PERFORMANCE AS A FUNCTION
OF
ABILITY, MOTIVATION AND EMOTION

by

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We accept this thesis as conforming to the
required standard

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ABSTRACT

In order to understand better the relationship between personal and environmental variables as determinants of performance, the present study investigated relevant literature in the behavioral sciences on motivation, emotion, ability and performance.

Maier's performance formula and Vroom's motivation equation were analyzed and re-interpreted, using the concepts of vector and scalar quantities and taking into consideration human limitations. It was demonstrated theoretically that Maier's performance formula does not account for the possibility that performance could decrease when a subject is highly motivated, although Young, McClelland and others have found that this is possible empirically. Emotion was postulated to be the cause of this phenomenon. Based on the theory of emotion as advanced by Leeper, Duffy and Young, and the theory of activation as formulated by Malmo, Hebb, Schlosberg and Lindsley, emotion was postulated as a possible moderator influencing the relationship between motivation and performance. Behavioral efficiency in work performance was assumed to be an inverted U-shaped function of emotion arousal.

The motivation variable in the performance formula was based on the cognitive theory of motivation as postulated by
Tolman and Lewis and subsequently modified by Vroom and Lawler and Porter. However, the concept of a reciprocating contractual relationship between performance and reward and the concept of a "multiple-discount" for the interactive relationship between valence and expectancy were incorporated into the cognitive theory of motivation.

By using qualitative interactive tests and hypothetical values for the variables, the interactive relationship between expectancy and valence in determining motivation was found to be algebraic multiplicative and the interactive relationship among motivation components toward various incentive components were found to be vector additive. Further, the algebraic multiplicative operator was found to be most appropriate to describe the interaction among ability, motivation and behavioral efficiency as determinants of performance.

It was concluded that the theoretical formula could be operationalized and that it could help managers to understand better the relationships between behavioral and economic variables so that scarce economic resources could be more efficiently utilized.
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Chapter 1
INTRODUCTION

The importance of performance effectiveness of managerial and non-managerial personnel to the success of a business organization is a well accepted fact. Ability and motivation as determinants of performance were recognized by Mace (1935), Viteles (1953), Maier (1955) and other industrial behavioral scientists. Maier (1955) suggested that:

\[
\text{Performance} = \text{Ability} \times \text{Motivation}
\]

From empirical research studies, evidence that performance \( = \int (\text{Ability} \times \text{Motivation}) \) has been found with airmen (French, 1957; Fleishman, 1958), delivery service supervisors (Vroom, 1960), civil service middle managers (Lawler, 1966), and with department store lower level managers (Mitchell, 1967). According to Mitchell, "it appears increasingly that the multiplicative model has some general validity" (Mitchell, 1967, p.77). In the same study where abilities and role perceptions were the two moderators used to test the relationship between motivation and performance, Mitchell suggested that there might be other moderators present. The present writer submits that, in addition to ability and role perception, emotion might also be considered as a moderator in the relationship between motivation and performance.
1.1 Statement of Problem

The influence of emotion on performance has been recognized by the activation theorists for a long time. To the present writer's knowledge, no attempt has been made by industrial behavioral scientists to use quantitative methods to consider explicitly emotion as a determinant of performance. The aim of this thesis is to formulate a quantitative model of performance as a function of ability, motivation and emotion based on existing theoretical knowledge and research studies.

The contributions of this thesis are:

(a) The introduction of the concepts of scalar and vector quantities as an analytical tool to study psychological hypothetical constructs.

(b) The expansion of the current Cognitive Theory of Motivation by

   (i) incorporating into it the concept of reciprocating contractual relationship between performance and reward;

   (ii) introducing the "multiple-discount" concept for the interactive relationship between basic valence and expectancy with reference to incentives to determine motivation.

(c) The derivation of a mathematical function to "fit" the inverted U-shaped curve of behavioral efficiency as a function of a person's emotional characteristics
and level of emotion arousal.

(d) The postulation of an interactive relationship between ability and motivation with emotion in determining performance.

1.2 Methodology and Limitations

In the present attempt to formulate performance as a function of ability, motivation and emotion, the method employed is a quantitative one based on certain assumptions. This thesis assumes that:

(a) the interactive relationship among hypothetical constructs like ability, motivation and emotion, and also the interactive relationship between hypothetical constructs and observable variables, such as reward and performance, can be represented by the use of appropriate mathematical operators such as addition and multiplication and the use of appropriate mathematical rules; and

(b) psychological hypothetical constructs such as ability, motivation and emotion can be measured indirectly.

In physical sciences the definition of physical quantities, such as force and velocity, is, at root, a specification of measuring and calculating operations leading ultimately to a number with a unit. Operational definitions involve two steps:
first, the choice of a standard; and second, the establishment of procedures for obtaining multiples or submultiples of the standard, that is, for obtaining units of the quantity. Once a standard is chosen and units have been determined, a direct comparison of a quantity to be measured with the standard can be made.

An ideal standard has two prime characteristics: it is accessible and it is invariable, having assumed the validity of the measurement. In the past, greater emphasis was placed first on accessibility, but as techniques of measurement improved, the need for greater invariability in the standards grew. The familiar yard, foot, and inch, for example, are descended directly from the human arm, foot and upper thumb. Today, such rough measures of length are not satisfactory, and a much less variable standard must be used, even at the expense of accessibility.

Psychological hypothetical constructs, just as any other construct, are intangible quantities. As a result, the problems of standardization of measurement, establishment of units, and the accessibility, invariability and validity of a standard of measurement pose serious limitations in any attempt to quantify hypothetical constructs accurately and objectively.

It is recognized that the assumption that an interactive relationship between psychological hypothetical constructs can be operationally represented by the rules of mathematical
operation has inherent limitations. First, one cannot be absolutely certain that mathematical operators such as multiplication and addition exactly "fit" the nature of interactive relationship between particular hypothetical constructs. Second, one cannot set up an objective standard of measurement for the operational definition of hypothetical constructs.

One of the better methods available for measuring the hypothetical constructs is the "intervening variables" method as shown in the following diagram.

\[ A - f + (X) - f + B \]

The diagram represents a simple case of an intervening variable (X) not directly observable but functionally related (f) to antecedent event (A) and to the consequent event (B), both A and B being directly observable. It is assumed that when an intervening variable is thus securely anchored to observable variables, the dynamic interactive relationship of the unobservable hypothetical constructs and the observable ones can be determined fairly accurately. In a complex case where there are several antecedent observables, several intervening variables, and several consequent observables, the limitations of employing this refined method of measuring and studying the interactive relationship between the hypothetical constructs themselves, and between the hypothetical constructs and the antecedent and consequent observables, become increasingly apparent. As Hull pointed out:
Despite the great value of logical constructs or intervening variables in scientific theory, their use is attended with certain difficulties and even hazards. At bottom this is because the presence and amount of such hypothetical factors must always be determined indirectly.

(Hull, 1943, p.22)

Use of the concepts of vector and scalar quantities is very basic in the physical sciences. By borrowing these concepts from the physical sciences, the present writer introduces into the field of behavioral science an analytical tool to study hypothetical constructs or variables such as ability, motivation, emotion, perception, and satisfaction and environmental variables such as reward and performance. The use of this methodology in behavioral science may help to define hypothetical constructs more clearly and precisely and may facilitate the analysis of interactive relationships among them.

The building blocks of physical sciences are the physical quantities in terms of which physical laws are expressed. These are classified into vector quantities and scalar quantities on the basis of their magnitude and direction. Vectors are quantities that have both magnitude and direction and they combine according to certain rules such as vector addition and vector multiplication. Physical quantities which are vectors are force, velocity, displacement, acceleration, electrical field induction, and magnetic induction. Scalars are quantities that can be completely specified by a number and unit and therefore have magnitude only. Some physical quantities
that are scalars are mass, length, time, density, energy and temperature. Scalars can be manipulated by the rules of ordinary algebra.

The writer assumes that psychological quantities or hypothetical constructs such as ability, motivation, emotion, perception, expectancy or satisfaction can be described in terms of direction and magnitude. For example, satisfaction can be considered a vector quantity because it has direction (positive, indifference or negative) and magnitude (intensity). Expectancy can be considered a scalar quantity because it has only magnitude which ranges from zero (absolute uncertainty) to one (absolute certainty). The object of expectancy such as reward can be considered a vector quantity having direction (positive, indifference or negative) and magnitude (intensity).

It is recognized that various limitations exist in the application of quantitative methods to determine the interactive relationship between reward as an antecedent observable variable, perception, expectancy, satisfaction, valence, ability, motivation and emotion as intervening variables, and performance as a consequent observable variable. Introduction of the concepts of vector and scalar quantities as an analytical tool does not eliminate these limitations but is done in an attempt to interpret the definitions and interactive relationship between psychological hypothetical constructs more clearly and precisely.
1.3 Definitions

The meaning of "psyche" is "the mind". Traditionally, psychologists divided psychological or mental processes functionally into those of cognition, affection and conation. Such a division of mental processes is commonly found in behavioral science literature. Other psychological hypothetical constructs are usually derived from these major functional divisions. Only brief definitions of the important terms used in this thesis are given in this introductory chapter. Expansion of these concepts will be found in subsequent chapters as they are discussed.

Cognition is what one thinks, believes and anticipates (Krech, Crutchfield and Ballachy, 1962, p.68) - a scalar quantity.

Affection is the totality of feelings and emotions with reference to pleasantness-unpleasantness quality as differentiated from the cognitive and conative parts of the mind (modified from Harriman, 1966, p.6) - a vector quantity.

Conation is that part of the mind which includes impulses, motives, wishes, drives, and appetites as distinguished from the cognitive and affective parts of the mind (Harriman, 1966, p.38) - a vector quantity.
Perception is the primary and basic form of cognition (Young, 1961, p.298). To perceive is to observe or communicate through the senses, such as to see, hear, touch, taste, smell and to sense internally some percepts (objects for perception) - a scalar quantity.

Expectancy is an attitudinal measure of one's antecedent cognition toward an object - a scalar quantity.

Satisfaction is an attitudinal measure of one's posterior affection toward an object - a vector quantity.

Valence is an attitudinal measure of one's antecedent conation toward an object - a vector quantity.

Goal is the tangible or intangible (abstract) object for which purposive activity was initiated and sustained - a vector quantity.

Incentive is the reward-performance stimulus offered by the institution to a person whose acceptance of it becomes his goal and would initiate and sustain a behavior sequence - a vector quantity.

Performance is the mental and/or physical work done by a person in the job situation - a vector quantity.

Reward is the material and/or non-material compensation a person receives from others for his performance in the job situation - a vector quantity.


**Ability**
is one's performance potential - a scalar quantity.

**Motivation**
is the combination of forces which initiate, direct and sustain behavior toward a goal (Lindsley, 1957, p.48) - a vector quantity.

**Emotion**
is a mental state related to some tangible or intangible external object, and is characterized by feelings of various intensities and accompanied by visceral reactions and motor expressions of various intensities which may or may not be apparent - a vector quantity.

1.4 Summary of Chapters

The theoretical background of this thesis is briefly discussed in chapter two.

Chapter three is an attempt to use the concepts of vector and scalar quantities to interpret Maier's (1955) performance formula and Vroom's (1964) motivation equation.

In chapter four the concept of a reciprocating contractual relationship between performance and reward in an incentive package and the concept of "multiple-discount" are introduced into the cognitive theory of motivation.

The concepts of emotion as an organized or disorganized response and of emotion being motivational in nature are reviewed in chapter five. From the experimental evidence of
the activation theorists, it is found that emotion arousal influences a person's behavioral efficiency in work performance and that the relationship between emotion arousal and behavioral efficiency is an inverted U-shaped curve. A mathematical function is derived to "fit" the curve.

The sixth chapter is an attempt to include emotion as a possible moderator which influences the relationship between motivation and performance. The performance formula as a function of ability, motivation and emotion is derived.

The last chapter is concerned with the operationality of the variables in the performance formula and the implications of the performance formula to management.
Chapter 2
THEORETICAL BACKGROUND

Mace (1935) and Viteles (1953) suggested that a person's "capacity to work" and "will to work" jointly determine his level of performance. Maier (1955) hypothesized that performance depends on both ability and motivation and that the relationship between them can be expressed by the following formula:

\[ \text{Performance} = \text{Ability} \times \text{Motivation} \]

Likewise, Gagne and Fleishman (1959) proposed explicitly that motivation does not add to skill but rather multiplies with it.

Maier's performance formula excludes the role of emotion as a determinant of performance which is well recognized by the activation theorist. Also, both groups of quantitative motivation theories, namely, the stimulus-response behavior theory and the cognitive theory do not take the relationship between emotion and motivation into consideration. (See Table 2-1 and Table 2-2).

2.1 The Stimulus-Response Behavior Theory of Motivation

The S-R behavior theory generally views the purpose of molar behavior of an organism as adaptive for survival. According to Hull,

Since the publication by Charles Darwin of
<table>
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<td>1918</td>
<td>Woodworth</td>
<td>General behavior</td>
<td>Drive, Mechanism</td>
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<td>1943</td>
<td>Hull</td>
<td>Maze behavior</td>
<td>Drive x Habit</td>
<td>Reaction potential</td>
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<td>1952</td>
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<td>1956</td>
<td>Spence</td>
<td>Maze behavior</td>
<td>(Drive + Incentive) x Habit</td>
<td>Excitatory potential</td>
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<td></td>
<td></td>
<td>Skinner box behavior</td>
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the Origin of Species it has been necessary to think of organisms against a background of organic evolution and to consider both organismic structure and function in terms of survival.

(Hull, 1943, p.17)

By integrating Cannon's (1932) "homeostasis" concept into the S-R behavior theory, Hull (1943) applied Cannon's equilibration principle to support the "adaptation for survival" concept of the S-R behavior theory. Rejecting the instinct theory of motivation, the S-R psychologists maintain that the reaction of an organism to environmental stimulations is learned. Hence, the principle of learning becomes the central issue in the S-R behavior theory. Hull in his revised theory formulated the following postulate:

Postulate VIII. The Constitution of Reaction Potential \( S^E_R \).

The reaction potential \( S^E_R \) of a bit of learned behavior at any given stage of learning, where conditions are constant throughout learning and response-evocation, is determined (1) by the drive (D) operating during the learning process multiplied (2) by the dynamism of the signaling stimulus trace \( V_1 \), (3) by the incentive reinforcement \( K \), and (4) by the habit strength \( S^H_R \), i.e.,

\[
S^E_R = D \times V_1 \times K \times S^H_R.
\]

(Hull, 1952, p.7)

Spence (1956) revised the concept and the interactive relationship of some of the hypothetical constructs in Hull's (1952) formulation. To Spence,
Excitory Potential $S^E_R = (D+K) \times S^H_R$.

2.2 **The Cognitive Theory of Motivation**

Advocates of cognitive theories view molar behavior of an organism as characteristically goal-seeking. Tolman asserted that an adequate description of what an animal is doing always makes reference to some end (goal) towards which or away from which the animal is, at the time, moving (Tolman, 1925, pp. 37-38).

One of the intervening variables in Tolman's theory is "strength of demand for goal object" which is influenced by the organism's state of physiological drive or disequilibrium and the type of incentive that is expected. Lewin, studying human behavior, referred to the same influence on behavior as "valence" of the goal for the organism, its attractiveness resulting from the momentary state of need ($t_g$) and the character of the goal object ($G$) (Lewin, 1938, p.107).

"Expectancy" is the other important intervening variable in the cognitive theory of motivation. Both Tolman (1932) and Lewin (1938) held that the tendency of an organism to perform one particular response rather than another at a choice point would depend also on its "knowledge" or "cognitive expectations" of means-end relations. To Tolman, an organism's cognitive expectations in a given stimulus situation refer to the organism's belief that one response would lead on to the demanded goal.
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<td>Expectancy of Goal, Demand for Goal</td>
<td>Performance vector</td>
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<td>Lewin, et al.</td>
<td>Level of aspiration, decision making</td>
<td>Potency x Valence</td>
<td>Force</td>
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<td>Rotter</td>
<td>Social learning and behavior</td>
<td>Expectancy, Reinforcement Value</td>
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<td>Expectancy x (Motive x Incentive)</td>
<td>Tendency (or Motivation)</td>
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<td>Subjective Probability x Utility</td>
<td>Subjectively-expected Utility</td>
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<td>Vroom</td>
<td>Voluntary choice</td>
<td>Expectancy x Valence</td>
<td>Force to perform</td>
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<tr>
<td>1967</td>
<td>Porter &amp; Lawler</td>
<td>Managerial performance</td>
<td>Effort+Reward Probability x Value of Reward</td>
<td>Effort</td>
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object and another would not (Tolman, 1932, pp.164-203). Lewin represented the organism's expectations as the perceived path connecting some immediate region in the life space with a more distant goal region. The Lewinian concept of potency is equivalent to Tolman's strength of expectancy (Lewin et al., 1944, p.358).

Different labels for the same concepts, "valence" and "expectancy", or the expansions of these concepts, have been used subsequently by other authors. (See Table 2-2).

2.3 A Review of Industrial Behavioral Science Literature

Both the S-R behavior theory and the cognitive theory treat motivation within a broader framework than those studies on specific personal variables such as needs (Maslow, 1954), the affiliation motive (Mayo, 1945; Schachter, 1959), the achievement motive (McClelland, 1953), the money motive (Whyte, 1955), the competence motive (White, 1959), or those studies on such specific environmental variables as job content (Davis, 1957), supervision (Likert, 1961), or the organization (Argyris, 1957). Dunnette and Kirchner recently remarked that:

So far, however, we have handled motivation in a rather cavalier way - as if simple listing of human wants and desires might be sufficient for completely understanding human motivational processes. Unfortunately, understanding motivation is not nearly so easy. The motivation of employees in industry is one of the most important but one of the least understood areas of industrial psychology today.

(Dunnette and Kirchner, 1965, p.124).
A review of industrial behavioral science literature shows that there is no lack of theories, conceptual models and empirical research on motivation. The detailed studies into specific areas of motivation mentioned earlier are important contributions but they often lead one to see the trees and miss the forest in one's attempt to understand the relationship between ability, motivation, emotion and performance as a process. The following remark made recently by Nevitt Sanford perhaps indicates what is seemingly lacking:

... the accent today is on the production of knowledge rather than on its organization. There are few attempts at systemization of the sort that would put particular facts in perspective to show their significance. More than that, there seem to be few attempts to organize knowledge in such a way that its relevance to practice or to policy becomes apparent.

(Nevitt Sanford, 1965, p.193)

Vroom (1964) updated important industrial research studies on work and motivation and introduced the cognitive theory of motivation into industrial psychology. He postulated the nature of the interactive relationship between the personal variables and environmental variables in the determination of the force on a person to perform an act. Lawler and Porter (1967) and Porter and Lawler (1968) have expanded Vroom's contribution in a more detailed model of variables which helps to determine the relationship between value of reward, the probability of effort leading to reward, effort, ability, role perceptions, performance, reward, and satisfaction.
Figure 2-1 A Theoretical Model of Individual Job Behavior

Job-Related Environment

- Goal
- Communication
  - Incentive
    - Reciprocation
  - Reinforcement
    - Reward
    - Performance
  - Response to Incentive
  - Goal Seeking

Person

- Past Experience
  - Valence
  - Satisfaction
  - Expectancy
  - Attitude
  - Ability
  - Motivation
  - Emotion
  - Behavior
  - Non-job-related Goal Seeking

Non-Job-Related Environment

- Non-job-related Stimulus
- Market
- Social Institutions - Family, Church, Union, Club, etc.
- Culture
- Other Non-job-related Influences
- Non-job-related Response
2.4 Some Underlying Theoretical Concepts

The theoretical concept in this thesis and the conceptual diagram formulated to show the relationship between performance, ability, motivation, emotion and other personal and environmental variables are principally extensions of the work of Maier, Vroom, Porter and Lawler, and Mitchell.

The conceptual diagram (see Figure 2-1) is an attempt:

(a) to incorporate "emotion" as a variable into the cognitive theory within the S-O-R framework;

(b) to show the link between some personal and environmental variables; and

(c) to show the relationship between the following generally recognized concepts:

(1) A person is subjected to (a) external stimulus from both his job-related environment and non-job-related environment through his perception, and (b) internal stimulus from his valence (conation) and emotion and satisfaction (affection).

(2) A person's ability, perception, emotion, attitude and motivation are influenced by his past experience.

(3) A person's perception of the external stimulus object at a point of time influences his expectancy (cognition), valence (conation), satisfaction and
emotion (affection) and vice versa.

(4) The way a person behaves in a situation (time-space considered) depends mainly on (a) his ability, his cognitive state, conative state and affective state; and (b) the incentive in the environment as perceived by him, both personal variables and environmental variables varying from time to time.

(5) Every person exhibits two principal types of purposive molar behavior — adaptive for survival (S-R behavior theory) and goal seeking (cognitive theory) — both of which have an interactive relationship.

(6) Any difference between the person's goal and the incentive offered by the institution results in a bargaining relationship which may or may not lead to a compromise between the person and the institution.

(7) Reward and performance are the two reciprocating outcomes of an incentive. A psychological contract, and sometimes a written contract, is the mutual commitment between the person and the institution based on a person's acceptance of the incentive and the institution's acceptance
of his service.

(8) A person's job performance depends partly on his job behavior which is determined in large measure by the interactive relationship between his ability, motivation and emotion.

(9) Job satisfaction is the posterior attitude closely affected by the amount of reward a person receives from others for his job performance that is perceived as equitable by the recipient. Satisfaction with past performance and reward influences a person's contemporaneous perceptions, expectancies and valences.

(10) A person's job performance influences the incentives that will be offered to him in the future.
Chapter 3

AN INTERPRETATION OF MAIER'S PERFORMANCE FORMULA AND VROOM'S MOTIVATION EQUATION

3.1 Introduction

The interactive relationship between ability and motivation to determine performance was postulated by Maier.

What a man is capable of doing and what he actually does are not necessarily the same. The term ability refers to a person's potential performance, whereas the term performance refers to what a actually does under given conditions. How a man performs on a job depends both on his ability and his willingness or motivation. We may express the relationship between these factors by the following formula:

$$\text{Performance} = \text{Ability} \times \text{Motivation}$$

(Maier, 1955, p.203)

The interpretations of the implications of Maier's formula are of great significance in the management of human resources in an organization especially when one of the main factors in the selection, placement and compensation of an employee is his ability. Maier's formula can be interpreted quantitatively as a limit or non-limit algebraic function. It is more realistic to everyday experience to assume that there are limits in a person's ability and motivation, and hence his level of performance is also restricted by these limits.
In order to interpret Maier's performance formula quantitatively, it is necessary to understand the two main terms in the formula, Ability and Motivation, in the light of the quantitative methodology employed in the present study and to analyze these two terms by using the concepts of vector and scalar quantities.

3.2 Concept of Ability

Ability is defined as a person's performance potential. This implies that ability marks the upper limit of a person's performance capability. Over a short period of time, ability is a relatively stable or constant individual characteristic and relatively independent of situational factors. It is considered a scalar quantity because it has only magnitude. Ability can be divided arbitrarily into two principal kinds: (a) mental ability; (b) non-mental ability.

Mental ability or intelligence refers to the degree or extent to which an individual is able to learn new things rapidly and solve problems correctly. The three main factors which influence a person's mental ability are:

(a) Native potential for learning - a hypothesized characteristic of the brain structure which serves to facilitate and limit the development of what is actually manifested in intelligence.
(b) Motivation to learn - refers to one's intention in learning (direction) and one's aspiration level in learning (magnitude).

(c) Environmental stimulus potential - refers to one's educational opportunity, experience, and social environment.

Together, these three factors help to determine a person's level of mental ability.

Non-mental abilities include psychomotor ability, athletic ability, musical ability, artistic ability (Kuch, 1963, pp.377-382). Ability in the present context refers to the task-relevant mental and non-mental abilities a person possesses or has acquired.

3.3 Concept of Motivation

"Motivation is generally defined as the combination of forces which initiate, direct and sustain behavior toward a goal" (Lindsley, 1957, p.48). By definition, motivation is a combined force toward a goal. Hence motivation is considered a vector quantity having both direction and magnitude. The direction of motivation, at any point of time, is a person's "behavioral intention" (Locke, Byran, Kendall, 1968, pp.104-121) or "preference among outcomes or states of nature" (Vroom, 1964, p.15). For any pair of outcomes x or y, a person either prefers x to y, prefers y to x, or is indifferent to x or y.
The magnitude of motivation refers to the intensity (or strength) of a person's preference (or attraction) toward an outcome; it is also referred to as an individual's performance goal or aspiration level (Locke, Byran, Kendall, 1968).

Both direction and magnitude of motivation are dynamic factors depending on the choice of the person at the point of time in a given environment. Hence motivation is a relatively dynamic personal variable and it is relatively dependent on situational factors.

Quantitative motivation theories, both the S-R behavior theory and the cognitive theory, assume that motivation is a monotonically increasing function of some hypothetical constructs. Vroom proposed that:

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

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

where

\[F_i = \text{the force to perform act } i\]

\[E_{ij} = \text{the strength of the expectancy}\]

\[(0 \leq E \leq 1)\]

\[V_j = \text{the valence of outcome } j\]

(Vroom, 1964, p.18)
3.4 Limitations of Vroom's Motivation Equation

The concepts of vector and scalar quantities are used to interpret Vroom's equation. Use of the algebraic multiplication operator for the interaction between expectancy and valence to determine a component force of motivation is considered operationally valid because expectancy is considered a scalar quantity and valence is considered a vector quantity. However, Vroom's assumption that the algebraic sum of component forces (EV) is equal to the resultant force (F) is considered operationally invalid. Since force is a vector quantity, theoretically, one must use the vector addition operator rather than the algebraic addition operator in the summation of the component forces to resolve the resultant force. However, if one assumes that a person's valence operates in either perpendicular (indifference) or in diagonally opposite directions, then, operationally, there is no difference between algebraic and vector addition although theoretically it is incorrect. Also, such an assumption is an over-simplified model of the interactive relationship between personal variables and environmental variables.

A more realistic model of interaction between a person and his environment is usually more complex. Consider the case of a person who is employed by a certain institution. For the reward that he receives, he is obliged, and often under pressure from his superior, to utilize his ability and energy toward
in institutional goals. However, his personal goals and the institutional goals may or may not be the same. The range of possible interactive relationships between personal and institutional goals can be represented diagrammatically as follows:

**Ordinal scale**

- Totally opposing
- Partially opposing
- Neutral
- Compatible
- Identical

This range of interactive relationships can be represented by vector diagram where the magnitude and direction of the forces acting on the person are defined by the length and direction of the arrows.

(a) Totally opposing personal and institutional goals.

(b) Partially opposing personal and institutional goals.
(c) Neutral personal and institutional goals.

![Diagram](image)

(d) Compatible personal and institutional goals.

![Diagram](image)

(e) Identical personal and institutional goals.

![Diagram](image)

Vroom's algebraic equation holds operationally but not theoretically if all human interactive relationships can be completely defined by vector diagrams (a), (b) and (c). Only vector addition can resolve the whole range of interactive relationships represented by vector diagrams (a), (b), (c), (d) and (e).

Vroom does not mention that motivation is finite in magnitude, which is fully recognized by Mitchell (1967, p.15).
A person has limited or finite energy and resources (scalar quantities) and hence the effort (which is a force) a person can exert toward a particular task or goal by expending his energy and resources is also finite.

3.5 Interpretation of Maier's Performance Formula

The implication of Maier's formula is that motivation does not add to ability but rather multiplies with it to determine the level of performance of a person. Since ability is considered a scalar quantity and marks the upper limit of one's performance capability, the extent to which a person's ability is utilized depends on the magnitude of his motivation, and the direction towards which his ability is being utilized (for company's objectives or against company's objectives) depends on the direction of his motivation. For example, the organizing ability of a worker can be utilized to organize strikes and sabotage or to organize production, depending on the direction of his motivation. The higher his level of organizing ability, the greater the harm or good he can do. Moreover, the direction of his motivation, be it positive, negative, or neutral, is relative to his frame of reference, which, however, is not fixed because a person's scale of values and needs is changeable with time and space. Hence the direction of motivation changes with the changing values and needs of a person in a particular situation. Arbitrarily, positive direction refers to the direction of motivation toward the
Figure 3-1 Hypothetical Performance Curve of C and D

Figure 3-2 Hypothetical Performance Curve of E and F
company's objective.

The multiplicative relationship between ability and motivation to determine performance can be interpreted mathematically as an algebraic equation.

\[
\text{Performance} = \text{Ability} \times \text{Motivation} \\
\bar{P} = A \times M
\]

Over a short period of time, A can be considered a constant and hence \( \bar{P} \) becomes a monotonically increasing function of M. The gradient of the linear algebraic equation represents the ability of the person. Different persons with different levels of ability will have different performance gradients; and different persons who have identical ability will have the same performance gradient.

It is assumed in the hypothetical performance curves in Figures 3-1 and 3-2 that level of performance is a linear increasing function of level of motivation and that it reaches an upper limit when the ability of a person is fully utilized. Figure 3-1 shows the levels of performance \( \bar{P}_C \) and \( \bar{P}_D \) of two persons, C and D, who have identical abilities \( A_C = A_D \) but different levels of positive motivation, \( M_C \) and \( M_D \). Figure 3-2 shows the levels of performance \( \bar{P}_E \) and \( \bar{P}_F \) of two persons, E and F, who have different levels of abilities, \( A_E \) and \( A_F \), but the same level of positive motivation, \( M_E = M_F \). When the ability of a person is fully utilized, or the limit of performance potential is reached, increases in the level of
motivation will not increase the level of performance.

When task-relevant ability $A$ of a person is very low, or the gradient of the function $P = A \times M$ approaches zero, then a very large increment in motivation will cause only a small increment in performance. When $A = 0$, that is, when a person has no task-relevant ability at all, performance will be zero no matter how large is his motivation. Similarly, a person may have high task-relevant ability but low motivation; his level of performance will also be low. When he has no motivation to work at all, his performance is equal to zero.

Maier's formula does not allow for the possibility that the performance level of a person can decrease as his motivation level increases. However, experiments with human and animal subjects show that performance decreases when these subjects are highly motivated. An attempt will be made in chapter six to account for this shortcoming in Maier's performance formula.
Chapter 4

THE DERIVATION OF THE "MULTIPLE-DISCOUNT" COGNITIVE MOTIVATION FUNCTION

4.1 Introduction

This chapter extends the discussion of some conceptual issues of the cognitive theory of motivation initiated in the previous chapter. The concept of algebraic addition assumed by Vroom and other cognitive theorists is replaced by the concept of vector addition in the present discussion. The simple model of interactive relationship between personal variables and environmental variables where there are only three possible directions (positive, neutral, and negative) assumed by Vroom, however, is adopted. An example of neutral direction of motivation from the company's point of view is the case where an employee utilizes his energy and organizing ability to manage his family and make it a happy one. As a result of adopting this simple model of an interactive relationship, operationally, there is no difference between Vroom's motivation function and the motivation function formulated in this chapter. However, there is a theoretical difference between the two motivation functions.

The aim of this chapter is to derive a quantitative motivation function based on the concept of "multiple-discount" and the concept of reciprocating contractual relationship between
reward and performance in an incentive package. The writer recognizes that the concept of "multiple-discount" is not entirely a novel concept as Tolman (1932), Lewin (1938), Peak (1955), Rotter (1955), Vroom (1964), Dunnette (1967), Lawler and Porter (1967) have formulated similar ideas. It is the method by which the concept is organized and formulated into a mathematical function that is new.

Vroom (1964) and Porter and Lawler (1967) do not explicitly distinguish reward and performance as the two reciprocating outcomes of an incentive. The motivation function derived by the writer takes into account that there is a psychological contract and sometimes a written contract of mutual commitment between the person (offeree) and the institution (offeror) when the offeree accepts the incentive offered to him and the offeror has accepted his services. As "business enterprise is a focal point for the rationalization of conflicting interests, conflicting expectations and conflicting needs" (Hall, 1967, p.1-1 ), the kind of relationship between the offeree and the offeror in an industrial situation is assumed to be one in which the offeree attempts to obtain at least what he considers an equitable return in exchange for his services. The same is true for the offeror.

4.2 Attitude as an Action Governing System

The derivation of the "multiple-discount" cognitive
motivation function is based on the assumption that a person's motivation toward or away from the incentive depends on his satisfaction with the incentive in his past experience and his present valence and expectancy. Satisfaction, valence and expectancy are components of a person's attitude. Attitude is generally used as a broad psychological concept to denote the organization of psychological processes which governs a person's action. Newcomb defines attitude as "... the individual's organization of psychological processes, as inferred from his behavior, with respect to some aspect of the world which he distinguishes from other aspects". (Newcomb, 1964). The concept of attitude is defined more explicitly as "an enduring system of positive or negative evaluations, emotional feelings, and pro or con action tendencies with respect to some social object" by Krech, Crutchfield and Ballachy (1962, p.177). Krech et al. emphasize that an attitude as a system consists of three interrelated components, namely, cognitive component, feeling component and action tendency component. In industrial psychology, Lawler and Porter (1967) and Porter and Lawler (1968) specifically point out that the probability of effort leading to reward (expectancy), subjective value of rewards (valence) and job satisfaction (satisfaction) are components of job attitudes.

For purposes of this thesis the above tripartite division of attitudes has been adopted, a division similar to the
traditional functional division of total psychological processes into those of cognition, affection and conation used by McDougall (1908), Tolman (1932), Young (1943) and others.

The writer is mindful of the criticism of such functional divisions of psychological processes by the activation theorists such as Duffy (1941), Leeper (1948) and Bindra (1959) who argued that such a division is invalid. According to Leeper,

Too commonly we have adopted, for all practical purposes, a faulty representation of psychological functions which was started back in the late 1700's - a division of psychological processes into those of cognition, affection, and conation. The view adopted by Young, Munn, and the others is essentially that same view, that matters of feeling or emotion (or, affection) are fundamentally different from matters of striving or motivation (or, conation). But it is time that psychology issued a declaration of independence from this antique tradition, and it is time that this declaration of independence took the form, not merely of change of words, but also of a rejection of the false dichotomy between affection and conation which that eighteenth-century view contained.

(Leeper, 1948, p.19)

Instead of treating motivation (conation) and emotion (affection) as a single functional psychological process labelled as activation, motivation (conation) and emotion (affection) are considered in the present analysis as two separate psychological processes which are highly interactive and are aroused simultaneously to determine a person's behavior in a given situation. The concept of emotion and the interactive relationship between motivation and emotion will be discussed in chapter five and chapter six respectively.
The remainder of this chapter will focus on a discussion of valence, expectancy and satisfaction as separate components of attitudes and how these interact to produce motivation. One must recognize that the name cognitive theory of motivation itself implies the assumptions that a person is rational and possesses knowledge of the situation in making his decision at a choice point.

4.3 Valence, Expectancy and Satisfaction as Components of Attitude

(a) Concept of Valence

Valence (V) is a person's antecedent hedonic orientation towards a particular outcome or incentive. It is a dynamic personal variable and relatively dependent on situational factors. Valence is considered a vector quantity having both direction (positive, neutral or negative) and magnitude (intensity, strength of attraction, or aspiration level). Conceptually, valence is divided into basic valence and instrumental valence.

Basic valence (V_B) refers to all those inner striving conditions variously described as needs, wants, wishes, desires, interests, values and the like. Conceptually, basic valence becomes instrumental valence when it has been discounted by one's expectancy evaluation or subjective probabilistic estimation of the degree to which the incentive is instrumental in satisfying his basic valence (V_B).
Some of the social wants mentioned by Krech et al. (1962) are affiliation wants, acquisitive want, prestige want, power want, altruistic want and curiosity want. Maslow (1954) suggests that the human needs, namely, physiological need, safety need, social need, ego need, and self-fulfilment need are related to one another in a developmental way and in an ascending hierarchy. It is these wants, needs, and other inner striving conditions that form the basis of motivation in a person.

**Instrumental valence** ($V_I$) is a person's antecedent hedonic orientation toward an incentive (or object, event, condition) in the environment because he perceives that the attainment of the incentive is instrumental to the satisfaction of his basic valence ($V_B$).

Hence the direction and magnitude of instrumental valence ($V_I$) depends on (a) the direction and magnitude of basic valence ($V_B$) and (b) the degree the person expects that the incentive will be instrumental in satisfying his basic valence.

As pointed out earlier in the chapter, there is a reciprocating relationship between anticipated reward and anticipated performance in a job incentive package as stipulated in the employment contract. Reward is defined as the material and non-material compensation given by the offeror to the offeree for his performance.

For a particular incentive ($I_i$) with reciprocating outcomes
of anticipated reward ($R_i$) and anticipated performance ($P_i$), the offeree's instrumental valence for the incentive ($V_{i_i}$) is assumed to be a function of the vector sum of ($V_{R_i}$) and ($V_{P_i}$).

$$V_{I_i} = \int_I (V_{R_i} + V_{P_i})$$

where $\int_I$ = Instrumental valence function;

$V_{R_i}$ = Instrumental valence for the anticipated material and non-material reward ($R_i$);

$V_{P_i}$ = Instrumental valence for the work itself in the anticipated performance ($P_i$) irrespective of the material and non-material rewards to be received from others.

To be more exact, $V_{R_i} = V_{R_i} + V_{P_i}$

where $V_{R_i}$ = Instrumental valence for the material rewards like pay, fringe benefits, promotion;

$V_{P_i}$ = Instrumental valence for the non-material rewards like praise for doing good work, increased responsibility, permissive supervision.

The interactive relationship between $V_{R_i}$ and $V_{P_i}$ is assumed to be vector additive. The offeree may have zero or neutral instrumental valence for the performance ($V_{P_i} = 0$).
But if his instrumental valence for the reward is positive, $(V_{R_i} > 0)$, the vector sum of his instrumental valence for the incentive offered to him is likely to be positive $(V_{I_i} > 0)$. If the interactive relationship between $V_{R_i}$ and $V_{P_i}$ is assumed to be vector multiplicative, then, $V_{I_i}$ for the above case will be zero, which is contrary to everyday experience. A person may have positive instrumental valence for both $R_i$ and $P_i$ if both reward and the work itself are attractive to him.

To prevent conceptual confusion, a person's basic valence $(V_B)$ is arbitrarily divided into two kinds, namely, basic valence for reward $(V_{BR})$ and basic valence for performance $(V_{BP})$, both of which can be considered as a person's characteristics indicating his hedonic orientation toward certain kinds of reward and certain kinds of work.

(b) **Concept of Expectancy**

Expectancy is an antecedent attitude indicating the degree to which one subjectively believes a certain outcome to be probable due to his perception of the situation. It is considered a scalar quantity having magnitude ranging from zero (absolute uncertainty) to one (absolute certainty). Expectancy is a relatively dynamic personal variable highly dependent on one's perceptions of the situational factors.

Three different kinds of expectancy are distinguished indicating that there are at least three kinds of cognitive
FIGURE 4-1. CONCEPTUAL DIAGRAM OF MULTIPLE DISCOUNT COGNITIVE MOTIVATION FUNCTION

Incentive - Condition of Motivation

OFFEROR

\[ I_i \]

\[ R_i \longrightarrow E_{P_i \rightarrow R_i} \longrightarrow P_i \]

\[ E_{R_i \rightarrow V_{BR}} \]

\[ E_{OR} \]

\[ E_{OP} \]

\[ E_{P_i \rightarrow V_{BP}} \]

OFFEREE

\[ V_{BR} \]

\[ V_B \]

\[ V_{BP} \]

Basic Valence - Basis of Motivation
expectations of means-end relationships (see Figure 4-1).

For a particular incentive \( I_i \) with reciprocating outcomes of anticipated reward \( R_i \) and anticipated performance \( P_i \),

\[
E_{R_i \rightarrow V^R_{B_R}} = \text{the degree the offeree subjectively believes that the attainment of the anticipated reward } (R_i) \text{ is instrumental in satisfying his basic valence for reward } (V^R_{B_R});
\]

\[
E_{P_i \rightarrow V^P_{B_P}} = \text{the degree the offeree subjectively believes that the anticipated performance } (P_i) \text{ itself is instrumental in satisfying his basic valence for performance } (V^P_{B_P});
\]

The above expectancy is a measure of the kind of reward and the kind of work the offeree wants or desires. It is the offeree's expectation of incentive-basic valence relationship.

\[
E_{O_R} = \text{the degree the offeree subjectively believes or trusts that the offeror will compensate him with the anticipated reward for his anticipated performance;}
\]

\[
E_{O_P} = \text{the degree the offeree subjectively believes or trusts that the offeror will really give him the kind of work to perform that he anticipated.}
\]
The above expectancy is a measure of the trust an offeree has that the offeror will honour the agreement. It is the offeree's expectation of the offeror-offeree relationship.

\[ E_{P_i \rightarrow R_i} = \text{the degree the offeree subjectively believes that the anticipated reward } (R_i) \text{ will depend on his anticipated performance } (P_i); \]

The above expectancy is a measure of the offeree's perception of the form of compensation. It is the offeree's expectation of performance-reward relationship.

Since \( 0 \leq E \leq 1 \) for each of the five expectancies, the effect of multiplying expectancy and basic valence is one of discounting the value of basic valence.

(c) Concept of Satisfaction

Satisfaction is a posterior attitude indicating one's feeling or affective orientation toward his performance, toward the material and non-material rewards received, and the extent to which these fulfil his basic valence \((V_B)\).

Satisfaction is considered a vector quantity having direction (positive, neutral or negative) and magnitude (intensity). It is a relatively transient personal variable and highly dependent on situational factors because one's performance is judged by others, and the material and non-material rewards one receives are given by others. Both of
these events are largely outside the person's control. The offeree's satisfaction with past performance and past reward will influence his present basic valence and expectancy.

4.4 The "Multiple-Discount" Concept of Motivation - The Interaction of Basic Valence and Expectancy

It is generally accepted that man is a wanting animal. The magnitude of human wants or basic valences before it has been discounted by one's expectancy can be very large or high. Both specific direction and magnitude of basic valence - needs, wants, wishes, desires, interests, values - vary from person to person due to individual differences. The multiple-discount concept of motivation assumes that a normal and rational person will evaluate both himself and the environment in making decisions and in his normal behavior. This thesis is concerned with the offeree's evaluation of the offeror and the offeror's incentive with reference to his basic valence. It is assumed that the offeree has already made a realistic self-evaluation or multiple discount of his basic valence with reference to his mental and non-mental ability, the amount of energy and resources he possesses, and probably with reference to his other personal qualities. In other words, it is assumed that a normal person's basic valence (direction and magnitude) is a realistic one because he knows his strengths and weaknesses. For example, an unrealistic basic valence will be the case of a high school drop-out wanting to be an university professor. One of the
probable reasons is that he has not made sufficient discount in his evaluation of his own ability.

The multiple-discount concept of motivation considers basic valence (a personal variable) and incentive (an environmental variable) as the fundamental components of motivation. Basic valence and incentive (reward and performance) are linked by cognitive paths of means-end expectancy. The means-end relationships between these personal variables and environmental variables are shown in Figure 4-1, which is a simplification of Figure 2-1 in chapter two.

The path concept comes from:

(a) the goal-path theory of motivation stated by Georgopoulos, Mahoney and Jones (1957); Vroom (1964); and Lawler and Porter (1967);
(b) Lewin's (1938) concept of an organism's perceived path connecting some immediate region in the life space with a more distant goal object;
(c) Tolman's (1932) concept of an organism's cognitive expectations or cognitive map of means-end relations.

According to this path concept, the person is motivated to do things that he perceives as having a high probability of leading to an outcome that is instrumental to the satisfaction of his basic valence.
The offeree's basic valence is considered the **basis of motivation** and the incentive offered to him is considered the **condition of motivation**. This is because a behavior sequence becomes operative, if and only if, the offeree has the basic valence for that incentive, without which it becomes valueless and unattractive to him, no matter how highly valuable and attractive it is to the offeror.

The offeree's motivation toward an incentive is assumed to be a function of his basic valence and his expectancy. The quantification of motivation requires an appropriate mathematical rule that is operationally valid and behaviorally rational to represent the interactive relationship between basic valence and expectancy.

### 4.5 The Hypothetical Interactive Relationships among Variables

The process of subjective evaluation of an incentive can be conceptualized as a multiple-discount operation if it is assumed that the mental process of evaluation can be represented operationally by appropriate mathematical rules. The limitations of this assumption are noted in chapter one.

Applying the concepts of vector and scalar quantities, then valence, reward, performance and motivation are considered as vector quantities having direction (positive, neutral, negative) and magnitude (intensity, aspiration level, strength
FIGURE 4-2

2x2 TEST OF INTERACTIVE RELATIONSHIP BETWEEN BASIC VALENCE AND EXPECTANCY

![Diagram showing the relationship between Basic Valence and Expectancy with four conditions: (a) H | H, (b) H | H, (c) L | L, and (d) L | H. H represents High, and L represents Low.]

H = High
L = Low

FIGURE 4-3

2x2 TEST OF INTERACTIVE RELATIONSHIP BETWEEN \( M_{R_i} \) and \( M_{P_i} \)

![Diagram showing the relationship between Motivation toward Reward and Motivation toward Performance with four conditions: (a) H | O, (b) H | H, (c) O | O, and (d) O | H. H represents High, and O represents Zero.]

Motivation toward Reward \( M_{R_i} \)
Motivation toward Performance \( M_{P_i} \)
of attraction) where both direction and magnitude are relative depending on the respective frame of reference and the standard scale of measurement that are chosen. Expectancy is considered a scalar quantity having magnitude ranging from zero (absolute uncertainty) to one (absolute certainty). The mathematical rule for the interactive relationship between

(1) expectancy and valence is assumed to be algebraic multiplicative;

(2) motivation toward reward and motivation toward performance is assumed to be vector additive.

A 2x2 interactive test is designed to verify the validity of assumptions (1) and (2).

Interactive Relationship between Basic Valence and Expectancy

The rationale for assuming that expectancy interacts multiplicatively with basic valence to determine the attractiveness of the incentive to the offeree is as follows (see Figure 4-2):

(a) If the offeree has high basic valence for the incentive but low expectancy of attaining it from the offeror, it is likely that the offeree will be weakly attracted by the incentive.

(b) If the offeree has high basic valence for the
Interactive Relationship between Motivation toward Reward and Motivation toward Performance

The rationale for assuming a vector additive interactive relationship between the offeree's motivation toward anticipated reward ($M_{R_i}$) and motivation toward anticipated performance ($M_{P_i}$) to determine his motivation towards the incentive ($M_{I_i}$) is as follows (see Figure 4-3):

(a) If the offeree has high positive motivation toward the anticipated reward and zero motivation or indifference toward the anticipated performance, it is likely that his motivation toward the incentive will be positive.

(b) If the offeree has high positive motivation toward both anticipated reward and anticipated performance, it is likely that his motivation toward the incentive will be high.

(c) If the offeree has zero motivation or is indifferent toward the anticipated reward and anticipated performance, it is likely that this motivation toward the incentive will be zero.

(d) If the offeree has zero motivation toward the anticipated reward and high positive motivation toward the anticipated performance, it is likely that his motivation toward the incentive will be positive.
Interactive Relationship between Motivation toward Reward and Motivation toward Performance

The rationale for assuming a vector additive interactive relationship between the offeree's motivation toward anticipated reward \( M_{R_i} \) and motivation toward anticipated performance \( M_{P_i} \) to determine his motivation towards the incentive \( M_{I_i} \) is as follows (see Figure 4-3):

(a) If the offeree has high positive motivation toward the anticipated reward and zero motivation or indifference toward the anticipated performance, it is likely that his motivation toward the incentive will be positive.

(b) If the offeree has high positive motivation toward both anticipated reward and anticipated performance, it is likely that his motivation toward the incentive will be high.

(c) If the offeree has zero motivation or is indifferent toward the anticipated reward and anticipated performance, it is likely that this motivation toward the incentive will be zero.

(d) If the offeree has zero motivation toward the anticipated reward and high positive motivation toward the anticipated performance, it is likely that his motivation toward the incentive will be positive.
compensate him with the anticipated reward for his anticipated performance;

(2) \((M_{p_i})\) is a monotonically increasing function of the vector sum of the algebraic products of:
   
   (a) his basic valence for performance \((V_{BP})\),
   
   (b) his expectancy that the anticipated performance \((P_i)\) is instrumental in satisfying his \((V_{BP})\),
   
   (c) his expectancy that the anticipated reward \((R_i)\) will depend on his anticipated performance \((P_i)\),
   
   (d) his expectancy that the offeror will really give him the kind of tasks he anticipated performing.

The proposed motivation function can be expressed operationally in the following equation:

\[
M_{I_i} = \sum_{i=1}^{R} (V_{BR})(E_{R_i \rightarrow V_{BR}})(E_{OR}) + \sum_{i=1}^{P} (V_{BP})(E_{P_i \rightarrow V_{BP}})(E_{P_i \rightarrow R_i})(E_{OP})
\]

(4-1)
compensate him with the anticipated reward for his anticipated performance;

(2) \( (M_{pi}) \) is a monotonically increasing function of the vector sum of the algebraic products of:

(a) his basic valence for performance \( (V_{bp}) \),

(b) his expectancy that the anticipated performance \( (P_i) \) is instrumental in satisfying his \( (V_{bp}) \),

(c) his expectancy that the anticipated reward \( (R_i) \) will depend on his anticipated performance \( (P_i) \),

(d) his expectancy that the offeror will really give him the kind of tasks he anticipated performing.

The proposed motivation function can be expressed operationally in the following equation:

\[
M_{I_i} = \int \left[ \sum_{i=1}^{R} (V_{BR}) (E_{R_i} \rightarrow V_{BR}) (E_{OR}) + \sum_{i=1}^{P} (V_{BP}) (E_{P_i} \rightarrow V_{BP}) (E_{P_i} \rightarrow R_i) (E_{OP}) \right]
\]

(4-1)
other words, the offeree is expected to do $P$ discrete tasks in his job, for which he is expected to receive $R$ discrete rewards as compensation from the institution. The strength of his motivation toward the incentive ($M_i$) is a function of the vector sum of his motivation toward the anticipated rewards ($M_{R_i}$) and his motivation toward the anticipated performance ($M_{P_i}$). Both ($M_{R_i}$) and ($M_{P_i}$) are derived from ($V_B$) by an evaluation process in the form of a multiple-discount operation by his expectancy or expectation of means-end relationships.

Motivation Toward Reward

The magnitude of the offeree's motivation toward the anticipated rewards ($M_{R_i}$) depends on his basic valence for reward ($V_{BR}$) at that point of time, the degree he subjectively believes that the anticipated reward ($R_i$) is instrumental in satisfying his basic valence for reward ($V_{BR}$), and the degree to which he believes that the institution will compensate him with the anticipated reward ($R_i$) for his anticipated performance ($P_i$). The implication of an algebraic multiplicative interactive relationship is that if one or more of the three variables - ($E_{R_i}$), ($E_{R_i} V_{BR}$), ($V_{BR}$) - is zero in value, the offeree's magnitude of motivation toward the anticipated reward ($R_i$) will be zero in value, that is, $M_{R_i} = 0$. Since expectancy has magnitude ranging from zero (absolute uncertainty) to one (absolute certainty), the magnitude of $M_{R_i} \leq V_{BR}$. Also, the
other words, the offeree is expected to do $P$ discrete tasks in his job, for which he is expected to receive $R$ discrete rewards as compensation from the institution. The strength of his motivation toward the incentive $(M_i)$ is a function of the vector sum of his motivation toward the anticipated rewards $(M_{R_i})$ and his motivation toward the anticipated performance $(M_{P_i})$. Both $(M_{R_i})$ and $(M_{P_i})$ are derived from $(V_B)$ by an evaluation process in the form of a multiple-discount operation by his expectancy or expectation of means-end relationships.

Motivation Toward Reward

The magnitude of the offeree's motivation toward the anticipated rewards $(M_{R_i})$ depends on his basic valence for reward $(V^R_B)$ at that point of time, the degree he subjectively believes that the anticipated reward $(R_i)$ is instrumental in satisfying his basic valence for reward $(V^R_B)$, and the degree to which he believes that the institution will compensate him with the anticipated reward $(R_i)$ for his anticipated performance $(P_i)$. The implication of an algebraic multiplicative interactive relationship is that if one or more of the three variables - $(E_{R_i})$, $(E_{R_i} \rightarrow V^R_B)$, $(V^R_B)$ - is zero in value, the offeree's magnitude of motivation toward the anticipated reward $(R_i)$ will be zero in value, that is, $M_{R_i} = 0$. Since expectancy has magnitude ranging from zero (absolute uncertainty) to one (absolute certainty), the magnitude of $M_{R_i} \leq V^R_B$. Also, the
expectancy is considered a scalar quantity.

4.8 The General Multiple-Discount Motivation Function

There may be other expectancies that have not been considered in formulating the present multiple-discount cognitive motivation function. Hence a general and flexible model is necessary that will allow the inclusion of other expectancies not identified in the present analysis. The present distinction between motivation toward the reward and motivation toward the performance is more of a conceptual emphasis than an operational necessity.

The incentive (I) comes in a single package either implicitly in the form of a psychological contract, or explicitly in the form of a written employment contract in which the P discrete tasks the employee is expected to perform and the R discrete rewards he anticipates to receive for his anticipated performance are mutually recognized by the two parties to the contract. Also, an employee's job behavior, which influences his job performance, is determined by the total or combined influences of the P discrete tasks he performs and the R discrete rewards he receives in his job. In reality, the relationship between incentive, reward and performance in the employment contract and in the job situation is \( I = P + R \).

Also, the division of basic valence for the incentive \( V_{BI} \) into basic valence for reward \( V_{BR} \) and basic valence for performance \( V_{BP} \) is arbitrary and operationally unnecessary.
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Also, the division of basic valence for the incentive $(V_{BI})$ into basic valence for reward $(V_{BR})$ and basic valence for performance $(V_{BP})$ is arbitrary and operationally unnecessary.
A more general, flexible, and operational model of the multiple-discount cognitive motivation function is as follows:

\[
M = \int M \left[ \sum_{i=1}^{I} (E_1 E_2 \ldots E_i \ldots E_n) (V_{B_i}) \right]
\]

(4-2)

where

- \( M \) = general indicator of a person's motivation in his job;
- \( \int M \) = motivation function;
- \( \int M' > 0 \)

- \( I \) = the number of discrete incentive components in the employment contract which consists of \( P \) discrete tasks the offeree expects to perform and \( R \) discrete rewards he expects to receive from the offeror for his anticipated performance as stipulated in the job contract: \( I = P + R \).

- \( V_{B_i} \) = offeree's basic valences for the \( I \) job incentive components;

- \( E_i \) = expectancy of the means-end relationship for incentive component \( i \), \( 0 \leq E_i \leq 1 \).

- \( n \) = number of discrete expectancies of means-end relationships for a particular incentive component \( i \) perceived by the offeree. For each of the \( R \) rewards and \( P \) performances the offeree may perceive \( n \) expectancies of means-
end relationships;

\[ \sum_{i=1}^{I} \] vector addition of the algebraic products of expectancies and basic valences for the I incentive components.

There is no conceptual and operational difference between equation (4-1) and equation (4-2) because

\[ I = R + P, \] and therefore, \[ \sum_{i=1}^{I} = \sum_{i=1}^{R} + \sum_{i=1}^{P}. \]

The multiple-discount cognitive motivation function is derived from an over-simplified model of human behavior. This simple model is preferred to a more realistic but more complicated model because its simplicity makes empirical testing of the motivation function easier. It is a sacrifice of reality for testability. This motivation function will be incorporated into the performance formula in chapter six of this thesis.
Chapter 5

BEHAVIORAL EFFICIENCY AS A FUNCTION OF EMOTION

5.1 Introduction

One of the probable reasons why industrial behavioral scientists do not explicitly consider emotion as a determinant of performance may lie in the fact that there is a lack of common agreement as to the concept of emotion. Unlike motivation, which is generally held to have been derived from a person's needs, wants, interests, values, and other basic valences, and which initiates, directs and sustains behavior toward or away from some object, "emotion is virtually impossible to define ... except in terms of conflicting theories" (English and English, 1958).

Brown and Farber in the theoretical paper on emotion remarked that:

... no genuine order can be discerned within this field. Instead, examination of current treatments of emotion reveals a discouraging state of confusion and uncertainty. Substantial advances have been made in recent years with respect to theories of learning and motivation, but the phenomena of emotion have not, as a rule, been considered in these formulations and remain a tangle of unrelated facts.

(Brown and Farber, 1951, p.465)
According to Young:

At best, the definition of emotion presents a difficult problem. No single definition has proved acceptable to all psychologists . . . The difficulty seems to be that no single criterion has been found that clearly distinguishes emotional and non-emotional states.

(Young, 1961, pp.350-351)

Realizing the confusion that surrounds the concept of emotion, the present analysis will consider only those aspects of the concept of emotion that have gained general acceptance by psychologists and are supported by empirical research studies. The conceptual issues reviewed in this chapter are: (a) whether emotion is an organized or disorganized response; (b) whether emotion is motivational in nature. This chapter also reviews the findings of the experimentally orientated activation theorists whose investigations centered mainly on the relationship between behavioral efficiency and level of emotion arousal by the use of various physiological measures such as skin conductance, brain wave pattern, muscular tension, cardiac rate, respiratory pattern, et cetera. Their studies include physiological deprivations, such as food and water, which are traditionally considered as leading to motivational arousal or activation. The various experiments carried out by the activation theorists will not be reviewed here. Only the general conclusions inferred from the results of their experiments will be examined.

While the existence of emotions such as anxiety, fear,
joy, feelings of confidence and assurance and other human emotions is accepted as a fact of experience, there is much confusion about the fundamental concept of emotion. The established view is that the words commonly used to describe emotional states - upset, disruption, emotional turbulence, disorganization, emotional outburst, disturbance, etc. - suggest that emotions are useless and that one would be better off without them. Leeper (1948) argued against this established view in an important and provocative paper, *A Motivational Theory of Emotion to Replace 'Emotion as Disorganized Response'*, which instigated a series of discussions on the concept of emotion by Duffy (1948), Webb (1948), Young (1949), Waters and Blackwood (1949) and others.

5.2 Emotion as an Organized or Disorganized Response

Leeper attacked the established viewpoint which considers emotion to be a disorganized and disorganizing response - a concept found in the widely used textbooks by Munn; Shaffer, Gilmer and Schoen; Young; Boring; Langfield and Weld; Dockeray; and Woodworth. Among the definitions of emotion quoted by Leeper is one given by Shaffer, et al. who defines emotion as "a disorganized response, largely visceral, resulting from the lack of an effective adjustment" (Shaffer, Gilmer, and Schoen, 1940, p.505).

None of the above writers, Leeper noted, had attempted
to give a definition of the key terms 'disorganized' and 'disorganizing' and thus sloppy thinking resulted. According to Leeper:

... a system is 'organized' when one part of it is functioning harmoniously with other parts. Something is 'organized' when the parts fit, or dovetail, or are congruous with one another. And on the other hand, something is 'disorganized' when the subordinate parts operate at cross purposes with each other. Something has an 'organizing' influence in a system when it tends to produce order or cooperation or harmony between different subordinate parts or subordinate activities.

(Leeper, 1948, p.12)

In terms of this definition, Leeper asserted that emotion produced organization in the person viscerally, behaviorally, and in conscious experience, rather than disorganization. He pointed out that a football coach typically put in considerable effort to get his men emotionally aroused (or even angry!). Leeper argued that a person in anger was definitely organized for attack behaviorally, his visceral processes were organized for the vigorous action required in a biological emergency and his conscious experience was organized along with the basic determination. He held that disorganization seen in intense emotion did not give the clue to the general influence of emotion because, as in physiology, extremes could not be taken as evidence of normal effects.

Leeper's concept of emotion as organized response received general support from Duffy (1948), Webb (1948), Young
(1949), Waters and Blackwood (1949). Duffy sympathized with Leeper's overall viewpoint but felt that the latter did not go far enough in that he only attacked one definition of emotion — that of emotion as disorganized response. She felt that other definitions of emotion were equally unacceptable.

Young (1949) in *Emotion as Disorganized Response — A Reply to Professor Leeper* agreed with Leeper in emphasizing the importance of the organized components of emotional behavior. He pointed out that organization and disorganization were simply different ways of viewing and interpreting one and the same event. Even the most completely disorganized emotional process, when looked at from another point of view, was found to contain integrated components of response. Young insisted that there was no real antagonism between the two views of emotional behavior. In his later discussion on "Emotional Organization and Disorganization", Young (1961) asserted that:

Some psychologists, e.g., Leeper (1948), have objected to defining emotion as a disorganized and disorganizing response. But I believe that if it were not for the fact of disorganization, psychologists could dispense with the concept of emotion entirely. . . . It is because disorganization exists as a fact of nature, and for no other reason, that we need the concept of emotional disturbance.

(Young, 1961, p.355)

In spite of their differences, Leeper, Young and others agreed that emotion existed in various degrees of intensity.
Emotion is considered an organized and organizing process when the intensity of emotion is moderate. When the intensity of emotion is high, it is considered predominantly a disorganizing psychological process.

5.3 The Motivational Nature of Emotion

While the quantitative-deterministic motivation theories, namely, the S-R behavior theory and the cognitive theory, exclude emotion as a motivational factor in their formulae (see Table 2-1 and Table 2-2), most qualitative-mentalistic psychologists recognized the motivational quality of emotion.

McDougall (1908) is one of the early qualitative-mentalistic psychologists who integrated emotion into motivation theory in his discussion on purposive and cognitive behavior. More recently, Leeper (1948), Young (1955), and Ruch (1963) explicitly pointed out that emotion is motivational in nature.

Leeper (1948) specifically asserted that emotional processes were one of the fundamental means of motivation in the higher animals and that the discussion of emotion belonged to the discussion of motivation. He reasoned:

Our factual knowledge says that if you can arouse anger in a person you can increase the probability that his behavior will be directed and sustained in a certain direction. If you can arouse sympathy and friendliness, you will increase the likelihood that his behavior will be directed and energized in a different direction. The stronger
the emotional process aroused (short of extremes that will perhaps run into qualitative different effects), the more certainly will his behavior be governed in a way consistent with his emotional reaction. This is a principle which permits prediction and control of human behavior and conscious experience . . . If this line of argument is sound, it means that emotional processes operate primarily as motives. It means that they are processes which arouse, sustain, and direct activity!

(Leeper, 1948, p.17).

Young pointed out that both motivational and affective processes are hedonic processes and that affect has direction and intensity. Young asserted that:

According to the hedonic theory, motivation lies in the affective processes. As human beings we are aware of feelings of delight and distress, of anger, anxiety, embarrassment, et cetera, and we repeatedly interpret our actions and the actions of others in terms of conscious feeling.

(Young, 1955, p.193).

Hence Young went one step further than Leeper's contention that emotional processes are one of the fundamental means of motivation in higher animals. He insisted:

Affective processes as primary motives arouse behavior; they sustain or terminate an activity in progress; they regulate and organize behavior according to the hedonic principle; and they lead to the acquisition of motives, stable dispositions to act, and value systems

(Young, 1955, p.194).

Recent textbooks by Heyns (1958), Ruch (1963), Hilgard and Atkinson (1967) support the concept that emotion is moti-
vational in nature. For example, Ruch stated that emotions like other motives might serve to direct behavior either toward some desired object or condition or away from some object or situation that is unpleasant (Ruch, 1963, p.173).

5.4 The Influence of Emotion on Performance

The influence of emotion on performance is a well recognized fact. The emotional health or mental health of employees has long been one of the concerns of management (Levinson, 1964). McGregor explicitly stated that a person's behavior, whether he is thinking, analyzing, reasoning, or interacting with others, is always influenced significantly by emotional factors, some conscious and some unconscious. The more important the problem or issue under consideration is for the person, the greater the influence of emotional factors on his responses. McGregor further pointed out that others cannot eliminate these influences by the giving of orders or the making of requests, nor can the person eliminate them by the conscious wilful effort to do so because the emotional and rational aspects of man are inextricably interwoven and only to a very slight degree separable (McGregor, 1964, pp.218-219).

There are substantial research studies on the relationship between behavioral efficiency and the level of emotion arousal in the literature of activation theories. The study of activation is considerably broader than emotion because it
Optimal level

Increasing alertness, interest, positive emotion

Increasing emotional disturbances, anxiety

Deep sleep

Point of waking

FIGURE 5-1. HYPOTHETICAL "INVERTED U-SHAPED" RELATIONSHIP BETWEEN BEHAVIORAL EFFICIENCY OR LEVEL OF CUE FUNCTION AND LEVEL OF AROUSAL. Reproduced from Hebb (1955, Fig. 2)
includes within its scope areas traditionally considered motivational. The consensus of evidence from these research studies shows that the relationship between behavioral efficiency and emotion arousal is an inverted U-shaped function. (Freeman, 1931, 1933, 1938, 1940; Duffy, 1932, 1951; Courts, 1939, 1942; Stauffacher, 1937; Schlosberg, 1954; Duffy and Lacy, 1946; Schlosberg and Stanley, 1953; Malmo, 1957, 1958, 1959; Bartoshuk, 1955; Belanger & Tetreau, 1961; Surwillo, 1956; Stennett, 1957).

Activation theorists such as Duffy, Schlosberg, Hebb and Malmo stressed that emotion arousal can be indicated by a variety of measures and that emotion arousal or activation is a continuum, varying from deep sleep to highly excited states and that behavioral efficiency is a curvilinear function of activation or arousal, being at its peak when arousal has reached intermediate magnitude (See Figure 5-1). Malmo remarked:

... the relation between activation and behavioral efficiency (cue function or level of performance) is described by an inverted U curve. That is from low activation up to a point that is optimal for a given function, level of performance rises monotonically with increasing activation level, but beyond this optimal point the relation becomes non-monotonic: further increase in activation beyond this point produces a fall in performance level, this fall being directly related to the amount of the increase in level of activation

(Malmo, 1959, p.368).

Malmo (1958) pointed out one major difference between
the motivation (drive) theorists and the activation theorists regarding the relationship between behavior and arousal; the former usually assume a monotonic function while the latter strongly stress an inverted U-shaped function.

5.5 Theoretical Assumptions on the Relationship between Emotion and Behavioral Efficiency

The empirical findings of the activation theorists seem to support the concept that emotion can be an organizing as well as a disorganizing psychological process. From everyday experience, one often finds that the same emotion can facilitate or inhibit performance depending on the intensity of emotion arousal. For example, a mild state of anxiety and fear may make a person perform more efficiently, but an intense state of anxiety and fear may inhibit his performance. Similarly, a feeling of confidence may facilitate performance but a feeling of over-confidence may impair performance. The empirical findings of the activation theorists cited in the previous section can be considered as tentative evidence to support the assumption that the relationship between behavioral efficiency and emotion arousal is an inverted U-shaped function. This assumption probably holds for many kinds of emotion but may not hold for all kinds of emotion.

It is reasonable to assume that human behavior is governed principally by the interaction of psychological
processes, one being the emotional process which can cause organization and disorganization in a person. The term "emotional process" implies that emotion, as a psychological hypothetical construct, is dynamic and varies in direction and magnitude with time under changing environmental conditions. The direction and magnitude of emotion at a particular point of time is termed "emotion arousal" or a "state of emotion". And the meaning of "psyche" is, as pointed out in chapter one, "the mind". Hence, broadly, emotion is a mental state related to some tangible or intangible external object, and is characterized by feelings of various intensities and accompanied by visceral reactions and motor expressions of various intensities which may or may not be apparent.

There are limitations and shortcomings in using the concept of "organization" as a conceptual tool to describe a person's state of mind when the mind itself, unlike the brain, is an intangible or abstract object. The terms "non-organized", "organized" and "disorganized" are concepts of arrangement of tangible physical objects. In the absence of a better conceptual tool, the concept of organization as defined by Leeper (1948) has been adopted.

Behavioral efficiency in work performance is assumed to be the consequence of a person's state of mental organization. It is defined as the ratio of a person's actual performance to his potential performance. In other words, it is a comparison
FIGURE 5-2. BEHAVIORAL EFFICIENCY AS A FUNCTION OF EMOTION AROUSAL WITH STATE OF MENTAL ORGANIZATION AS INTERVENING VARIABLE
between the actual work done by a person and the maximum work of which he is capable. The value of behavioral efficiency ranges from zero to one.

It is assumed that a person's level of emotion arousal \((e)\) influences his state of mental organization which in turn influences his behavioral efficiency in work performance \((B_e)\) since it is assumed earlier that mental or psychological processes coordinate and govern a person's behavior. Emotion arousal such as anger and work performance such as rate of output are observables. State of mental or psychological organization is the unobservable intervening variable that is anchored between the two observables and explains the relationship between them (See Figure 5-2).

By using an arbitrary unity scale, the level of emotion arousal ranges from zero when a person is in deep sleep to one when he is highly aroused \((i.e., \ 0 \leq e \leq 1)\). A person's mind is assumed to be relaxed and non-organized for goal-directed behavior when he is in deep sleep and hence his behavioral efficiency in work performance is zero \((i.e., B_e = 0 \text{ when } e = 0)\). As his level of emotion arousal increases from zero, conceptually, his mental state becomes more organized since emotion is assumed to be an organized and organizing psychological process when the level of emotion arousal is low. As a result, his behavioral efficiency in work performance also increases \((i.e., B_e > 0 \text{ when } e > 0)\). A person's mental organization, and hence his
behavioral efficiency, reaches an optimal state at a certain intermediate level of emotion arousal which varies in a person from situation to situation. When the level of emotion arousal increases beyond this optimal point, the influence of emotion as a disorganized and disorganizing process becomes predominant. When a person is highly aroused emotionally, his mind is assumed to be disorganized. Hence at this stage his behavioral efficiency in work performance becomes zero (i.e., \( B_e = 0 \) when \( e = 1 \)).

Since it is assumed that behavioral efficiency is a function of level of emotion arousal with the state of mental organization as intervening variable, it follows that a person's behavioral efficiency must be equal or less than his level of emotion arousal \( (B_e \leq e \text{ for all value of } e) \).

5.6 Derivation of the Behavioral Efficiency Function

Source

The inverted U-shaped behavioral efficiency function derived from emotion is a modification of the projectile equation in physical mechanics.

\[
h = vt - \frac{1}{2}gt^2
\]

where
\[
h = \text{height of projection of a particle at time } t;
\]
\[
v = \text{initial velocity}
\]
\[
g = \text{gravitational acceleration}
\]
Requirements

Modification of this equation is necessary to meet the following requirements:

(a) to reduce the number of variables;

(b) to increase the flexibility of the function (i.e., to include a wider range of possible outcomes);

(c) to satisfy the conditions of the following theoretical assumptions:

\[ B_e \leq e \text{ for all value of } e; \]
\[ B_e = 0 \text{ when } e = 0 \text{ and } e = 1; \]
\[ B_e > 0 \text{ when } 0 < e < 1; \]

where behavioral efficiency \( 0 \leq B_e \leq 1 \)
emotion arousal \( 0 \leq e \leq 1 \)

Procedure of Modification

Divide equation (5-1) by \( v \),

\[
\frac{h}{v} = t - (\frac{q}{2v})t^2
\]  
(5-2)

Substitute the following equation (5-2)

\[ B_e \text{ for } \frac{h}{v}, \]
\[ e \text{ for } t, \]
\[ a \text{ for } \frac{q}{2v}, \]
\[ b \text{ for } 2. \]
Equation (5-2) becomes

\[ B_e = \int_{B_e} (e - ae^b) \quad (5-3) \]

where
- \( e \) = level of emotion arousal;
- \( B_e \) = behavioral efficiency in work performance;
- \( \int B_e \) = behavioral efficiency function;
- \( a, b \) = emotional characteristics of a person;

5.7 Testing of the Behavioral Efficiency Function

The aims of the tests are:

1. to show the effect of variation of \( a \) on behavioral efficiency for constant value of \( b \);
2. to show the effect of variation of \( b \) on behavioral efficiency for \( a = 1 \);
3. to determine the valid value of \( b \) for satisfying the conditions:

\[ B_e \leq e \quad \text{for all value of } e, \]
\[ B_e = 0 \quad \text{when } e = 0 \text{ and } e = 1, \]
\[ B_e > 0 \quad \text{when } 0 < e < 1 \]

where
- \( 0 \leq B_e \leq 1 \)
- \( 0 \leq e \leq 1 \)
(1) Effect of constant value of $b$ and variable value of $a$

The values of $B_e$ derived from the function

$$B_e = \int_{B_e} (e - ae^b)$$

for values of:

(i) $b = 2$, $a = 0.3, 0.5, 0.8, 1.0, 1.2, 1.5, 2.0$;
(ii) $b = 5$, $a = 0.3, 0.5, 0.8, 1.0, 1.2, 1.5, 2.0$;

are tabulated in Table 5-1 and plotted in Graph 5-1.

Graph 5-1 shows that for values of $b = 2$ and $b = 5$, the only curves that "fit" or satisfy the conditions of the theoretical assumptions that for:

$$1 \leq B_e \leq 1$$
$$1 \leq e \leq 1$$
$$B_e \leq e \text{ for all value of } e$$
$$B_e = 0 \text{ when } e = 0 \text{ and } e = 1$$
$$B_e > 0 \text{ when } 0 < e < 1$$

is the value of $a = 1$.

Hence only the value of $a = 1$ is valid and all other values of $a$ are invalid for the hypothetical behavioral efficiency equation, which thus becomes:

$$B_e = \int_{B_e} (e - e^b)$$

(5-4)
### TABLE 5-1

Values of $B_e$ for $b = 2$

<table>
<thead>
<tr>
<th>$a$</th>
<th>0</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
<th>0.9</th>
<th>1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3</td>
<td>0</td>
<td>0.097</td>
<td>0.188</td>
<td>0.273</td>
<td>0.352</td>
<td>0.425</td>
<td>0.492</td>
<td>0.533</td>
<td>0.608</td>
<td>0.657</td>
<td>0.70</td>
</tr>
<tr>
<td>0.5</td>
<td>0</td>
<td>0.095</td>
<td>0.180</td>
<td>0.255</td>
<td>0.320</td>
<td>0.375</td>
<td>0.420</td>
<td>0.455</td>
<td>0.480</td>
<td>0.495</td>
<td>0.50</td>
</tr>
<tr>
<td>0.8</td>
<td>0</td>
<td>0.092</td>
<td>0.168</td>
<td>0.228</td>
<td>0.272</td>
<td>0.300</td>
<td>0.312</td>
<td>0.308</td>
<td>0.288</td>
<td>0.252</td>
<td>0.20</td>
</tr>
<tr>
<td>1.0</td>
<td>0</td>
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<td>0.210</td>
<td>0.240</td>
<td>0.250</td>
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Values of $B_e$ for $b = 5$

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<td>0.523</td>
<td>0.472</td>
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</tbody>
</table>
GRAPH 5-1. EFFECTS OF VARIATION OF a
(2) Effect of variation of \( b \) value

The values of \( B_e \) derived from the function
\[
B_e = \int_{B_e} (e - e^b) \quad \text{for values of } b = 1.5, 2.0, 2.5, 3.0, 5, 9, 20
\]
are tabulated in Table 5-2 and plotted in Graph 5-2.

The graph shows that (i) a person with high \( b \) value has higher level of behavioral efficiency (vertical effect) than a person with low \( b \) value; (ii) a person with high \( b \) value is less susceptible to mental disorganization (horizontal effect) at high level of emotion arousal than a person with low \( b \) value.

Hence \( b \) value represents a person's emotional characteristics.

(3) Limits of valid value of \( b \)

From the function
\[
B_e = \int_{B_e} (e - e^b)
\]
and value of \( 0 \leq e \leq 1 \)
when \( b \to 1 \), \( B_e \to 0 \) for all value of \( e \);
when \( b < 1 \), \( B_e < 0 \) for all value of \( 0 < e < 1 \);
when \( b \to \infty \), \( B_e \to e \) for all value of \( 0 < e < 1 \).

The only valid range of \( b \) value which fits the theoretical assumption that:
\[
B_e \leq e \quad \text{for all value of } e
\]
\[
B_e = 0 \quad \text{when } e = 0 \text{ and } e = 1
\]
\[
B_e > 0 \quad \text{when } 0 < e < 1
\]
is the value of \( 1 < b < \infty \). In other words, \( b \) can be any
TABLE 5-2

Values of $B_e$ for $a = 1$

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<td>.273</td>
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<td>.288</td>
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</tr>
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<td>.472</td>
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</tr>
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<td>.7</td>
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</table>
GRAPH 5-2. EFFECTS OF VARIATION OF $b$

Level of Emotion Arousal ($e$)

Behavioral Efficiency ($B_e$)

$b=20$

$b=9$

$b=5$

$b=3$

$b=2.5$

$b=2$

$b=1.5$
positive finite number greater than one. The behavioral efficiency function \( B_e = \int_{B_e} (e - e^b) \) will be integrated into Maier's performance formula as a possible moderator between motivation and performance in chapter six.

5.8 Interpretation of \( b \) Value

Similar to the concept of "disorganization" used by the psychologists is the concept of "emotional disorder" or the more widely used concept of "mental disorder" by the clinical psychiatrists. According to Miner, in a general sense the two terms refer to the same thing. A person suffering from emotional or mental illness such as psychosis or neurosis can be considered to have low \( b \) value. Miner noted that:

The borderline between emotional health and illness is difficult to establish. . . . In psychosis, the person is bound up in his emotions and the process of defending against them that responsiveness to the demands of the outside world becomes minimal or is totally lost. Emotion is experienced with overpowering intensity, and equally drastic defensive processes are mobilized. These defenses characteristically manifest themselves through behavior (or speech) or through perceptions and beliefs. That is, although physical symptoms precipitated by emotion may exist in psychosis, they are not sufficient alone to define the disorder. Distorted ideas or perceptions are, however, always present, and the degree of commitment to them is likely to be strong. Interpretations which are inconsistent with reality are not regarded by the person simply as possibilities. The individual moves to a state of certainty without any attempt to check on the validity of what were mere hypotheses only moments before. The defenses become totally inflexible. As a result, these distorted thoughts and perceptions may on occasion manifest themselves in bizarre
A person with such emotional characteristics will likely exhibit disorganized response at a low level of emotion arousal. It follows that his behavioral efficiency in work performance will probably be very low.

Neurosis is a less severe form of mental disorder. Such a person does not lose contact with the realities of the environment. He can be considered as having a higher $b$ value than a person having psychosis. Miner said:

In neurosis . . . this break with reality does not occur; the individual does not lose himself entirely to the processes of emotion and defense. Instead, he adopts methods for warding off emotion which are generally consistent with the demands of social convention and the need for survival.

A rational person with high emotional stability is considered to have high $b$ value. His mental state is highly organized even at a high level of emotion arousal and hence he has a high level of behavioral efficiency in work performance.
Chapter 6

PERFORMANCE AS A FUNCTION OF ABILITY, MOTIVATION AND EMOTION

6.1 Introduction

This chapter is an extension of the quantitative analysis in chapter three of performance as a function of ability and motivation. Emotion is explicitly considered as a moderator which influences the relationship between motivation and performance. In chapters four and five, motivation and emotion were treated as two separate and non-interactive psychological processes. In this chapter these two variables are considered as simultaneous and highly interactive psychological processes which together help to activate behavior. A person's work performance is assumed to be the algebraic product of his ability, motivation and behavioral efficiency where behavioral efficiency is assumed to be a function of a person's emotional characteristics and his emotion arousal at a particular point of time.

6.2 Relationship between Motivation and Performance

The empirical studies of French (1957), Fleishman (1958), Vroom (1960), Lawler (1966), and Mitchell (1967) support the assumption that ability, as a moderator, interacts multipli-
FIGURE 6. REPRESENTATION OF THE GENERAL RELATION BETWEEN LEVEL OF PERFORMANCE AND DEGREE OF MOTIVATION. Reproduced from Young (1961, Fig. 1).
catively with motivation to help determine performance. Since motivation is a dynamic personal variable and ability is a more or less constant personal variable over a short period of time, performance will vary with the variation in motivation.

The cognitive theory of motivation assumed that motivation is a monotonically increasing function of expectancy and valence. If the cognitive motivation function is substituted into Maier's performance formula, theoretically, performance will increase monotonically as motivation increases monotonically since ability is considered a constant. When a person is intensely motivated, theoretically, his level of performance must be very high and there should not be any lowering in the level of performance. However, there is evidence to show that this is not empirically true. According to Young (See Figure 6-1):

Experiments with human and animal subjects have shown that the level of performance varies with the degree of motivation. For any task there is optimal degree, or level, of motivation, i.e., a degree of motivation that yields the maximal output . . . But when the degree of motivation is above a critical level, there is disturbance of performance and lowered efficiency. The subject is over motivated.

(Young, 1961, pp.2-3)

The possibility of decreases in performance under high levels of motivation also is recognized by Yerkes and Dodson (1908), Patrick (1934), Birch (1945), McClelland (1951), and Vroom (1964). There are two possible explanations to account
for the phenomenon of an inverted U-shaped function for the relationship between performance and motivation. The first explanation is that there are other moderators which have not been taken into consideration, that interact with motivation to help determine performance. The second explanation is that the components of motivation may produce other side-effects, besides motivational effect which will reduce an organism's efficiency in performance. McClelland (1951) gives the first explanation, while Vroom (1964) recognizes that two explanations are possible. McClelland reasons that:

... as a motive increases in intensity it first leads to an increase in the efficiency of instrumental activity and then to a decrease. Thus it would appear that as far as adjustment is concerned there is a certain optimum level of motive intensity, a level of "creative anxiety", which leads to maximum problem-solving efficiency. Too little motivation leads to sluggishness and inertia, too much to disruption and defense against anxiety. The theoretical problems still unsolved are the discovery of what this area of optimum intensity is and why higher intensities lead to inefficiency.

(McClelland, 1951, p.485)

Vroom explains that a highly motivated person may attend only to those cues which he expects to be useful in the attainment of his goals. If the task is a novel or difficult one, his intense motivation may lead to his ignoring relevant information. This explanation, according to Vroom, is based on the assumption made by Tolman (1948) that a high level of motivation is accompanied by a "narrowing of cognitive field"
(Vroom, 1964, p.207). The other explanation given by Vroom is:

... the supposition that a high level of motivation to attain a goal tends to be associated with anxiety, or some other strong emotional state which in turn impairs performance. The idea that high levels of motivation tend to be accompanied by anxiety is not intuitively unreasonable.

(Vroom, 1964, p.207)

Both McClelland and Vroom suggest that motivation is associated with emotion. While McClelland sees the possibility of "creative anxiety", Vroom considers that emotion will "impair performance".

6.3 Emotion as a Moderator between Motivation and Performance

In this chapter emotion is considered explicitly as a moderator that influences the relationship between motivation and performance. Emotion may interact with motivation in two ways. First, emotion as a hedonic process may influence the direction and magnitude of motivation. Second, emotion may have "organizing" (or facilitating) and "disorganizing" (or disrupting) effects on a person's perception of the situation and his rationality in decision-making or selection of choice.

Since emotion and motivation are hedonic processes and both of them initiate, direct and sustain behavior toward or away from some tangible or intangible object, emotion and motivation can be considered as two interrelated, simultaneous and highly interactive psychological processes. It is assumed
Figure 6.2 Hypothetical Performance Curves

Figure 6.2(a)

Level of Performance

Ability

M=0 Level of Motivation M=1

Figure 6.2(b)

Level of Performance

Ability

Behavioral Efficiency

e=0 Level of Emotion e=1

Figure 6.2(c)

Level of Performance

Ability

Behavioral Efficiency

M=0 Level of Motivation M=1
in the present analysis that motivated behavior is associated, tinged or accompanied with emotion in all its stages.

Emotion is considered a vector quantity. However, it is a behavioral efficiency in work performance (a function of a person's emotional characteristics and emotion arousal) that is considered in the performance formula. Behavioral efficiency is considered a scalar quantity having magnitude ranging from zero to one.

6.4 Interactive Relationship between Motivation and Behavioral Efficiency

The rationale is as follows for assuming that behavioral efficiency interacts multiplicatively with motivation to help determine performance:

(a) Maier's hypothetical performance curve is a monotonically increasing function of motivation since ability is considered a constant and marks the upper limit of a person's performance capability. A person's motivation toward an incentive is finite and is considered maximum (M=1) when all his effort is directed toward that particular incentive. (See Figure 6-2a).

(b) The empirical behavioral efficiency curve is an inverted U-shaped function of emotion arousal. Since behavioral efficiency is assumed to be a
function of a person's emotional characteristic and emotional arousal, it is assumed $B_e \leq e$ in the hypothetical behavioral efficiency curve. (See Figure 6-2b).

(c) The empirical performance curve is an inverted U-shaped function of motivation. This assumes that the hypothetical performance curve is an inverted U-shaped function of motivation but that the level of performance is restricted by the person's ability and emotion arousal. (See Figure 6-2c).

The interactive relationship between motivation and behavioral efficiency is algebraic because motivation is considered a vector quantity and behavioral efficiency is considered a scalar quantity. In the formulation above, since (c) is assumed to be a function of (a) and (b), only the algebraic multiplication operator is likely to satisfy or "fit" the assumption. Algebraic addition of (a) and (b) will result in a monotonically increasing performance function which does not "fit" or satisfy the assumption (c) that performance is an inverted U-shaped function of motivation.

6.5 Interactive Relationship between Ability and Behavioral Efficiency

The rationale for assuming that the interactive relation-
2x2 TEST OF INTERACTIVE RELATIONSHIP BETWEEN ABILITY AND BEHAVIORAL EFFICIENCY

<table>
<thead>
<tr>
<th>Ability (A)</th>
<th>Behavioral Efficiency ($B_e$)</th>
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</thead>
<tbody>
<tr>
<td>H</td>
<td>(a) H</td>
</tr>
<tr>
<td>L</td>
<td>(c) L</td>
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<tr>
<td>H</td>
<td>(b) H</td>
</tr>
<tr>
<td>L</td>
<td>(d) L</td>
</tr>
</tbody>
</table>

H = High
L = Low
ship between ability and behavioral efficiency is algebraic multiplicative is as follows. (See Figure 5-3).

(a) If a person has high ability but low behavioral efficiency, it is probable that his performance will be moderate.

(b) If a person has high ability and high behavioral efficiency, it is probable that his performance will be very high.

(c) If a person has low ability and low behavioral efficiency, it is probable that his performance will be very low.

(d) If a person has low ability but high behavioral efficiency, it is probable that his performance will be moderate.

Since both ability and behavioral efficiency are considered scalar quantities, the interactive relationship between them can be represented by the algebraic operator. The 2x2 test of an interactive relationship between ability and behavioral efficiency indicates that only the algebraic multiplication operator seems to satisfy assumptions (a), (b), (c), and (d). Algebraic addition operator seems to satisfy assumptions (b) and (c) only.

6.6 Derivation of the Performance Formula

Maier's performance formula with the inclusion of behavioral
efficiency as a moderator between motivation and performance becomes:

\[
\text{Performance} = \int_{\overline{P}} (\text{Ability} \times \text{Motivation} \times \text{Behavioral Efficiency})
\]

\[
\overline{P} = \int_{\overline{P}} (A \times M \times B_e)
\]  \hspace{1cm} (6-1)

From previous derivations,

\[
M = \int_{M} \left[ \sum_{i=1}^{I} (E_1 E_2 \ldots E_n) (V_{B_i}) \right]
\]  \hspace{1cm} (4-2)

and

\[
B_e = \int_{B_e} (e - e^b)
\]  \hspace{1cm} (5-4)

If the M function and B_e function are substituted into equation (6-1), the performance formula becomes:

\[
\overline{P} = \int_{\overline{P}} \left[ A \left[ \sum_{i=1}^{I} (E_1 E_2 \ldots E_n) (V_{B_i}) \right] \left[ e - e^b \right] \right]
\]  \hspace{1cm} (6-2)

where \( \overline{P} = \) Work performance.

\( \int_{\overline{P}} = \) Performance function.

\( A = \) Job-relevant abilities.

\( I = \) The number of discrete incentive components in a job contract which consists of \( P \) discrete tasks the offeree expects to perform and \( R \) discrete rewards he expects to receive from the offeror for his anticipated performance, as stipulated in the job contract; \( I = P + R \).
$V_{BI} = \text{Offeree's basic valences for the I job incentive components;}

E_i = \text{Expectancy of means-end relationship for incentive component } I_i \ 0 \leq E_i \leq 1.

n = \text{Number of discrete expectancies of means-end relationships for a particular incentive component } I_i \text{ perceived by the offeree. For each of the } R \text{ rewards and } P \text{ performances the offeree may perceive } n \text{ expectancies of means-end relationships.}

\sum_{i=1}^{I} = \text{Vector addition of algebraic products of expectancies and basic valences for the I incentive components.}

b = \text{Offeree's emotional characteristics;}
\quad 1 < B < \infty.

e = \text{Offeree's emotion arousal at a particular point of time; } 0 \leq e \leq 1.$
Figure 7-1 Theoretical Diagram of Performance Formula

Valences for Job Incentives ($V_{Bi}$)

Means-end Expectancies ($E_1 \cdots E_i \cdots E_n$)

Motivation ($M_i$)

Abilities ($A$)

Job Incentives ($I$)

Performance ($P$)

Rewards ($R$)

Behavioral Efficiency ($B_e$)

Emotional Characteristics ($b$)

Level of Emotion Arousal ($e$)
Chapter 7

DISCUSSION AND CONCLUSION

7.1 Operationality of the Performance Formula

The variables of the performance formula and their inter-relationship are represented diagrammatically in Figure (7-1). This conceptual diagram is the operational form of the conceptual diagram of job behavior in Figure (2-1). It is an expansion of the theoretical model of job performance advanced by Lawler and Porter (1967). The absence of role perceptions as a moderator in the present conceptual diagram does not mean the writer considers role perceptions unimportant or invalid as a moderator between motivation and performance. Rather, it is because the inclusion of role perceptions into the present model may complicate the study of the probable influence of emotion as a probable moderator between motivation and performance. In a more complete model, role perceptions should be taken into consideration as a moderator of motivation.

Devising valid and reliable measures of the variables in the performance formula is fundamental in testing the theoretical soundness of the hypothesized interactive relationship. The inherent difficulties and limitations in devising methods to measure these variables objectively and precisely are mentioned in chapter one. For each of the variables in the
performance formula, there is no single standard criterion, single standard scale or single completely satisfactory method of measurement. The optimal method of measurement depends on the nature of the variables and the types of research used such as (a) controlled laboratory research; (b) non-controlled field research; (c) survey research; and (d) ex post facto research. The definition, nature and some of the methods of measurement of the variables in the performance formula are briefly discussed below.

**Performance** ($P$) is the work done by a person in the job situation. It is difficult to measure objectively and precisely the work done by a person in his job. This is especially true of mental work and work that requires team effort. Subjective methods such as self-rating and panel rating of "how well he is performing in his job" can be used. Physical work done such as rate of output, amount of sales et cetera are some of the more objective methods of measuring performance.

**Ability** ($A$) is a person's performance potential. This term embraces a number of slowly changing or long term personal characteristics such as intelligence, manual skills, personality traits, etc. Abilities can be developed and modified, but typically, they do not change very much over the short run. Methods of measuring ability depend upon the specific ability one wants to measure. Some of the many available methods of measuring ability are (1) I.Q. Test; (2) Ghiselli Self-
Description Inventory; (3) Discrete tests of specific motor abilities such as the Minnesota Peg-Board Test; (4) Panel (supervisor) Ratings; (5) Thurstone Mental Abilities Test; (6) Thurstone Temperament Schedule. Conceptually, ability is considered a scalar quantity having only magnitude which marks the upper limit of a person's performance capability.

Job incentives (I) refer to the P discrete different tasks (Pᵢ) an employee is expected to perform and the R discrete different material and non-material rewards (Rᵢ) he expects to receive from the institution for his anticipated performance as stipulated in the psychological or written job contract. Job incentive components (or incentives) are considered as the conditions of motivation. The five major job incentives (Iᵢ) identified by Vroom (1964) are wages, promotion opportunities, the social work group, work content and supervision.

Valences for job incentives (Vᵢ) are made up of

(1) the employee's antecedent hedonic orientation towards the work itself for the P discrete different tasks (Pᵢ) he expects to perform irrespective of the material and non-material rewards, and

(2) the employee's antecedent hedonic orientation toward the R discrete different material and non-material rewards (Rᵢ) he expects to receive from others (institution) for his anticipated performance.
Valence (V) is considered the basis of motivation. It is a very dynamic personal variable, the direction and magnitude of which is likely to fluctuate over a wide range of job incentive components. With respect to a particular job incentive component, however, its mean value may remain more or less constant or change only gradually over a long period of time. Some of the available methods of measuring an employee's valence for job incentives are as follows:

(1) Individual ranking of R discrete potential rewards and P discrete potential tasks in the job contract.

(2) Individual rating of the absolute values of the R discrete potential rewards and P discrete potential tasks in the job contract.

(3) Administering some sort of projective device, such as the TAT, in which the investigator would infer the values from the responses from the subjects.

(4) Providing the person with an actual choice of two or more rewards and two or more different kinds of tasks to perform.

(5) Individual ranking or rating the list of needs suggested by Maslow (1954) as operationalized by Porter (1961).

Expectancy (E) is an antecedent attitude indicating the degree one subjectively believes a certain outcome to be probable due to his perception of its means-end relationship.
For a particular incentive component (reward or performance) if the person perceives \( n \) discrete means-end relationships, then there will be \( n \) expectancies for that particular incentive component. For the \( I \) discrete different incentives in the contract, theoretically, there will be \((nI)\) discrete expectancies of means-end relationships. Expectancy is considered a scalar quantity having magnitude ranging from zero (absolute uncertainty) to one (absolute certainty). Expectancy is a relatively dynamic personal variable highly dependent on one's perceptions of the means-end relationships. Expectancy is a person's subjective probability which may be, and usually is, different from the actual probabilities. To measure this variable, the investigator must obtain an estimation from the person himself concerning his subjective expectancies toward the job incentives and the institution.

Motivation \((M_I)\) is the combination of forces derived from a person's valences for the job incentives and his expectancies of means-end relationships, which initiate, direct and sustain behavior toward or away from the job incentives. Motivation is considered a vector quantity. It is a derived personal variable which is highly dynamic and influenced by both personal and environmental factors. Lawler and Porter (1967) theorize that an expression of an individual's motivation to perform his job can be found in the amount of effort and energy he expends in job-related activities. In non-psychological terms, motivation or effort refers to how hard
an individual tries to perform a task. Effort can be measured by (1) self-rating; (2) panel (supervisors) rating. Mitchell (1967) devised a self-rating percentile measure of the effort and energy a person put in his job relative to others around him at his level of the organization.

Emotion (e) is a mental state related to some tangible or intangible external object, and is characterized by feelings of various intensities and accompanied by visceral reactions and motor expressions, which may or may not be apparent. A person's level of emotion arousal, at a particular point of time, ranges from zero (deep sleep) to one (highly excited) leading to various degrees of organized and disorganized responses which influence his behavioral efficiency (B_e) in work performance. Emotion is a relatively dynamic personal variable and is highly dependent on situational factors. Over a period of twenty-four hours, there is a wide range of fluctuation in the level of emotion arousal in a person ranging from deep sleep to a moderate and sometimes high level of arousal. However, during the intervals of a person's working hours in a job situation, it can be assumed that his level of emotion arousal is moderate and is relatively stable unless some abnormal situational incidents occur which strongly disturb him.

Interpretation of the levels of emotion arousal can come from (a) physical responses and (b) visceral or physio-
logical reactions. Some of the physical responses which indicate levels of emotion arousal are facial expression (Jenness, 1932; Kanner, 1931; Lands, 1929; Coleman, 1949; Fields, 1953); vocal expression (Ruch, 1963, pp.175-177); graphical representation (Peters and Merrifield, 1958); and patterns of overt behavior like destruction, approach, avoidance, retreat or flight, stopping of response (Ruch, 1963, pp.177-178).

Of all the indicators of emotion arousal, the most objectively measured are the internal physiological activities. Whereas awareness of emotion arousal may be suppressed by the individual, visceral responses are not usually subject to voluntary control. The measurement of physiological changes is the most sensitive and objective method of studying emotion arousal and is the source of most experimental data under laboratory conditions. Some of the physiological emotional indicators are galvanic skin response-GSR (Ellson, 1952; Schlosberg, 1954; Malmo, 1958; Cooper, 1959; Lykken, 1960); brain potential or electroencephalogram - EEG (Lindsley, 1950, 1957, 1958, 1960; Lansing, 1957; Hebb, 1955); heart rate (Malmo, 1959, Belanger and Tetreau, 1961; Ducharme and Belanger, 1961); muscular tension and tremor (Duffy, 1951, 1957; Arnold, 1950; Stennett, 1957). Other emotional indicators mentioned by Hilgard and Atkinson (1967, pp.165-166) are pupillary response, salivary secretion, pilomotor response, respiration, blood distribution, and blood composition. However, the utility of some of these tests for measuring emotion arousal in an industrial
situation may be limited because of the inconvenience of some of these tests and the accessibility of the instruments. Also, the use of such physiological tests in an industrial situation may disturb a person's performance because a significant environmental variable is added which may introduce unwarranted experimental error into the measurement. This poses a formidable problem in operationalizing the performance formula. In order to avoid introducing additional environmental variables which may make the investigation a biased one, a composite measure of physical responses may be used composed of elements such as facial expression, vocal expression, or graphical representation and of patterns of overt behavior such as destruction, approach, avoidance or stopping of response. The validity and reliability of these two composite measures can be subjected to correlation test.

*Emotional characteristics* (b) of a person is a measure of his emotional stability indicating the level of behavioral efficiency a person can attain when emotionally aroused after which his responses become increasingly disorganized with increase in the levels of emotion arousal \( e \). In other words, it is a measure of a person's susceptibility to disorganized response by emotion arousal. Conceptually, a person with a low \( b \) value is more susceptible to disorganized response than a person with a high \( b \) value at the same level of emotion arousal. It is a relatively stable personal variable indicating
a person's emotional characteristics. It is suggested that an employee's \( b \) value may be measured by (1) self-ratings; (2) panel (supervisor) ratings; (3) projective devices; (4) the forced choice adjectival scale method; and (5) his past record of emotional health.

**Behavioral efficiency** in work performance \( (B_e) \) is the ratio of a person's actual performance to his potential performance at a particular situation. For purposes of empirical testing it is a measure of a person's actual job performance in comparison with his best job performance recorded for the same task under similar environmental conditions. If the quality and quantity of his output in his job performance can be objectively measured, \( (B_e) \) can be established as a performance ratio. Otherwise, subjective methods such as self-rating and panel (supervisors) rating can be used to derive the value of behavioral efficiency in work performance. Behavioral efficiency is considered a scalar quantity having magnitude ranging from zero to one.

The above discussion of the variables in the performance formula suggests that these variables can be measured within experimental limitations and hence the theoretical soundness of the hypothesized interactive relationship between these variables can be tested empirically. The detailed formulation of relatively simple but valid and reliable methods of measuring these variables in an industrial setting is not within the scope of this analysis.
7.2 Implications of the Performance Formula

If the preceding theoretical discussion, derived from psychological hypothetical constructs, is to be meaningful to practicing managers, it must be demonstrated that it can help to explain some of the economic problems faced in managing organizations. In other words, the usefulness of the performance formula lies in its ability to help managers understand the functional relationship among some of the psychological variables and some of the economic variables. However, it would be pretentious to suggest that the theoretical performance formula developed in the present study will help managers solve their problems.

On the behavioral level, the performance formula indicates that a person's level of performance will be high only if all the three constructs - ability, motivation and behavioral efficiency - are high. The assumed algebraic multiplicative interactive relationships among these three constructs in the performance formula implies that if one or more of these variables is low in value, the performance of the person will also be low.

Performance and reward are two very important variables in the economic activities of a business enterprise. The anticipated performances and rewards stipulated in an individual employment contract or collective agreement between company and trade union on behalf of its members employed by the enterprise
reflect the culmination of the bargaining and negotiation activities through which the mutual needs and conflicting demands of the parties are compromised and resolved. In an industrial situation, performance and reward are ultimately expressed primarily in monetary terms. The shareholders expect from the performance of the managerial and non-managerial employees of the firm a "fair rate of return" commensurate with the risks involved, alternate investment opportunities and the potential for future earnings. On the other hand, the managerial and non-managerial employees expect from the firm "fair monetary and non-monetary rewards" commensurate with performance contributed, the demands of the job and the level of salary or wages paid for comparative skills or abilities in other firms in the same industry or different industries.

A more general discussion of the implications of the performance formula to management should include those public organizations such as schools, public hospitals and military organizations where profit is not the goal. An organization usually has more than one goal and different types of organizations have different kinds of goals. However, one common goal in all organizations is the efficient utilization of scarce economic resources which include human resources. The monetary reward received by the managerial and non-managerial employees is the cost of labour to the organization. The aggregate performances of the employees are instrumental to the organization's output of goods and services. Hence, rewards and
Figure 7-2 Relationship Between Performance, Motivation and Reward

Motivation (M)

Performance Constraint

Emotion Constraint

Ability Constraint

Motivation Constraint

Performance Curve

Organization Constraint

Motivation Constraint

Motivation (M)

Performance (p)

Revenue Product of Labour

Reward (r)

Cost of Labour

Incremental Performance

Marginal Revenue Product of Labour

Incremental Reward

Marginal Cost of Labour

\[ \Delta p_{45} \Delta p_{34} \Delta p_{23} \Delta p_{12} \Delta p_{01} \Delta r_{01} \Delta r_{12} \Delta r_{23} \Delta r_{34} \Delta r_{45} \]
performances are related to the efficient use of scarce economic resources which is essential for the viability of an organization.

Relationship between Reward, Motivation and Performance

It is assumed that the link between reward and performance is the motivation of the employee (see Figure 7-2). The behavioral expression of motivation is the amount of effort a person puts into his work performance. It is assumed that an employee is motivated to work in his present job because he has certain needs or valences and he subjectively believes that the incentives offered to him by the institution are instrumental in satisfying his needs. It is further assumed that motivation \( (M) \) is a negatively accelerated monotonically increasing function of reward \( (r) \) because of diminishing utility of incremental reward \( (\Delta r) \), and that performance is an inverted U-shaped function of motivation because of the constraints imposed on the person by his ability and behavioral efficiency in work performance.

Reward, motivation and performance are all finite quantities. The amount of reward the organization can offer to its employees is limited or constrained by the amount of resources it possesses and other institutional factors within the internal environment and in the broader external environment. On the other hand, the maximum amount of effort an employee can expend in his work is limited by the amount of time, energy and
other resources he possesses. The performance function indicates that level of performance is not only constrained by the motivation of the employee, but also by his ability and his behavioral efficiency in work performance. These are some of the constraints within which the manager must operate.

Conceptually, motivation or effort, unlike valence which is considered as an antecedent attitude, is the action phase of a behavior sequence. Unless an employee is absent from work for various reasons, the very fact that he puts in effort in his task in a job situation implies that he is motivated to work. The two main concerns of management on the relationship between performance, motivation and reward should be:

(a) whether the reward (r) offered to the employee or the cost of labour has aroused in him the level of motivation (M) that will produce a level of performance (p) or revenue product of labour such that p > r in monetary terms;

(b) whether the incremental reward (Δr), or marginal cost of labour, offered to the employee can arouse in him an incremental motivation (ΔM) which will produce an incremental performance (Δp), or marginal revenue product of labour, such that \( \frac{Δp}{Δr} = 1 \) in monetary terms, where conceptually,

\[
\frac{Δp}{Δr} = \frac{ΔM}{Δr} \times \frac{Δp}{ΔM}.
\]

Theoretically, incremental or marginal reward should be
Figure 7-3  Moderating Influence of Ability on Performance

Motivation

Incremental Performance or Marginal Revenue Product of Labour

Incremental Reward or Marginal Cost of Labour
offered until it is equal to incremental or marginal performance in monetary terms, that is, $\Delta p = \Delta r$ (see Figure 7-2). At this level of reward ($r$), theoretically, the monetary value of $(p - r \geq 0)$ is maximum. It is not worthwhile economically to offer additional reward to the employee beyond the optimum point at $\Delta p = \Delta r$ when $(p - r \geq 0)$ is maximum because further increases in $r$ will decrease $(p - r \geq 0)$. Figure 7-2 also shows that it may be unwise in some cases to bring forth maximum performance from the employee by offering him additional monetary rewards because it is possible that $p < r$.

(a) Implications of the Moderating Influence of Ability on Performance

Assume that two employees X and Y are motivated to the same extent by the same reward (i.e., $M_X = M_Y$) and that they have the same behavioral efficiency in work performance (i.e., $B_X = B_Y$) relative to their own abilities. However, the task-relevant abilities of employee X are twice that of employee Y (i.e., $A_X = 2A_Y$). Since ability is considered a constant in the performance formula, A becomes the gradient of the performance function. In this example, the performance gradient of X is twice that of Y (see Figure 7-3). The hypothetical performance curves show that:

(a) it is profitable to employ X since $p > r$ for a certain range of values of $r$ because of his
high task-relevant abilities. Employee X should be offered reward $r_3$ when $(p - r \geq 0)$ is of a maximum beyond which further increase in $r$ will decrease $(p - r \geq 0)$;

(b) it is unprofitable to employ Y since $p < r$ for all values of $r$ because of his low task-relevant abilities. Management can either devise means to develop the task-relevant abilities of employee Y or terminate his services.

Since ability marks the upper limit of a person's performance capability, in the long run, the performance of the firm will improve if, and only if, the task-relevant abilities of the managerial and non-managerial employees are raised. However, the introduction of employee training programs will not immediately raise the level of abilities of the employees as one common feature of all abilities is that they are relatively stable, long term characteristics of the person. Abilities can be developed and modified, but typically, they do not change very much over the short run.

Some of the practical problems facing the behavioral scientist and manager in their attempt to measure abilities are as follows:

(1) What abilities are relevant and contributing to performance for a particular job.
(2) What combinations of abilities are required for
different kinds of jobs.

(3) What are the valid and reliable methods of measuring
these abilities.

The lack of information and proper tools for measuring
job-relevant abilities makes demarcation of the ability
constraints in the performance formula difficult and inaccurate.
At the present time, the measurement of job-relevant abilities
that seems best suited to evaluating the hypothesized
performance formula appears to be the overall estimates provided
by panel (supervisory) rating. However, these are of little
utility in personnel selection programs. Much more research is
needed to identify specific task-relevant abilities and means
for their effective, valid, operational measurement in the
context of work.

(b) Implications of the Moderating Influence of Behavioral
Efficiency

Assume that two employees X and Y are motivated to the
same extent by the same reward (i.e., \( M_X = M_Y \) ) and that they
have the same job-relevant ability (i.e., \( A_X = A_Y \) ). Assume
also that the emotional characteristics or \( b \) value of employee
X are higher while the \( b \) value of employee Y is low. The
performance formula indicates that a person with high \( b \) value
will have high behavioral efficiency in work performance while
Figure 7.4 Moderating Influence of Behavioral Efficiency on Performance

Behavioral Efficiency

Emotion Constraint

Performance (p) or Revenue Product of Labour

Reward (r) or Cost of Labour

Employee X: \[ P_5 P_4 P_3 P_2 P_1 0 \]

Incremental Performance or Marginal Revenue Product of Labour

Employee Y: \[ P_3 P_2 P_1 0 \]

Incremental Reward or Marginal Cost of Labour

Motivation (M)

\( \Delta M_{12} \)

\( \Delta M_{23} \)

\( \Delta M_{34} \)

\( \Delta M_{45} \)
a person with low $b$ value will have low behavioral efficiency. Since $M_X = M_Y$ and $A_X = A_Y$, the difference in performance between employee $X$ and employee $Y$ is caused by the difference in their behavioral efficiency in work performance, i.e., $B_e^X > B_e^Y$.

This is illustrated in the hypothetical performance curves in Figure 7-4.

In reality, the behavioral efficiency constraint on performance is caused by emotion which is considered as an organizing process when the intensity of emotion arousal is low and a disorganizing process when the intensity of emotion arousal is high. The present analysis only evaluates the intensity factor of emotion in conjunction with a person's emotional characteristics or his capacity to withstand or cope with emotion arousal. It is assumed that some people can handle considerable intensity of emotion arousal, such as anxiety, without resorting to defensive maneuvers or allowing emotion to disrupt normal behavior. Others seem to be affected almost immediately and react in drastic ways to the slightest tinge of fear.

The implications of the inverted U-shaped behavioral efficiency function are of limited utility to management. First, it is difficult to measure the intensity of a person's emotional arousal in a particular situation and his emotional characteristics. Second, there are other pertinent factors such as:
(1) the kind of emotion being experienced,
(2) the frequency and duration of exposure to a particular stimulus, which the writer believes has important influences on a person's behavioral efficiency but which has not been taken into consideration in the present analysis.

Further research into devising relevant and valid measures of $e$ value and $b$ value are essential before this hypothetical behavioral efficiency function can be verified. Also, the relationship between $e$ and $b$ values, on the one hand, and the other factors that are omitted from the present analysis, on the other, must be taken into consideration in a more complete study of behavioral efficiency in work performance and its moderating influence on motivation.

7.3 Conclusion

The present postulation that emotion may be a probable moderator influencing the relationship between motivation and performance derives support from theoretical propositions and tentative empirical evidence reviewed in relevant behavioral science literature. At the theoretical level, the concept advanced by Leeper, Duffy and Young that emotion is a psychological process that can cause organization or disorganization in a person's response to stimulation suggests that emotion may be an added moderating variable in Maier's performance
formula. At the empirical level, experimental findings of the activation theorists such as Malmo, Hebb and Schlosberg point out that behavioral efficiency is an inverted U-shaped function of emotion arousal, indicating that emotion can moderate the relationship between effort and job performance.

The present study has suggested that:

(a) it is reasonable to postulate emotion as a moderator of motivation; and

(b) empirical tests should be designed and conducted to verify the postulation.

A significant aspect of the present analysis is the use of mathematical operators such as the vector additive operator and the algebraic multiplicative operator to represent the interactive relationship between personal and environmental variables. The choice of an operator is important since an operator will indicate whether an interactive relationship is dynamic or static. An algebraic multiplicative operator implies that the interactive relationship is dynamic, while an additive operator implies that it is static.

The relationship between personal and environmental variables can be considered as an interactive system made up of sub-systems. The use of multiplicative operators to represent the interactive relationship among the variables or sub-systems implies that the interaction between them is highly
dynamic and that the effect is widespread. Changes in one variable or sub-system affect the whole system. For example, use of the algebraic multiplicative operator to represent the interactive relationship among personal variables, such as ability, motivation and behavioral efficiency to help determine a person's job performance, implies that these personal variables as an inter-related system are highly dynamic and interactive. The dynamic and widespread effect on the system as a whole caused by the change of one variable is exactly what the multiplicative operators in the performance formula have implied. That is, when one or more of the variables in the performance formula has a low value, performance will have a low value.

The use of the vector additive operator to represent the interactive relationship between valences implies that the interaction between the valences for incentive components is very low. The five important incentive components outlined by Vroom are (1) supervision, (2) work group, (3) job content, (4) wages, and (5) promotional opportunities. In other words, use of the vector additive operator to describe the nature of this interactive relationship implies that if a person's valence for supervision is low, but his valences for other incentive components are high, his valence for the incentive system as a whole will still be fairly high. In other words, valence as a sub-system is a relatively stable phenomenon. There is very little or no interactive relationship between the component valences. Hence, changes in one part of the system
do not affect other parts of the system.

The above explanation also applies to use of the vector additive operator to represent the interactive relationship between components of motivation.

The preceding analysis seems to imply a high interaction among personal variables as sub-systems but little interaction within the sub-systems themselves. However, this finding is not definitive. For example, in an industrial bargaining situation, it is found frequently that disagreement between the parties over one of the incentive components can lead to rejection of the whole incentive package. If the vector additive operator represents the real interactive relationship within the valence or motivation sub-system, then this phenomenon should not occur. Some of the possible explanations for the occasional occurrence of such phenomena are as follows:

(a) The over-simplified model of human behavior used for the derivation of the performance formula does not adequately describe the whole range of human interactive relationships.

(b) The interactive relationships among valence components or motivation components of the incentive system are more complicated than the vector addition operator can represent and imply. Perhaps other mathematical functions will better "fit" these types of interactive relationship.
The derivation of the behavioral efficiency function is an example where an exponential function is used instead of the multiplicative or additive operator.

(c) There are other personal or environmental variables that can act as moderators of motivation. Mitchell goes a step further and postulates that some personal variables may behave as moderators when instigated by certain environmental variables but may not behave as moderators when these unidentified environmental variables are absent.

Further research is necessary to know which explanation is the correct one to this complex problem.

One of the findings of the present study is the lack of understanding of the nature or intrinsic properties of specific personal variables and environmental variables despite the voluminous amount of literature in behavioral science. Additional information or knowledge on specific personal and environmental variables is essential in order that the interactive relationships among these variables can be postulated qualitatively and formulated into quantitative hypothetical functions. Information is also essential that will aid in designing relevant and valid measures of the variables so that the hypothetical quantitative function can be operationalized and verified.
Finally, the present study indicates a need for greater integration between behavioral theories and economic theories. Greater integration between these two disciplines is desirable because in reality behavioral variables and economic variables are inter-related, as has been demonstrated in the earlier part of this chapter. Further research or investigation in this direction may provide knowledge useful to practicing managers in their attempt to utilize scarce economic resources more efficiently.
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