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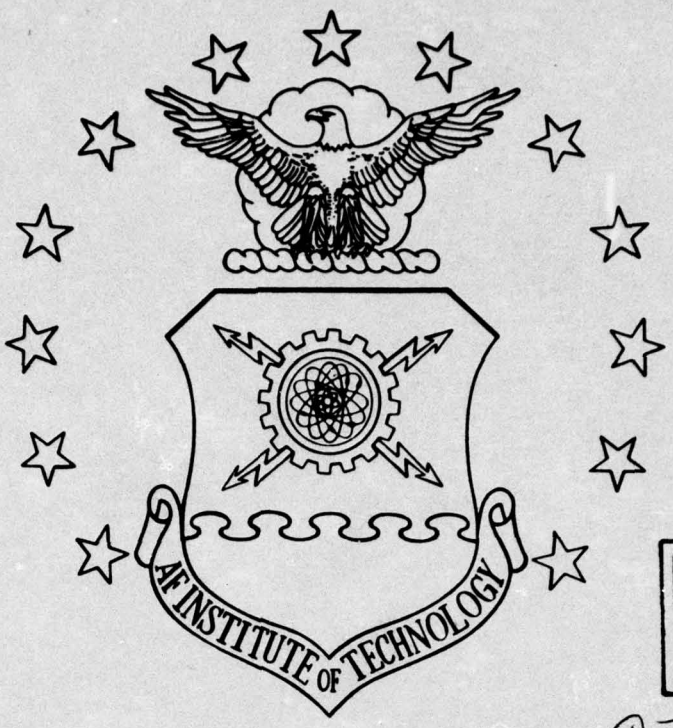

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AN EMPIRICALLY TESTABLE MODEL OF MASLOW'S THEORY OF HUMAN MOTIVATION: SPECIFICATION AND ANALYSIS

AFIT TR 76-11 George C. Young, Jr.
Major USAF

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I gained my initial interest in motivation theory at The University of Wisconsin (Madison) in the summer of 1967. I was taking a graduate course in organizational theory, one small part of that course being an introduction to Maslow's theory of human motivation. I was hooked.

The kernel of an idea which started back in Wisconsin was rejuvenated at Stanford. In 1973 this idea was nurtured and began growing healthy and strong under the tutelage of Professor Doug Daetz in two seminars I took from him. His interest in and support of my then-still-fuzzy ideas gave me the intellectual freedom and encouragement necessary to further develop those ideas into what eventually became this dissertation. My heartfelt thanks, Doug.

Professor Fran Gordon led me gently yet insistently to the trough to drink of the works of Lawler and Vroom, where I learned that needs are not the same things as motivators. This cleared up quite an important concept for me and for this dissertation. My thanks to you also, Fran.

I also want to express my thanks to Professor W. Grant Ireson, who helped me out in a pinch. I came to know and respect him not only as a teacher but also as a coworker. My deepest thanks, Professor Ireson.

Finally, with the help of my principal adviser, Professor Jim Jucker, I put it all together. Jim, more than anyone else, helped me turn the verbal theory into a coherent, internally consistent, testable model. He also gave me valuable guidance and direction through the statistical maze that grew up during the data analysis. He was always available to offer oft-needed encouragement as well as honest criticism and suggestions for improvements. In the best sense of the word he was my Tutor. To Jim, most of all, I express my deepest thanks.

ABSTRACT

Introduction: This dissertation takes as its point of departure Abraham H. Maslow's hierarchical theory of human motivation, first hypothesized in 1943 and updated by Maslow as recently as 1970. Maslow's theory involves five different types of needs (levels) and describes the hypothesized relationships between them as they vary in their degree of strength and satisfaction. None of the other researchers who have attempted to test Maslow's theory have fully specified that theory in mathematical form. The objectives of this work are threefold: (1) to mathematically model the basic parameters and relationships in the theory, (2) to derive hypotheses from this model, and (3) to use empirical data to test these hypotheses and reach conclusions about the validity of the underlying theory.

The Model and the Hypotheses: The model first takes the strength range for the five Maslowian need levels and divides this range into four empirical categories for each level: Strongly Potent (or Clearly Operating at the level), Potent (or Operating at the level), Prepotent (or an Unemerged level), and Largely Satisfied. The model then specifies ten hypotheses, nine derived directly from Maslow's theory and the tenth derived from a secondary source and only indirectly related to the theory.

The first three hypotheses are static relationships: between mean ages (conditioned on clearly operating at a given need level); between mean need strengths (conditioned on clearly operating at a given need level); and cross-correlations between unemerged and largely satisfied need strengths. There are three hypotheses involving the dynamic relationships between age and prepotent need strength, potent need strength, and largely satisfied need strength. Two hypotheses, derived from the core of Maslow's theory, cover the relationships between prepotent and potent need strengths of adjacent need levels, and between potent and largely satisfied need strengths of adjacent need levels. The ninth hypothesis covers a suggested upward shift over time in the distribution of adult Americans in the need level at which they are operating. The final hypothesis specifies a psychological health factor and its constraints on need level strengths and operating levels.

More than twenty explicit mathematical relationships are developed in specifying these hypotheses. Seventeen of the relationships, covering nine of the ten hypotheses, were directly testable against six sets of survey data supplied by the U.S. Air Force. Using this data also required developing a secondary model and questionnaire-based methodology for converting different external motivators, or the things people want and do, into the five internal need types people are hypothesized to have. This part of the work also required developing relationships between need (or motivator) strength, satisfaction and importance.

The Results and Alternatives: The results of the statistical analyses, most of them flowing from multiple linear regressions, displayed little or no evidence supporting the directly derived Maslowian hypotheses. Only the ninth hypothesis, which was indirectly tied to Maslow's theory, received strong support from the statistical evidence.

In the course of analyzing the results an alternative relationship was suggested between strengths of different types of needs. This is a convex, second-order relationship and was dubbed "The Pendulum Theory of Motivation" as descriptive of the dynamic manner in which people are hypothesized to satisfy their different types of needs. This relationship closely resembles the equilibrium-disequilibrium theory of motivation.

Conclusions: Maslow's hierarchical need theory was specified and analyzed, with the results of the analysis offering little evidence in support of this theory. However, these results did suggest an alternative relationship between the strengths of different types of human needs. This relationship is found to be consistent with the equilibrium-disequilibrium theory of motivation.

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CHAPTER 1

INTRODUCTION AND BACKGROUND

I. Introduction

In 1943 Abraham H. Maslow published a paper entitled "A Theory of Human Motivation" (1943), which has since been revised slightly, the last update occurring in 1970. Few articles have been reprinted more often (at least fifteen times to date) or have had a greater effect. Since its publication Maslow's theory has been attacked and lauded; in recent years, beginning in 1968, there have even been some empirical tests of parts of it. However, to my knowledge the essential theory has not yet been properly specified and tested. My primary objective is threefold: to take what Maslow and others have said of his five-level hierarchy of human motivation and quantitatively model its basic parameters and constraints, to derive hypotheses from this model, and then to use empirical data to test these hypotheses and draw conclusions about the validity of the theory.

II. Rationale

Industrial engineering has over the last decade been putting more and more human parameters into its analyses.

We have come to realize that true efficiency and effectiveness involve not only the man-machine interface, but the larger and broader needs of man in his entire work environment. My work continues this developing awareness and attempts to further enlarge and enlighten our view of man at work. By so enlarging our area of concern we are more likely to be successful in solving those problems that arise in the work environment.

III. Background

Before proceeding with the background discussion, a definitional comment is in order. The term "need" applies to the internal drives of the organism - hunger, for example. The term "motivator" applies to the external triggering object that couples to one or more (internal) needs - food, for example. Seeing a steak could be a motivator that might arouse both the hunger need (steak as food) and the esteem need (steak as status). These two terms, motivator and need, will be used separately in the discussion, as it is necessary to keep a clear distinction between them. Illustration 1.1 portrays this distinction. The terms "motivation" and "need," however, have been used interchangeably in the literature, and I shall perpetuate this practice.

Two caveats are also needed before proceeding. First, not all behavior is considered to be motivated. We can divide behavior into three categories: instrumental, or

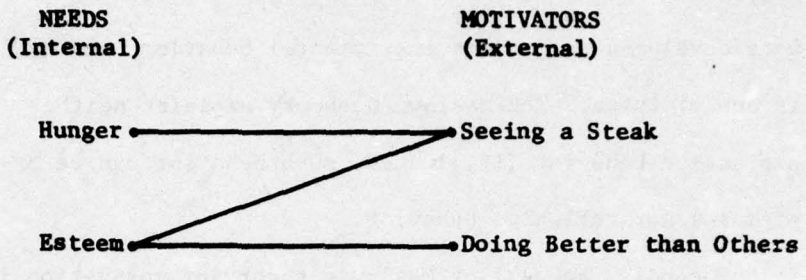

Illustration 1-1.—Needs and Motivators

coping, behavior; noninstrumental, or expressive, behavior; and reflexive, or involuntary, behavior. An example of expressive behavior is the pitch of one's voice. Examples of reflexive behavior are the "knee jerk" reflex and wincing one's eyes at the rapid approach of an unexpected object towards one's face. Most theories of motivation were developed to explain instrumental behavior, and Maslow's is one of these. The Maslowian theory explains neither expressive behavior (if, indeed, such behavior can be explained) nor reflexive behavior.

Secondly, not all of Maslow's theory of motivation is being modeled and tested. Only the basic part, involving the five-level hierarchy itself and the mechanism by which the levels are hypothesized to relate to one another (the prepotency-satisfaction mechanism), has been specified. In addition to this basic theory, however, several other variables have been developed and added.

Finally, the words "he," "him," or "his" as used in this dissertation are assumed to mean "he/she," "him/her," or "his/hers" when not used in connection with a specific person, and the noun "man" is assumed to mean "man" or "woman" when not used with reference to a specific person.

A. Some Non-Hierarchical Motivation Theories

Except for hierarchical motivation theory, most other motivation theories are not so much theories of human motivation as partial theories of certain types of motivation.

To portray the full range of motivation of normal people at their work, I need a theory which covers the full range of human motivations. One of the hierarchical theories, Maslow's, seems to do this. It is a theory that purports to explain normal human beings in normal environments.

For the most part the other theories cover partial motivation or abnormal motivation. Freud's (1957) unconscious motivation theories were largely based upon and developed to explain various neuroses and psychoses. McClelland's (1961) need achievement theory treats only the need to achieve or to avoid achievement, a very specific and limited set of motives. Lewin's (1935) field theory considers direction of behavior (attraction towards or avoidance away) and does well in explaining the environmental effect on behavior, but does not very well explain the internal human needs that drive behavior. Lewin's work, coupled with Tolman's (1932), formed the basic underpinnings of the Expectancy Theory school of motivational theorists. This school includes the concepts of expectancy, or the perceived likelihood that an action will lead to a certain outcome or goal, and valence, or the attractiveness of that outcome. These factors are thought to combine multiplicatively, hence they can be referred to as Expectancy X Valence theories of motivation. Atkinson (1958) and Vroom (1964) further developed these basic concepts.

Vroom presents a very nice algebraic model of what he considers the motivation process itself to be. He

identifies force (his term for strength of motivation) as the algebraic sum over all possible outcomes of the product of the valence (subjective value) of an outcome and the strength of the expectancy (personal probability estimate) that the act will be followed by the attainment of that outcome. Thus, given the personal valences and expectancies for any individual in a situation one could determine the force, or strength of motivation, on that individual in that specific situation. Again, however, this is a model that fits any specific motivator but does not help very much in explaining the hierarchical relationship between different types of needs. One important contribution of his theory is that it is quite useful in decoupling motivators from needs. Vroom considers any given outcome, or motivator, capable of changing the strength of a person's desire or aversion for outcomes in the same or a different class of outcomes. That is, a given outcome can have second order effects on other types of desires or needs. For example, if one's motivator is to work with other people, the needs being satisfied may be both the need to belong and the need for security. Illustration 1.1 portrays this distinction.

Thorndike's (1913) and Hull's (1943) learning theories only incidentally cover motivation. In fact, Hull at one time felt that all behavior could be explained only in terms of learned behavior. However, Hull did develop the basic model of what is commonly called Drive Theory, in which the impetus to respond (based on a hypothesized

stimulus-response connection) is a multiplicative function of both the strength of the drive involved and the strength of habits, or past training, surrounding the drive.

B. Some Hierarchical Motivation Theories

A basic distinction can be made in any type of need by distinguishing between deficiency motivation and growth motivation. The early motivation theorists spent much time and effort (e.g., Hull and Thorndike) explaining how the organism was motivated by various deficiencies - food, water, sex, etc. Their explanation was that instrumental behavior results from a need, a need which represents a deficit to the organism (e.g., hunger is a need which results from a deficiency of food). The organism cycles from disequilibrium, when the need is unsatisfied, to equilibrium, when the need is satisfied. A basic shortcoming of this concept is that some behavior clearly seems not to be motivated by deficiencies, such as the artist who voluntarily deprives himself of more basic needs (e.g., adequate diet) in order to pursue his need to create.

The second class of theories, growth motivation, holds that the organism is positively motivated to grow and develop, to become all that it is inherently capable of becoming. Goldstein's (1939) concept of the self-actualization need is clearly a growth motivation concept. White's (1959) review of motivation theories makes strong use of the concept of maturation in explaining autonomous growth of the

ego. Further, White's concept of competence is closely akin to the idea of the self-actualization need.

Virtually all psychologists today concur with some kind of a lower-higher need system. The hierarchical theorists have developed this concept into various levels of hierarchy and relationships between the levels and other exogenous variables. In general, the lower hierarchy needs can be considered to be deficiency oriented, whereas the higher needs tend to be growth oriented.

Herzberg's (1966) breakout of hygienic factors and satisfiers fits this taxonomy. Alderfer (1969) has proposed a three-level hierarchy: Existence, Relatedness, and Growth. However, Alderfer does not rely as strongly on the prepotency concept (to be explained in the next section) as does Maslow. The hierarchies proposed by Herzberg, Alderfer and Maslow are displayed and compared in Illustration 1.2.

C. Maslow's Basic Hierarchical Motivation Theory

1. The Five Types of Needs

Maslow theorized the existence of five basic types of human motivations (or needs) that are active in a hierarchical order. That is, as one type of need becomes largely satisfied, the next one in the hierarchy becomes strong, or dominant. These five levels of needs are:

1. Physiological needs, including the need for food, water, air, and a minimum level of personal physical comfort.

2. Safety needs, which include the need for security,

Herzberg Categories	Maslow Categories	Alderfer Categories
Hygienic Factors (Lower)	1. Physiological	Existence
	2.1 Safety—Material	Existence
	2.2 Safety—Interpersonal	Relatedness
	3. Belongingness (Social)	Relatedness
Satisfiers (Higher)	4.1 Esteem—Interpersonal	Relatedness
	4.2 Esteem—Self-Confirmed	Growth
	5. Self-Actualization	Growth

Illustration 1.2.—Three Hierarchical Need Structures

stability, dependency, protection; freedom from fear, anxiety and chaos; absence from pain, threat, or illness; need for structure, order, law, limits; strength in the protector; and so on.

3. Belongingness and love needs, or the need for affiliation and affection; the presence of friends, or a sweetheart, or a wife or husband, or children; the need for affectionate relations with people in general, namely, for a place in one's group or family; the absence of loneliness, of ostracism, of rejection, of friendlessness, of rootlessness; the need for social interrelationships with those around you; and so on.

4. Esteem needs, including self-esteem, esteem from others, and esteem for others. Self-esteem includes the need for a stable, firmly based, high evaluation of oneself, for self-respect. Also included are the desires for strength, for achievement, for adequacy, for mastery and competence, for confidence in the face of the world, for independence and freedom, for reputation or prestige (that is, as respect or esteem from other people), status, fame and glory, dominance, recognition, attention, importance, dignity, and appreciation. Satisfaction of the self-esteem need leads to feelings of self-confidence, worth, strength, capability, and adequacy, of being useful and necessary in the world. Thwarting of these needs produces feelings of inferiority, of weakness, and of helplessness.

5. The need for self-actualization. If all the

previous four need types are satisfied, we may still often (if not always) expect that a new discontent and restlessness will soon develop, unless the individual is doing what he, individually, is best fitted for. A musician must make music, an artist must paint, a poet must write, a teacher must teach, if he is to be ultimately at peace with himself. What a person can be, he must be. He must be true to his own nature. This all refers to man's desire for self-fulfillment, namely, to the tendency for him to become actualized in what he is potentially, to become everything that he is capable of becoming, the realization of his potential.

2. The Prepotency and Satisfaction Concepts

As important as the five need levels is the hypothesized process by which each class of needs becomes important or active. The five need categories exist in a hierarchy of prepotency, such that satisfaction of the lower or more basic needs normally must sequentially precede emergence and satisfaction of the higher or less basic needs. This means that before any of the higher level needs will become potent, or strong, a person's physiological needs must first be largely satisfied. "A person who is lacking food, safety, love, and esteem would most probably hunger for food more strongly than for anything else." (Maslow 1970, p. 37)

Once these physiological needs have been satisfied, however, their strength or importance decreases, and the

next higher level of need, safety, becomes the strongest drive of behavior. This process of "increased satisfaction - decreased importance - increased importance of the next higher need " repeats itself until the highest level of the hierarchy is reached, given that certain other conditions are satisfied. These other conditions will be discussed in Chapter 2.

At the highest level, self-actualization, Maslow has proposed in later revisions to his theory that a reversal occurs in the satisfaction-importance relationship. He states that for the self-actualization need, increased satisfaction leads to increased need strength. "When we examine people who are predominantly growth-motivated ... gratification breeds increased rather than decreased motivation ..." (Maslow 1968, p. 30)

3. An Additional Comment

Maslow makes a critical distinction between the psychological concepts of needs and appetites. A need is an ongoing, long-term want of the organism, whereas an appetite is the short-term drive of an organism. For example, the average well-fed U.S. citizen is experiencing appetite rather than the hunger need when he says, "I am hungry." (Maslow 1970) Thus, in Maslow's theory short-lived appetites have negligible effect on the (long-term) importance and satisfaction of the various levels of needs.

D. Empirical Use and Tests of Maslow's Basic Theory

There are several different approaches that have been taken in testing Maslow's basic theory. Porter (1961, 1962, 1963) assumed the hierarchy exists and is valid. He then developed a questionnaire which had one or more questions involving each level of the hierarchy. The questions are of the type, "How much of this is there in your present job? How much should there be?" From this data Porter calculated the satisfaction deficiency of each need type (amount-there-should-be minus amount-there-is). He used a separate set of questions to determine the importance of each need type, and hence treated Importance and Satisfaction as separate variables. Porter then related these derived data to other factors, such as job level (upper, middle, or first-level management) and line or staff. Significant relationships were discovered, such as: higher level managers tend to operate at (be more concerned with) higher need levels. This finding is largely consistent with the alternative (but untested) hypothesis that higher need levels emerge with greater age; for, by and large, there is a fairly high correlation between age and level of management.

Note that Porter made two implicit assumptions in his work. First, he assumed the validity of the hierarchy as incorporated in Maslow's basic theory. He never tested the theory itself. Secondly, he assumed that each need level question he asked did in fact measure deficiency (or

importance) of only the need level the question was tied to, and to no other need level. While this second assumption may very well be true, no objective method was employed to verify the correspondence between each of his questions and each of the types of needs in the hierarchy he used.

Maslow's need hierarchy theory has also enjoyed widespread acceptance by other theoreticians, particularly in the writings of many prominent organizational theorists (e.g., Haire 1956; McGregor 1960; Argyris 1964; Schein 1965). It has also been used to explain such diverse issues as why pay can become unimportant and why self-actualization seems very important to people today.

Other researchers, headed by Hall and Nougaim (1968), have taken the hierarchy and satisfaction-prepotency concepts as interrelated hypotheses to be tested. Goodman (1968), Lawler and Suttle (1972), Alderfer (1969), and Schneider and Alderfer (1973) have also taken the hierarchy and the satisfaction-prepotency concepts as a deterministic model with no outside constraints. Using the Porter-type questionnaire, as well as some other measurement instruments, these researchers have tested various hypotheses, such as: (1) satisfaction of a given level of needs will be positively correlated with the strength of the needs at the next higher level; and (2) changes in the satisfaction of a given level of needs will be positively correlated with changes in the strength of the needs at the next higher

level. Various levels of rigor have been employed by the different researchers. Hall and Nougaim's work covers the longest period of analysis with one set of personnel (five years) and is as statistically rigorous as any of the other works, and more so than most. None of these studies have confirmed all of the hierarchical relationships. Some have confirmed parts of the hierarchy. For example, Hall and Nougaim found a statistically significant relationship ($p < .05$) between a decrease in concern for safety needs and an increase in concern for belongingness, esteem, and self-actualization needs. For the most part, however, this body of research has found little to validate the basic theory.

It is worth noting that Hall and Nougaim measured need strength with a different instrument than they used to measure need satisfaction. This methodology yielded results that showed positive correlations (sometimes statistically significant) between strength and satisfaction of a given need type. That is, as a need type showed high satisfaction it also tended to show high strength. We might expect such a situation in a disturbed personality, but in the normal personality we (and Maslow) would expect a negative correlation between the strength of a need and its satisfaction, at least in the four lower need levels. In fact, we can state as an axiom of the theory that for lower type needs the normal relationship between strength and satisfaction of a given need type is: the more a need is satisfied,

the lower its strength. "An increase (change) in the satisfaction of the needs in one category causes the strength of these needs to decrease ..." (Lawler and Suttle 1972, p. 266) However, for the highest need level, and perhaps for even the third and fourth need levels, it is not as clearly evident that this relationship must hold. Maslow is insistent that it in fact does hold for the first four need categories, and consequently the model that has been developed reflects this insistence.

The relationship between satisfaction and importance of a given need type can also be argued to be an inverse one, at least for the lower need levels. The more satisfied a need becomes, the less important it is to the organism. There is a great deal of data on both animals and humans which demonstrate this to be so. (Cofer and Appley 1964; Dachler and Hulin 1969; Friedlander 1965)

Finally, the relationship between need strength and need importance is being taken as roughly an equivalent one: the stronger a need is, the more important it is to the organism; and the weaker it is, the less important it is to the organism. Thus, for the four lower need levels this study takes need strength and need importance to be roughly the same thing, and need satisfaction to be inversely related to both need strength and need importance. Furthermore, all that has been said about need strength, importance and satisfaction is assumed to hold for motivator strength, importance and satisfaction. Illustration 1.3

STRENGTH:	Very Weak	Weak	Average Strength	Above Average Strength	Maximum Strength
SATISFACTION:	Totally Satisfied	Largely Satisfied	Satisfied	Largely Unsatisfied	Totally Unsatisfied
IMPORTANCE:	Unimportant	Slightly Important	Average Importance	Above Average Importance	Extremely Important

Illustration 1.3.—The Continua of Need (or Motivator) Strength, Satisfaction and Importance

portrays these relationships. They will be more rigorously developed in Chapter 2.

A critical factor in all the empirical testing to date has been the assumption that Maslow's hypothesized relationship between strength (or satisfaction) of adjacent need levels holds over all ranges of the strength-satisfaction spectrum. It will be shown in the following chapter that the logic of the theory never required or even implied this. The strength-satisfaction relationship is a conditional one, depending on where on the strength spectrum an individual is operating.

In the remaining chapters we will develop the model in mathematical form and derive hypotheses from this model. We will then develop arguments for transformation of the empirical data into the five Maslowian need levels and need strengths of those need levels. Next, we will use the transformed data as a base for statistically testing many of the hypotheses, analyze the results of such tests, and draw conclusions about the hypotheses and the underlying theory. Finally, we will discuss alternative explanations (hypotheses) suggested by the results of the statistical analyses.

CHAPTER 2

THE MODEL AND THE HYPOTHESES

I. Overview

An underlying weakness in all the previous empirical tests of Maslow's theory is that none of the researchers fully and formally specified the mathematical relationships and constraints implicit in the theory. This chapter attempts to specify a model of Maslow's theory that will permit the formulation of testable hypotheses about the theory.

II. Verbal Summary and Interpretation of Maslow's Theory

Clearly, according to Maslow's theory, the strength of any need level (except the physiological) will be low prior to its emergence from prepotency. When the immediately next lower need level (say level i-1) has been largely satisfied (or, equivalently, according to Maslow, has fallen to a low value of strength), then the strength of the next higher need level, level i, will emerge and become potent. When this occurs the person will organize much of his behavior around satisfying these now-potent needs. Note, however, that as long as the need strength of level i-1 remains low it exerts little, if any, control on the strength of the

now-potent needs of level i. "... a want that is satisfied is no longer a want." (Maslow 1970, p. 38) Hence, high satisfaction (low strength) of a lower need level allows emergence of the need strength of the next higher level, but does not control satisfaction of higher need levels. Thus, as long as strength of need level i-1 is high, then the strength of need level i should be low. Once strength of level i-1 goes to a low, largely satisfied value, and strength of level i has risen to a high value and begun decreasing, then we can no longer talk about a direct cause-effect relationship between strength of need level i-1 and strength of need level i, for now outside satisfiers (motivators) control the decreasing strength of level i. Only in that narrow range when level i-1 needs have just become largely satisfied, and level i needs have just emerged into their potent operating range, is there a direct cause-effect dynamic relationship hypothesized between need strength of level i-1 and need strength of level i.

Over time, and assuming that no other constraints keep a person from satisfying his needs, the person will engage in behavior that does in fact result in satisfaction of his needs, which means a falling off of their strength, coupled with emergence of the strength of the next higher level needs. This explanation applies to levels 2, 3 and 4. Exceptions to this explanation are physiological needs, which are hypothesized to be strong

at birth (or before?) and hence start at maximum strength and decrease from there as they are satisfied, and the self-actualization need, which emerges into potency as the esteem needs become largely satisfied and then remains strong, never becoming satisfied. The self-actualization need can be thought of as feeding on itself.

III. Formal Definitions and Relationships

The goal of this section is to develop a set of explicit relationships that define two separate areas: (1) The static situation, in which a person is clearly operating at one need level. The relationships of interest here are those between the other need levels. And (2) the dynamic situation, in which the relationships of interest are between the strengths of prepotent, potent and largely satisfied adjacent need levels.

A. Operational Definitions for Various Ranges of Need Strength

Before proceeding with the model development we must operationally define four ranges of need strength corresponding to: (1) a largely satisfied need; (2) a prepotent, or unemerged, need; (3) an operating, or emerged, or potent, need; and (4) a high, or clearly operating, need.

(1) The strength of a largely satisfied need. This is that low range of need strength to which the strength of a need type descends when it has become largely satisfied.

Operationally this can be defined as the lowest 25 percent of the possible range of need strength. For the data used in this study (see Chapter 3) the possible range of need strength is from one to five, and if the strengths were uniformly distributed in this range, the strength of a largely satisfied need would be in the range from two to one. However, due to an upward bias in the data the operational range of need strength for a largely satisfied need is being defined as any value less than three, which is the lower 50 percent of the possible range but approximately 25 percent of the observed strengths.

To standardize the subscript conventions used throughout this dissertation subscript "i-1" or equivalently, subscript "k," where k=i-1, will be used to denote a need level that has a largely satisfied strength.

(2) The strength of a prepotent, or unemerged, need. This is the range in which need strength operates prior to emerging into its potent, or operating, range. This range must clearly start at minimum strength and extend upward to some low-to-intermediate level. However, it could terminate at some upper limit different from the upper limit for the strength of a largely satisfied need. From reading Maslow it appears that this prepotent range extends upward to some strength value higher than the upper limit for the largely satisfied range. However it is also clear that whatever differences there might be in these two values, the prepotent

range for the most part overlaps the largely satisfied range.

In the interest of simplicity we are defining these two ranges to be identical. Thus, this prepotent range can also be set at the lowest 25 percent of the possible need strength range. However, due to an upward bias in the actual data being used the operational range for prepotent need strength is redefined as any value between one and three, or the lower 50 percent of the possible range of need strength.

Again, to standardize the subscript notation subscript "i+1" or equivalently, subscript "j," where j=i+1, will be used throughout to denote a need level which has prepotent (unemerged) need strength.

(3) The strength of an operating, or emerged, or potent need. This is any value of strength that a need takes on between the time it has emerged from its prepotent range and before it has descended into its largely satisfied range. Theoretically, this would be any value in the upper 75 percent of the possible need strength range. Operationally, this is any value of need strength greater than three and less than five, or any value in the upper 50 percent of the need strength range.

The standardized subscript "i" will always be used throughout to denote a need level that has potent need strength.

(4) The strength of a high, or clearly operating, need. This is that range of need strength that is exhibited by a person who is clearly directing his attentions and energies to satisfying the needs associated with a particular need level. We want this to be a high value so as to ensure that we can select people who, theoretically, are operating at this need level and no other, for as Maslow has hypothesized, a person clearly operating at one need level is unlikely to be operating at any other need level. Operationally this range is being set at the upper 25 percent of the possible range of need strength. This means a value of need strength between four and five. The subscript "i" will always be used to denote need levels with high need strength.

There is another way we could have defined these ranges. For example, we could define "clearly operating at a need level" to mean those individuals who are in the upper 25 percent of the distribution of the need strength for a given need level. This approach seems to make sense when we consider the biased distributions that the various need strengths could (and do) have. However, to adopt this approach would violate an underlying premise of the model. A priori, we are not sure at which need level any members of a sample are actually operating. If, for example, most of the individuals in one sample happened in fact to be clearly operating at need level 4, then most of them would have a very high value for strength of need level 4, S_4.

Accepting this second rule, that S_4 be greater than the 75th percentile of the S_4 distribution, would exclude from the group of those selected many others who in fact were clearly operating at need level 4. Those excluded had a high "operating at" strength for need level 4, but not high enough to fall in the upper 25 percentile of the S_4 distribution. Thus, we are led to a more absolute definition of "clearly operating at a need level." The result is that we operationally define "clearly operating at a given need level" in the manner described in the first part of this section.

We would also like to hold to absolute definitions for the other three ranges (prepotent, potent and largely satisfied) for the same reasons. However, there is a consistent upward bias in most of the response patterns in the available data. To ensure obtaining some reasonable proportion of the sampled population in all of the various ranges, we have thus increased these lower ranges.

B. The Static Relationships

The method used for developing both the static model and the dynamic model uses as its point of departure the need strength-age relationships depicted in Illustration 2.1. This illustration is a pictorial summary of Maslow's hierarchical theory. Note that it shows all five need levels and divides the need strength spectrum into four ranges: largely satisfied, unemerged or prepotent, potent or emerged,

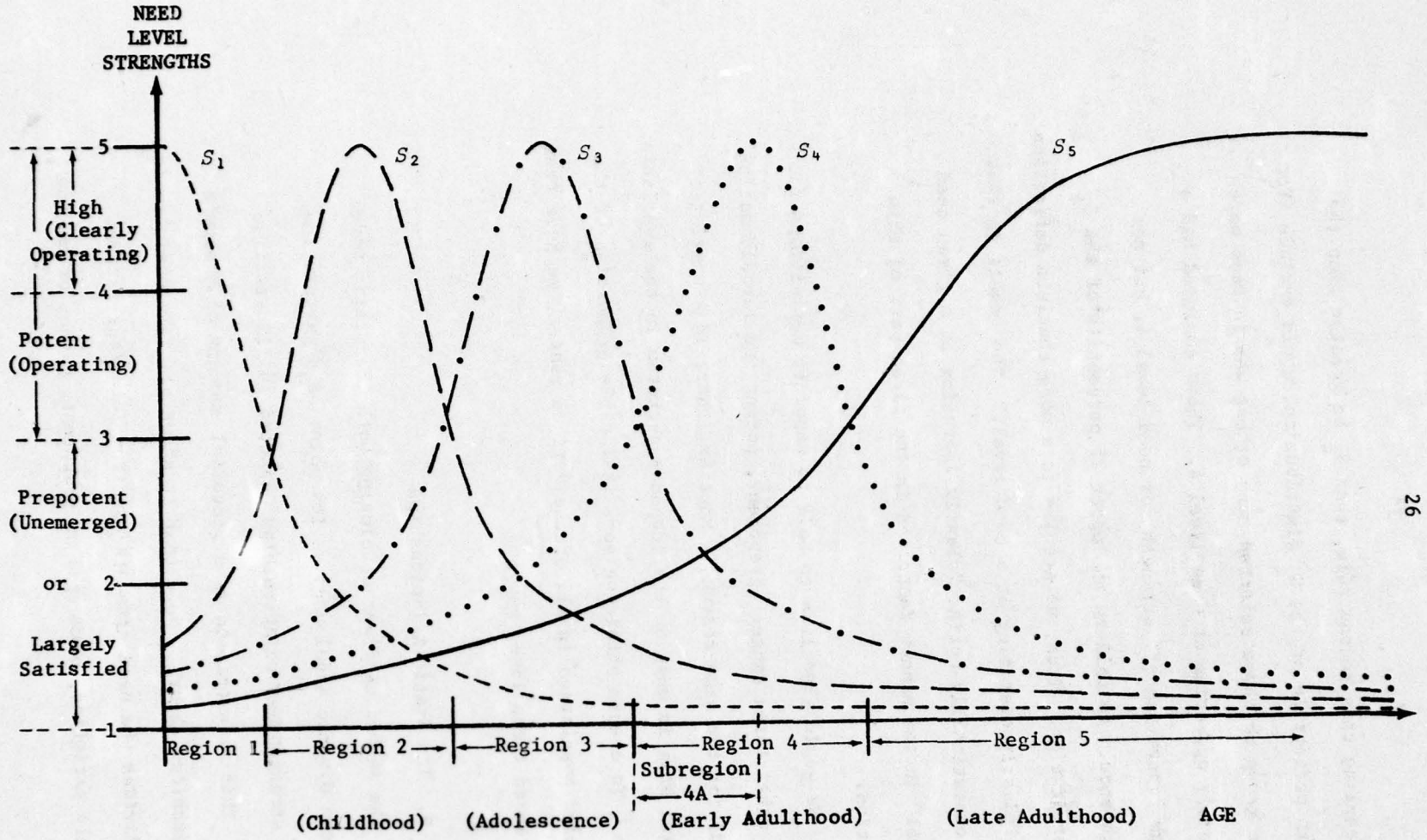

Illustration 2.1.—The Model: Relationships among the Strengths of Needs for the Five Need Levels as a Function of Age

and high or clearly operating. Recall that the range for largely satisfied need strength is identical to the range for prepotent need strength. The Age (or Time) axis has also been divided into five regions. Each of these regions represents that age range in which the need strength of a given need level is potent. Illustration 2.1 forms the basis for the development of all of the relationships in this section.

1. Mean Age for Persons Clearly Operating at a Given Need Level

In response to the Hall and Nougaim study which failed to verify most of the interrelationships between each pair of adjacent need levels, Maslow stated that he conceived of a long time period (in years) between the emergence of the various need levels for any individual. He suggested that in the fortunate (psychologically healthy) life history the safety needs are salient and satisfied during childhood, the belongingness needs during adolescence, and the esteem needs during early adulthood. Only as a person nears his 50's will the self-actualization need generally become strongly salient. (Hall and Nougaim 1968, p. 34) White's (1959) use of the concept of maturation (i.e., "growing up") in partially explaining autonomous ego development buttresses the use of the age factor in the model. My interpretation of this relationship between age and strength of different need types is as shown in Illustration 2.1.

Virtually all of the management trainees in the Hall and Nougaim study were in their 20's and early 30's. This age concentration could explain the emergence of the one statistically significant relationship that did show up, as well as the nonemergence of the other relationships, assuming that this age span of 20 to 35 is the one at which normal humans are able to move from safety needs to belongingness and even esteem needs.

It is not clear from the brief note Maslow made concerning age in relation to his hierarchy whether age is to be considered a constraint (a person can only be at a certain need level if he has attained a minimum age) or whether age is a secondary phenomenon (given people at a certain need level, we would tend to find that they are in a certain age range). The latter explanation does, however, seem more appropriate.

If this latter explanation is the one we choose, then a simple test can be used for Maslow's age hypothesis. Given a group of individuals who are clearly operating at need level i (as determined by $S_i>4$), then we can compute the mean age for all such individuals in the group: $\bar{A}_i|S_i>4$. The test is then quite simple:

(2.1a) $(\bar{A}_2|S_2>4) \simeq 7$ (childhood)

(2.1b) $(\bar{A}_3|S_3>4) \simeq 15$ (adolescence)

(2.1c) $(\bar{A}_4|S_4>4) \simeq 30$ (early adulthood)

(2.1d) $(\bar{A}_5|S_5>4) \simeq 50$ (late adulthood)

The numerical ages shown in relationships 2.1a through

2.1d are my interpretation of the labels "childhood," "adolescence," "early adulthood" and "late adulthood" that Maslow gave to the periods of life in which he considered each of the various need levels to become salient.

A similar, though less rigorous, test would be:

$$(2.2)\quad (\bar{A}_5|S_5>4) > (\bar{A}_4|S_4>4) > (\bar{A}_3|S_3>4) > (\bar{A}_2|S_2>4) > (\bar{A}_1|S_1>4)$$

These conditional age differences are clearly depicted in Illustration 2.1.

The age spread on the data used in this study varies (see Chapter 3), but in several of the data sets the age spread is from 21 to 57 years, certainly enough to cover the upper two need levels, and perhaps even need level three.

In relationships 2.1 and 2.2 above we have used the vertical bar "|" as a mathematical symbol having a specific meaning. This symbol will be used throughout this dissertation, so at this point we shall pause and clarify its meaning. This vertical bar is used to mean "given that" or "conditional upon" the constraint immediately following the symbol. For example, $(\bar{A}_5|S_5>4)$ means to select the records of all individuals which meet the condition that the strength for need level five, S_5, is greater than 4, and then to compute the mean (average) for all the values for age found in these conditionally selected records.

2. Mean Need Strengths for Persons Clearly Operating at a Given Need Level

From Illustration 2.1 one can see that there are several clearly different regions to be investigated in developing the model. Region 2 is that part of the Age axis where the strength of level 3 needs, S_3, is in the unemerged or prepotent range, but is beginning to emerge towards potency due to the strength of level 2 needs, S_2, decreasing towards the largely satisfied range. Note also that level 4 need strength, S_4, is held to the low, prepotent range throughout Region 2 due to the unemerged, and hence still unsatisfied, needs of level 3.

Region 3 is where S_3 emerges into potency (allowed by S_2 now having fallen into the largely satisfied range), reaches a maximum, "clearly operating at" level of strength, and then begins to decrease due to its satisfaction by outside motivators. Note that in Region 3 the need strength of level 4 needs, S_4, continues to be held at its prepotent level due to the potent and unsatisfied need strength of level 3 needs, S_3. However, as S_3 begins to decrease toward its largely satisfied range S_4 is allowed to begin emerging into potency. Note also that S_2 remains largely satisfied throughout Region 3.

Region 4 is where level 4 needs finally emerge into potency, due to S_3 dropping into the largely satisfied range. In Region 4 level 4 needs climb to their maximum level, due in theory to the largely satisfied condition for level 3 needs. However, once the level 4 needs have fully emerged level 3 needs no longer control them. Any decrease in S_4 now occurs due to the person seeking and finding satisfaction

for type 4 needs in his life. Thus, beyond that part of Region 4 where S_4 has reached its maximum value and begun to decrease, no direct cause-effect relationship between S_3 and S_4 is hypothesized. Note that throughout all of Region 4 both S_3 and S_2 remain in the largely satisfied range.

That part of Region 4 where S_4 is still increasing has been labeled Subregion 4A. It is only in this subregion that Maslow's satisfaction-potency concept is hypothesized to operate dynamically between need levels 3 and 4. To the left of Subregion 4A S_4 is still prepotent, due either to the prepotent, and hence unsatisfied, condition of S_3 (Regions 1 and 2), or due to the potent and still unsatisfied condition of S_3 (Region 3). To the right of Subregion 4A the changes in S_4 are now directly controlled by need satisfiers of type 4 needs, and S_3 no longer affects S_4.

Let us take a person who is clearly operating at need level i, which will be need level 3 in Illustration 2.1. That is, such a person has a value for S_3 greater than four. This puts him (and us) strictly in Region 3. In such a situation the theory says that not only the immediately next lower need level, level 2, but all need levels below that one must have been largely satisfied and therefore should have low strength. Similarly, the immediately next higher need level, 4, and all levels above level 4 cannot yet have emerged, due to the high, largely unsatisfied condition of need level 3, and therefore we should

also find low strength for all need levels above level 3.

In general, if we group individuals by the criterion that $S_i>4$, we should find for such groups a high value for the mean need strength of level i, S_i, and correspondingly low, largely satisfied or prepotent values for the need strength means of all other need levels, S_l, where l is different from i. Operationally, we would have:

(2.3) $(\bar{S}_i|S_i>4) > 4$, $i=1,\ldots,5$, by definition.

And we would expect:

(2.4) $(\bar{S}_l|S_i>4) < 3$, $i,l=1,\ldots,5$; $i\neq l$.

This hypothesized relationship could easily be tested empirically.

A less rigorous test, but one still in the spirit of the theory, is to determine if

(2.5) $(\bar{S}_l|S_i>4) < \bar{S}_l$, $i,l=1,\ldots,5$; $i\neq l$.

That is, if an individual is clearly operating at need level i, as determined by $S_i>4$, then all other need level strengths should be low (either prepotent or largely satisfied), since an individual is, by and large, hypothesized to operate at only one need level at a time. Now if we do not condition the mean need level strengths, but instead simply calculate the overall mean strength for each need need level S_l $(l=1,\ldots,5)$, then such a measure will include all individuals, both those operating at need level l (and thus having high S_l values) and those not operating at need level l (and therefore hypothesized to have low S_l values). Thus, from the theory, the conditional mean need level

strengths for a group, given that the individuals in the group are operating at another need level, should be lower than the universal mean need level strengths for all individuals, no matter the need level at which they are operating. This is the rationale for relationship 2.5.

3. Cross-Correlations Between Unemerged and Largely Satisfied Need Strengths

Let us remain in Region 3 on Illustration 2.1, under the condition that S_3 be greater than its high, clearly operating at, value and see what relationships we can discern for three different situations: first, the relationship between the still prepotent need level strengths (S_4 and S_5); second, between the largely satisfied need level strengths (S_1 and S_2); and third, between a prepotent need level strength and a largely satisfied need level strength (S_2 and S_4).

In Region 3 we see that a positive correlation is hypothesized between any need strengths that are unemerged. Specifically, given that we are clearly operating in need level 3 ($S_3>4$), then S_4 and S_5 are held to low, unemerged levels, where they are slightly increasing or holding constant. As such they should exhibit positive correlations amongst themselves, given the "clearly operating at" condition for S_3. Similarly, in Region 3 all need levels lower than level 3, namely levels 1 and 2, must be in their largely satisfied range, and as such they should be mildly decreasing or holding con-

stant. Thus they, too, should exhibit positive correlations amongst themselves. And finally, any need strength pair consisting of an unemerged need strength and a largely satisfied need strength should exhibit a negative correlation, since the unemerged need strength should be slightly increasing and the largely satisfied need strength should be slightly decreasing in this region. This relationship can be seen between S_2 and S_4 in Region 3 of Illustration 2.1.

Let us now generalize to cover all need levels. For any reasonably large group of normal people, there should be a positive correlation between any pairs of unemerged need level strengths (for individuals in the group) for all need levels higher than level i, given that the individuals in the group are clearly operating in level i ($S_i>4$). This yields the following formal relationship:

(2.6) $r_{lm}>0$, where r_{lm} indicates the cross-correlation between $(S_l|S_i>4)$ and $(S_m|S_i>4)$;
$i=1,2,3;$
$l=i+1,\ldots,5;$
$m=i+2,\ldots,5;$
$l\neq m.$

The second relationship of this type is that the cross-correlations between any pairs of largely satisfied need level strengths should be positive, given a sufficient sample size:

(2.7) $r_{pq}>0$, where r_{pq} indicates the cross-correlation between $(S_p|S_i>4)$ and $(S_q|S_i>4)$;

$i=3,4,5;$

$p=1,\ldots,i-1;$

$q=1,\ldots,i-2;$

$p\neq q.$

Finally, there is the relationship that the cross-correlations between any need strength pairs consisting of an unemerged and a largely satisfied need strength should be negative, given a sufficient sample size:

(2.8) $r_{jk}<0$, where r_{jk} indicates the cross-correlation between $(S_j|S_i>4)$ and $(S_k|S_i>4)$;

$i=2,3,4;$

$j=i+1,\ldots,5;$

$k=1,\ldots,i-1;$

$j\neq k.$

These relationships can be easily checked with the empirical data, involving only the computation of the cross-correlations, given a selection of individuals who satisfy the condition of clearly operating at need level i.

C. The Dynamic Relationships

We will develop two different sets of dynamic relationships. The first set will be those that are hypothesized to exist between age and need strength (prepotent, potent and largely satisfied). The second set will be those that are hypothesized to exist between adjacent need level need

strengths (prepotent-potent and potent-largely satisfied). Throughout this section we will use the simplest functions that can be used which still capture the relationship at hand. Simplicity should be, I feel, one of the goals of exploratory research.

1. The Relationship Between Age and Prepotent Need Strength

Since strength of need level 1, S_1, is hypothesized to be always either potent or largely satisfied we need not concern ourselves with any age-prepotent need strength relationship for need level 1. For need levels 2 through 5 these relationships are hypothesized to exist and are all of the same form. Let us start by specifying the conditions that force a need strength into its prepotent range. We will deal specifically in Region 2 of Illustration 2.1, with S_2 (potent), S_3 (prepotent) and Age (A), and then generalize.

From Illustration 2.1 we can see that for need strength S_3 to be prepotent we must have S_3 less than 3. However, simply requiring S_3 to be less than 3 will not ensure that S_3 is prepotent (in Regions 1 and 2), for S_3 is also less than 3 when it is largely satisfied (in Regions 4 and 5). But a single condition derived from the theory which ensures that S_3 should be prepotent rather than largely satisfied is to require that S_2 be potent ($S_2 > 3$). S_2 is potent only in Region 2, and everywhere in Region 2 S_3 is prepotent. Thus, given this single condition, that S_2 be greater than 3,

we are sure that S_3 should be prepotent and as such can only be increasing very slowly, if at all. Therefore, we can build a positive linear approximation for the relationship between S_3 and Age. Generalizing, we have:

(2.9) $S_j = B_j + C_jA, \quad j=2,\ldots,5;$

$S_i>3 \ (i=j-1);$

and we hypothesize that the parameter C_j is positive. This hypothesis could easily be tested. Note that we would expect the slope of such a line to be only slightly positive, reflecting the slowly increasing nature of a prepotent need strength. Note also that B_j could be negative, positive, or zero, depending on the magnitude of the slope (C_j) in this relationship.

2. The Relationship Between Age and Potent Need Strength

Looking again to Illustration 2.1, the only condition required on a need level strength for it to be potent is that it be greater than 3. Given this condition for S_1 we are assured of being in Region 1 of Illustration 2.1. In this region we find that the simplest approximation of the shape of the potent part of the S_1 curve is a simple inverse relationship, and we have:

(2.10) $S_1 = + D_1/A, \quad S_1>3;$

and we hypothesize that the parameter D_1 is positive. This hypothesis is testable.

This approximation is not good for high strength values

of S_1. However we are not likely to find such data with the individuals being studied.

For need strengths S_2 through S_4 we can approximate the shape of the potent parts of these curves with a second-order equation. A convex parabolic form can be represented by:

(2.11) $S_i = - D_i A^2 + E_i A + F_i, \quad i=2,3,4;$

$S_i > 3;$

and we hypothesize that the parameters D_i and E_i are positive. The parameter F_i is indeterminate in sign and value. This hypothesis is reasonably easy to test.

For need strength S_5 we can also use a fairly simple form to capture the hypothesized relationship. This form is:

(2.12) $S_5 = + D_5 - E_5/A, \quad S_5 > 3;$

and we hypothesize that the parameters D_5 and E_5 are positive. Furthermore, parameter D_5 should be approximately equal to 5, the highest value for need strength, since D_5 is the asymptotic value for this curve.

Relationships 2.10, 2.11 and 2.12 can be tested with the available data. However, the relatively simple and testable form for relationship 2.12 was developed from a more complex and untestable form after all the data analysis had been done. Though no direct tests were conducted on it reasonable deductions can be made about the outcome of such tests based on the results of the other tests.

There is one remaining relationship to specify between

age and potent need strength. If, in addition to having, say, S_i potent, we could also limit ourselves only to that portion of the potent S_i curve where S_i was increasing over time, then we could generate the following linear approximation for a need level strength in terms of age:

(2.13) $S_i = \alpha_i + \beta_i A, \quad i=2,\ldots,5;$

$S_i > 3;$

S_i increasing with age;

and we hypothesize that the parameter β_i is positive. The value and sign of the constant term α_i are indeterminate. Note that this relationship requires longitudinal need strength-age data on the same individuals over a long period of time. Thus, it cannot be tested with the available data (see Chapter 3). However, we will return to this relationship later.

3. The Relationship Between Age and Largely Satisfied Need Strength

Since S_5 is hypothesized never to be largely satisfied we need only concern ourselves with need strengths S_1 through S_4 in this section. We will develop S_3 as the largely satisfied need strength and then generalize.

For S_3 to be largely satisfied we need specify only one condition: that the strength of the next higher need level, S_4, be potent, for the only way S_4 could become potent (as stated by the theory) is for the needs in level 3 to become largely satisfied. Thus, requiring that S_4 be potent ($S_4>3$)

puts us strictly in Region 4 of Illustration 2.1, and everywhere in this region S_3 is largely satisfied.

Note that in the higher portion of its largely satisfied range need strength S_3 appears fairly curvilinear, whereas lower down in this range it appears fairly linear. Note also that this shape derives from the theory. For these reasons we will approximate the largely satisfied part of the need strength curves in Region 4 by both a linear and a non-linear form. Generalizing, we have for the linear approximation:

(2.14a) $S_k = + G_k - H_k A, \quad k=1,\ldots,4;$

$$S_i > 3 \ (i=k+1);$$

and we hypothesize that the parameters G_k and H_k are positive. We are able to hypothesize the sign of the constant term as positive due to the required first-quadrant location of the relationship and its hypothesized negative slope (H_k). This hypothesis is easily testable.

For the simplest non-linear approximation that is appropriate, we have:

(2.14b) $S_k = + L_k/A, \quad k=1,\ldots,4;$

$$S_i > 3 \ (i=k+1);$$

and we hypothesize that the parameter L_k is positive. This is also an easily testable hypothesis.

This completes all of the important hypothesized relationships between age and need strengths. All of these dynamic relationships are nicely summarized in Table 2.1.

There is one final note of interest concerning the rela-

TABLE 2.1

DYNAMIC RELATIONSHIPS BETWEEN AGE AND NEED LEVEL STRENGTHS

Need Level Strength	S_j Prepotent ($j = i + 1$)	S_i Potent ($i = 1, \cdots, 5$)	S_k Largely Satisfied ($k = i - 1$)
S_1	No Relationship Hypothesized	(2.10) $S_1 = +D_1/A$, $S_1 > 3$ (Hypothesis 5a: $D_1 > 0$)	(2.14a) $S_k = +G_k - H_k A$, $k = 1, \cdots, 4$, $S_i > 3$ ($i = k + 1$). (Hypothesis 6a: G_k, $H_k > 0$) OR (2.14b) $S_k = +L_k/A$, $k = 1, \cdots, 4$; $S_i > 3$ ($i = k + 1$). (Hypothesis 6b: $L_k > 0$)
S_2	(2.9) $S_j = B_j + C_j A$, $j = 2, \cdots, 5$; $S_i > 3$ ($i = j - 1$). (Hypothesis 4: $C_j > 0$)	(2.11) $S_i = -D_i A^2 + E_i A + F_i$, $i = 2, 3, 4$; $S_i > 3$. (Hypothesis 5b: D_i, $E_i > 0$)	
S_3			
S_4			
S_5		(2.12) $S_5 = +D_5 - E_5/A$, $S_5 > 3$ (Hypothesis 5c: D_5, $E_5 > 0$)	No Relationship Hypothesized
S_2, S_3, S_4, S_5		S_i Potent and S_i Increasing with Age	
		(2.13) $S_i = \alpha_i + \beta_i A$, $i = 2, \cdots, 5$; $S_i > 3$; $(S_i)_{A=a} < (S_i)_{A=a+b}$. (Hypothesis: $\beta_i > 0$)	

tionships between age and need strength. Most of the available data (surveys) include the variables Rank and Education Level as well as Age. Since these can both be considered "growth" variables, much like age, we can replace age in each of these age-need strength relationships with rank or education level and test the same form of the relationships for these other two surrogates for age.

4. The Relationship Between Prepotent and Potent Adjacent Need Strengths

The relationships developed in this section and the following one are the very heart of the dynamic part of Maslow's theory. Together these relationships comprise the prepotency-potency-satisfaction concept, which has usually been referred to as the prepotency-satisfaction concept.

If a person is operating at, say, need level 2 then he must have the strength of need level 2 potent, or greater than 3. Also, if he is operating at need level 2 this means that his security needs are not largely satisfied, and hence need levels 3, 4 and 5 cannot emerge from prepotency. The strongest hypothesized link is between S_2 and S_3, where the potency of need level 2 keeps the prepotent needs of need level 3 from emerging. Put another way, strong type 2 needs hold type 3 needs down, and they are hypothesized to do so as long as the need strength of type 2 needs remain potent.

Generalizing, if we specify that S_i is potent ($S_i>3$), then we are strictly in Region i of Illustration 2.1, and

everywhere in Region i S_i must be potent. We can therefore represent S_i by relationship 2.10 for S_1; or by 2.11, for S_2 through S_4. Similarly, S_j (j=i+1) being prepotent means we can represent S_j by relationship 2.9.

Let us first develop the prepotency-potency relationship between S_1 and S_2 (S_1 potent, S_2 prepotent). Combining relationships 2.10 and 2.9 and simplifying the name of one parameter we have:

(2.15) $S_2 = B_2 + M_2/S_1, \quad S_1>3;$

and we hypothesize that the parameter M_2 is positive. The value and sign of the parameter B_2 are indeterminate. This hypothesis can be easily tested.

Note that the simple fact that S_1 is potent should, from the theory, automatically keep S_2 at prepotent levels. Hence, we do not have to add as a condition that S_2 be less than 3.

Now we shall develop the prepotency-potency relationship for S_3-S_2, S_4-S_3, and S_5-S_4. We use relationship 2.11 for potent S_2, S_3 or S_4, and relationship 2.9 for prepotent S_3, S_4 or S_5. Unfortunately, we find that we cannot express the prepotent need strength as an explicit function of the potent need strength, but we can do the reverse, which is to express the potent need strength (S_i) as a function of the prepotent need strength (S_j). Doing this, simplifying parameter names and analyzing the sign requirements we have:

(2.16) $S_i = - N_i S_j^2 + O_i S_j + P_i$, $j=3,4,5$;

$i=j-1$;

$S_i>3$;

and we hypothesize that the parameters N_i and O_i are positive. The parameter P_i is indeterminate in sign and value. This hypothesis is testable. Again, note that simply requiring $S_i>3$ should mean that S_j $(j=i+1)$ is in its prepotent range.

5. The Relationship Between Largely Satisfied and Potent Adjacent Need Strengths

This particular set of relationships is probably the most important that evolve from the theory. It is these relationships that portray the idea that a lower level need, upon becoming largely satisfied, "opens the door" for the emergence into potency of the heretofore held-down (prepotent) next higher level need.

We will use S_3 and S_4 as our adjacent becoming-largely-satisfied, emerging-into-potency need pair. Note that this situation will occur only in Subregion 4A of Illustration 2.1. In order to be in Subregion 4A we must first specify one condition: that S_4 be potent ($S_4>3$). This puts us strictly in Region 4. But this is not enough. As need level 3 needs become largely satisfied this "opens the door" for emergence of level 4 needs. However, once the door is opened and level 4 need strength emerges to some high, "clearly operating at" value then level 3 need strength loses control over level 4 need strength, and a cause-effect

relationship no longer exists between level 3 and 4 needs (assuming, of course, that level 3 needs remain largely satisfied, as they are hypothesized to do). Thus, the only place where the satisfaction-potency concept holds between the strength of these adjacent need levels is where S_4 is not only greater than its prepotent range, but where it is also increasing with age. Thus, our second condition for the satisfaction-potency part of the model is: $(S_4)_{A=a} < (S_4)_{A=a+b}$, where the subscripts indicate Age (A) at some lower (younger) level, a, versus age at some higher (older) level, a+b, where b is some positive increment of time.

Generalizing, we have two conditions that must be met simultaneously for the directly hypothesized satisfaction-potency part of the model to hold. These conditions are: $S_i > 3$; and $(S_i)_{A=a} < (S_i)_{A=a+b}$. Note that this second condition requires longitudinal data on the same individuals over a large number of time periods.

As already noted, no direct cause-effect relationship is hypothesized to hold between S_3 and S_4 when S_4 is decreasing and S_3 is in fact largely satisfied. However, if the general shapes of the S_3 and S_4 curves remain roughly as shown in Region 4 of Illustration 2.1, and as required by the theory, then even though other exogenous variables are driving S_4 in the region to the right of Subregion 4A we can still develop the relationship that S_3 and S_4 should exhibit with respect to each other in all of Region 4.

Under the single condition that S_4 be potent ($S_4>3$), we are strictly in Region 4, and in Region 4 we can approximate the largely satisfied portion of the S_3 curve by relationship 2.14a or 2.14b, depending on our preference for the linear or the non-linear form. The potent portion of the S_4 curve can again be approximated by relationship 2.11, a concave-down parabola. Note that since the S_5 curve does not approximate a parabola in its potent range we can only apply this first satisfaction-potency relationship to need level pairs S_1-S_2, S_2-S_3 and S_3-S_4. Combining relationships 2.14a and 2.11, simplifying the parameter symbols, and analyzing the sign requirements we have:

(2.17a) $S_i = - Q_i S_k^2 + R_i S_k + T_i$, $k=1,2,3$; $i=k+1$; $S_i>3$;

and we hypothesize that the parameters Q_i and R_i are positive. The parameter T_i is indeterminate in sign and value. This is a testable hypothesis.

Taking relationships 2.14b and 2.11, combining them, simplifying parameter symbols and analyzing sign requirements we have:

(2.17b) $S_i = - U_i/S_k^2 + V_i/S_k + W_i$, $k=1,2,3$; $i=k+1$; $S_i>3$;

and we hypothesize that the parameters U_i and V_i are positive. The parameter W_i is indeterminate in sign and value. This hypothesis can also be tested.

According to Maslow's theory relationship 2.17a (or b) should hold for any reasonably normal individual. Therefore the relationship should also hold collectively. For a large group of individuals we can first select data records based on the constraint on S_i (S_i>3), and then use these records to regress values of S_i and S_k against a regression equation of the form of 2.17a or b. If the signs of the parameters are the same as the signs for the hypothesized terms, if the F-statistics for the overall regression and the estimated coefficients are significant, and if the R-squared values are reasonably high, this would tend to validate the satisfaction-potency concept, as well as an even more general relationship between S_i and S_k. The beauty of these relationships, and a big reason for developing them, is that they are hypothesized to apply to cross-sectional data as well as longitudinal data. There are no time nor age constraints tied to relationships 2.17a and b.

We can now go on to derive the satisfaction-potency relationship for the S_4-S_5 need strength pair. We will use relationship 2.12 for approximating the S_5 curve in its potent range, and 2.14a or 2.14b for approximating the S_4 curve in its largely satisfied range.

Combining 2.14a and 2.12, simplifying parameter names and analyzing sign requirements we have:

(2.18a) $S_5 = + a_5 + b_5/(S_4-c_5), \quad S_5>3;$

and we hypothesize that the parameters a_5, b_5 and c_5 are positive. Unfortunately this expression can neither be

further simplified nor can the hypothesis be tested with the available data.

Combining relationships 2.13b and 2.12, simplifying parameter names and analyzing sign requirements we have:

(2.18b) $S_5 = + f_5 - g_5 S_4, \quad S_5 > 3;$

and we hypothesize that the parameters f_5 and g_5 are positive. Note that this is a testable relationship. However, this testable form for the largely satisfied S_4-potent S_5 relationship was developed from a more complex and untestable form after all the data analysis had been accomplished. Therefore this relationship was not systematically tested, though we have a few regressions of its form and can make reasonable deductions about what all such results would have yielded, based not only on these few regressions but also on the results of the other tests.

Let us now move on to the case where we require both satisfaction-potency conditions to hold and see what sort of relationship we can build between S_3 and S_4 for the two-constraint, directly hypothesized satisfaction-potency concept.

If, in addition to requiring $S_4 > 3$, we also require that $(S_4)_{A=a} < (S_4)_{A=a+b}$, then we are clearly in Subregion 4A of Illustration 2.1. In this situation it is quite clear that S_3 strictly decreases as S_4 strictly increases, as derived from the theory. In Subregion 4A we can again approximate the relationship for this part of the strictly increasing S_4 curve in terms of age by the linear relationship of 2.13.

For the largely satisfied portion of the S_3 curve we can again use relationship 2.14a or 2.14b.

Combining relationships 2.13 and 2.14a, analyzing the sign requirements, and simplifying the parameter symbols we have:

(2.19a) $S_i = n_i - p_i S_k$, $k=1,\ldots,4$;

$i=k+1$;

$S_i > 3$;

$(S_i)_{A=a} < (S_i)_{A=a+b}$;

and we hypothesize that the parameter p_i is positive. The parameter n_i is indeterminate in sign and value. Note that we can now include the S_4-S_5 need level pair in this relationship, since relationship 2.19a covers only what occurs at the satisfaction-potency stage for need level 5.

Combining relationships 2.13 and 2.14b, analyzing the sign requirements, and simplifying the parameter symbols we have:

(2.19b) $S_i = q_i + r_i/S_k$, $k=1,\ldots,4$;

$i=k+1$;

$S_i > 3$;

$(S_i)_{A=a} < (S_i)_{A=a+b}$;

and we hypothesize that the parameter r_i is positive. The parameter q_i is indeterminate in sign and value.

Relationships 2.19a and b hold, hypothetically, for any normal adult, subject to the constraint conditions. If these relationships hold in the individual case then they must also hold in the aggregate. We could therefore use empirical data

TABLE 2.2

DYNAMIC RELATIONSHIPS BETWEEN ADJACENT NEED LEVEL STRENGTHS

Need Level Strength Pair	S_i Potent and S_j Prepotent ($j = i + 1$)	S_k Largely Satisfied and S_i Potent ($k = i - 1$)
S_1-S_2	(2.15) $S_2 = B_2 + M_2/S_1$, $S_1 > 3$. (Hypothesis 7a: $M_2 > 0$)	(2.17a) $S_i = -Q_i S_k^2 + R_i S_k + T_i$, $i = 2, 3, 4$; $k = i - 1$; $S_i > 3$. (Hypothesis 8a: $Q_i, R_i > 0$) OR (2.17b) $S_i = -\frac{U_i}{S_k^2} + \frac{V_i}{S_k} + W_i$, $i = 2, 3, 4$; $k = i - 1$; $S_i > 3$. (Hypothesis 8b: $U_i, V_i > 0$)
S_2-S_3	(2.16) $S_i = -N_i S_j^2 + O_i S_j + P_i$, $i = 2, 3, 4$; $j = i + 1$; $S_i > 3$ (Hypothesis 7b: $N_i, O_i > 0$)	
S_3-S_4		
S_4-S_5		(2.18a) $S_5 = +a_5 + b_5/(S_4 - c_5)$, $S_5 > 3$. (Hypothesis: $a_5, b_5, c_5, > 0$) OR (2.18b) $S_5 = +f_5 - g_5 S_4$, $S_5 > 3$. (Hypothesis 8c: $f_5, g_5 > 0$)
		S_k Largely Satisfied, S_i Potent, and S_i Increasing with Age
S_1-S_2 S_2-S_3 S_3-S_4 S_4-S_5		(2.19a) $S_i = n_i - p_i S_k$, $i = 2, \cdots, 5$; $k = i - 1$; $S_i > 3$; $(S_i)_{A=a} < (S_i)_{A=a+b}$ (Hypothesis: $p_i > 0$) OR (2.19b) $S_i = q_i + r_i/S_k$, $i = 2, \cdots, 5$; $k = i - 1$; $S_i > 3$; $(S_i)_{A=a} < (S_i)_{A=a+b}$ (Hypothesis: $r_i > 0$)

to run linear regressions of the form of relationships 2.19a and b, to see if, in fact, such data validates these relationships. However, the problem with testing 2.19a and b is that they require longitudinal data, with numerous need strength readings over a large number of time periods. This is due to the last constraint condition which requires that S_i be increasing with age. Unfortunately, not many (if any) researchers have such data. For example, this researcher has no such data. My data covers, at most, one and one-half years, with no ability to match the records of the same individuals over time. So, though relationships 2.19a and b are quite nice in their simplicity, they shall, for the present at least, have to remain untested.

This completes the development of all the dynamic relationships between prepotent and potent need strengths of adjacent need levels and between potent and largely satisfied need strengths of adjacent need levels. Table 2.2 nicely summarizes these dynamic relationships.

D. Other Factors

1. The Time Factor

The factor of time itself bears directly on the model. Stanford Research Institute (SRI) published a 1969 Long Range Planning Report entitled "American Values." In it they hypothesize a shift upward in the distribution of the adult American population over the five need levels from 1965 to 1990. Illustration 2.2 displays the hypothe-

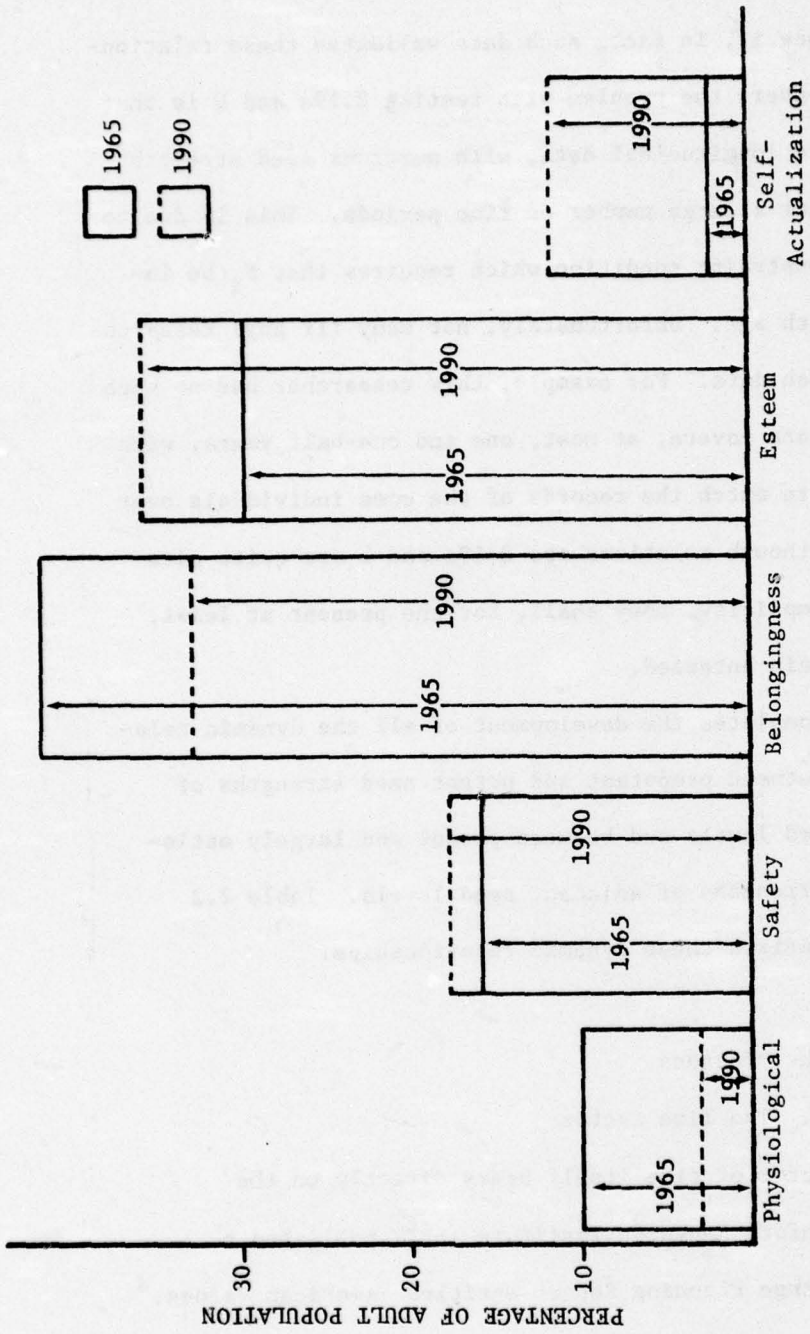

Illustration 2.2.—Hypothesized Shift in the Distribution of Operational Need Levels for Adult Americans, 1965-1990

sized shift. Thus time (i.e., Year) could be included as a variable in the model. To test the strength of this variable longitudinal data covering at least ten (and preferably fifteen or twenty) years should be used.

Unfortunately the data available cover only one and one-half years. It is unlikely that an upward shift in the need level distribution as hypothesized by SRI will occur in such a short period. However, we can easily develop a test of this hypothesis. The test would be: determine the proportion of the sampled population in the lowest possible need levels (level 2 and level 3 for this data) at the earliest time (T=0); and also determine the proportion of the sampled population in the highest need level (level 5), at the earlier time. Then, generate equivalent proportions at the latest time (T=1), and compare. For need level 2 or need level 3, a shift out of the lower levels over time means a lower proportion of the population in the lower levels at the earliest time vs. the latest time, and we have:

$$(2.20) \qquad \left(\frac{n_i|S_i>4}{N}\right)_{T=0} > \left(\frac{n_i|S_i>4}{N}\right)_{T=1}, \quad i=2,3;$$

where n_i is the number of people who have $S_i>4$, and N is the number of people in the entire group, all at T=0 and T=1 respectively. Note that Illustration 2.2 shows an hypothesized increase over time for that proportion of people in need level 2. However, due to the short time period covered by the data I am modifying the pictured SRI hypothesis to the formal hypothesis specified in relationship 2.20.

For need level 5, a shift into this need level over time means a higher proportion in this need level at the later time vs. the earlier time, and we have:

$$(2.21) \qquad \left(\frac{n_i|S_i>4}{N}\right)_{T=0} < \left(\frac{n_i|S_i>4}{N}\right)_{T=1}, \quad i=5.$$

The groups compared at T=0 and at T=1 must be similar in all other respects, particularly age, for this test to be valid. To successfully separate the Age and Time variables we must find two different groups that have nearly identical mean ages at the two different time periods. For example, determine the need level distribution of a random sample of a group of military personnel aged 21 to 57 at T=0, and statistically compare this distribution to the distribution of a random sample of military personnel age 21 to 57 at T=1. If the mean ages of the two groups are not statistically significant in their differences, this would effectively remove the Age variable from the comparison.

These tests of the effect of the Time variable cannot be conclusive for the data used. The reason they cannot be conclusive tests is that for this data the sample groups are not composed of the same individuals at each time period. However, these tests would at least be capable of detecting a trend, assuming that the samples were indeed random and representative.

One final comment is needed concerning the variable Time. When time is used as a variable in a model it is

usually the case that it is actually a surrogate for some other unmeasurable or unknown factors. This is likely the situation here. The Stanford Research Institute report does not indicate what these factors might be. However, affluence and the growing awareness of psychological health are probably some of the direct factors involved. Affluence seems necessary for satisfaction of the more basic needs, and hence it becomes a necessary but not sufficient condition for movement to higher need levels.

One good measure of affluence is per capita net national product. Thus, it is possible to use this variable instead of Time. However, it seems clear from the literature that affluence can only help people move through the more basic need levels (perhaps physiological and, to some extent, security needs). Thus, it is not a theoretically valid independent variable to use across all need levels. Hence, I will stick with using the variable Time.

2. The Psychological Health Factor

Another possible constraint on need levels emerges from reading Maslow's theory. Mental illness (i.e., poor psychological health) can "reduce people to the concrete," to use one of Maslow's more colorful phrases. This phrase describes an individual who is stuck at a lower need level beyond the normal stage of life expected for that level. A frustrated need in early life tends

to generate persistence of the need past its normal time of satisfaction and also tends to generate greatly increased activity of the need. (Maslow 1970)

The Psychological Health factor (P) is clearly meant to be a constraint. As such, an instrument is needed to measure psychological health. If such an instrument were available we could code it so that various levels of the Psychological Health factor would indicate the highest possible need level a person could usually achieve. For example, P=2 could indicate a person who could normally achieve need level 2, but no higher; P=3, normally achieve level 3, but no higher; and so on for levels 4 and 5. Given such a measure, we could then add the following constraints to relationship 2.19a or b:

(2.22a) P=2, i=1,2;

(2.22b) P=3, i=1,2,3;

(2.22c) P=4, i=1,2,3,4;

(2.22d) P=5, i=1,2,3,4,5.

A more interesting way to handle this factor would be as follows: for example, if P=3, we could require the potent part of the relationship for need strength S_3 to be replaced by the form of relationship 2.12, which is in fact what is hypothesized for the potent range of strength of need level 5, S_5. That is, by shifting equations we force S_3 to take on a form that can never become satisfied, and thereby ensure that such an individual is represented as being stuck in this need level forever.

While we can accept the intuitive appeal of this constraint, it is difficult to find readily available factors in empirical data that allow us to operationalize the Psychological Health factor. Furthermore, the available data (see Chapter 3) was collected from what was assumed to be a population reasonably healthy in the psychological sense. For these reasons the Psychological Health variable has been excluded from testing in the empirical study. It is included in the discussion for completeness.

IV. Summary of Testable Hypotheses and Relationships

A. Hypothesis 1: The Age Hypothesis

Given individuals who are clearly operating in one need level, then the higher the need level at which they operate the higher their mean age. Formally:

(2.2) $(\bar{A}_5 | S_5>4) > (\bar{A}_4 | S_4>4) > (\bar{A}_3 | S_3>4) > (\bar{A}_2 | S_2>4) > (\bar{A}_1 | S_1>4)$

These comparisons will be made on an adjacent pairwise basis. At a more rigorous level these conditions are:

(2.1a) $(\bar{A}_2 | S_2>4) \simeq 7$ (childhood)

(2.1b) $(\bar{A}_3 | S_3>4) \simeq 15$ (adolescence)

(2.1c) $(\bar{A}_4 | S_4>4) \simeq 30$ (early adulthood)

(2.1d) $(\bar{A}_5 | S_5>4) \simeq 50$ (late adulthood)

The test that will be used for testing the relationships of 2.1 will be to compute the number of standard deviations between the conditional sample age and the hypothesized age, and then use the normal distribution two-tailed test of

significance for checking on equality. Relationship 2.2 will be tested by computing the number of standard deviations in the difference between the mean ages of any two groups operating at adjacent need levels, and then employing the one-tailed test for significant differences. The null hypothesis for relationship 2.2 is that the mean ages of groups operating at adjacent need levels are equal.

B. Hypothesis 2: Mean Need Strengths

Given individuals who are clearly operating at one need level, then the mean need strength of all other need levels for these individuals should be low and in the prepotent or largely satisfied range. Formally:

(2.4) $(\bar{S}_1 | S_i > 4) < 3, \quad i,1=1,\ldots,5; \; i \neq 1.$

Or, less rigorously:

(2.5) $(\bar{S}_1 | S_i > 4) < \bar{S}_1, \quad i,1=1,\ldots,5; \; i \neq 1.$

After generating these statistical means relationship 2.5 can be tested by computing the number of standard deviations between the means and, for the large sample sizes available, using the normal distribution one-tailed test of significance to check for significant differences between the unconditional and the conditional mean need strengths. In this test the unconditional mean need strength is being taken as the target, or population, mean. Relationship 2.4 can be tested by computing the number of standard deviations in the difference between the conditional mean and the hypothesized maxiumum value of 3, and again employing the one-tailed test of significance.

C. Hypothesis 3: Need Strength Correlations

Given individuals who are clearly operating in one need level, the cross-correlations between their prepotent need strengths should be positive, the cross-correlations between their largely satisfied need strengths should be positive, and the cross-correlations between different need level pairs consisting of prepotent with largely satisfied need strengths should be negative. Stated more rigorously, we have:

(2.6) $r_{lm}>0$, where r_{lm} indicates the cross-correlation between $(S_l|S_i>4)$ and $(S_m|S_i>4)$;
$i=1,2,3;$
$l=i+1,\ldots,5;$
$m=i+2,\ldots,5;$
$l\neq m.$

(2.7) $r_{pq}>0$, where r_{pq} indicates the cross-correlation between $(S_p|S_i>4)$ and $(S_q|S_i>4)$;
$i=3,4,5;$
$p=1,\ldots,i-1;$
$q=1,\ldots,i-2;$
$p\neq q.$

(2.8) $r_{jk}<0$, where r_{jk} indicates the cross-correlation between $(S_j|S_i>4)$ and $(S_k|S_i>4)$;
$i=2,3,4;$
$j=i+1,\ldots,5;$
$k=1,\ldots,i-1;$
$j\neq k.$

The test of this hypothesis involves a simple inspection

of the cross-correlations, as calculated for data satisfying the constraint conditions. The SPSS package will be used to select the cases and calculate the cross-correlations.

D, Hypothesis 4: Age and Prepotent Need Strength

Given individuals with potent need strength for level i needs ($S_i>3$), they should have a prepotent need strength for level j (j=i+1) needs, and the relationship between their Age (A) and their prepotent need strength (S_j) should be of the following positive linear form:

(2.9) $S_j = B_j + C_jA, \quad j=2,\ldots,5;$

$S_i>3 \ (i=j-1);$

where the parameter C_j is hypothesized to be positive and the parameter B_j is indeterminate in value and sign.

The SPSS multiple linear regression package will be used to run these regressions. Three measures of quality provided by the SPSS package will be used with these regressions. The first is R-squared, which is the proportion of the variance in the dependent variable accounted for by the regression equation. The second measure is the F-statistic for the overall equation, which is the ratio of the mean square due to the regression to the mean square due to the residual, and measures the significance of the regression equation representing more than mere chance. The third measure is the F-statistic computed for each coefficient, which is the value of the coefficient divided by the standard error of the coefficient, the entire quantity then

squared. This statistic is in fact the t-statistic squared (with, say, n-1 degrees of freedom), which is identical to the F-statistic with 1 and n-1 degrees of freedom. These measures of quality together with this methodology will be used not only for testing Hypothesis 4, but also for testing Hypotheses 5, 6, 7 and 8.

In addition, the Durbin-Watson d-statistic can be "special-ordered" with any SPSS regression. This statistic is a measure of the statistical presence of autocorrelation at appropriate levels of significance. This statistic will be requested in at least one set of regressions in order to check for autocorrelation.

E. Hypothesis 5: Age and Potent Need Strength

Given individuals with a potent need strength for level i needs, the relationship between their Age (A) and their potent need strength (S_i) should be of the following inverse form for need level 1:

(2.10) $S_1 = + D_1/A, \quad S_1 > 3;$

where the parameter D_1 is hypothesized to be positive.

The relationship should be of the following convex parabolic form for need levels 2, 3 and 4:

(2.11) $S_i = - D_i A^2 + E_i A + F_i, \quad i=2,3,4;$

$S_i > 3;$

and the parameters D_i and E_i are hypothesized to be positive. The parameter F_i is indeterminate in sign and value.

The relationship should be of the following inverse

form for need level 5:

(2.12) $S_5 = + D_5 - E_5/A, \quad S_5>3;$

and the parameters D_5 and E_5 are hypothesized to be positive.

The SPSS package will be used to accomplish these regessions and evaluate them. For regressions such as these where more than one coefficient is being estimated the F-statistics for both the overall regression and the separate coefficients can be evaluated.

F. Hypothesis 6: Age and Largely Satisfied Need Strength

Given individuals with potent need strength for level i needs ($S_i>3$), they should have largely satisfied need strength for level k (k=i-1) needs, and the relationship between their Age (A) and their largely satisfied need strength (S_k) should be of the following negative linear form:

(2.14a) $S_k = + G_k - H_kA, \quad k=1,\ldots,4;$

$S_i>3 \ (i=k+1);$

and the parameters G_k and H_k are hypothesized to be positive.

Or, the relationship should be of the following inverse form:

(2.14b) $S_k = + L_k/A, \quad k=1,\ldots,4;$

$S_i>3 \ (i=k+1);$

and the parameter L_k is hypothesized to be positive.

G. Hypothesis 7: Prepotent and Potent Need Strengths

Given individuals with potent need strength for level

i needs (S_i>3), they should have prepotent need strength for level j (j=i+1) needs, and the relationship between their prepotent need strength (S_j) and their potent need strength (S_i) should be of the following inverse form for S_1-S_2:

(2.15) $S_2 = B_2 + M_2/S_1, \quad S_1>3;$

where the parameter M_2 is hypothesized to be positive. The parameter B_2 is indeterminate in sign and value. Note that relationship 2.15 can only be tested where measures of the strength of level 1 needs are available.

The relationship should be of the following convex parabolic form for S_2-S_3, S_3-S_4 and S_4-S_5:

(2.16) $S_i = - N_i S_j^2 + O_i S_j + P_i, \quad j=3,4,5;$

$i=j-1;$

$S_i>3;$

where the parameters N_i and O_i are hypothesized to be positive. The parameter P_i is indeterminate in sign and value.

H. Hypothesis 8: Largely Satisfied and Potent Need Strengths

Given individuals with potent need strength for level i needs (S_i>3), they should have largely satisfied need strength for level k (k=i-1) needs, and the relationship between their potent need strength (S_i) and their largely satisfied need strength (S_k) should be of the following convex parabolic form for need strength pairs S_1-S_2, S_2-S_3 and S_3-S_4:

(2.17a) $S_i = - Q_i S_k^2 + R_i S_k + T_i$, $k=1,2,3;$ $i=k+1;$ $S_i>3;$

where the parameters Q_i and R_i are hypothesized to be positive. Parameter T_i is indeterminate in sign and value.

Or, the relationship should be of the following inverse parabolic form:

(2.17b) $S_i = - U_i/S_k^2 + V_i/S_k + W_i$, $k=1,2,3;$ $i=k+1;$ $S_i>3;$

where the parameters U_i and V_i are hypothesized to be positive. The parameter W_i is indeterminate in sign and value.

For need strength pair S_4-S_5 the relationship should be of the following (testable) linear form:

(2.18b) $S_5 = + f_5 - g_5 S_4$, $S_5>3;$

where the parameters f_5 and g_5 are hypothesized to be positive.

I. Hypothesis 9: The Time Hypothesis

Over time there will be an increase in the proportion of people operating at the highest need level, and a decrease in the proportion of people operating at the lower need levels. Formally:

(2.20) $$\left(\frac{n_i|S_i>4}{N}\right)_{T=0} > \left(\frac{n_i|S_i>4}{N}\right)_{T=1}, \quad i=2,3;$$

and;

$$(2.21)\qquad \left(\frac{n_i|S_i>4}{N}\right)_{T=0} < \left(\frac{n_i|S_i>4}{N}\right)_{T=1}, \quad i=5.$$

The test used here will be to compute the number of standard deviations in the difference between the two proportions and then use the one-tailed normal test to check for significant differences.

CHAPTER 3

THE DATA

I. Ideal Data

Maslow's rejoinder to the Hall and Nougaim study was that age was an important independent variable - that he visualized the need levels emerging over a long period of time. It seems, almost, that the need levels can be seen as stages of life. If this is the case then data must be found that covers all, or much, of the adult life span of the respondents. The Stanford Research Institute report (1969) hypothesizes an upward shift over a rather long period of time in the need level distribution among the adult population. These two factors taken together mean that data should be found which covers both a significant age span and a large number of calendar years. Thus, ideal data would cover fifteen or twenty years on the same population, or on a statistically valid sample of the same population. Data should include age, psychological health, calendar year, statements or questions concerning the need level in which the respondent is currently operating, and statements or questions concerning the strengths of all the need types of the respondent. Unfortunately, to my knowledge no common body of directly coded need hierarchy data covering the

required variables is available.

II. The Search for Data

Since the object of this work was not only to develop a model of Maslow's basic theory but also to test the resulting hypotheses with empirical data, it became important to locate such data. This effort covered four separate sources, only one of which successfully yielded what was sought.

A. The Porter Data

The first potential source investigated was Professor Porter. His original works in the early 1960's gave the first tentative confirmation of Maslow's hierarchy, albeit in a rather indirect manner. Since his data included lack of satisfaction of each need level as well as age of the respondents it seemed like an ideal source. I wrote to Prof. Porter and requested his raw data. He wrote back and told me that, unfortunately, he had destroyed it in 1967 upon his move to The University of California at Irvine.

B. The Hall and Nougaim Data

In their 1968 article Hall and Nougaim described their data, which consisted of need satisfaction and strength measures for 49 young AT&T managers over a five year period. I wrote to Professor Hall requesting his raw data. He informed me that the data was the property of AT&T and to

redirect my request to Dr. Bray at AT&T corporate offices in New York City. Dr. Bray responded that his office was heavily involved with four other researchers in the project of which this data was a part, and therefore he was unwilling to release it to me.

C. The Berkeley/Oakland Growth Studies Data

These studies are part of the work of the Institute of Human Development at The University of California, Berkeley. The data is overwhelmingly comprehensive, covering longitudinal information on over 500 individuals over a period of 30 years or more. Unfortunately the data is not in a form that is easily redefined into need level strengths and satisfactions. Any analysis and recoding of this data would involve not only a great deal of personal judgment (which could very likely bias the results if performed by only one person or a few individuals), but also a very large number of manhours. These factors convinced me that it was inappropriate to pursue this effort further. However, the data is available and with an objective, verifiable coding technique and sufficient manpower it could very likely be used in further tests of the model at a later date.

D. The Air Force Data

The U.S. Air Force has been sending out surveys to statistically valid random samples of its officer and enlisted personnel once to four times a year since 1951.

This data was made available to me. The surveys include important demographic factors, such as age, sex, educational level, rank, marital status, etc. Also included in some of the surveys are questions and statements involving how the respondent feels about different factors, called motivators.

On researching this data at the Pentagon I found that raw data was available only back to 1971. Also, of all the surveys conducted since 1971 only ten contained sets of statements that were appropriate for measuring motivator strength and satisfaction. Of these ten I was able to obtain only six, for one reason or another. Table 3.1 lists and briefly describes each of the six sets of survey data. Copies of appropriate sections of each of these surveys appear in Appendix A. All the surveys were administered to five or ten percent random samples of active Air Force enlisted and officer personnel.

Four surveys measured the respondent's degree of agreement or disagreement with the motivator statements presented. Each of these four surveys had basically the same set of 18 statements, and all four used the same five-choice response set for these statements: Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree. These responses were recoded in the statistical analyses to numerical values of 5, 4, 3, 2 and 1, respectively; or, in separate analyses, 5, 4, 3, 0 and 0, respectively (where 0 was defined as unuseable), since disagreements with a motivator could be different in quality than low strength for that motivator.

TABLE 3.1

THE AIR FORCE SURVEYS

Survey No.	Date Given	Sample Size	Pertinent Variables Used	Type of Motivator Strength Measure
1. 72-34(O)*	Nov. 1971	9,674	Age, Rank, Motivator Strengths	Degree of Agreement
2. 72-34(A)*	Nov. 1971	20,454	Age, Rank, Education Level, Motivator Strengths	Degree of Agreement
3. 72-73(O & A)*	July 1972	19,102	Age, Education Level, Motivator Strengths	Degree of Importance
4. 73-22(O)*	Nov. 1972	9,387	Age, Rank, Education Level, Motivator Strengths	Degree of Agreement
5. 73-22(A)*	Nov. 1972	23,356	Age, Rank, Education Level, Motivator Strengths	Degree of Agreement
6. 73-50(O)*	March 1973	8,538	Age, Rank, Education Level, Motivator Strengths	Degree of Importance

* (O) indicates Officer survey; (A) indicates Airman, or enlisted, survey; (O & A) indicates Officer and Airman survey.

The remaining two surveys measured the degree of personal importance each statement held for that respondent. These two surveys included several identical or near-identical statements, but they also included several statements distinct to that survey alone. However, the five-choice response set from which the respondents could choose was the same on both surveys and was: Extremely Important (to me), Above Average Importance, Average Importance, Below Average Importance, and Not Important (or Not Important at All). These responses were also recoded for the statistical analyses to values of 5, 4, 3, 2 and 1, respectively.

There were only two statements in this second group of two surveys that were roughly the same as any of the 18 statements used in the first group of four surveys. Thus we had two basically different measurement instruments, the first being the 18 statements with degree-of-agreement responses, and the second being the other two survey statement sets with degree-of-importance responses. This allowed cross-checking the statistical results based on two basically different measurement instruments.

III. Theoretical Justifications and Practical Requirements

The issue was now what to do with these motivator statements in order to match them up with Maslow's need types. It was at this point that I felt an unwanted detour was required in order to accomplish this matching process. However, upon later reflection it appears that the methodology

described in this section and the results flowing therefrom were not only wanted, but necessary and very important.

A. Need and Motivator Strengths, Satisfactions and Importances

Several factors have already been discussed in the first two chapters concerning the relationships between need (or motivator) strength, satisfaction and importance. These factors and assumptions are: the more a need (or motivator) is satisfied the lower its strength; the more a need is satisfied the lower its importance; and the stronger a need is, the greater its importance. These assumptions rest on theoretical and empirical work already cited. (Maslow 1970; Alderfer 1969; Cofer and Appley 1964; Dachler and Hulin 1969; Friedlander 1965) It should be pointed out, however, that in the view of Mobley and Locke (1970) need satisfaction does not determine need importance. Be that as it may, this work assumes that it does, as specified in the preceding statement. This work also assumes that degree of agreement with a motivator statement is equivalent to degree of strength of that motivator statement for that person.

B. Motivators Mapped into Need Types

Vroom (1964) has pointed out the importance of distinguishing between needs and motivators. Lawler (1972) finds that pay is likely to be most instrumental in satisfying autonomy and security needs and is likely to be least instru-

mental in satisfying social and self-actualization needs.

Porter (1961, 1962, 1963) assumed a one-to-one correspondence between the questions he asked and each of the need levels he was investigating. Lawler and Suttle (1972, p. 282) comment on Porter's questions: "Despite the extensive use and acceptance of the Porter items, there is little direct evidence that they represent a valid operationalization of Maslow's need categories." Alderfer (1969), Porter (1961) and Beer (1966) have each equated several different motivator items into specified levels of Maslow's hierarchy. Illustration 3.1 displays these hypothesized equivalencies.

Based on these and other comments and findings, I prefer initially to look at any and all statements or questions querying people about their degree of satisfaction or dissatisfaction, importance or unimportance, or agreement or agreement with a statement or question to be measures of their feelings about motivators, and not about needs. True, we may in fact find a one-to-one correspondence between any given motivator and a certain need type. However, it is also likely that any given motivator is instrumental in satisfying more than one type of need. Thus, it seems more appropriate (and rigorous) to take the motivator-to-need-type concept as a hypothesis to be tested rather than an assumption to be accepted. How, then, can this be done?

The methodology devised to accomplish just this objective was to query a number of individuals, all of them know-

EXISTENCE NEEDS

Pay:
1. Good pay for my work
2. Frequent raises in pay

Fringe Benefits:
1. A complete fringe benefit program
2. Frequent improvements in fringe benefits

RELATEDNESS NEEDS

Respect from co-workers:
1. Cooperative relations with my co-workers
2. Respect from my co-workers
3. Openness and honesty with my co-workers

Respect from superiors:
1. Respect from my boss
2. Openness and honesty between my boss and me
3. Mutual trust between my boss and me

BELONGINGNESS (LOVE) NEEDS

1. The opportunity to be helpful to my co-workers
2. The opportunity to develop close friendships at work

ESTEEM (STATUS) NEEDS

1. The status my job gives me
2. The feeling that my job is regarded as important

Illustration 3.1.—Hypothesized Relationships of Some Specific Motivators to Different Need Levels (Porter, 1961; Beer, 1966; Alderfer, 1969)

ledgeable of Maslow's different need types, about which of these need types (or no need type) given motivator statements represent. The results of this query were then tabulated and statistically analyzed. This methodology is both replicable and objective, or at least more objective than one person making up statements or questions designed to measure the degree of satisfaction or importance of different types of needs; or, just as potentially dangerous, one person deciding what particular need type a particular motivator statement matches on a one-to-one basis. Such a methodology yields what I call the motivator-to-need-type transformation factors. For a given motivator such transformation factors could result in showing a one-to-one correspondence, a partial (weighted) correspondence, or a zero correspondence between the motivator and the five Maslowian need types.

It can be argued that the transformation factors generated by this process only represent what each of the motivator statements means in terms of the personal need-type strengths of the individuals performing the coding, much akin to the process whereby hungry people read many more food-associated items into Thematic Apperception Tests than do comfortably full people. (McClelland 1961) This could be true, just as it could be true for Porter's set of questions. However, we can make some checks of just how personality-dependent such a coding process is by subdividing our coders into different demographic categories (e.g., age, sex, college major, etc.) and comparing how the trans-

formation factors agree across these different subcategories. This was done and is discussed in the next section.

Illustration 3.2 previews and summarizes the actions that were taken with the survey motivator statements and their responses in order to yield the desired need level strengths for each individual.

IV. Transformations from Motivator Statements into Need Levels and Derivation of Strengths of the Need Levels

A. The Transformation Factors

A questionnaire was developed to objectively determine the transformation factors for motivators into need types. The questionnaire consisted of a section which discussed each of the five Maslowian need levels, using much direct quotation from Maslow's latest discussion of his need hierarchy theory (1970). Then the statements from the Air Force surveys were listed, with the respondent instructed to break out each statement into one or more of the five Maslowian need levels (coded A through E), or none (coded F, for failure). The questionnaire concluded with a request for demographic information on the respondent, including age, sex, college major or profession, citizenship, and level of college education.

The actual coding process was done in two different ways. The first was a forced response format, in which the respondent placed each motivator statement into the need level which he felt best encompassed it, or into a "None" category. However, because it was feared that "minority need level" repre-

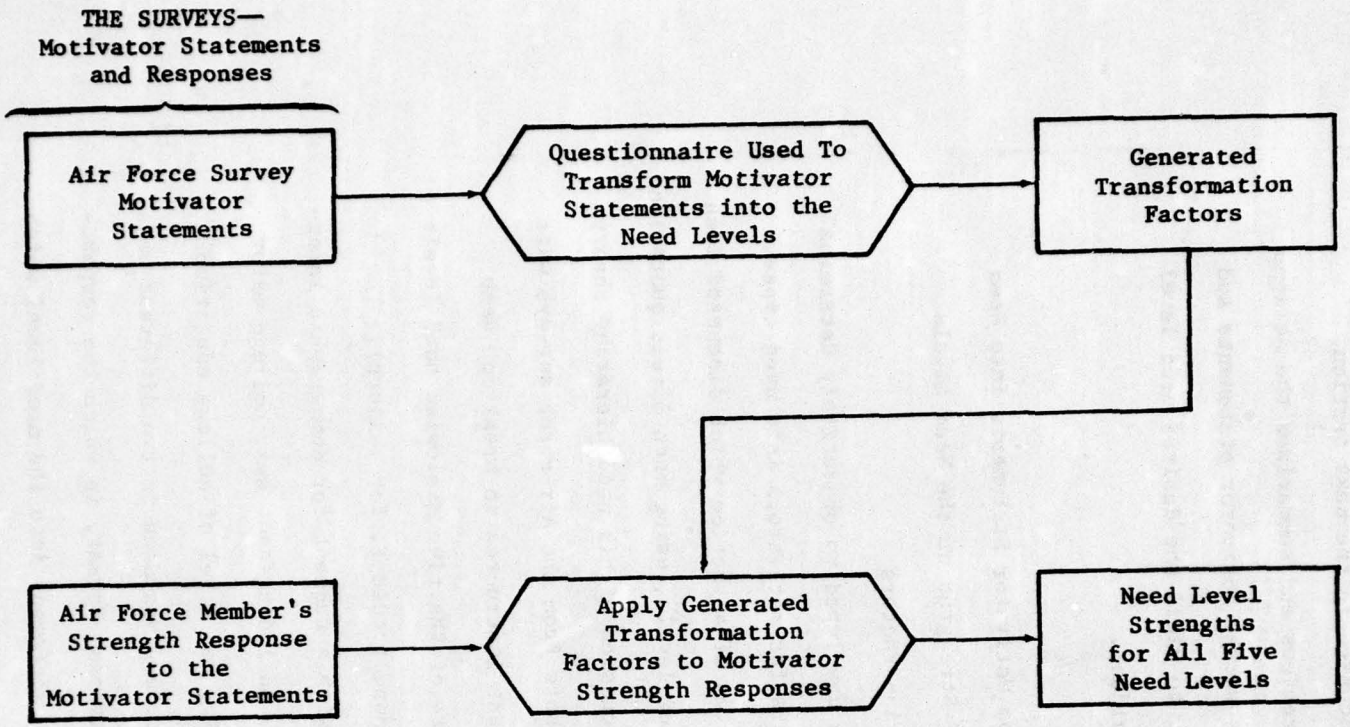

Illustration 3.2.—Motivator Statements into Need Levels (Types) and Motivator Statement Strength Responses into Need Level Strengths

sentation could get lost by this easier-to-code, easier-to-accomplish method (which also generated higher return rates from the potential coders), a second coding process was also performed. This latter one involved breaking out each statement into each of the given need levels, or "None," in increments of ten percent, totalling to 100% for each statement. This was a much more time-consuming coding process (taking upwards of one hour for coding 18 statements) and also yielded lower returns on the questionnaire.

The questionnaires containing each of the coding methods were randomly distributed to individuals coding the 18 statements used in four of the Air Force surveys. Due to the high coding agreement which resulted between these methods, only the forced response method was used in coding the statements from the remaining two Air Force surveys.

All questionnaires were answered by certain Stanford University faculty and students on a purely voluntary and anonymous basis. All those to whom the questionnaires were given, however, were already knowledgeable about Maslow's five different need levels. A copy of appropriate sections from each of the three questionnaires may be found in Appendix B.

1. Questionnaires 1A and 1B

These two questionnaires yielded 73 useable answer sheets: 41 of the forced response variety, and 32 of the percent-breakout variety. Both questionnaires coded the

same 18 statements. The questionnaires were administered during September and October 1974 to Stanford University students and faculty in the engineering and business schools. Tabulated data for the results of these two questionnaires is found in Table 3.2.

In Table 3.2 the first column of numbers shows the overall tabulations for the 41 answer sheets of the forced-response type. The next column gives the overall tabulations for the 32 percent-breakout answer sheets. Note one critical fact: the percentages given in these two columns represent two completely different things. For the forced-response questionnaire (1A) these percentages are simply the percentage of the total respondents coding a given statement into the indicated need level. However, for the percentage-breakout questionnaire (1B) these percentages are the average of the percentage breakouts that each respondent gave to each need type. The next column, labeled "1A+1B," is a combination of columns one and two, wherein the 32 percentage-breakout answer sheets were recoded into the forced-response format. (E.g., if a person chose 20% for Need Level C and 80% for Need Level D for a given statement in Questionnaire 1B, then it was assumed that under the forced response format he would have chosen Need Level D for that same statement.)

The tabulated answers from the forced-response questionnaire agree nicely with the tabulated data from the percentage-breakout questionnaire. The only important difference was that, where there was very high or very low coding (where 80%

TABLE 3.2

TABULATED DATA FROM QUESTIONNAIRES 1A, 1B, AND 1A/1B COMBINED

Item	1A Forced Response	1B Percent Breakout	1A + 1B Forced Response	Age		Major		Citizenship		Education Level			Sex	
	Quest. 1A	Quest. 1B	Quest. 1A + 1B	Young Group	Old Group	Eng./ Science	Business/ Human.	U.S. Citizen	Non-U.S.	Under-grad.	Grad.	Prof.	Male	Female
N (Sample Size)	41	32	73	38	35	28	45	63	10	19	49	5	56	17
Mean Age (Years)	24.6	25.1	24.8	21.2	28.7	25.0	24.8	24.7	25.8	20.1	25.5	36.2	24.8	24.9
Sex: Male (%)	80	72	77	79	74	93	67	73	100	79	76	80	100	0
Female (%)	20	28	23	21	26	7	33	27	0	21	24	20	0	100
Education Level:														
U-grad. (%)	24	28	26	50	-	43	16	27	20	100	-	-	27	24
Grad. (%)	71	63	67	50	86	46	80	65	80	-	100	-	66	71
Prof. (%)	5	9	7	-	14	11	4	8	-	-	-	100	7	6
Major:														
Business (%)	54	59	56	50	63	0	91	60	30	26	69	40	52	71
Engineer (%)	34	31	33	34	31	86	0	29	60	42	27	60	41	6
Humanities (%)	5	6	6	5	6	0	9	5	10	11	4	0	2	18
Science (%)	7	3	5	11	0	14	0	6	0	21	0	0	5	6
Citizen: U.S. (%)	90	81	86	92	80	79	91	100	0	90	84	100	82	100
Non-U.S. (%)	10	19	14	8	20	21	9	0	100	11	16	0	18	0
#1 A (Physio.)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
B (Security)	2	1	3	3	3	4	2	2	10	5	2	0	4	0
C (Belonging.)	49	52	53	47	60	39	62	56	40	42	59	40	48	71
D (Esteem)	39	26	27	32	23	39	20	29	20	26	27	40	29	24
E (S-A)	10	18	16	18	14	18	16	14	30	26	12	20	20	6
F (None)	0	2	0	0	0	0	0	0	0	0	0	0	0	0

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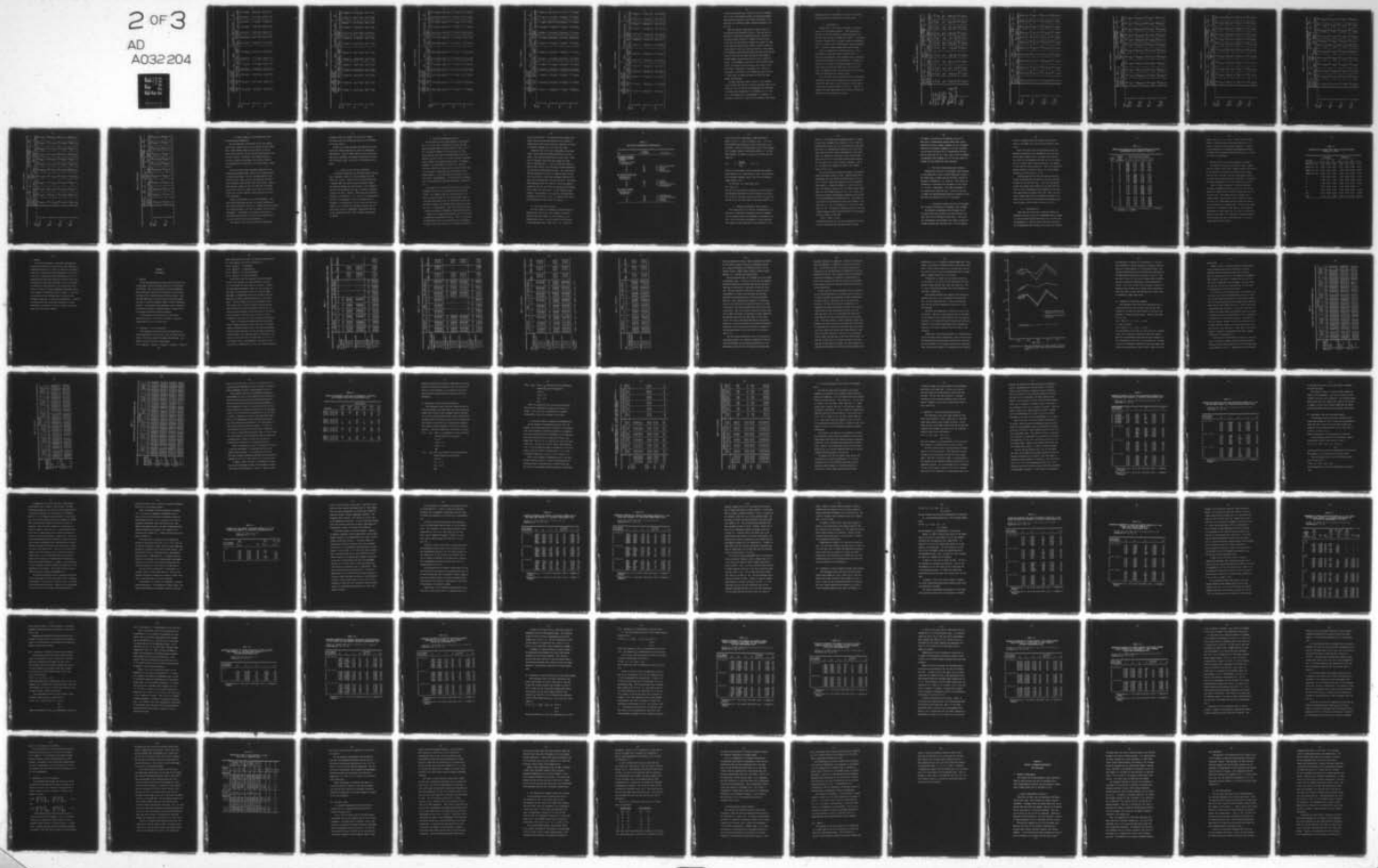

TABLE 3.2 (continued)

Item		1A Forced Response	1B Percent Breakout	1A + 1B Forced Response	Age		Major		Citizenship		Education Level			Sex	
		Quest. 1A	Quest. 1B	Quest. 1A + 1B	Young Group	Old Group	Eng./ Science	Business/ Human.	U.S. Citizen	Non-U.S.	Undergrad.	Grad.	Prof.	Male	Female
#2	A	2	9	10	11	9	14	7	10	10	11	6	40	13	0
	B	27	15	22	34	9	14	27	22	20	26	22	0	21	24
	C	10	14	7	3	11	11	4	6	10	5	6	20	7	6
	D	27	17	22	26	17	25	20	22	20	21	25	0	20	29
	E	24	37	32	26	37	32	31	32	30	37	29	40	34	24
	F	10	8	8	0	17	4	11	8	10	0	12	0	5	18
#3	A	2	6	4	5	3	7	2	2	20	5	4	0	5	0
	B	10	10	10	13	6	4	13	10	10	16	8	0	9	12
	C	15	8	11	16	6	7	13	13	0	16	10	0	11	12
	D	12	7	8	11	6	11	7	10	0	5	8	20	7	12
	E	46	50	51	37	66	50	51	51	50	37	53	80	52	47
	F	15	19	16	18	14	21	13	16	20	21	16	0	16	18
#4	A	20	17	21	21	20	25	18	22	10	16	25	0	21	18
	B	27	25	26	32	20	29	24	27	20	42	20	20	23	35
	C	24	18	21	24	17	21	20	19	30	21	20	20	23	12
	D	2	8	4	3	6	7	2	5	0	5	2	20	5	0
	E	12	9	10	11	9	4	13	10	10	11	10	0	11	6
	F	15	23	19	11	29	14	22	18	30	5	22	20	16	29

TABLE 3.2 (continued)

Item		1A Forced Response	1B Percent Breakout	1A + 1B Forced Response	Age		Major		Citizenship		Education Level			Sex	
		Quest. 1A	Quest. 1B	Quest. 1A + 1B	Young Group	Old Group	Eng./ Science	Business/ Human.	U.S. Citizen	Non-U.S.	Under-grad.	Grad.	Prof.	Male	Female
#5	A	2	1	3	3	3	4	2	3	0	5	0	20	4	0
	B	37	24	33	32	34	29	36	33	30	27	33	20	34	29
	C	29	29	30	32	29	36	27	32	20	37	29	20	29	35
	D	20	25	21	18	23	18	22	21	20	5	25	40	21	18
	E	7	9	4	5	3	4	4	5	0	5	4	0	4	6
	F	5	12	10	11	9	11	9	6	30	11	10	0	9	12
#6	A	20	19	18	21	14	21	16	21	0	42	8	20	20	12
	B	17	11	14	16	11	18	11	14	10	11	16	0	16	6
	C	17	4	11	16	6	18	7	11	10	5	12	20	9	18
	D	2	3	3	3	3	0	4	2	10	0	4	0	4	0
	E	27	32	27	21	34	18	33	29	20	16	33	20	25	35
	F	17	31	27	24	31	25	29	24	50	26	26	40	27	29
#7	A	20	14	21	24	17	25	18	19	30	37	12	40	27	0
	B	49	28	40	37	43	43	38	43	20	42	39	40	33	65
	C	2	4	3	3	3	0	4	3	0	0	4	0	2	6
	D	2	3	3	5	0	0	4	3	0	0	4	0	2	6
	E	17	12	14	18	9	21	9	13	20	16	14	0	18	0
	F	10	35	19	11	29	11	24	18	30	5	25	20	18	24

TABLE 3.2 (continued)

Item		1A Forced Response	1B Percent Breakout	1A + 1B Forced Response	Age		Major		Citizenship		Education Level			Sex	
		Quest. 1A	Quest. 1B	Quest. 1A + 1B	Young Group	Old Group	Eng./ Science	Business/ Human.	U.S. Citizen	Non-U.S.	Under-grad.	Grad.	Prof.	Male	Female
#8	A	10	9	12	16	9	11	13	13	0	26	6	20	16	0
	B	10	14	11	11	11	7	13	11	0	11	12	0	11	12
	C	5	2	3	0	6	0	4	3	0	0	4	0	4	0
	D	24	16	21	21	20	21	20	24	0	11	22	40	14	41
	E	29	14	22	21	23	25	20	21	30	11	25	40	23	18
	F	22	46	32	32	31	36	29	29	50	42	31	0	32	29
#9	A	5	11	10	5	14	4	13	10	10	0	12	20	11	6
	B	90	71	84	87	80	86	82	84	80	84	84	80	84	82
	C	0	3	0	0	0	0	0	0	0	0	0	0	0	0
	D	5	3	4	5	3	7	2	3	10	11	2	0	2	12
	E	0	7	1	3	0	4	0	2	0	5	0	0	2	0
	F	0	4	1	0	3	0	2	2	0	0	2	0	2	0
#10	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	2	2	1	3	0	4	0	0	10	0	2	0	2	0
	C	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	D	93	68	89	87	91	86	91	92	70	95	88	100	91	88
	E	5	23	7	8	6	7	7	6	10	6	8	0	7	6
	F	0	3	1	0	3	0	2	2	0	0	2	0	0	6
#11	A	7	9	12	13	11	14	11	11	20	26	6	20	14	6
	B	5	11	7	11	3	0	11	8	0	11	6	0	7	6
	C	2	6	4	0	9	0	7	3	10	0	6	0	4	6
	D	20	17	16	13	20	21	13	19	0	11	16	40	13	29
	E	32	13	23	24	23	21	24	24	20	11	27	40	25	18
	F	34	43	37	40	34	43	33	35	50	42	39	0	38	35

TABLE 3.2 (continued)

Item		1A Forced Response	1B Percent Breakout	1A + 1B Forced Response	Age		Major		Citizenship		Education Level			Sex	
		Quest. 1A	Quest. 1B	Quest. 1A + 1B	Young Group	Old Group	Eng./ Science	Business/ Human.	U.S. Citizen	Non-U.S.	Under-grad.	Grad.	Prof.	Male	Female
#12	A	0	2	0	0	0	0	0	0	0	0	0	0	0	0
	B	5	16	7	8	6	14	2	3	30	11	6	0	9	0
	C	12	11	11	13	9	4	16	13	0	11	12	0	9	18
	D	71	43	64	61	69	68	62	70	30	68	61	80	64	65
	E	5	19	10	8	11	11	9	8	20	5	10	20	11	6
	F	7	10	8	11	6	4	11	6	20	5	10	0	7	12
#13	A	2	3	6	5	6	7	4	5	10	0	6	20	7	0
	B	15	12	12	16	9	14	11	13	10	21	8	20	13	12
	C	10	10	8	8	9	4	11	8	10	0	12	0	9	6
	D	46	45	48	47	49	43	51	51	30	47	49	20	45	59
	E	17	15	15	16	14	18	13	13	30	21	14	0	18	6
	F	10	15	11	8	14	14	9	11	10	11	10	20	9	18
#14	A	2	3	3	3	3	0	4	3	0	0	2	20	4	0
	B	7	10	8	5	11	18	2	6	20	11	8	0	9	6
	C	17	6	14	16	11	7	18	16	0	16	12	20	16	6
	D	44	48	49	42	57	43	53	49	50	37	55	40	41	77
	E	24	23	22	26	17	29	18	21	30	26	20	20	27	6
	F	5	10	4	8	0	4	4	5	0	11	2	0	4	6
#15	A	2	5	4	5	3	7	2	3	10	5	4	0	5	0
	B	15	2	8	11	6	14	4	8	10	5	10	0	9	6
	C	12	1	7	8	6	7	7	6	10	5	8	0	9	0
	D	20	16	18	16	20	25	13	18	20	21	12	60	20	12
	E	37	36	38	45	31	25	47	43	10	47	37	20	30	65
	F	15	40	25	16	34	21	27	22	40	16	29	20	27	18

TABLE 3.2 (continued)

Item		1A Forced Response	1B Percent Breakout	1A + 1B Forced Response	Age		Major		Citizenship		Education Level			Sex	
		Quest. 1A	Quest. 1B	Quest. 1A + 1B	Young Group	Old Group	Eng./ Science	Business/ Human.	U.S. Citizen	Non-U.S.	Under-grad.	Grad.	Prof.	Male	Female
#16	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	2	7	6	5	6	11	2	5	10	5	4	20	7	0
	C	93	72	86	87	86	75	93	91	60	79	92	60	82	100
	D	2	11	3	3	3	7	0	2	10	5	0	20	4	0
	E	2	4	3	5	0	7	0	2	10	11	0	0	4	0
	F	0	7	3	0	6	0	4	2	10	0	4	0	4	0
#17	A	0	1	1	0	3	0	2	2	0	0	0	20	2	0
	B	20	23	21	18	23	14	24	18	40	11	22	40	23	12
	C	42	27	36	34	37	32	38	40	10	42	35	20	27	65
	D	29	21	25	29	20	39	16	22	40	26	25	20	32	0
	E	5	4	4	5	3	4	4	5	0	5	4	0	4	6
	F	5	24	14	13	14	11	16	14	10	16	14	0	13	18
#18	A	2	2	3	3	3	4	2	2	10	0	2	20	4	0
	B	17	5	12	11	14	11	13	10	30	16	10	20	11	18
	C	2	6	4	3	6	4	4	5	0	0	6	0	5	0
	D	59	53	62	61	63	64	60	62	60	53	67	40	66	47
	E	12	20	11	16	6	11	11	13	0	21	8	0	9	18
	F	7	14	8	8	9	7	9	10	0	11	6	20	5	18

or more was considered high, and 20% or less was considered low) on the forced-response coding, the percentage-breakout coding showed consistently lower coding percentages on the high side, and consistenly higher coding percentages on the low side.

Note the important implication of these overall results between Questionnaires 1A and 1B. They say that the motivator-to-need-type transformation factors that derive from the tabulated results of a number of people forced to choose only one need type per motivator are roughly the same as the tabulated results from a number of people allowed to choose among all five need types per motivator. More simply, the individual transformation factors that each person carries around in his head are roughly the same as the average of forced-response transformation factors across a number of people. This phenomenon could well be worth further investigation, particularly since there was a fair degree of different ages, backgrounds, citizenships, etc., among the respondents, as indicated by the remaining columns in Table 3.2 which show the tabulated results for different demographic subcategories.

In these remaining columns of Table 3.2 the combined forced-response data was cut in several different ways: by age (young vs. old); by college major (engineers and scientists vs. business and humanities); by citizenship (U.S. vs. non-U.S.); by education level (undergraduate vs. graduate vs. professor); and by sex. Again we find reasonably high coding

agreement across all subcategories, except in a few cases when the subcategory sample sizes get rather small.

2. Questionnaire 2

Questionnaire 2 was identical in format to Questionnaire 1A (forced-response answers). This questionnaire was used to code the combined 23 useable statements from both Air Force Surveys 72-73(O&A) and 73-50(O). It was administered in February 1975 to students taking an introductory course at Stanford called "Organizations: Theory and Management." Fifty-two useable answer sheets were returned.

Table 3.3 summarizes the tabulated results of this questionnaire in the same format as used in Table 3.2. Since this questionnaire coded statements from two different surveys those statements coming from Survey 72-73(O&A) have the term "72-73" under the statement number in Table 3.3, those coming from Survey 73-50(O) have the term "73-50" under the statement number, and those found in both surveys have both terms under the statement number.

As in the other table we again find that the subcategory tabulations across various demographic factors agree quite nicely with each other as well as with the overall results (in the first numerical column of Table 3.3). Overall it appears that this questionnaire also yielded consistent and apparently valid transformation factors.

TABLE 3.3

TABULATED DATA FROM QUESTIONNAIRE 2

Item	Overall	Age		Major			Citizenship		Education Level		Sex	
	Total Forced Response	Young Group	Old Group	Eng./ Science	Human./ Soc. Sci.	Unde-clared	U.S.	Non-U.S.	Under-grad.	Grad.	Male	Female
N (Sample Size)	52	29	22	27	17	8	41	11	36	16	45	7
Mean Age (Years)	22.1	19.5	25.5	23.4	21.6	19.3	21.1	23.8	20.0	25.3	22.6	19.1
Sex: Male (%)	86	76	100	93	82	75	83	100	81	100	100	0
Female (%)	14	24	0	7	18	25	17	0	19	0	0	100
Education Level												
Undergrad. (%)	69	100	32	48	94	88	88	0	100	0	64	100
Grad. (%)	31	0	68	52	6	13	12	100	0	100	36	0
Major:												
Hum./ Soc. Sci. (%)	33	41	23	100	0	0	42	0	44	6	31	43
Eng./ Science (%)	52	34	73	0	100	0	42	91	36	88	56	29
Undeclared (%)	15	24	5	0	0	100	17	9	19	6	13	29
Citizenship: U.S. (%)	79	100	54	63	100	88	100	0	100	69	76	100
Non-U.S. (%)	21	0	46	37	0	13	0	100	0	31	24	0
#1 A	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
(72-73) B	2	3	0	4	0	0	2	0	3	0	2	0
(73-50) C	4	7	0	0	6	13	5	0	6	0	4	0
D	79	79	82	82	71	87	81	73	81	75	78	86
E	15	10	18	15	24	0	12	27	11	25	16	14
F	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 3.3 (continued)

Item		Overall	Age		Major			Citizenship		Education Level		Sex	
		Total Forced Response	Young Group	Old Group	Eng./ Science	Human./ Soc. Sci.	Unde-clared	U.S.	Non-U.S.	Under-grad.	Grad.	Male	Female
#2	A	23%	31%	14%	11%	41%	25%	24%	18%	28%	13%	22%	29%
(73-50)	B	15	17	14	15	0	50	20	0	19	6	16	14
	C	17	10	27	22	18	0	15	27	17	19	18	14
	D	6	7	5	7	6	0	5	9	6	6	7	0
	E	27	21	32	30	24	25	24	36	19	44	24	43
	F	12	14	9	15	12	0	12	9	11	13	13	0
#3	A	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
(73-50)	B	4	3	5	7	0	0	2	9	3	6	4	0
	C	92	93	91	89	94	100	95	82	94	88	91	100
	D	2	3	0	0	6	0	2	0	3	0	2	0
	E	2	0	5	4	0	0	0	9	0	6	2	0
	F	0	0	0	0	0	0	0	0	0	0	0	0
#4	A	2%	0%	5%	0%	6%	0%	2%	0%	3%	0%	2%	0%
(72-73)	B	15	7	27	26	6	0	12	27	8	31	13	29
(73-50)	C	0	0	0	0	0	0	0	0	0	0	0	0
	D	35	41	23	30	24	75	42	9	42	19	31	57
	E	29	28	32	30	35	13	22	55	25	38	33	0
	F	19	24	14	15	29	13	22	9	22	13	20	14
#5	A	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
(72-73)	B	4	7	0	7	0	0	5	0	6	0	2	14
(73-50)	C	8	7	9	7	12	0	7	9	8	6	7	14
	D	37	31	41	33	41	38	34	46	39	31	36	43
	E	44	45	46	41	47	50	44	46	39	56	49	14
	F	8	10	5	11	0	13	10	0	8	6	7	14

TABLE 3.3 (continued)

Item		Overall	Age		Major			Citizenship		Education Level		Sex	
		Total Forced Response	Young Group	Old Group	Eng./ Science	Human./ Soc. Sci.	Unde-clared	U.S.	Non-U.S.	Under-grad.	Grad.	Male	Female
#6	A	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
(72-73)	B	2	3	0	4	0	0	2	0	3	0	2	0
(73-50)	C	4	7	0	4	6	0	5	0	6	0	4	0
	D	89	90	86	89	88	88	90	82	89	88	87	100
	E	4	0	9	4	6	0	2	9	3	6	4	0
	F	2	0	5	0	0	13	0	9	0	6	2	0
#7	A	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
(72-73)	B	48	45	55	52	35	63	51	36	47	50	47	57
(73-50)	C	21	28	9	22	29	0	22	18	25	13	22	14
	D	12	10	14	7	12	25	10	18	11	13	11	14
	E	2	0	5	4	0	0	0	9	0	6	2	0
	F	17	17	18	15	24	13	17	18	17	19	18	14
#8	A	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
(73-50)	B	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0
	D	60	68	50	50	77	57	68	30	71	33	55	100
	E	38	32	46	50	23	29	32	60	29	60	43	0
	F	2	0	4	0	0	14	0	10	0	7	2	0
#9	A	2%	0%	0%	4%	0%	0%	0%	9%	0%	6%	2%	0%
(72-73)	B	21	21	23	18	18	38	22	18	22	19	22	14
(73-50)	C	14	10	18	18	6	13	10	27	11	19	16	0
	D	37	48	23	37	35	38	44	9	44	19	31	71
	E	23	21	27	19	41	0	24	18	22	25	24	14
	F	4	0	9	4	0	13	0	18	0	13	4	0

TABLE 3.3 (continued)

Item		Overall	Age		Major			Citizenship		Education Level		Sex	
		Total Forced Response	Young Group	Old Group	Eng./ Science	Human./ Soc. Sci.	Unde-clared	U.S.	Non-U.S.	Under-grad.	Grad.	Male	Female
#10	A	2%	3%	0%	0%	6%	3%	2%	0%	3%	0%	0%	14%
(73-50)	B	0	0	0	0	0	0	0	0	0	0	0	0
	C	6	3	9	11	0	0	5	9	6	6	7	0
	D	71	69	73	74	65	75	73	64	69	75	71	71
	E	17	17	18	15	24	13	15	27	17	19	20	0
	F	4	7	0	0	6	13	5	0	6	0	2	14
#11	A	14%	17%	9%	4%	24%	25%	17%	0%	17%	6%	16%	0%
(72-73)	B	56	55	59	70	41	50	54	73	53	69	53	86
(73-50)	C	0	0	0	0	0	0	0	0	0	0	0	0
	D	23	24	23	22	29	13	27	9	28	13	24	14
	E	4	3	5	0	6	13	2	9	3	6	4	0
	F	2	0	5	4	0	0	0	9	0	6	2	0
#12	A	2%	3%	0%	0%	0%	13%	2%	0%	3%	0%	2%	0%
(72-73)	B	90	86	96	100	82	75	88	100	86	100	93	71
(73-50)	C	2	3	0	0	6	0	2	0	3	0	2	0
	D	6	7	4	0	12	13	7	0	8	0	2	29
	E	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0
#13	A	2%	3%	0%	0%	0%	13%	2%	0%	3%	0%	0%	14%
(72-73)	B	0	0	0	0	0	0	0	0	0	0	0	0
	C	4	7	0	4	0	13	5	0	6	0	4	0
	D	42	48	32	52	29	38	44	36	39	50	40	57
	E	14	3	27	15	12	13	7	36	8	25	13	14
	F	39	38	41	30	59	25	42	27	44	25	42	14

TABLE 3.3 (continued)

Item		Overall	Age		Major			Citizenship		Education Level		Sex	
		Total Forced Response	Young Group	Old Group	Eng./ Science	Human./ Soc. Sci.	Unde-clared	U.S.	Non-U.S.	Under-grad.	Grad.	Male	Female
#14	A	2%	0%	5%	0%	6%	0%	2%	0%	3%	0%	2%	0%
(72-73)	B	4	7	0	7	0	0	5	0	6	0	4	0
	C	4	0	9	7	0	0	0	18	0	13	4	0
	D	10	10	9	15	0	13	7	18	8	13	7	29
	E	27	24	27	22	35	25	22	46	22	38	24	43
	F	54	59	50	48	59	63	63	18	61	38	58	29
#15	A	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
(72-73)	B	0	0	0	0	0	0	0	0	0	0	0	0
	C	4	3	5	7	0	0	2	9	3	6	4	0
	D	23	17	32	30	18	13	17	46	17	38	22	29
	E	73	79	64	63	82	88	81	46	81	56	73	71
	F	0	0	0	0	0	0	0	0	0	0	0	0
#16	A	2%	0%	0%	4%	0%	0%	0%	9%	0%	6%	2%	0%
(72-73)	B	2	0	5	0	6	0	2	0	3	0	2	0
	C	6	3	9	11	0	0	2	18	3	13	7	0
	D	52	55	50	52	47	63	59	27	58	38	47	86
	E	39	41	36	33	47	38	37	46	36	44	42	14
	F	0	0	0	0	0	0	0	0	0	0	0	0
#17	A	4%	3%	0%	4%	6%	0%	2%	9%	3%	6%	4%	0%
(72-73)	B	0	0	0	0	0	0	0	0	0	0	0	0
	C	6	7	5	4	0	25	5	9	6	6	2	29
	D	64	69	59	63	71	50	68	46	69	50	64	57
	E	25	21	32	26	24	25	24	27	22	31	27	14
	F	2	0	5	4	0	0	0	9	0	6	2	0

TABLE 3.3 (continued)

Item		Overall	Age		Major			Citizenship		Education Level		Sex	
		Total Forced Response	Young Group	Old Group	Eng./ Science	Human./ Soc. Sci.	Unde-clared	U.S.	Non-U.S.	Under-grad.	Grad.	Male	Female
#18	A	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
(72-73)	B	6	3	9	11	0	0	2	18	3	13	7	0
	C	54	62	41	48	71	38	59	36	64	31	56	43
	D	29	24	36	30	24	38	29	27	25	38	24	57
	E	6	3	9	7	0	13	5	9	3	13	7	0
	F	6	7	5	4	6	13	5	9	6	6	7	0
#19	A	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
(72-73)	B	6	10	0	7	6	0	7	0	8	0	4	14
	C	2	3	0	4	0	0	2	0	3	0	2	0
	D	73	69	77	67	77	88	73	73	69	81	71	86
	E	10	7	14	11	12	0	7	18	8	13	11	0
	F	10	10	9	11	6	13	10	9	11	6	11	0
#20	A	6%	3%	9%	0%	12%	13%	7%	0%	8%	0%	4%	14%
(72-73)	B	0	0	0	0	0	0	0	0	0	0	0	0
	C	2	3	0	0	0	13	2	0	3	0	2	0
	D	56	62	46	56	59	50	59	46	56	56	58	43
	E	35	28	45	44	29	13	29	55	31	44	33	43
	F	2	3	0	0	0	13	2	0	3	0	2	0
#21	A	6%	10%	0%	4%	6%	13%	7%	0%	8%	0%	4%	14%
(72-73)	B	46	38	55	48	47	38	42	64	39	63	44	57
	C	21	17	27	26	18	13	22	18	22	19	22	14
	D	2	0	5	0	0	13	0	9	0	6	2	0
	E	12	17	5	7	18	13	12	9	14	6	11	14
	F	14	17	9	15	12	13	17	0	17	6	16	0

TABLE 3.3 (continued)

Item		Overall	Age		Major			Citizenship		Education Level		Sex	
		Total Forced Response	Young Group	Old Group	Eng./ Science	Human./ Soc. Sci.	Unde-clared	U.S.	Non-U.S.	Under-grad.	Grad.	Male	Female
#22	A	2%	3%	0%	0%	6%	0%	2%	0%	3%	0%	2%	0%
(72-73)	B	54	66	41	44	65	63	61	27	61	38	51	71
	C	15	14	18	19	18	0	17	9	19	6	16	14
	D	14	10	14	15	6	25	10	27	11	19	13	14
	E	4	0	9	7	0	0	0	18	0	13	4	0
	F	12	7	18	15	6	13	10	18	6	25	13	0
#23	A	2%	3%	0%	4%	0%	0%	2%	0%	3%	0%	2%	0%
(72-73)	B	15	7	23	22	12	0	10	36	11	25	18	0
	C	79	83	77	74	77	100	83	64	81	75	76	100
	D	0	0	0	0	0	0	0	0	0	0	0	0
	E	2	3	0	0	6	0	2	0	3	0	2	0
	F	2	3	0	0	6	0	2	0	3	0	2	0

3. General Comments on the Questionnaires and the Questionnaire Respondents

One very important consideration is that the Stanford coders had no vested interest in the results of their coding. Few of these Stanford coders had ever served in the Air Force, and as such few (if any) had ever answered one of the Air Force surveys. Furthermore, the coding process was strictly voluntary and anonymous, which aids our faith in the dispassionate (?) objectivity of the respondents' coding efforts.

On many occasions those respondents using the forced response questionnaires made comments in the remarks section of their answer sheets. The most important remark, which occurred several times, was that the coder felt most motivator statements contained more than one need type. Another less prevalent comment was that the coder felt the coding could easily reflect the needs of the coder and not necessarily the "true and objective" needs inherent in the motivator statements.

There are some biases over all the respondents. They were fairly young (mean age about 23 years), predominantly male (about 83 percent), mostly U.S. citizens (about 85 percent), all college educated at one level or another, and all fairly intelligent. Interestingly, the biases in age and sex of the Stanford group roughly coincide with the biases in age and sex of the Air Force survey respondents.

The results of the coding process also yielded some

statements coded quite highly into the "None" category. The decision rule for dealing with these will be discussed in the next section.

Overall, the coding agreements were surprisingly high across both coding techniques and across all demographic subcategories. Based on these results we can be quite sure that valid, replicable and objective transformation factors were obtained for most, if not all, of the motivator statements.

4. Quality of the Motivator Statements

A frequency distribution was developed showing the number of statements coded at various percentages into the "None" (F) category. Based on both this distribution and a judgment made from analyzing those statements coded at *such high percentages into this category*, it was decided to throw out all statements receiving a 19 percent or greater coding in the "None" category. These decisions resulted in throwing out Statements 6, 7, 8, 11 and 15 in Questionnaires 1A and 1B, and Statements 13 and 14 in Questionnaire 2. Statement 4 on Questionnaires 1A and 1B was not thrown out, however, as it received very consistent codings into the need levels across all demographic subcategories and was on the borderline with its "None" category percentage of 19 percent.

5. The Final Transformation Factors

The net result of this coding tabulation and analysis was to use as the final transformation factors the need level percentages shown in Column "1A+1B" of Table 3.2 for the 13 accepted statements in the first four Air Force surveys and the need level percentages shown in the first numerical column of Table 3.3 for the 21 accepted statements used in either of the remaining two surveys. For example, Statement 1 in Questionnaire 1A (Table 3.2), which is, "The main satisfaction a person can get out of work is helping other people." transforms into .00 for Need Level A (Physiological), .03 for Need Level B (Security), .53 for Need Level C (Belongingness), .27 for Need Level D (Esteem), and .16 for Need Level E (Self-Actualization), totaling to .99.

The result of all this was that the sum of all transformation factors for all accepted motivator statements totaled .81 or higher across the five need levels. The total was usually around .90, but did not always total to 1.00 since some small part of the transformation went into the "None" category, and rounding errors could also account for up to a .01 discrepancy. This, then, resulted in what I called the weighted correspondence transformation factors.

There is one rather weak hypothesis that can be tested concerning the transformation factors. This is to test the null hypothesis that all five need-level-cell percentages are equal, which they would be if the coding were done on a

strictly random basis. The multinomial data-testing technique using the Chi-squared method with four degrees of freedom (Ostle 1954) rejects this null hypothesis at levels of confidence ranging from .01 to less than .0005.

There were also one-to-one correspondence transformations. These resulted from using statements which were coded at very high percentages into one need level. There were no reasonably high percentage codings into Need Level A (Physiological), so that this need level was not used in later analysis involving need strengths obtained by this one-to-one transformation process. Also, Need Level E (Self-Actualization) received its highest codings of only 51%, 73% and 44% for those three statements used for the one-to-one transformations into this need level. The reason these statements were still used for one-to-one transformations was that the later analysis required need strengths for the upper four need levels. In the interest of more complete, though perhaps not as rigorous, analysis these statements were selected. Table 3.4 summarizes the one-to-one transformations used for all six surveys.

B. The Derived Need Strengths

The final weighted correspondence transformation for generating an individual's need strengths is guided by Vroom's (1964) force model. We first define f_{ij}, the transformation factor, as that fraction of any motivator j which represents type i needs (i=1,...,5). These fac-

TABLE 3.4

ONE-TO-ONE CORRESPONDENCE TRANSFORMATIONS

Item	Coding Proportion	Need Level
For Surveys 72-34(O), 72-34(A), 73-22(O), 73-22(A):		
Questionnaire 1A/1B Statement No.		
3	.51	E = Self-actualization
9	.84	B = Security
10	.89	D = Esteem
16	.86	C = Belongingness
For Survey 72-73(O & A):		
Questionnaire 2 Statement No.		
6	.89	D = Esteem
12	.90	B = Security
15	.73	E = Self-actualization
23	.79	C = Belongingness
For Survey 73-50(O):		
Questionnaire 2 Statement No.		
3	.92	C = Belongingness
5	.44	E = Self-actualization
6	.89	D = Esteem
12	.90	B = Security

tors are the overall percentages already discussed in Tables 3.2 and 3.3. Next, we define S_i (i=1,...,5) to be the normalized need strength for type i need level for any individual. Finally, we define MS_j as the Air Force respondent's strength response to motivator statement j. Putting these together, we define S_i in terms of the other two variables as:

$$(3.1) \qquad S_i = \frac{\sum_j f_{ij} MS_j}{\sum_j f_{ij}} \quad , \qquad i=1,\ldots,5$$

Note that this definition yields normalized need strength values which will all range between 1 and 5, since the motivator statement responses used by the Air Force personnel ranged between 1 and 5.

We also want, in a rough sense, that:

$$(3.2) \qquad \sum_i f_{ij} \approx 1$$

That is, the usual motivator is made up in total of only the five Maslowian need types and can be divided up into none, one, or more of these need types, and we want the sum of the factors for the five need types to total approximately to 1.

1. Weighted Correspondence Need Strengths

What remains left to do with the transformations is to show how an individual's normalized need level strengths (S_i) are computed based on the weighted correspondence concept. This is done per relationship 3.1, which says that the strength for each need level for an individual is com-

puted by: (1) multiplying his response strength to a specific motivator statement, MS_j, (valued at 1 to 5) times the transformation factor, f_{ij}, for that motivator for the given need level; (2) repeating this process for all other motivator statements which validly transformed into this need level; (3) summing all such terms; and (4) dividing this sum by the sum of all the motivator transformation factors for that need level, for all motivator statements used, so as to normalize this weighted sum back to the original range of from 1 to 5.

Let us go partially through this process for an hypothesized individual, Airman L. Class. Suppose Airman Class had answered Air Force Survey 72-73(O&A) way back in July 1972. Further, suppose his responses for our (renumbered) Questionnaire 2 statements numbered 4, 5 and 6 were as follows: #4--Extremely Important (=5); #5--Below Average Importance (=2); #6--Average Importance (=3). Let us begin computing his weighted correspondence normalized need strength for his Belongingness Need (Need Level C). From Table 3.3 we find that the transformation factor for Statement 4 into Need Level C is .00; for Statement 5 is .09; and for Statement 6 is .07. Following the technique outlined in the preceding paragraph, Airman Class's Need Level C need strength, called S_3, begins to look like:

$$.00(5) + .09(2) + .07(3) \ldots$$

Following through for all the other transformation factors for the accepted motivator statements used in Survey

72-73(O&A), we would end up multiplying a total of 15 Need Level C transformation factors times Airman Class's respective motivator strength responses for the corresponding motivator statements, summing all 15 terms, and dividing this sum by the sum of all 15 transformation factors, which in this case is 2.42. This, then, is how the weighted correspondence need strengths for all five need levels (S_1 through S_5) were computed for each individual.

2. One-to-One Correspondence Need Strengths

Computing the one-to-one correspondence need strengths is very simple and is really already summarized in Table 3.4. For Airman Class we simply take his motivator strength responses for Statements 6, 12, 15 and 23. These values are considered to be his need level strengths for need levels D, B, E and C, respectively. Note that relationship 3.1 also applies here, where now $f_{ij}=1$. Note also that this is roughly the same methodology implicitly assumed by Porter and others concerning Porter's set of questions.

3. Correlations Between One-to-One Correspondence Need Strengths and Weighted Correspondence Need Strengths

The weighted correspondence need strengths for all five need levels were calculated for each individual and made a part of the individual's data record. The one-to-one correspondence need strengths were tagged as being the strength response each individual gave to the appropriate

motivator statements which were coded by the Stanford coders at the highest rates into the given Maslowian need levels.

Cross-correlations were then calculated between the weighted correspondence need strengths for one need level and the need strengths for all four need levels based on the one-to-one correspondence data set, for all six surveys. Table 3.5 displays these cross-correlations. For example, in this table we find for Survey No. 1 that the correlations between weighted S_2 and one-to-one S_2 is +.82 and between weighted S_2 and one-to-one S_3 is +.12.

Surveying this table we find nice high correlations between the weighted need strength and the one-to-one need strength for the same need level. Also, the correlations between the weighted need strength for one need level and the one-to-one correspondence need strengths for the other three need levels are usually fairly low. Thus, from this data it appears that we have successfully developed a consistent set of one-to-one and weighted correspondence need level strengths, which is what we had set out to do.

4. A Cautionary Note

Given that we now have both a person's weighted correspondence and his one-to-one correspondence need strengths for each need level (except Need Level A for the one-to-one transformation), we must be aware of one fact: the one-to-one correspondence need strengths take on only five discrete

TABLE 3.5

CORRELATIONS BETWEEN ONE-TO-ONE CORRESPONDENCE AND WEIGHTED CORRESPONDENCE NEED STRENGTHS S_2 THROUGH S_5

Survey No.[a]	Weighted Need Strengths	One-to-One Need Strengths			
		S_2 (1-1)	S_3 (1-1)	S_4 (1-1)	S_5 (1-1)
1	S_2	0.82	0.12	0.29	0.05
2	S_2	0.82	0.10	0.36	0.11
3	S_2	0.79	0.52	0.48	0.41
4	S_2	0.81	0.19	0.29	0.06
5	S_2	0.80	0.12	0.33	0.16
6	S_2	0.87	0.43	0.47	0.35
1	S_3	0.18	0.69	0.21	0.26
2	S_3	0.30	0.66	0.25	0.24
3	S_3	0.51	0.79	0.48	0.48
4	S_3	0.20	0.74	0.19	0.19
5	S_3	0.26	0.69	0.26	0.22
6	S_3	0.37	0.94	0.38	0.49
1	S_4	0.28	0.09	0.62	0.04
2	S_4	0.42	0.06	0.64	0.06
3	S_4	0.53	0.43	0.69	0.58
4	S_4	0.28	0.13	0.67	-0.002
5	S_4	0.37	0.07	0.66	0.07
6	S_4	0.40	0.40	0.73	0.63
1	S_5	0.05	0.16	0.27	0.70
2	S_5	0.28	0.18	0.36	0.61
3	S_5	0.45	0.41	0.46	0.79
4	S_5	0.15	0.18	0.33	0.60
5	S_5	0.27	0.15	0.39	0.62
6	S_5	0.36	0.50	0.48	0.78

[a] 1 = 72-34(O); 2 = 72-34(A); 3 = 72-73(O & A); 4 = 73-22(O); 5 = 73-22(A); 6 = 73-50(O).

values, namely, 1, 2, 3, 4 and 5. As such we must be very careful in performing any sophisticated statistical techniques on such data, such as linear regressions. There is no such problem for the weighted correspondence data since it becomes fairly continuous within the range of 1 to 5 from its method of calculation.

V. Sampling the Air Force Surveys (Samples of Samples)

The number of records in the surveys is huge, ranging from over 8,000 to over 23,000. Computer resources are scarce. In the interest of conserving such resources some experiments were run to see what level of random samples taken of the survey data records would give a high level of confidence as being representative of all the records in each survey.

Table 3.6 shows the results of one such experiment. The means and standard deviations for all the critical variables were computed for a 30 percent random sample and for the total file. (The sample sizes vary slightly due to missing values in some records, which caused that value to be thrown out.) These means were then tested for equality on a two-tailed test of significance. All 30 percent sample means could be accepted as being equal to their respective grand means at a much better than .01 level of significance. Based on these results all statistical techniques performed with the survey data were accomplished with a 30 percent random sample from each survey.

TABLE 3.6

COMPARISON OF 30% RANDOM SAMPLE MEANS TO POPULATION MEANS, SURVEY NO. 72-34(O)

	30% Sample			Population			
Statistic	μ_s	σ_s	N_s	μ_p	σ_p	N_p	Z_s
VAR009 (S_2, 1-1)	3.861	0.965	2,833	3.863	0.964	9,561	-0.110
VAR016 (S_3, 1-1)	2.896	1.034	2,818	2.914	1.042	9,509	-0.917
VAR010 (S_4, 1-1)	3.940	0.956	2,823	3.923	0.949	9,547	+0.952
VAR003 (S_5, 1-1)	3.258	1.123	2,824	3.265	1.128	9,530	-0.330
S_1	3.516	0.484	2,763	3.523	0.484	9,340	-0.760
S_2	3.519	0.511	2,749	3.525	0.508	9,292	-0.619
S_3	3.244	0.493	2,754	3.256	0.495	9,313	-1.272
S_4	3.551	0.492	2,749	3.551	0.483	9,292	0
S_5	3.271	0.484	2,749	3.278	0.490	9,292	-0.749
Age	32.733	8.098	2,850	32.617	8.054	9,637	+0.769
Rank	4.344	1.337	2,863	4.330	1.342	9,674	+0.557

VI. Summary

The motivator-statement to need-level transformation factors seem consistent and valid based on the comparisons performed in Tables 3.2, 3.3 and 3.5. Moreover, the methodology used for generating these transformation factors gives us objective, statistically based-confidence that we are using motivators and their respective strengths which, when transformed into need level strengths, do in fact represent an individual's need strengths at the various need levels. Finally, we have two largely independent measurement instruments (Surveys 72-73(O&A) and Survey 73-50(O), vs. the other four surveys) and two different ways to calculate need strengths (one-to-one vs. weighted correspondence). Together, all these factors give us powerful leverage for testing hypotheses of the model as well as for drawing conclusions based on our *statistical analyses.*

CHAPTER 4

THE RESULTS

I. Overview

Of the nine hypotheses tested only the last one received strong support from the evidence offered up by the statistical analyses. This last hypothesis is the Time Hypothesis which, ironically, derives not from Maslow's theory directly but rather from a Stanford Research Institute report. Only one other hypothesis, the need strength correlations hypothesis (No. 3) received reasonable support from the statistical evidence. The remaining seven hypotheses, some of them deriving from the very heart of Maslow's theory, received little or no support from the statistical evidence.

It should again be noted that all of the tabular results presented in this chapter are based on 30 percent random samples of the six surveys used.

II. Hypothesis 1: The Age Hypothesis

This hypothesis states that given individuals who are clearly operating in one need level, then the higher the need level at which they operate the higher their mean age. From Chapter 2 we have the formal relationships:

$$(2.2)\quad (\bar{A}_5 | S_5>4) > (\bar{A}_4 | S_4>4) > (\bar{A}_3 | S_3>4) > (\bar{A}_2 | S_2>4) > (\bar{A}_1 | S_1>4)$$

These comparisons will be made on an adjacent pairwise basis. At a more rigorous level these conditions are:

(2.1a) $(\overline{A}_2 | S_2 > 4) \simeq 7$ (childhood)

(2.1b) $(\overline{A}_3 | S_3 > 4) \simeq 15$ (adolescence)

(2.1c) $(\overline{A}_4 | S_4 > 4) \simeq 30$ (early adulthood)

(2.1d) $(\overline{A}_5 | S_5 > 4) \simeq 50$ (late adulthood)

Since data on Rank and Education Level was available in most of the surveys, the same hypothesis of the form of 2.2 was tested for these other two variables. Verbally, the less rigorous hypothesis states that the mean age (or mean rank or mean education level) of a group of people operating at a higher need level will be greater than the mean age of a group of people operating at a lower need level. The more rigorous form of the hypothesis states that the mean age of a group of people operating at need level three will be around adolescence; the mean age of a group of people operating at need level four will be around early adulthood; and the mean age of a group of people operating at need level five will be around late adulthood.

Table 4.1 includes the conditional and unconditional means, standard deviations, sample sizes, and the computed number of standard deviations (Z) in the difference between adjacent conditional means, for the Age, Rank and Education Level variables. The inequality test of relationship 2.2 is based on a one-tailed test of significance, at .01 or .05. The equality test of relationships 2.1 is based on a two-tailed test of significance at .01 or .05. Age and Education

TABLE 4.1

MEAN AGE, RANK, AND EDUCATION LEVEL FOR GROUPS CLEARLY OPERATING AT DIFFERENT NEED LEVELS

Item	Age (Years)			Rank			Ed. Level (Years)			Z_{Age}	Z_{Rank}	$Z_{Ed.\ Lev.}$
	μ	σ	*N*	μ	σ	*N*	μ	σ	*N*			
1. 72-34(0)												
Population	32.733	8.098	2,850	4.344	1.337	2,863	-	-	-			
1:1 Correspondence												
$S_2 \geq 4.0$	33.491	8.139	2,181	4.405	1.327	2,181	-	-	-	> -5.68	-3.95	
$S_3 \geq 4.0$	31.733	7.970	970	4.197	1.381	970	-	-	-	> +4.72	+3.43	
$S_4 \geq 4.0$	33.193	8.147	2,185	4.378	1.336	2,185	-	-	-	> -4.76	-3.24	
$S_5 \geq 4.0$	31.919	7.687	1,427	4.233	1.304	1,427						
Weighted Corresp.												
$S_1 \geq 4.0$	35.644	8.601	385	4.673	1.324	385	-	-	-	> +0.96	+0.56	
$S_2 \geq 4.0$	36.224	8.542	424	4.726	1.367	424	-	-	-	> -3.58	-0.85	
$S_3 \geq 4.0$	33.982	8.662	165	4.612	1.500	165	-	-	-	> +4.54	+1.94	
$S_4 \geq 4.0$	36.757	8.489	460	4,870	1.351	460	-	-	-	> -2.67	-1.42	
$S_5 \geq 4.0$	34.799	8.144	174	4.707	1.272	174	-	-	-			
2. 72-34(A)												
Population	27.540	7.707	6,213	4.592	1.614	6,225	12.589	1.284	6,216			
1:1 Correspondence												
$S_2 \geq 4.0$	28.437	7.810	5,061	4,765	1.622	5,061	12.573	1.199	5,061	>-11.17	-11.54	-0.56
$S_3 \geq 4.0$	26.231	7.369	2,017	4.277	1.599	2,017	12.555	1.241	2,017	>+10.57	+10.87	+1.72
$S_4 \geq 4.0$	28.384	7.816	4,189	4.751	1.627	4,189	12.613	1.249	4,189	> -6.54	-6.68	+0.47
$S_5 \geq 4.0$	27.179	7.645	3,024	4.492	1.622	3,024	12.627	1.278	3,024			

TABLE 4.1 (continued)

Item	Age (Years)			Rank			Ed. Level (Years)			Z_{Age}	Z_{Rank}	$Z_{Ed.\ Lev.}$
	μ	σ	*N*	μ	σ	*N*	μ	σ	*N*			
2. 72-34(A) (cont.)												
Weighted Corresp.												
$S_1 \geq 4.0$	30.421	8.193	1,701	5.062	1.694	1,701	12.395	1.120	1,701	> +2.38	+2.02	-0.37
$S_2 \geq 4.0$	31.083	8.096	1,735	5.178	1.674	1,735	12.381	1.119	1,735	> -5.45	-6.46	-1.52
$S_3 \geq 4.0$	28.949	8.504	626	4.663	1.724	626	12.297	1.211	626	> +7.10	+7.83	+0.74
$S_4 \geq 4.0$	31.917	8.187	1,131	5.329	1.679	1,131	12.341	1.164	1,131	> -4.73	-5.02	-0.66
$S_5 \geq 4.0$	30.045	8.460	735	4.917	1.766	735	12.304	1.201	735			
3. 72-72(O & A)												
Population	22.684	1.993	4,841	-	-	-	13.281	1.891	5,180			
1:1 Correspondence												
$S_2 \geq 4.0$	22.687	1.878	3,100	-	-	-	13.166	1.750	3,100	> +0.13	-	+0.92
$S_3 \geq 4.0$	22.693	1.901	3,421	-	-	-	13.206	1.774	3,421	> +2.01	-	+1.94
$S_4 \geq 4.0$	22.792	1.939	2,753	-	-	-	13.296	1.836	2,753	> +0.67	-	+1.75
$S_5 \geq 4.0$	22.825	1.913	3,369	-	-	-	13.378	1.815	3,369			
Weighted Corresp.												
$S_1 \geq 4.0$	22.666	1.868	2,054	-	-	-	13.149	1.731	2,054	> +0.90	-	+0.51
$S_2 \geq 4.0$	22.717	1.846	2,231	-	-	-	13.176	1.721	2,231	> +1.12	-	+1.73
$S_3 \geq 4.0$	22.778	1.867	2,467	-	-	-	13.264	1.767	2,467	> +1.37	-	+1.86
$S_4 \geq 4.0$	22.851	1.914	2,558	-	-	-	13.358	1.817	2,558	> -0.02	-	+0.42
$S_5 \geq 4.0$	22.850	1.895	2,816	-	-	-	13.379	1.811	2,816			
4. 73-22(O)												
Population	33.251	8.040	2,726	4.455	1.328	2,736	16.363	1.516	2,059			
1:1 Correspondence												
$S_2 \geq 4.0$	33.752	7.994	1,666	4.448	1.337	1,666	16.427	1.303	1,666	> -1.01	+0.06	+0.39
$S_3 \geq 4.0$	33.366	8.629	683	4.452	1.434	683	16.452	1.429	683	> +0.92	+0.53	+0.19
$S_4 \geq 4.0$	33.723	8.012	1,548	4.486	1.336	1,548	16.464	1.302	1,548	> -3.00	-3.29	+0.61
$S_5 \geq 4.0$	32.857	7.826	1,466	4.327	1.319	1,466	16.493	1.302	1,468			

TABLE 4.1 (continued)

Item	Age (Years)			Rank			Ed. Level (Years)			Z_{Age}	Z_{Rank}	$Z_{Ed.\ Lev.}$
	μ	σ	N	μ	σ	N	μ	σ	N			
4. 73-22(0) (cont.)												
Weighted Corresp.												
$S_1 \geq 4.0$	35.425	8.373	365	4.693	1.358	365	16.303	1.395	365	+0.49	+0.55	-0.50
$S_2 \geq 4.0$	35.714	8.103	405	4.746	1.325	405	16.254	1.326	405	-0.48	-0.14	-0.63
$S_3 \geq 4.0$	35.306	9.156	147	4.728	1.388	147	16.157	1.674	147	+2.13	+2.21	+0.61
$S_4 \geq 4.0$	37.180	8.376	344	5.026	1.321	344	16.252	1.311	344	-2.33	-2.19	+0.86
$S_5 \geq 4.0$	35.442	8.590	208	4.764	1.389	208	16.356	1.403	208			
5. 73-22(A)												
Population	27.761	7.636	6,926	4.723	1.532	6,941	12.600	1.276	5,449			
1:1 Correspondence												
$S_2 \geq 4.0$	28.484	7.741	4,631	4,840	1.567	4,631	12.582	1.257	4.631	-10.21	-10.14	+0.22
$S_3 \geq 4.0$	26.295	7.353	1,636	4.397	1.502	1,636	12.590	1.304	1,636	+10.55	+10.52	+0.31
$S_4 \geq 4.0$	28.605	7.784	3,604	4.876	1.580	3,604	12.602	1.283	3,604	-4.72	-4.94	+0.31
$S_5 \geq 4.0$	27.779	7,648	4,251	4.701	1.549	4,251	12.011	1.292	4,251			
Weighted Corresp.												
$S_1 \geq 4.0$	30.349	8.151	1,807	5.099	1.606	1,807	12.452	1.199	1,807	+2.35	+2.28	-1.36
$S_2 \geq 4.0$	30.981	8.021	1,804	5.220	1.588	1,804	12.398	1.183	1,804	-5.76	-6.32	-0.75
$S_3 \geq 4.0$	28.754	8.325	609	4.742	1.622	609	12.356	1.201	609	+6.43	+7.39	+0.53
$S_4 \geq 4.0$	31.470	8.145	1,028	5.350	1.584	1,028	12.389	1.246	1,028	-3.59	-4.25	-0.42
$S_5 \geq 4.0$	30.163	8.279	1,013	5.052	1.587	1,013	12.366	1.231	1,013			
6. 73-50(0)												
Population	32.846	7.801	2,597	4.339	1.304	2,598	16.345	1.621	2,567			

TABLE 4.1 (continued)

Item	Age (Years)			Rank			Ed. Level (Years)			Z_{Age}	Z_{Rank}	$Z_{Ed.\ Lev.}$
	μ	σ	N	μ	σ	N	μ	σ	N			
6. 73-50(0) (cont.)												
1:1 Correspondence												
$S_2 \geq 4.0$	33.083	7.939	1,668	4.333	1.333	1,668	16.321	1.442	1,668	> -1.69	-1.29	+3.49
$S_3 \geq 4.0$	32.634	7.794	1,873	4.276	1.292	1,873	16.489	1.418	1,873	> +2.32	+2.51	-0.71
$S_4 \geq 4.0$	33.228	7.759	1,820	4.382	1.276	1,820	16.457	1.340	1,820	> -1.43	-1.91	+0.75
$S_5 \geq 4.0$	32.880	7.764	2,281	4.305	1.293	2,281	16.488	1.280	2,281			
Weighted Corresp.												
$S_1 \geq 4.0$	31.691	7.459	993	4.118	1.291	993	16.482	1.368	993	> +3.88	+3.08	-1.35
$S_2 \geq 4.0$	32.929	7.893	1,368	4.285	1.317	1,368	16.405	1.357	1,368	> -1.21	-0.53	+2.41
$S_3 \geq 4.0$	32.573	7.798	1,507	4.259	1.284	1,507	16.526	1.326	1,507	> +2.47	+1.96	-0.40
$S_4 \geq 4.0$	33.240	7.820	1,881	4.346	1.280	1,881	16.508	1.261	1,881	> -1.66	-1.45	+0.55
$S_5 \geq 4.0$	32.817	7.772	1,841	4.285	1.294	1,841	16.531	1.278	1,841			

Level are expressed in years. Rank is expressed as follows: for the officer surveys, 7=Colonel, 6=Lieutenant Colonel, etc., 2=Second Lieutenant and 1=Warrant Officer; for the enlisted surveys, 9=Chief Master Sergeant, 8=Senior Master Sergeant, etc., 2=Airman and 1=Airman Basic.

The more rigorous tests (2.1b through 2.1d) can be made by inspection alone. In Table 4.1 we see that the observed difference between the conditional mean age and the hypothesized age is statistically significant in virtually every case. The only test which comes close to equality is for relationship 2.1c, where the conditional age sometimes approaches the hypothesized age of 30 (early adulthood). However on closer inspection this appears to be spurious, since all the conditional mean ages are found to be within a few years of the overall unconditional mean age for each survey group. That is, no matter at which need level a person is clearly operating, the mean age of groups composed of such persons stays about the same, which is also fairly close to the overall population mean age for each survey. Therefore, we find the differences are usually statistically significant, thus offering little evidence to support the age hypotheses based on their null from in the relationships of 2.1.

The less rigorous inequality tests of relationship 2.2 yield mixed results. On a pairwise comparison we find the observed difference was statistically significant in the hypothesized direction for the following conditional mean

age pairs: $(\bar{A}_1|S_1>4)$ vs. $(\bar{A}_2|S_2>4)$, in three of the six surveys; and $(\bar{A}_3|S_3>4)$ vs. $(\bar{A}_4|S_4>4)$, in five of the six surveys. For the other two pairs (2-3 and 4-5) there is no evidence that the age differences are significant in the hypothesized direction. Note, however, that had we stated the alternative hypothesis of inequality in relationship 2.2 in the other direction for pairs 2-3 and 4-5 we would have found evidence that these observed differences were statistically significant.

Putting aside the formal hypotheses tests and looking now for interesting results, we find that out of a total of 42 possible pairwise age comparisons 29 were significantly different based on a one-tailed test in the appropriate direction. Of these 29 significant differences, in 13 comparisons the groups operating at a higher need level had a higher mean age than the groups operating at the next lower need level, and in 16 comparisons such groups had a lower mean age than the groups operating at a lower need level. There was, however, a fairly consistent pattern that emerged: mean age of need level two groups was usually higher than mean age of need level one groups; mean age of need level three groups was usually lower than mean age of need level two groups; mean age of need level four groups was usually higher than mean age of need level three groups; and mean age of need level five groups was usually lower than mean age of need level four groups. For the weighted correspondence need strength data this pattern held statistically

significant in 16 of 24 possible pairwise comparisons. Note, however, that Survey 72-73(O&A) showed no significant differences. This is due in large part to the fact that this survey, and this survey alone, was administered only to younger people, ranging in age from 16 to 25 years.

Illustration 4.1 shows a plot of these patterns for all six surveys. So, across all five need levels the usual pattern of mean ages was: Low, High, Low, High, Low. This is a most interesting phenomenon, and I have absolutely no idea what it might mean.

Age and Rank correlate very highly in the survey data used for this study. The correlations were always above +0.7, and often approached +0.8. Thus, everything said about the Age variable consistently carries over to the Rank variable.

Education Level appeared as a variable in five of the six surveys. There was no particular pattern in the shifts of mean education level between adjacent need level operating groups. The difference between adjacent need level mean education levels reached significance in the hypothesized direction on far fewer occasions than for the Age or Rank variables.

Summarizing, the difference between the conditional mean age of each group clearly operating at a given need level and its hypothesized adolescence/early adulthood/late adulthood age (relationship 2.1) was usually statistically significant. Thus, there is good evidence for rejecting the more rigorous

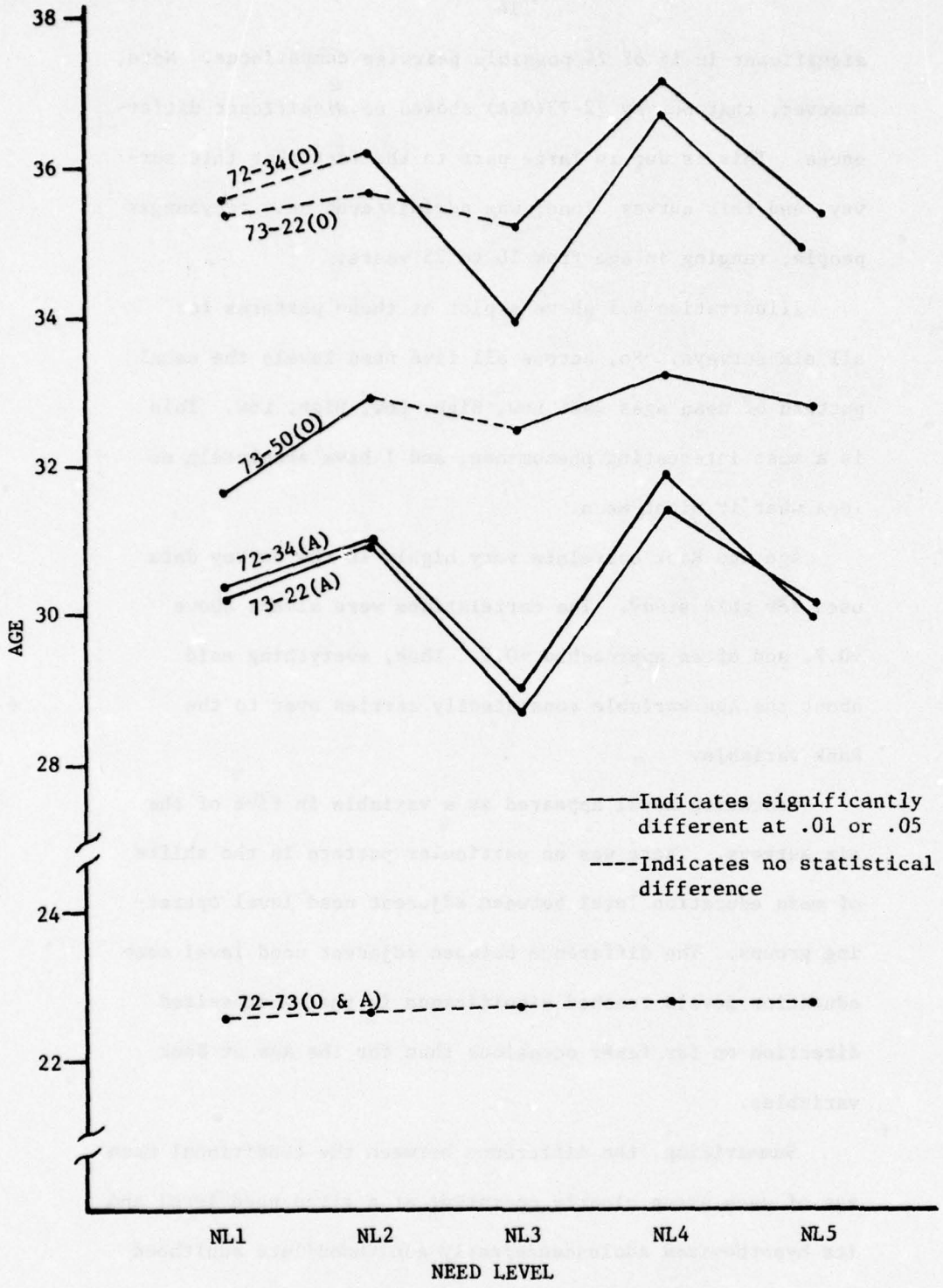

Illustration 4.1.—Mean Age Differences for Groups Clearly Operating at Different Need Levels (Weighted Correspondence Data)

null hypotheses of equality in relationship 2.1. For the other statement of this age hypothesis, as given by the inequalities of relationship 2.2, we find mixed results. The observed differences were often statistically significant in the hypothesized direction for age pairs 1-2 and 3-4. For age pairs 2-3 and 4-5 there was no evidence that the difference was statistically significant in the hypothesized direction. All in all, we find little evidence to support the hypothesis that the mean age of groups clearly operating at lower need levels is less than the mean age of groups clearly operating at higher need levels.

III. Hypothesis 2: Mean Need Strengths

This hypothesis states that given individuals who are clearly operating at one need level, then the mean need strength of all other need levels should be low and in the prepotent or largely satisfied range. Formally, from Chapter 2 we have:

(2.4) $(\bar{S}_l | S_i > 4) < 3, \quad i,l=1,\ldots,5; \; i \neq l.$

Or, less rigorously:

(2.5) $(\bar{S}_l | S_i > 4) < S_l, \quad i,l=1,\ldots,5; \; i \neq l.$

For relationship 2.4 the test is a one-tailed test of significance of the difference between the conditional (sample) mean and the hypothesized population mean need strength of 3. For relationship 2.5 the test is a one-tailed test of significance of the difference between the conditional sample mean and the unconditional mean, which is being taken as the pop-

ulation mean.

Tables 4.2 and 4.3 present the means, standard deviations and sample sizes for the conditional need level strengths and the unconditional need level strengths. Table 4.2 displays the data for the weighted correspondence need strengths, and Table 4.3 displays the data for the one-to-one correspondence need strengths. The data covers all five need levels (four need levels for the one-to-one correspondence data) and all six surveys.

For the test of the differences per relationship 2.4 we find that for all the conditional means in Table 4.2 there is no evidence that the difference is statistically significant in the hypothesized direction between these conditional means and the need strength value of 3. For the one-to-one correspondence data in Table 4.3 we find ten cases (out of a total of 96 cases) where the difference between the conditional mean and the need strength value of 3 is statistically significant in the observed direction. Even these ten cases are suspect, however, since the corresponding unconditional mean need strength for the same need level in the same survey is also less than 3. Thus, there is very little evidence to support the hypothesized need level strength differences of relationship 2.4.

For the test of the differences in means per relationship 2.5 we find no evidence that the hypothesized differences are statistically significant, for all the means shown in both Tables 4.2 and 4.3. Summarizing for both relation-

TABLE 4.2

MEAN NEED LEVEL STRENGTHS (WEIGHTED CORRESPONDENCE DATA)

Need Strength and Condition	Survey Number																	
	1. Nov. 1971 72-34(O)			2. Nov. 1971 72-34(A)			3. July 1972 72-73(O & A)			4. Nov. 1972 73-22(O)			5. Nov. 1972 73-22(A)			6. March 1973 73-50(O)		
	μ	σ	*N*	μ	σ	*N*	μ	σ	*N*	μ	σ	*N*	μ	σ	*N*	μ	σ	*N*
Population $\overline{S_1}$	3.516	0.484	2,763	3.655	0.578	6,087	4.060	0.601	4,793	3.576	0.497	2,556	3.736	0.567	6,821	3.871	0.648	2,568
$S_1 \geq 4.0$																		
S_1 (≥ 4)	4.234	0.184	385	4.322	0.240	1,701	4.476	0.296	2,054	4.240	0.202	365	4.320	0.231	1,807	4.521	0.336	993
S_2	4.139	0.272	385	4.232	0.321	1,701	4.459	0.354	2,054	4.161	0.275	365	4.242	0.306	1,807	4.428	0.459	993
S_3	3.577	0.471	385	3.683	0.522	1,701	4.461	0.409	2,054	3.612	0.483	365	3.650	0.525	1,807	4.483	0.477	993
S_4	4.006	0.354	385	3.977	0.444	1,701	4,500	0.358	2,054	3.945	0.397	365	3.926	0.435	1,807	4.492	0.405	993
S_5	3.783	0.377	385	3.653	0.458	1,701	4.557	0.354	2,054	3.907	0.359	365	3.980	0.388	1,807	4.550	0.365	993
Population $\overline{S_2}$	3.519	0.511	2,749	3.646	0.596	6,066	4.077	0.609	4,729	3.610	0.499	2,545	3,716	0.588	6,799	4.043	0.588	2,559
$S_2 \geq 4.0$																		
S_1	4.101	0.309	424	4.227	0.347	1,735	4.393	0.370	2,231	4.106	0.310	405	4.242	0.326	1,804	4.217	0.537	1,368
S_2 (≥ 4)	4.216	0.179	424	4.306	0.232	1,735	4.473	0.298	2,231	4.226	0.191	405	4.304	0.220	1,804	4.478	0.322	1,368
S_3	3.646	0.455	424	3.735	0.484	1,735	4.478	0.369	2,231	3.658	0.448	405	3.705	0.494	1,804	4.361	0.529	1,368
S_4	4.030	0.363	424	4.012	0.420	1,735	4.467	0.376	2,231	3.962	0.373	405	3.967	0.409	1,804	4.497	0.376	1,368
S_5	3.681	0.439	424	3.773	0.516	1,735	4.532	0.360	2,231	3.800	0.403	405	3.925	0.430	1,804	4.457	0.392	1,368
Population $\overline{S_3}$	3.244	0.493	2,754	3.289	0.566	6,082	4.171	0.610	4,699	3.253	0.510	2,547	3,299	0.566	6,808	4.106	0.599	2,559
$S_3 \geq 4.0$																		
S_1	3.955	0.402	165	4.249	0.446	626	4.299	0.445	2,467	4.049	0.437	147	4.276	0.412	609	4.127	0.576	1,507
S_2	4.032	0.406	165	4.296	0.421	626	4.360	0.411	2,467	4.158	0.372	147	4.332	0.366	609	4.281	0.489	1,507
S_3 (≥ 4)	4.182	0.204	165	4.290	0.265	626	4.502	0.297	2,467	4.213	0.172	147	4.297	0.251	609	4.491	0.344	1,507
S_4	4.041	0.392	165	4.090	0.495	626	4.440	0.380	2,467	4.117	0.348	147	4.099	0.454	609	4.472	0.367	1,507
S_5	3.798	0.427	165	4.006	0.527	626	4.512	0.365	2,467	3.991	0.400	147	4.126	0.429	609	4.466	0.343	1,507

TABLE 4.2 (continued)

Need Strength and Condition	Survey Number																	
	1. Nov. 1971 72-34(O)			2. Nov. 1971 72-34(A)			3. July 1972 72-73(O & A)			4. Nov. 1972 73-22(O)			5. Nov. 1972 73-22(A)			6. March 1973 73-50(O)		
	μ	σ	N	μ	σ	N	μ	σ	N	μ	σ	N	μ	σ	N	μ	σ	N
Population $\overline{S_4}$	3.551	0.492	2,749	3.483	0.592	6,066	4.202	0.586	4,758	3.552	0.489	2,545	3.478	0.599	6,799	4.283	0.477	2,557
$S_4 \geq 4.0$																		
S_1	3.875	0.454	460	4.205	0.452	1,131	4.300	0.431	2,558	3.940	0.477	344	4.248	0.441	1,028	3.994	0.620	1,881
S_2	3.954	0.410	460	4.258	0.380	1,131	4.317	0.440	2,558	4.030	0.407	344	4.295	0.358	1,028	4.200	0.517	1,881
S_3	3.604	0.467	460	3.785	0.511	1,131	4.404	0.420	2,558	3.682	0.476	344	3.080	0.509	1,028	4.255	0.523	1,881
S_4 (≥ 4)	4.234	0.192	460	4.304	0.248	1,131	4.494	0.296	2,558	4.233	0.193	344	4.288	0.231	1,028	4.494	0.293	1,881
S_5	3.745	0.414	460	3.929	0.506	1,131	4.548	0.307	2,558	3.918	0.382	344	4.102	0.410	1,028	4.435	0.330	1,881
Population $\overline{S_5}$	3.271	0.484	2,749	3.301	0.590	6,066	4.290	0.584	4,689	3.430	0.470	2,545	3.517	0.543	6,799	4.250	0.480	2,559
$S_5 \geq 4.0$																		
S_1	4.103	0.413	174	4.362	0.394	735	4.241	0.464	2,816	4.165	0.392	208	4.344	0.349	1,013	4.043	0.601	1,841
S_2	3.995	0.479	174	4.284	0.438	735	4.258	0.476	2,816	4.115	0.408	208	4.268	0.385	1,013	4.202	0.529	1,841
S_3	3.790	0.458	174	3.938	0.494	735	4.356	0.448	2,816	3.824	0.447	208	3.815	0.503	1,013	4.292	0.497	1,841
S_4	4.196	0.332	174	4.212	0.389	735	4.419	0.364	2,816	4.176	0.309	208	4.133	0.365	1,013	4.476	0.332	1,841
S_5 (≥ 4)	4.212	0.199	174	4.310	0.257	735	4.531	0.286	2,816	4.218	0.179	208	4.279	0.229	1,013	4.472	0.285	1,841

TABLE 4.3

MEAN NEED LEVEL STRENGTHS (ONE-TO-ONE CORRESPONDENCE DATA)

Need Strength and Condition	Survey Number																	
	1. Nov. 1971 72-34(O)			2. Nov. 1971 72-34(A)			3. July 1972 72-73(O & A)			4. Nov. 1972 73-22(O)			5. Nov. 1972 73-22(A)			6. March 1973 73-50(O)		
	μ	σ	*N*	μ	σ	*N*	μ	σ	*N*	μ	σ	*N*	μ	σ	*N*	μ	σ	*N*
Population $\overline{S_2}$	3.861	0.965	2,833	4.134	0.993	6,174	4.089	0.962	5,545	4.050	0.936	2,617	4.267	0.948	6,909	3.862	0.937	2,580
$S_2 \geq 4.0$																		
S_2 ($\geq$ 4)	4.295	0.456	2,181	4.516	0.500	5,061	4.560	0.497	3,100	4.390	0.488	1,666	4.589	0.492	4,631	4.435	0.496	1,668
S_3	2.290	1.023	2,181	2.878	1.090	5,061	4.472	0.733	3,100	2.876	1.046	1,666	2.812	1.112	4,631	4.137	0.817	1,668
S_4	4.019	0.889	2,181	3.818	1.034	5,061	4.101	0.951	3,100	3.978	0.933	1,666	3.757	1.036	4,631	4.180	0.818	1,668
S_5	3.209	1.108	2,181	3.229	1.183	5,061	4.443	0.827	3,100	3.817	1.053	1,666	4.042	1.022	4,631	4.450	0.733	1,668
Population $\overline{S_3}$	2.896	1.034	2,818	2.869	1.090	6,164	4.290	0.875	5,241	2.861	1.043	2,611	2.805	1.103	6,906	4.010	0.838	2,588
$S_3 \geq 4.0$																		
S_2	3.929	0.920	970	4.288	0.964	2,017	4.249	0.857	3,421	4.167	0.852	683	4.347	0.890	1,636	3.983	0.879	1,873
S_3 ($\geq$ 4)	4.107	0.310	970	4.197	0.398	2,017	4.617	0.486	3,421	4.103	0.304	683	4.237	1.046	1,636	4.419	0.494	1,873
S_4	4.035	0.932	970	3.844	1.045	2,017	4.047	0.969	3,421	4.019	0.980	683	3.824	1.046	1,636	4.116	0.838	1,873
S_5	3.417	1.114	970	3.465	1.194	2,017	4.435	0.828	3,421	3.911	1.029	683	4.182	0.879	1,636	4.528	0.663	1,873
Population $\overline{S_4}$	3.940	0.956	2,823	3.722	1.075	6,174	3.968	1.009	5,507	3.926	0.966	2,627	3.682	1.072	6,910	4.025	0.866	2,580
$S_4 \geq 4.0$																		
S_2	3.947	0.918	2,185	4.278	0.893	4,189	4.292	0.839	2,753	4.131	0.872	1,548	4.411	0.843	3,604	4.017	0.871	1,820
S_3	2.919	1.035	2,185	2.907	1.101	4,189	4.468	0.738	2,753	2.880	1.047	1,548	2.837	1.123	3,604	4.087	0.822	1,820
S_4 ($\geq$ 4)	4.367	0.482	2,185	4.360	0.480	4,189	4.533	0.499	2,753	4.358	0.480	1,548	4.342	0.474	3,604	4.484	0.500	1,820
S_5	3.243	1.116	2,185	3.281	1.186	4,189	4.444	0.838	2,753	3.853	1.038	1,548	4.081	1.003	3,604	4.491	0.697	1,820
Population $\overline{S_5}$	3.258	1.123	2,824	3.240	1.180	6,617	4.343	0.935	5,521	3.822	1.070	2,610	4.026	1.041	6,917	4.396	0.780	2,584
$S_5 \geq 4.0$																		
S_2	3.844	0.987	1,427	4.155	1.005	3,024	4.220	0.871	3,369	4.097	0.893	1,466	4.301	0.927	4,251	3.904	0.900	2,281
S_3	3.002	1.044	1,427	3.003	1.111	3,024	4.418	0.764	3,369	2.907	1.037	1,466	2.846	1.121	4,251	4.080	0.781	2,281
S_4 ($\geq$ 4)	3.954	0.972	1,427	3.800	1.074	3,024	4.041	0.962	3,369	3.959	0.943	1,466	3.727	1.065	4,251	4.082	0.820	2,281
S_5	4.238	0.426	1,427	4.317	0.465	3,024	4.679	0.467	3,369	4.364	0.481	1,466	4.491	0.500	4,251	4.597	0.491	2,281

ships, we find that there is little or no evidence for rejecting the null hypotheses in favor of either of the alternative hypotheses as stated in relationships 2.4 or 2.5.

Note, however, that had the alternative hypotheses in relationships 2.4 and 2.5 been stated with the inequality in the other direction we would have found overwhelming evidence supporting these restated alternative hypotheses. In every comparison in Table 4.2 we would have found the difference between the conditional means and the need strength value of 3 to be statistically significant at the .01 level or better. Similarly, in Table 4.3 there would have been 86 out of 96 comparisons in which the differences would have been statistically significant. For relationship 2.5 the results would also have been similar. In Table 4.2 the difference would have been statistically significant at a level of significance much better than .01 in all cases. For relationship 2.5 the differences between the mean need strengths shown in Table 4.3 would not all have been statistically significant in the opposite direction.

Table 4.4 summarizes the level of significance at which a restated relationship 2.5 would have held had the inequality been reversed. In this table we see that the mean need strength differences would have been statistically significant (at .01 or .05) in 58 out of 72 possible cases.

In summary, there is little or no evidence for rejecting the null hypotheses in favor of the alternative hypotheses stated in relationships 2.4 and 2.5. However, had we

TABLE 4.4

LEVEL OF SIGNIFICANCE IN THE TEST FOR DIFFERENCES IN MEAN NEED LEVEL STRENGTHS (ONE-TO-ONE CORRESPONDENCE DATA)

Statistic	Survey Number					
	72-34 (O)	72-34 (A)	72-73 (O & A)	73-22 (O)	73-22 (A)	73-50 (O)
$(\bar{S}_2/S_3 > 4)$ vs. $\bar{S}_2$	.05	.01	.01	.01	.01	.01
$(S_2/S_4 > 4)$ vs. $\bar{S}_2$	.01	.01	.01	.01	.01	.01
$(S_2/S_5 > 4)$ vs. $\bar{S}_2$	.05	-	.01	.05	.01	.05
$(\bar{S}_3/S_2 > 4)$ vs. $\bar{S}_3$	-	-	.01	-	-	.01
$(\bar{S}_3/S_4 > 4)$ vs. $\bar{S}_3$	-	.05	.01	-	.05	.01
$(\bar{S}_3/S_5 > 4)$ vs. $\bar{S}_3$	.01	.01	.01	.05	.01	.01
$(\bar{S}_4/S_2 > 4)$ vs. $\bar{S}_4$	.01	.01	.01	.05	.01	.01
$(\bar{S}_4/S_3 > 4)$ vs. $\bar{S}_4$	.01	.01	.01	.01	.01	.01
$(\bar{S}_4/S_5 > 4)$ vs. $\bar{S}_4$	-	.01	.01	-	.01	.01
$(\bar{S}_5/S_2 > 4)$ vs. $\bar{S}_5$	.05	-	.01	-	-	.01
$(\bar{S}_5/S_3 > 4)$ vs. $\bar{S}_5$	.01	.01	.01	.05	.01	.01
$(S_5/S_4 > 4)$ vs. $\bar{S}_5$		.05	.01	-	.01	.01

originally stated these alternative hypotheses in the other direction (reversed the inequality), then we would have rejected the null hypotheses, as we would have found overwhelming evidence supporting these restated alternative hypotheses.

IV. Hypothesis 3: Need Strength Correlations

This hypothesis states that given individuals who are clearly operating in one need level, the cross-correlations between their prepotent need strengths should be positive, the cross-correlations between their largely satisfied need strengths should be positive, and the cross-correlations between different need level pairs consisting of prepotent with largely satisfied strengths of need levels should be negative. Stated more rigorously, from Chapter 2 we have:

(2.6) $r_{lm} > 0$, where r_{lm} indicates the cross-correlation between $(S_l | S_i > 4)$ and $(S_m | S_i > 4)$;
$i = 1,2,3$;
$l = i+1,\ldots,5$;
$m = i+2,\ldots,5$;
$l \neq m$.

(2.7) $r_{pq} > 0$, where r_{pq} indicates the cross-correlation between $(S_p | S_i > 4)$ and $(S_q | S_i > 4)$;
$i = 3,4,5$;
$p = 1,\ldots,i-1$;
$q = 1,\ldots,i-2$;
$p \neq q$.

(2.8) $r_{jk}<0$, where r_{jk} indicates the cross-correlation between $(S_j|S_i>4)$ and $(S_k|S_i>4)$;

$i=2,3,4;$

$j=i+1,\ldots,5;$

$k=1,\ldots,i-1;$

$j\neq k.$

Table 4.5 presents all the cross-correlations calculated from the conditionally selected data from all six surveys. Both one-to-one correspondence and weighted correspondence results are presented in this table.

A. Correlations Based on Weighted Correspondence Data

For the weighted correspondence data there were 120 possible correlations predicted to be positive by the hypothesis, and 60 possible correlations predicted to be negative. Of the 120 predicted positive correlations all 120 were positive, and virtually all of them were quite strong. They ranged from a low of +.23 to a high of +.85, with most being around +.50. The mean of all 120 of these correlations was +.55. Of the 60 predicted negative correlations, all 60 were actually positive and had an overall mean of +.51. These correlations ranged from a low of +.16 to a high of +.71.

Based on the weighted correspondence data we find good evidence supporting those two parts of the hypothesis predicting positive correlations and no evidence supporting that part of the hypothesis predicting negative correlations.

TABLE 4.5

CROSS-CORRELATIONS BETWEEN UNEMERGED-UNEMERGED (U-U), LARGELY SATISFIED-LARGELY SATISFIED (L-L), AND UNEMERGED-LARGELY SATISFIED (U-L OR L-U) NEED LEVEL STRENGTHS

Item	Weighted Correspondence Data						One-to-One Correspondence Data					
	72-34 (O)	72-34 (A)	72-73 (O & A)	73-22 (O)	73-22 (A)	73-50 (O)	72-34 (O)	72-34 (A)	72-73 (O & A)	73-22 (O)	73-22 (A)	73-50 (O)
$S_1 \geq 4$												
(Pos.) 2-3 (U-U)	+.46	+.57	+.70	+.51	+.55	+.50						
2-4 (U-U)	+.57	+.62	+.52	+.55	+.62	+.59						
2-5 (U-U)	+.29	+.46	+.47	+.36	+.45	+.52						
3-4 (U-U)	+.47	+.47	+.61	+.50	+.47	+.50						
3-5 (U-U)	+.49	+.57	+.56	+.52	+.53	+.57						
4-5 (U-U)	+.53	+.53	+.84	+.63	+.61	+.87						
$S_2 \geq 4$												
(Pos.) 3-4 (U-U)	+.40	+.40	+.61	+.42	+.41	+.46	+.05	+.07	+.22	+.05	+.08	+.16
3-5 (U-U)	+.43	+.53	+.56	+.50	+.50	+.64	+.13	+.17	+.20	+.09	+.11	+.40
4-5 (U-U)	+.60	+.58	+.85	+.64	+.62	+.83	+.02	+.08	+.18	+.09	+.10	+.21
(Neg.) 1-3 (L-U)	+.16	+.35	+.51	+.21	+.32	+.56						
1-4 (L-U)	+.28	+.44	+.63	+.39	+.45	+.34						
1-5 (L-U)	+.50	+.67	+.59	+.58	+.68	+.59						
$S_3 \geq 4$												
(Pos.) 1-2 (L-L)	+.75	+.81	+.84	+.76	+.79	+.66						
4-5 (U-U)	+.60	+.68	+.83	+.59	+.68	+.83	+.003	+.11	+.16	+.08	+.09	+.24

TABLE 4.5 (continued)

Item	Weighted Correspondence Data						One-to-One Correspondence Data					
	72-34 (O)	72-34 (A)	72-73 (O & A)	73-22 (O)	73-22 (A)	73-50 (O)	72-34 (O)	72-34 (A)	72-73 (O & A)	73-22 (O)	73-22 (A)	73-50 (O)
$S_3 \geq 4$ (cont.)												
(Neg.) 1-4 (L-U)	+.53	+.61	+.67	+.39	+.56	+.36						
1-5 (L-U)	+.60	+.71	+.61	+.62	+.72	+.58						
2-4 (L-U)	+.51	+.65	+.58	+.42	+.59	+.57	+.17	+.27	+.26	+.13	+.24	+.28
2-5 (L-U)	+.33	+.56	+.51	+.40	+.53	+.56	-.06	+.02	+.18	+.06	+.06	+.12
$S_4 \geq 4$												
(Pos.) 1-2 (L-L)	+.74	+.76	+.84	+.75	+.77	+.71						
1-3 (L-L)	+.36	+.44	+.59	+.35	+.37	+.59						
2-3 (L-L)	+.45	+.53	+.72	+.44	+.47	+.55	+.04	+.05	+.32	+.06	+.02	+.25
(Neg.) 1-5 (L-U)	+.47	+.60	+.57	+.59	+.63	+.65						
2-5 (L-U)	+.28	+.47	+.51	+.43	+.48	+.55	-.05	-.01	+.22	+.04	+.06	+.07
3-5 (L-U)	+.40	+.56	+.55	+.45	+.51	+.63	+.12	+.17	+.20	+.09	+.09	+.34
$S_5 \geq 5$												
(Pos.) 1-2 (L-L)	+.75	+.78	+.85	+.76	+.73	+.68						
1-3 (L-L)	+.32	+.41	+.61	+.23	+.30	+.56						
1-4 (L-L)	+.31	+.41	+.69	+.27	+.41	+.34						
1-5 (L-L)	+.40	+.55	+.74	+.45	+.45	+.54	+.06	+.07	+.33	+.09	+.04	+.28
2-4 (L-L)	+.51	+.54	+.64	+.47	+.55	+.56	+.17	+.23	+.29	+.16	+.24	+.27
3-4 (L-L)	+.40	+.41	+.64	+.35	+.41	+.42	+.11	+.11	+.25	+.06	+.07	+.20

B. Correlations Based on One-to-One Correspondence Data

For this data there were 48 possible correlations predicted to be positive and 24 possible correlations predicted to be negative. Of the 48 predicted positive correlations all 48 were positive. They ranged from a low of +.003 to a high of +.40, and their overall mean was +.14. These results tend to support that part of the hypothesis predicting positive correlations. Of the 24 predicted negative correlations three were actually negative. They ranged from a low of -.06 to a high of +.34, and their overall mean was +.13. These results give good support to those two parts of the hypothesis predicting positive correlations and little support to that part of the hypothesis predicting negative correlations.

The results of the tests of this hypothesis are mixed. The correlations based on both the weighted and one-to-one correspondence data sets yield evidence strongly supporting those parts of the hypothesis predicting positive correlations. However, the correlations based on both data sets yield little or no evidence supporting that part of the hypothesis predicting negative correlations.

On another note, when we combine these results with the results of the tests of Hypothesis 2, we reach the conclusion that in fact different need level strengths correlate fairly strongly in a positive direction no matter where in their range they are being observed.

It begins to appear that people operate at many different need levels at the same time. If this is so, then we would get almost all strong positive correlations from the data. The fact that this occurred is a stronger validation of this alternate hypothesis than of the one tested. Therefore we must look at these results with a very critical eye.

V. Hypothesis 4: Age and Prepotent Need Strength

This hypothesis states that given individuals with potent need strength for level i needs ($S_i > 3$), then they should have prepotent need strength for level j (j=i+1) needs, and the relationship between their Age (A) and their prepotent need strength (S_j) should be of the following positive linear form, from Chapter 2:

(2.9) $S_j = B_j + C_jA, \quad j=2,\ldots,5;$

$S_i > 3 \ (i=j-1);$

where the parameter C_j is hypothesized to be positive and the parameter B_j is indeterminate in value and sign.

The SPSS multiple linear regression package is being used to run these regressions. Three measures of quality provided by the SPSS package are used with these regressions. The first is R-squared, which is the proportion of the variance in the dependent variable accounted for by the regression equation. The second measure is the F-statistic for the overall equation, which is the ratio of the mean square due to the regression to the mean square due to the

residual, and measures the significance of the regression equation representing more than mere chance. The third measure is the F-statistic computed for each coefficient, which is the value of the coefficient divided by the standard error of the coefficient, the entire quantity then squared. This statistic is in fact the t-statistic squared (with, say, n-1 degrees of freedom), which is identical to the F-statistic with 1 and n-1 degrees of freedom. (Mood and Graybill 1963, p. 233) These measures of quality together with this methodology will be used not only for testing Hypothesis 4, but also for testing Hypotheses 5, 6, 7 and 8.

This is the first of the five dynamic relationships to be tested. Table 4.6 gives the summarized regression parameters for the regressions based on the weighted correspondence data, and Table 4.7 gives similar results for the one-to-one correspondence data. The results in Table 4.6 show that the coefficient C_j (hypothesized to be positive) was positive and significant (at the .05 or .01 level or better) in 21 of 24 possible cases. However, the R-squared values were very low, ranging from a high of .14 down to virtually nothing.

Note the varying selection rate, n/N, in this table. This ratio is the number of individual records which met the selection criterion ($S_i>3$) divided by the total number of individual records eligible for selection. This rate varies from .51 to .97 for the regressions in Table 4.6. All of selection rates will be given in each of the tables presented for Hypotheses 4 through 8. We will return to the subject

TABLE 4.6

REGRESSION PARAMETERS FOR THE LINEAR RELATIONSHIP BETWEEN AGE (A) AND PREPOTENT NEED STRENGTH (S_j) (WEIGHTED CORRESPONDENCE DATA)

(2.9) $S_j = B_j + C_j A$, $j = 2, 3, 4, 5$; $S_i \geq 3$ $(i = j - 1)$
(Hypothesis 4: $C_j > 0$)

Survey Number and Condition	B_j	C_j	R^2	n	n/N
$j = 2$: $S_1 \geq 3$					
1. 72-34(O)	3.09	.016*	.09	2,409	.85
2. 72-34(A)	3.13	.023*	.13	5,199	.86
3. 72-73(O & A)	4.56	-.019*	.005	3,676	.78
4. 73-22(O)	3.14	.017*	.10	1,747	.66
5. 73-22(A)	3.24	.021*	.11	4,854	.70
6. 73-50(O)	4.07	.0012	.0002	2,359	.92
$j = 3$: $S_2 \geq 3$					
1.	3.19	.004*	.004	2,404	.85
2.	3.32	.002**	.001	5,182	.85
3.	4.11	.005	.0003	3,671	.78
4.	3.17	.004**	.004	2,633	.68
5.	3.33	.002	.0005	4,868	.70
6.	4.35	-.006*	.007	2,435	.95
$j = 4$: $S_3 \geq 3$					
1.	3.06	.018*	.11	1,950	.69
2.	2.99	.024*	.14	4,187	.69
3.	3.93	.013*	.003	3,685	.79
4.	3.05	.019*	.10	1,354	.51
5.	3.01	.023*	.12	3,809	.55
6.	4.18	.004*	.005	2,437	.95
$j = 5$: $S_4 \geq 3$					
1.	3.24	.003*	.003	2,417	.86
2.	3.33	.004*	.004	4,758	.78
3.	3.87	.020*	.01	3,704	.79
4.	3.32	.005*	.01	1,707	.65
5.	3.50	.006*	.01	4,348	.62
6.	4.38	-.003*	.003	2,477	.97

*Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

**Significant at $\alpha < .05$ on the F test with 1 and $n - 1$ degrees of freedom.

TABLE 4.7

REGRESSION PARAMETERS FOR THE LINEAR RELATIONSHIP BETWEEN AGE (A) AND PREPOTENT NEED STRENGTH (S_j) (ONE-TO-ONE CORRESPONDENCE DATA)

(2.9) $S_j = B_j + C_jA$, $j = 2, 3, 4, 5$; $S_i \geq 3$ $(i = j - 1)$
(Hypothesis 4: $C_j > 0$)

Survey Number and Condition	B_j	C_j	R^2	n	n/N
$j = 3$: $S_2 \geq 3$					
1.	3.44	-0.016*	.01	2,491	.88
2.	3.69	-.029*	.04	5,508	.91
3.	4.81	-.020*	.002	4,059	.87
4.	3.31	-.013*	.01	2,420	.92
5.	3.67	-.030*	.04	6,589	.95
6.	4.31	-.008*	.005	2,416	.94
$j = 4$: $S_3 \geq 3$					
1.	3.61	.010*	.01	1,601	.57
2.	3.14	.024*	.03	3,334	.55
3.	3.92	.002	<.0001	4,092	.87
4.	3.61	.011*	.01	1,412	.54
5.	3.14	.023*	.03	3,703	.53
6.	3.85	.006*	.003	2,482	.97
$j = 5$: $S_4 \geq 3$					
1.	3.82	-.018*	.02	2,527	.89
2.	3.77	-.179*	.01	4,936	.81
3.	3.01	.060*	.02	3,938	.84
4.	4.54	-.021*	.03	2,282	.87
5.	4.16	-.005*	.001	5,687	.82
6.	4.51	-.002	.0005	2,477	.97

*Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

of selection rates after all of these dynamic hypotheses have been discussed.

The results in Table 4.7 offer even less evidence in support of this hypothesis. Only six of 18 possible coefficients are positive and significant. The R-squared values here are also very low, ranging from a high of .04 on down. In summary, we find little evidence supporting the hypothesized relationship between age and prepotent need strength.

VI. Hypothesis 5: Age and Potent Need Strength

This hypothesis states that given individuals with a potent need strength for level i needs, the relationship between their Age (A) and their potent need strength (S_i) should be of the following inverse form for need level 1:

(2.10) $S_1 = + D_1/A, \quad S_1 > 3;$

where the parameter D_1 is hypothesized to be positive.

The relationship should be of the following concave-down parabolic form for need levels 2, 3 and 4:

(2.11) $S_i = - D_iA^2 + E_iA + F_i, \quad i=2,3,4;$

$S_i > 3;$

and the parameters D_i and E_i are hypothesized to be positive. The parameter F_i is indeterminate in sign and value.

The relationship should be of the following inverse form for need level 5:

(2.12) $S_5 = + D_5 - E_5/A, \quad S_5 > 3;$

and the parameters D_5 and E_5 are hypothesized to be positive.

In attempting to test the first part of Hypothesis 5 (relationship 2.10) a change of plan occurred. The SPSS statistical package will not perform linear regressions with a forced-zero intercept, as is required to test relationship 2.10. One alternative would have been to rerun the six sets of survey data using a statistical package such as BMD, which can perform the required forced-zero intercept regressions. This would have resulted in a significant increase in computer costs and time. A second possible alternative was to simply analyze the correlations between the inverse of age and need strength S_1 (given $S_1 > 3$), data which was already available from the SPSS runs. While not as rigorous as actual regressions, such correlations will clearly indicate the signs of the sought-after coefficients, though not their actual significance. That is, if the correlation between S_1 and the inverse of age is found to be positive (given that S_1 is in its operating range), this would be evidence which supports the hypothesized relationship between age and need strength S_1. Finding a correlation which is zero or negative would be evidence not supportive of this hypothesized relationship. This second alternative was accepted and used for testing relationship 2.10.

This identical problem occurs in testing the non-linear form of Hypothesis 6, namely relationship 2.14b. Therefore, relationship 2.14b also was not directly tested, but instead the correlations were analyzed. However, since relationship 2.14b is only one of two forms for testing Hypothesis 6,

and since the other form is testable by regression analysis, this is not a very serious problem.

Table 4.8 displays the data concerning relationship 2.10. Note that only weighted correspondence data is used, as there was no one-to-one correspondence data for need strength of level 1 (S_1). Also, due to the lack of regression coefficients, Rank and Education Level were added as surrogates for Age to see what correlations these "growth" variables would display with respect to the operating need strength of S_1. These correlations are also shown in Table 4.8.

The results are not supportive of the hypothesis. The Age-S_1 correlations vary from .121 to -.251. Four out of the six are negative, though none are strongly negative. The Rank-S_1 correlations give about the same results. Only the Education Level-S_1 correlations show a predominantly positive nature, though weakly so. In summary, while we cannot for the present test the hypothesized relationship directly, the available correlational evidence does not offer much support for this first part of Hypothesis 5.

The second part of Hypothesis 5, relationship 2.11, involves testing a second-order equation. There are two specific statistical problems this situation creates, which will be discussed prior to the direct analysis.

Relationship 2.11 involves as "independent" variables Age and Age-squared. This immediately creates strong colinearity between these two independent variables which are,

TABLE 4.8

PARAMETERS FOR THE INVERSE RELATIONSHIP BETWEEN AGE (A) AND POTENT NEED STRENGTH (S_1) (WEIGHTED CORRESPONDENCE DATA)

(2.10) $S_1 = +D_1/A \quad (S_1 \geq 3)$
(Hypothesis 5a: $D_1 > 0$)

Survey Number and Condition	Age	n	n/N	Rank	Ed. Level
	$r_{S_1, 1/A}$			$r_{S_1, 1/R}$	$r_{S_1, 1/E}$
$S_1 \geq 3$					
1.	-.210	2,409	.85	-.127	-
2.	-.251	5,199	.86	-.081	.110
3.	.054	3,676	.78	-	.061
4.	-.223	1,747	.66	-.130	-.003
5.	-.233	4,854	.70	-.088	.101
6.	.121	2,359	.92	.128	-.036

in fact, closely related to each other. Given such colinearity the least squares methodology used for these regressions can easily misapportion the coefficient strength between any strongly colinear independent variables. The technique should, however, still choose the correct sign of the estimated coefficients. We can do absolutely nothing about this problem, given that we require regressing such relationships, except to be aware of the situation.

The second problem can be easily handled. Whenever we regress a dependent variable against more than one independent variable we are immediately in the realm of simultaneous statistical inference. "The basic premise of simultaneous statistical inference is to give increased protection to a null hypothesis involving a group of parameters." (Miller 1966, p. 32) What this means is simply that we should require each of the coefficients and the overall equation to be significant at higher levels than in the case of relationships with only one independent variable, for then the overall joint relationship will still maintain a reasonable level of significance. Thus, where we might have been satisfied with a .05 level of significance for the coefficient and overall equation involving a single independent variable, we would probably be wise to require moving down to .025 or even .01 for accepting as significant the coefficients and the overall equation in relationships involving two (or more) independent variables.

We can now move on to analyzing the regression results for relationship 2.11. Table 4.9 shows the regression parameters for the weighted correspondence data and Table 4.10 shows the parameters for the one-to-one correspondence data.

In Table 4.9 the coefficients are both significant and of the hypothesized signs in three of the 18 possible cases. The F-statistic for the overall equation is also significant (at .01) in all three cases (on an F-test with 2 and n-2 degrees of freedom). However, in these three cases R-squared ranges from less than .01 up to only .08.

In Table 4.10 both coefficients are significant and of the hypothesized sign in seven out of 18 possible cases. The corresponding F-statistic for the overall equation is also significant (at .01 or better, on an F-test with 2 and n-2 degrees of freedom) in all seven cases. However, the corresponding R-squared values are again very low, ranging between .01 and .07.

As previously noted in Chapter 2 relationship 2.12 was developed from a more complex and untestable form after all the data analyses had been accomplished. However, based on the other available results we can make reasonable inferences about what the results of regressions of the form of relationships 2.12 would have yielded.

Specifically, for the weighted correspondence data we know that S_4 and S_5 have, overall, a highly positive cor-

TABLE 4.9

REGRESSION PARAMETERS FOR PARABOLIC RELATIONSHIP BETWEEN AGE (A) AND POTENT NEED STRENGTH (S_i) (WEIGHTED CORRESPONDENCE DATA)

(2.11) $S_i = -D_iA^2 + E_iA + F_i$, $i = 2, 3, 4$; $S_i \geq 3$
(Hypothesis 5b: $D_i, E_i > 0$)

Survey Number and Condition	D_i	E_i	F_i	R^2	F Overall Sig. at >	n	n/N
$i = 2$: $S_2 \geq 3$							
1.	.0003*	.034*	2.90	.07	.01	2,404	.85
2.	-.0001	.014**	3.36	.11	.01	5,182	.85
3.	.0073*	.316*	0.76	.01	.01	3,671	.78
4.	.0001	.009	3.36	.07	.01	1,785	.68
5.	.0002	.028*	3.22	.10	.01	4,868	.70
6.	-.0005*	-.037*	4.73	.004	.01	2,435	.95
$i = 3$: $S_3 \geq 3$							
1.	-.0001	-.005	3.54	.005	.01	1,950	.69
2.	-.0006*	-.033*	3.99	.01	.01	4,187	.69
3.	.0066*	.303*	0.77	.002	.05	3,685	.79
4.	-.0002	-.009	3.63	.005	.05	1,354	.51
5.	-.0004*	-.022*	3.88	.003	.01	3,809	.55
6.	-.0006*	-.046*	5.03	.01	.01	2,437	.95
$i = 4$: $S_4 \geq 3$							
1.	.0003*	.034*	2.89	.08	.01	2,417	.86
2.	-.00004	.014**	3.28	.09	.01	4,758	.78
3.	.0005	.037	3.67	.003	.01	3,704	.79
4.	-.0001	.007	3.33	.07	.01	1,707	.65
5.	.0001	.020*	3.21	.07	.01	4,348	.62
6.	-.00001	.003	4.20	.004	.01	2,477	.97

*Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

**Significant at $\alpha < .05$ on the F test with 1 and $n - 1$ degrees of freedom.

TABLE 4.10

REGRESSION PARAMETERS FOR PARABOLIC RELATIONSHIP BETWEEN AGE (A) AND POTENT NEED STRENGTHS (S_i) (ONE-TO-ONE CORRESPONDENCE DATA)

(2.11) $S_i = -D_iA^2 + E_iA + F_i$, $i = 2, 3, 4$; $S_i \geq 3$
(Hypothesis 5b: $D_i, E_i > 0$)

Survey Number and Condition	D_i	E_i	F_i	R^2	F Overall Sig. at >	n	n/N
$i = 2$: $S_2 \geq 3$							
1.	.0007*	.057*	3.06	.02	.01	2,491	.88
2.	.0007*	.064*	3.19	.07	.01	5,508	.91
3.	.0106*	.439*	-.228	.02	.01	4,059	.87
4.	.0005*	.043*	3.48	.01	.01	2,420	.92
5.	.0009*	.072*	3.18	.06	.01	6,589	.95
6.	-.0008*	-.055*	4.88	.005	.01	2,418	.94
$i = 3$: $S_3 \geq 3$							
1.	-.0003	-.020	4.04	.001	-	1,601	.57
2.	-.0005**	-.026**	4.03	.003	.01	3,334	.55
3.	.016*	.709*	-3.25	.02	.01	4,092	.87
4.	-.0003	-.019	4.01	.002	-	1,412	.54
5.	-.0006*	-.033*	4.13	.004	.01	3,703	.53
6.	-.0001*	-.082*	5.57	.01	.01	2,482	.97
$i = 4$: $S_4 \geq 3$							
1.	.0002	.025**	3.64	.01	.01	2,527	.89
2.	.0003	.031*	3.53	.02	.01	4,936	.81
3.	.0006	.014	4.08	.001	-	3,938	.84
4.	.0001	.016	3.87	.005	.01	2,282	.87
5.	.0003**	.033*	3.48	.02	.01	5,687	.82
6.	.0001	.012	3.84	.001	-	2,477	.97

*Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

**Significant at $\alpha < .05$ on the F test with 1 and $n - 1$ degrees of freedom.

relation, ranging from .63 to .92 across the six surveys with no range constraints on either variable. We also know that S_4 and Age correlate positively (.05 to .35 across the six surveys), given that S_5 is in its operating range. We also have one direct correlation between S_5 and Age, given $S_5 > 4$, which is .03. This correlation was available from a test run made on Survey 73-22(0). Finally, we have the results of the regressions between S_4 and Age, given $S_5 > 3$, in Table 4.11. From all this we can deduce that S_5 regressed against the inverse of age (per relationship 2.12) would show all positive estimates for the constant term D_5 and negative estimates for the coefficient E_5. Further, we would likely see some of these coefficients signficant and some not significant, and we would also find low R-squared values, probably around .10 or less.

For the one-to-one correspondence data we find low positive correlations between S_4 and S_5, ranging from .03 to .22 across all six surveys, with no range constraints on either variable. Also, S_4 and Age correlate weakly positive or weakly negative, given $S_5 > 3$, with the correlations ranging from -.001 to +.16. We also have one S_5-Age correlation, given $S_5 > 3$, which is -.06. This was available from a test run on Survey 73-22(0). Finally, we have the regressions between S_4 and Age, given $S_5 > 3$, in Table .12. Our deductions here are much more precarious than for the weighted correspondence data, due to the low correlations for the S_4-Age link and the S_4-S_5 link in our chain of

logic. However, we would probably see mostly positive estimates for the constant term D_5 and mostly negative, usually significant estimates for the coefficient E_5. The values for R-squared would probably be very low, ranging under .02 in all cases.

In summary, we would likely find little evidence in support of the hypothesized relationship between S_5 and Age, as stated in relationship 2.12. The signs of the parameters would probably be as predicted. However the low R-squared values would give us little evidence to support this hypothesized relationship.

Summarizing the results of all the tests for Hypothesis 5 we find little evidence in either Tables 4.9 and 4.10 or in the other data to support the hypothesized relationships between age and strength of a potent need level. Though some of the coefficients are significant and of the hypothesized sign, the low R-squared values are certainly not very supportive of the hypothesis.

VII. Hypothesis 6: Age and Largely Satisfied Need Strength

This hypothesis states that given individuals with potent need strength for level i needs ($S_i > 3$), then they should have largely satisfied need strength for level k (k=i-1) needs, and the relationship between their Age (A) and their largely satisfied need strength (S_k) should be of the following negative linear form, from Chapter 2:

(2.14a) $S_k = + G_k - H_k A, \quad k=1,\ldots,4;$

$S_i > 3 \ (i=k+1);$

and the parameters G_k and H_k are hypothesized to be positive.

Or, the relationship should be of the following inverse form:

(2.14b) $S_k = + L_k/A, \quad k=1,\ldots,4;$

$S_i > 3 \ (i=k+1);$

and the parameter L_k is hypothesized to be positive.

Tables 4.11 and 4.12 display the results of the regressions of the form of relationship 2.14a for the weighted and one-to-one correspondence data, respectively. In Table 4.11 all 24 of the constant-term values for G_k were positive, as hypothesized. For the coefficient H_k only five of the 24 estimated values were significant and of the hypothesized sign. Also, in these five cases R-squared was quite low, ranging from .01 downward.

In Table 4.12 the story is about the same. All 18 of the constant-term estimates were positive. Seven of the 18 estimates for the coefficient H_k were significant and of the hypothesized sign. In these seven significant regressions R-squared was quite low, varying from .05 downward.

In summary, we find very little evidence to support the linear relationship hypothesized between age and largely satisfied need strength.

The inverse relationship hypothesized in 2.14b could not be directly tested, due to the inability of the SPSS

TABLE 4.11

REGRESSION PARAMETERS FOR LINEAR RELATIONSHIP BETWEEN AGE (A) AND LARGELY SATISFIED NEED STRENGTH (S_k) (WEIGHTED CORRESPONDENCE DATA)

(2.14a) $S_k = +G_k - H_kA$, $k = 1, 2, 3, 4$; $S_i \geq 3$ $(i = k + 1)$
(Hypothesis 6a: $G_k, H_k > 0$)

Survey Number and Condition	G_k	H_k	R^2	n	n/N
$k = 1$: $S_2 \geq 3$					
1.	3.35	-.008*	.02	2,404	.85
2.	3.39	-.014*	.05	5,182	.85
3.	4.43	.014*	.003	3,671	.78
4.	3.33	-.012*	.03	1,785	.68
5.	3.46	-.013*	.04	4,868	.70
6.	4.24	.010*	.01	2,435	.95
$k = 2$: $S_3 \geq 3$					
1.	3.12	-.016*	.09	1,950	.69
2.	3.15	-.025*	.14	4,187	.69
3.	4.56	.019*	.005	3,685	.79
4.	3.24	-.016*	.08	1,354	.51
5.	3.32	-.021*	.12	3,809	.55
6.	4.10	.001	<.001	2,437	.95
$k = 3$: $S_4 \geq 3$					
1.	3.23	-.0025**	.002	2,417	.86
2.	3.42	-.0002	<.001	4,758	.78
3.	4.11	-.0041	<.001	3,704	.79
4.	3.25	-.0023	.001	1,707	.65
5.	3.48	.0024**	.001	4,348	.62
6.	4.38	.0072*	.01	2,477	.97
$k = 4$: $S_5 \geq 3$					
1.	3.09	-.018*	.12	1,965	.70
2.	3.07	-.022*	.13	4,097	.68
3.	3.93	-.014*	.003	3,774	.80
4.	2.97	-.020*	.11	1,627	.62
5.	2.97	-.023*	.12	4,539	.65
6.	4.19	-.004*	.004	2,466	.96

*Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

**Significant at $\alpha < .05$ on the F test with 1 and $n - 1$ degrees of freedom.

TABLE 4.12

REGRESSION PARAMETERS FOR LINEAR RELATIONSHIP BETWEEN AGE (A) AND LARGELY SATISFIED NEED STRENGTH (S_k) (ONE-TO-ONE CORRESPONDENCE DATA)

(2.14a) $S_k = +G_k - H_kA$, $k = 2, 3, 4$; $S_i \geq 3$ $(i = k + 1)$
(Hypothesis 6a: $G_k, H_k > 0$**)**

Survey Number and Condition	G_k	H_k	R^2	n	n/N
$k = 2$: $S_3 \geq 3$					
1.	3.30	-.019*	.03	1,601	.57
2.	3.24	-.035*	.06	3,334	.55
3.	4.98	.038*	.01	4,092	.87
4.	3.68	-.015*	.02	1,412	.54
5.	3.56	-.028*	.05	3,703	.53
6.	3.73	-.005	.002	2,482	.97
$k = 3$: $S_4 \geq 3$					
1.	3.37	.014*	.01	2,527	.89
2.	3.66	.027*	.04	4,936	.81
3.	5.09	.033*	.01	3,938	.84
4.	3.29	.013*	.01	2,282	.87
5.	3.73	.032*	.05	5,687	.82
6.	4.29	.007*	.005	2,477	.97
$k = 4$: $S_5 \geq 3$					
1.	3.46	-.014*	.01	1,847	.65
2.	3.20	-.020*	.02	3,880	.64
3.	3.99	.0005	<.001	4,355	.93
4.	3.49	-.013*	.01	2,188	.83
5.	3.13	-.022*	.02	6,057	.87
6.	3.87	-.005*	.002	2,498	.98

*Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

package to run forced-zero intercept linear regressions. However, the correlations between the inverse of age and largely satisfied need strength give us a reasonable indication of what the data looks like, though these correlations are not as rigorous as regression coefficients would be. Also, since relationship 2.14b is an alternative way of testing the same hypothesis (the first way being via relationship 2.14a, which was directly tested), we need not be too concerned that a direct test is not made. Finally, Rank and Education Level were also available, and the correlations between largely satisfied need strength and the inverse of these two "growth" variables are also calculated and analyzed. Table 4.13 displays these correlations for both the weighted correspondence data and the one-to-one correspondence data.

In Table 4.13 we find seven of the 24 possible weighted-correspondence-data correlations between the inverse of age and largely satisfied need strength are positive, as hypothesized. For the one-to-one data set eight of the 18 possible correlations are positive. Note that none of these positive correlations are very strong, ranging from a low of .003 to a high of .238.

The correlations between the inverse of rank and largely satisfied need strength yield about the same results as for age. Six of the 20 possible correlations (weighted data only) were positive, ranging from .003 to .129. For the education level variable we find more sup-

TABLE 4.13

PARAMETERS FOR INVERSE RELATIONSHIP BETWEEN AGE (A) AND LARGELY SATISFIED NEED STRENGTH (S_k) (WEIGHTED CORRESPONDENCE [W] AND ONE-TO-ONE CORRESPONDENCE [1:1] DATA)

(2.14b) $S_k = +L_k/A$, $k = 1, 2, 3, 4$; $S_i \geq 3$ $(i = k + 1)$
(Hypothesis 6b: $L_k > 0$)

Survey Number and Condition	Age (W) (W) $r_{S_k, 1/A}$	(W) n	(W) n/N	Rank (W) (W) $r_{S_k, 1/R}$	Ed. Level (W) (W) $r_{S_k, 1/E}$	Age (1:1) (1:1) $r_{S_k, 1/A}$	(1:1) n	(1:1) n/N
$k = 1$: $S_2 \geq 3$								
1.	-.159	2,404	.85	-.097	-	-	-	-
2.	-.203	5,182	.85	-.061	.076	-	-	-
3.	.051	3,671	.78	-	.052	-	-	-
4.	-.166	1,785	.68	-.103	-.040	-	-	-
5.	-.199	4,868	.70	-.070	.059	-	-	-
6.	.131	2,435	.95	.129	-.061	-	-	-
$k = 2$: $S_3 \geq 3$								
1.	-.306	1,950	.69	-.185	-	-.171	1,601	.57
2.	-.369	4,187	.69	-.164	.128	-.255	3,334	.55
3.	.064	3,685	.79	-	.066	.068	4,092	.87
4.	-.289	1,354	.51	-.197	.099	-.148	1,412	.54
5.	-.343	3,809	.55	-.154	.116	-.224	3,703	.53
6.	.023	2,437	.95	.078	-.051	-.023	2,482	.97
$k = 3$: $S_4 \geq 3$								
1.	-.032	2,417	.86	-.003	-	.118	2,527	.89
2.	.022	4,758	.78	.091	.106	.212	4,936	.81
3.	-.022	3,704	.79	-	-.012	.069	3,938	.84
4.	-.010	1,707	.65	.003	.062	.115	2,282	.87
5.	.047	4,348	.62	.092	.064	.238	5,687	.82
6.	.110	2,477	.97	.116	-.112	.087	2,477	.97
$k = 4$: $S_5 \geq 3$								
1.	-.350	1,965	.70	-.194	-	-.120	1,847	.65
2.	-.342	4,097	.68	-.132	.143	-.144	3,880	.64
3.	-.054	3,774	.80	-	-.032	.003	4,355	.93
4.	-.325	1,627	.62	-.225	.116	-.011	2,183	.83
5.	-.340	4,539	.65	-.162	.122	-.161	6,057	.87
6.	-.060	2,466	.96	-.017	-.070	-.049	2,498	.98

portive results, where 12 of the 20 possible correlations (weighted correspondence data) were positive, ranging from .052 to .143.

Summarizing the results of the tests for both relationships 2.14a and 2.14b, we find some slight evidence in support of the hypothesized relationships between age and largely satisfied need strength.

VIII. Hypothesis 7: Prepotent and Potent Need Strengths

This hypothesis states that given individuals with potent need strength for level i needs ($S_i > 3$), then they should have prepotent need strength for need level j (j=i+1) needs, and the relationship between their prepotent need strength (S_j) and their potent need strength (S_i) should be of the following inverse form for the S_1-S_2 need strengths:

(2.15) $S_2 = B_2 + M_2/S_1, \quad S_1 > 3;$

where the parameter M_2 is hypothesized to be positive. The parameter B_2 is indeterminate in sign and value. Note that relationship 2.15 can only be tested where measures of the strength of level 1 needs are available.

The relationship should be of the following convex parabolic form for S_2-S_3, S_3-S_4 and S_4-S_5:

(2.16) $S_i = -N_i S_j^2 + O_i S_j + P_i, \quad j=3,4,5;$

$i=j-1;$

$S_i > 3;$

where the parameters N_i and O_i are hypothesized to be posi-

tive. The parameter P_1 is indeterminate in sign and value.

Table 4.14 shows the results of the regressions for relationship 2.15, for weighted correspondence data only. (Recall that no one-to-one correspondence need strength data is available for S_1.) None of the six coefficients are significant and of the hypothesized sign. The R-squared values are, for the first time, reasonably high, ranging from .49 to .71. Thus, we find no evidence to support the hypothesized relationship between prepotent need strength S_2 and potent need strength S_1. Note, however, that had we hypothesized the coefficient to be of the opposite sign we would have found strong evidence in support of this restated hypothesis.

Tables 4.15 and 4.16 display the results for the regressions of the form of relationship 2.16. In Table 4.15, based on the weighted correspondence data, we find no coefficients which are significant and of the hypothesized signs, in the 18 possible regressions. All the R-squared values are reasonably high, ranging from .18 to .74. All the F-statistics for the overall equation are significant (at a level of .01 or better on an F-test with 2 and n-2 degrees of freedom). Thus, we find no evidence in these regressions to support the hypothesized relationship. Note, however, that had we hypothesized coefficients of the opposite signs than those actually hypothesized we would have found strong evidence in support of such a restated hypothesis.

TABLE 4.14

REGRESSION PARAMETERS FOR INVERSE RELATIONSHIP BETWEEN PREPOTENT NEED STRENGTH (S_2) AND POTENT NEED STRENGTH (S_1) (WEIGHTED CORRESPONDENCE DATA)

(2.15) $S_2 = B_2 + M_2/S_1$, $S_1 \geq 3$
(Hypothesis 7a: $M_2 > 0$)

Survey Number and Condition	B_2	M_2	R^2	n	n/N
$S_1 \geq 3$					
1.	6.78	-11.65*	.54	2,409	.85
2.	7.20	-12.87*	.62	5,199	.86
3.	7.61	-14.12*	.71	3,676	.78
4.	6.87	-11.62*	.56	1,747	.66
5.	7.15	-12.65*	.62	4,854	.70
6.	6.72	-10.16*	.49	2,359	.92

*Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

TABLE 4.15

REGRESSION PARAMETERS FOR PARABOLIC RELATIONSHIP BETWEEN PREPOTENT (S_j) AND POTENT (S_i) NEED STRENGTHS (WEIGHTED CORRESPONDENCE DATA)

(2.16) $S_i = -N_i S_j^2 + O_i S_j + P_i$, $j = 3, 4, 5$; $i = j - 1$; $S_i \geq 3$
(Hypothesis 7b: $N_i, O_i > 0$)

Survey Number and Condition	N_i	O_i	P_i	R^2	F Overall Sig. at >	n	n/N
$j = 3$: $S_2 \geq 3$							
1.	-.090*	-0.223	3.40	.25	.01	2,404	.85
2.	-.087*	-0.099	3.14	.37	.01	5,182	.85
3.	-.218*	-1.036*	4.57	.60	.01	3,671	.78
4.	-.079*	-0.105	3.20	.30	.01	1,747	.68
5.	-.049*	0.142	2.81	.36	.01	4,868	.70
6.	-.231*	-1.308*	5.48	.38	.01	2,435	.95
$j = 4$: $S_3 \geq 3$							
1.	-.147*	-0.750*	4.24	.18	.01	1,950	.69
2.	-.168*	-0.849*	4.38	.26	.01	4,187	.69
3.	-.158*	-0.591*	3.85	.52	.01	3,685	.79
4.	-.137*	-0.669*	4.10	.19	.01	1,354	.51
5.	-.170*	-0.861*	4.40	.25	.01	3,809	.55
6.	-.281*	-1.711*	6.27	.32	.01	2,437	.95
$j = 5$: $S_4 \geq 3$							
1.	-.143*	-0.478*	3.65	.37	.01	2,417	.86
2.	-.176*	-0.705*	3.99	.45	.01	4,758	.78
3.	-.191*	-0.693*	3.63	.78	.01	3,704	.79
4.	-.270*	-1.340*	5.00	.43	.01	1,707	.65
5.	-.291*	-1.545*	5.39	.49	.01	4,348	.62
6.	-.095*	0.058	2.29	.74	.01	2,477	.97

*Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

TABLE 4.16

REGRESSION PARAMETERS FOR PARABOLIC RELATIONSHIP BETWEEN PREPOTENT (S_j) AND POTENT (S_i) NEED STRENGTHS (ONE-TO-ONE CORRESPONDENCE DATA)

(2.16) $S_i = -N_i S_j^2 + O_i S_j + P_i$, $j = 3, 4, 5$; $i = j - 1$; $S_i > 3$
(Hypothesis 7b: N_i, $O_i > 0$)

Survey Number and Condition	N_i	O_i	P_i	R^2	F Overall Sig. at >	n	n/N
$j = 3$: $S_2 \geq 3$							
1.	-.040*	-.256*	4.54	.01	.01	2,491	.88
2.	-.096*	-.572*	5.12	.03	.01	5,508	.91
3.	-.111*	-.538*	4.38	.13	.01	4,059	.87
4.	-.068*	-.374*	4.75	.02	.01	2,420	.92
5.	-.072*	-.423*	5.01	.02	.01	6,589	.95
6.	-.162*	-.995*	5.26	.09	.01	2,416	.94
$j = 4$: $S_3 \geq 3$							
1.	-.036*	-.209**	3.95	.01	.01	1,601	.57
2.	-.093*	-.558*	4.41	.04	.01	3,334	.55
3.	-.097*	-.498*	4.74	.11	.01	4,092	.87
4.	-.074*	-.497*	4.45	.02	.01	1,412	.54
5.	-.081*	-.471*	4.26	.03	.01	3,703	.53
6.	-.062*	-.297**	4.24	.05	.01	2,482	.97
$j = 5$: $S_4 \geq 3$							
1.	-.070*	-.431*	4.78	.02	.01	2,527	.89
2.	-.097*	-.584*	4.87	.04	.01	4,936	.81
3.	-.098*	-.536*	4.50	.06	.01	3,938	.84
4.	-.048*	-.294*	4.60	.01	.01	2,282	.87
5.	-.075*	-.468*	4.71	.03	.01	5,687	.82
6.	-.129*	-.822*	5.13	.05	.01	2,477	.97

*Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

**Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

In Table 4.16 we again find no coefficients which are significant and of the hypothesized signs. The R-squared values for this one-to-one correspondence data are low, ranging from .01 up to .13. All the F-statistics for the overall equation are significant (at a level of .01 or better, on an F-test with 2 and n-2 degrees of freedom).

In summary, we find no evidence to support either of the hypothesized relationships (2.15 and 2.16) between prepotent and potent need strengths. Note, however, that we would have found fair to strong evidence supporting restated hypotheses which predicted coefficient signs opposite to those actually predicted by the given hypotheses.

IX. Hypothesis 8: Largely Satisfied and Potent Need Strengths

This hypothesis states that given individuals with potent need strength for level i needs ($S_i > 3$), then they should have largely satisfied need strength for level k (k=i-1) needs, and the relationship between their potent need strength (S_i) and their largely satisfied need strength (S_k) should be of the following convex parabolic form for need strength pairs S_1-S_2, S_2-S_3 and S_3-S_4, from Chapter 2:

(2.17a) $S_i = -Q_i S_k^2 + R_i S_k + T_i$, $k=1,2,3;$ $i=k+1;$ $S_i > 3;$

where the parameters Q_i and R_i are hypothesized to be posi-

tive. Parameter T_i is indeterminate in sign and value.

Or, the relationship should be of the following inverse parabolic form:

(2.17b) $S_i = - U_i/S_k^2 + V_i/S_k + W_i$, $k=1,2,3$; $i=k+1$; $S_i>3$;

where the parameters U_i and V_i are hypothesized to be positive. The parameter W_i is indeterminate in sign and value.

For the S_4-S_5 need strength pair we have the following (testable) relationship from Chapter 2:

(2.18b) $S_5 = + f_5 - g_5 S_4$, $S_5>3$;

and we hypothesize that the parameters f_5 and g_5 are positive.

Tables 4.17 and 4.18 show the regression results of the form of relationship 2.17a, for the weighted and one-to-one correspondence data respectively. In Table 4.17 we find no coefficients that are significant and of the hypothesized signs. The R-squared values are reasonably high, ranging from .20 up to .74. The F-statistics for the overall equation are all significant (at a level of .01 or better, on the F-test with 2 and n-2 degrees of freedom). Thus, the regressions based on the weighted correspondence data offer no evidence to support the hypothesized relationship of 2.17a. Note, however, that had we hypothesized coefficients of the opposite signs than those actually hypothesized we would have found strong evidence in support of such a restated hypothesis.

TABLE 4.17

REGRESSION PARAMETERS FOR PARABOLIC RELATIONSHIP BETWEEN LARGELY SATISFIED (S_k) AND POTENT (S_i) NEED STRENGTHS (WEIGHTED CORRESPONDENCE DATA)

(2.17a) $S_i = -Q_i S_k^2 + R_i S_k + T_i$, $k = 1, 2, 3$; $i = k + 1$; $S_i \geq 3$
(Hypothesis 8a: $Q_i, R_i > 0$)

Survey Number and Condition	Q_i	R_i	T_i	R^2	F Overall Sig. at >	n	n/N
$k = 1$: $S_2 \geq 3$							
1.	-.253*	-1.184*	4.60	.60	.01	2,404	.85
2.	-.239*	-1.091*	4.46	.67	.01	5,182	.85
3.	-.112*	-0.066	2.50	.74	.01	3,671	.78
4.	-.265*	-1.288*	4.84	.59	.01	1,747	.68
5.	-.230*	-1.043*	4.43	.66	.01	4,868	.70
6.	-.089*	-0.082	3.01	.53	.01	2,435	.95
$k = 2$: $S_3 \geq 3$							
1.	-.200*	-1.106*	4.84	.20	.01	1,950	.69
2.	-.270*	-1.596	5.66	.32	.01	4,187	.69
3.	-.109*	-0.173	3.05	.59	.01	3,685	.79
4.	-.236*	-1.367*	5.28	.24	.01	1,354	.51
5.	-.298*	-1.819*	6.07	.31	.01	3,809	.55
6.	-.145*	-0.613*	4.21	.39	.01	2,437	.95
$k = 3$: $S_4 \geq 3$							
1.	-.107*	-0.348**	3.63	.22	.01	2,417	.86
2.	-.122*	-0.403*	3.62	.29	.01	4,758	.78
3.	-.153*	-0.598*	4.01	.52	.01	3,704	.79
4.	-.113*	-0.383**	3.66	.22	.01	1,707	.65
5.	-.114*	-0.376*	3.62	.27	.01	4,348	.62
6.	-.081	-0.231	3.85	.31	.01	2,477	.97

*Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

**Significant at $\alpha < .05$ on the F test with 1 and $n - 1$ degrees of freedom.

TABLE 4.18

REGRESSION PARAMETERS FOR PARABOLIC RELATIONSHIP BETWEEN LARGELY SATISFIED (S_k) AND POTENT (S_i) NEED STRENGTHS (ONE-TO-ONE CORRESPONDENCE DATA)

(2.17a) $S_i = -Q_i S_k^2 + R_i S_k + T_i$, $k = 2, 3$; $i = k + 1$; $S_i \geq 3$
(Hypothesis 8a: $Q_i, R_i > 0$)

Survey Number and Condition	Q_i	R_i	T_i	R^2	F Overall Sig. at >	n	n/N
$k = 2$: $S_3 \geq 3$							
1.	-.016	-.079	3.77	.003	-	1,601	.57
2.	-.087*	-.524*	4.31	.04	.01	3,334	.55
3.	-.083*	-.348*	4.35	.13	.01	4,092	.87
4.	-.075*	-.480*	4.37	.03	.01	1,412	.54
5.	-.077*	-.462*	4.22	.03	.01	3,703	.53
6.	-.066*	-.252**	4.02	.09	.01	2,482	.97
$k = 3$: $S_4 \geq 3$							
1.	-.063*	-.378*	4.70	.01	.01	2,527	.89
2.	-.100*	-.584*	4.86	.03	.01	4,936	.81
3.	-.105*	-.507*	4.25	.02	.01	3,938	.84
4.	-.071*	-.367*	4.62	.02	.01	2,282	.87
5.	-.084*	-.497*	4.75	.03	.01	5,687	.82
6.	-.092*	-.529*	4.68	.04	.01	2,477	.97

*Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

**Significant at $\alpha < .05$ on the F test with 1 and $n - 1$ degrees of freedom.

In Table 4.18 we again find no coefficients that are significant and of the hypothesized signs. The R-squared values are fairly low for this one-to-one correspondence data, ranging from .003 up to .13. Eleven of the 12 F-statistics for the overall equation are significant at a level of .01 or better, on an F-test with 2 and n-2 degrees of freedom.

Summarizing, we find no evidence in either data set to support the hypothesized concave-down parabolic relationship (2.17a) between largely satisfied and potent need strengths.

Tables 4.19 and 4.20 display the regression results of the form of relationship 2.17b, for the two different data sets. In Table 4.19 we, once again, find no coefficients that are significant and of the hypothesized signs. The R-squared values are reasonably high, ranging from .18 to .74. The F-statistics for the overall equation are all significant (at a level of .01 or better, on an F-test with 2 and n-2 degrees of freedom). We thus find no support from the weighted correspondence data for the hypothesized relationship of the form of 2.17b.

In Table 4.20 the results are similar. Again, no coefficients are significant and of the hypothesized signs. The R-squared values range from .002 to .12 for these regressions based on the one-to-one correspondence data. Eleven of the 12 F-statistics for the overall equation are significant at a level of .01 or better on an F-test with

TABLE 4.19

REGRESSION PARAMETERS FOR INVERSE PARABOLIC RELATIONSHIP BETWEEN LARGELY SATISFIED (S_k) AND POTENT (S_i) NEED STRENGTHS (WEIGHTED CORRESPONDENCE DATA)

(2.17b) $S_i = -U_i/S_k^2 + V_i/S_k + W_i$, $k = 1, 2, 3$; $i = k + 1$; $S_i \geq 3$
(Hypothesis 8b: U_i, $V_i > 0$)

Survey Number and Condition	U_i	V_i	W_i	R^2	F Overall Sig. at >	n	n/N
$k = 1$: $S_2 \geq 3$							
1.	-58.61*	-41.76*	10.76	.60	.01	2,404	.85
2.	-56.95*	-41.44*	10.76	.66	.01	5,182	.85
3.	-63.42*	-45.97*	11.56	.74	.01	3,671	.78
4.	-60.92*	-43.15*	10.94	.59	.01	1,747	.68
5.	-56.57*	-40.99*	10.68	.65	.01	4,868	.70
6.	-40.75*	-31.12*	9.38	.53	.01	2,435	.95
$k = 2$: $S_3 \geq 3$							
1.	-26.55*	-19.56*	6.85	.18	.01	1,950	.69
2.	-28.96*	-21.92*	7.31	.27	.01	4,187	.69
3.	-41.60*	-32.68*	9.71	.59	.01	3,685	.79
4.	-32.98*	-23.60*	7.44	.21	.01	1,354	.51
5.	-36.55*	-26.36*	7.91	.26	.01	3,809	.55
6.	-24.23*	-21.25*	7.94	.36	.01	2,437	.95
$k = 3$: $S_4 \geq 3$							
1.	-13.64*	-12.49*	6.20	.21	.01	2,417	.86
2.	-22.01*	-18.54*	7.23	.28	.01	4,758	.78
3.	-46.90*	-34.55*	9.81	.52	.01	3,704	.79
4.	-18.14*	-15.45*	6.66	.22	.01	1,707	.65
5.	-21.73*	-18.05*	7.10	.26	.01	4,348	.62
6.	-22.61*	-18.45*	7.45	.30	.01	2,477	.97

*Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

TABLE 4.20

REGRESSION PARAMETERS FOR INVERSE PARABOLIC RELATIONSHIP BETWEEN LARGELY SATISFIED (S_k) AND POTENT (S_i) NEED STRENGTHS (ONE-TO-ONE CORRESPONDENCE DATA)

(2.17b) $S_i = -U_i/S_k^2 + V_i/S_k + W_i$, $k = 2, 3$; $i = k + 1$; $S_i \geq 3$
(Hypothesis 8b: $U_i, V_i > 0$)

Survey Number and Condition	U_i	V_i	W_i	R^2	F Overall Sig. at >	n	n/N
$k = 2$: $S_3 \geq 3$							
1.	-0.528	-0.67	3.85	.002	-	1,601	.57
2.	-3.13*	-3.51*	4.38	.03	.01	3,334	.55
3.	-5.63*	-7.29*	5.86	.12	.01	4,092	.87
4.	-2.35*	-2.43*	4.17	.01	.01	1,412	.54
5.	-2.55*	-2.99*	4.27	.02	.01	3,703	.53
6.	-4.54*	-5.90*	5.34	.08	.01	2,482	.97
$k = 3$: $S_4 \geq 3$							
1.	-0.684*	-0.60**	4.31	.01	.01	2,527	.89
2.	-1.09*	-1.11*	4.36	.01	.01	4,936	.81
3.	-7.16*	-8.87*	5.78	.10	.01	3,938	.84
4.	-1.24*	-1.49*	4.59	.01	.01	2,282	.87
5.	-0.81*	-0.79*	4.27	.01	.01	5,687	.82
6.	-4.86*	-5.44*	4.16	.04	.01	2,477	.97

*Significant at $\alpha < .01$ on the F test with 1 and $n - 1$ degrees of freedom.

**Significant at $\alpha < .05$ on the F test with 1 and $n - 1$ degrees of freedom.

2 and n-2 degrees of freedom. Thus, there is no evidence in this table to support the hypothesized relationship.

At this point let us pause and compare the goodness-of-fit between relationships 2.17a and 2.17b. This is the first time we have had regressions with a good enough fit to warrant such an exercise. For both sets of data relationship 2.17a seems to give a slightly better fit than does relationship 2.17b, though both yield reasonably good fits. For the weighted data 2.17a yields R-squared values ranging between .20 and .74, and 2.17b yields R-squared values ranging from .18 to .74. Both relationships yield equivalently significant coefficients and overall F-statistics for this data. Thus, there is a slight edge, as indicated by the R-squared values, for the goodness-of-fit for relationship 2.17a over 2.17b, based on the weighted correspondence data. For the one-to-one correspondence data we find that 2.17a yields R-squared values ranging from .003 to .13, whereas 2.17b yields R-squared values ranging from .002 to .12. Both relationships yield equivalently significant coefficients and overall F-statistics. Thus, based on the slight edge in R-squared values, 2.17a seems to yield a slightly better fit than does 2.17b against the one-to-one correspondence data.

Returning now to the hypothesis tests, we find no evidence to support the hypothesized relationships between largely satisfied and potent need level strengths. Note,

however, that we would have found fair to strong evidence supporting hypotheses which predicted coefficient signs opposite to those actually predicted by our stated hypotheses.

For relationship 2.18b no coordinated tests were made. However, we do have the results for three regressions of the form of 2.18b made as part of test runs. Two of the regressions are from Survey 73-22(O) and one is from Survey 72-34(O). Two regressions were done with weighted correspondence data and the third with one-to-one correspondence data. All three regressions were performed with data that met the constraint condition that S_5 be greater than or equal to 4.

For the two weighted correspondence regressions the estimates for the constant term f_5 were both positive, the estimates for the coefficient g_5 were both negative and significant (at a level better than .01), and the R-squared values were .21 and .16 respectively. The regression on the one-to-one correspondence data yielded a positive estimate for the constant term f_5 , a positive but not significant estimate for the coefficient g_5 and an R-squared value less than .01.

In addition to these three regressions we know that the weighted correspondence data yields S_4-S_5 correlations (under no constraint conditions) that are strongly positive, ranging from .63 to .92 across all six surveys. The one-to-one correspondence data yields S_4-S_5 correlations ranging

from .07 to .34 across all six surveys.

Given this evidence of three regressions and the correlations between S_4 and S_5 we can state that it gives little support to the hypothesized relationship between largely satisfied S_4 need strength and potent S_5 need strength. Furthermore, this evidence also suggests that a full set of regressions on all six surveys of the form of relationship 2.18b would also yield little evidence in support of the hypothesis.

X. Hypothesis 9: The Time Hypothesis

This hypothesis states that over time there will be an increase in the proportion of people operating at the highest need level, and a decrease in the proportion of people operating at lower need levels. Formally, from *Chapter 2 we have:*

$$(2.20) \quad \left(\frac{n_i|S_i>4}{N}\right)_{T=0} > \left(\frac{n_i|S_i>4}{N}\right)_{T=1}, \quad i=2,3;$$

and;

$$(2.21) \quad \left(\frac{n_i|S_i>4}{N}\right)_{T=0} < \left(\frac{n_i|S_i>4}{N}\right)_{T=1}, \quad i=5.$$

When comparing across time we must take care to obtain a good match in the samples. Thus, only officer surveys can be compared to officer surveys, and only enlisted surveys compared to enlisted surveys. Furthermore, I required the same motivator strength measurement instrument to have been used in these across-time surveys.

The result was that the only two enlisted surveys which could be compared were 72-34(A) and 73-22(A), which were given in November 1971 and November 1972, respectively; and the only two officer surveys which could be compared were 72-34(O) and 73-22(O), given on the same dates as the enlisted surveys. Thus, only a one year time change can be used to test this hypothesis.

Once we have satisfied ourselves that the across-time measurement instruments were the same and the samples were taken from the same population, then we must verify that the mean ages of the compared groups were equal. This is to ensure that age has been removed as a factor in the across-time results. The results of this comparison are a mean age of 27.540 for Survey 72-34(A), and a mean age of 27.761 for Survey 73-22(A), which can be accepted as being equal at the .01 or .05 levels of significance on a two-tailed test. For the officer surveys, Survey 72-34(O) yielded a mean age of 32.730 and Survey 73-22(O) yielded a mean age of 33.251 years. At a .01 level there is no significant difference between these ages, but at the .05 level the difference is just barely significant. Thus, age does not seem to be significantly different between the survey pairs, which puts to rest that concern.

Table 4.21 displays the calculated proportions, the sample sizes, and the computed number of standard deviations (Z) of the difference between corresponding proportions in two different time periods. The statistical

TABLE 4.21

PROPORTION OF PEOPLE CLEARLY OPERATING AT EACH NEED LEVEL AT DIFFERENT TIMES

Weighted Corresp.	(November 1971) 72-34(A), $T = 0$ n_0	N_0	$P_0 = \frac{n_0}{N_0}$	(November 1972) 73-22(A), $T = 1$ n_1	N_1	$P_1 = \frac{n_1}{N_1}$	Z	Sig. at:	$P_0 \gtrless P_1$	Hyp.
Condition										
$S_2 \geq 4$	1,735	6,066	.2860	1,804	6,799	.26533	+ 2.62	.01	>	>
$S_3 \geq 4$	626	6,082	.1029	609	6,808	.08945	+ 2.59	.01	>	>
$S_5 \geq 4$	735	6,066	.1212	1,013	6,799	.14899	- 4.60	.01	<	<
	72-34(O), $T = 0$			73-22(O), $T = 1$						
$S_2 \geq 4$	424	2,749	.1542	405	2,545	.1591	- 0.49	-	<	>
$S_3 \geq 4$	165	2,754	.0599	147	2,547	.0577	+ 0.34	-	>	>
$S_5 \geq 4$	174	2,749	.0633	208	2,545	.0817	- 2.59	.01	<	<
One-to-One Corresp.	72-34(A), $T = 0$			73-22(A), $T = 1$						
Condition										
$S_2 \geq 4$	5,061	6,174	.8197	4,631	6,909	.6703	+19.47	.01	>	>
$S_3 \geq 4$	2,017	6,164	.3272	1,636	6,906	.2369	+11.49	.01	>	>
$S_5 \geq 4$	3,024	6,167	.4904	4,251	6,917	.6146	-14.27	.01	<	<
	72-34(O), $T = 0$			73-22(O), $T = 1$						
$S_2 \geq 4$	2,181	2,833	.7699	1,666	2,617	.6366	+10.79	.01	>	>
$S_3 \geq 4$	970	2,818	.3442	683	2,611	.2616	+ 6.61	.01	>	>
$S_5 \geq 4$	1,427	2,824	.5053	1,466	2,610	.5615	- 4.16	.01	<	<

test is the one-tailed test of significance, at the .01 or .05 level.

For the weighted correspondence need strengths we find that the hypothesized difference between the proportions is statistically significant (at the .01 or .05 level) in five of the six possible comparisons. For the one-to-one correspondence need strengths the hypothesized difference between the proportions is statistically significant, at a level of .01 or better, in all six possible comparisons.

Rather surprisingly, considering the negative or very weak evidence in support of the other hypotheses tests and the short time period (one year) involved in testing this hypothesis, we find good evidence in support of the time hypothesis.

XI. Some Side Issues

A. Agreement-Disagreement Five-Point Motivator Strength Scale vs. Agreement-Undecided Three-Point Motivator Strength Scale

Four of the six surveys used a five-point degree-of-agreement scale as the response set for the motivator statements. As already noted in Chapter 3 there could easily be a qualitative difference between the agreement and the disagreement sides of the scale. To check out this possibility Survey 73-22(0) was run with only the three upper responses (Strongly Agree=5, Agree=4, Unde-

cided=3) coded into strength measures. A set of regressions identical to that run on the full five-point-strength-scale data set was run on this data set, the only difference being that the selection point for "operating at" a need level was moved up to 4 to coincide with the new strength scale, which now ranged from 3 to 5. Survey 73-22(O) was selected as it seemed to be fairly representative of all four surveys using the degree-of-agreement responses.

The results of these regressions were highly consistent with their counterpart regressions run on the full five-point scale. Out of the 77 regressions run on both data sets, in 28 cases the equivalent regression coefficient sets were both significant (at .05, .01 or better), and in 27 of these 28 cases both significant coefficient sets also agreed in sign. The only exception involved S_2 as a linear function of age. However in this case R-squared was less than .01 in both regressions. There were 16 cases where the signs of the corresponding coefficient sets differed, but in all 16 cases either one or both coefficients did not reach significance (at the .01 or .05 level). There were also 33 cases where the signs of the corresponding coefficient sets matched and either one or both coefficients did not reach significance. It was also the usual situation that the F-statistics were higher for the five-point regression coefficients and overall equation than in the three-point regressions. The corresponding R-squared values in the

three-point-strength regressions were sometimes higher and sometimes lower than their counterparts in the five-point-strength regressions. These values usually differed by only a few percentage points at most, though in a few cases the difference reached almost 20 percentage points.

Based on these comparisons we can say that it appears to make little difference whether a full five-point agreement-disagreement scale is used or whether a three-point agreement-undecided scale is used. The results were largely the same for both data sets, thus further validating both the way the data was used as well as the hypotheses tests performed using the full five-point strength scale.

B. The "Operating At" Range for Need Level Strength

A second problem closely associated with the one just discussed is that of the cutoff level set for need strength, so that those with a higher need strength than this cutoff level are considered to be "operating at" a given need level. In the tables associated with the tests for Hypotheses 4 through 8 we can see that the selection rate for individuals "operating at" a given need level (with a need strength greater than or equal to 3) varied quite a bit, from a low of .51 to a high of .98.

All the hypothesized dynamic relationships should hold no matter how high the "operating at" strength range is set, as long as there remains enough variance in the variables being regressed to successfullly perform the

regressions. However, if the "operating at" range runs to too low a strength level we should see a weakening of some of these hypothesized relationships, as can be seen in Illustration 2.1.

In order to handle this concern an experiment was run in which the "operating at" range was raised, to now be between 4 and 5. The experiment was performed using Survey 73-22(0). Two sets of 45 regressions were run involving the variables age, need strength, and need strength in its various transforms (e.g., need-strength-squared, need-strength-inverse), covering all the testable relationships in Hypotheses 4 through 8. One set was run under the old "operating at" selection rule of $S_i > 3$. The second set was run under the higher selection rule of $S_i > 4$. The full five-point-strength-scale data set was used for both sets of regressions.

The two sets of selection rates (n/N) are as listed below (for N=2,626):

	WEIGHTED DATA		ONE-TO-ONE DATA	
	$S_i>3$	$S_i>4$	$S_i>3$	$S_i>4$
S_1	.66	.14	-	-
S_2	.67	.16	.91	.85
S_3	.51	.05	.54	.36
S_4	.65	.13	.87	.78
S_5	.61	.08	.83	.76

Thus, there was a large difference in several of the selection rates, making this a good test for checking on our con-

cern about the possibility of different regression results for different "operating at" strength ranges.

Out of 45 regressions, on a pairwise comparison of corresponding coefficients 32 regressions in both sets had coefficients that were both significant and of the same sign, six had coefficients where either one or the other, or both, were not significant but had the same sign, and seven had coefficients where one or the other, or both, were not significant and had opposite signs. In no comparison were any differences in sign found where both corresponding coefficients were significant. The corresponding R-squared values also matched up reasonably well. Thus, different "operating at" ranges seem to make little or no significant differences in the regression results. We can therefore put more faith in all the regressions run under the selection rule of $S_i > 3$.

C. Possible Autocorrelation Problems

The extremely low R-squared values for many of the regressions raised the issue of possible autocorrelation in the disturbance, or error, term. If serious autocorrelation is present it throws the conventional standard error formula completely off the mark, and it renders the conventional t- and F-tests inapplicable. (Johnston 1960, p. 35) While the presence of autocorrelation is potentially serious in all time series applications, its presence is much less probable in cross-sectional studies such as this one. How-

ever, the problem could be present and thus deserves checking out, for its worst effects can be disastrous to the least-squares regression technique being used.

The Durbin-Watson d-statistic (which directly measures the statistical significance of the presence of autocorrelation) was computed on two different sets of regressions against Survey 73-22(0), our old standby survey for running experiments. Each set of regressions involved 45 separate regression equations, where one set was run with the selection criterion of $S_i > 3$ and the second set was run with the selection criterion of $S_i > 4$. We therefore had 90 d-statistics to use for checking on the possible presence of autocorrelation at appropriate levels of significance.

The results were unanimous. All 90 d-statistics ranged between 1.62 and 2.21, with most clustering in the range of 1.9-2.1. In no case was the d-statistic significant (at the .01 or .05 level), thereby giving no statistical indication of the presence of autocorrelation. Thus, given no statistical evidence to support the hypothesized presence of autocorrelation we can put to rest any concern we might have had about autocorrelation in these analyses.

XII. Summary

The analyses of the main results are best summarized in a comment made by one of the students who answered the need level coding questionnaire. This individual, a 38-year old male graduate student in Electrical Engineering,

stated: "I think the problem of Maslow's needs is that more than one need can occur at a time and also the hierarchy does not in all cases follow a definite pattern." This statement fairly well covers the statistical evidence concerning Hypotheses 1, 2, 4, 5, 6, 7 and 8. Hypothesis 3 received good support from the evidence for two of its three parts, but little support for the remaining part. Only Hypothesis 9, which came not from Maslow's works but from Stanford Research Institute, received any strong supporting evidence from the data analysis.

CHAPTER 5

VALIDITY, ALTERNATIVE EXPLANATIONS AND CONCLUSIONS

I. Validity of Measurement

The validity of the measurements in this dissertation rests on three factors: the type of instruments used, their transformation functions, and the population sampled. Each of these factors will be discussed in turn.

A. Types of Measurement Instruments

There were two basic types of measurement instruments used in this study. Both consisted of personal interest statements - statements about the things people want and do and how they feel about such things. Each set of statements had its own unique set of possible responses. There was little overlap in the two sets of statements. These statements were called motivators. Air Force personnel responded to these statements as part of recurring Air Force surveys.

The possible responses the Air Force personnel could make with the first set of motivator statements were: Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree. In this dissertation these responses were equated with the strength of a motivator for that person, where

"Strongly Agree" was coded as maximum strength, and "Strongly Disagree" was coded as minimum strength. In a separate analysis these responses were coded differently, so that "Undecided" became minimum strength, and "Disagree" and "Strongly Disagree" responses were not used because negative feelings about a statement could perhaps be considered not to be the same thing as low strength for that motivator for that individual. As it turned out the method of coding made no difference. The results were the same with both methods.

The responses available to the Air Force personnel in responding to the second set of motivator statements were: Extremely Important (for me), Above Average Importance, Average Importance, Below Average Importance, and Not Important At All. A response of "Extremely Important" was equated with maximum strength for that individual to that motivator, and a response of "Not Important At All" was equated with minimum strength. There was no problem with this range of responses with respect to negative responses being different than low strength, since there were no negative responses available in the response set.

Thus, two separate sets of motivator statements were used, each with a different response set. Only two of the statements (out of 41) covered the same topic across both sets of motivator statements. We therefore have two basically different sets of motivator statements, each with its own unique set of responses that the Air Force personnel could use. This amounts to two largely independent measure-

ment instruments.

The equating of the response sets with a range of motivator strengths is supported by both empirical studies and theoretical reasons. High agreement and high importance were thus equated with high motivator strength, and low agreement (or disagreement) and low importance were equated with low motivator strength. Given these empirical and theoretical supports (see Chapters 1 and 3), it seems reasonably clear that the measurement instruments were in fact measuring motivator strength, or certainly something closely resembling it.

B. The Transformations

The next major issue involves the transformations of the motivator statements into different need types. There are numerous studies showing that the external things people want or do tend to satisfy several different types of needs. For example, Lawler states: "... there is fairly good evidence that pay is instrumental for the satisfaction of security, esteem, and autonomy needs." (1971, p. 30) The issue then becomes: how do we go about dividing up a motivator into its constituent need types? And closely associated with this issue is the issue that the same motivator might satisfy different needs for different people.

The Air Force motivator statements were coded into the five Maslowian need types, or into a no-need category, by Stanford University students and faculty who were know-

ledgeable about Maslow's need levels. Two different types of coding questionnaires were administered. The results showed fairly high coding agreement no matter how the respondents were broken out: Male, Female; Young, Old; Undergraduate, Graduate, Professor; Humanities and Social Sciences Majors, Science and Engineering Majors, or Undeclared Majors; U.S. Citizen, Non-U.S. Citizen. All the respondents were familiar (in varying degrees) with Maslow's theory prior to coding the questionnaire. In addition, the questionnaire included a description of the need levels that was largely verbatim from Maslow's works. The coders could refer to the need type descriptions as they coded each statement. As important as all this was the fact that none of these respondents had any vested interest in how the coding came out. The questionnaires were voluntary and few, if any, of the respondents had any military job experience. The respondents were, however, clearly biased in the directions of: male (about 80%), young (mean age about 23 years), college educated, and above average intelligence.

Considering all these factors, especially the fairly high coding agreement for all subsets of the respondents, we can be reasonably sure that these motivator statements break out into the different need types in a manner quite close to the final transformations that the coding effort yielded. Finally, each respondent was asked to comment on the completeness of the need levels, especially as to

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the overlap between need levels and any important need types that might have been left out. Except for a few comments concerning the lack of religious needs in Maslow's hierarchy the responses were largely negative.

One very strong point concerning these transformations is that for security, belongingness, and esteem needs at least one Air Force motivator statement was coded into one of the Maslowian need types by over 80 percent of the respondents. For most of these the agreement approached or exceeded 90 percent. For the self-actualization need three statements were coded into that need type at 51 percent, 73 percent and 44 percent, respectively. All these high-agreement statements were used for a one-to-one-correspondence transformation between a need type and a motivator statement, and all the hypotheses were tested by using a data set based on the one-to-one transformations as well as a data set based on the more complex transformations involving weighted correspondence.

The results for all the hypothesis tests were consistent between the two different data sets. Of the nine hypotheses tested all but two received little or no supporting evidence from both data sets. For the remaining two hypotheses there was good evidence from both data sets supporting two of the three parts of the cross-correlations hypothesis, and little or no evidence from both data sets supporting the third part of this hypothesis. The time hypothesis was strongly supported by the evidence from both data sets. So, we can be reasonably sure that the transformations employed were valid

and consistent, since the two different types of transformations produced the same results in the hypothesis testing process. The two different data sets also showed mutual consistency in the experiment run on changing the range of the "operating at" need strength, and in the negative results yielded by both data sets in the check for autocorrelation.

In summary, the coding percentages agreed quite well across many different demographic factor breakouts on the respondents, and the one-to-one transformations yielded just about the same results on the hypotheses tests as did the weighted correspondence transformations. Given these facts it seems that the motivator-to-need-type transformations were consistent, valid, and applicable to the data.

C. The Air Force Population Sampled

Both enlisted and commissioned active duty Air Force personnel answered the original motivator statements. The Air Force officer surveys were administered to a ten percent random sample of all commissioned officers. The enlisted surveys were administered to a five percent random sample of all active enlisted Air Force personnel. The sample sizes were certainly adequate, ranging in size from over 8,000 to over 23,000. Results from six surveys were available and used in this study.

The Air Force population is biased in one very important way: it is over 95 percent male. This population

is also biased in the direction of having more education than the general U.S. population. Over 90 percent of all officers have baccalaureate degrees, and virtually all of the enlisted force have high school diplomas. This Air Force population is probably also biased in the direction of "Conservative" on the Conservative-to-Liberal spectrum. Concerning their normalcy, though much has been printed about the abnormal military mind the few solid sociological studies on the military population in general (and including the Air Force population in particular) show it to be fairly normal, sharing roughly the same values and biases as the male U.S. population at large. (Janowitz 1960)

Thus, the Air Force population, and the samples drawn therefrom, represent a reasonably normal, predominantly male, fairly well educated group as compared to the U.S. population at large. Certainly no serious case can be made for attacking the results of this study due to crippling biases in the population sampled.

II. Validity of the Model

I cannot say much about the validity of the model. It evolved from careful reading (and rereading) of Maslow's works and the other empirical works that have attempted to test his theory, as well as from numerous discussions with professors quite knowledgeable about the theory. Thus, the validity of the model itself must stand or fall on the response it elicits from the academic community at large.

The model is available for use by other researchers against other data bases. I will therefore leave the issue of its validity to other investigators.

III. Summary of the Analyses

If we accept as valid the measurement instruments, the transformation functions and the Air Force samples, then we find that our results are largely unsupportive of Maslow's theory. Of the eight hypotheses that devolved in a fairly direct manner from his theory (three static and five dynamic), only part of one hypothesis received reasonably good support from the evidence. The one hypothesis that derived from a source other than Maslow, the time hypothesis, found some supporting evidence in the results of the data analysis.

Unfortunately, the pure longitudinal forms of the hypothesized relationships between prepotent and potent need strengths and between potent and largely satisfied need strengths could not be tested due to lack of appropriate time-series data. These two relationships are perhaps the most basic of all the hypotheses and underlie much of the development of the theory and the model.

What these results indicate is that adults tend to operate at any or all of the need levels, no matter what their age, and that operating at one need level does not seem to keep them from operating at any other need level or levels. Thus, though Maslow's different need levels may

be valid, it appears that his hypothesized relationships between them are not - or, if they are, they are not nearly as strong as he has described them to be.

IV. Other Work and Alternative Explanations Suggested by This Work

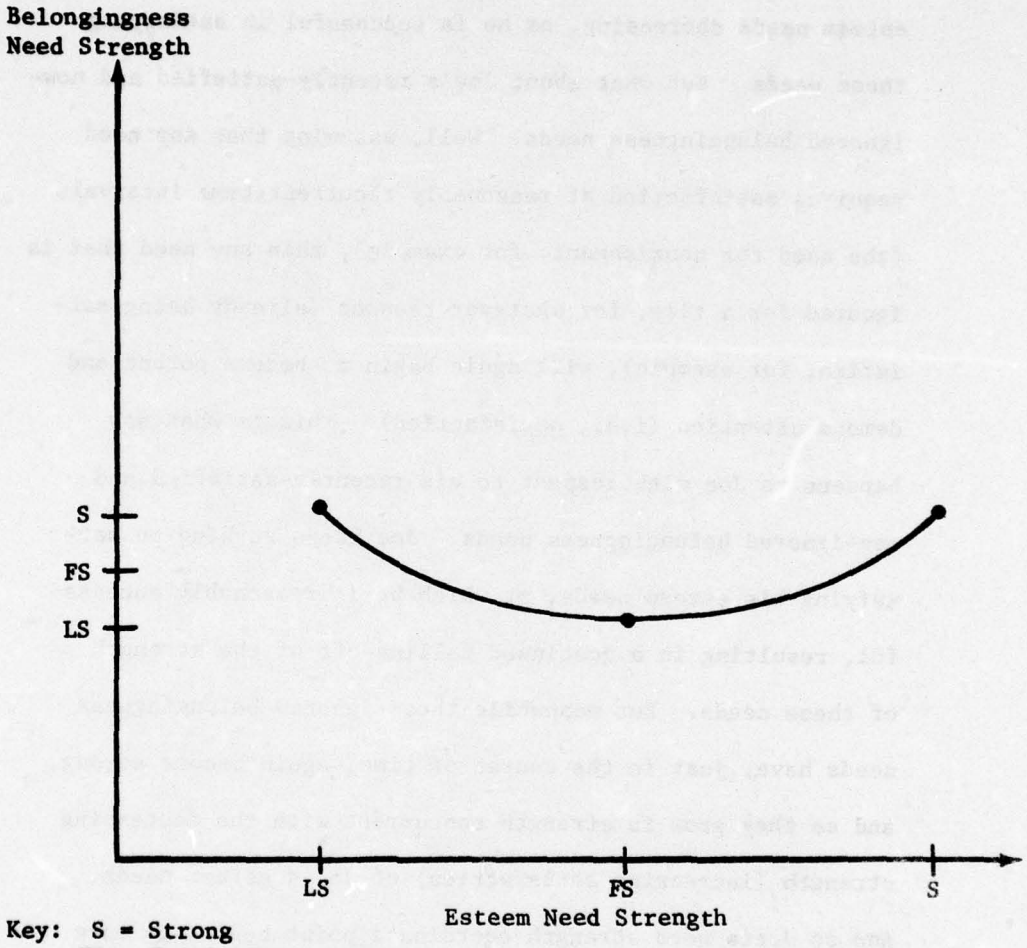
One item immediately suggested by this work is that the model should be tested with other empirical data. Specifically the Hall and Nougaim data, covering five years of results on the same population, would be an excellent data base to use, especially for testing the two linear forms for the hypothesized dynamic relationships between adjacent need level strengths over time. The longitudinal data in Hall and Nougaim's work is exactly the sort of data needed to thoroughly test this model, and thereby also to test Maslow's theory. Had this data been made available to this author such tests would have been accomplished.

Another suggestion of this work is that the emergence of higher need levels is not nearly as dependent on the satisfaction of lower need levels as Maslow has suggested. Though there may be some tendency for different types of needs to be emphasized as one satisfies other need types, this emphasis is certainly too subtle to be picked up very strongly by the available measurement instruments.

There were two sets of reasonably strong regressions that, while not supporting the hypotheses, did in fact yield a fair-to-good fit against the data. This was for

relationships 2.16 and 2.17a. Taken together, the results of the regressions for these relationships imply that, given one need level with a fairly high strength (S_i>3), there is a positive parabolic relationship between this need level and the ones adjacent to it in either direction. See Illustration 5.1 for a diagram of this relationship. What sense can we make of this?

There is a reasonable explanation (or hypothesis, if you wish) to rationalize a bowl-shaped relationship between the strengths of adjacent (or perhaps even non-adjacent) need levels. Let's look at a typical Joe, named Joe, who we assume starts out in the upper right part of the parabola shown in Illustration 5.1. That is, Joe has (at least) two strong needs at the start of this discussion, his esteem needs and his belongingness needs. We suggest that Joe, responding to both these needs being strong, seeks out activities (motivators) that will in fact satisfy both needs. We assume that over time he is moderately successful in this endeavor, which results in both needs becoming less strong. Joe therefore begins to slide down and to the left on the parabola. However, his needs are out of phase in the rate at which they become satisfied (a reasonable assumption - e.g., "You can't have your cake and eat it, too."), so that his belongingness needs become largely satisfied while his esteem needs remain fairly strong, though not as strong as when we first started this discussion about Joe and his needs. This brings Joe (and us) to the minimum (bottom) part of the parabola.



Key: S = Strong
FS = Fairly Strong
LS = Largely Satisfied

Illustration 5.1.—The Pendulum Theory (or Young's Swinging Motivation Theory)

And now what happens? Well, Joe now seeks out motivators that primarily satisfy his still fairly strong esteem needs, and he begins to ignore those motivators that help to keep his largely satisfied belongingness needs satisfied. As this happens we see the strength of Joe's still fairly strong esteem needs decreasing, as he is successful in satisfying these needs. But what about Joe's recently-satisfied and now-ignored belongingness needs? Well, assuming that any need requires satisfaction at reasonably recurrent time intervals (the need for nourishment, for example), then any need that is ignored for a time, for whatever reasons (already being satisfied, for example), will again begin to become potent and demand attention (i.e., satisfaction). This is what now happens to Joe with respect to his recently-satisfied and now-ignored belongingness needs. Joe keeps working on satisfying his esteem needs, at which he is reasonably successful, resulting in a continued falling-off of the strength of these needs. But meanwhile those ignored belongingness needs have, just in the course of time, again become strong, and so they grow in strength concurrent with the decreasing strength (increasing satisfaction) of Joe's esteem needs. And so Joe's need strength coordinate point begins to move up and to the left on the parabola in Illustration 5.1, eventually bringing Joe to the upper left portion of the curve. Here Joe's belongingness needs are again strong, while his esteem needs have become fairly well satisfied.

What happens next? Well, the cycle starts all over

again. Joe now seeks satisfaction for his recently-satisfied but now-strong belongingness needs, and he starts sliding back down and to the right on the curve. And so it goes, back and forth, until Joe dies.

This whole mechanism, which conjures up the concept of a pendulum or swing, is consistent with (in fact, rests upon) the equilibrium-disequilibrium school of motivation theorists, who hypothesize that a person cycles back and forth between disequilibrium (an unsatisfied need) and equilibrium (a satisfied need) in handling his various types of needs. Joe swings back and forth between working at satisfying his currently-strong needs while ignoring his currently-satisfied needs, which results in the strong needs getting satisfied while the satisfied (and now ignored) needs again grow strong; then the pendulum swings the other way, and Joe begins working on satisfying his again-strong, heretofore-satisfied needs, while ignoring his now-satisfied and heretofore-strong needs. And on and on it goes, back and forth, back and forth.

Having no intention of being flippant, I choose to dub this theory of motivation with the name of "The Pendulum Theory of Motivation" or, alternatively, "Young's Swinging Motivation Theory." It rests on some fairly good empirical evidence found in Tables 4.15 and 4.17 of this dissertation and also rests on some solid theoretical groundwork already laid by the equilibrium-disequilibrium motivation theorists. (Lewin 1935; Hull 1943; Cofer and Appley 1964) This Pen-

dulum Theory can be extended to three or more types of needs. A three-dimensional portrayal of this theory would be bowl-shaped, with restrictions on lateral movement around the bowl but not on movement up and down within the bowl. A portrayal in n-dimensions requires an n-dimensional "bowl" in n-dimensional space, with equivalent restrictions on lateral movement.

There is at least one model that can go reasonably far in synthesizing Maslow's theory with the results of this work. This model is pictured in Illustration 5.2. The illustration shows all the need levels as present and strong throughout the normal life, in consonance with the empirical results showing positive correlations between the strengths of all need types. However, at each stage of life one particular need type is more salient than the other types, even though all of them are salient and needing satisfaction at any one age.

Another model encompassing this concept would be one somewhat like Alderfer's, or the one implicitly assumed by Porter, in which high strength of one need type does not preclude high strength of any other need type, and satisfaction of one need type does not imply emerging strength of other need types.

One final idea suggested by both Illustrations 5.1 and 5.2 deals with the relative strength of different types of needs. Though all need types may be strong at any one time, as a person satisfies one need type the others automatically become stronger relative to the now-satisfied need type,

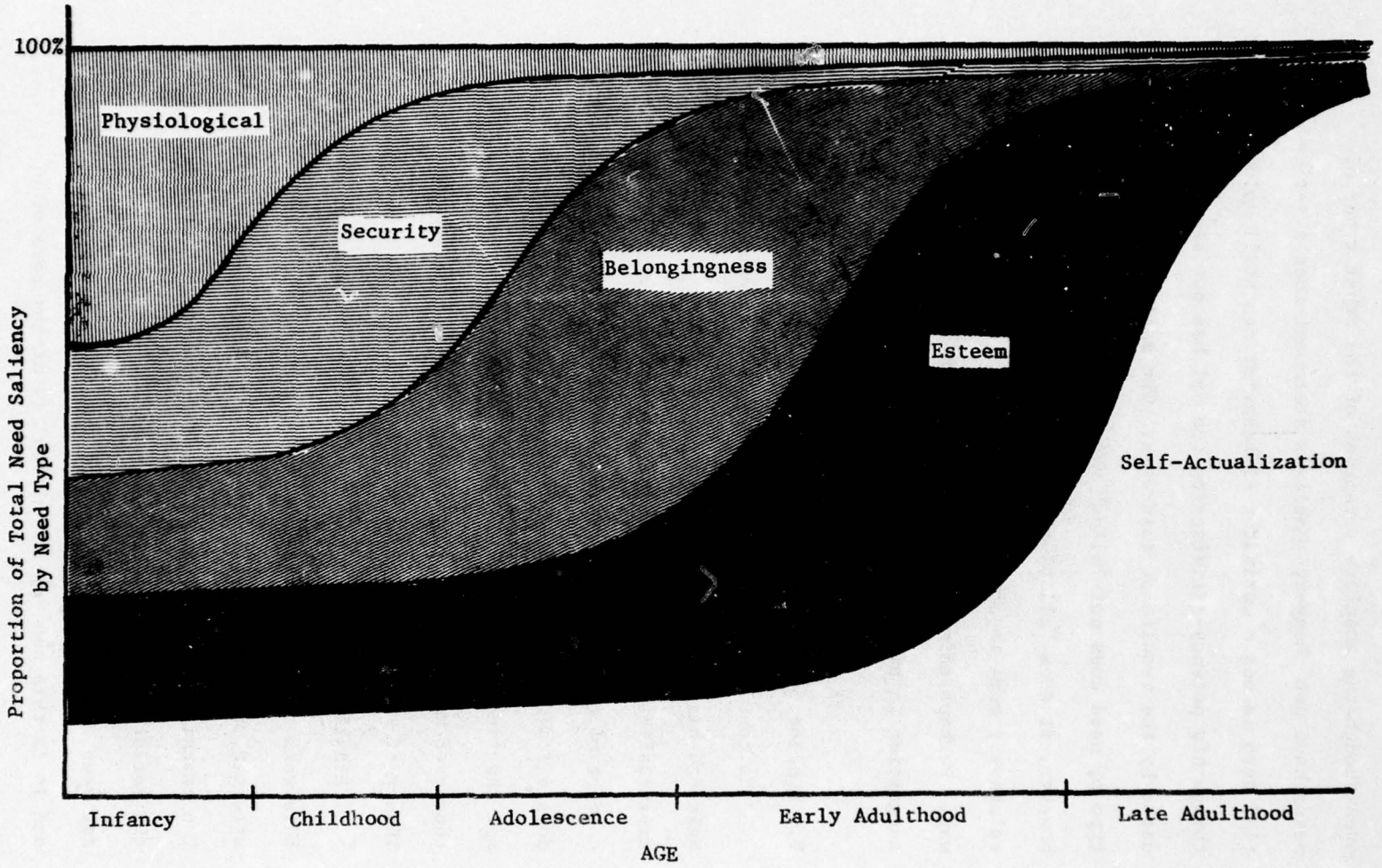


Illustration 5.2.—An Alternative Need Levels Model

even though the absolute strengths of the other types of needs have not changed. Maslow's statement that a satisfied need is not a motivator of behavior can still hold, though his potency-satisfaction concept has not been validated by the results of this work. The satisfaction of one type of need does not "allow" any other need type to emerge; however, it does "allow" the other need types to now be relatively more important, or strong, in an almost axiomatic way. Perhaps this is all that Maslow was perceiving and suggesting in his theory.

V. Conclusions

In conclusion, Maslow's satisfaction-potency hypothesis and his age hypothesis are not supported by the empirical results of this dissertation. However, the concept of need strength relative to other need strengths does allow a partial synthesis between Maslow's concepts and the findings, while also suggesting an interesting theory of motivation which I have dubbed the "Pendulum Theory of Motivation."

Finally, I feel the most important contribution of this work is the mathematical model that has been constructed, a model whose heart is that of conditionality: the emerging strength of one need is conditional upon the satisfaction of other need types. This concept has not been captured nor modeled by the other researchers, and it is this concept that I feel is at the core of

Maslow's theory. It certainly deserves further testing against other data.

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APPENDIX A

MOTIVATOR STATEMENTS FROM SIX AIR FORCE SURVEYS

PART II - CAREER STATEMENTS

Please indicate the extent to which you agree or disagree with the following statements. There are no "right" or "wrong" answers to these statements--we merely want to know how you honestly feel about each statement.

For example: If you strongly agree with question #76, you would mark response "A" of item #76 on your answer sheet.

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
76. Work should be the most important part of a person's life.	A	B	C	D	E
77. The main satisfaction a person can get out of work is helping other people.	A	B	C	D	E
78. A person has a right to expect his work to be enjoyable.	A	B	C	D	E
79. The geographic location of my place of employment is important to me.	A	B	C	D	E
80. All things considered, working for a large organization appeals to me.	A	B	C	D	E
81. One should not put off present pleasure for potential benefits.	A	B	C	D	E
82. I like the kind of work you can forget about after the work day is over.	A	B	C	D	E
83. Most jobs in civilian life are routine and monotonous.	A	B	C	D	E
84. To me, retirement plans and fringe benefits are important in job selection.	A	B	C	D	E

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
85. It's important to do a better job than the next person.	A	B	C	D	E
86. Most jobs in the Air Force are routine and monotonous.	A	B	C	D	E
87. Even if you dislike your work, you should do your best.	A	B	C	D	E
88. A person should constantly try to succeed at work even if it interferes with other things in life.	A	B	C	D	E
89. Sometimes it may be right for a person to lose friends in order to get ahead in his work.	A	B	C	D	E
90. If a person doesn't want to work hard, it's his own business.	A	B	C	D	E
91. Association with colleagues after working hours is an important consideration to me in job selection.	A	B	C	D	E
92. Much of what is wrong with the military would be cured by a return to the old values--pride in country and service, respect for authority, unit spirit, etc.	A	B	C	D	E
93. The privileges of rank improve or at least do not damage the morale of junior military members because they give them a goal.	A	B	C	D	E

UNITED STATES AIR FORCE MARCH 1973 OFFICER SURVEY

FOREWORD

The USAF Military Survey Program is designed to obtain your attitude and opinions or thoughts and ideas about important items of interest and concern to Headquarters USAF. Your answers, along with others, are used by the Air Staff to develop policies and procedures to improve your Air Force life and the Air Force as a whole.

You may not see these changes immediately, but your feelings and those of other officers expressed in surveys have resulted in many changes in the past and will continue to do so in the future.

Please answer each question as honestly as you can. Your answers will be forwarded without review directly to Headquarters USAF where they will be combined with all others by computer to obtain Air Force-wide results.

Your answers to this survey will never be related to you personally nor will they ever become a part of your individual Air Force records.

SURVEY RESULTS:

The raw data from this survey are computed and provided to the offices of the Air Staff which submitted the questions. These offices analyze the answers and use the results to make a better Air Force. Although surveys generally are designed only for internal use and therefore not released to the public, news releases concerning survey results occasionally may be issued to Air Force and civilian publications after the data have been analyzed. Thus, while it is not possible to provide survey results to you personally, you may be assured that your answers to this survey are actively considered and used by Air Force Headquarters in planning and evaluating the quality of programs and policies.

PART 9 - AIR FORCE JOB

People differ in what they want from their job. The questions in this part concern various features that may be important to you on your job.

Rate the following statements in terms of their IMPORTANCE to you.

For example: If being promoted on the basis of ability is extremely important to you, mark response "E" to question #95 on your answer sheet.

	Not Important At All	Below Average Importance	Average Importance	Above Average Importance	Extremely Important
95. Be promoted on the basis of ability	A	B	C	D	E
96. Have adequate time for leisure and recreational activities	A	B	C	D	E
97. Work with friendly and cooperative people	A	B	C	D	E
98. Gain technical training and experience	A	B	C	D	E
99. Be assigned to an interesting job	A	B	C	D	E
100. Receive recognition for work well done	A	B	C	D	E
101. Have competent supervisors	A	B	C	D	E
102. Feel a sense of accomplishment	A	B	C	D	E
103. Have a say in what happens to you	A	B	C	D	E
104. Be able to assume important responsibilities	A	B	C	D	E
105. Obtain a good salary	A	B	C	D	E
106. Have adequate job security	A	B	C	D	E

FOR EXAMPLE: If having an interesting and challenging job is extremely important to you, mark response A to Item 23. If it is not important at all, mark response E.

QUESTION	EXTREMELY IMPORTANT	ABOVE AVERAGE IMPOR-TANCE	AVERAGE IMPOR-TANCE	BELOW AVERAGE IMPOR-TANCE	NOT IMPOR-TANT
27. Have interesting and challenging job	A	B	C	D	E
28. Obtain good salary	A	B	C	D	E
29. Be in competitive situation	A	B	C	D	E
30. Have competent supervisors	A	B	C	D	E
31. Do a great deal of travelling	A	B	C	D	E
32. Have a job which effectively utilizes my personal talents and abilities	A	B	C	D	E
33. Be promoted on the basis of my ability	A	B	C	D	E
34. Do work that gives me a feeling of achievement/ accomplishment	A	B	C	D	E
35. Chance to be independent and self-reliant by using my own discre-tion about details of my job	A	B	C	D	E
36. Be given recognition for work well done	A	B	C	D	E
37. Have a say in what happens to me	A	B	C	D	E
38. Work with high quality of co-workers, peers	A	B	C	D	E

QUESTION	EXTREMELY IMPORTANT	ABOVE AVERAGE IMPOR-TANCE	AVERAGE IMPOR-TANCE	BELOW AVERAGE IMPOR-TANCE	NOT IMPOR-TANT
39. Have adequate job security	A	B	C	D	E
40. Gain technical training and experience	A	B	C	D	E
41. Advance in rank at a fairly rapid rate	A	B	C	D	E
42. Have a job with important responsi-bilities	A	B	C	D	E
43. Exercise leadership potential and initiative	A	B	C	D	E
44. Settle down in a certain area	A	B	C	D	E
45. Work under consis-tent and intelligent personnel policies	A	B	C	D	E
46. Work in a friendly and warm job environment	A	B	C	D	E

APPENDIX B

NEED HIERARCHY QUESTIONNAIRES 1A, 1B AND 2

I. Introduction.

The goal of this questionnaire is to determine the validity of taking a number of statements and questions concerning the types of things people consider important (or not important) - things they are motivated by - and place these statements and questions into one of five different categories. The categories are the five-level need hierarchy proposed by A. H. Maslow.

The way you will respond to this questionnaire is to first thoroughly acquaint yourself with Maslow's need hierarchy as explained in the next section. Then, proceed to Section III and, using the attached Coding Form and Answer Sheet, indicate which of the five need levels you feel the indicated statement or question best fits into. Please note that there are no right or wrong answers on this exercise. Your judgment is really your only guide.

The statements and questions used in this questionnaire are all taken from surveys given to members of the U.S. Air Force over the past several years. Therefore, you will find that some of these statements have a very military-sounding orientation. In view of this, would you please try to put aside any pro- or anti-military sentiments you might have when answering this questionnaire.

II. Maslow's Need Hierarchy.

Maslow theorized the existence of five basic types of human motivations (or needs) which are active in a hierachical order. That is, as one type of need becomes largely satisfied, the next one in the hierarchy becomes dominant. These five levels of needs are:

1. Physiological needs, including the need for food, water, air, a minimum level of personal physical comfort, etc.

2. Safety needs, or the need for security; stability; dependency; protection; freedom from fear, from anxiety and chaos; absence from pain, threat, or illness; need for structure, order, law, limits; strength in the protector; and so on.

3. Belongingness and love needs, or the need for affiliation and affection; the presence of friends, or a sweetheart, or a wife, or children; the need for affectionate relations with people in general, namely, for a place in your group or family; the absence of loneliness, of ostracism, of rejection, of friendlessness, of rootlessness; the need for social interrelationships with those around you; and so on.

4. Esteem needs, or the need for a stable, firmly based, high evaluation of oneself, for self-respect, or self-esteem; and the need for esteem from others. These include the desire for strength, for achievement, for adequacy, for mastery and competence, for confidence

in the face of the world, and for independence and freedom. Also included are the desires for reputation or prestige (that is, as respect or esteem from other people), status, fame and glory, dominance, recognition, attention, importance, dignity, and appreciation. Satisfaction of the self-esteem need leads to feelings of self-confidence, worth, strength, capability, and adequacy, of being useful and necessary in the world. Thwarting of these needs produces feelings of inferiority, of weakness, and of helplessness.

5. The Need for Self-Actualization. If all the previous four need types are satisfied, we may still often (if not always) expect that a new discontent and restlessness will soon develop, unless the individual is doing what he, individually, is best fitted for. A musician must make music, an artist must paint, a poet must write, if he is to be ultimately at peace with himself. What a woman can be, she must be. She must be true to her own nature. This all refers to man's desire for self-fulfillment, namely, to the tendency for him to become actualized in what he is potentially, to become everything that he is capable of becoming, the realization of his potential.

III. Instructions for Need Hierarchy Coding Form.

A. Instructions for Section 1 of Coding Form. Each of the statements and questions in Section 1 of the attached Coding Form may be considered a query involving one (or more) of the five types of needs Maslow has hypothesized. For purposes of responding to the coding form, please consider only the most important need which you feel the given statement or question corresponds to. For example Statement 1 is: "The main satisfaction a person can get out of work is helping other people." Now that you are familiar with Maslow's need hierarchy you might consider this statement an indication of Belongingness needs, or Esteem needs, or both. (If you are still not clear on Maslow's hierarchy, please refer back to Section II as needed.) If you consider the statement a type of Belongingness need, then mark Column C for question 1 on the answer sheet. (Column A corresponds to Physiological Needs; Column B to Safety Needs; Column C to Belongingness Needs; Column D to Esteem Needs; Column E to Self-Actualization Needs.) There is a sixth response for each statement (Column F on the answer sheet), which is to be marked if you feel the statement does not fall into any need category. Finally, if you feel any statement falls into more than one need category, then mark only the need category which you feel best encompasses the statement. The second section of the Coding Form allows you to describe the percentage of statements which you feel fell into more than one need category.

B. Instructions for Section 2 of Coding Form. In this section my concern is: How valid do you feel your coding process was? Do you feel most statements clearly fell into one and only one need category, or do you feel many fell into more than one category? For each of the statements in this section please mark your response. For example, if you feel 80 to 100 percent of the statements clearly fell into one and only one need category, then mark Column E for this question number on the answer sheet. (Recall that in Section 1 of the coding form you already coded those questions that you felt did not fall into any of the five need categories.)

C. Instructions for Section 3 of Coding Form. This is a general comments, non-quantitative section, to use for any comments you feel moved to make about the exercise you have just completed. Please respond in Section 3 of the Answer Sheet. For example, you might want to respond to some of the following questions:

How valid do you feel the coding process was?
How valid do you feel Maslow's need hierarchy is?
Are there too many levels to the hierarchy? Too few?
Are some levels innacurate?
Do you feel the statements and questions you coded do a fairly complete job of covering all of the things people feel are important in their lives?
What was left out? (e.g., sex, food, etc.)
What did you have for breakfast?
Who cares?

Or, feel free to make any general comments you would like to make.

D. Instructions for Section 4 of Coding Form. This section is to collect basic demographic data on those who have participated in this exercise. Please respond in Section 4 of the Answer Sheet.

Need Hierarchy Coding Form 1A

For all Sections (1 through 4), please place your answers on the attached Answer Sheet.

SECTION 1: Statements to be Coded.
For each of the following statements select the appropriate need level which you feel best fits the statement. If no need level fits, mark Column F. Use the attached answer sheet for your answers.

Need Levels:
A. Physiological
B. Safety
C. Belongingness
D. Esteem
E. Self-Actualization
F. None

1. The main satisfaction a person can get out of work is helping other people.

2. Work should be the most important part of a person's life.

3. A person has a right to expect his work to be enjoyable.

4. The geographic location of my place of employment is important to me.

5. All things considered, working for a large organization appeals to me.

6. One should not put off present pleasure for future potential benefits.

7. I like the kind of work you can forget about after the work day is over.

8. Most jobs in civilian life are routine and monotonous.

9. To me, retirement plans and fringe benefits are important in job selection.

10. It's important to do a better job than the next person.

11. Most jobs in the Air Force are routine and monotonous.

12. Even if you dislike your work, you should do your best.

13. A person should constantly try to succeed at work even if it interferes with other things in life.

14. Sometimes it may be right for a person to lose friends in order to get ahead in his work.

15. If a person doesn't want to work hard, it's his own business.

16. Association with colleagues after working hours is an important consideration to me in job selection.

17. Much of what is wrong with the military would be cured by a return to the old values--pride in country and service, respect for authority, unit spirit, etc.

18. The privileges of rank improve or at least do not damage the morale of junior military members because they give them a goal.

SECTION 2: Validity of Coding Process.
Use the attached answer sheet for your answers.

19. Of the statements in Section 1 which I placed into one of the five need categories, I feel the indicated percentage clearly fell into one and only one need category.
A. 0-19%
B. 20-39%
C. 40-59%
D. 60-79%
E. 80-100%

20. Of the statements in Section 1 which I placed into one of the five need categories, I feel the indicated percentage fell into more than one need category.
A. 0-19%
B. 20-39%
C. 40-59%
D. 60-79%
E. 80-100%

SECTION 3: General Comments.
Make any general comments you feel appropriate concerning this exercise. (Please place your responses in Section 3 on the attached Answer Sheet.)

SECTION 4: Demographic Data. (Please place your responses in Section 4 on the attached Answer Sheet.)

Need Hierarchy Answer Sheet 1A

Section 1.

1.	A	B	C	D	E	F	10.	A	B	C	D	E	F
2.	A	B	C	D	E	F	11.	A	B	C	D	E	F
3.	A	B	C	D	E	F	12.	A	B	C	D	E	F
4.	A	B	C	D	E	F	13.	A	B	C	D	E	F
5.	A	B	C	D	E	F	14.	A	B	C	D	E	F
6.	A	B	C	D	E	F	15.	A	B	C	D	E	F
7.	A	B	C	D	E	F	16.	A	B	C	D	E	F
8.	A	B	C	D	E	F	17.	A	B	C	D	E	F
9.	A	B	C	D	E	F	18.	A	B	C	D	E	F

Section 2.

19.	A	B	C	D	E	
20.	A	B	C	D	E	

Section 3. General Comments.

Make any general comments you feel are appropriate concerning this exercise. (Use back of sheet if necessary.)

Section 4. Demographic Data.

Age:

Sex:

Undergraduate; Graduate; Professor:

Course for which you are taking part in this exercise (e.g., IE 100):

Major:

U.S. Citizen (Yes/No):

I. Introduction.

The goal of this questionnaire is to determine the validity of taking a number of statements and questions concerning the types of things people consider important (or not important) - things they are motivated by - and place these statements and questions into one or more of five different categories. The categories are the five-level need hierarchy proposed by A. H. Maslow.

The way you will respond to this questionnaire is to first thoroughly acquaint yourself with Maslow's need hierarchy as explained in the next section. Then, proceed to Section III and, using the attached Coding Form and Answer Sheet, indicate which of the five need levels you feel the indicated statement or question best fits into. Please note that there are no right or wrong answers on this exercise. Your judgment is really your only guide.

The statements and questions used in this questionnaire are all taken from surveys given to members of the U.S. Air Force over the past several years. Therefore, you will find that some of these statements have a very military-sounding orientation. In view of this, would you please try to put aside any pro- or anti-military sentiments you might have when answering this questionnaire.

II. Maslow's Need Hierarchy.

Maslow theorized the existence of five basic types of human motivations (or needs) which are active in a hierachical order. That is, as one type of need becomes largely satisfied, the next one in the hierarchy becomes dominant. These five levels of needs are:

1. Physiological needs, including the need for food, water, air, a minimum level of personal physical comfort, etc.

2. Safety needs, or the need for security; stability; dependency; protection; freedom from fear, from anxiety and chaos; absence from pain, threat, or illness; need for structure, order, law, limits; strength in the protector; and so on.

3. Belongingness and love needs, or the need for affiliation and affection; the presence of friends, or a sweetheart, or a wife, or children; the need for affectionate relations with people in general, namely, for a place in your group or family; the absence of loneliness, of ostracism, of rejection, of friendlessness, of rootlessness; the need for social interrelationships with those around you; and so on.

4. Esteem needs, or the need for a stable, firmly based, high evaluation of oneself, for self-respect, or self-esteem; and the need for esteem from others. These

include the desire for strength, for achievement, for adequacy, for mastery and competence, for confidence in the face of the world, and for independence and freedom. Also included are the desires for reputation or prestige (that is, as respect or esteem from other people), status, fame and glory, dominance, recognition, attention, importance, dignity, and appreciation. Satisfaction of the self-esteem need leads to feelings of self-confidence, worth, strength, capability, and adequacy, of being useful and necessary in the world. Thwarting of these needs produces feelings of inferiority, of weakness, and of helplessness.

5. The Need for Self-Actualization. If all the previous four need types are satisfied, we may still often (if not always) expect that a new discontent and restlessness will soon develop, unless the individual is doing what he, individually, is best fitted for. A musician must make music, an artist must paint, a poet must write, if he is to be ultimately at peace with himself. What a woman can be, she must be. She must be true to her own nature. This all refers to man's desire for self-fulfillment, namely, to the tendency for him to become actualized in what he is potentially, to become everything that he is capable of becoming, the realization of his potential.

III. Instructions for Need Hierarchy Coding Form.

A. Instructions for Section 1 of Coding Form. Each of the statements and questions in Section 1 of the attached Coding Form may be considered a query involving one (or more) of the five types of needs Maslow has hypothesized. For purposes of responding to the coding form, please divide up each Statement into one or more of the Need Levels, using a percentage breakout in increments of ten percent. For example, Statement 1 is: "The main satisfaction a person can get out of work is helping other people." Now that you are familiar with Maslow's Need Hierarchy you might consider this statement an indication of Belongingness Needs, or Esteem Needs, or both. (If you are still not clear on Maslow's hierarchy, please refer back to Section II as needed.) If you consider this statement to be an indication of only Belongingness Needs, then assign 100% to Need Level C for Statement 1 on the Answer Sheet. (Column A corresponds to Physiological Needs; Column B to Safety Needs; Column C to Belongingness Needs; Column D to Esteem Needs; Column E to Self-Actualization Needs; and Column F to None, or no need category.) On the other hand, if you consider this statement an indication of, say, 60% Belongingness Needs, and 40% Esteem Needs, then assign 60% to Need Category C and 40% to Need Category D. "None", Column F, is also a permissible category to assign a percentage. That is, if you consider Statement 1 to be an indication of 70% Belongingness Needs,

and 30% of no need level listed, then assign 70% to Need Category C and 30% to Category F (None). All percentages for each statement should total up to 100%, and any statement can be assigned to none, one, or more categories.

B. Instructions for Section 2 of Coding Form. This is a general comments, non-quantitative section, to use for any comments you feel moved to make about the exercise you have just completed. Please respond in Section 2 of the Answer Sheet. For example, you might want to respond to some of the following questions:

How valid do you feel the coding process was?
How valid do you feel Maslow's need hierarchy is?
Are there too many levels to the hierarchy? Too few?
Are some levels innacurate?
Do you feel the statements and questions you coded do a fairly complete job of covering all of the things people feel are important in their lives?
What was left out? (e.g., sex, food, etc.)
What did you have for breakfast?
Who cares?

Or, feel free to make any general comments you would like to make.

C. Instructions for Section 3 of Coding Form. This section is to collect basic demographic data on those who have participated in this exercise. Please respond in Section 3 of the Answer Sheet.

Need Hierarchy Coding Form 1B

For all Sections (1 through 3), please place your answers on the attached Answer Sheet.

SECTION 1: Statements to be Coded.

For each of the following statements select the appropriate need levels which you feel best fit the statement, and assign percentages to each need level in increments of ten percent. If you feel part or all of a statement does not code into any need category, then assign an appropriate percentage to Column F (None). Use the attached Answer Sheet for your answers.

Need Levels:
A. Physiological
B. Safety
C. Belongingness
D. Esteem
E. Self-Actualization
F. None

1. The main satisfaction a person can get out of work is helping other people.

2. Work should be the most important part of a person's life.

3. A person has a right to expect his work to be enjoyable.

4. The geographic location of my place of employment is important to me.

5. All things considered, working for a large organization appeals to me.

6. One should not put off present pleasure for future potential benefits.

7. I like the kind of work you can forget about after the work day is over.

8. Most jobs in civilian life are routine and monotonous.

9. To me, retirement plans and fringe benefits are important in job selection.

10. It's important to do a better job than the next person.

11. Most jobs in the Air Force are routine and monotonous.

12. Even if you dislike your work, you should do your best.

13. A person should constantly try to succeed at work even if it interferes with other things in life.

14. Sometimes it may be right for a person to lose friends in order to get ahead in his work.

15. If a person doesn't want to work hard, it's his own business.

16. Association with colleagues after working hours is an important consideration to me in job selection.

17. Much of what is wrong with the military would be cured by a return to the old values--pride in country and service, respect for authority, unit spirit, etc.

18. The privileges of rank improve or at least do not damage the morale of junior military members because they give them a goal.

SECTION 2: General Comments.

Make any general comments you feel appropriate concerning this exercise. (Please place your responses in Section 2 on the attached Answer Sheet.)

SECTION 3: Demographic Data. (Please place your responses in Section 3 on the attached Answer Sheet.)

Need Hierarchy Answer Sheet 1B

Section 1. Statement No.	Need Categories and Percentages A	B	C	D	E	F
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.						
18.						

Section 2. General Comments.

Make any general comments you feel are appropriate concerning this exercise. (Use back of sheet if necessary.)

Section 3. Demographic Data.

Age:

Sex:

Undergraduate; Graduate; Professor:

Course for which you are taking part in this exercise (e.g., IE 100):

Major:

U.S. Citizen (Yes/No):

For all Sections (1 through 4), please place your answers on the attached Answer Sheet.

SECTION 1: Statements to be Coded.
For each of the following statements select the appropriate need level which you feel best fits the statement. If no need level fits, mark Column F. Use the attached answer sheet for your answers.

Need Level Coding:
A. Physiological
B. Safety
C. Belongingness
D. Esteem
E. Self-Actualization
F. None

1. Be promoted on the basis of ability.

2. Have adequate time for leisure and recreational activities.

3. Work with friendly and cooperative people.

4. Gain technical training and experience.

5. Be assigned to an interesting job.

6. Receive recognition for work well done.

7. Have competent supervisors.

8. Feel a sense of accomplishment.

9. Have a say in what happens to oneself.

10. Be able to assume important responsibilities, or to have a job with important responsibilities.

11. Obtain a good salary.

12. Have adequate job security.

13. Be in a competitive situation.

14. Do a great deal of traveling.

15. Have a job which effectively utilizes one's personal talents and abilities.

16. Do work that gives one a feeling of achievement and/or accomplishment.

17. A chance to be independent and self-reliant by using one's own discretion about details of one's job.

18. Work with high quality of co-workers and peers.

19. Advance in rank at a fairly rapid rate.

20. Exercise leadership potential and initiative.

21. Settle down in a certain area.

22. Work under consistent and intelligent personnel policies.

23. Work in a friendly and warm job environment.

SECTION 2: Validity of Coding Process.
Use the attached answer sheet for your answers.

24. Of the statements in Section 1 which I placed into one of the five need categories, I feel the indicated percentage clearly fell into one and only one need category.
A. 0-19%
B. 20-39%
C. 40-59%
D. 60-79%
E. 80-100%

25. Of the statements in Section 1 which I placed into one of the five need categories, I feel the indicated percentage fell into more than one need category.
A. 0-19%
B. 20-39%
C. 40-59%
D. 60-79%
E. 80-100%

SECTION 3: General Comments.
Make any general comments you feel appropriate concerning this exercise. (Please place your responses in Section 3 on the attached Answer Sheet.)

SECTION 4: Demographic Data. (Please place your responses in Section 4 on the attached Answer Sheet.)

Need Hierarchy Answer Sheet 2

Section 1.

1.	A	B	C	D	E	F	13.	A	B	C	D	E	F
2.	A	B	C	D	E	F	14.	A	B	C	D	E	F
3.	A	B	C	D	E	F	15.	A	B	C	D	E	F
4.	A	B	C	D	E	F	16.	A	B	C	D	E	F
5.	A	B	C	D	E	F	17.	A	B	C	D	E	F
6.	A	B	C	D	E	F	18.	A	B	C	D	E	F
7.	A	B	C	D	E	F	19.	A	B	C	D	E	F
8.	A	B	C	D	E	F	20.	A	B	C	D	E	F
9.	A	B	C	D	E	F	21.	A	B	C	D	E	F
10.	A	B	C	D	E	F	22.	A	B	C	D	E	F
11.	A	B	C	D	E	F	23.	A	B	C	D	E	F
12.	A	B	C	D	E	F							

Section 2.

24.	A	B	C	D	E
25.	A	B	C	D	E

Section 3. General Comments. Make any general comments you feel are appropriate concerning this exercise. (Use back of sheet if necessary.)

Section 4. Demographic Data.

Age:

Sex:

Undergraduate/Graduate/Professor:

Course for which you are taking part in this exercise (e.g., IE 100):

Major:

U.S. Citizen (Yes/No):

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This takes as its point of departure Abraham H. Maslow's hierarchical theory of human motivation, first hypothesized in 1943 and updated by Maslow as recently as 1970. Maslow's theory involves five different types of needs (levels) and describes the hypothesized relationships between them as they vary in their degree of strength and satisfaction. The objectives of this work are three-fold; (1) to mathematically model the basic parameters and relationships in Maslow's theory, (2) to derive hypotheses

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from this model, and (3) to use empirical data to test these hypotheses and reach conclusions about the validity of the underlying theory.

The model specifies ten hypotheses, all in mathematical form, nine of which are testable against six sets of survey data on Air Force officer and enlisted personnel. The results of the statistical analyses, most of them flowing from multiple linear regressions, displayed little or no evidence supporting the hypotheses derived directly from Maslow's theory. Only one hypothesis, which was indirectly tied to Maslow's theory, received good support from the statistical evidence.

In the course of analyzing the results an alternative relationship was suggested between strengths of different types of needs. This is a convex, second-order relationship and was dubbed "The Pendulum Theory of Motivation" as descriptive of the dynamic manner in which people are hypothesized to satisfy their differnet types of needs. This theory closely resembles the equilibrium-disequilibrium theory of motivation.