidence for the operation of cognitive processes. This contemporary clash between alternative views illustrates how very fundamental are these essentially historic and philosophical assumptions. (p. 250).

Skinner (1974) refers to inferred cognitive structures as "convenient fictions" and holds to the belief that the inside, or cognitive, story will eventually be explained through biology and chemistry.
If the issue were simply one of how to treat behavior, evidence versus essence, or how to conduct experiments, within versus between-subjects designs, there would be little practical significance of this type of confrontation, especially in view of the fact that the actual evidence is not disputed. But as noted in the introduction, very different attacks on practical problems in many areas spring from these differing presuppositions and different theories based on them. And as noted shortly, different prescriptions about how to manage behavior and predictions of work behavior derive from operant and expectancy theory in the area of industrial/organizational psychology and organizational behavior.

**Nature of Cognitive-Acognitive Differences in Industrial/Organizational Psychology and Organizational Behavior**

Perhaps the most comprehensive treatment of the similarities and differences between operant and expectancy theory paradigms is contained in the comparative analysis of differing predictions from the two conducted by Mawhinney and Behling (1973). They posit that variable ratio schedules produce systematic objective probabilities of reinforcement and that these probabilities are the same as the \( E_2 \) perception that performance will lead to a valent outcome \( V \) if perceptions of the person match the real environmental response outcome relationship. That is to say that a VR-\( N \) schedule has a mean ratio of \( N \) responses to one reinforcement. Thus the probability of any one response being reinforced over a series is \( 1/N \) and a VR-2 schedule then results
in 1/2 or a .50 probability of reinforcement. Under CRF or FR-1 schedule, of course, the probability that any response would be reinforced or the selection of a certain level of work would result in a desired or valent outcome equals 1.00. From the definition of valence throughout both the psychological and industrial/psychological literature, positive reinforcers and positively valent outcomes are one in the same, especially operationally as defined by Vroom (1964) (i.e., a valent outcome is one which when made contingent on act \( i \) results in an increase in act \( i \)). Thus objectively the terms from the two paradigms are identical. But like Lewin (1938), Vroom (1964) and his successors (Mitchell, 1974) have held that it is not the objective environment which directly controls behavior, but one's cognitive interpretation of it, i.e., one's perceptions of a VR-2 schedule may or may not produce an \( E_2 \) perception equal to .50. For that reason expectancy theorists, as Lewin (1955) before them, rely upon verbal reports and questionnaires to tap these perceptions. At the same time, they believe that over time at least, subjective perceptions tend to match objective reality.

As Mawhinney and Behling (1973) and others (Berger et al., 1975; Yukl et al. 1972) have observed, a change from a CRF schedule to a VR-2 assuming perceptions of \( E_2 \) match objective probabilities, should result in a significant decrement to the value of force acting on a person to perform some response or act \( i \). In the original expectancy model presented by Vroom (1964) for example, such a change would cut the value of force in half resulting in a fifty percent reduction in motivational force or the contingent response rate. In the other models
there are other sources of force besides the contingent extrinsic outcomes, e.g., IV_a and IV_b, which might mean a less drastic prediction of response decrement from the CRF to VR-2 change. The values of these noncontingent outcomes can be measured by observing the rate of behavior before introduction of a contingent outcome, (the operant baseline in the operant conditioning paradigm). One might then establish such a baseline before introduction of some contingency between a response and a valent outcome, i.e., a schedule of reinforcement. If an experimenter first introduced a CRF and then a VR-2 with value of the valent outcome held constant and let baselines (steady states of response rates) develop under each condition, what predictions would be made about asymptotic response rates under each condition? This is the type of question addressed by Mawhinney and Behling (1973). And under these particular conditions, of course, the expectancy model predicts that whatever increase in rate of response occurred as a result of introducing the CRF schedule would be cut in half by a subsequent change to a VR-2 schedule, ceteris paribus. But this is contrary to the results of the operant conditioning research findings we have just reviewed. An almost identical procedure was used by Staats et al. (1964) with a preschool child as a subject. After initial conditioning on a CRF schedule the schedule was stretched until finally the child was responding faster on a VR-6 than on CRF for marbles as tokens for the purchase of toys.
Comparative Tests of Operant and Expectancy Theory Predictions in Simulated Work Environments

Organizational behaviorists appear to accept the facts upon which the principle of higher response rates from schedule stretching is based but question the applicability of the principle to adult subjects in a normal work setting. Thus their question has been "in accord with which theory or paradigm respectively, expectancy or operant, will the individual adult working on a normal task behave?"

There have been two attempts to address the issue reported in the literature of industrial/organizational psychology and organizational behavior.

Yukl et al. (1972) examined the effects of three schedule-magnitude of reinforcer combinations, $.25 CRF, $.25 VR-2, and $.50 VR-2, using three groups of five women each who worked for two weeks, one hour per day on an exam scoring task. The task was simple scoring of 25 item IBM answer cards from a psychology course in order to minimize the effects of ability and isolate motivation as the major factor in any differences in productivity. The subjects were hired through a university employment office for the ostensible purpose of accomplishing this clerical task. All subjects worked for $1.50 per hour for the first week, and then for $1.50 per hour for a second week with an additional $.25 or $.50 administered by the CRF and VR-2 schedules, with each group of five subjects receiving a different schedule of additional pay. The reinforcement schedules of the VR-2 groups were implemented by having each subject "call heads or tails" for a coin
flip by one of the experimenters who passed out and collected the work. If the subject correctly called the coin flip she was told that the E would write the extra payment on her time sheet and she would be paid later at the end of the two week period for which time pay checks would be made out. The following hypotheses were tested, the rationale for the operant portions of the hypotheses being derived solely from the animal studies of Ferster and Skinner (1957). These hypotheses were based upon a comparison of the operant principle of higher response rates from stretching from CRF to VR schedules and the expectancy model originally presented by Vroom (1964), i.e., the terms were related multiplicatively \( E_{ij} \times V_j = \text{Force} \) and intrinsic valences were not considered:

1. Production will be higher in the $.50 VR-2 group than in the $.25 VR-2 group.

2. Production in the $.50 VR-2 group will equal production in the $.25 CRF group.

3a. Production will be higher in the $.25 CRF group than in the $.25 VR-2 group.

3b. Production will be lower in the $.25 CRF group than in the $.25 VR-2 group.

The first week of the experiment was defined as the base period and the second the treatment period for each group. The hypotheses were evaluated by using a t-test of the differences among group gain scores; gain scores were based on the differences in performances during the base and treatment periods. The first hypothesis was supported at the .05 level and the others were not supported. The mean gain scores
were as follows for the three groups: $.50 VR-2 > $.25 VR-2 = $.25 CRF.

Berger et al. (1975) criticized Yukl et al. (1972) for use of inefficient statistical methods (and used instead of gain scores an analysis of covariance), for use of a coin-flip to implement the VR-2 schedules since it constituted a potential treatment (and used instead sealed envelopes to deliver reinforcers according to a random set of numbers for the VR-2), and for failing to measure expectancy perceptions of subjects concurrent with treatments (and administered questionnaires during early, middle, and late phases of treatments). Berger et al. (1975) also used a criterion of no "appreciable change" in response rates over three consecutive twenty minute time intervals for ending the hourly pay only period and treatment periods and $1.60 per hour wage. The task used by Berger et al. (1975) was coding of questionnaires from another research project. With these exceptions and consideration of additional hypotheses, the Berger et al. (1975) study was a partial replication of the Yukl et al. (1972) study. Berger et al. tested the following hypotheses:

Hypothesis 1
Performance for all groups will be higher in the incentive period than in the no-incentive period.

Hypothesis 2
Performance of all groups will increase over time within incentive periods.

Hypothesis 3
Within incentive periods there will be a reinforcement x time period interaction, in which performance of the two VR groups will increase more rapidly than will performance of the 25¢ CRF group.
Hypothesis 4
When differences in baseline performance have been controlled, performance in the 50¢ VR-2 group will be greater than performance in the 25¢ CRF group.

Hypothesis 5
When differences in baseline performance have been controlled, performance in the 50¢ VR-2 group will equal performance in the 25¢ CRF group.

Hypothesis 6
When differences in baseline performance have been controlled, performance will be higher in the 25¢ CRF group than in the 25¢ VR-2 group.

Hypothesis 7
When differences in baseline performance have been controlled, performance will be lower in the 25¢ CRF group than in the 25¢ VR-2 group.

Hypothesis 8
When differences in baseline performance and the effects of schedules of reinforcement have been controlled, expectancy theory variables will explain additional performance variation in the incentive period.

These hypotheses were drawn from the expectancy models discussed in Chapter I and the results have implications for the multiplicative and additive formulations. The first hypothesis was supported; this is a condition necessary in order to characterize the pay systems reinforcing for the performance of the groups studied. Using planned comparisons with a Type I error rate of .017 to maintain an experiment-wise error rate of .05, hypotheses three through seven were not supported and hypothesis two was trivially supported, i.e., it follows logically from hypothesis one. A multiple regression analysis of three time periods during the incentive periods with schedule effects partialled out produced one significant $\bar{R}$ of .83 across subjects. In terms of gains in performance Berger et al. (1975) indicated that the patterns were similar to those of Yukl et al. (1972) but as noted above, significance levels were lower.
Criticisms of Previous Studies

Since schedule stretching involves the orderly change from a more to a less dense reinforcement schedule (Skinner, 1969); the previous studies could not have addressed the issue since in each case the treatment designs were between groups. Thus no subject ever went from, for example, CRF to VR-2 regardless of the magnitude of the reinforcer. Staats et al. (1964) found that children may reduce rate of response if the change from CRF to a VR schedule is too great; response rate dropped with a change from CRF to a VR-6 for example. But an orderly progression from CRF to VR-2 to VR-4 and finally to VR-6 produced higher response rates on the VR-6 than on the CRF schedule (Staats et al., 1964). In the previous two experiments the subjects went, not from CRF to VR-2, but from hourly wages only to either $.25 CRF, $.25 VR-2, or $.50 VR-2. Thus, the basic procedure upon which the prediction of an increased response rate is predicated within the operant paradigm was not applied to the subjects in the studies by Berger et al. (1975) and Yukl et al. (1972). The higher response rates on VR schedules found by Staats et al. (1964) were achieved only after careful schedule stretching. Thus it remains to be determined whether or not the stretching procedure will produce higher response rates for adults on VR schedules.

Both Berger et al. (1975) and Yukl et al. (1972) suggested that the hypothesis of higher response rates on $.50 VR-2 compared to $.25 VR-2 is compatible with evidence from the operant paradigm. But in an operant experiment with pigeons magnitude of reinforcer was found to have no systematic relation to rate of response where only one operant response was studied by holding the schedule constant and
varying reinforcer magnitudes (Catania, 1963). If applicable to humans, these results suggest equivalent effects from a VR-2 with $.50 and $.25 reinforcers. The prediction of higher response rates on either of the two VR-2 schedules compared to the CRF remains, however, if it is assumed that there is no schedule by magnitude interaction. But the effects of VR-2 with $.25 and $.50 reinforcers should be approximately the same if magnitude has no effect.

Berger et al. (1975) and others (Hilgard & Bower, 1975; Mawhinney, 1975) have noted that the operant predictions refer to post-acquisition baseline response rates. In both of the previous studies, however, all responses within the treatment period for all subjects were aggregated for analysis. Assuming that some additional learning was involved in obtaining higher response rates, it can be argued that inclusion of acquisition responses might obscure the fact of increased response rates among some subjects and lack of such increases among others. That is to say, if the data analyzed were both acquisition and post acquisition, i.e., no distinctions between the two sets of data, two subjects could arrive at the same asymptotic rate while the aggregated data might indicate one was faster than the other because of a faster acquisition or the asymptotic rate of response. This same point has been made by Lounsbury, Arvey, and Malone (Note 2).
Lounsbury et al. (Note 2) have argued that the third hypothesis by Berger et al. (1975) (i.e., faster response acquisition on VR as opposed to CRF) is incorrect, and that in fact the rate of response acquisition predicated on data from operant analyses suggests that conditioning is faster on CRF than on VR schedules. But Skinner (1950) has shown that conditioning can take place with the occurrence of a single contingent reinforcement if the experimental task is simple and the subject well adjusted to the situation before conditioning begins. Thus the only difference one might expect in rate of response acquisition would be initial ability of the subjects. Given the fact that the tasks used by Berger et al. (1975) and Yukl et al. (1972) were simple and instructions were given on the tasks and payment systems for contingent pay, there seems no reason to predict differential rates of response acquisition other than differences which might result from differences in ability of the subjects.

Lounsbury et al. (Note 2) also argue that the use of instructions by the previous two research teams circumvented a true operant analysis since the subjects were told what the contingencies were rather than being shaped up to them by the contingencies per se. A pilot test for the current research revealed that whether or not instructions were used for a task similar to that of Yukl et al. (1972) made no difference whatever in response acquisition or discrimination of the reinforcement contingency. In addition, the instructions in these cases constitute $S_D$s which could be confirmed or refuted by the subsequent actions of the researchers. In both of the previous cases some form of consequence followed subjects' responses, coin-flip and
recording of payments due or receipt for money due in an envelope.

The question then is what were the reinforcers and were they reinforc-
ing for all of the subjects. Clearly many of the subjects in both
of the previous studies must have been reinforced if it is assumed
for the moment that the base periods were in fact base periods (i.e.,
that subjects were not still increasing response rates independent of
the introduction of the treatments when the treatments were started).
Otherwise we would have to seek another explanation for the higher
treatment period response rates. These experiments would therefore
appear to conform to predictions from the operant paradigm but with
larger units of behavior and environmental complexity. But this line
of argument raises another issue; were all of the subjects actually
reinforced by the payment systems?

Since neither Berger et al. (1975) nor Yukl et al. (1972)
examined their data on a subject by subject basis, they must have in-
ferred from the mean increases for their groups that all of the sub-
jects were reinforced by the application of the reinforcement schedules.
This is a dubious practice especially where there exists the potential
for an initial acquisition of a response on a VR schedule and then later
extinction. Ford and Mawhinney (Note 3 ) have presented a summary of the
arguments against such practices. And Mawhinney (1975) has noted that
it makes no sense to speak of a schedule of reinforcement for a person
for whom a contingent outcome is not reinforcing. Failing to examine
individual behavior patterns independent of the aggregate analysis,
therefore, provides a situation in which some people may be included
in the analysis when in fact they were not being reinforced by the
wouldbe reinforcement schedule.

Lounsbury et al. (Note 2) also argue that the previous studies actually involved the analysis of fixed ratio (FR-N) schedules since the subjects did more than one unit of work (e.g., tasks were comprised of some N sorts, checks, etc.) before taking the work (batch) into a supervisor for possible receipt of extra pay. While this logic can be applied in order to claim that the previous researchers mislabeled the schedules, an operant response need not be restricted to the narrow interpretation suggested by Lounsbury et al. (Note 2) according to Schick's (1971) recent review of the concept and definition of operant behavior. It is functional utility which is important in terms of whether or not the behavior unit selected is lawfully related to its consequences. Even so Zeller (1970) has shown that the set of responses on an FR-N schedule can be treated as a unit of operant behavior. And in a chain of responses and schedules (e.g., pick up a batch of work; go to work area; sort or file etc.; return work for possible reinforcer), the last one (in this case turning in a unit of work) and its schedule of reinforcement tend to control the entire chain (Findley, 1962; Kelleher, 1966). Thus, it can be argued that the behavior chain of sorting, checking, etc., was in fact controlled by the final unit of behavior (turning in completed work) and its schedule (CRF, VR, etc.). These studies were clearly not interspecies replications nor were they intended to be. At the same time they must incorporate features which make the manipulations in the applied laboratory setting
very similar to the operant laboratory set ups upon which their hypotheses were predicated. And in this regard it is true that the previous studies were not modelled after the literature used to generate the hypotheses since no reference was made to complex set ups with conditioned reinforcers and chains of behavior and reinforcers like those used by Staats et al. (1964). Yet the previous researchers did provide models which were comparable to the work of Staats et al. (1964) even though they were apparently unaware of this previous work.

Both Mawhinney (1975) and Lounsbury et al. (Note 2) have noted that in none of the animal studies have the subjects had access to a noncontingent source of the reinforcer during the stretching procedure. This is also true of the studies in which humans were used as subjects. Thus a major departure in the previous studies from the literature upon which the predictions of higher response rates on VR compared to CRF schedules is the use of $1.50 and $1.60 hourly wages by Yukl et al. (1972) and Berger et al. (1975). But this departure seems quite reasonable if one wishes to evaluate both the theoretical and practical significance of the procedure. It is truly a rare case when a person works strictly for a commission as opposed to some form of base pay plus commission or incentives in our industrial society. This departure from the original paradigms for comparing CRF and VR effects is not a problem unless one suspects that there is an interaction between one of the schedules and base pay and not the other. If base pay had the effect of differentially reducing the rate of response on CRF as opposed to VR schedules or vice versa a problem would certainly exist. But given no reason to suspect such an interaction,
i.e., assuming that noncontingent pay has the same effect on response rates on VR and CRF in combination with it, the hypothesis that stretching will produce higher response rates on VR than on CRF schedules still seems viable.

Hypotheses Indicated

In order to draw the hypotheses from the two theories, we must make certain assumptions about the conditions under which the two theories produce the differing conditions. The validity of these assumptions cannot be evaluated before hand, so they are accepted as true simply for the purposes of setting forth the hypotheses. After the data have been analyzed, those assumptions which are amenable to empirical verification can be examined in case one or the other theory is not supported, e.g., operant and expectancy theory predictions are both predicated on the contingent outcome of some act being respectively reinforcing and valent. The following assumptions state the conditions under which the hypotheses have been made:

1. Noncontingent source of the reinforcer effects VR and CRF schedules equally,

2. The consequences scheduled contingent on work responses produce significant reductions in time per response when initially made contingent on work responses,

3. Effort-performance (E₁) perceptions are unaffected by
reinforcement schedule, i.e., remain constant over time,

4. Performance-reward (reinforcement) perceptions ($E_2$) of the subject match the objective values of the different schedules (CRF and VR-2),

5. Perceived valences of extrinsic rewards (reinforcements) vary relatively with the objective values ($$.50 and $$.25),

6. The intrinsic valences of task accomplishment and task behavior ($IV_a$ and $IV_b$) remain constant from one schedule to another.

One final observation should be made before setting forth the research hypotheses. In this experiment subjects respond over extended periods of time. In the previous animal and human laboratory experiments level of deprivation has been found to significantly influence the effects of reinforcers (Staats et al., 1964). In the animal work these levels were held constant over time. This condition is not likely to hold in the present circumstance. In addition, Ferster and Skinner (1957) have observed that the response rates on reinforcement schedules tend to drift over extended periods of time. Thus the steady states observed might differ for the same schedule at temporally distant points in time due to either of these sources of variation, e.g., the exact level of response on a VR-2 in two different weeks might not be exactly the same. Thus the hypotheses are stated in such a way as to get at the differences in rates between CRF and VR-2 schedules which are temporally contiguous. The following hypotheses
conform to these conditions, the literature reviewed, and the assumptions above:

**Hypothesis 1**

Changes from $.25 CRF to $.25 VR-2 will result in increased response times, within-subjects, going from CRF to VR and decreased response times going from VR-2 to CRF.

**Hypothesis 2**

Changes from $.25 CRF to $.50 VR-2 will result in increased response times going from CRF to VR-2 and decreases for changes from VR-2 to CRF.

**Hypothesis 3**

Changes from $.25 CRF to either $.25 VR-2 or $.50 VR-2 will result in decreases in response times going from CRF to VR-2 and increased response times will result from changes from VR-2 to CRF.

The first two hypotheses are from the additive expectancy theory formulation used by Berger et al. (1975) (see Table 1) stated in terms of changes in response times from treatment to treatment and the third is from the operant model under the assumptions outlined above regarding magnitude effects. It should be noted that the hypotheses are stated in terms of response times as opposed to response rates because response time is the dependent variable. But response time is simply another way of expressing response rate since dividing average response time into 60 yields response rate, i.e., they simply change in opposite directions.
TABLE 1

EXPECTANCY THEORY PREDICTIONS OF RELATIVE RESPONSE RATES

Multiplicative Model

<table>
<thead>
<tr>
<th>Schedule</th>
<th>IVb</th>
<th>IVa</th>
<th>EI</th>
<th>EII</th>
<th>Valence of Contingent Pay</th>
<th>Motivational Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>25C-CRF</td>
<td>$k_1$</td>
<td>$k_2$</td>
<td>1.00</td>
<td>1.00</td>
<td>$.25</td>
<td>$.25 + $k_1 + k_2$</td>
</tr>
<tr>
<td>25C-VR2</td>
<td>$k_1$</td>
<td>$k_2$</td>
<td>1.00</td>
<td>.50</td>
<td>$.25</td>
<td>$.125 + $k_1 + k_2$</td>
</tr>
<tr>
<td>50C-VR2</td>
<td>$k_1$</td>
<td>$k_2$</td>
<td>1.00</td>
<td>.50</td>
<td>$.50</td>
<td>$.25 + $k_1 + k_2$</td>
</tr>
</tbody>
</table>

Note: $k_1$ and $k_2$ represent some arbitrary positive constants

Additive Model

<table>
<thead>
<tr>
<th>Schedule</th>
<th>IVb</th>
<th>IVa</th>
<th>EI</th>
<th>EII</th>
<th>Valence of Contingent Pay</th>
<th>Motivational Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>25C-CRF</td>
<td>$k_1$</td>
<td>$k_2$</td>
<td>1.00</td>
<td>1.00</td>
<td>$.25</td>
<td>$2.25 + k_1 + k_2$</td>
</tr>
<tr>
<td>25C-VR2</td>
<td>$k_1$</td>
<td>$k_2$</td>
<td>1.00</td>
<td>.50</td>
<td>$.25</td>
<td>$1.75 + k_1 + k_2$</td>
</tr>
<tr>
<td>50C-VR2</td>
<td>$k_1$</td>
<td>$k_2$</td>
<td>1.00</td>
<td>.50</td>
<td>$.50</td>
<td>$2.00 + k_1 + k_2$</td>
</tr>
</tbody>
</table>

Note: $k_1$ and $k_2$ represent some arbitrary positive constants

Table 1 adapted from Berger and Cummings (1974).
Methodological Improvements

Appropriate statement of the hypotheses provides the first step toward rectifying the shortcomings of the previous work on the issue of differing predictions. But a methodology compatible with these hypotheses must also be employed. Each of the previous studies was quite similar in several respects. There is a definite advantage to replications of this sort; the better aspects of the previous work being replicated and improvement being made in subsequent work permits one to estimate the possible significance of methodological differences on the conclusions drawn from the data. Thus, Berger et al. (1975) replicated the essential aspects of the Yukl et al. (1972) study with slightly different and improved methods of data analysis and treatment implementation. Though their results differed in a statistical sense, i.e., different levels of statistical significances, the directional similarities and differences in the two studies were strikingly similar. We see here the basic elements of a paradigm which may permit cumulative and comparable data from study to study. Thus it behooves us to replicate those features of the previous two studies, e.g., type of task, instructions etc., and to alter only those features which will bring about an improved attack on the hypotheses. Our re-statement of the hypotheses to conform to a within-subject analysis was a step in this direction.

In the experiment reported in the following chapter, there are distinct differences in methods as compared to the previous studies.
First the order of treatments is such that stretching can actually occur within subjects and groups. The order of treatments is counterbalanced so that any potential order effects can be estimated from the data from two groups receiving different treatment orders. Criteria for determination of whether or not contingent outcomes were valent and reinforcing for a subject have been set forth explicitly and the same is true of baseline steady state determination for the early phases of the experiment where learning might still occur. These criteria are based upon heuristics developed in the operant paradigm (Sidman, 1960). With these criteria it is possible to identify post-acquisition baselines so that only they are analyzed in the evaluation of the hypotheses. The data may also be analyzed using within and between group statistics since treatment orders for two groups were counterbalanced which permits an almost direct replication of certain aspects of the previous two studies. Perceptual measures were taken from subjects only after baselines were established and the subjects were paid to fill them out to prevent reactivity of the measures. Subjects filled out questionnaires tapping personality dimensions known to differentiate among people more or less responsive to CRF versus VR schedules just in case some such individual difference variable were found to be operative. Instead of working only one hour per day as in the previous two studies subjects worked three hours per day five days per week for four weeks, thus extending the tests to a half-time work situation; in most cases subjects worked a total of 57 hours.
With these changes in attack upon the question of differing predictions then, it is believed that much more definitive conclusions may be drawn regarding the nature and extent of the differences, the relative accuracy of the two models, and the significance of differing methodologies in determination of experimental findings. We turn now to consideration of the experiment.
CHAPTER II

EXPERIMENTAL METHODS AND RESULTS

Introduction

The proposed experiment is described in chronological order. The discussion of the experimental results is in the order developed for the hypotheses tests in the previous chapter except for consideration of assumptions amenable to empirical evaluation. Detailed consideration of the implications of findings are presented in the final chapter.

Subjects

An advertisement for students to work preparing research data for computer analysis was placed on the "Part-Time Temporary Employment" section of the bulletin board located in the Student Employment Office at The Ohio State University where it remained from June 19 to June 24, 1975. The advertisement directed the applicants to sign up for pre-employment interviews and testing by placing their names, social security numbers, and phone numbers on the sheet held by a member of the employment office staff who then informed the individual that she would be contacted by phone if she were to be considered for the job. While only females were to be called, both males and females were permitted to sign up for the interviews.

Of the 32 individuals who signed up for the interviews, 15 were female, 13 of whom appeared for the testing and interviews held
June 24 and 25, 1975. Each subject was seated in a cubicle similar to the one she would work in during the experiment should she be hired. Identical decks of 200 computer cards were on a desk in the cubicle as well as a sheet of task instructions (see Appendix A), a biographical data sheet, and the personality test forms (see Appendix C). The prospective subjects were asked to read the instructions along with the experimenter. They were told that these methods had been found to be most effective for the work and then told to complete the card decks as fast as they could if they had no questions. They were also told to bring the completed decks to the experimenter as soon as they were completed and then return to their desks. As each applicant completed the card deck and returned to her desk the experimenter went to her desk and asked that she fill out the biographical data sheet and personality inventories and bring them to the experimenter when finished. At that time the experimenter asked if the applicant was still interested in the job. Though the experimenter had determined whether the applicants could work either morning or afternoon in the telephone call inviting the applicant to take tests, this information was again confirmed. The applicant was then told that she would receive a call by the end of the week if she had been hired for the job. One applicant indicated that she would probably not accept the job if it were offered to her. The advertisement was then replaced in the employment office for another two days and three more females signed up, all of whom could work only the afternoon shift.

From the pool of 14 applicants only five indicated that they were free to work either the morning or the afternoon shifts.
Assignment of subjects to groups was accomplished in the following manner in order to approximate random assignment. The applicants' names were placed on a sheet of paper in no particular order except that all five applicants who were able to work either shift were among the first ten names on the list. A table of random numbers was then used to place a number next to each name. Applicants with odd numbers next to their names were assigned to the afternoon group and even to the morning group unless the number and their availability did not match; the applicants who could work only one shift were assigned to the shift only if their random number and shift restriction matched. Thus, the individuals with such restrictions cannot be said to have been randomly assigned to the two groups. At the same time, the assignment of these applicants was random within groups.

After the assignment had been made, the applicants assigned to the morning group were telephoned and asked if they knew any of those who were to be assigned to the afternoon group. The information was requested on the pretext that the experimenter could not seem to get in touch with these people and hoped that the applicant might know them. The real reason, of course, was to insure that they did not know anyone in the other group since the two groups would receive very different pay incentives initially with the possible result being feelings of inequity if the lower paid group were aware of the higher paid group's pay system. One such case was thus revealed and the assignments altered to place the two subjects in the same group.
On the first day of the experiment, one subject from the afternoon group informed the experimenter that she had another job. This information was received during the break between the morning and afternoon work shifts. The first individual reached by the experimenter in an attempt to replace the subject was one of the two remaining applicants who had not been interviewed. She arrived for testing and the interview shortly before the afternoon group was to begin the first day of work. Thus, she was given the ability test, personality tests, and interviewed as the afternoon session began. After completing the routine above, she was asked if she would like to begin work immediately, answered yes, and was given the same task instructions and introduction to the job as the others. Subject assignment to groups was random with the exception of these two cases.

**Task**

The task consisted of sorting through IBM computer cards and identifying error cards. An error card was one which had a six digit correlation (each card had six correlations placed in a field of ten spaces) with a misplaced decimal, a character letter instead of a number, etc. Accompanying each deck of 200 cards, which was defined as one unit of work, was a listing of all of the cards in the deck with the error cards underlined. Cards were also color coded and had to be sorted by color before a unit of work was considered complete. Examples of correct and error cards may be seen in Appendix A with the work instructions.
Variables

The variables measured included independent, dependent, and several control variables, i.e., variables which might help explain differential responses among subjects if response patterns departed from either or both theories.

Independent Variables

Three treatment conditions: 1) a $.25 CRF schedule of reinforcement, 2) a $.25 VR-2, and 3) a $.50 VR-2 were used. The schedules were operationalized by giving each subject a slip of paper which indicated that either $.50 or $.25 had been earned for a given unit of work (200 card deck of computer cards). Like the previous studies, the CRF was established by giving a slip of paper in lieu of the actual $.25 for every unit of work turned in. The VR schedules were operationalized in a fashion identical to that used by Berger et al. (1975), a minimum of 4 out of every consecutive 8 units of work was accompanied by an experimenter giving a slip of paper for either $.25 or $.50 depending on the value of the schedule. The slips were not placed in envelopes, however, as in the Berger et al. (1975) study, rather an experimenter simply placed it with the next card deck and indicated that it was for the one turned in.

Intervening perceptual constructs.—In the expectancy theory paradigm the environment, or independent variables above, are hypothesized to influence perception of $E_1$, $E_2$, $IV_a$, $IV_b$, and $V$ which then determine force to perform at a certain level. Thus they mediate between independent and dependent variables. They were measured with the same 5 items
reported by Berger et al. (1975) (see Appendix B) though measures from other experiments were also collected.

**Dependent Variables**

The dependent variable was time spent for each unit of work completed. It was measured in terms of the difference between the time when the unit of work was picked up from one of the experimenters and the time returned to the pickup point. Any personal time taken was not included in calculating time per unit of work or response time. Thus there was a measure of the time taken for every unit of work done by every subject.

**Control Variables**

During the preemployment interviews, information on the age, educational level, ability, and personality of each subject was collected. The questionnaires and personality measures may be seen in Appendix C. The measure of ability was the time each subject took to do a single 200 card deck (the task) as fast as she could doing the work she would be doing if hired for the job. The speed with which one might complete the card sorting task might be improved by giving up quality, i.e., a person might simply find only a portion of the errors before turning in the work. By the same token high accuracy might preclude quick performances. Since concern here was for only one dimension of performance, output or response time, the task had been designed to control for quality by giving subjects enough information so that all errors could be found. This involved providing a
listing of all of the cards in each deck with error cards underlined and the total number of error cards written in at the top of each sheet. Thus subjects had no reason for not finding all errors in every deck. In addition, all instructions ended with an emphasis on quality of performance in terms of error finding.

**Setting**

Subjects worked in a well-lighted, air conditioned office complex containing eight cubicles measuring approximately 6 x 8 feet each. Each cubicle contained a metal desk, a well-cushioned fabric covered swivel chair, and a metal file cabinet and book case. The cubicles opened onto a common aisle which led to an anteroom and exit door. A table measuring 3 x 8 feet and a small table measuring 2 x 4 feet were arranged in an L-shaped pattern in the anteroom area. A file cabinet and a very large stack of computer card boxes were located behind the tables in this area. Two experimenters sat behind the tables in this area; the tables were also covered with computer boxes and computer listings.

**Procedure**

Groups of five subjects reported to work at either 9 a.m. or 2 p.m. June 30, 1975. Introduction to the job included reminders that the project director was concerned primarily with accuracy of the work and that the task instructions (which were still on the desks) should be reread before beginning work. In addition, the subjects were
told that it was extremely important that they handle the computer cards with care since bent or otherwise damaged cards would not go through the computer card reader. They were admonished not to write on the computer listings since there would be others who would review their work from time to time and these people would also need to use the sheets. Since boxes of cards would be rotated approximately five times during the experiment the subjects were told that they might see the same errors numerous times since the errors were produced by a machine which had made the same errors more than once.

During the pre-employment interviews and when asked to take the job, subjects had been told that they would not be paid until the project was completed and were so reminded on the first day of work. Experimenter I, who gave the above introduction, explained that his role was simply to coordinate the work of the subjects with that of others involved in the project (the author played this role). Experimenter II was described as in charge of the actual work of the subjects and that they were to pick up and return their card decks to him. Experimenter II was, in fact, hired for this purpose. During the experiment, both Experimenters I and II worked at counting the error cards found by the subjects and replacing them in the card decks and shuffling them for reuse. Much of the time Experimenter I worked at making computer listings for the card decks which were replaced after the second week of the experiment. In addition, he recorded the times taken by each subject to complete card decks in minutes and quarter minutes using a wrist watch concealed in a partially opened box of computer cards in front of him. Experimenter II kept track of the card decks each subject worked on and the order
in which cards were checked. This was simplified by using two boxes of nine card decks for each of the five subjects per group. He also managed the rotation of the card boxes to insure that each subject was systematically exposed to all of the card boxes during the experiment. Experimenter II was blind to the experimental hypotheses.

**Breaks and Social Interaction**

Because the subjects were required to work for three hour periods, provision was made for breaks. During the introduction to the job, subjects were told that they would be permitted to take ten minute breaks each day according to a schedule which would be posted daily. They were informed that the project director's only major concern was that only one person be out of the room at a time. They were reminded that they would be free to work through without a break if they liked. Each day, the subjects' names were randomly assigned to ten minute break periods between 10:00 a.m. and 11:00 a.m. or between 3:00 p.m. and 4:00 p.m.

**Noncontingent Baseline and Treatment Baseline Determination**

The subjects in each group worked three hours per day for six days before the series of treatments in Table II were begun. Experimenter I computed the average time per card deck over the entire period and the standard deviation for that average plus the average of the last three responses per period; the first treatment began after the last overall mean and mean of the last three responses were either within ten percent of the previous period means or were within
### TABLE 2

**TREATMENT ORDERS AND TIME PER TREATMENT**

<table>
<thead>
<tr>
<th>Periods</th>
<th>1 through 6 (18 hrs.)</th>
<th>7-9 (9=Baseline)</th>
<th>10-12 (12=baseline)</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
</tr>
</thead>
</table>

**Group I (9:00 a.m.)**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Hourly pay only</th>
<th>Hourly plus:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>($2.00 per hr.)</td>
<td>$ .25 CRF (A₁) $ .25VR-2 (B₁)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A₂ B₂ A₃ C₁ A₄ C₂</td>
</tr>
</tbody>
</table>

**Group II (2:00 p.m.)**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Hourly pay only</th>
<th>Hourly plus:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>($2.00 per hr.)</td>
<td>$ .25VR-2 (B₁) $ .25 CRF (A₁)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B₂ A₂ C₁ A₃ C₂ A₄</td>
</tr>
</tbody>
</table>

Each period was three hours in length and periods 9, 12, and 13 through 14 were baselines. Treatment C was Hourly pay plus $.50 VR-2. Phase I was periods 7 through 14 and Phase II was periods 15 through 18.
ten percent of one of the means prior to that. Thus the means for the final period were compared to all of the previous means and the treatments began only when the last period means were within ten percent of one of those period means including the one just prior as indicated in the initial criterion. This criterion was then applied to the next two treatment conditions for the two groups with two exceptions (subjects 5 and 12).

The ten percent criterion was used to assure against beginning the treatments when the subjects were still learning the task. Past studies had been criticized on the grounds that they may not have had true steady state baselines. Thus changes in performance could be attributed to the learning which began in the base period and continued into the treatment periods.

Selection of the ten percent criterion was not entirely an arbitrary choice. In a pilot test with a single subject, the subject responded for extended periods of time under several of the actual conditions of the experiment. Known periods of stable steady states of various levels were analyzed to determine what decision rule in terms of a required change in response time would correctly indicate when there was no change and when there was a change due to treatment rather than daily fluctuations in response times. For this subject the ten percentage change criterion so discriminated. As a possible estimate of experimental error it was considered conservative since smaller percentages permitted discriminations between treatment level differences in response times.
The rationale for the procedures used to select the criterion have been discussed in detail by Sidman (1960). And it must ultimately be admitted that the selection of the criterion involves a judgment on the part of the experimenter regarding his best estimate of the typical level of experimental error in his particular laboratory setup. But within-subjects under the current circumstance there was no alternative estimate of error variation for each subject since N=1 in each case.

Examination of the data after 18 hours noncontingent responding revealed a great deal of variation of responses. Variability was reduced for most subjects once the extra money treatments began and very stable response rates occurred within single treatment sessions. The above criterion was waived in two cases. Subjects 5 and 12 exhibited reductions in response rates during the last session of treatment 3 which were believed to represent method variances. Post experimental interviews revealed that these were in fact cases of method variance rather than alterations of the motivational states of the subjects. With two exceptions then, the baselines for subjects under treatments 2 and 3 of Table II satisfied the above criterion. And it was the use of this criterion with daily inspection of fine-grained response patterns which permitted the experimenters to identify these cases at all.

The logic of the treatment design, ABAB, and ten percent criterion for changes is that if there are reversals in mean performance levels with greater than ten percent (estimate of error variance) changes which are systematic, the treatments are responsible for
the observed changes and the experimenter has demonstrated control over the behavior which he analyzed. A **multiple schedule** (one in which two reinforcement schedules are alternately applied in ABAB fashion) of CRF and VR-2 with $.25 reinforcers lasting three hours or one period each was implemented for the remainder of the first portion of the treatments (treatments 4 and 5) and the procedure was continued for the treatments involving $.25 CRF and $.50 VR-2. All treatments were introduced by a brief description of the reinforcement schedule which was to be used; this constituted the correlated stimuli referred to in the description of the multiple schedule by Ferster and Skinner (1957), i.e., in the multiple schedule the onset of each change of schedule is correlated with a change in an observable stimulus which serves to signal the onset of the new schedule. During this phase of the experiment, based upon concurrent analyses of the previous patterns over 18 hours of noncontingent and 18 hours of contingent responding by subjects, it was concluded that baseline response rates were achieved within each of the three-hour treatment periods. By "Baseline" is meant a stable pattern of responding without clear increases or decreases in rate of response. The two cases of method variance for subjects 5 and 12, and a subsequent case of method variance for subject 13 serve to verify the correctness of this assumption (see Table 5 for data on these subjects and footnotes regarding method variance).
Questionnaire Procedure

Subjects were informed before each questionnaire administration that they would be paid whatever rate of extra pay they were working for when they filled out the questionnaires and the money would be certain in the case of subjects on the VR schedules. A pilot study revealed the fact that filling out questionnaires had an effect on the rate of subsequent responses when not accompanied by pay and no effect when pay in the amount of the contingent pay was given for filling out the questionnaire. In addition they were told that neither of the Es would see the questionnaires which subjects placed in a plain brown envelope on the central work table and then picked up a slip for the money owed them for the questionnaire.

The questionnaires were initially administered in the final few minutes of each treatment period for periods 9, 11, and 12. But subjects 2 and 13 placed zeros in response to item 1 which tapped $E_2$ perceptions. Since unfinished card decks were picked up whenever a change in treatments occurred, it was suspected that these subjects might have known that they would not finish the decks and thus not be paid for them. So the procedure was changed to administer the questionnaires so that at least one more deck of cards would be finished after the questionnaire was completed. Subject 2 was unaffected by the change and subject 13 correctly estimated the probabilities from then on. But she had placed a 1 in response to item 1 on the very first administration suggesting that procedure was not what produced her responses. In any event the change had no observable effect on any of the subjects.
Introduction of Experimental Treatment in General

The contingent reward period was introduced in a manner similar to that used by Yukl et al. (1972). Subjects were told that the Bureau of Business Research had appropriated funds to study the effects of various pay systems on the satisfaction of part-time temporary employees on several jobs on campus. Experimenter I introduced the topic and explained that the offer had been accepted since it would mean more money for them and all they had to do was fill out some questionnaires for which they would be paid (see Appendix E for full text). They were reminded that Experimenter I and his superior were still concerned about errorfree work, so they should continue to be accurate.

Conclusion of Experiment

On the day following treatment 9 the subjects were informed that there would be no more extra money but that they were to continue working. After approximately one and one-half hours subjects were told to stop work and asked to fill out Part I of the questionnaire in Appendix D. When completed, they returned it and picked up Part II and filled it out. After all of the subjects had filled out these questionnaires, they and Experimenters I and II went into an adjoining seminar room where the exact purpose of the project was revealed. In addition, questions regarding method variances, etc., were discussed as were the various deceptions which were used. Subjects were assured that they would not be personally identified with any of the data from the project and would receive their checks by mail.
Analysis

The analysis included an evaluation of the following:

1) relative homogeneity of the two groups, 2) whether or not the contingent extra pay was valent and reinforcing for subjects on a subject by subject basis 3) the hypotheses using only subjects for whom the contingent pay was reinforcing and valent and were present for all of the treatment conditions, 4) the correlations between changes in perceptions and response times, 5) effects of treatment order, and 6) the effects on conclusions from analysis of aggregated data versus data from baseline periods only.

Homogeneity of Groups

Since there was some question regarding differences among subjects assigned to different treatments, the significance of differences among groups on the dimensions of age, educational attainment (in quarters), ability, and personality was tested using the Mann-Whitney U test (Siegel, 1956). This nonparametric test requires no assumptions about the population distributions from which the two samples might have been drawn. The test was applied to the sample both before and after subjects had been eliminated for various reasons.

Evaluation of Contingent Outcomes

The expectancy and operant predictions of performance differences under differing conditions of pay require that the pay be respectively valent and reinforcing. If pay were not, then it would make
no sense to attempt to evaluate the differing predictions. Only those subjects for whom the contingent pay systems were valent and reinforcing, of course, can be used in analyses of the predictions. Thus the analysis was conducted on a subject by subject basis using the following criterion. The dependent response was defined as time spent per unit of work on the task described in Appendix A. The mean and standard deviation of the distributions of response times for each 3 hour work day was computed. The post acquisition mean then was the last period of responding to the first treatment of contingent pay, i.e., the first baseline response time for each subject. This time was compared to the lowest mean response time of the six periods of noncontingent pretreatment work. The contingent pay system was considered valent or reinforcing if the post acquisition mean was 10 percent or more lower than the lowest mean period of noncontingent responding. The ten percent criterion was again selected because of our a priori assumption of the probable experimental error variation. If the individual error variation was similar across subjects, it was reasoned, a group statistic should provide results similar to one based on each subject. Thus the significance of the number of subjects being reinforced out of a total of ten subjects was tested using the Binomial test (Siegel, 1956). Then the changes in means from noncontingent to contingent baseline responding were tested for significance using a matched t-test which is a common test for evaluation of within sample changes between treatments (Blalock, 1960).
Evaluation of Hypotheses

The hypotheses were evaluated in the following manner. The post-acquisition rate of response for each subject (baseline response time) for each consecutive treatment period was compared in terms of the percentage change from the previous period. For example, with the exception of subjects 5 and 12 the mean time per card deck for period 9 was subtracted from that of period 12 and then divided by the period 9 mean yielding a value of the percentage change from period 9 to period 12 with the sign of the change (− indicated that less time was taken per deck in period 12 than in 9 and vice versa for a + change). The changes were classified as a + if they were positive and equal to or more than 10 percent. Likewise decreases of −10 percent or more was classified as a − change. Those changes which were less than 10 percent in either direction were classified as $ or null with respect to change. The pluses and minuses are hereafter referred to as "significant" changes and the null as "nonsignificant" changes. They always appear in quotes to avoid confusion with the more traditional notions of significance.

Since the experiment involved a sequence of treatments in ABAB fashion (with A=CRF and B=VR-2) and BABA for the two groups (group I and II respectively) there were at least three comparable change scores for each subject with the signs having opposite directions for the two groups as noted below:
Hypothesis 1: Expectancy Theory ($.25 reinforcers)

Group I CRF to VR = -10%, VR to CRF = +10%, CRF to VR = -10%

Group II VR to CRF = +10%, CRF to VR = -10%, VR to CRF = +10%

Hypothesis 2: Expectancy Theory ($.25 CRF and $.50 VR-2)

Group I CRF to VR = -10%, VR to CRF = +10%, CRF to VR = -10%

Group II VR to CRF = +10%, CRF to VR = -10%, VR to CRF = +10%.

These hypotheses cover the entire experiment and are related to what is now termed Phase I and Phase II of the experiment. Phase I is the comparison of $.25 CRF and $.25 VR-2 and Phase II is the comparison of $.25 CRF and $.50 VR-2. Phase II involves comparisons of treatments for groups I and II in ACAC and CACA order respectively (where A = $.25 CRF and C = $.50 VR-2). The first phase of the experiment was analyzed by comparing changes from periods 9 to 12, 12 to 13, and 13 to 14. The second phase was analyzed by comparing changes from periods 15 to 16, 16 to 17, and 17 to 18. The operant hypothesis was evaluated in exactly the same manner as the expectancy theory hypotheses except the signs on each of the changes predicted in hypothesis 1 and 2 would be opposite in hypothesis 3. That is to say whenever there is a predicted increase from expectancy theory there is a predicted decrease from the operant paradigm. For a hypothesis to be supported the number of subjects exhibiting the patterned changes in accord with the hypothesis would have to be such that it was not likely to have occurred by chance as computed with the Binomial test (Siegel, 1956) using the traditional .05 level. For purposes of description the Binomial probability was also computed for each case of a change, e.g., from period 12 to 13, etc.
Correlation Analysis

If assumptions 3 through 6 from Chapter I were not satisfied, i.e., if they were not valid for the sample, it would be possible for the expectancy theory to be judged inadequate even though not the case. If the changes in direction were not in accord with those predicted but the values of motivational force also varied with these changes, expectancy theory would be predicting concurrently these changes but not those predicted under the assumptions in Chapter I. In order to rule out this potential bias against the expectancy theory, the percentage changes in the sum of each subject's responses to items 1 through 5 of the questionnaire in Appendix B, which tapped perceptions of $IV_a$, $IV_b$, $E_1$, $E_2$, and $V$, were computed for the seven possible changes from eight treatments in the same manner as the percentage changes in performance had been computed. The signs on the changes in performance were changed so that a positive correlation would indicate that changes in the motivational force were directly related to changes in performance (i.e., before this change reductions in response times and increases in force would give a negative correlation but a reduction in response time is actually an increase in response rate). Spearman's Rank Order Correlation Coefficient (Siegel, 1956) was used for these computations since it requires only ordinal data. A further analysis was conducted to determine whether or not some factors related to individual differences also related to differences in these correlations by correlating the motivational force-performance correlations with the variables age, education, ability and personality.
Evaluation of Treatment Order Effects

Since the operant predictions are based on a particular treatment order, i.e., stretching involves a change from CRF to VR, it would be possible for the order of treatments for Group II to be biased against the operant predictions. In order to evaluate this potential bias, the means and standard deviations for all of the subjects in each of the groups were used to provide a group mean and standard deviation for each treatment condition. And since time and treatment order were confounded within groups, the means for both groups had to be compared for each phase of the experiment as well as on a period by period basis. No statistics were used since the groups tended to diverge in terms of response times apparently due to ability differences and the many hours of baseline responding meant that these means alone were representative of the groups for the periods considered, i.e., we observed all of their behavior and not just a sample of it for each group.

In addition, the percentage of difference between group response times on VR and CRF using CRF as base were computed for each phase of the experiment and for all CRF and all VR response times.
Evaluation of Inappropriate Baseline Estimates

In order to investigate the possibility of differential results from alternative experimental periods, a type of between group time series analysis was used to compare change scores between groups in a fashion similar to that used by Yukl et al. (1972) but using several lengths of time, i.e., 1, 2, and 3 periods of treatment. Campbell and Stanley (1963) present the notion of a time series experiment as a series of observations before and after some experimental intervention (X): 000X000 where 0 = observations before the treatment and after it with equal observations before and after X the intervention which may be momentary or continue on. In this phase of the analysis difference scores were calculated (raw as opposed to percentage change scores) for each of the two groups for mean response time changes from periods 6 to 7, periods 5 and 6 to 7 and 8, and periods 4, 5, and 6 to 7, 8, and 9, and finally just period 6 to 9 (under the assumption that period 6 was as good a measure of pretreatment responding as any period and perhaps better because it was temporally the closest to the post-acquisition period 9). Since each period was three hours in length, the comparison of periods 5 and 6 to 7 and 8 provided the closest approximation to the Yukl et al. (1972) experiment since their experiment was characterized by five hours each of pretreatment and treatment condition. The only other difference between the current analysis and Yukl et al. (1972) was that the data were collected in a four day period in this case while it took Yukl et al. (1972) ten days because subjects worked for only one hour each day.
Summary

The analysis employed in this investigation was designed to test several experimental hypotheses or observational predictions with a methodology appropriate to those hypotheses. Thus both intra-subject, within-group and between-group tests were utilized to test the hypotheses and the assumptions upon which they were predicated. In addition it was possible to evaluate the probable effects of conducting experiments in which baselines have not been adequately established. For these reasons, conclusions regarding both theoretical, practical, and methodological issues may be considered in the discussion in Chapter III.
Results

The experimental results are reported in the order described in the analysis section of the previous chapter. The implications of the findings are not considered in this chapter; the evidence is simply presented. The implications and limitations of the findings are considered in the following chapter.

Homogeneity of Groups

The attempt to generate two comparable groups of subjects based on a random assignment procedure was hampered by the small number of subjects who were able to work either morning or afternoon and the necessity of replacing one subject who declined the job at the last moment after having previously accepted the job by phone. These assignment limitations represent a problem only if they biased the samples on some important characteristic. Between group comparisons, for example, would make little sense if the groups differed significantly on the ability dimension. A summary of group character in terms of age, educational level, ability, and personality is provided in
Table 3. The only dimension on which the groups approach significant differences is educational attainment (quarters of college completed) and that difference appears to result from a single subject in Group II. Without this subject the significance level decreases to .412. Thus the initial groups appear to be rather homogeneous with respect to these dimensions.

One subject was eliminated from the sample because she did not meet the criterion of responsiveness to the contingent outcomes (subject 2) and subject 15 was absent for a significant portion of the experiment beginning with period 12. Subject 2 was not reinforced by the treatments and data for subject 15 were not comparable to the data of other Ss due to her absence. The effect of dropping these two subjects from the samples was to further increase the homogeneity of the groups and decrease the significance levels for age and education to .24 and .44 respectively. But the groups then differed more in terms of ability, locus of control, and extraversion, with significance levels of .17, .34, and .17 respectively. Thus the groups finally used for the analyses of hypotheses tended to differ in terms of ability with means of 51.16 and 38.81 respectively for groups I and II, and extraversion with means of 11.25 and 9.5 respectively for groups I and II. Thus Group II was higher in ability and more introverted than Group I initially though not statistically significant in differences. Elimination of these two subjects makes description of the resulting groups as randomly assigned a dubious argument.
## TABLE 3

**SUMMARY OF INDIVIDUAL AND GROUP CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Group I Subject</th>
<th>Age</th>
<th>Education in Quarters</th>
<th>Ability in Time Per Deck</th>
<th>Personality Extraversion</th>
<th>Locus of Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>20</td>
<td>9</td>
<td>30.00 Min.</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>02</td>
<td>22</td>
<td>6</td>
<td>30.16</td>
<td>8</td>
<td>16</td>
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<tr>
<td>03</td>
<td>19</td>
<td>3</td>
<td>60.50*</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>04</td>
<td>22</td>
<td>12</td>
<td>55.66</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>05</td>
<td>20</td>
<td>9</td>
<td>58.50*</td>
<td>8</td>
<td>14</td>
</tr>
</tbody>
</table>

**Group I Means**

<table>
<thead>
<tr>
<th>Age</th>
<th>Education in Quarters</th>
<th>Ability in Time Per Deck</th>
<th>Personality Extraversion</th>
<th>Locus of Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>(20.25)</td>
<td>(8.3)</td>
<td>(51.16)</td>
<td>(11.25)</td>
<td>(9.75)</td>
</tr>
</tbody>
</table>

**Group II Subject**

<table>
<thead>
<tr>
<th>Age</th>
<th>Education in Quarters</th>
<th>Ability in Time Per Deck</th>
<th>Personality Extraversion</th>
<th>Locus of Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>22</td>
<td>8</td>
<td>32.60 Min.</td>
<td>8</td>
</tr>
<tr>
<td>12</td>
<td>24</td>
<td>18</td>
<td>34.16</td>
<td>11</td>
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<tr>
<td>13</td>
<td>21</td>
<td>9</td>
<td>56.00</td>
<td>12</td>
</tr>
<tr>
<td>14</td>
<td>21</td>
<td>12</td>
<td>32.50</td>
<td>7</td>
</tr>
<tr>
<td>15</td>
<td>24</td>
<td>12</td>
<td>71.66</td>
<td>10</td>
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</table>

**Group II Means**

<table>
<thead>
<tr>
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<th>Education in Quarters</th>
<th>Ability in Time Per Deck</th>
<th>Personality Extraversion</th>
<th>Locus of Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>(22.00)</td>
<td>(11.75)</td>
<td>(38.81)</td>
<td>(9.5)</td>
<td>(10.0)</td>
</tr>
</tbody>
</table>

**Difference of Means**

| 1 - II | -1.8 | -4.0 | 1.58 | 1.0 | 1.0 |

**Mann-Whitney U**

| 5 | 3 | 11 | 9 | 9 |

**a Level for Two Tailed Test**

| .15 | .056 | .842 | .548 | .548 |

*These two subjects made errors on their first ability tests and were retested at which time no errors were made. Their ability scores are the means of the time taken for the two trials. Means with subject 02 from Group I and subject 15 from Group II omitted in parentheses.
Results of Contingent Outcome Analysis

The results of the analysis of the effects of the promise of contingent extra pay as the percentage difference between lowest mean response time for any noncontingent period compared to the final period of the first contingent pay treatment are summarized in Table 4. With the exception of one subject, the introduction of extra pay contingent upon performance was a valent outcome or reinforcing for the subjects according to the criterion of 10 or more percent change in response time. Thus the sample was reduced from 10 to 9 in number on this account and finally to 8 due to the absences of subject 15. The Binomial $p\left(x \geq 9\right) < .0003$ suggests that the changes where not likely to have occurred by chance alone where $P = 1/3$, $Q = 2/3$ and $N = 10$. The mean difference score was $-4.358$ and the $t = 5.75$ resulted in a one tailed $p < .0005$ suggesting that the similar results obtain from both methods of considering error variance, i.e., the heuristic of 10 percent change subject by subject and the summary across subjects. Since the design is within subjects and the two statistics yield similar results across subjects, the 10 percent criterion and methods discussed in the previous chapter seem to be a valid approach to testing the hypotheses.
TABLE 4

EVALUATIVE DATA ON REINFORCING EFFECTS OF PROMISE
OF CONTINGENT MONEY

<table>
<thead>
<tr>
<th>Subject</th>
<th>Lowest Average for Noncontingent Period</th>
<th>Averages for First Three Contingent Periods</th>
<th>IIC Minus I Difference</th>
<th>Ten Percent of I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>14.95</td>
<td>13.08</td>
<td>11.12</td>
<td>-4.28</td>
</tr>
<tr>
<td>02</td>
<td>22.92</td>
<td>18.50</td>
<td>21.44</td>
<td>-2.13</td>
</tr>
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<td>03</td>
<td>21.38</td>
<td>17.45</td>
<td>16.65</td>
<td>-2.47</td>
</tr>
<tr>
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<td>19.00</td>
<td>15.42</td>
<td>11.47</td>
<td>-8.14</td>
</tr>
<tr>
<td>05</td>
<td>24.50</td>
<td>24.89</td>
<td>21.75</td>
<td>-3.07</td>
</tr>
<tr>
<td>11</td>
<td>13.77</td>
<td>12.78</td>
<td>11.48</td>
<td>-2.46</td>
</tr>
<tr>
<td>12</td>
<td>14.64</td>
<td>11.65</td>
<td>12.14</td>
<td>-2.56</td>
</tr>
<tr>
<td>13</td>
<td>23.56</td>
<td>14.25</td>
<td>13.54</td>
<td>-8.61</td>
</tr>
<tr>
<td>14</td>
<td>12.39</td>
<td>8.43</td>
<td>8.76</td>
<td>-4.05</td>
</tr>
<tr>
<td>15</td>
<td>32.50</td>
<td>19.07</td>
<td>18.79</td>
<td>-5.81</td>
</tr>
</tbody>
</table>

* Subject 02 is the only subject for whom the effect of contingent money was not reinforcing by the criterion used. Her difference from column III is 0.162 percent below the required ten percent which is 7 percent of the ten percent criterion.
Hypotheses Tests

The response times as means per period, standard deviations, and mean of the final three responses per period are presented in Table 5. Changes in response times as a percentage of the previous period mean response time and sign indicating direction of the change are presented in Table 6. In Table 7 the percentage changes are interpreted and summarized in terms of the predictions from each of the theories. A 0 following a percentage change score in Table 7 indicates that the change was in accord with the operant prediction and a V after it indicates a change in accord with an expectancy prediction. If in addition to the letter there is also an asterisk (*) (e.g., +.10 V) the change was considered "significant."

Inspection of Table 7 reveals that for the eight subjects included in the analysis of hypotheses tests, none had the required pattern of three "significant" changes in a row in either Phase I or Phase II of the experiment which was in accord with either theory. Thus the hypotheses from neither theory are clearly supported.

Inspection of the first two columns of summary data in Table 7, however, indicates that of the changes that were "significant," twice as many were in accord with the operant as those in accord with the expectancy theory predictions. Disregarding the 10 percent criterion and looking only at "nonsignificant" changes there are about as many in accord with each theory, 24 and 30 for operant and expectancy respectively. Thus, the hypothesis that the observed patterns of
<table>
<thead>
<tr>
<th>Day and Condition</th>
<th>01</th>
<th>02</th>
<th>03</th>
<th>04</th>
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<td>M</td>
<td>SD</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>2.61</td>
<td>21.83</td>
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</tr>
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<td>4.11</td>
<td>18.42</td>
<td>32.94</td>
<td>9.81</td>
</tr>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>13.08</td>
<td>1.56</td>
<td>13.00</td>
<td>18.50</td>
<td>4.31</td>
</tr>
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<td>2.05</td>
<td>10.83</td>
<td>20.79</td>
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</tr>
<tr>
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</tr>
<tr>
<td>10</td>
<td>9.49</td>
<td>.98</td>
<td>9.83</td>
<td>19.84</td>
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</tr>
<tr>
<td>17</td>
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<td>6.33</td>
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<td>3.51</td>
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<tr>
<td>$.50 VR-2</td>
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</tr>
<tr>
<td>18</td>
<td>7.69</td>
<td>.95</td>
<td>7.92</td>
<td>21.00</td>
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</table>
TABLE 5 (Continued)

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<th>15</th>
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<tbody>
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<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Noncontingent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>6.55</td>
</tr>
<tr>
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<td>18.17</td>
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<td>12.14</td>
<td>3.29</td>
</tr>
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<td>2.98</td>
<td>11.33</td>
<td>12.08</td>
<td>2.02</td>
</tr>
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<td>10.44</td>
<td>2.80</td>
<td>9.67</td>
<td>11.00</td>
<td>1.59</td>
</tr>
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<td>2.46</td>
<td>9.00</td>
<td>8.71</td>
<td>1.69</td>
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<td>10.33</td>
<td>9.43</td>
</tr>
<tr>
<td>$.25 CRF</td>
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<td>10.80</td>
<td>3.50</td>
<td>10.75</td>
<td>9.47</td>
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<td>1.45</td>
<td>8.75</td>
<td>8.23</td>
</tr>
<tr>
<td>$.25 CRF</td>
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<td>9.79</td>
<td>1.93</td>
<td>9.83</td>
<td>7.84</td>
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<tr>
<td>$.50 VR-2</td>
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<td>2.51</td>
<td>14.00</td>
<td>8.07</td>
</tr>
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<td>19</td>
<td>11.63</td>
<td>2.67</td>
<td>13.50</td>
<td>9.07</td>
</tr>
</tbody>
</table>

Subject 05 made an error on these days and reworked batches. Subject 02 was absent (sick) day 18. This decrease was due to method variance. Subject 05 did less than 3 batches on these days. Subject 05 absent (job interviews). This decrease result of method variance.
### TABLE 6

**PERIOD TO PERIOD CHANGES IN RESPONSE TIMES AS A PERCENTAGE OF PRIOR PERIOD**

<table>
<thead>
<tr>
<th>Period - Period</th>
<th>Subject 01</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
</tr>
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<tbody>
<tr>
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<td>-.13</td>
<td>.04</td>
<td>-.27</td>
<td>-.07</td>
<td>-.07&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-.14</td>
<td>-.09&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-.32</td>
<td>+.12</td>
<td>-.27&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>13 - 12</td>
<td>+.008</td>
<td>-.19</td>
<td>+.10</td>
<td>-.10</td>
<td>+.04</td>
<td>+.12</td>
<td>+.08</td>
<td>-.19</td>
<td>-.22</td>
<td>----&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>14 - 13</td>
<td>+.05</td>
<td>+.19</td>
<td>-.03</td>
<td>+.05</td>
<td>+.08</td>
<td>-.007</td>
<td>+.004</td>
<td>-.07</td>
<td>+.06</td>
<td>----</td>
</tr>
<tr>
<td>15 - 14</td>
<td>-.08</td>
<td>+.05</td>
<td>+.33</td>
<td>-.07</td>
<td>-.07</td>
<td>-.22</td>
<td>-.13</td>
<td>+.21</td>
<td>-.10</td>
<td>----</td>
</tr>
<tr>
<td>16 - 15</td>
<td>-.03</td>
<td>-.09</td>
<td>-.30</td>
<td>+.13</td>
<td>+.01</td>
<td>+.16</td>
<td>-.05</td>
<td>-.07</td>
<td>+.08</td>
<td>----</td>
</tr>
<tr>
<td>17 - 16</td>
<td>-.14</td>
<td>+.05</td>
<td>-.04</td>
<td>-.09</td>
<td>-.03</td>
<td>+.06</td>
<td>+.03</td>
<td>-.19&lt;sup&gt;d&lt;/sup&gt;</td>
<td>-.10</td>
<td>-.04</td>
</tr>
<tr>
<td>18 - 17</td>
<td>+.03&lt;sup&gt;b&lt;/sup&gt;</td>
<td>+.01</td>
<td>0.00</td>
<td>+.04</td>
<td>-.07</td>
<td>+.007</td>
<td>-.05</td>
<td>+.21</td>
<td>-.11</td>
<td>----</td>
</tr>
<tr>
<td>19 - 18</td>
<td>+.21</td>
<td>+.007</td>
<td>-.02+</td>
<td>+.009</td>
<td>+.04</td>
<td>+.21</td>
<td>+.12</td>
<td>+.10</td>
<td>+.10</td>
<td>+.12</td>
</tr>
</tbody>
</table>

<sup>a</sup> Change score for subject 05 is for periods 11 - 9 because she reached a base in period 11 followed by a method variance in period 11. 
<sup>b</sup> Subject 02 was absent period 18. 
<sup>c</sup> Subject 12 reached base in period 11 followed by a method variance in period 12, her score based on periods 11 - 9. 
<sup>d</sup> Magnitude of difference between periods 17 - 16 for subject 13 due to method variance. 
<sup>e</sup> Subject 15 exhibited classic pattern of extinction in period 9, therefore her score is based on difference between periods 12 - 8 would have been +.05. 
<sup>f</sup> Subject 15 absent periods 13 through 15 and her last change scores for periods 17 - 16 and 18 - 17 involve the treatments given other subjects in her group for difference of periods 13 - 12 and 14 - 13. 

*Each set of differences for subjects 11 through 15 are just the opposite of those for subjects 01 through 05.*
response changes within each phase of the experiment happened simply due to chance cannot be rejected and hypotheses 1, 2, and 3 are not supported by these data. At the same time the only subject who exhibited a pattern of response changes in accord with either theory for all seven reversals was subject 14 and her changes were in accord with the operant predictions.

Results of Correlation Analysis

Because violations of the assumptions upon which the hypotheses from expectancy theory were predicated might account for the failure of those hypotheses to be supported the correlation analysis was conducted as described in the previous chapter; percentage changes in response times were correlated with percentage changes in motivational force and then this correlation was correlated with age, etc. The results of the correlation analysis for the subjects with usable data (subject 11 admitted that her responses from questionnaire administration five onwards were not honest) are summarized in Table 7 (N = 7 subjects out of 8). The correlations ranged from -.5803 to +.7142 (significant at .05 for N = 7 within subject) and the median correlation was +.2428. There are four positive correlations and three negative ones. Only one of the correlations is significant and only two are above .50. If expectancy theory predictions were actually correct and the assumptions upon which they were based were violated for most of the subjects, then the majority of the within subjects correlations between performance changes and changes in motivational force should have been high and positive. The fact that few of the correlations were high and positive and several were
TABLE 7

SUMMARY OF PERCENTAGE CHANGES IN RESPONSE TIMES FROM TREATMENT TO TREATMENT

<table>
<thead>
<tr>
<th>Baseline Periods Compared</th>
<th>Subject 01</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>Sums without 10% Criterion</th>
<th>Sums With 10% Binomial Criterion Probability with 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-9/9</td>
<td>-.13 *</td>
<td>-.27 *</td>
<td>-.07 0</td>
<td>-.07 0</td>
<td>-.14 V*</td>
<td>-.09 V</td>
<td>-.32 V*</td>
<td>+.12 0*</td>
<td>5 3 8 3 2 5</td>
<td>.5317 .8048</td>
</tr>
<tr>
<td>13-12/12</td>
<td>+.01 0</td>
<td>+.10 0*</td>
<td>-.10 V*++.04 0</td>
<td>+.12 V*</td>
<td>+.08 V</td>
<td>-.19 0*</td>
<td>-.22 0*</td>
<td>5 3 8 3 2 5</td>
<td>.5317 .8048</td>
<td></td>
</tr>
<tr>
<td>14-13/13</td>
<td>+.05 V</td>
<td>-.03 0</td>
<td>+.05 V</td>
<td>+.08 V</td>
<td>-.01 V</td>
<td>+.004 0</td>
<td>-.07 V</td>
<td>+.06 0</td>
<td>3 5 8 0 0 0</td>
<td>1.00001 .0000</td>
</tr>
<tr>
<td>15-14/14*</td>
<td>-.08 V</td>
<td>+.33 0*</td>
<td>-.07 0</td>
<td>-.07 0</td>
<td>-.22 0*</td>
<td>-.13 0*++.21 V*</td>
<td>-.10 0*</td>
<td>4 4 8 4 1 5</td>
<td>.1735 .9412</td>
<td></td>
</tr>
<tr>
<td>16-15/15</td>
<td>-.03 0</td>
<td>-.30 0*</td>
<td>+.13 V*+.01 V</td>
<td>+.16 0*</td>
<td>-.05 V</td>
<td>-.07 V</td>
<td>+.08 0</td>
<td>4 4 8 2 1 3</td>
<td>.8048 .9606</td>
<td></td>
</tr>
<tr>
<td>17-16/16</td>
<td>-.14 V*</td>
<td>-.04 V</td>
<td>-.09 V</td>
<td>-.03 V</td>
<td>+.06 V</td>
<td>+.03 V</td>
<td>XXXb</td>
<td>-.21 0*</td>
<td>1 6 7 1 1 2</td>
<td>.9609 .9609</td>
</tr>
<tr>
<td>18-17/17</td>
<td>+.03 V</td>
<td>+.01 V</td>
<td>0.00 0</td>
<td>+.04 V</td>
<td>-.07 V</td>
<td>+.01 0</td>
<td>-.05 V</td>
<td>+.21 0*</td>
<td>2 5 7 1 0 1</td>
<td>.9609 1.000</td>
</tr>
</tbody>
</table>

Individual Totals

Less than 10% Change

<table>
<thead>
<tr>
<th>Subjects</th>
<th>0s</th>
<th>Vs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than</td>
<td>3 5 1 2 2 3 1 7</td>
<td>4 2 5 5 4 5 0</td>
</tr>
<tr>
<td>More than</td>
<td>1 4 0 0 2 1 1 5</td>
<td>1 0 2 0 2 0 0</td>
</tr>
</tbody>
</table>

The change from period 14 to 15 is transitional between phases I and II. A drastic change in response times during period 16 indicated a method variance which was confirmed in post experimental interviews.
### TABLE 2

CORRELATIONS BETWEEN PERCENTAGE CHANGES IN PERFORMANCES AND MOTIVATIONAL FORCE AND ITS CORRELATION WITH OTHER FACTORS

<table>
<thead>
<tr>
<th>Subject</th>
<th>Rs (Within Subjects)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>+.2857</td>
<td>7</td>
</tr>
<tr>
<td>03</td>
<td>-.3571</td>
<td>6</td>
</tr>
<tr>
<td>04</td>
<td>+.7142*</td>
<td>7</td>
</tr>
<tr>
<td>05</td>
<td>-.3571</td>
<td>7</td>
</tr>
<tr>
<td>12</td>
<td>+.6071</td>
<td>7</td>
</tr>
<tr>
<td>13</td>
<td>+.2428</td>
<td>6b</td>
</tr>
<tr>
<td>14</td>
<td>-.5803</td>
<td>7</td>
</tr>
</tbody>
</table>

Significant at .05 for Rs = .714 if N = 7, for Rs = .829 if N = 6 indicated by *

<table>
<thead>
<tr>
<th>Correlation Matrix</th>
<th>Motivational Force-Performance</th>
<th>LOC</th>
<th>EXTRA</th>
<th>AGE</th>
<th>Education Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locus of Control (LOC)</td>
<td>.0982</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extraversion (EXTRA)</td>
<td>.4821</td>
<td>-.2768</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (in years)</td>
<td>.5536</td>
<td>.0804</td>
<td>-.1473</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education (in quarters)</td>
<td>.4018</td>
<td>.0714</td>
<td>-.1786</td>
<td>.9286</td>
<td></td>
</tr>
<tr>
<td>Ability (time per deck)</td>
<td>.2143</td>
<td>-.0089</td>
<td>-.5357</td>
<td>.3750</td>
<td>.4911</td>
</tr>
</tbody>
</table>

**Indicates significant at .01 for N=7 if Rs more than .8930

*aSubject 11 response data inaccurate and incomplete. bSubject 13 had one method variance with no other baseline for computation so has one less data point than others.
negative leads to the conclusion that the assumptions were violated for at most a couple of subjects. As a quite valid test of expectancy theory's ability to predict concurrent changes in perceptions and performance then, the correlation analysis results do not support the expectancy theory as operationalized in this study.

The correlations between the motivational force-performance correlations and extraversion, age, and education are moderately high, all above .40, but none of them are significant. And since age and education are significantly correlated it would be dubious to conclude which was in fact related to the performance correlations independent of the other.

Results of Treatment Order Analysis

The means and standard deviations of the two groups for all treatment condition baselines and summaries of the two phases of the experiment are presented in Table 9. The within group means for groups I and II in Table 9 indicate the possibility of an order effect since the means for both VR periods with $.25 reinforcer for Group I are lower than for CRF while the opposite is true for the other group which did not have the appropriate treatment order initially (i.e., Group II initially went from VR to CRF instead of vice versa). But the differences are small and could be due to temporal order since there was a steady drift among all subjects to respond more rapidly over time (i.e., lower mean response times). However, both groups' mean response times are slightly lower for the $.50 VR-2 compared with
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Period &amp; Group I</th>
<th>Period &amp; Group II</th>
<th>Group I and Group II</th>
</tr>
</thead>
<tbody>
<tr>
<td>$.25 CRF A\textsubscript{1}</td>
<td>9</td>
<td>15.4975 (4.7866)</td>
<td>12.0675 (0.6254)</td>
</tr>
<tr>
<td>$.25 CRF A\textsubscript{2}</td>
<td>13</td>
<td>12.0400 (2.7964)</td>
<td>8.9250 (1.2985)</td>
</tr>
<tr>
<td>$.25 CRF A\textsubscript{3}</td>
<td>15</td>
<td>13.0000 (4.3865)</td>
<td>8.4325 (0.8791)</td>
</tr>
<tr>
<td>$.25 CRF A\textsubscript{4}</td>
<td>17</td>
<td>11.0275 (2.7979)</td>
<td>8.1325 (1.0607)</td>
</tr>
<tr>
<td>$.25 VR B\textsubscript{1}</td>
<td>12</td>
<td>13.9400 (5.2287)</td>
<td>11.6700 (2.3529)</td>
</tr>
<tr>
<td>$.25 VR B\textsubscript{2}</td>
<td>14</td>
<td>12.4300 (2.7303)</td>
<td>8.9700 (1.3359)</td>
</tr>
<tr>
<td>$.50 VR C\textsubscript{1}</td>
<td>16</td>
<td>11.8250 (2.4726)</td>
<td>8.2200 (0.8187)</td>
</tr>
<tr>
<td>$.50 VR C\textsubscript{2}</td>
<td>18</td>
<td>11.2500 (3.2562)</td>
<td>8.0250 (1.4286)</td>
</tr>
</tbody>
</table>

Combined Treatment means

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Group I</th>
<th>Group II</th>
<th>Group I and Group II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A\textsubscript{1} and A\textsubscript{2}</td>
<td>13.7538 (4.2780)</td>
<td>9.4963 (1.1679)</td>
<td>11.6250 (3.7902)</td>
</tr>
<tr>
<td>B\textsubscript{1} and B\textsubscript{2}</td>
<td>13.1850 (4.2388)</td>
<td>10.3200 (2.3416)</td>
<td>11.7525 (3.7117)</td>
</tr>
<tr>
<td>A\textsubscript{3} and A\textsubscript{4}</td>
<td>12.0138 (3.8087)</td>
<td>8.2825 (0.9856)</td>
<td>10.1482 (3.3494)</td>
</tr>
<tr>
<td>C\textsubscript{1} and C\textsubscript{2}</td>
<td>11.5375 (2.7203)</td>
<td>8.1225 (1.1684)</td>
<td>9.8300 (2.7015)</td>
</tr>
<tr>
<td>A\textsubscript{1} to A\textsubscript{4}</td>
<td>12.8838 (4.1425)</td>
<td>8.9644 (0.4439)</td>
<td>10.9241 (3.6687)</td>
</tr>
<tr>
<td>B\textsubscript{1} &amp; B\textsubscript{2} &amp; C\textsubscript{1} &amp; C\textsubscript{2}</td>
<td>12.3613 (3.6553)</td>
<td>9.2213 (2.1518)</td>
<td>10.7913 (3.3853)</td>
</tr>
</tbody>
</table>

Standard deviations in parentheses. Means in minutes per unit of work.
$.25 CRF in the second phase of the experiment, which indicates that either the order effect was dissipated with time or there was a magnitude effect. The magnitude effect is not indicated since the difference between CRF and VR in phase two is less for Group I than in phase one (assuming for the moment that the groups are comparable even though they differ in terms of absolute response times). Thus there may very well have been a bias against the operant predictions due to the order of treatments for Group II, though subject 14 appears to have been unaffected by order (see Table 7.) and the operant hypothesis would not be supported even if Group I were evaluated independent of Group II. Taking all baseline responses for CRF in phase one compared to all VR baseline responses, the CRF provides a lower mean response time with the VR about one percent less than CRF. For phase two the VR schedule is about three percent lower in mean response times than the CRF for that phase. Taking all baseline responses for CRF and VR regardless of the phase of the experiment, the means are CRF = 10.9241 minutes per card deck and VR = 10.7913. While the direction favors the operant predictions the difference is not significant from a statistical point of view.

Results of Analysis of Acquisition versus Post-Acquisition Responses

The comparative analysis of within-group gain scores for Groups I and II for the initial changes from noncontingent to contingent treatment conditions (periods 4, 5, and 6, versus 7, 8, and 9; each period being three hours in length) suggests that inclusion
of acquisition responses together with post acquisition responses can make a difference in the conclusions one would draw from these data (see Table 10). The comparison of periods 5 and 6 versus 7 and 8 most closely approximates the time devoted to base period and treatments in the Yukl et al. (1972) study; they found no significant difference between $.25 CRF and $.25 VR-2 groups; we find a difference significant at .05 for a one tailed test, with N = 5 per group as in their work. Inspection of Table 10 reveals the fact that with very short intervals there are no differences between the two groups in terms of gain scores (periods 6 versus 7) and significant or near significant differences for longer intervals (i.e., periods 5 and 6 versus 7 and 8; and 4, 5, and 6 versus 7, 8, and 9, respectively). When either period 6 or periods 4, 5, and 6 are compared with post-acquisition baseline period 9, however, there is no significant difference. Use of acquisition and post-acquisition responses in an analysis as opposed to post-acquisition responses alone appears to make a difference in the conclusions one might draw from the data.
Table 10

DIFFERENCES IN GROUP GAIN SCORES

<table>
<thead>
<tr>
<th>Group</th>
<th>Base Periods</th>
<th>(6) vs (7)</th>
<th>(5+6) vs (7+8)</th>
<th>(4+5+6) vs (7+8+9)</th>
<th>(4+5+6) vs (9)</th>
<th>(6) vs (9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>M</td>
<td>-5.252</td>
<td>-4.728</td>
<td>-5.546</td>
<td>-5.944</td>
<td>-6.498</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>4.605</td>
<td>2.730</td>
<td>3.224</td>
<td>2.885</td>
<td>3.781</td>
</tr>
<tr>
<td>II</td>
<td>M</td>
<td>-6.512</td>
<td>-7.583</td>
<td>-7.605</td>
<td>-6.548</td>
<td>-5.074</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>4.350</td>
<td>4.572</td>
<td>4.316</td>
<td>2.897</td>
<td>2.082</td>
</tr>
<tr>
<td></td>
<td>Difference</td>
<td>1.260</td>
<td>2.855</td>
<td>2.059</td>
<td>.604</td>
<td>1.424</td>
</tr>
<tr>
<td></td>
<td>t value</td>
<td>.842</td>
<td>2.113</td>
<td>1.500</td>
<td>.5020</td>
<td>1.176</td>
</tr>
<tr>
<td></td>
<td>Df</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>One tail</td>
<td>NS</td>
<td>.05</td>
<td>.10</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Two tail</td>
<td>NS</td>
<td>.10</td>
<td>.20</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>
CHAPTER III

DISCUSSION

The initial review of developments in the areas of clinical psychology, pedagogy, and criminology in Chapter I confirmed Hitt's (1969) contention that adoption of either the cognitive expectancy model or the acognitive operant model as a basis for research and practice in these areas leads to significantly different approaches and results. The practical and theoretical implications of adopting one or the other model to guide research on and the practice of management of human resources in organizations, it was pointed out, results from the fact that significantly different predictions about employee behavior (and therefore differing prescriptions and proscriptions for managers as well) can be deduced from the two models in certain circumstances. A review of the literature, like Hitt's (1969) review, revealed evidence supporting the descriptive accuracy of both models. A critical analysis of the two models (Berger et al., 1975; Yukl et al., 1972) revealed the fact that the basic procedure upon which the differing predictions were predicated, i.e., schedule stretching, could not have possibly been accomplished in these studies due to their use of inappropriate research designs and methods of data analysis. Thus, until the current research was conducted, neither the theoretical nor the practical implications of the differing predictions from the two models as enunciated by Mawhinney and Behling (1973) had been evaluated. While admitting certain
limitations of all controlled laboratory research and some peculiar to this study, we are now in a position to draw some conclusions regarding the theoretical and practical value of the two models based on this experiment.

**Theoretical Conclusions**

The basic theoretical issue is "which model provides the most accurate description of individual work behavior under a specific set of circumstances?" Neither model can be unambiguously judged to be superior to the other in this regard based on the results of this experiment. The expectancy model provided a prediction of a minimum of fifty percent decrease in performances with changes from pay for every unit of work completed (CRF schedule) to a unit of pay for approximately every other unit of work completed (VR-2 schedule) with magnitude of the contingent outcome held constant. No subject at any time exhibited a change in performance which even approximated this prediction. Several subjects, however, exhibited patterns of reversals in response times in accord with the directional predictions of change from the cognitive expectancy model. But the only pattern of reversals in complete accord with either the cognitive model or the acognitive model was in accord with the acognitive operant model. The correlation analysis also failed to support the cognitive expectancy model. This may be due to limitations in the methods of measuring the cognitive components of the model, however. As Mitchell
has observed, it would require approximately 75 subject responses
to properly evaluate three levels of effort with five outcome levels.
Even with the limited number of questions used in this research, one
subject became frustrated with the questionnaire. It may be that the
questioning required for a rigorous analysis of expectancy percep­tions is simply not feasible. Admitting these limitations, however,
it seems appropriate to conclude that the expectancy model failed to
adequately account for the behavior of the majority of subjects in
this sample.

It is not as easy to condemn a model which does not provide
sharp and concise quantitative predictions. Thus the operant model
cannot be evaluated as rigorously as was the expectancy model. Though
a higher response rate (lower response time) can be predicted to
result from schedule stretching, the specific amount of change cannot
be predicted from the operant model. In addition, deprivation levels
were held constant in the animal research (Ferster & Skinner, 1957)
and deprivation was found to be an important dimension of stretching
(Staats et al., 1964) but clearly cannot be carefully controlled in
complex situations with human subjects. To control for this factor,
however, only subjects for whom the introduction of contingent pay
was effective in reducing response times "significantly" were
included in the sample for this research. These limitations not­
withstanding, only one of the subjects out of a total of eight
exhibited a pattern of reversals completely in accord with the operant
predictions without regard to magnitude of changes in response time reversals. And behavior of only one other subject was well described by the operant predictions for only a portion of the reversals predicted. Yet of the 21 reversals which were "significant," 14 were in accord with the operant predictions. In terms of the descriptive accuracy in the specific circumstances investigated here, the acognitive operant model cannot be judged superior to the cognitive expectancy model. By the same token, the cognitive expectancy model is by no means superior to the acognitive operant model on this theoretical dimension.

**Practical Conclusions**

The practical issue reduces to the question "can the same or higher level of performance be maintained with half the number of contingent incentive payments?" The operant model suggests that at least the same or better performances can be maintained by schedule stretching after initial conditioning on a dense reinforcement schedule like CRF. But according to the expectancy model the best performances are to be achieved with CRF and the only result which can accrue to schedule stretching is an attenuation of performance levels; a fifty percent reduction in force to perform and performance are predicted under the circumstances investigated in this study.

The evidence here clearly favors the operant prescription as opposed to the expectancy proscription against schedule stretching. There were neither practically nor statistically significant
decrements in performance level for either group of subjects in this experiment as a result of changing from CRF to VR-2 with magnitude of the reinforcer held constant. This result obtained in spite of the fact that one of the groups experienced the schedule changes initially in an order not conducive to effective schedule stretching. In addition, the results were obtained without any form of prior consultation with the subjects regarding which forms of pay schedule they would prefer. From a practical point of view the acognitive operant model would appear to provide a more viable source of information for managers under circumstances similar to those examined in this study. Thus the expectancy model's implications for proscriptions against schedule stretching would appear to be unfounded in these circumstances.
Methodological Conclusions

This research was conducted using methods similar to those typically used in operant research (i.e., treatment design was counterbalanced ABAB, baseline reversal criterion, data analysis for one subject at a time, and aggregated baseline analysis for all subjects) which contrast sharply with the previous two investigations of the issue of reinforcement schedules by Berger et al. (1975) and Yukl et al. (1972). Because of the counterbalancing of the treatments it was possible to partially replicate the previous two studies and to determine whether or not certain data analysis procedures made a difference in the conclusion which would be drawn from the data.

Several conclusions are in order based on this analysis. First, the inclusion of acquisition responses in the early phases of treatments, i.e., before subjects have learned to work faster (lower response times) for contingent pay, provides a different result than analysis of the data for only those responses judged to be baseline or post-acquisition responses. In this case the results were biased such that inclusion of acquisition responses indicated a difference in gain scores between the two groups which disappeared when only post-acquisition responses were analyzed. Second, no difference was found within subjects for the $.25 CRF versus $.50 VR-2 contrasts except for an initial reaction for members of Group II who received the treatments in an order which began with VR-2 instead of the CRF. But this effect was not replicated in the second phase of the treatment, i.e.,
the second change from the $.25 CRF to the $.50 VR-2 did not produce
significant changes in response times for any of the subjects.
This result suggests that the significant difference found by Yukl
et al. (1972) between their $.25 CRF and $.50 VR-2 groups might have
dissipated over time if the experiment had been run longer and used
multiple exposures of subjects to the various contingencies. There
was essentially no reaction to the introduction of the $.50 VR-2
for three of the four subjects in the other group and the one which
did react initially did not have the reaction again when the schedule
was imposed the second time. There was some indication of an order
effect in that the two groups tended to respond to the whole treatment
sequence in a slightly different manner. It may, however, have been
a result of group differences since the two groups did tend to be
somewhat different from the start on certain dimensions including the
initial noncontingent level of baseline response times. Finally,
the within subject correlations provided by this research could not
have been accomplished with the previous two designs. And these are
essentially the first within subject correlations for expectancy
perceptions and performances under the three different schedules of
contingent pay.
The preceding conclusions should be considered in context including certain limitations on the generality of the results. Like the previous two studies of pay schedules the sample size in this case was small. But this fact must also be weighed in view of the fact that this small number of subjects did experience the treatments over an extended period of time with a variety of treatment orders. The limited sample size did, however, preclude drawing any definitive conclusion about the possible interaction between individual differences (e.g., age, educational level, and personality) and the treatments as manifest in differential performances under the various contingencies. Thus future research should examine the effects of pay schedule stretching using larger samples in order to determine whether the interactions suggested in this research were real or simply statistical aberrations in a small sample.

The subjects in this experiment were all female college students working on a university campus at a very simple clerical task. This sampling and task design strategy provided an opportunity to generate data very comparable to that provided in the previous two studies of pay schedules. But it did nothing to extend the generality of the schedule stretching without decrement to performances to a wider population of people and tasks. In addition the stretching of the schedules was limited to a change from CRF to VR-2. The superiority of the VR schedule over the CRF found by Staats et al. (1964)
was accomplished by stretching from CRF up to a VR-6. Since the current research served its purpose in terms of providing data very comparable to the previous studies and answering some important methodological questions, future studies should not have to suffer these sampling, task, and schedule design limitations. Thus future research on schedule stretching should utilize a wider range of subject types in a wider range of environmental settings and examine larger parameters of stretching, e.g., stretching up to at least a VR-6 should be attempted. From a practical point of view the larger the ratio the more efficient the schedule if there are no decrements to performance. Thus such an investigation might be warranted simply on practical grounds.

The criterion used to determine significance of changes in baseline response times in the present case was rather crude. It required that the experimenter enter into the decision process more than we are accustomed to and more than many methodologists would recommend. While this is a common practice in operant laboratory research with infrahuman subjects where experimenter control is great, the present context was very complex and not amenable to a high degree of control. But Mawhinney and Pack (Note 4) are currently involved in the development of a statistical procedure specifically designed to overcome this limitation to single subject-within-subject research with a time series statistical procedure. Once developed and validated, researchers in the future should consider designing their research so that it conforms to the requirements of this methodology unless, of course, it would
diminish the external validity of the research.
APPENDIX A

GENERAL AND SPECIFIC TASK, PAY, AND PAY INCENTIVE INSTRUCTIONS
INSTRUCTIONS

Your job will consist of "combing" decks of punched cards, that is to say, you will be searching for certain errors in the punched data on the cards. We suspect that there are anywhere from 10 to 15% of the cards which have incorrect punches on them. Perhaps the best way to tell you what you are to do is by example.

Each of the cards if correctly punched should have six sets of numbers which take up six spaces on the card. Each number should begin with a zero followed by a four-digit number ranging from 0000 to 9999. A correct card would be like the one below:

| 0.3353 | 0.3755 | 0.1758 | 0.1635 | 0.3558 | 0.4335 |

Notice that each number ends in a tenths column, i.e., each number is in a field of ten spaces and set to the right of those ten spaces (we call this right justified). The computer has been told to look for six numbers on each card in six fields of ten spaces and set to the right (right justified) side of the field. So if a number is to the left or right of where it is
supposed to be, it is out of place or an error. The card below has such an error in it.

<table>
<thead>
<tr>
<th>0.3341</th>
<th>0.4502</th>
<th>0.7218</th>
<th>0.5261</th>
<th>0.7388</th>
<th>0.2225</th>
</tr>
</thead>
</table>

Now there may be other errors besides the one above. As we said before each number must begin with a zero followed by a decimal point followed by four (4) numbers ranging from 0 to 9. If there is anything other than a zero in the first digit or space of the number it is an error. If there is anything other than a decimal point after that it is an error. If there is anything other than a number from 0 to 9 in the next four (4) spaces it is an error.

The cards are arranged in a kind of order so you must pick up each deck from the main desk. will give you a deck of cards and you will take it to your desk. The rest is simple. You see that each deck has a piece of paper which is wrapped around the deck with a rubber band. Take the band off and open the paper; it has a list of the cards with the errors underlined. But you must be careful. The cards are not in the same
order in the deck as they are on the listing. Next you search the deck and set aside all of the error cards. You will notice that the cards have four color codes, rather, three colors and a plain type. After pulling out the error cards, sort the others into four decks by color. Then stack them up in order with plain on top followed by dark blue, green, and finally yellow. Place the error cards on top of the deck and replace the list and rubber band around the deck of cards and return it to the main desk.

Your will be paid $2.00 per hour for this work and receive payment for all of the hours accumulated on your time sheet when the job has been completed. It is very important that you attend work every day on-time in order for the job to progress on schedule. So please try to be on time and attend every day.
I have good news for you. You are going to be making some more money. The College of Administrative Sciences has a grant to study different pay systems to see how people like them. They want to try out these pay systems on some part-time employees here at the university before using them in industrial plants. We have agreed to cooperate in the project, project 0049, since it will mean more money for you. It basically involves extra money for the card decks that you complete. Different systems for determining the extra pay will be used from time to time. We will let you know whenever we plan to change the system and at that time we will also describe the way the system works, and how much money is involved. We must have you fill out some questionnaires about your reactions to the pay systems from time to time and your honesty in answering the questions asked is very important according to the fellow in charge of the project. So important that they will give you whatever you would have made in extra money by completing a deck of cards just for filling out the questionnaire honestly. Thus there will be no way you could lose any extra money by taking the time to fill out the questionnaire honestly. Another thing, you will be identified only by an employee number we have assigned to each of you. Whenever you fill out the questionnaire, you will place it in an envelope that will go directly to the people in charge of the project so that all of your answers will be kept confidential.
Instructions for CRF

While this pay system is in effect, you will receive a receipt for $0.25 from Randall for every deck of cards that you turn in. The receipts will permit you to keep track of how much money we owe you in extra payments. I will also make a record of each of the payments you receive. You will receive this extra money with your regular hourly pay when the project is finished. Remember, this money is in addition to your hourly pay.

Instructions for VR

While this pay system is in effect, you will receive a receipt for $0.25/$0.50 from Randall for approximately 50 percent of the card decks you turn in. So you will not receive a payment for every deck that you turn in. But you can be sure that on average you will receive an extra money receipt for half of the decks that you turn in. I will also make a record of each of the payments you receive. You will receive this extra money with your regular hourly pay when the project is finished. Remember, this money is in addition to your hourly pay.
APPENDIX B

EXPECTANCY MODEL QUESTIONNAIRE ITEMS
1. How likely do you think it is that once you complete this set of cards you will receive an extra money payment?

0 1 2 3 4 5 6 7 8 9 10

Certain that I will not  Equally likely to receive as  Certain that I will
Receive the payment  not to receive the payment  receive the payment

2. If you decided to work a little harder sorting this set of cards, how likely would it be that you could complete it a little faster?

0 1 2 3 4 5 6 7 8 9 10

Certain that I could not  About as likely to complete  Certain that I could com-
complete this set of cards any faster  this set of cards faster as  plete this set of cards
not to complete it faster  a little faster

3. Disregarding the money you are earning, how interesting do you feel this job is?

0 1 2 3 4 5 6 7 8 9 10

Extremely dull and boring  Neither dull nor interesting  Extremely interesting

4. Without considering your possibilities of earning any extra money payments, how pleasing is it to you just to finish each set of cards?

0 1 2 3 4 5 6 7 8 9 10

Extremely displeasing  Neither pleasing nor  Extremely pleasing
displeasing

5. Disregarding the hourly pay you are earning, how pleased are you with the money you are earning through extra money payments?

0 1 2 3 4 5 6 7 8 9 10

Extremely displeased  Neither pleased nor  Extremely pleased
displeased

6. Disregarding the money you are earning, how pleased are you with the manner in which the extra money payments are determined?

0 1 2 3 4 5 6 7 8 9 10

Extremely displeased  Neither pleased nor  Extremely pleased
displeased
7. How pleased are you with the hourly pay rate of $2.00?

0 1 2 3 4 5 6 7 8 9 10

+ Extremely displeased + Neither pleased nor displeased + Extremely pleased

8. In general, how important is money to you as a reward?

0 1 2 3 4 5 6 7 8 9 10

+ Very unimportant + Neither unimportant nor important + Extremely important

9. How interesting is this job?

0 1 2 3 4 5 6 7 8 9 10

+ Very dull and boring + Neither dull nor interesting + Very interesting

10. How satisfied are you with the extra pay system?

0 1 2 3 4 5 6 7 8 9 10

+ Very dissatisfied + Neither satisfied nor dissatisfied + Completely satisfied

11. If you were to increase your performance on this job (finish more sets of cards), what are the chances in 10 that you will make more money? _____

12. The chances are _____ in 100 that a person who finishes a lot of work on this job will make more money than a person who finishes a small amount of work.

13. The chances are _____ in 100 that a person who puts in a lot of effort on this job will make more money than a person who puts in a little effort.

14. If you decided not to work as hard sorting cards as you are now working, how likely would it be that you would complete each batch a little slower?

0 1 2 3 4 5 6 7 8 9 10

+ Certain that I would not complete this set of cards + About as likely to complete this set of cards slower as to complete it slower + Certain that I would complete this set of cards a little slower

15. Disregarding the questions asked, how pleased are you with the fact that you have to fill out this questionnaire?

0 1 2 3 4 5 6 7 8 9 10

+ Extremely displeased + Neither pleased nor displeased + Extremely pleased
16. Which of the following would you prefer to happen when you turn in your next deck of cards? (please check only one of the blanks)

1._____ receive $.25 (twenty-five cents)

2._____ receive $.50 (fifty cents)

3._____ receive either $.25 or $.50 since I am indifferent between the two amounts of money.

17. If you had a choice of pay systems, which of the following systems do you think you would prefer? (check only one)

1._____ System I: provides for the payment of $.25 for about half of the card decks you turn in.

2._____ System II: provides for the payment of $.25 for every card deck you turn in.

3._____ System III: provides for the payment of $.50 for about half of the card decks you turn in.

4._____ Any of the systems is alright for me since I am indifferent among the systems; I have no preference.

18. Place a check mark in the blank next to the statements below which describe you best:

1._____ I would be just as pleased to receive $.25 as $.50 for each card deck I turn in.

2._____ I would be twice as pleased to receive $.50 for each deck as I would be if I received $.25 for each deck I turned in.

3._____ I would be less than twice as pleased to receive $.50 than if I received $.25 for each deck I turned in.

4._____ I would be more than twice as pleased to receive $.50 than if I received $.25 for each deck I turned in.

5._____ Money really doesn't mean that much to me.
APPENDIX C

ROTTER AND EYSENCK PERSONALITY MEASURES FOR PROJECT 0049
PART I: PERSONALITY INVENTORY

Name ______________________________ Age ________ Sex ________
Current Occupation __________________________________________
Position Being Sought _________________________________________

INSTRUCTIONS
Please answer each question by putting brackets around the 'YES' or the 'NO' following the question. There are no right or wrong answers, and no trick questions. Work quickly and do not think too long about the exact meaning of the question.

REMEMBER TO ANSWER EACH QUESTION

1. Do you often long for excitement? YES NO
2. Do you often need understanding friends to cheer you up? YES NO
3. Are you usually carefree? YES NO
4. Do you find it very hard to take no for an answer? YES NO
5. Do you stop and think things over before doing anything? YES NO
6. If you say you will do something do you always keep your promise, no matter how inconvenient it might be to do so? YES NO
7. Does your mood often go up and down? YES NO
8. Do you generally do and say things quickly without stopping to think? YES NO
9. Do you ever feel 'just miserable' for no good reason? YES NO
10. Would you do almost anything for a dare? YES NO
11. Do you suddenly feel shy when you want to talk to an attractive stranger? YES NO
12. Once in a while do you lose your temper and get angry? YES NO
13. Do you often do things on the spur of the moment? YES NO
14. Do you often worry about things you should not have done or said? YES NO
15. Generally, do you prefer reading to meeting people? YES NO
16. Are your feelings rather easily hurt? YES NO
17. Do you like going out a lot? YES NO
18. Do you occasionally have thoughts or ideas that you would not like other people to know about? YES NO
19. Are you sometimes bubbling over with energy and sometimes very sluggish? YES NO
20. Do you prefer to have few but special friends? YES NO
21. Do you daydream a lot? YES NO
22. When people shout at you, do you shout back? YES NO
23. Are you often troubled about feelings of guilt? YES NO
24. Are all your habits good and desirable ones? YES NO
25. Can you usually let yourself go and enjoy yourself a lot at a gay party? YES NO
26. Would you call yourself tense or 'highly-strung'? YES NO
27. Do other people think of you as being very lively? YES NO
28. After you have done something important, do you often come away feeling you could have done better? YES NO
29. Are you mostly quiet when you are with other people? YES NO
30. Do you sometimes gossip? YES NO
31. Do ideas run through your head so that you cannot sleep? YES NO
32. If there is something you want to know about, would you rather look it up in a book than talk to someone about it? YES NO
33. Do you get palpitations or thumping in your heart? YES NO
34. Do you like the kind of work that you need to pay close attention to? YES NO
35. Do you get attacks of shaking or trembling? YES NO
36. Would you always declare everything at the Customs, even if you knew that you could never be found out? YES NO
37. Do you hate being with a crowd who play jokes on one another? YES NO
38. Are you an irritable person? YES NO
39. Do you like doing things in which you have to act quickly? YES NO
40. Do you worry about awful things that might happen?  YES NO
41. Are you slow and unhurried in the way you move?  YES NO
42. Have you ever been late for an appointment or work?  YES NO
43. Do you have many nightmares?  YES NO
44. Do you like talking to people so much that you never miss a chance of talking to a stranger?  YES NO
45. Are you troubled by aches and pains?  YES NO
46. Would you be very unhappy if you could not see lots of people most of the time?  YES NO
47. Would you call yourself a nervous person?  YES NO
48. Of all the people you know, are there some whom you definitely do not like?  YES NO
49. Would you say that you were fairly self-confident?  YES NO
50. Are you easily hurt when people find fault with you or your work?  YES NO
51. Do you find it hard to really enjoy yourself at a lively party?  YES NO
52. Are you troubled with feelings of inferiority?  YES NO
53. Can you easily get some life into a rather dull party?  YES NO
54. Do you sometimes talk about things you know nothing about?  YES NO
55. Do you worry about your health?  YES NO
56. Do you like playing pranks on others?  YES NO
57. Do you suffer from sleeplessness?  YES NO
Part II: The following section is aimed at finding out the way in which certain important events in our society affect different people. Each item consists of a pair of statements lettered a or b. Please circle the letter (a or b) of the statement in each pair which you more strongly believe to be the case as far as you're concerned. Be sure to select the one you actually believe to be more true rather than the one you think you should choose or the one you would like to be true. This is a measure of personal belief: obviously there are no right or wrong answers.

Please answer these items carefully but do not spend too much time on any one item. Be sure to find an answer for every choice. In some cases you may feel that you believe both statements or neither one. In such cases, be sure to select the one you more strongly believe to be true as far as you're concerned. Also try to respond to each item independently when making your choice; do not be influenced by your previous choices.

1. a. Children get into trouble because their parents punish them too much.
   b. The trouble with most children nowadays is that their parents are too easy with them.

2. a. Many of the unhappy things in people's lives are partly due to bad luck.
   b. People's misfortunes result from the mistakes they make.

3. a. One of the major reasons why we have wars is because people don't take enough interest in politics.
   b. There will always be wars, no matter how hard people try to prevent them.

4. a. In the long run people get the respect they deserve in this world.
   b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.

5. a. The idea that teachers are unfair to students is nonsense.
   b. Most students don't realize the extent to which their grades are influenced by accidental happenings.

6. a. Without the right breaks one cannot be an effective leader.
   b. Capable people who fail to become leaders have not taken advantage of their opportunities.

7. a. No matter how hard you try, some people just don't like you.
   b. People who can't get others to like them don't understand how to get along with others.
8. a. Heredity plays the major role in determining one's personality.
   b. It is one's experiences in life which determine what they're like.

9. a. I have often found that what is going to happen will happen.
   b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

10. a. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.
    b. Many times exam questions tend to be so unrelated to course work that studying is really useless.

11. a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.
    b. Getting a good job depends mainly on being in the right place at the right time.

12. a. The average citizen can have an influence in government decisions.
    b. This world is run by the few people in power, and there is not much the little guy can do about it.

13. a. When I make plans, I am almost certain that I can make them work.
    b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.

14. a. There are certain people who are just no good.
    b. There is some good in everybody.

15. a. In my case getting what I want has little or nothing to do with luck.
    b. Many times we might just as well decide what to do by flipping a coin.

16. a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.
    b. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.

17. a. As far as world affairs are concerned, most of us are victims of forces we can neither understand or control.
    b. By taking an active part in political and social affairs the people can control world events.
18. a. Most people don't realize the extent to which their lives are controlled by accidental happenings.
   b. There really is no such thing as luck.

19. a. One should always be willing to admit mistakes.
   b. It is usually best to cover up one's mistakes.

20. a. It is hard to know whether or not a person really likes you.
   b. How many friends you have depends upon how nice a person you are.

21. a. In the long run the bad things that happen to us are balanced by the good ones.
   b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

22. a. With enough effort we can wipe out political corruption.
   b. It is difficult for people to have much control over the things politicians do in office.

23. a. Sometimes I can't understand how teachers arrive at the grades they give.
   b. There is a direct connection between how hard I study and the grades I get.

24. a. A good leader expects people to decide for themselves what they should do.
   b. A good leader makes it clear to everybody what their jobs are.

25. a. Many times I feel that I have little influence over the things that happen to me.
   b. It is impossible for me to believe that chance or luck plays an important role in my life.

26. a. People are lonely because they don't try to be friendly.
   b. There is not too much use in trying too hard to please people; if they like you, they like you.

27. a. There is too much emphasis on athletics in high school.
   b. Team sports are an excellent way to build character.

28. a. What happens to me is my own doing.
b. Sometimes I feel that I don't have enough control over the direction my life is taking.

29. a. Most of the time I can't understand why politicians behave the way they do.

b. In the long run the people are responsible for bad government on a national as well as a local level.
Final Questionnaire

The Bureau of Business Research has provided the funds for your extra pay systems in the hope that something could be learned about these pay systems and employee satisfaction, performance, etc. In addition to the questionnaires you filled out during the various pay systems, this one would be very helpful in terms of evaluating the study of pay systems. You can help by answering the following questions as honestly as you can.

Part I

1. Usually when someone gives out money like the Bureau did here, they have some idea about what will happen as a result of giving the money. For example they might have expected you to find more or fewer errors or to be more or less satisfied, etc depending upon the type of pay system you were working under. What do you think they were interested in here and what did they think would happen as a result of the different pay systems. If you don't have any ideas, just say so. If you do, please describe them briefly below.
Final Questionnaire

Part II

1. Why did you take this job?

2. Why did you work more or less carefully at finding all of the error cards?

3. Did you ever miss any error cards that you know of?

4. About how fast did you work at the job; how many decks of cards were you finishing per hour or per day?

5. Did you ever speed up or slow down your work intentionally? Yes___ No___ If you answered yes, please give a brief explanation of why you did so, if you can remember. And indicate when you did this if possible.

6. Can you recall any time when you speeded up or slowed down your work for reasons other than the amount or manner in which you were being paid? Yes___ No___ If you answered yes, what were those other reasons?

7. Did you ever work on a deck of cards longer than usual just because it was more interesting than others? Yes___ No___ If you answered yes, please indicate how often this occurred. About ________ percent of the time.

8. Did you ever work on a deck of cards faster than usual just to be rid of it? Yes___ No___ If you answered yes, how often did this occur? About ________ percent of the time.

9. Do you think you ever worked on the same deck of cards more than once? Yes___ No_______ If yes, please indicate how many times you think you worked on the same deck, for example two or three, etc. ____________.

10. Did you know that someone kept track of all of the work that you did? Yes_______ No__________ If you answered yes, please indicate below when you became aware of this.
   a._______ I knew from the start.
   b._______ Before the extra pay systems were used.
   c._______ During the first week of extra pay.
   d._______ During the second week of extra pay.
During the last week of extra pay.

11. Did you wear a watch to work? Yes No If yes, did you ever use it to time yourself at the job you were doing? Yes No

12. Was anyone else keeping track of the time you were taking on the work? Yes No If you answered yes, when do you think this timing began?

12. Did you ever work extra fast so that you would not lose money by taking a break? Yes No If yes, approximately when did you do this?

13. There are many ways to decide how much work to do, how fast and how carefully to work. Can you describe what factors you considered, if any, in deciding how fast and how carefully to work each day? Yes No If you answered yes, please describe these factors below.

14. You were frequently asked to indicate your estimate of the chances that you would receive an extra money payment after completing a deck of cards. Were you ever able to predict exactly, like zero or 100 percent when you were under the 50 percent of the time pay system? Yes No
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