This dissertation has been
microfilmed exactly as received

69-12,066

CARVALHO, Gerard Francis, 1933-

ROLE CONFLICT AND ROLE AMBIGUITY IN RESEARCH AND DEVELOPMENT ORGANIZATIONS.

The University of Michigan, Ph.D., 1968
Business Administration

University Microfilms, Inc., Ann Arbor, Michigan

ROLE CONFLICT AND ROLE AMBIGUITY IN RESEARCH AND DEVELOPMENT ORGANIZATIONS

by
Gerard Francis Carvalho

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy in
The University of Michigan
1968

Doctoral Committee:

Professor George S. Odiorne, Chairman
Professor Lee E. Danielson
Associate Professor Wallace W. Gardner
Professor Sidney Jones
Professor Wilbur C. Nelson

ABSTRACT

ROLE CONFLICT AND ROLE AMBIGUITY IN RESEARCH AND DEVELOPMENT ORGANIZATIONS

by

Gerard Francis Carvalho

Chairman: George S. Odiorne

This thesis is a theoretical and experimental investigation of the phenomena of role conflict and role ambiguity in the managerial hierarchies of research and development organizations.

A review of some of the important research on the reactions to conflict indicates that conflict is multi-dimensional in nature; that there are two basic types of reactions to conflict, compliance or avoidance; that motor conflicts are among the simplest of conflicts; and that existing theories of conflict are severely limited in usefulness. It is the general objective of this research to develop a new model to explain the nature of conflict and to begin to develop a more generalized theory of conflict than those presently available.

A vector spaces model of conflict is developed in which the behavior space is said to contain three sub-spaces. The stimulus space has a basis consisting of the cognitive organization of an individual, his needs structure, and his personality. The response space has a basis consisting of the ways an individual has learned to act. The transformations space has a basis consisting of all those methods by which an individual associates a particular element in the stimulus space with a particular element in the response space.

Study of the vector spaces conflict model reveals that conflict exists only when an individual (1) is subjected to a force or combination of forces, (2) is compelled to respond to that force or combination of forces, and (3) is unable to identify the appropriate major dimension and minor dimensions of the force or set of forces in S-space so that a transformation to a non-zero vector in R-space can occur.

Response time is a poor indicator of degree of conflict because it does not distinguish between conflict (resultant force lying on a neutral axis) and learning (expansion of dimension of basis of the behavior space). Stress measures are far more appropriate measures of intensity of conflict because they are directly related to the degree of accommodation (strain) required before a response is possible.

The dimensionality of influences, and the location of the resultant stimulus forces, is determined by the individual subjected to the influences. Whenever stimulus forces are linearly dependent and the resultant linear combination is non-zero and non-neutral, a response to the forces will occur.

Research data were collected from a sample of managers in four different research and development organizations. Additional data were also made available to the author by the Institute of Social Research, The University of Michigan.

Four hypotheses were formulated and tested using the two independently collected sets of data.

A statistical relationship was found to exist between the indexes of experienced role conflict and experienced role ambiguity, but causation was not established. It was also found that respondents experienced higher role ambiguity when they were dissatisfied with the effort being devoted to setting specific work objectives. Experienced role conflict was found to be highly correlated with disagreement with one's superior over degree of authority to allocate organizational rewards, e.g. pay, promotions, to one's subordinates. Granting managers a high degree of authority to define their own jobs had no significant relationship to the degree of role conflict and role ambiguity they experienced.

It was concluded that sensitivity training may have some effect on the degree of role ambiguity experienced if such training resulted in the development of strong feelings of liking, trust, and respect between members of a role set. It was also concluded that managing a research and development organization by objectives appears to be the most promising managerial strategy currently available to R and D managers.

ACKNOWLEDGEMENTS

The author is deeply indebted to many people who gave of their time to assist in the completion of this dissertation. The members of the committee were very helpful in providing advice and encouragement, especially Dr. George Odiorne who continuously gave his help and wise counsel first as a student advisor and then as chairman of my dissertation committee. Special thanks are due also to Dr. Lee Danielson, whose critical comments have improved this thesis greatly.

The Bureau of Industrial Relations, Graduate School of Business Administration, The University of Michigan supported this research by providing funds for the preparation and production of the questionnaire and the travel required to collect the field data. The College of Business of the University of Utah and the University of Michigan both provided the computer time required to conduct the statistical analyses. The Bureau of Economic and Business Research of the University of Utah provided the clerical, editorial and printing assistance required to make the final draft of this thesis a reality.

The ideas and stimulation provided to this author by many different teachers and colleagues over the years are embodied in this thesis, either overtly or covertly. My debts to them will not be easily repaid.

Finally, I owe an eternal debt to my wife, Shirley Jean. She has worked and sacrificed throughout all my years in undergraduate and graduate school. Furthermore, she has admirably handled the role conflicts and role ambiguities that befall anyone who tries to be both mother and father to six energetic boys while "daddy is studying."

TABLE OF CONTENTS

		Page
ACKNOWLEDGEMENTS		ii
LIST OF TABLES		vi
LIST OF FIGURES		viii
LIST OF APPENDICES		ix
Chapter		
1.	THE NATURE OF CONFLICT	1
	Introduction	1
	Relevant Research	4
	Some Mathematical Models of Conflict	15
2.	A VECTOR SPACES MODEL OF CONFLICT	23
	Introduction	23
	The Concept of Behavior Space	27
	The Concept of the Zero Vector	35
	The Concept of Independence	37
	Theoretical Relationship between Conflict and Learning	39
	Summary	43
3.	APPLICATION OF THE VECTOR SPACES MODEL OF CONFLICT TO THE PHENOMENA OF ROLE CONFLICT AND ROLE AMBIGUITY	45
	Extensions of the Vector Spaces Model of Conflict	45
	Relationship Between Role Conflict and Role Ambiguity	50
	Hypotheses	51
4.	METHODOLOGY	55
	Tests of Hypotheses	55
	Research Procedure	59
	Research Sample Characteristics	61

Chapter		Page
5.	RELATIONSHIP BETWEEN EXPERIENCED ROLE AMBIGUITY AND EXPERIENCED ROLE CONFLICT . . .	64
	Introduction	64
	Test of Hypothesis H:1	67
6.	CAUSES OF ROLE AMBIGUITY AND ROLE CONFLICT .	70
	Introduction	70
	Causes of Role Ambiguity	71
	Causes of Role Conflict	80
7.	MECHANISMS FOR MANAGING ROLE CONFLICT AND ROLE AMBIGUITY	95
	Introduction	95
	Mechanism 1: Opportunity to Define One's Own Job .	95
	Mechanism 2: Frequency of Communication	98
	Mechanism 3: Affective Interpersonal Bonds	100
	Mechanism 4: Choice of Role Set Members	102
8.	SUMMARY AND CONCLUSIONS	105
	Introduction	105
	Relationship Between Role Conflict and Role Ambiguity	106
	Causes of Role Ambiguity	107
	Causes of Role Conflict.	108
	Mechanisms for Controlling Role Conflict and Role Ambiguity	110
	Conclusions	111
	Implications for Future Research	113
LIST OF REFERENCES		117
APPENDICES		121
SELECTED BIBLIOGRAPHY		160

LIST OF TABLES

Table		Page
1	Correlation Ratio Analysis Results for Experienced Role Conflict as a Function of Experienced Role Ambiguity	67
2	Experienced Role Ambiguity in Relation to Contact Time with Various Classes of Role Set Members	73
3	Experienced Role Ambiguity in Relation to Effort Devoted to Setting and Communicating Organizational Objectives	75
4	Mean Experienced Role Ambiguity in Relation to Priority Structure of Information Sources: Respondent and Supervisor	78
5	Mean Experienced Role Ambiguity in Relation to Priority Structure of Information Sources: Respondent and Subordinates	78
6	Experienced Role Conflict in Relation to Perceived Pressure from Superior to Change Time Allocated to Various Categories of Role Set Members When Respondent Feels Time Allocations Are Proper	82
7	Experienced Role Conflict in Relation to Perceived Pressure from Subordinates to Change Time Allocated to Various Categories of Role Set Members When Respondent Feels Time Allocations Are Proper	84
8	Mean Experienced Role Conflict in Relation to Satisfaction with Emphasis Being Devoted to Several Types of General Objectives	88
9	Mean Experienced Role Conflict in Relation to Degree of Agreement with Supervisor on Authority to Make Certain Kinds of Decisions about Subordinates	91
10	Mean Experienced Role Conflict in Relation to Degree of Agreement with Subordinates on Authority to Make Certain Kinds of Decisions about Subordinates	92

LIST OF TABLES (Continued)

Table		Page
11	Correlation Ratios for Experienced Role Ambiguity and Experienced Role Conflict as Functions of Opportunity to Define One's Own Job (Kahn, et al., data)	97
12	Correlation Ratios for Experienced Role Ambiguity and Experienced Role Conflict as Functions of Frequency of Communications (Kahn, et al., data)	99
13	Correlation Ratios for Experienced Role Ambiguity and Experienced Role Conflict as Functions of Strength of Affective Interpersonal Bonds (Kahn, et al., data)	101
14	Correlation Ratios for Experienced Role Ambiguity and Experienced Role Conflict as Functions of Opportunity to Associate with Role Set Members of One's Own Choosing	103

LIST OF FIGURES

Figure		Page
1	Stimulus space with legitimacy--sanctions dimension; moral-expedient orientation to conflict	30
2	Stimulus space containing Legitimacy Sub-space and Sanctions Sub-space	30
3	One of sixteen types of role conflicts according to the Gross, et al., theory of role conflict resolutions	32
4	Type of role conflict experienced by a focal person with a moral orientation. Gross Prediction: compliance with B	32
5	Type of role conflict experienced by a focal person with an expedient orientation. Gross Prediction: compliance with A	33
6	Type of role conflict experienced by a person with a moral-expedient orientation. Gross Prediction: compromise between A and B	33
7	Uni-dimensional S-space when an independent force is applied	41
8	A theoretical model of factors involved in adjustment to role conflict and ambiguity	47
9	Role set structure perceived by supervisor when supervisor is satisfied and dissatisfied with amount of time an immediate subordinate (respondent) spends with higher-ups	83

LIST OF APPENDICES

Page

APPENDIX I

Questionnaire: Work Patterns of Research and Development Managers 121

APPENDIX II

Correlation Coefficient Matrix for Items of Question 30, Appendix I 159

CHAPTER 1

THE NATURE OF CONFLICT

Introduction

Conflict and ambiguity in the extreme cause disorientation, disorder and debilitation. Intuition and some slight evidence, however, indicate that conflict and ambiguity in proper amounts are necessary if mankind is to progress, as progress is defined today.[1]

The existence of conflict and ambiguity has been recognized and recorded throughout the entire history of man. Wars between tribes and nations have been recorded since the beginning of history, as has the slow and sometimes painful progress made by man in developing an understanding of his environment. The first book of the Bible contains an accounting of the creation of the universe which can be viewed as an attempt by early man to reduce the ambiguity surrounding his very existence. This same book also contains one of the best known early accounts of conflict in interpersonal relations, the story of Cain and Abel.

Conflict appears to be inevitable. Man is always in conflict with his physical environment, searching for his identity and struggling for survival. Industrialization has done much to minimize the intensity of the struggle for survival but the search for identity goes on. It does not eliminate this type of conflict, but rather it merely causes a shifting in focus from the struggle for survival to the search for identity.

The process of industrialization also seems to be responsible for exacerbating a second category of conflict, conflict between men. With the increase in specialization in industry there has been a concomitant increase in the interdependency between men. Serious inquiry into the relationships between organization structure, production systems, and conflict is in its infancy, but available data indicate that some relationships exist.[2]

A by-product of industrialization is the development of a communications network that allows people all over the world to keep informed of events outside of their own daily environments. Constant research has led to a greater understanding of the nature of the universe and the nature of man. Yet however much of mankind's store of knowledge and communications network increase, individuals still experience ambiguity. Businessmen must plan and make decisions without knowing with certainty what the future will be. Students must make career decisions under uncertainty. It seems almost a law of nature that regardless of how much knowledge is accumulated, or how efficient communications are, more questions are always generated than it is possible to answer.

This work is an inquiry into the causes of role conflict and role ambiguity, the relationships between these phenomena and mechanisms by which the phenomena can be controlled. If a causal relationship exists between these phenomena, then control of the independent phenomenon will result in control of the dependent phenomenon. Once the causes of the phenomena are understood it will be possible to identify mechanisms that can be used to control the phenomena.

A major assumption underlying this work is that uncontrolled role conflict and role ambiguity can result in lower productivity in organizations. If it were

possible to devise productivity measures for all organizations, then it would be possible to use the productivity measures as indicators of problems existing in organizations. Given a measure of productivity one could work backward and conceivably identify role conflicts and role ambiguities that were causing lower than normal productivity.

Currently there are no measures of productivity that can be satisfactorily applied to research and development organizations. The nature of the work done in R & D organizations is highly intangible and the indicators of results accomplished, i.e., papers, patents, reports, designs, etc., provide no clues as to whether those results were obtained efficiently.

Certainly research into methods to measure intangible activities, e.g., research and development, should continue. However this author believes that another line of investigation is worthwhile: the identification of barriers to productivity and methods to overcome those barriers. Thus underlying this paper is the assumption that greater productivity can be obtained in research and development organizations provided that role conflict and role ambiguity are maintained at optimum levels. No attempt will be made to define what an optimum level is for either role conflict or role ambiguity. Rather this thesis is an attempt to identify at least some elements of a managerial strategy that can be used to move toward those optimum levels.

Obviously identification of optimum levels of role conflict and role ambiguity must await further research. It is believed however that even before the optimum levels are defined the characteristics which identify those optimum levels will be known. As soon as those characteristics are identified it will be

possible to apply managerial strategies to more organizations and individuals toward those optimum levels with little fear of making serious managerial mistakes.

Relevant Research

So much has been written about conflict that an exhaustive review of the literature on the subject is an almost insurmountable task. (See Bibliography) Therefore in this section only a few carefully selected research studies on conflict will be reviewed. The relevant research reviewed has been selected because it contains ideas and/or data that are important to the model of conflict developed in Chapter 2, and it is representative of a broader class of research studies on conflict. Research studies on conflict between groups has not been included because it is believed that the model of conflict developed in this work can be extended to include that class of conflict. That will be the subject of future research.

The generally accepted definition of conflict is that it is the existence, in a field, of incompatible forces of approximately equal strength. Lewin, using the field concept, identified three basic types of conflict:

1. Type I (now called approach-approach)--the person is located between two positive valences in the field.
2. Type II (now called approach-avoidance)--the person is faced with an object in the field which has both a positive and a negative valence.
3. Type III (now called avoidance-avoidance)--the person is located between two negative valences in the field.[3]

The positive valences represent something desirable and tend to attract the person toward them while the negative valences represent something undesirable and tend to repel the person from them. Conflict is said to exist whenever a person is located in a field which contains one of the three sets of valences, cannot escape from that field, and is forced to choose one of the two valences in the set in the case of Type I and Type III conflict, or is forced to decide between choosing or not choosing the object with counterbalancing valences in the case of Type II conflict.

Lewin's field theoretic model of conflict has served as a basis for design of many of the experiments in motor conflict, regardless of whether the subjects were animals or humans. Most of the research to be reviewed now is based on Lewin's model, or can be interpreted in light of Lewin's model. In the next chapter Lewin's model of conflict will be extended along lines he proposed but was unable to pursue in depth in his lifetime.

Implicit in the work of Pribram is the idea that conflict is necessary for progress in the development of harmonious relations between nations.[4] He analyzes international problems in terms of the conflicting patterns of thought that are used by various social philosophers when defining the basic concepts of society, the relationships that should exist between members of society, and the effects that these concepts and relationships have on the peaceful settlement of international problems. He very carefully points out that the conflict is among specific individuals who disagree on what assumptions regarding the cognitive capacity of the human mind should be adopted as the major premises for subsequent thinking. As a result of disagreement on basic assumptions, social

institutions are conceptualized and developed which are in conflict with each other, e.g., democratic vs. communistic forms of government.

Although conflict appears to be harmful, Pribram is not alone in arguing that some good can come from conflict. Simmel points out that conflict is in reality one form of sociation and "is a way of achieving some kind of unity, even if it be through the annihilation of one of the conflicting parties."[5] In this thesis it is assumed that conflict, in carefully controlled amounts, is beneficial to mankind. However, so little is known about the nature of conflict that it is impossible at present to predict what amount of conflict in a given situation is most beneficial, or to control conflict so that it remains within reasonable limits. In fact it seems obvious, that in social groups that are established to produce a product or service for sale, excessive or insufficient conflict will result in lower productivity. It is hoped that this inquiry into the nature of conflict will provide some ideas on how to manage conflict so as to achieve maximum productivity.

Miller and Swanson are concerned primarily with the ways that social class and method of child-rearing will influence reactions to inner conflict, where inner conflict is described as a phenomenon of oscillation between opposing forces approximately equal in strength.[6] They limited their samples to males: one group of males was drawn from those in the seventh through ninth grades in school, and the other group was drawn from college students. The results obtained were many and not amenable to summarization within a limited space. The authors do not present any general theory of reaction to inner conflict but the results of their work do permit limited predictions to be made in the sense that if the experimental conditions are categorized, for each category of conditions,

i.e., set of stimuli, a specific reaction would be expected. However this method of prediction is cumbersome, not always feasible to use, and sheds little light on the essence of the phenomenon of conflict.

Kendall is primarily concerned with the stability of response over time to a conflict situation.[7] In Kendall's work, conflict refers to a condition in which an individual perceives the alternative responses to a question on a questionnaire to be equal or nearly equal. It was found that in general as the alternatives become more nearly equal, conflict is intensified and responses become more unstable over time. This result appears compatible with Lewin's conceptualization of a reaction to the approach-avoidance type conflict.[8] Instability of reaction has also been obtained experimentally by Hovland and Sears to an approach-avoidance type conflict.[9] This evidence leads one to speculate that (1) any reaction to any type conflict is possible, (2) all reactions to conflict might be unstable over time and, (3) the ways in which the subjects cognize the stimuli presented will determine their reactions regardless of what type of conflict situation the experimenter thinks he is presenting. The results obtained by Kendall, plus speculations of this type, led her to conclude that conflict is somehow related to decision-making.

Research in which the phenomena of conflict and decision-making were combined was conducted by Worell and Worell.[10] The dependent variable in this research was time to make a decision, and the independent variable was intensity of illumination. The subjects were exposed to a weak conflict situation in which there were two distinctly different brightness levels, observed through two milk glass windows, and a strong conflict situation in which both windows were

illuminated to equal intensity. In each case the subjects were asked to indicate which of the two lights was the brightest. The subjects were instructed to concentrate on accuracy in response with no mention made of response time. Based on the results obtained, the authors conclude that decision speed is facilitated by training in weak conflict, and hindered by training in strong conflict.

There are some serious limitations in this research, however. First, the researchers do not report any relationship between decision speed and accuracy, the result the subjects were instructed to produce. In fact, in the strong conflict situation it was impossible for the subjects to produce an accurate response due to the research design. Since the subjects perceived themselves to be in a decision-making situation, accuracy of decision should have been a control variable.

Second, it is difficult from the reported results to determine which of Lewin's three types of conflict situations the subjects perceived themselves to be in. Miller added to Lewin's three types of conflict another type of conflict situation called the double approach-avoidance.[11] Miller and others, as summarized in Yates,[12] have found that approach gradients[13] and avoidance gradients differ in value. Oram and Heilizer point out that the relative values of the gradients are related to the particular type of conflict experienced.[14] Since the concept of gradient involves time it is important to control for the type of conflict situations subjects experience whenever response time is a dependent variable. Worell and Worell give no indication of exerting control over type of conflict in their research. Therefore their reported results which indicate that decision speed is a function of intensity of conflict must be interpreted very carefully.

Almost all research data available to date on reactions to conflict have been obtained under conditions in which the number of stimuli and number of responses have been very carefully controlled. The most common experimental condition consists of one stimulus and two possible responses. When the experiments have used nonhuman subjects, withdrawal from the field is usually prevented by construction of physical barriers. In experiments with human subjects withdrawal from the field is typically prevented by offering positive rewards, e.g., money.

Hovland and Sears conducted an experiment in which the effective number of stimuli was increased to two rather than one, and the number of possible responses was increased to four, rather than two.[15] In the experiment the subjects were trained to respond in a prescribed singular fashion to one of two sets of lights by moving a stylus from a base point toward one of the sets of lights. Throughout the training trials only one set of lights at a time was flashed. Conflict was then created by flashing both lights simultaneously without any prior knowledge on the part of the subject that such a situation would ever be encountered. The results indicate a general trend to react to a simple approach-approach conflict with a singular response and to react to a relatively complex double approach-avoidance conflict with a blocking response.

Andreas points out that the ambiguity surrounding the presentation of multiple stimuli in the Hovland and Sears work may be a sufficient condition to elicit extraneous responses.[16] In his work therefore, he presented the multiple stimuli but informed the subjects of the multiple stimuli and trained them, through trial-and-error learning, to respond to the "correct" stimulus.

The results Andreas obtained are intriguing, especially where compared with the above-mentioned work of Worell and Worell. Both experiments used response time as the dependent variable. Although Andreas could easily control the type of conflict situation presented to the subject, he did not report response times as a function of type of conflict either. Also, in both the Andreas and Worell experiments, the subjects presumably could block but the researchers make no mention of any attempts by the subjects to do so, or of the construction of strong barriers to prevent blocking.

Since Hovland and Sears have shown that blocking is a possible response to conflict, it is necessary to probe further into the work of Worell and Worell and Andreas to see if any plausible explanations exist to account for a lack of blocking under the conditions similar to those in which Hovland and Sears found blocking to be a frequent response. First, in the Worell and Worell experiment the subjects were asked to respond with "accuracy" but were never informed about whether or not they were responding accurately. And, in fact, as mentioned above, in the case called strong conflict any response other than blocking would be inaccurate. Thus in the Worell and Worell work the subjects were always free to assume that they had responded accurately each time, especially since they were under no time pressures in making their decisions.

Now it would seem that in Andreas' work blocking would be the reaction to the avoidance-avoidance type conflict situation. The explanation for the failure to block seems to lie again in the research methodology employed. Andreas, in the familiarization trials, did not provide any electric shocks for responding to lights #2 and #6. However immediately after the familiarization trials electric

shocks were given for responding to lights #2 and #6. The subjects had had an opportunity to respond once to a stimulus, which was later to be always a "wrong" response, without receiving a negative reward. Thus the question arises as to whether the subsequent training sessions were sufficient to obliterate the knowledge of having executed a specific behavior once without punishment. If they were not, then it seems plausible that the subjects could be operating under the assumption that the reward for responding to lights #2 and #6 would change from negative to positive, just as it had effectively changed from positive to negative. This assumption is further strengthened by the results obtained for the group subjected to four training trials. The mean response time for the second conflict trial increases markedly over that for the first conflict trial, indicating that learning could still be taking place; and just as plausibly, that the one identical rewarded response has not yet been extinguished. The strength of this assumption would be markedly increased if the data indicated that, irrespective of length of training, the subjects first responded to one of the "wrong" stimuli on the first conflict trial and to the other of the "wrong" stimuli on the second trial. Unfortunately the author did not report that data.

It would be helpful at this point to reflect on some implications of the relevant research cited. The work of Andreas, Hovland and Sears, and Worell and Worell is based primarily on the S-R theory of behavior. In research on conflict which is based on this theory, the alternative stimuli and possible responses are usually very carefully controlled so that conflict can be defined as the existence of two opposing forces of approximately equal strength existing in the field. Since the Andreas-Worell type of research uses response time as the dependent

variable and the Hovland-Sears type of work uses type of response as the dependent variable, it is not possible to synthesize a theory of conflict directly from the results obtained. Thus one is led to speculate about the possible relationship between response time and type of response, where blocking is a permissible response. Also, one wonders if this relationship would possess the same characteristics under a condition of certainty concerning the number and types of stimuli to be presented, versus a condition of ambiguity.

In the work of Kendall, and of Miller and Swanson mentioned above, the restraints on number of stimuli presented and number of responses permitted were relaxed and response time was not a dependent variable. Also ambiguity about the exact nature of the stimuli being presented to the subjects was not directly controlled and the subjects were relatively free to formulate their own perceptions of what the precise stimulus was before responding.

Finally in work of the type done by Pribram one sees that when all restrictions on stimuli are relaxed, i.e., one is free to choose a set of assumptions about behavior, apparently unlimited different responses are possible. But once again it must be pointed out that all of the research cited is concerned with reaction to conflict. However in the research reviewed above there are some clues and insights into the nature of conflict. Before attempting to develop a new model of conflict it will be profitable to review very briefly two other research studies.

The research studies of Gross, et al.,[17] and of Kahn, et al.,[18] have been major exploratory attempts to generalize the research work on conflict and its resolution. In each of these studies the subjects, who occupied specified roles in organizations were requested to respond to a series of questions designed to identify

their perceptions of the expectations placed upon them (the stimuli), and their methods of resolving conflicting expectations (the responses). Thus both the stimuli and responses were theoretically unlimited in number, point of application, and intensity.

Gross, et al., propose a theory of conflict resolution which contains two dimensions, legitimacy and sanctions, and show how the theory can be used to predict the behavior of a subject (a school superintendent) exposed to two incompatible expectations. The important fact to recognize is that their model, which was limited to two dimensions and two expectations, always allows sixteen possible combinations of dimensions and expectations to exist. This means that an individual who uses only two dimensions when analyzing only two conflicting expectations can view the conflict situation in any one of sixteen different ways before deciding how to react to the conflict. To make the theory have a higher probability of success of prediction than one in sixteen, the authors add a personality orientation parameter to their theory. Thus by knowing the orientation, e.g., moral orientation, of the person exposed to two conflicting expectations, it becomes theoretically possible to predict a compliance, compromise or avoidance reaction to conflict.

Kahn, et al., have developed a theoretical model of some of the factors involved in role conflict and role ambiguity. Their model, while not predictive in the same sense as the Gross, et al., theory, does assume that the development of role conflict and the adjustment to it is analogous to an open system with feedback loops. Within this framework they then obtain empirical correlations between degree of role stress experienced by the subjects and their positions on

five different personality dimensions, three dimensions in a category called organizational processes, e.g., system boundaries, and several not too clearly defined dimensions in a category called interpersonal relations.

Kahn and his associates also deal very briefly with the relationship between conflict and ambiguity. The reader will recall that the major point of controversy between Andreas, and Hovland-Sears was whether or not experiments dealing with motor conflicts and their resolution should be designed to protect the subjects from experiencing any ambiguity about the stimuli they were to receive. Kahn and his associates suggest that both ambiguity and conflict are independent sources of stress and produce similar consequences for the subject. Since their data do not permit the formulation of any strong conclusions, however, the relationship between conflict and ambiguity is still hypothetical at this point.

In summary, this review of some of the important research on the reactions to conflict indicates that conflict is multi-dimensional in nature; that there are two basic types of reactions to conflict, compliance or avoidance; that motor conflicts are among the simplest of conflicts; and that existing theories of conflict are severely limited in usefulness. It is the general objective of this research then, to develop a new model to explain the nature of conflict and to begin to develop a more generalized theory of conflict than those presently available.

In view of the multi-dimensional nature of conflict, it seems that any new model of conflict must be mathematical in nature in order to permit efficient summarization of the existing knowledge about conflict, and to permit efficient analysis of the multi-dimensionality of conflict and ambiguity. The next section

of this chapter contains a review of some mathematical models of conflict as a prelude to the new mathematical model which is introduced in the next chapter.

Some Mathematical Models of Conflict

There are essentially two approaches to use when applying mathematical models to intangible concepts. The first approach is to search for a model that seems to fit most closely to the concept as presently understood, and then use the model to develop further insights into the nature of the concept being modelled. The second approach is to begin with a mathematical model and develop the concept from the model, with the hope that the concept will be realistic when developed. Neither of these approaches is completely satisfactory. Both approaches are inefficient and yield results that only approximate reality. Yet it is generally accepted that the greatest gains in knowledge and insight into the true nature of intangible concepts comes about when some model is available for analysis.

Luce has attempted to apply probability theory to phenomena in psychology that have a common theme of choice, e.g., motivation, selective learning, reaction time (where reaction time includes time for choice and time for motor response).[19] Basic to this type of model is the existence of a well-defined set of alternatives over which a probability distribution exists.

Consider stimuli as one set of alternatives and response to those stimuli as another, different set of alternatives. When the assumption is made that a subject, who is forced to choose from a set of alternatives, is able to select from certain finite subsets of a set of alternatives those elements that are superior (or inferior) along a specified dimension, it is possible to construct a probability

distribution over the entire set of alternatives.[20] In constructing the probability distribution the subject is exposed only to finite subsets of, say, two or three elements. However, after the distribution is constructed it is possible to predict which single element will most likely be chosen when the subject is exposed to the entire set at once and is forced to choose one element from the entire set. The research of Worell and Worell cited above is an example of the type of choice situation where the probability model can be readily applied.

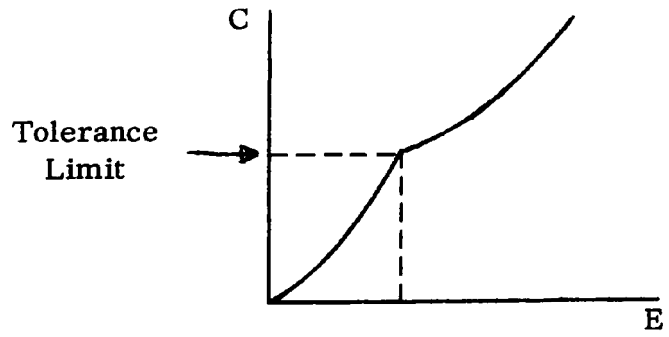
Luce has also made an attempt to apply probability theory to choice situations in which the probability distribution, over the set of alternatives changes with learning rather than remaining static. In this type of application, a further assumption is made which is usually called the independence-of-path assumption. This assumption states that the probability distribution on the n+1 trial is dependent only on trial n, i.e., that learning is cumulative in a stepwise fashion. The research of Andreas cited above is an example of the type of choice situation where the probability model with the independence-of-path assumption can be readily applied.

Luce has shown that information theory and his theory of choice behavior are interrelated whenever one allows the probability distributions over a subset T of a set of alternatives V (when only T is presented to make a choice from) to be the conditional probability distribution that exists over T when V is presented. Berlyne used the uncertainty formula from information theory to write a <u>degree of conflict</u> equation that is based on the existence of a well-defined set of responses to a conflict situation.[21] In this application it is assumed that the probability that a particular response will be chosen is some function of the strength of

response tendency. Thus if the strength of response tendency for element i of the set of responses is denoted as E_i, then the probability that element i will be selected is $P_i = f(E_i)$. Then the degree of conflict equation is written as:

$$C = \bar{E} \sum_i P_i \log_2 P_i$$

Berlyne's specification of the properties of a degree of conflict function imply that the nature of conflict is well established. However careful analysis of his specification of properties raises several interesting questions. The first property states that C is continuous and symmetric in E_i. This property implies that it is impossible to exceed a subject's tolerance of conflict instantaneously; that even when an individual reaches the limit of his tolerance for conflict, conflict still increases at some well-defined rate. This property permits the rate of buildup of conflict to be defined in the range from zero conflict to tolerance limit, and it allows for the nonexistence of the rate of buildup at the tolerance limit, provided that the rate of buildup of conflict is well defined beyond the point of discontinuity. Graphically this property can be portrayed as follows:



Another essential implication of this property is that there is no such thing as a limit to the amount of conflict an individual can withstand or that such a limit is only transitory, i.e., through some learning or cognitive reorganization

process an individual becomes capable of withstanding conflict indefinitely. The fact that people commit suicide, plus the fact that people in mental institutions are there generally because of inability to cope with conflicts in their lives indicates that this is too weak a property to use to define conflict. It seems that this questioning of the existence of a limit to the amount of conflict an individual can tolerate can be resolved by allowing the degree of conflict function to be continuous up to the tolerance limit, from which point on, regardless of the strength of response tendency E, the degree of conflict is essentially infinite.

Another property which a degree of conflict function should have, according to Berlyne, is the property that states that when all response tendencies in the response set are equal and another response is added to the set with a response tendency greater than zero, then the degree of conflict increases. Thus this property states that the individual who must choose an element from the response set will recognize all those response tendencies which have some strength, regardless of the relative differences in strengths of the elements in the set. It implies the ability to evaluate strength of response tendency on an absolute scale as well as a relative scale. Cardinal vs. ordinal utility theory economists have not been able to settle their differences to date[22] and the question of whether strength of response tendencies should be measured on an absolute or relative scale cannot be settled within the limits of this paper.

There are several operational limitations inherent in using a probability model to describe conflict. First, if blocking is admitted as one element in the set of responses the Berlyne formulation still holds, but any attempts to measure degree of conflict experimentally by establishing a functional relationship between

probability of response and response time will yield meaningless results. Blocking implies infinite time to respond. Therefore if time is to be measured as a dependent variable, it must be time required to make a choice of response.

Also, one can easily see that if the blocking response is prohibited so that response time may be measured as a dependent variable, the subject must always make a logical two-step decision. The first decision would be whether or not to comply with the rules of the experiment, which would be equivalent to choosing either the response set or the null set. If the null set is chosen then the experiment is aborted, but if the response set is chosen then the next decision in sequence must be made, i.e., which element in the response set to choose. These comments have tremendous significance when interpreting the results of motor conflict experiments.

The second operational limitation lies in the method prescribed for developing the probability distribution. The subject is required to choose which element, from among two or three, is superior according to a specified criterion or dimension. If the set is large, considerable time can be required to obtain enough data to develop a distribution, especially if the distribution is multivariate.

Presumably probability theory can be applied to any situation in which a choice of one element is to be made from among a set of well-defined alternatives. Attempts have been made to broaden the probability model to be dynamic as well as static by adopting the independence-of-path assumption in applications of probability theory to learning situations. Very little has been done, however, to develop functional relationships between two or more sets of elements from which choices are made. For example, in S-R theory, it is easy to conceive a set of

stimuli and a set of responses and apply the probability concepts to each set independently. But practically no work has been done to develop probability models of the functional relationships between stimuli and response, perhaps because very little is known about the nature of the relationships, and also perhaps because developing probability distributions over separate sets of elements that are functionally related is extremely difficult. When a probability model is applied to a conflict situation by examining the response set, what stimulates the making of a choice? Is it force, or a desire to participate, or a monetary reward, or a compulsion to submit to physical pain? Certainly these questions must be answered if the relationship between stimulus and response is ever to be understood.

On a conceptual plane, application of probability theory to choice behavior presumes that such behavior is probabilistic whereas the word choice implies determinism. The use of probability theory to describe conflict implies that conflict is a random phenomenon whereas existing evidence cited above indicates that it is not. Arguments to the effect that probability models are more feasible than other types of mathematical models available pale in view of the complexity of probability theory and, more importantly, the fundamental misconceptions that may be developed. It may be true that there exists an infinite number of possible behavior patterns and that they can be summarized effectively only by use of probability distributions. But researchers must always be on guard against developing incorrect concepts when research tools are chosen on the basis of feasibility alone.

At this point it is imperative to state clearly a most fundamental set of assumptions which underlie this research:

1. Human behavior is deterministic.
    a. Behavior is determined by a person making a conscious decision.
    b. Behavior is conditioned by the environment, including the physiological, in which the person exists.
2. A limited number of consciously determined general behavior patterns exist which lead to satisfaction of the composite needs of the person and his environment, as he perceives those needs to be.
3. A limited number of acceptable, environmentally conditioned behavior patterns exist.

It should now be obvious to the reader that the model of conflict to be developed herein will be deterministic in nature. Before proceeding to the development of that model however, it will be fruitful to mention briefly another major effort to develop mathematical models to describe intangible concepts.

Lewin has attempted to develop models of psychological concepts by using concepts from topology and vector analysis.[23] In this limited review it is not possible to point out many contributions to psychology that were derived from his set-theoretic model, but several implications of his work will be listed.

Although Lewin used a set-theoretic approach to modelling psychological concepts, it appears that he did not advocate a probabilistic approach to behavior in the same sense as Luce. With topological concepts Lewin was able to model the concepts of life space, boundary to a region within the life space, and

relationship of two regions. However he was not able to handle dynamic questions satisfactorily and, consequently, was not able to develop completely such concepts as field of psychological forces and conflict. He summed up the dilemma in the very last paragraph of his book on topological psychology:

> But these dynamic questions are connected in one way or another with problems which go beyond topological psychology. Topological psychology can represent only the framework of events which are "possible" in a life space. In order to determine which events actually occur and what conflicts underlie them one has to take into account directed magnitudes, especially the concept of psychological force and the concept of field of force. The relevant concepts and coordinating definitions are to be treated as part of vector psychology.[24] (emphasis added)

Lewin made a beginning at developing vector psychology with limited application to conflict. From his force-field model he deduced that there are conflicts between driving forces (which are now called approach-approach or avoidance-avoidance types of conflict) and conflicts between driving and restraining forces (which are now called approach-avoidance types of conflict).

Lewin's force-field model of conflict has direct application to the study of simple motor conflicts, examples of which were cited above, and limited application to other types of conflict situations such as role conflict. In the next chapter an attempt will be made to develop a model of conflict by extending Lewin's force-field concept and by using some of the mathematical concepts found in linear algebra.

CHAPTER 2

A VECTOR SPACES MODEL OF CONFLICT

Introduction

It is generally accepted that the behavior of a person is a function of the person, P, and the environment, E, in which the person is located. Functionally this assumption is written[1] as B=F(P,E). Also the interrelatedness between the person and his environment can be written functionally as P=G(E) or E=G^{1}(P), where G^{1} is the inverse of G.

If the assumption is made that the function, F, is single-valued, then for each state of the person and each state of the environment there is one and only one behavior that will be observed. Each possible state of the person constitutes one element in what can be called the person space, and each possible state of the environment constitutes one element in what can be called the environment space. The assumption of interrelatedness requires the function G relating P and E to be single-valued, as well as the function G^{1} relating E and P.

The value in a probability approach to behavior is now apparent even though the implication of that type of approach violates the determinism implied by the above function. If one allows m different elements in the person space and n different elements in the environment space, then it is possible to have m x n elements of behavior in the behavior space, B. Furthermore, if the combinatorial

approach is applied in the same sense that Gross, et al., used it to develop their theory of role conflict resolution,[2] there exist $2^{(m \times n)}$ combinations of person and environment states to examine. If there are only two states of the person and two states of the environment, then there are sixteen combinations that need to be examined. If there are only four states of the person and four states of the environment, then 65,536 possible combinations exist. By extrapolation the reader can see that a combinatorial approach rapidly becomes unfeasible, and hence probability theory is of extreme value in limiting the number of permissible combinations.

The major stumbling block to predicting behavior is the present lack of sufficient information to develop the functions F and G. Besides pinpointing deficiencies in the current state of knowledge, the above functional statement of behavior raises some interesting implications.

Some students of management, e.g., Odiorne,[3] have been advocating restructuring of the environment within which people work as a means of shaping the work behavior of those people. Although such an argument has been advocated on an ethical basis, the above discussion shows that such an argument is justified on an analytic basis. This justification, coupled with the relative feasibility of changing the environment state versus changing the person state, seems to provide ample basis for the approach to management adopted by management students such as Odiorne.

It is not difficult to argue that the behavior exhibited by a person affects the state of that person and the environment in which the person exists. For example, a person smoking (1) affects his physiological state by depositing

residues from the tobacco smoke in his body, (2) affects his mental state by fulfilling his need to smoke, and (3) affects the environment by burning up the tobacco and producing smoke. Using a more complex example, a research scientist who quits his job to take another (1) affects his physical state in that he must now develop a different transportation pattern to move from his home to his work station, and perform in a different work environment, (2) affects his mental state in that he must identify and adjust to his new role, (3) affects his new work environment by being a new element in that environment, and (4) affects his old work environment by removing himself from it. Thus one can see that not only is it true that $B=F(P,E)$, but also $(P \cap E) = F^{1}(B)$. When these ideas are viewed in the context of the S-R theory of behavior the implication is that a stimulus results in a response and that response is in turn a stimulus.

The essential characteristics for a model of conflict are now clear:

1. The model must reflect the interrelationship that exists between stimulus and response.
2. The model must encompass existing definitions of conflict, or permit development of explanations of why existing definitions are inadequate.
3. The model must allow for the development of operational concepts which can be tested, thereby permitting testing the validity of the model itself.
4. A model need not permit development of explanations for all existing research data on conflict because at present there are no guarantees that all existing data validly reflect some aspects

of the true nature of conflict.

The remainder of this section will now be devoted to developing a model of conflict using linear algebra concepts. The model will represent conflict as experienced by an individual, not conflict between groups.

All of the researchers mentioned in Chapter 1 have established a definition of conflict. It is not necessary to repeat all of the specific definitions here because they all imply that conflict exists whenever opposing and incompatible forces exist. There is no apparent need to develop a new definition of conflict for the purpose of this paper, but there is a need to clarify the generally accepted definition which is included in Chapter 1. Clarification can be obtained if answers to the following questions are developed:

1. What is a force, in the psychological sense?
2. Relative to the function B=F(P,E), where can a force, or set of forces, exist?
3. Relative to the function B=F(P,E), when will a force, or set of forces, exist?
4. What is the time dimension of a force?
   a. How long does it take to develop a force?
   b. How long does it take for a force to be eliminated?

In physics a force is an explicitly definable vector quantity that tends to produce a change in the motion of objects. In this paper a force will be defined as an explicitly definable vector quantity that tends to produce a change in the behavior space of a person. Symbolically, a force in space is

$$F = \int_{dA} P(A)$$

where A is an arbitrary plane in space, and P is the force per unit area exerted on that plane.

Force per unit area is the definition for pressure in physics. In psychology the analogue for pressure is influence. Thus for forces to exist in the psychological sense an individual must resolve (integrate) influences into forces that have a magnitude, direction, and point of application in the behavior space. Perceptual processes govern the way in which influences are resolved.

The Concept of Behavior Space

Behavior space in this paper is defined as a vector space, the elements of which are possible behaviors. The behavior space is said to contain three subspaces called the stimulus space, the transformations space, and the response space.

The reader can see that this formulation of the behavior space draws heavily on the S-R theory of behavior. In this formulation the transformations space will have as its elements all those methods by which an individual associates a particular element in the stimulus space with a particular element in the response space. For the sake of simplicity, the stimulus space (hereafter called S-space) and the response space (hereafter called R-space) will be assumed to be isomorphic. Establishing the reasonableness of this assumption is beyond the scope of of this paper.

S-space will be assumed to have a basis which consists of the cognitive organization of an individual, his needs structure and his personality. R-space will be assumed to have a basis which consists of the ways an individual has

learned how to act. The basis of T-space (transformations space) consists of the decision-making processes used by the individual. The dimension of each sub-space is a function of the individual and his environment. There is no restriction placed on the number of sub-spaces that may exist in S-space, T-space, and R-space.

At this point further discussion of the theory of role conflict resolution developed by Gross, et al., will clarify the concept of space which forms the core of the model of conflict being developed in this section. Gross, et al., were concerned with only two dimensions, legitimacy and sanctions. This is equivalent to dealing with a stimulus space of dimension N=2, which means that all influences felt by the school superintendents would be resolved into forces that will have a legitimacy component and a sanctions component.

The attempts made by Gross, et al., to predict how conflict would be resolved with this simplified concept of a stimulus space failed because they did not allow for consideration of the magnitude and direction of the conflicting forces. Thus they were led to think in terms of primacy of one or the other of the dimensions in making predictions of how role conflicts would be resolved. Assuming that the legitimacy and sanctions dimensions are orthogonal, selecting a primary dimension is equivalent to defining a sub-space. In terms of the theory of linear spaces this would mean that school superintendents would resolve the influences imposed on them into forces which would have a greater component along the "primary dimension"

Gross, et al., also established a response space that had a basis of dimension N=2, with the dimensions being compliance[4] and avoidance. Although no transformations space was defined by the researchers, it essentially consisted of a function compatible with the verbal statement that school superintendents will react to the strongest influence they perceive.

Let us reanalyze the Gross theory now that it has been transformed to the model being developed in this paper. Referring to Figures 1 and 2, it is possible to get a graphic representation of the reformulated theory. In Figure 1 the coordinate system represents the two-dimensional stimulus space of the Gross theory which corresponds to the "moral-expedient orientation". In Figure 2 the coordinate system again represents the stimulus space, and also differentiates the sub-spaces. Relative to the Gross theory, those school superintendents who have a "moral orientation" will resolve influences into forces that will lie within the 45^{o} lines that enclose the legitimacy axis, and those who have an "expedient orientation" will resolve influences into forces that will lie within the 45^{o} lines enclosing the sanctions axis.

Justification for the statement above, that the response space consists of only two dimensions in this theory, can now be developed. Clearly if any force lies in quadrant I of Figure 1, compliance will occur. Also, if any force lies in quadrant III avoidance will occur. Furthermore, it appears that any forces lying above the 45^{o} line which cuts through quadrants II and IV will result in compliance, and any forces lying below that line will result in avoidance. Notice that these statements regarding resolution of conflict imply a compulsion to react whenever a stimulus is applied, and that avoidance implies that behavior which

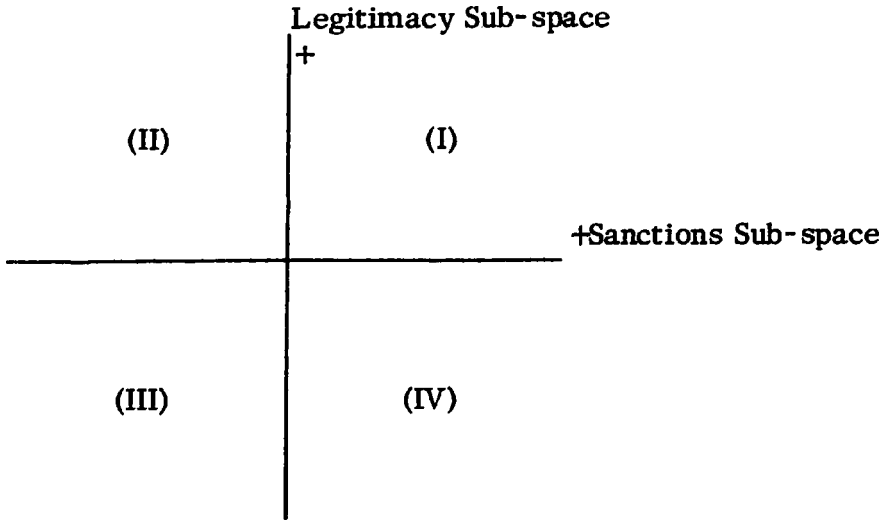


Figure 1. Stimulus space with legitimacy - sanctions dimension; moral-expedient orientation to conflict

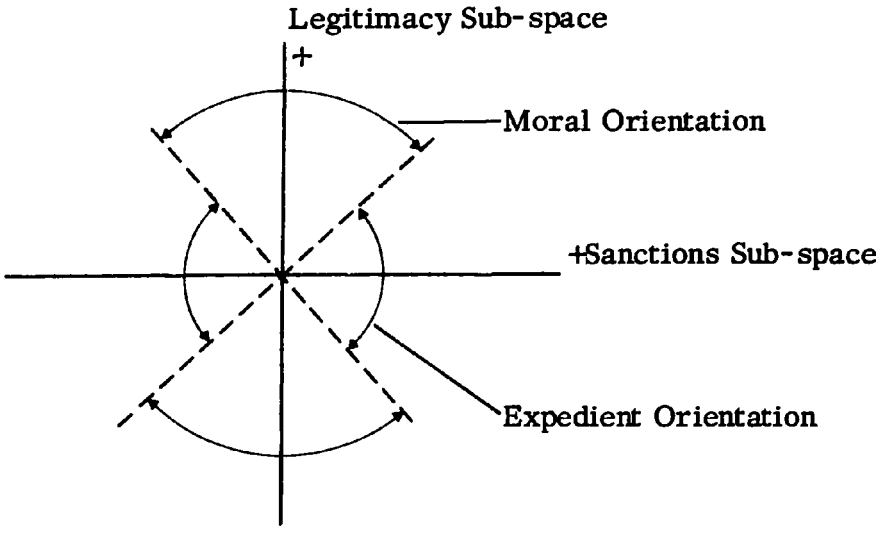


Figure 2. Stimulus space containing Legitimacy Sub-space and Sanctions Sub-space

blocks forces from entering the stimulus field is undertaken, when compliance would otherwise result in net undesirable consequences for the person. Also note that this formulation implies that "inner conflict" occurs whenever the forces in the stimulus space lie on the 45^{o} diagonal in quadrants II and IV because any forces with this orientation cannot be transformed into some kind of compliant behavior or some kind of avoidance behavior. The 45^{o} diagonal is, then, a point of neutrality.

Some of the limitations of the Gross, et al., theory become readily apparent upon examining a case of conflicting influences, one of which lies in quadrant II and one of which lies in quadrant IV.[5]

Consider the situation of a person in role who perceives that two different people are attempting to influence his behavior. The focal person perceives person A to be attempting to get him to do something that the focal person considers to be illegitimate, while person B is attempting to get him to do something that the focal person considers to be legitimate. Furthermore, the focal person also feels that person A can apply strong negative sanctions if he doesn't comply, while person B is perceived as being unable to apply strong negative sanctions for noncompliance. (See Figure 3)

This case is presented graphically in Figures 4, 5, and 6 along with the predictions obtained by direct application of the Gross, et al., theory. One can immediately see the need for specifying the magnitude and direction of the conflicting forces which are obtained by resolving expectations. Notice in each case that if the forces are equal in magnitude and opposite in direction, i.e., conflicting, that the net force is zero and hence there should exist inner conflict

Role Sender	Focal Person's Perception of Influence Attempt: Legitimacy	Sanctions
A	I	+
B	L	-

Figure 3. One of sixteen types of role conflicts according to the Gross, et al., theory of role conflict resolutions

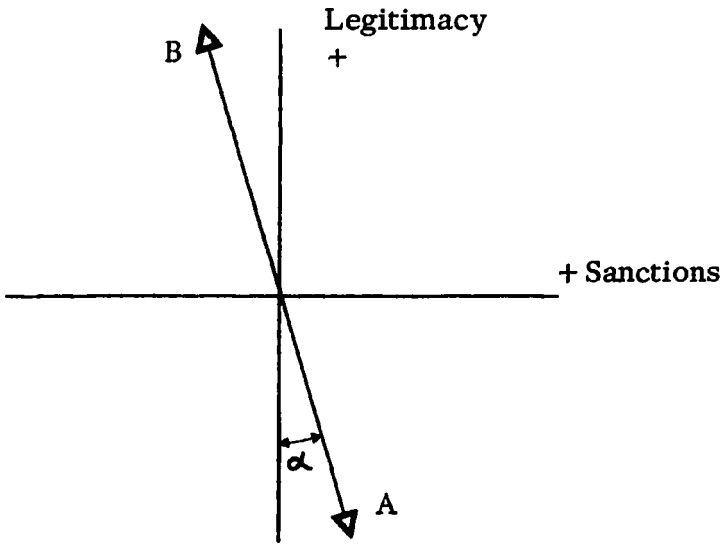


Figure 4. Type of role conflict experienced by a focal person with a moral orientation. Gross Prediction: compliance with B

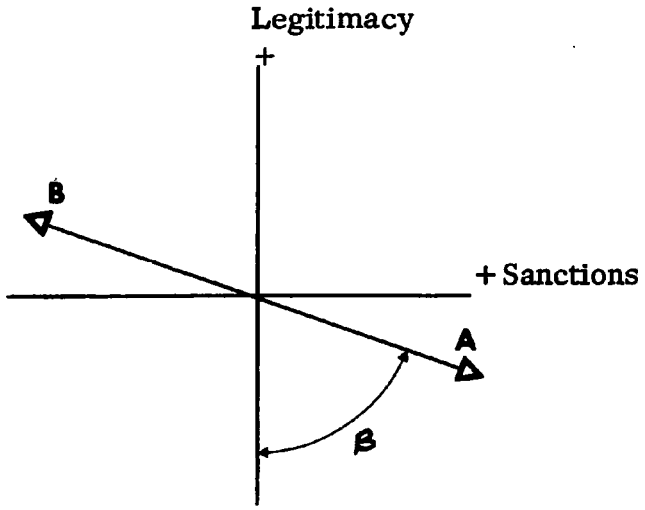


Figure 5. Type of role conflict experienced by a focal person with an expedient orientation. Gross Prediction: compliance with A

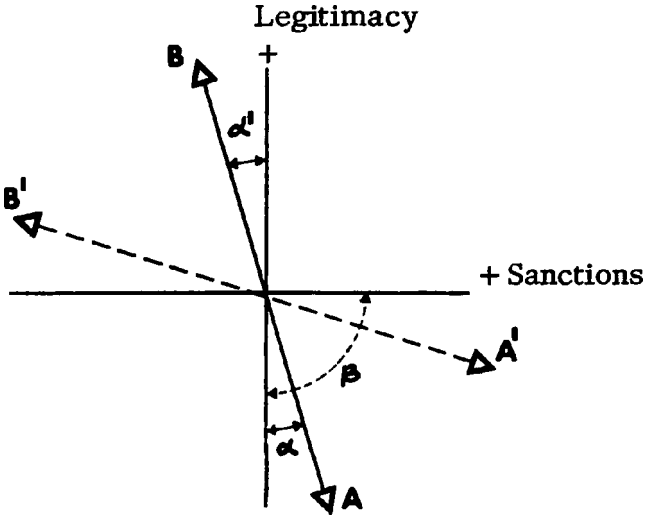


Figure 6. Type of role conflict experienced by a person with a moral-expedient orientation. Gross Prediction: compromise between A and B

rather than compliant or avoidance behavior. Thus in the Gross, et al., theory, "primacy of dimension" really implies that (a) one expectation is stronger than the other or (b) the direction cosines between the forces and the dimensions of the basis are not the same for all forces.

The seriousness of this deficiency in the Gross, et al., theory becomes most apparent when one tries to use the theory to predict behavior of people who have a "moral-expedient orientation". (See Figure 6) What angle should be attributed to the force, α or β ? Should the magnitudes attributed to the forces A and B be the same? Should $\alpha = \alpha'$? Obviously the combinatorial approach of the Gross theory does not readily yield answers to these questions, but it does highlight crucial questions which must be answered before a complete understanding of the nature of conflict can be developed.

It has been implied above that there currently exist no explanations in any theory of conflict to enable prediction of behavior if any individual is subjected to an influence that has equal components among two orthogonal dimensions, i.e., the force lies along the 45^{o} line. Clearly, if the force lies along the 45^{o} line in quadrant I (Figure 1) there exists the approach-approach type conflict and without the existence of any other forces in the field no choice will be made (until the magnitude of the force reaches the conflict tolerance limit for the individual when breakdown occurs). If the force lies along the 45^{o} line in quadrant III there exists the avoidance-avoidance type of conflict, and again no choice will be made. Finally if the force lies along 45^{o} line in quadrant II or IV there exists the case of approach-avoidance conflict, and again, no choice will be made.

Reanalysis of the Hovland and Sears research in light of this new model indicates that they were successful in developing experimental conditions in which the stimulus force had equal components along two dimensions, one dimension being the red light and the other being the green light.[6] They found a significant number of instances where the reaction to a complex conflict situation was a reaction called "blocking", i.e., the subject did not move the stylus at all.

The Concept of the Zero Vector

The concept of the zero vector in the theory of linear algebra appears compatible with the experimental finding of Hovland and Sears and the above theoretical explanations of the neutral point between dimensions. The zero vector has zero magnitude and arbitrary direction. If one permits the R-space to contain the zero vector then the experimental data of Hovland and Sears indicate that any forces in S-space that have equal components in all existing dimensions of that space will be transformed into the zero vector of the R-space. Conversely, any nonzero vector in the response space implies that a vector exists in the S-space that does not have equal components in all dimensions of S-space. This formulation implies that the dimensions of S-space can be identified by identifying R-space completely whenever S-space and R-space are isomorphic.

The reader will recall that Kendall found an instability in responses to conflict situations over time.[7] An explanation for those results in addition to that supplied by Kendall, can be obtained by analysis of the model of conflict being developed herein.

Kendall had no way of insuring that the only force existing in S-space was induced by the question posed to the subject. The instability noted could have

easily been caused by the existence of other forces in S-space, which when combined with the force induced by the question, yielded a resultant force in S-space (which was then transformed to R-space) which was different from the resultant force the experimenter thought existed. Then when these "extraneous" forces changed with time, the resultant force in S-space changed also, and hence the corresponding response changed too.

The instability noted by Kendall could also have been due to the fact that she had no way of controlling the basis in S-space for each subject. The theory of linear algebra admits the possibility of the existence of more than one basis which spans a space. This explanation gains strength when one recognizes the possibility that the forces Kendall was inducing were oriented along the line of neutrality. From the model being developed, if a force is oriented along the line of neutrality, that force will be transformed into the zero vector. Since Kendall elicited responses, it is possible that the basis of S-space was changing in terms of changing elements or changing size.

The development of the model in this paper began with the "classical" definition of conflict, i.e., "equal and opposing forces". It is now apparent that that definition is not completely adequate, and in fact, may even be misleading.

The classical definition of conflict implies that one person can predict when another person will be in conflict and that measure of time to respond is one indicator of the severity of the conflict experienced. In this new model, however, an individual can experience "conflict" when subjected to a single influence which is resolved into a single force, if the nonzero components of that force along all dimensions of the basis of S-space are equal in magnitude. Thus, according to

this new model of conflict, prediction of the existence of conflict is possible only when (a) the basis of S-space is known and (b) the manner in which any influence will be resolved into a force is known, i.e., when the set of direction cosines corresponding to a given influence, or class of influences, is known. Here, a direction cosine corresponds to the amount of a given dimension that is included in the influence.

The question now arises concerning the applicability of this model in situations where an influence impressed on S-space cannot be resolved completely into components along the existing basis in S-space. Obviously, one alternative is a change of basis, but if one or more components of the influence are "new" then there are no corresponding elements in S-space which correspond to the "new" elements of the influence. This is the equivalent of a learning situation.

The Concept of Independence

The next question then is: are learning situations and conflict situations identical in terms of this model? To answer this question it appears necessary to explore the concept of linear dependence.

The concept of linear dependence states that in a space of dimension n the basis elements are mutually independent and any n+1 element in that space will be a linear combination of the n elements. The n+1 element can be decomposed into n components along the n dimensions, where not all of those n components have zero magnitude. Whenever the n+1 element cannot be decomposed completely into n components along the n dimensions, that element is said to be linearly independent.

This concept of linear dependence can be used to expand on Lewin's formulation of force-fields. (In the model developed herein force-field has been replaced with vector space.) If a single force exists in S-space, and that force is linearly dependent, then the person who is subjected to that force can resolve it into components, according to the basis of S-space. (The basis for S-space is similar to "frame of reference".) Since any linearly dependent force can be transformed with any of the transformations existing in T-space, the individual subjected to the force is able to "decide" how to respond to the force. If the components of the force are all of equal magnitude, that linearly dependent force is transformed into the zero vector in R-space. Therefore, since any linearly dependent force is the equivalent of a set of n forces, it is possible for a situation to exist that has all of the characteristics of a conflict situation with only one force existing in S-space.

Continuing the analysis further one can see that two apparently "opposite and equal" influences may not result in a conflict situation at all. The individual subjected to the influences must resolve them in light of the basis of his S-space and then, and only then, decide whether the forces are indeed "opposite and equal". The important point here is that the individual subjected to a force is the one who determines the orientation of that force in S-space, not the person applying the force. Thus the existence of conflict is not dependent on whether the number of forces in S-space is odd or even but rather it does depend on whether or not a set of forces in S-space, when resolved into components along the dimensions of the basis, have components all of equal magnitude.

Theoretical Relationship between Conflict and Learning

If a force impressed on S-space is linearly independent this means that the force cannot be completely analyzed in terms of the existing basis, and hence cannot be transformed to R-space. The result is equivalent to "blocking" in the terms of the Hovland and Sears work. The individual subjected to such a force cannot respond until the basis is expanded to accommodate the "new" elements of the stimulus, or until the individual has "analyzed all aspects of the problem" or "considered all ramifications of the situation", and a new set of transformations is developed that is compatible with the new basis.

Expansion of the basis of S-space and development of new sets of transformations are the results of the learning process. New information is assimilated and a new cognitive organization established. Thus learning situations and conflict situations exhibit many of the same characteristics, of which response time is a summary characteristic.

It seems inappropriate to say that learning and conflict are synonomous, however. Learning is "objective conflict" in the sense that a person is not yet equipped to decide how to react to all influences imposed on him, whereas conflict in the traditional sense is "subjective" in that the person is equipped to decide how to react. The decision to comply or to avoid compliance is a logical consequence that follows after influence attempts have been arbitrarily located in S-space by the person subjected to them.

Conflict, in the classical definition of the term, can never be resolved because it implies a balance of power. However resolutions to apparently "true conflict" situations can be developed by changing the basis of S-space, either in

terms of size or in terms of the particular elements that make up the basis. This change of basis is equivalent to what Lewin calls "locomotion", and to what is familiarly referred to as a "change in point of view".

Individuals who do not know that they are subjected to conflict will not know that they are in conflict. They will, however, act along a limited number of dimensions because they are subjected to a resultant force in S-space. Thus in the Hovland and Sears research many of the subjects acted as though they were not subjected to "conflict", but rather acted along one or more of the dimensions of S-space that had been established during the training trials. For some of the subjects the result of the training trials was the development of a single dimension: go toward the green light when it flashes. For others there were two dimensions: go toward the green light when it flashes; go away from the red light when it flashes. Still others appeared to convert the training instructions into one dimension with extreme points of opposite polarity, and when presented with both lights simultaneously felt compelled to satisfy both demands (forces) simultaneously, i.e., exhibit the compromise response (which indicates the existence of a dimension in S-space that was not controlled by the researchers). The final category of subjects in Hovland-Sears experiments responded to the "conflict" situations by "blocking" which seems to indicate that the "conflict" was a force with more components than could be accommodated by the basis in S-space that was established as a result of the training, or that the training failed to develop a sufficiently large set of transformations to handle the "conflict" forces generated, or that the resultant force was oriented along a line of neutrality.

It might be profitable at this point to develop a hypothetical application of the vector spaces model of conflict as an aid to further understanding of the concepts of basis and linear dependence. Suppose a person has an S-space of only one dimension, say, physical needs. Then the basis of S-space is of dimension N=1. Further suppose that a neutral point exists in this dimension (which has a positive and a negative direction from the neutral point). Now suppose that the person is at the neutral point on this single dimension, i.e., physical needs are of no immediate concern to the person, and that a stimulus is applied which is independent of physical need. Pictorially, the situation is

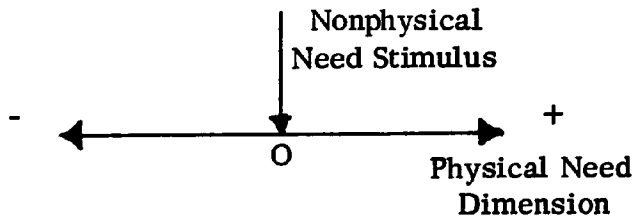


Figure 7. Uni-dimensional S-space when an independent force is applied

Then it is easily seen that the only component of the applied stimulus force that exists in the basis of the person is the zero vector. When the zero vector is transformed to R-space, it is transformed to the zero vector, and no behavior is observed which can be related to the application of the stimulus force.

For the individual to react to the applied stimulus force he must first expand the basis of S-space to a basis of two dimensions, and develop transformations adapted to fit the new basis. This "awakening" to other things in life

besides purely physical needs is the result of learning. Until the "awakening" is complete the individual cannot react to the stimulus. No conflict ever existed because there was no basis for it, the applied stimulus force was linearly independent.

This hypothetical application has been well summed up by Lewin in his discussion of the relationship between force and behavior:

> Whenever a resultant force (different from zero) exists, there is either a locomotion in the direction of that force or a change in cognitive structure equivalent to this locomotion. The reverse also holds: whenever a locomotion or change of structure exists, resultant forces exist in that direction.[8]

This quote implies that whenever a stimulus force can be resolved into all dimensions of the basis of S-space there will be a response. If the force cannot be so resolved there will be a new dimension (or dimensions) added to the existing basis. Thus whenever a force is applied there is always some stress induced and that stress is relieved only by responding directly or absorbing the stress in a change of cognitive organization.

The model as developed thus far reveals two important implications. First, if the dimension of S-space is not sufficiently large there is the real danger that a person may respond to an influence without considering all relevant facets of that influence. Any response under these conditions would conceivably be inappropriate and even dangerous. Thus the child who responds to the "pretty red color" in the element of an operating electrical appliance by touching it suffers a severe burn.

Second, if analysis of a stimulus force with one basis yields a resultant force on the line of neutrality no response is theoretically possible. A search is

then initiated for another basis with which to analyze the stimulus. If too much time is consumed in this search for a different basis additional forces may be impressed on S-space in an attempt to elicit a response. However to the subject of the impressed forces, the additional forces could easily be seen as additional dimensions of the original force and the conclusion drawn that the new basis must not only have different elements but more of them. A vicious cycle is then set up as the search is expanded to include identification of more useful elements which can be added to the basis. But as shown above, the addition of elements to a basis is the result of learning, and learning in general is a slow and difficult process. Thus in situations where the original force is oriented along a neutral "axis" or is linearly independent, and additional forces of large magnitude are rapidly added, a complete breakdown is possible because the individual is unable to develop any basis for response within the time required for responding.

Summary

A careful study of the vector spaces conflict model reveals that conflict exists only when an individual (1) is subjected to a force or combination of forces, (2) is compelled to respond to that force or combination of forces, and (3) is unable to identify the appropriate major dimension and minor dimensions of the force or set of forces in S-space so that a transformation to a nonzero vector in R-space can occur.

Theoretically, the response time in a situation of pure conflict is infinite. Response time is a poor indicator of degree of conflict because it does not distinguish between conflict (resultant force lying on a neutral axis) and learning

(expansion of dimension of basis of the behavior space). Stress measures are far more appropriate measures of intensity of conflict because they are directly related to the degree of accommodation (strain) required before a response is possible.

The dimensionality of influences, and the location of the resultant stimulus forces, is determined by the individual subjected to the influences. Whenever stimulus forces are linearly dependent and the resultant linear combination is nonzero and nonneutral, a response to the forces will occur.

Whenever a force is impressed on S-space a stress is induced. That stress is relieved by responding in such a fashion that the force is removed. The response can be immediately possible or may be delayed until a change of basis in S-space is completed. Finally every response of an individual A can be considered as a stimulus to another organism to stop impressing forces on the S-space of individual A.

CHAPTER 3

APPLICATION OF THE VECTOR SPACES MODEL OF CONFLICT TO THE PHENOMENA OF ROLE CONFLICT AND ROLE AMBIGUITY

Extensions of the Vector Spaces Model of Conflict

The vector spaces model of conflict developed in the previous chapter has three major sub-spaces, Stimulus-space, Transformations-space, and Response-space. In the model each of these sub-spaces is a valid vector space, a fact which allows for the existence of other sub-spaces nested within these three major sub-spaces.

Most of the research conducted to date on the phenomenon of conflict has provided some insight into the construction of some of these nested sub-spaces. Originally conflict and frustration research of the type conducted by Maier[1] and that summarized by Yates[2] was designed to investigate "motor conflict", i.e., choice between alternative motor responses when under stress. When this type of research is reanalyzed by application of the vector spaces model of conflict it is easily seen that "motor conflict" is a misnomer. The stress surrounding the choice of response to be made depends on the degree of difficulty encountered in identifying the magnitudes of the various components of the stimulus force. It also depends on whether or not the subject knows that another stimulus force will be impressed immediately in S-space if incorrect identification of the components of the original stimulus force is made.

The early research on conflict was obviously very limited, but limited in most instances by design and not by default, because the complexity of conflict has long been recognized. Only recently have some researchers been broadening the scope of research on conflict. The work of Miller and Swanson, Gross, et al., and Kahn, et al., which were discussed in Chapter 1 are examples of this more intensive research. It will be valuable, at this point, to discuss the Kahn, et al., model of role conflict and relate it to the vector spaces model of conflict developed in the preceding chapter.

The Kahn model (reproduced in Figure 8) established a focal person as a reactor to stimuli.[3] The role senders initiate the stimuli, impress them on the focal person, i.e., direct role pressures toward the focal person, and observe his response. The response of the focal person is evaluated by the role senders in terms of interpersonal relations factors, personality factors, and organizational factors. Then if the response is not satisfactory to the role senders, i.e., not according to the role expectations that the senders have developed for the focal person, the senders then initiate other pressures in an attempt to obtain a more favorable or conforming pattern of behavior from the focal person.

In organizations some people are initiators of stimuli by virtue of their position in the formal organization, others because of their personality orientation, and still others because of their individual needs. The vector spaces model of conflict places no limitation, explicitly or implicitly, on who can or will initiate stimuli, or, for that matter, to whom the stimuli will be directed.

A limitation of the Kahn, et al., model of role conflict lies in the fact that in reality each role sender is also a focal person, unless the person happens to

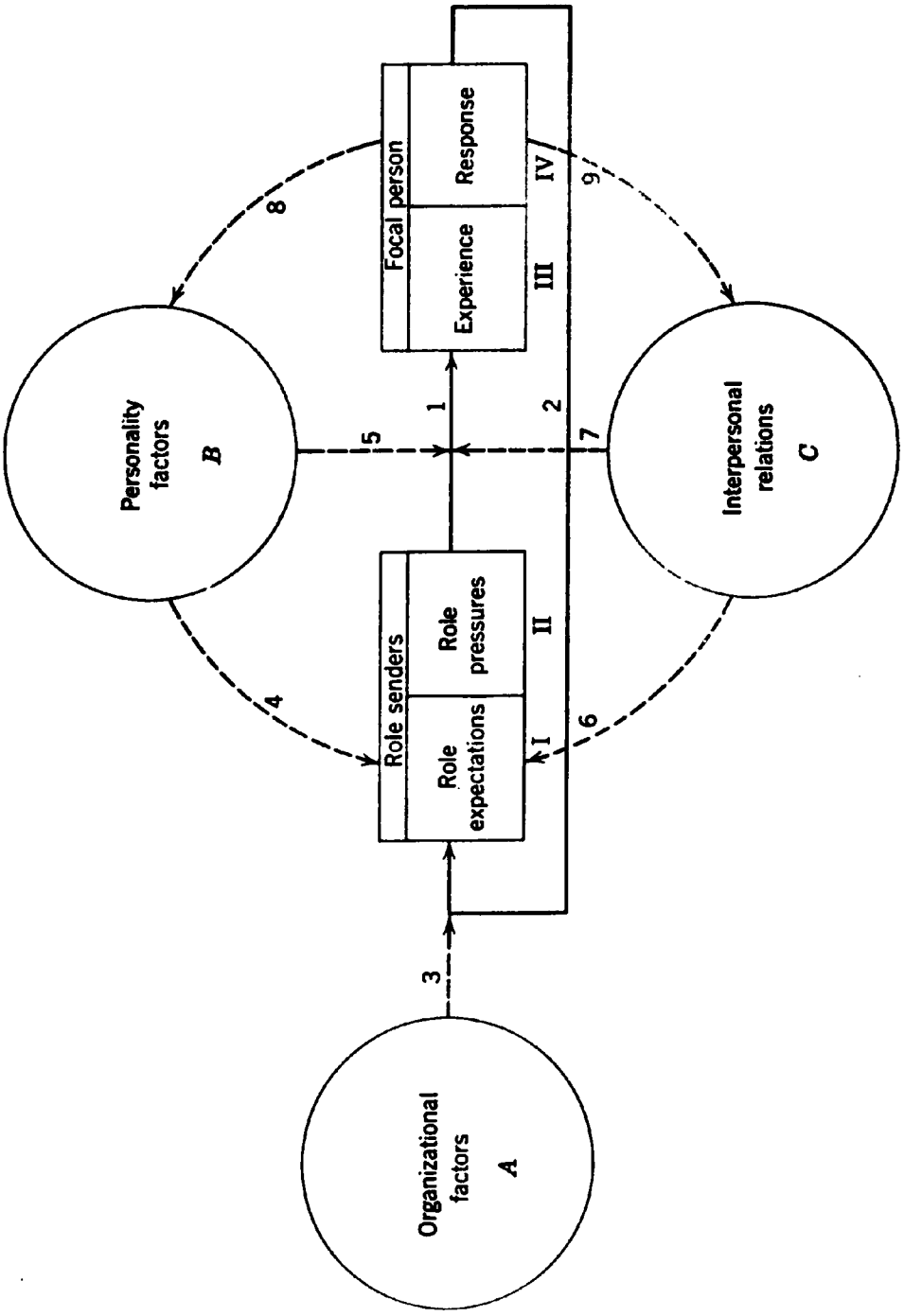


Figure 6 . A theoretical model of factors involved in adjustment to role conflict and ambiguity.

be in the extreme fringe of his group. Thus using the Kahn et al., model of role conflict it is not possible to examine the degree of conflict experienced by those members of the group who are never focal persons because, by definition, they never experience role conflict. But the existence of this condition does not prove that the fringe elements of a group never suffer any conflict at all. Conceivably they could suffer far more inner conflict than any other members of their group. By using the vector spaces model of conflict one can conceivably measure the degree of conflict experienced by any member of any group.

It may appear that comparing the Kahn, et al., model of role conflict with the vector spaces model of conflict is like trying to compare apples with oranges. Obviously then it is incumbent upon this writer to explain the basis for these comparisons. Essentially the comparison is based on the belief that the vector spaces model of conflict is more fundamental than the Kahn, et al., model of role conflict and, therefore, that the Kahn, et al., model of role conflict is a special case of the vector spaces model of conflict. Implicit in this belief is the assumption that conflict is experienced within an individual even when the conflict is ostensibly between groups of people or between members of groups.

The reader will recall the discussion at the beginning of the previous chapter that centered around the functional statement of behavior: $B=F(P,E)$. A person is subjected to many pressures that come from the environment and are generated internally, and is moved to act in such a manner as to relieve those pressures. An assumption implicit in the vector spaces model of conflict is that a person responds not only to relieve pressures imposed on him, but also to restructure the environment and to establish different behavior to prevent

recurrence of pressures or to maintain a "no-pressure" condition. Thus the person is the receiver of responses from others which are stimuli to him, and his responses in turn are stimuli to others.

The stimulus forces are received into the person's S-space. There the forces are analyzed in terms of personality factors, interpersonal relations factors, socioeconomic factors, ethic and moral factors, and organizational factors. Each of these sets of factors constitutes a sub-space of S-space. After analysis and transformation of the forces in S-space to R-space, a response or set of responses is performed to relieve the pressures in S-space and hopefully prevent their recurrence. If the pressures are not relieved outwardly they are absorbed inwardly in terms of experienced strain.

No mention has been made yet of the magnitude of the force that must exist in S-space before there is a transformation and response. For simplicity it is assumed that there is a response to every force in S-space which is proportional to that force. Thus for small forces in S-space the response may be hardly discernible. However in later chapters, no attempt will be made to measure the absolute magnitudes of any forces. All experimental data will reflect measurements of relative magnitudes only.

With these comments, then, the reader can easily see that the Kahn et al., model of role conflict is in reality an application of the vector spaces model of conflict to a role set. S-space of <u>all</u> members of the role set contains personality, interpersonal relations, organizational factors, role expectations, and experience sub-spaces. In Figure 8, which is a graphical representation of the Kahn, et al., model, boxes I and III represent S-space, while boxes II and IV

represent R-space. Role conflict, then, is one possible application of the vector spaces model of conflict. Other applications are beyond the scope of this present work.

The work of Kahn and his associates represents a major effort to identify some of the major sub-spaces of S-space, and some of the dimensions within those sub-spaces. They also attempted to identify some of the consequences that will result when role conflicts are analyzed by the focal person in terms of a limited number of dimensions and within one sub-space of S-space. Some specific results obtained by Kahn and his associates will be reviewed in subsequent chapters of this book.

Relationship Between Role Conflict and Role Ambiguity

It is almost trite to say that members of an organization have some role to perform, however ill-defined that role may be. Therefore it would seem to be important in any application of the vector spaces model of conflict to have some idea of the relationship between incomplete information about role requirements (i.e., role ambiguity) and conflict experienced in role. Herein lies one of the limitations of the vector spaces model of conflict; it implies that the person has complete information about pressures imposed on him, can integrate the pressures into forces in S-space, analyze the forces, and transform them to R-space. Conflict is said to exist whenever any forces in S-space are transformed into the zero vector in R-space, i.e., the forces in S-space are lying along the neutral axes.

Inclusion of the concept of linear independence allows for situations in which

the basis of S-space is not adequate to handle the forces imposed, i.e., there are cognitive elements in the forces which cannot be analyzed in terms of the existing basis of S-space. The reader will recall that under conditions of linear independence there will be no transformation to R-space until new bases in S-space and T-space are established. Beyond this there has been no discussion whatsoever of a possible relationship between ambiguity and conflict, or that a relationship between them is implied or included in the vector spaces model of conflict.

Kahn, et al., raised the question of the relationship between role conflict and role ambiguity in their work. They hypothesized that the consequences of the two phenomena should be about the same. Their tests for a relationship were inconclusive, however, so that the question is still unanswered. Obviously if there is a dependence relationship between role conflict and role ambiguity, understanding the nature of that dependence will be of tremendous importance when developing a model of role conflict. The question of the relationship between role conflict and role ambiguity, as well as several other questions considered important to an understanding of the nature of role conflict form the substance of the hypotheses stated in the next section of this chapter.

Hypotheses

A general theory of conflict is not presently possible. The review of relevant research and development of the vector spaces model of conflict seem to raise more questions about the nature of conflict than existing research data permit us to answer. Hopefully, however, by conducting rigorous tests of carefully constructed hypotheses we will obtain more information about conflict that might

eventually lead to the development of a general theory.

The first hypothesis to be tested in this research is concerned with the relationship between conflict and ambiguity. It was argued in Chapter 2 that some of the characteristics which describe a learning situation may be identical to some of the characteristics that describe a conflict situation. Since learning and ambiguity are related it appears possible to develop concrete theoretical distinctions between learning and conflict by examining the relationship between ambiguity and conflict. If ambiguity and conflict always coexist, then insofar as learning situations are constructed for the purpose of eliminating or reducing ambiguity, it will be extremely difficult, if not impossible, to distinguish between learning and conflict. However, if ambiguity and conflict do not always coexist, then it should be possible to design a model of conflict which is different from a model of learning.

The vector spaces model above, as presently formulated, is a partial model of learning as well as being a model of conflict. It implies that conflict and ambiguity always coexist. Therefore the question arises, is there a causal relationship between conflict and ambiguity? Since all data collected during this research are role-related data, the question of the causal relationship between conflict and ambiguity will be stated in the first hypothesis of this paper.

H:1 The existence of role ambiguity is a sufficient, but not a necessary condition for the existence of role conflict.

The second hypothesis is concerned with some of the possible causes of role ambiguity. Ambiguity in general exists because a person has not learned something. The reasons for not learning can be many, ranging from sheer

inability to learn due to limited brain capacity to elimination of opportunity to learn by overt action. The second hypothesis is designed to cover this spectrum of causes of role ambiguity by concentrating on the end points of the spectrum and a point somewhere in the middle.

H:2 A member of an organization will experience role ambiguity whenever:

a. He fails to utilize all available sources of information which could provide data to define his role.

b. He is prevented from utilizing all available sources of information which could provide data to define his role.

c. He establishes a priority structure for information sources that is different from the priority structures established by others, where all members of the role set are mutually dependent.

The third hypothesis is concerned with some of the possible causes of role conflict. Implicit in this hypothesis is the assumption that all conflict, inner conflict as well as manifest conflict, can occur only after a decision has been made. In the case of inner conflict the decision relates to determination of the magnitudes and direction cosines of the components of the resultant force in S-space. In the case of manifest conflict the decision relates to the selection of the transformation by which the force in S-space is converted into some behavior. Also implicit in this hypothesis (H:3c) is the idea that power and conflict are related and that organization structures in general are designed to formalize that relationship.

H:3 A member of an organization will experience role conflict whenever:

a. He uses a decision-making system that results in decisions not identical to the decisions made by other members of his role set, as those decisions are reflected in role behavior.

b. His value systems differ such that decisions different from those made by members of his role set are made, when all members of the role set have the same data input and use the same decision system.

c. Disagreement exists among members of the role set over degree of authority and responsibility to make decisions.

The fourth hypothesis to be tested implies that there are some optimal levels of conflict and ambiguity that should exist between members of an organization. If it can be proven that there are optimal levels for conflict and ambiguity then a search for those levels can be initiated with the hope that eventually controls will be designed which will permit the maintenance of conflict and ambiguity at those optimal levels.

H:4 Role conflict and role ambiguity will develop to harmful[4] proportions whenever mechanisms for identifying and resolving role conflicts and role ambiguities do not exist.

CHAPTER 4

METHODOLOGY

Tests of Hypotheses

Before any tests of hypotheses can be conducted it is necessary to make operational the theoretical concepts embodied in them. This step in research is always a most difficult one. Theoretical concepts, when they are being formulated, may lend themselves to multiple operational definitions, each of which is questionable to some degree. However this questioning of the operational definitions of theoretical concepts is one of the major processes by which theories become useful and reliable as guides to decision-making. Since the research reported in this thesis is based on some new concepts of conflict it is expected that any healthy questioning of the operational definitions of the theoretical concepts used in this work will hasten the day when managers of research and development activities, and other types of work also, will be able to manage conflict effectively.

Novit[1] has pointed out that there are many possible different operational definitions of conflict. Since it does not appear possible to obtain one all-inclusive definition of conflict (or ambiguity either), definitions of these terms will be governed primarily by the limitations of the data available for testing the hypotheses. Therefore it must be clearly stated that all results obtained in this work

are not conclusive but are conditional. The results will be applicable only to the definitions used and the behavioral constraints under which those definitions apply. The reader should note this caveat, especially where the results presented herein appear to be different from results obtained in other research studies.

Each hypothesis to be tested requires that some measure of role conflict and role ambiguity be available. Therefore operational definitions of ambiguity and conflict must now be formulated so that the tests can be conducted. As mentioned above, however, these operational definitions are contingent upon the availability of research data. Stated in other words, when the questionnaire was designed, operational definitions of role conflict and role ambiguity had been formulated and questions were incorporated into the questionnaire to allow for measurement of those operational concepts.

Kahn and his associates developed two lists of questions which provide a measure of the relative amount of stress an individual is experiencing in his work role. One list was used in the Kahn, et al., intensive survey and the other was used in their national survey. The list of stress items used by Kahn in his intensive survey was selected for incorporation in this study to provide operational definitions of role conflict and role ambiguity.[2]

The Kahn intensive survey respondents were all managers, just as the respondents in the current research are all managers. Since Kahn and his associates kindly made all their data available to this researcher, some of the hypotheses in this thesis will be tested using two independently collected sets of data.

To get measures of role conflict and role ambiguity the items in question 30 (the entire questionnaire is reproduced in Appendix I) were combined into indexes of experienced role ambiguity (B, C, F, G, H, L, M) and experienced role conflict (A, D, E, I, J, K, N). Each of these individual items is assumed to measure one dimension of role conflict or role ambiguity. These indexes do not imply that there are only seven dimensions to role conflict and role ambiguity, however.

Although it is easy to see how items B, C, G, and H are related to some of the dimensions of role ambiguity, the relationships between items L and M require some explanation. "Feeling that your progress on the job is not what it should be or could be" (item L) could be interpreted as an item designed to measure insecurity felt by the respondent. However, if it is assumed that it is possible to plan for progress on the job and then compare actual progress with expected progress, then item L also is a measure of one dimension of ambiguity whenever the planning is not done. If job progress is planned and then results attained are compared with results expected the respondent would know what his progress was. Further assuming that the plan is compatible with the skills and abilities of the individual, then the individual is in a position to know at all times what he should be accomplishing and whether or not he is accomplishing his goals. With planning information available this dimension of ambiguity should be minimized.

One can also interpret item M as an item designed to measure some dimension of insecurity. However it is also a fact of organizational life that information about promotions is seldom available until a final decision has been made

about who gets promoted. When this lack of information about who gets promoted is coupled with the fact that promotions occur across organizational lines as well as up a single line, then it is clear that this is an ambiguity condition and that item M is a valid ambiguity item.

Item F is one dimension of ambiguity that appears to be very heavily personality oriented. A person may have basic feelings of inadequacy and "rather often" feel "not fully qualified" to handle his job. On the other hand, this type of ambiguity could perhaps be resolved if a person had a clear understanding of the qualifications required for the job and was able to compare his qualifications with those expected of the job incumbent. Thus this item could conceivably be an indirect measure of the ability of an organization to communicate to its employees, especially during the recruiting and selection process.

The items of question 30 which operationally relate to role conflict are items A, D, E, I, J, K, and N. Item A measures the age-old conflict between existing degree of authority vs. responsibility. Item D measures the type of conflict commonly referred to as role overload, i.e., having more work to do than can be done in the available time. Item E is obviously compatible with the concept of conflict used in this paper.

Decisions result whenever the decision-maker has selected one of several alternatives. The need to select one of a set of alternative actions creates a conflict situation. Usually in decision-making some decision rule or set of decision rules is applied to make a choice and thereby resolve the conflict. Item I, which is related to decision-making, is, in this sense, a conflict item.

Continuing the arguments relative to item I, item K is seen to be a conflict item also. However with item K the conflict is concerned with influence in decision-making, i.e., with the relative weights that will be attached to each of the solution characteristics under analysis. Obviously the assignment of relative weights requires a decision, hence conflict exists before the decision on the weight assignments is made. Therefore the person who must decide the weight assignments experiences some conflict. Also those who are affected by the weight assignments experience conflict, first in trying to develop enough influence (pressure) to obtain favorable weight assignments, and second, in trying to resolve the conflicts that may be created by the final weight assignments. Item J measures one dimension of conflict that is related to the personality of the individual. It is entirely possible that some individuals have absolutely no need to be liked and accepted by their co-workers, while other individuals have a very strong acceptance need. The conflict arises then, whenever there is a strong internal need for acceptance on the one hand, and, on the other hand, observed behavior of co-workers which is indicative of no or only slight acceptance.

Finally item N is a conflict item of the same type as item A, except that item N is on the opposite end of the spectrum from item A.

Research Procedure

The questionnaire reproduced in Appendix I was distributed to 111 managers in four research and development organizations. In one organization all employees classified as managers were included in the sample. In the three remaining organizations managers were randomly selected to be included in the

sample. Thus in the sub-sample from each organization there are managers from the various levels in the organization and representing the various types of research and development work done by the organization.

At each research site the researcher met with the sub-sample of respondents in a brief meeting. During this meeting the objectives of the research were explained and cooperation was elicited. No one was compelled to complete the questionnaire and only one person refused to cooperate. After the brief meeting the respondents remained in the meeting room with the researcher until the questionnaires were completed and turned in. Signing of the questionnaire was carefully explained as being optional and about 70 per cent of the respondents signed their names.

Additional data was gathered from each research site by means of interviews with two members of the top management of the organization. The interviews were conducted to obtain detailed information about the type of work the organization was doing to insure that the organization could be classified as a research and development organization. All questionnaire respondents were told of the interviews (they were always held before the mass meeting) and that their top management supported the research effort but would not compel cooperation nor ever see the results contained in any specific individual's questionnaire.

Correlation ratio analysis techniques will be the primary statistical method used to examine possible relationships between the indexes of experienced role conflict and role ambiguity and other variables specified in each hypothesis. Correlation ratio analysis is an excellent research tool to use whenever hypotheses state or imply that a causal relationship exists between variables because proper

application of the model is not dependent on the existence of any particular sampling distribution.

If a hypothesized relationship does exist between two variables, then a significant statistical relationship should be found between the variables. However it is possible that a statistical relationship could be found between two variables that have no causal relationship between them, but rather they are both related to an unidentified common cause. In all correlation ratio tests of hypotheses conducted in this research the alternative hypothesis will be that the correlation between the variables being tested is zero, with the probability of rejecting the alternative hypothesis when it is true being set at $p = 0.05$. Thus the probability of accepting a hypothesis that a causal relationship exists between two variables when only a statistical relationship may exist is $p = 0.05$.

Research Sample Characteristics

For purposes of this study, a research and development organization is defined to include one in which basic and applied research in the sciences and engineering, and the design and development of prototypes and processes is conducted. This definition of R & D is compatible with the definition of R & D used by the National Science Foundation. Although the definition is broad, routine product testing, market research, sales promotion and service, research in the behavioral sciences, and other nontechnological activities are excluded.

Each site in which data were gathered conformed to the above definition of an R & D organization. It was not required that the total organization be an R & D organization, but only that an identifiable segment of the organization be identified

as an R & D organization.

One site concentrated on electronics research and electronics product development. Approximately 1,000 people were employed in the total organization of which about 20 per cent were identifiable as R & D employees, including managers of R & D. About 60 per cent of the R & D managers of this site participated in the research.

The second site was a semi-autonomous division of a chemical company. The division concentrated its efforts on R & D in the area of solid state physics and was mainly concerned with prototype development and limited manufacture of radiation detection devices. There were about 200 employees in the whole division and all R & D managers in the division participated in the research.

The third site was a laboratory serving a major corporation and was primarily concerned with fundamental and applied research, and product and process engineering in the field of electrochemistry. Employment at the laboratory was about 600, including support people. About 70 per cent of the R & D managers at this site participated in the research.

The fourth site was a division of a major chemical company and was concerned with engineering design and development of production processes and facilities for the corporation. About 1,000 people were employed at this site and about 30 per cent of the R & D managers participated in the survey.

Approximately 13 per cent of the respondents had no college degree or certificate while 49 per cent had bachelor's degrees, 20 per cent had master's degrees, 14 per cent had doctoral degrees, and the remainder had diplomas or certificates. About 40 per cent of the respondents had worked for their present

division or department for less than three years, while about 29 per cent of the respondents had worked for ten years or more in the same division. About 20 per cent of the respondents had worked for their present supervisor for less than one year, while about 32 per cent had worked for their present supervisor for three years or more. About 12 per cent of the respondents were one level below the top manager at the particular research site, 17 per cent were two levels below, 19 per cent were three levels below, 28 per cent were four levels below, and the remainder were five levels below the top manager.

About 10 per cent of the members of the selected sub-samples failed to attend the meetings and fill out questionnaires because of travel or last-minute problems at work that needed to be attended to. Since the causes of this failure to participate appeared to be random and unrelated to the study, it is felt that only minimal bias may exist in the data obtained because of these events.

CHAPTER 5

RELATIONSHIP BETWEEN EXPERIENCED ROLE AMBIGUITY AND EXPERIENCED ROLE CONFLICT

Introduction

This researcher had available to him the data collected by Kahn and his associates during the intensive survey part of their study of organizational stress, as well as the data collected personally during this study. Two independent correlation analyses were conducted on the responses to the items in question 30 (Appendix I). The resulting matrices of correlation coefficients are contained in Appendix II. Analysis of the correlation matrices do not reveal any consistent patterns of correlation among the various index items. In fact, when a factor analysis was performed on both correlation coefficient matrices and a common number of factors were extracted and rotated by the Varimax method, no consistent factors underlying both sets of data could be identified to the satisfaction of the researcher.

This finding is somewhat interesting. If "pure" factors of role conflict and role ambiguity had been identified by the factor analysis, then the first hypothesis would have to be rejected as a result of any correlation analysis of those factors. The existence of "pure" factors would mean that they are orthogonal and hence uncorrelated.

Kahn, et al., conducted a test to see if a relationship exists between conflict, ambiguity and stress. In their test they constructed an index of objective role conflict by combining the responses of role senders to questions about the pressures they put on a focal person to change his activities performance and personal style. They constructed an index of experienced ambiguity by combining the responses of the focal person to questions about the ambiguities he felt in connection with his role. They also constructed a tension index by combining the responses of the focal person to the same items as contained in question 30 (Appendix I). In general, they found an insignificant relationship between the measures of objective conflict and experienced ambiguity, and that both conflict and ambiguity are apparently tension producing in the same degree.[1]

These results provoke some speculation. Is the index of objective conflict significantly related to an index of experienced conflict? A major assumption in the work of Kahn, et al., is that the pressures indicated by the index of objective conflict are actually communicated to, and experienced by, the focal person. In another test in which the focal persons were separated into categories of those who had a high frequency of communication with subordinates vs. low frequency of communication, there is a significant relationship between the experienced conflict and objective conflict indexes for the high frequency communicators only.[2] This result, which indicates that the relationship between objective conflict and experienced conflict is a function of the frequency of communication existing within a role set, is intuitively reasonable, and is in support of Kahn's assumption that pressures to change role behavior are communicated to the focal person. However in a difference of means test conducted by Kahn, et al., it is

shown that the difference in mean intensity of experienced conflict for high and low degrees of objective role conflict is significant at the level $p < 0.07$ without any control for the frequency of communication.[3] Kahn and his associates offer no explanations for these apparently inconsistent results.

The results presented by Kahn, et al., and reviewed above, do not indicate conclusively that any general relationship exists between their two different indexes of objective role conflict and experienced ambiguity. One could attempt to resolve this dilemma by conducting a multiple correlation analysis of the experienced conflict, objective conflict, and frequency of communication variables. To do that, however, one would have to assume the existence of a multivariate distribution, which seems just as tenuous as Kahn's original assumption. Therefore, it seems testing should be limited to seeking relationships between measures of experienced conflict and experienced ambiguity, or objective conflict and objective ambiguity until conclusive evidence exists to show that role senders always effectively communicate pressures to change to their focal person.

The second line of speculation provoked by the results cited above leads directly into the first hypothesis of this research. Does ambiguity cause conflict? If in a given role a person is not clear about what he should do but he acts anyway, it would seem that his chances of doing something wrong, i.e., developing conflict, would be relatively great. It would also seem that if the person experiencing ambiguity in a role does not act he could cause conflicts because people are expected to act in role. However it would seem that if a person experiencing role ambiguity notified other role set members of a temporary suspension of role activities while the ambiguity is cleared up, then the chances of

creating conflict are greatly lessened.

If a causal relationship exists between conflict and ambiguity, then one would expect to find a significant statistical relationship between measures of the two phenomena. However such a correlation would not prove causation (and in this case causation may run in either direction). It is entirely possible that if a significant statistical relationship exists between the two phenomena that some third, unidentified factor is a common cause of both phenomena.

Test of Hypothesis H: 1

A correlation ratio analysis, in which the experienced role conflict index was regressed on the experienced ambiguity index, was conducted to test the first hypothesis. The results are presented in Table 1. C_r is the correlation ratio and C_c is the correlation coefficient.

Table 1

Correlation Ratio Analysis Results for Experienced Role Conflict as a Function of Experienced Role Ambiguity

Data Source	C_r	F-value ($C_r = 0$)	C_c	F-value ($C_r = C_c$)	Degrees of Freedom n_1	Degrees of Freedom n_2	F-value ($p = 0.05$)
P-260*	.657	5.94	.615	0.73	12	93	1.86
Kahn**	.841	7.86	.783	1.01	12	38	2.02

*P-260 is the project number assigned to the data gathered during the course of this research by means of the questionnaire in Appendix I.

**Kahn refers to data made available to this author by Kahn and his associates.

Analysis of the results in Table 1 shows that one must accept the hypothesis that experienced role conflict is statistically related to experienced role ambiguity. The probability of incorrectly accepting such a hypothesis is less than $p = 0.001$ for both sets of data. One must also accept the hypothesis that an essentially linear relationship exists between the measure of experienced role conflict and experienced role ambiguity.

These results pose a dilemma. On the one hand, one must find a relationship between experienced role conflict and experienced role ambiguity in order to be able to accept the first hypothesis. If experienced role ambiguity causes experienced role conflict then a significant statistical relationship should exist. However as noted above, the relationship found is essentially linear so that it is just as likely that experienced role conflict causes experienced role ambiguity.

To prove the hypothesis that experienced role ambiguity is a sufficient, but not a necessary condition for the existence of experienced role conflict, one would have to find that whenever experienced role ambiguity exists, experienced role conflict exists also. It would also be necessary to show that a focal person could experience role conflict without experiencing role ambiguity. If the data in Table 1 had indicated that a nonlinear relationship existed between the measures of experienced role conflict and role ambiguity then it might have been possible to conduct worthwhile T-tests of the first hypothesis. However in view of the fact that one must accept the hypothesis that $C_r = C_c$, then any test in which the measure of role ambiguity is regressed in the measure of role conflict will yield the same results.

On the basis of the results in Table 1 it must be concluded that outright

acceptance of the first hypothesis of this paper is not warranted. It is entirely possible that some third, as yet unidentified, factor (or factors) causes a person to experience role conflict and role ambiguity simultaneously. If some unidentified factor causes both phenomena to occur then the statistical relationship found is completely reasonable. It must be pointed out, however, that at this stage of the testing the first hypothesis cannot be rejected either.

Some speculation on a possible factor which could cause both role conflict and role ambiguity appears to be in order at this point. This unknown factor would have to be something which is common to both sets of data analyzed in this chapter. Since the data came from a total of seven different organizations (Kahn collected intensive survey data in three organizations) with differing organization structures, policies, objectives, etc., the organizational environment must be ruled out. The respondents all differ in terms of age, education, personality, type of work, etc.; hence these variables are not likely candidates.

Managerial positions are positions of power. People who seek out, obtain, and remain in managerial positions are likely to have some need to possess and use power. Since all respondents in both data samples were managers one factor which may cause both role conflict and role ambiguity to exist is power. As managers strive to increase the power of their positions they may unknowingly create role conflicts. They may also alienate themselves from other role set members who could help them to reduce experienced role ambiguity. However further investigation of this possibility is beyond the scope of the present research.

CHAPTER 6

CAUSES OF ROLE AMBIGUITY AND ROLE CONFLICT

Introduction

An assumption underlying the whole of this research is that there is some optimal relationship between the degree of role conflict experienced by a person and his efficiency. If such a relationship does exist and managers can control the amount of role conflict experienced by subordinates, then they can achieve maximum efficiency in their departments.

In Chapter 5 we saw that it appears impossible to control the level of experienced role conflict by controlling the level of experienced role ambiguity because causation was not established. In this chapter therefore we will search for some causes of experienced role conflict and experienced role ambiguity. If causes of these phenomena can be identified, then managers can work directly on controlling the causes as a means of controlling the phenomena themselves.

Kahn, et al., established three classifications of core problems that lead to role conflict: (1) intra-psychic, (2) role-person mismatch, and (3) environmental.[1] In this research we will concern ourselves only with possible causes of role conflict and role ambiguity that can fit into the second and third classifications.

Causes of Role Ambiguity

The second hypothesis of this paper is concerned with some possible causes of role ambiguity. Parts (a) and (c) of the second hypothesis could be classified as relating to role-person mismatch problems and part (b) as relating to environmental problems. Possible causes of role ambiguity which would be classified in the intra-psychic category are beyond the scope of this research.

In testing hypothesis H:2(a) it is necessary to specify what information sources could be used by a focal person[2] in a role set. Obviously an exhaustive listing of all possible information sources is not possible; each focal person will have access to some highly specialized role-related information sources as well as some other information sources that would be applicable to all roles in the organization. Therefore we will limit ourselves to testing for a few information sources that would be generally applicable to all roles within an organization.

Some obvious sources of information which any focal person could use to obtain data to define his role are other members of his role set. A focal person will spend some part of his working time in contact with other members of his role set. During this contact time problems will be identified, ambiguities cleared up, and conflicts resolved if the stresses being caused by the conflicts are sufficiently discomforting and there is no "escape from the field."

In testing the first part of the second hypothesis, H:2(a) the measure of utilization of other role set members as information sources will be the amount

of time spent engaged in activities with them, as a percentage of total time worked. With this measure, failure to utilize an information source would be indicated by 0.0% contact time. One way to test hypothesis H:2(a) would be to identify all respondents who indicated that they spend 0.0% time with various classes of role set members and compare their mean experienced role ambiguity to the mean role ambiguity experienced by those respondents who spent a considerable amount of time with the same classes of role set members.

Such a pure test of the hypothesis is impossible. By definition, a focal person has to spend some time in communication with all members of his role set, even if the communications are not face-to-face. Therefore instead of a difference of means test, a correlation ratio analysis will be conducted in which mean experienced role ambiguity is regressed on the measure of contact time.

The results contained in Table 2 show that there is no significant relationship between the degree of ambiguity experienced and amount of time spent in contact with four classes of role set members. It would appear therefore that there is no predictable minimum amount of time that should be spent with each class of role set members in order to avoid the experience of role ambiguity.

The reader must remember that these data apply to R & D managers who would normally have considerable opportunity to define their own jobs and the jobs of their subordinates. It is possible that with considerable latitude in defining one's own job, one can define the job so as to minimize role ambiguities. To check on this possibility an additional correlation ratio

Table 2

Experienced Role Ambiguity in Relation to Contact Time with Various Classes of Role Set Members

Class of Role Set Members	C_r	F-value ($C_r = 0$)	C_c	F-value ($C_r = C_c$)	Degrees of Freedom n_1	Degrees of Freedom n_2	F-value ($p = 0.05$)
Subordinates (9b-2)*	.352	1.36	-.018	1.34	10	95	1.94
Colleagues (9b-3)	.339	1.60	-.073	1.51	8	97	2.03
Higher-ups (9c-2)	.278	1.39	.057	1.32	6	99	2.19
Self (9b-1)	.197	0.49	.017	0.48	8	97	2.03

*The notations in parentheses refer to questionnaire items, Appendix I.

analysis was conducted in which experienced role ambiguity was regressed on a measure of the autonomy the respondent has in choosing the specific objectives he will be responsible for (Question 13 - Myself category). The results show no significant relationship between degree of autonomy and experienced role ambiguity.

By virtue of the assumptions underlying the use of contact time as an independent variable in the tests of hypothesis H:2(a), it is necessary to identify sources of information other than role set members to test hypothesis H:2(b), and to identify them in such a fashion that it is possible to determine when a focal person is denied access to those sources.

Knowledge about the objectives of an organization can be used by a member of an organization to assist in defining his role and thereby reducing experienced role ambiguity. Therefore if the higher management of an organization has not specified objectives for the organization, or does not communicate effectively any specified objectives to all organization members, it can be said that the members of the organization are effectively prevented from using one source of information that might be valuable in reducing experienced role ambiguity.

Conceivably role ambiguity can also be reduced by giving a person considerable weight in deciding what his goals or objectives will be. Conversely where individuals or their immediate supervisors have relatively little weight in deciding on specific objectives one might expect to find relatively more role ambiguity. Specific goals and objectives must be determined by someone. If the individual, or his boss, does not have power to do so, then someone higher in the organization does. These decisions must then be communicated downward, but with the time delays and information losses that occur during the communication process, the individual is effectively prevented from complete access to information about his job.

The results contained in Table 3 are compatible with the analysis above. Where the perceived ability of the organization to set and communicate objectives is not highly rated, the respondents report experiencing high levels of role ambiguity. Likewise where the respondents feel that much more effort should be devoted to setting specific work objectives, experienced role ambiguity is high. (The negative correlation coefficients noted in Table 3 are due to the coding scheme used and have no other particular significance.)

Table 3

Experienced Role Ambiguity in Relation to Effort Devoted to Setting and Communicating Organizational Objectives

Variable	C_r	F-value ($C_r = 0$)	C_c	F-value ($C_r = C_c$)	Degrees of Freedom n_1	Degrees of Freedom n_2	F-value ($p = 0.05$)
Perceived ability to set and communicate objectives (11e)*	.255	2.39	-.209	0.78	3	102	2.70
Satisfaction with effort devoted to setting specific objectives (12a)	.317	3.82	-.304	0.29	3	102	2.70

*The notations in parentheses refer to questionnaire items, Appendix I.

The measure of satisfaction (12a) is significant in terms of the rejection probability level established for these tests. The perceived ability (11e) would be significant at about the $p = 0.07$ level of significance.

In review of the results obtained from the tests of hypothesis H:2(b) it appears that this part of the hypothesis must be accepted. If higher management in an organization does not do a good job of setting and communicating general organizational objectives and then follow up with sufficient effort to translate those general objectives into specific objectives, then members of the organization will experience relatively high levels of role ambiguity. Failure in this

area of management results in effectively preventing members of the organizations from obtaining important information which can be used to define their roles.

The last part of hypothesis 2, H:2(c), is concerned with where a focal person might go to seek information which could be useful to him in his job. In testing this hypothesis we will again assume that the various classes of role set members serve as information sources and will examine the focal person's perceptions of the priority structures that various role set members may have established for those information sources.

In Question 9 each respondent was asked to indicate the amount of time he spent on various activities as a percentage of his total working time. Then in Question 10a the respondent was asked whether or not he felt the amount of time recorded in Question 9 should be changed. In Question 10b he was asked for his perception of whether or not his supervisor wanted him to change the time recorded in Question 9, and in Question 10c he was asked for his perception of whether or not his subordinates desired any change in his time allocations.

We will assume that the respondent's answers to Question 10a reflect his priority structure relative to the various categories of role set members as information sources. For example, if the respondent indicates in Question 10a(C) that the amount of time he is currently spending with subordinates (supervising the technical work of others) should remain the same, then he has established a time allocation priority that he is satisfied with. Likewise if he indicates he should greatly increase the amount of time he is currently spending

with subordinates, then he is placing a higher priority on contact with them; he is currently dissatisfied with the time allocation priority assigned to them.

We will also assume, in similar fashion, that the respondent's answers to Questions 10b and 10c are his perceptions of the priority structures that his supervisor and subordinates, respectively, have for various categories of role set members as information sources.

With these limiting assumptions in mind the sample data were sorted into two sub-samples. In one sub-sample the respondent's perceptions of his supervisor's or subordinate's priority structure agreed with his own. For example where the respondent indicated in Question 10a(C) that the amount of time he spent should "greatly increase," and he also indicated that he perceived his supervisor as wanting him to "greatly increase" that amount of time, he was placed in a sub-sample labeled "agreement." He and his supervisor had identical priority structures for information sources as reflected by the responses to this item. The other sub-sample contained all those cases in which the respondent's desires were not in agreement with his perceptions of his supervisor's desires.

After these two sub-samples were identified a difference of means test was conducted to see if any significant difference in mean level of experienced role ambiguity existed. On the basis of the hypothesis H:2(c) we would expect to find a significantly lower level of mean experienced role ambiguity for the sub-sample "agreement" than in the sub-sample "disagreement."

The results for the difference-of-means tests relative to hypothesis H:2(c) are contained in Tables 4 and 5. These results show that when the

Table 4

Mean Experienced Role Ambiguity in Relation to Priority Structure of Information Sources: Respondent and Supervisor

Category of Information Source	Agreement Mean	Agreement N	Disagreement Mean	Disagreement N	Significance Level
Subordinates [10a(C) & 10b(C)]*	2.49 (.49)	41	2.68 (.48)	49	N.S.
Colleagues [10a(D) & 10b(D)]	2.55 (.44)	57	2.70 (.56)	33	N.S.
Higher-ups [10a(H) & 10b(H)]	2.49 (.46)	49	2.72 (.55)	39	$p < 0.05$

*The notations in parentheses refer to questionnaire items, Appendix I.

Table 5

Mean Experienced Role Ambiguity in Relation to Priority Structure of Information Sources: Respondent and Subordinates

Category of Information Source	Agreement Mean	Agreement N	Disagreement Mean	Disagreement N	Significance Level
Subordinates [10a(C) & 10c(C)]*	2.55 (.50)	44	2.65 (.53)	47	N.S.
Colleagues [10a(D) & 10c(D)]	2.58 (.53)	45	2.69 (.54)	33	N.S.
Higher-ups [10a(H) & 10b(H)]	2.66 (.52)	45	2.62 (.57)	32	N.S.

*The notations in parentheses refer to questionnaire items, Appendix I.

respondent (focal person) is in agreement with his supervisor about how much time he should spend communicating with higher-ups he experiences a higher level of role ambiguity than would be expected if he were in agreement with his supervisor. They also show that the difference in means is significant at the $p = 0.05$ level. The results in Table 4 also show the same result for the "Subordinates" category at about the $p = 0.07$ level of significance. Although the 5% level has been chosen as the acceptance level for all tests reported herein, the results in the "Subordinates" category cannot be ignored. They tend to support the hypothesis.

Finally one can see from the results in Table 4 that agreement or disagreement with one's supervisor on how much time should be spent with colleagues has no apparent effect on the level of ambiguity experienced.

The results in Table 5 are not significant for all three categories of information sources. If one were to look at these results alone then hypothesis H:2(c) would have to be rejected.

The results in Table 5 will be considered as being inconclusive. The respondents were asked to consider their subordinates as a group when answering questions about their subordinates. In doing this at least two things could have happened. In an attempt to report a perception of a group pressure toward change the respondent could have easily focused on one or two group members who held views and attitudes similar to his and reported those as being the group views and attitudes. Likewise he could have focused on one or two group members with whom he disagreed most and reported their views and attitudes as being the group views and attitudes. Unfortunately the data

collected do not permit us to control for this variable, if in fact it was operating.

Another possible reason for the results in Table 5 may be that subordinates, as a group, are relatively unimportant members of a role set. Kahn, et al., have shown that "the focal person receives the greatest amount of pressure from his direct supervisors, the least amount from his peers,"[3] and that his superior is likely to know more about his job than his subordinates or peers.[4] Considering these results obtained by Kahn, the results contained in Tables 4 and 5 are not unreasonable, and coupled with the Kahn results indicate at least that hypothesis H:2(c) ought not be rejected, even though it cannot be accepted on the basis of the data reported herein.

Causes of Role Conflict

The major assumption that underlies hypothesis H:3 is that role conflict will not exist unless a person in role decides on, and executes, a behavior pattern that is contrary to the expectations of other members of his role set. It has been shown above that in certain limited instances where a person has a priority structure for information sources that is different from that held by other important role set members he will experience a higher level of role ambiguity than if his priorities were consonant with those other important role set members. In the above tests there was no requirement that the respondent had to act to implement his priority structure, he merely had to indicate that he had one.

In testing hypothesis H:3 a major requirement will be that the respondent has to act to implement his priority structure. The existence of the priority structure is evidence of a decision and the implementing of that decision is the required behavior.

To obtain the conditions required for the tests of hypothesis H:3(a), the responses to the items in Question 10a (Appendix I) were sorted so that all those respondents who indicated that the amount of time they were spending with the several categories of role set members "should remain the same" were identified as a separate sub-sample. A correlation ratio analysis was then conducted in which experienced role conflict was a function of the respondents perceived pressure to change his time allocations for the case where the respondent felt his time allocations were proper. Presumably, if the respondent has decided that his present time spent with the specified categories of role set members is satisfactory and at the same time senses some pressure from other role set members to change that time, he is experiencing some role conflict.

The results in Table 6 are quite interesting. They show that there is no significant relation between experienced role conflict and pressure from one's supervisor to change the amount of time spent with subordinates or colleagues. However there is a significant relationship when the pressure is related to changing the amount of time spent with higher-ups. Furthermore the positive correlation in Table 6 indicates that when the respondent perceives his supervisor as wanting him to decrease the amount of time spent with higher-ups, experienced role conflict is the highest.

Table 6

Experienced Role Conflict in Relation to Perceived Pressure from Superior to Change Time Allocated to Various Categories of Role Set Members When Respondent Feels Time Allocations Are Proper

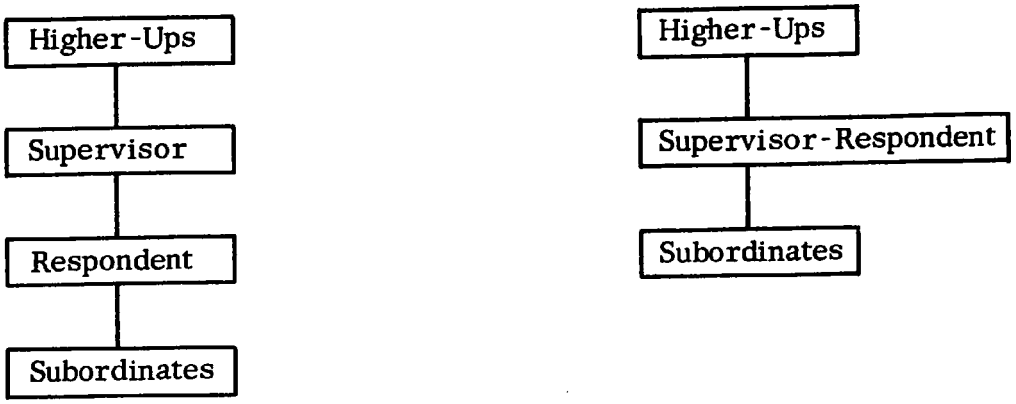
Category of Role Set Member	C_r	F-value ($C_r=0$)	C_c	F-value ($C_r=C_c$)	Degrees of Freedom n_1	Degrees of Freedom n_2	F-value ($p=0.05$)
Subordinates [10a(C) - 10b(C)]*	.285	1.68	-.230	0.57	2	37	3.25
Colleagues [10a(D) - 10b(D)]	.275	1.68	-.058	1.57	2	40	3.23
Higher-ups [10a(H) - 10b(H)]	.334	5.40	.288	1.36	1	42	4.07

*The notations in parentheses refer to questionnaire items, Appendix I.

Once again the implication can be drawn from these results that those members of a role set who are superior to the focal person in the organizational hierarchy are more important to the focal person than either colleagues or subordinates. A further implication is that spending too much time with higher-ups can lead one into conflict with his boss.

These results warrant further analysis. If the supervisor sees one of his subordinates spending too much time with higher-ups it could be interpreted as an attempt on the part of the subordinate to "go around" the supervisor and obtain recognition from a higher level in the organization. The supervisor might feel that if such recognition were forthcoming then the subordinate

would perhaps be accorded status equal to his supervisor in the eyes of the higher-ups.



a. Role Set Structure when Supervisor is satisfied

b. Role Set Structure when Supervisor is dissatisfied

Figure 9. Role set structure perceived by supervisor when supervisor is satisfied and dissatisfied with amount of time an immediate subordinate (respondent) spends with higher-ups.

This kind of situation is depicted in Fig. 9. In Fig. 9a the respondent, who is a subordinate, is spending a satisfactory amount of time with higher-ups. The supervisor does not put excessive pressure on the respondent to cut back on his time allocation. The hierarchy within the role set is compatible with the formal organizational authority and status structure, and the respondent experiences a relatively low level of role conflict.

In Fig. 9b however, the respondent is spending more time with higher-ups than his supervisor thinks he should. The supervisor conceivably senses that his superiors will see the formal organizational authority and status structure as in Fig. 9b. He therefore puts pressure on the respondent (which the respondent perceives) to cut back on the time spent with higher-ups in an

attempt to insure that the higher-ups perceive the structure as in Fig. 9a rather than as in Fig. 9b.

Table 7

Experienced Role Conflict in Relation to Perceived Pressure from Subordinates to Change Time Allocated to Various Categories of Role Set Members When Respondent Feels Time Allocations Are Proper

Category of Role Set Member	C_r	F-value ($C_r = 0$)	C_c	F-value ($C_r = C_c$)	Degrees of Freedom n_1	n_2	F-value ($p = 0.05$)
Subordinates [10a(C) - 10c(C)]*	.112	0.25	-.099	0.05	2	38	3.24
Colleagues [10a(D) - 10b(D)]	.391	2.80	-.036	2.69	2	30	3.32
Higher-Ups [10a(H) - 10c(H)]	.508	3.48	-.272	2.40	3	29	2.93

*The notations in parentheses refer to questionnaire items, Appendix I.

The results in Table 7 show that there is no significant relationship between experienced role conflict and pressure from one's subordinates to change the amount of time spent with either one's subordinates or colleagues. However there is a significant relationship between experienced role conflict and pressure from subordinates to change the amount of time spent with higher-ups. The negative correlation coefficient in Table 7 indicates that the greatest role conflict is experienced when the respondent perceives his subordinates as wanting him to increase the amount of time he spends with higher-ups.

The results in Tables 6 and 7 depict an R & D manager as a man caught between opposing forces. On the one hand his supervisor puts pressure on him to hold down the amount of time spent with higher-ups, and on the other hand his subordinates put pressure on him to increase the amount of time spent with higher-ups. Thus hypothesis H:3(a) cannot be rejected when that hypothesis is interpreted to refer to decisions about how much time is spent in communication with higher-ups in the organization.

The data collected during this research work provide no direct way for determining the value systems of the respondents and making comparisons with the value systems of other role set members. To test the second part of the third hypothesis H:3(b), therefore, it will be assumed that the amount of effort the respondent feels he should be devoting to each of several categories of general objectives will reflect at least part of his value system. For example, if a respondent indicates that considerably more time should be spent on basic research, then it is inferred that he has the value systems and orientations most commonly attributed to scientists, i.e. he highly values knowledge for its own sake, may be highly individualistic and may feel everyone should be the same, and may be inclined to be an anti-organization man.

Those in top management are members of each respondent's role set even though they may be located at a relatively great distance away from the respondent in terms of role set relationships. Also, presumably, the top managers in every organization strive to obtain some balance in organizational objectives between the desires of the lower level organization members who work toward specific objectives and any higher level officials or owners who

have the power to dictate general objectives. Therefore on the basis of hypothesis H:3(b) we would predict that when a respondent indicates that the amount of effort being spent on each of the different categories of organizational objectives is satisfactory he will report experiencing less role conflict than others who are not so satisfied.

Data were collected concerning the amount of effort that the top management of the respondent's organization was devoting to several classes of general, R & D type, organizational objectives. Each respondent was also asked to indicate how much effort he felt should be devoted to each of these categories of organizational objectives (Question 11b).

The respondents were separated into two subsets. One subset included all respondents who felt that the amount of effort being devoted to a particular type of general objective was "just about right" or who had "no opinion." This subset is then considered to contain all those respondents whose value systems (as reflected by satisfaction with the general objectives of the organization) are the same as the value systems of other role set members who are top management officials. The other subset included all those respondents who felt that the emphasis devoted to one type of general objective was either too much or too little. This subset is considered to contain all those respondents whose value systems are different from the value systems of other role set members who are top management officials.

A test of difference in mean experienced role conflict was conducted to see if any significant difference in mean experienced role conflict existed between the two subsets.

The results in Table 8 show that there is no significant difference in mean level of experienced role ambiguity between the group of "satisfied" respondents and the group of dissatisfied respondents.

On the basis of these results hypothesis H:3(b) must be rejected, but before moving on two points should be considered. First it is conceivable that the respondents are too far removed conceptually from general organizational objectives to be very concerned with them. Satisfaction or dissatisfaction with these types of objectives could be relatively far less important to the respondent than satisfaction or dissatisfaction with his particular job. Thus if an R & D manager has the kind of job he likes personally and is able to do the kind of work he thinks is important, then the overall goals of the organization are far less important. If this is the case, then using degree of satisfaction with the several types of general objectives listed is not an adequate indicator of one's value system, in whole or in part.

Secondly, it is also possible that members of an organization remain as members because they are in general agreement with the organizational goals even though they may disagree with spatially distant role set members about the amount of emphasis devoted to those goals. Those members who violently disagree with the goals of an organization can be expected to dissociate themselves from it. Thus it can be expected that within each organization a stable level of acceptance of organizational goals by the members is obtained over time. Through recruiting and selection procedures those individuals who are most likely to be unhappy with, and adversely affected by, the amounts of

emphasis devoted to various types of organizational goals hopefully are prevented from ever joining the organization.

Table 8

Mean Experienced Role Conflict in Relation to Satisfaction with Emphasis Being Devoted to Several Types of General Objectives

Type of Objectives	Satisfied Respondents	Dissatisfied Respondents	Significance Level
Discovering General Knowledge (11bA)*	2.33 (.41) (n=32)	2.33 (.44) (n=79)	N.S.
Solving Particular Problems (11bB)	2.33 (.43) (n=45)	2.33 (.44) (n=66)	N.S.
Improving Products, Processes or Hardware (11bC)	2.26 (.40) (n=42)	2.38 (.45) (n=69)	N.S.
Inventing New Products or Processes (11bD)	2.33 (.42) (n=41)	2.33 (.44) (n=70)	N.S.
Testing (11bE)	2.30 (.40) (n=55)	2.39 (.45) (n=55)	N.S.

*The notations in parentheses refer to questionnaire items, Appendix I.

Classical organization theorists maintain that every job within an organization should have a very clearly defined set of responsibilities and authority. If every organizational member clearly understands what his job is he can work at peak efficiency. Conceivably one can use logic to design sets of

interrelated responsibilities and authorities so that everything that must be done to insure organizational success will be done by someone.

Implementation of this theory has always proven to be most difficult. The way in which people use the authority given to them will have an important bearing on the efficiency with which things are accomplished. The dynamics of technology and the socio-economic system are such as to necessitate relatively frequent changes in the composition and relatedness of the sets of responsibilities and authorities. Without some flexible, efficient method for defining these sets of responsibilities and authorities, then, it seems inevitable that disagreement over the composition and interrelatedness of the sets will always exist in organizations.

The last part of the third hypothesis, H:3(c) states that whenever this type of disagreement exists role conflict will be higher than when there is agreement. In testing this hypothesis we will be concerned with the disagreement that the respondent feels he has with his supervisor and with his subordinates regarding authority to make certain kinds of managerial decisions.

To conduct the tests the respondents were again divided into two subsets. In one subset were those respondents who felt that their supervisor and subordinates wanted him to have the same amount of authority to make a certain kind of decision as he wanted, i.e. the response to a particular item in Question 17 (Appendix I) was the same as the response to that same item in Question 16 and Question 18. The other subset contained all respondents who felt that their supervisor and subordinates wanted him to have a different degree of authority than he felt he needed.

The decision items tested were only those relating directly to subordinates. Presumably the respondent, his supervisor, and his subordinates were all intimately concerned with the degree of authority the respondent has over the subordinates. Those decision items which are of mutual concern to all members of a role set are considered sufficient for the purposes of testing hypothesis H:3(c).

The decision items in Tables 9 and 10 relate to four basic kinds of role related decisions: (1) choice of objectives and allocation of work, (2) standards of performance, (3) performance evaluation, and (4) rewards, both positive and negative. The results in Table 9 show that those respondents who are in disagreement with their supervisors concerning the authority they have to dispense organizational rewards to their subordinates experience a higher level of role conflict than those respondents who agree with their boss. The results in Table 10 indicate that those respondents who disagree with their subordinates on authority to dispense negative rewards tend to experience higher than "normal" role conflict. Since the significance level for acceptance of any hypothesis is $p = 0.05$, hypothesis H:3(c) can be accepted only as it applies to disagreement with one's supervisor relative to the administration of organizational rewards.

It is rather interesting that an R & D manager apparently can disagree with his supervisor about how much authority he should have to make the first three kinds of decisions and not suffer relatively more role conflict than "normal." It is also interesting that he can disagree with his supervisor about negative rewards to be given to subordinates and not suffer excessively. But

if he disagrees with his supervisor about how much authority he has to allocate positive rewards to subordinates, he experiences a higher degree of role conflict.

Table 9

Mean Experienced Role Conflict in Relation to Degree of Agreement with Supervisor on Authority to Make Certain Kinds of Decisions about Subordinates

Decision Item	Agree on Authority	Disagree on Authority	Significance Level
Amount and Timing of Salary Increases for Subordinates	2.21 (.42) (n=43)	2.42 (.43) (n=60)	$p < 0.02$
Promotions Given to Subordinates	2.19 (.41) (n=39)	2.41 (.43) (n=63)	$p < 0.02$
Assignment of Personnel to Specific Jobs	2.36 (.43) (n=62)	2.27 (.44) (n=44)	N.S.
Evaluation of Performance of Subordinates	2.28 (.43) (n=71)	2.42 (.43) (n=34)	N.S.
Choice of Work Objectives for Subordinates	2.31 (.46) (n=58)	2.35 (.41) (n=46)	N.S.
Timing and Kinds of Rewards (other than salary increases) to Give Deserving Subordinates	2.22 (.43) (n=38)	2.45 (.42) (n=60)	$p < 0.02$
Timing and Kinds of Disciplinary Actions to be Taken with Subordinates	2.29 (.46) (n=58)	2.39 (.40) (n=48)	N.S.
Performance Standards for Subordinates	2.30 (.41) (n=59)	2.38 (.47) (n=49)	N.S.

Table 10

Mean Experienced Role Conflict in Relation to Degree of Agreement with Subordinates on Authority to Make Certain Kinds of Decisions about Subordinates

Decision Item	Agree on Authority	Disagree on Authority	Significance Level
Amount and Timing of Salary Increases for Subordinates	2.34 (.36) (n=32)	2.36 (.45) (n=70)	N.S.
Promotions Given to Subordinates	2.40 (.43) (n=32)	2.32 (.42) (n=69)	N.S.
Assignment of Personnel to Specific Jobs	2.28 (.44) (n=25)	2.34 (.43) (n=80)	N.S.
Evaluation of Performance of Subordinates	2.31 (.48) (n=34)	2.34 (.42) (n=72)	N.S.
Choice of Work Objectives for Subordinates	2.21 (.42) (n=20)	2.36 (.44) (n=85)	N.S.
Timing and Kinds of Rewards (other than salary increases) to Give Deserving Subordinates	2.41 (.37) (n=27)	2.35 (.46) (n=73)	N.S.
Timing and Kinds of Disciplinary Actions to be Taken with Subordinates	2.21 (.39) (n=28)	2.39 (.45) (n=77)	$p < 0.06$
Performance Standards for Subordinates	2.23 (.46) (n=24)	2.37 (.43) (n=83)	N.S.

These results seem to indicate that R & D managers have a high degree of independence in designing the jobs of their subordinates. Within some rather general guidelines, they are free to do just about anything they wish. They know how far they can go in setting work objectives and performance standards, evaluating performance and disciplining subordinates. It is not important that they agree with their boss on these matters. It is important, however, that they agree with their boss on the amount of authority they have to dispense positive organizational rewards. Apparently if a manager dispenses rewards to his subordinates without being given the authority to do so by his boss, he is encroaching on the power possessed by his boss and creating conflicts for himself (see Chapter 5).

R & D work usually is highly individualistic. Each person in R & D has his own job to do, and his job may constitute a single project. For an R & D manager, then, it is more probable that the work of his department is related to some specific project. Other departments may depend on the results he obtains, but do not have to work directly with him.

The same cannot be said for the allocation of rewards. In this matter all departments are interrelated. Therefore one's own supervisor is liable to be more concerned about these kinds of decisions than other kinds, and increase the pressure on his subordinate in an attempt to induce conformity or compliance when non-conformity and/or non-compliance is noticed. Thus when hypothesis H:3(c) is interpreted as applying to authority and responsibility for allocating and dispensing organizational rewards it must be accepted if the disagreement is with someone higher up in the organizational hierarchy.

The results in Table 10 seem to indicate that disagreement with one's subordinates is not damaging except when the decisions relate to negative rewards. Perhaps this is the only area of decision in which supervisors are sensitive to the wishes of their subordinates. Administering punishment is never a happy chore for normal people. But one wonders if such concern and sensitivity stems from a mature distaste for temporarily harming others or a guilt associated with inability to help others avoid situations which demand that organizational sanctions be administered.

A manager and his subordinates must work together if, as a group, they are to achieve objectives that none of them could achieve alone. The imposing of negative rewards on subordinates will tend to break down favorable role relationships and may even lead to break-up of the work group. Thus no matter how intelligently and maturely negative rewards are administered, such behavior is potentially dangerous. The results in Table 10 could also be an indication that the managers in this survey do not recognize the potential dangers of punishing subordinates.

CHAPTER 7

MECHANISMS FOR MANAGING ROLE CONFLICT AND ROLE AMBIGUITY

Introduction

In earlier chapters we have seen that a significant relationship exists between experienced role ambiguity and experienced role conflict. We have also identified some causes of role ambiguity and role conflict.

In this chapter we will be concerned with identifying some mechanisms that can be used by R & D managers to control the levels of role ambiguity and role conflict experienced by their subordinates. This part of the research is extremely important because, as the reader will recall, the long-term objective of this line of research is the development of a managerial strategy that will yield optimum productivity on the part of people in research and development.

Mechanism 1: Opportunity to Define One's Own Job

One mechanism which might be used to control experienced role ambiguity would be to give individual managers sufficient authority to define their own jobs. Where an individual cannot define his own job, or even small parts of it, it is obvious that he won't know what to do until someone else tells him what to do. Conversely, where an individual has great opportunity and authority in defining his own job, one might expect to find little experienced role ambiguity.

As discussed in Chapter 6, the classical management theory states that responsibilities and duties for a given job should be defined and then assigned to an individual to be carried out. Presumably some one person knows enough about all jobs in an organization to insure that there are no gaps or overlaps in the responsibilities and duties as between jobs.

If gaps exist, then some work won't get done and the organization will be relatively less efficient than otherwise. If there are overlaps, either one person will do that overlapping part of the job while some other person does nothing (resulting in lower efficiency), or both will try to do the same job, resulting in inefficiency and conflict. One would expect therefore that where one is able to define his own job to a considerable extent there may be gaps and overlaps between jobs within a role set, and hence a high degree of role conflict.

It would seem that as a person has increased opportunity to define his own job he would become more independent in his work and he would experience a lower level of role ambiguity. But within a role set where the members are interdependent, it seems that opportunity to define one's own job would have to be limited somehow. If some members of a role set are too independent of the others, the remaining members may not know what is going on. Therefore interdependencies within a role set should be sufficient motivation for some role set members to take action to prevent other role set members from being too independent in defining their own jobs.

Based on this line of reasoning we would expect to find a significant positive relationship between experienced role conflict and opportunity to define one's own job, and a significant negative relationship between experienced role

ambiguity and opportunity to define one's own job.

Included in the Kahn intensive survey was one question which probed for the degree to which individuals felt they could define their own jobs.[1] The results of a correlation analysis wherein experienced role ambiguity and experienced role conflict were regressed on the measure of the degree to which individuals could define their own jobs is contained in Table 11.

Table 11

Correlation Ratios for Experienced Role Ambiguity and Experienced Role Conflict as Functions of Opportunity to Define One's Own Job (Kahn, et al., data)

Experience Measure	C_r	F-value ($C_r = 0$)	C_c	F-value ($C_r = C_c$)	Degrees of Freedom n_1	Degrees of Freedom n_2	Significance Level P
Role Ambiguity	.259	1.76	-.058	1.64	2	48	N.S.
Role Conflict	.276	2.02	-.097	1.73	2	48	N.S.

These results indicate that there is no significant relationship between the opportunity to define one's own job and degree of experienced role ambiguity. Therefore it seems that just giving individual managers a chance to define their own jobs provides higher management with no guarantee that lower level managers will not experience role ambiguity.

The results also indicate that one must reject the idea that experienced role conflict is related to ability to define one's own job. In fact, the correlation

coefficient, even though not significant, shows that experienced role conflict tends to decrease as opportunity to define one's job increases.

The question about ability to define one's own job is very general. The respondents were not given an opportunity to indicate if possessing this ability is more important in some areas of responsibility or activity than others (e.g., providing rewards to subordinates). Perhaps if the question were more specific different results would be obtained. In light of these results one must conclude that while opportunity to define one's own job may be a good motivator, it has no significant effect on the level of role conflict or role ambiguity that an individual will experience.

Mechanism 2: Frequency of Communication

Another mechanism which may serve to minimize experienced role conflict and role ambiguity is communication between members of a role set. Communications should serve to reduce role ambiguities as role information is exchanged. Also, communications require some form of contact between people and thereby minimize opportunities for withdrawal. Since people in conflict have a tendency to withdraw from each other, any mechanism which minimizes the opportunity for withdrawal may cause people to seek ways to resolve conflicts and ambiguities in order to rid themselves of the discomforts associated with conflict and ambiguity.

Kahn, et al., developed an index of the frequency with which a respondent (focal person) communicated with other members of his role set. They found a significant relationship between experienced ambiguity and objective

conflict when the frequency of communication is high, and no significant relationship when the frequency of communication is low.[2] The results in Table 12 show that there is no significant relationship between frequency of communication and experienced role ambiguity as defined herein, while there is a significant, non-linear relationship between frequency of communication and experienced role conflict.

Table 12

Correlation Ratios for Experienced Role Ambiguity and Experienced Role Conflict as Functions of Frequency of Communications (Kahn, et al., data)

Experience Measure	C_r	F-value ($C_r = 0$)	C_c	F-value ($C_r = C_c$)	Degrees of Freedom n_1	Degrees of Freedom n_2	Significance Level P
Role Ambiguity	.427	1.67	-.104	1.53	6	44	N.S.
Role Conflict	.519	2.76	-.189	2.34	6	44	$p < 0.025$

One must conclude, on the basis of the results in Table 12, that frequency of communication is not a reliable mechanism to use to control the level of experienced role ambiguity. Role set members could talk to each other frequently and yet not resolve role ambiguities unless the discussions were specifically directed toward resolving role ambiguities. Discussions about the weather, baseball, the family, etc., do not help a person discover what his role in the role set is, or what his job is in the organization. However it does appear to be

a reliable way to control experienced role conflict. While people are communicating they cannot withdraw from each other. If they are prevented from withdrawing from each other apparently they will work to resolve their conflicts.

It is possible that there is a factor which underlies both opportunity to define one's own job and frequency of communication. Mellinger[3] has shown that communication between parties A and B increases A's accuracy in perceiving agreement with B when B trusts A. This implies that if people who trust each other communicate they should experience less ambiguities about their respective roles. Mellinger did not obtain data that might have indicated how accuracy varies under conditions of trust when frequency of communication varies. But if it is assumed that people who are role interdependent and who distrust each other are not going to communicate any more frequently than absolutely necessary, then there should be a relationship between trust and experienced ambiguity.

Mechanism 3: Affective Interpersonal Bonds

Kahn, et al., obtained data which were combined into an index of affective interpersonal bonds. This index combines scores of trust in other members of a role set, respect for other members, and liking of other members, into a single index. Thus on the basis of Mellinger's results wherever there is a high score on this index we would expect to find a low level of experienced role ambiguity because the members of the role set will talk more frequently to each other and minimize ambiguity by maximizing knowledge of common points of agreement.

The results in Table 13 are as predicted. A significant relationship exists between the strength of affective interpersonal bonds and experienced role

ambiguity. As the strength of the bonds increases, experienced role ambiguity decreases.

Table 13

Correlation Ratios for Experienced Role Ambiguity and Experienced Role Conflict as Functions of Strength of Affective Interpersonal Bonds (Kahn, et al., data)

Experience Measure	C_r	F-value ($C_r = 0$)	C_c	F-value ($C_r = C_c$)	Degrees of Freedom n_1	Degrees of Freedom n_2	Significance Level P
Role Ambiguity	.671	2.16	-.350	1.53	14	36	$p < 0.03$
Role Conflict	.639	1.82	-.289	1.14	14	36	$p < 0.07$

Also significant is the result that the hypothesis that the correlation ratio is equal to the correlation coefficient cannot be rejected. This means that one can assume a linear relationship to exist between the index of affective interpersonal bonds and the index of experienced role ambiguity.

The results in Table 13 also indicate that the same kind of relationship exists between the index of affective interpersonal bonds and the index of experienced role conflict. However the significance level at which this statistical relationship exists is higher than the significance level specified in Chapter 4. Therefore the same conclusions cannot be drawn for the case of role conflict as for the case of role ambiguity.

Mechanism 4: Choice of Role Set Members

Another mechanism which may serve to reduce experienced role ambiguity and experienced role conflict could be the opportunity to associate with role set members of one's own choosing.

In classical management theory unity of command is advocated. Unity of command simply means that each person in an organization should have only one boss. Whenever the unity of command principle is in operation it is presumed that everyone knows to whom he should report.

If people are allowed to choose the members of their role set, then reporting relationships ought to be quite clear. If reporting relationships are clear, then ambiguities regarding one's job should be minimal because each person knows whom he should contact to resolve ambiguities. Likewise when conflicts arise, the cause and source of the conflict should be easily identifiable, providing greater opportunity to resolve the conflicts.

It is also possible that individuals who have an opportunity to choose those with whom they will associate, will choose those people with whom they already have (or feel they can develop) strong interpersonal bonds. If this is true then we should expect to find, based on the results in Table 13, that when individuals have the opportunity to choose their role set members they will experience lower role ambiguity than otherwise. Also, we should notice no significant effect on the level of role conflict experienced.

Data collected during this research can be used to check the validity of this line of analysis. The respondents were asked to indicate the degree of availability they had to associate with various categories of role set members as

a reward for a job well done (question 27: E, F, G; Appendix I). Their responses to these items will be an indication of the opportunity they feel they have to choose members of their role sets.

Table 14

Correlation Ratios for Experienced Role Ambiguity and Experienced Role Conflict as Functions of Opportunity to Associate with Role Set Members of One's Own Choosing

A. Experienced Role Ambiguity

Category of Role Set Membership	C_r	F-value ($C_r = 0$)	C_c	F-value ($C_r = C_c$)	Degrees of Freedom n_1	Degrees of Freedom n_2	Significance Level P
Colleagues (27E)*	.151	1.21	.033	1.14	2	103	N.S.
Supervisor (27F)	.307	3.56	-.237	1.41	3	102	$p < 0.025$
Top Executives (27G)	.334	4.32	-.290	1.06	3	102	$p < 0.01$

B. Experienced Role Conflict

Category of Role Set Membership	C_r	F-value ($C_r = 0$)	C_c	F-value ($C_r = C_c$)	Degrees of Freedom n_1	Degrees of Freedom n_2	Significance Level P
Colleagues (27E)*	.196	2.07	.137	1.04	2	103	N.S.
Supervisor (27F)	.239	2.08	-.176	0.95	3	102	N.S.
Top Executives (27G)	.207	1.54	-.167	0.54	3	102	N.S.

*The notations in parentheses refer to questionnaire items, Appendix I.

The results in Table 14 substantiate the above predictions. When an individual has the opportunity to choose his supervisor and associate more frequently with top executives, he will experience relatively less role ambiguity.

As pointed out in Chapter 6, one's supervisor is the most important member of one's role set. Colleagues are relatively unimportant. Therefore failure to find a significant relationship between opportunity to choose one's colleagues and experienced role ambiguity is not totally unexpected.

Also as predicted, there is no significant relationship between opportunity to choose role set members and experienced role conflict. Apparently when people are given the chance, they will associate with those people with whom they disagree as well as with those people with whom they agree. This is healthy, if out of such associations come solutions to problems which are acceptable to all concerned.

CHAPTER 8

SUMMARY AND CONCLUSIONS

Introduction

This thesis has two major purposes: (1) the development of a new model of conflict and (2) the testing of some hypotheses that were suggested by the model developed.

The model was developed after a careful review of some of the previous work done on conflict. Not all previous work was reviewed, which would be an almost impossible task, but rather selected research which seemed most related to the model being developed was reviewed in depth.

The tests of the hypotheses were carried out using two independently collected sets of research data. It was not always clearly possible to accept or reject the hypotheses, but in a few instances the results obtained from the two different sets of data reinforced each other. Such reinforcement not only strengthens the conclusions drawn in this chapter, but also indicates a lack of serious methodological errors in the conduct of the experimental part of this thesis.

Apart from the limited sample data (which prohibit drawing valid, general conclusions) a methodological difficulty was encountered whenever several tests were made of one hypothesis. As the theoretical model indicates, role conflict and role ambiguity are multidimensional. Yet the tests conducted were usually

limited in their dimensions, and sometimes one test result indicated acceptance of a hypothesis whereas another test result indicated rejection of the same hypothesis. Perhaps this is part of the price one must pay for conducting research on so nebulous a phenomenon as conflict. But it also reinforces the idea that role conflict and role ambiguity are multidimensional.

One can view this methodological problem in another way, however. When one test result indicates that a hypothesis should be rejected and another test result indicates that a hypothesis should be accepted, both results, when taken together, identify some of the important and unimportant dimensions of the hypothesis being tested. In behavioral sciences research any nontrivial hypothesis is bound to be multidimensional. So this particular problem under discussion, and the results contained herein, represent an important advance in the current state of knowledge about role conflict and role ambiguity.

Relationship Between Role Conflict and Role Ambiguity

The reader will recall that the vector spaces model of conflict developed in Chapter 2 serves also as a partial model of learning. This prompted the first hypothesis which essentially stated that whenever role ambiguity existed, role conflict would exist also, and that role conflict could exist without role ambiguity existing. In the test of this hypothesis a definite statistical relationship was found between the measures of role conflict and role ambiguity used in this thesis. However the results were such as to prevent the identification of any direction of causation.

If the results had shown that role ambiguity was a cause of role conflict,

then one would have to conclude that whenever any member of an R & D organization was subjected to role ambiguity he would always experience role conflict. This would mean that every time someone joined an organization or was transferred or promoted to a new position where he had to learn his new role, he would experience role conflict. It would mean also that all supervisors would have difficulty in identifying when their subordinates were experiencing conflict because they were learning vs. other causes. Thus supervisors would not have any clear guidelines to help them to decide whether they should work directly with individual subordinates to help them learn their roles, or whether they should try to effect changes in the organizational environment as a means of controlling the role conflict experienced by subordinates.

Since the results of the test of the first hypothesis are still equivocal, it is not possible to state categorically that a change of basis in S-space corresponds to a conflict situation and an expansion of basis in S-space corresponds to a learning situation. (The reader will recall that measure of time to respond to a stimulus does not differentiate between time to find a new basis in S-space versus time to expand the basis in S-space, and that time to respond, therefore, could be a measure of conflict as well as a measure of ambiguity.) Thus it is still not known if it is proper to use the vector spaces model of conflict as a model of learning also.

Causes of Role Ambiguity

A line of analysis was followed in an attempt to identify some causes of role ambiguity and to test the second hypothesis. It would seem that there should be some minimal amount of time a person should spend with other members of his

role set in order to avoid experiencing role ambiguity, yet in the tests conducted no such result was found. This does not mean however that an R & D manager need spend no time with other members of his role set. It is possible that the test conducted was not sufficiently sensitive to identify a threshold level of contact time below which an R & D manager would experience relatively more role ambiguity.

A significant relationship was found between the degree of satisfaction with the effort spent in setting specific objectives and experienced role ambiguity. R & D managers recognize that one way to reduce role ambiguity is to spend more time discussing and deciding what specific things are going to be accomplished in a particular role.

It was found that when R & D managers see their organization as doing a poor job in setting and communicating general objectives for the organization they tend to experience higher levels of role ambiguity. Thus these results tend to demonstrate the value of managing R & D by objectives.

Causes of Role Conflict

The results of the tests of hypothesis 3(a) indicate that experienced role conflict is related to decision-making. These results paint the picture of the R & D manager as a man subjected to pressures, which when resolved into forces in S-space, result in conflict.

These results are compatible with the vector spaces model of conflict developed in Chapters 2 and 3. The R & D manager, by virtue of his formally prescribed role as intermediary between his superior and his subordinates, is in a

role in which he is subjected to opposing pressures. He must somehow resolve those pressures into forces and respond. The opposing forces are such that they are transformed into one response dimension: associate with higher-ups. However the forces are opposing in the sense that when they are transformed from S-space to R-space, they fall at different ends of the response dimension. The person subjected to such opposing forces must then decide where along this response dimension his particular response will lie. No matter what point he chooses, he cannot satisfy everyone. Therefore he is forced to choose a point that is satisfactory to himself in order to be able to bear the continual pressures from other members of his role set to change his decision.

It has been found (Table 9) that mere disagreement with other organizationally important role set members (one's supervisor) is not sufficient to cause role conflict. However when that disagreement concerns the power to administer rewards, then one experiences a higher level of role conflict.

These results once again point to the need for further understanding of the relationship between role conflict and role ambiguity. It seems imperative that each R & D manager identify those things that he and his boss can disagree about without his experiencing higher role conflict. However, identification of areas for "friendly" disagreement seems to be related to the reduction of role ambiguity. Therefore at least part of the time spent in contact with other members of one's role set should purposely be spent in identifying these areas for "friendly" disagreement.

Mechanisms for Controlling Role Conflict and Role Ambiguity

In Chapter 6 it was pointed out that there was no significant relationship between the degree of autonomy in setting specific objectives for oneself and experienced role ambiguity. The data used in this test were collected by this researcher.

In Chapter 7 it was shown that authority to define one's own job was not significantly related to experienced role ambiguity. The data used in this test were collected by Kahn and his associates.

The results of these two different tests, using two different sets of data, reinforce each other. They disprove the oft-made statement that R & D people should be allowed a great deal of freedom in defining their own jobs. They tend to indicate that formally defined role relationships can't be all bad. The data currently available to this researcher do not permit a determination of where the optimum point between completely formally defined role relationships and completely autonomously defined role relationships should lie.

The results in Table 12 show that an enforced frequency of communication between members of a role set could be one way to control the degree of role conflict experienced. However, the results do not indicate the amount of time required for this mechanism to operate nor the side effects it may have on quantity and quality of R & D work done. Also there is no indication of how prevention of "withdrawal from the field" by enforcing a certain frequency of communication will affect the quality of any solutions to conflicts that may exist. Committee meetings, etc., can serve a useful purpose, but they can also cause new problems while solving old ones.

Sensitivity training can be helpful in developing strong interpersonal bonds and thereby ultimately result in lowering the degree of experienced role ambiguity. The results in Table 13 show, however, that one cannot also reasonably expect role conflicts to vanish as a result of sensitivity training.

Role conflicts are barriers to productivity. Strong interpersonal bonds that lead people to resolve role ambiguities will result in people having a clearer picture of their job. But if they cannot overcome the barriers to high productivity that are created by role conflicts, they cannot produce.

Conclusions

Role conflict and role ambiguity are still scarcely understood phenomena that bother some people constantly, other people occasionally, and still other people are never bothered by them. Of those who are bothered by these phenomena, some experience a great amount of stress while others experience uncomfortable but bearable amounts of stress. Furthermore those who are bothered constantly by these phenomena may be experiencing uncomfortable but bearable amounts of stress, while others who are bothered only occasionally may experience a great deal of stress. Thus the phenomena of role conflict and role ambiguity appear to be dynamic in nature.

The research works reviewed in Chapter 1 all have a common underlying assumption: that conflict is a static or quasi-static phenomenon. The vector spaces model of conflict developed in Chapters 2 and 3 also has the same underlying assumption. In view of the apparent dynamic nature of conflict this is most unfortunate. However it has long been recognized that in studying complex

phenomena, rarely, if ever, is anyone successful in developing a dynamic model without first developing a static model.

The vector spaces model of conflict does appear to serve a useful purpose. As we struggle to understand completely what role conflict and role ambiguity are, some characteristics of the model serve as valuable guides to thinking.

Foremost of these characteristics is the concept of basis of a vector space. With this concept a possible relationship between conflict and ambiguity was identified. This identification led to the formulation and testing of the first hypothesis of this paper. Unfortunately the results of that test were not unequivocal. Thus the possible relationship between conflict and ambiguity still remains as just a possibility.

The measures of experienced role conflict and experienced role ambiguity used to test the first hypothesis were developed from questionnaire items that were designed for another research study. Those items were adopted in this research study because they appeared acceptable and because such adoption would permit testing hypotheses using two sets of data. The items which comprise these indexes of experienced role conflict and experienced role ambiguity were considered as some of the dimensions of the basis of S-space. It is entirely possible that these items were too general and therefore not sufficiently sensitive to permit a good test of the first hypothesis. Subsequent researchers may want to design completely different indicators of conflict and ambiguity.

As pointed out in earlier chapters, some of the results of this research support some of the findings of other researchers, especially Kahn and his

associates. Results were obtained which also disprove the often made and generally unsupported claim that researchers need a great deal of autonomy and freedom in their jobs in order to perform well.

On the basis of the results contained herein R & D managers are seen as human beings who need to set objectives in order to minimize experienced role ambiguity and need to talk to other important members of their role set (their boss) if they are to minimize experienced role conflict. Since the system of Management by Objectives requires that managers set objectives, and talk to their boss about those objectives and barriers to achievement of them, it appears that Management by Objectives is the system of management that should be used in R & D organizations. This conclusion is drawn because this whole work is based on the assumption that excessive (or insufficient) levels of role conflict and role ambiguity are barriers to high productivity. However the true value of the MBO system of managing will not be completely revealed until additional research work is done on the relationship between productivity and role conflict, and productivity and role ambiguity.

Implications for Future Research

The results of the tests of the first hypothesis did not provide for clear acceptance or rejection of that hypothesis. Since the hypothesis is a central issue in the development of a complete model of conflict, further work needs to be done along these lines. Ambiguity and conflict are both said to be stress producing. Perhaps there are some differences in the character of the stress produced by ambiguity as compared to the stress produced by conflict. If such differences

can be identified, different measures of conflict and ambiguity could be developed and the hypothesis retested. Pending the outcome of further work along these lines, the model of conflict developed in this thesis also can be used to investigate the phenomenon of learning.

A search should be undertaken to identify the threshold level of time one is required to be in contact with other members of his role set in order to minimize the amount of role ambiguity experienced. It is suspected that such a level exists, but further research along this line is beyond the scope of this thesis.

The results of the tests of the second hypothesis indicate that merely spending time with other members of one's role set will not affect the level of experienced ambiguity, and neither will the degree of autonomy in setting specific objectives for oneself. In view of the demonstrated importance of objectives, however, the question arises as to where the power to define a role should reside. In classical management theory it resides in the boss. In the Kahn, et al., work it implicitly resides in the members of the focal person's role set. If there is a concensus of opinion as to where this power should lie and steps are taken to insure that this power does rest in its proper place, then that locus of power will be able to manipulate the degree of role ambiguity experienced by those people within the purview of that locus. Therefore further research should be conducted to determine just where the power to set objectives, both general and specific objectives, should lie in the organizational hierarchy.

The tests of hypothesis H: 3(b) were not robust. It is possible that attitudes toward general R & D objectives are not sufficiently clear indications of the value systems held by R & D managers. Therefore it seems that more rigid

identification of, and control for value systems held by R & D people is necessary to provide a good test of this hypothesis. Unfortunately the resources available to conduct this research were not sufficiently generous to permit the research controls needed for proper testing.

A good test of hypothesis H: 3(b) is needed because it provides the beginning point for identifying the elements that exist in S-space. If the hypothesis is accepted then infinitely many elements could exist in S-space. If there were infinitely many elements, then one would have to resort to probability theory in order to make some progress in defining the elements of the basis of S-space. However if the hypothesis is rejected, then it should be much easier to identify the basis of S-space.

Some research should be conducted in an attempt to identify the degree to which individual R & D managers should be involved in defining their own jobs. Participative management has been advocated by many people as the way to manage R & D (and other intangible type work). However the proper degree of participation has never been specified by other writers, and it cannot be specified on the basis of the results contained herein. It remains an open, and intriguing, question.

Finally, it seems that neither sensitivity training nor training in management by objectives as it is currently practiced adequately prepares R & D managers to manage role conflict and role ambiguity. The results contained herein indicate that both types of training are required. It remains for the results of future research to show whether it is most efficient to prepare R & D managers by subjecting them to the current versions of both sensitivity training and

management by objectives training, or whether some hybrid combination of the two is more efficient, or whether some other type of training is more efficient.

LIST OF REFERENCES

Chapter 1

1. Boulding, Kenneth E., "Two Principles of Conflict," in Power and Conflict in Organizations, ed. by Kahn, Robert L. and Boulding, Elise (New York: Basic Books, 1964), pp. 75-76.

2. Kahn, Robert, et al., Organizational Stress: Studies in Role Conflict and Ambiguity (New York: John Wiley and Sons, Inc., 1964).

3. Lewin, Kurt, Field Theory in Social Science: Selected Theoretical Papers, ed. by Cartwright, Darwin (New York: Harper and Row, 1951), pp. 256-269.

4. Pribram, K., Conflicting Patterns of Thought (Washington, D.C.: Public Affairs Press, 1949).

5. Simmel, Georg, Conflict (Glenroe, Ill.: The Free Press, 1955), p. 13.

6. Miller, Daniel and Swanson, Guy, Inner Conflict and Defense (New York: Volt, 1959).

7. Kendall, Patricia, Conflict and Mood (Glenroe, Ill.: The Free Press, 1954).

8. Lewin, Kurt, op. cit., p. 264.

9. Hovland, C. and Sears, R., "Experiments on Motor Conflict. I. Types of Conflict and Their Modes of Resolution," J. of Experimental Psychology, 1938, 23, 477-493.

10. Worell, L. and Worell, J., "Generalization of Conflict and Conflict Tolerance," Psychological Reports, 1964, 14, 203-215.

11. Miller, N. E., "Experimental Studies of Conflict," in Personality and the Behavior Disorders, ed. by Hunt, J. McV. (New York: Ronald Press, 1944), pp. 431-465.

12. Yates, A. J., Frustration and Conflict (New York: John Wiley and Sons, Inc., 1962).

13. Gradients here refers to the rate at which the subject in conflict approaches or avoids an object in the environment while experiencing conflict.

14. Oram, P., and Heilizer, F., "A Note on the Concept of Conflict," J. of Psychology, 1965, 59, 35-43.

15. Hovland, C. and Sears, R., op. cit.

16. Andreas, B., "Motor Conflict Behavior As a Function of Motivation and Amount of Training," J. Experimental Psychology, 1958, 55, 173-178.

17. Gross, N., Mason, W., and McEachern, A., Explorations in Role Analysis (New York: John Wiley and Sons, Inc., 1958).

18. Kahn, Robert, et al., op. cit.

19. Luce, R., Individual Choice Behavior: A Theoretical Analysis (New York: John Wiley and Sons, Inc., 1959).

20. This is the method by which consumer preference functions are developed in economic studies on the nature of utility.

21. Berlyne, D., "Uncertainty and Conflict: A Point of Contact Between Information Theory and Behavior Theory Concepts," Psychological Review, 1957, 64, 329-339.

22. Utility theory economists are concerned with how consumers establish the utility or value of different goods. Since people in conflict evaluate the utility or value of alternative responses in terms of which response relieves conflict most effectively, it appears that the basic problem of scale of measurement in utility theory also exists in conflict theory.

23. Lewin, K., Principles of Topological Psychology (New York: McGraw-Hill Book Company, 1936); See also Lewin, op. cit.

24. Lewin, K., Principles of Topological Psychology, p. 205.

Chapter 2

1. Lewin, K., op. cit., p. 12.

2. To make this application it is necessary that each element in P space and E space is equivalent to a dimension with only two possible points on that dimension. See Gross, N., Mason, W., and McEachern, A., Explorations in Role Analysis, Chapter 17.

3. Odiorne, George, Management by Objectives (New York: Pitman Publishing Company, 1965).

4. Compliance includes conformity to one or the other of two mutually exclusive influences, and compromise.

5. Gross, N., Mason, W., and McEachern, A., op. cit., pp. 287-295.

6. Hovland, C. and Sears, R., op. cit.

7. Kendall, Patricia, op. cit.

8. Lewin, Kurt, Field Theory in Social Science, p. 256.

Chapter 3

1. Maier, N. R. F., Frustration: The Study of Behavior Without a Goal (New York: McGraw-Hill Book Company, 1949).

2. Yates, A. J., op. cit.

3. The Kahn, et al., model of role conflict and ambiguity is based on the definition of an organization as an open, dynamic system which is characterized by a continuing process of input, transformation, and output. This definition of an organization and the Kahn, et al., model of role conflict and ambiguity are directly analogous to the vector spaces model of conflict developed herein. This fact is most important and forms the basis for the comparison of the two models.

4. "Harmful" as used here is a relative concept. Obviously, it will be impossible to specify "harmful" levels of role conflict and role ambiguity until (a) sophisticated, universally acceptable measures of role conflict and role ambiguity are available and (b) agreement is reached regarding what it is that role conflict and role ambiguity harms, e.g., the mental health of the person, job satisfaction, job performance, productivity, etc.

Chapter 4

1. Novit, Mitchell S., A Field Study of Role Conflict and Ambiguity Among Managers In a Modern Department Store, Unpublished Ph.D. Dissertation, University of Michigan, 1966.

2. Kahn, Robert, et al., op. cit., pp. 424-25.

Chapter 5

1. Kahn, Robert, et al., op. cit., pp. 88-9.

2. Ibid, pp. 206-07.

3. Ibid, p. 66.

Chapter 6

1. Kahn, Robert, et al., op. cit., Chapter 18.

2. The definition of focal person for purposes of this thesis is essentially the same as that employed by Kahn, et al., Chapter 2.

3. Kahn, Robert, et al., op. cit., p. 174.

4. Ibid, p. 178.

Chapter 7

1. Kahn, Robert, et al., op. cit., item B-2, p. 436.

2. Ibid, p. 208.

3. Mellinger, Glen, "Interpersonal Trust and Communication," J. Abnormal and Social Psychology, 52, 3, (May 1956), 304-09.

Appendix I

Bureau of Industrial Relations
Graduate School of Business Administration
The University of Michigan
George Odiorne, Director

Work Patterns of Research and Development Managers

To respondents:

The Bureau of Industrial Relations has conducted a number of studies on the problems of management. In this study we want to concentrate on the work patterns of managers in research and/or development organizations. In this questionnaire we are attempting to obtain reliable data on many factors which may affect the performance of R & D managers.

We hope that this study will help to identify the kinds of work patterns which help R & D managers to do their best work. The knowledge gained in this study will be used in special seminars for R & D managers that the Bureau will sponsor beginning in early 1968.

Confidentiality

As with all studies conducted by the Bureau, answers of individual respondents will be kept in strict confidence. Under no circumstances will the names of particular persons, units, or organizations be used in any reports or seminars. When reporting the results, individual responses will be grouped together into meaningful categories.

Comments

It is difficult to design questionnaire items which can capture the details of all possible situations. We therefore invite your comments and qualifications as you go along, either in the margins or on the back of the page.

We are grateful for your assistance.

Sincerely,

Gerard F. Carvalho

Gerard F. Carvalho
Program Director

Instructions

Some terms used

Your "technical division" refers to your overall scientific or engineering department or division.

"R & D" refers to the kind of work usually done by scientists and engineers. We use "R & D" to indicate the complete spectrum of work from basic research to product improvement and development.

The adjective "technical" will often be used as equivalent to "scientific and engineering."

Your "supervisor" refers to the person to whom you officially report, in terms of salary, recommendations, promotion, approval of budgets, etc.

The term "your subordinates" refers to those who officially report to you, in terms of salary, recommendations, promotion, approval of budgets, etc.

Some of the questions ask you about the opinions and attitudes of "your subordinates." For each of these questions you should consider the group opinion or group attitude of your subordinates, and choose the answer that corresponds most closely with that group opinion or group attitude.

Format of the Check-answer Questions

Many of the questions can be answered by checking one of several answers.

Often it is convenient to apply the same set of answers to several situations. In the following illustration the scale runs horizontally:

11a. In your opinion, how much emphasis is devoted to each of the following general objectives by the top level managers in your organization?

	In my opinion the amount of emphasis is:				
	None	Slight	Moderate	Large	Very Large
A) Discovering general knowledge relevant to a broad class of problems.....→	___	___	___	___	___
B) Discovering knowledge to solve particular problems.....→	___	___	___	___	___
:					
E) Testing; use standardized or special techniques to obtain data needed by others.....→	___	___	___	___	___

In each instance the arrow reminds you that you are to check one space in each horizontal row.

Format of other questions

Some other questions list a number of items and ask you to rank order the top two or three. For each question of this type write the letter (or number) designation of the particular item you are ranking on the line provided. The following is an illustration of this type of question format:

Among the following types of recreation which ones appeal to you?

A) Active sports

B) Hobbies and crafts

C) Bridge

D) .....

B	A	D	E
Most appealing	Second most appealing	Third most appealing	Least appealing

Some questions ask for rough percentages, which should add to 100%.

Items not applicable: no opinion

If an item is not applicable to you please draw a line through that item.

If you have no opinion, so indicate.

Please read carefully all possible answers before selecting the answer that is most appropriate for your situation.

Please give an answer to all questions, or else mark "not applicable" or "no opinion."

Please answer all questions in order; do not skip around.

1. How many years have you worked in this technical division (or department) of this organization?

___ Less than one year
___ One year (up to two)
___ Two years (up to three)
___ Three to four years
___ Five to nine years
___ Ten to fourteen years
___ Fifteen to twenty-five years
___ Over twenty-five years

2. Present title or rank _____

Present job grade (if you have a numbered system) _____

3. How long have you had this title or grade? Check one answer.

___ Less than 6 months
___ 6 - 11 months
___ One year (up to two)
___ Two years (up to three)
___ Three to four years
___ Five to nine years
___ Ten years or more

4. How long have you worked for your present supervisor?

___ Less than 6 months
___ 6 - 11 months
___ One year (up to two)
___ Two years (up to three)
___ Three years (up to four)
___ Four years (up to five)
___ Over five years

5. Please enter here number of personnel who officially report to you or to your subordinates. (If you are not a supervisor, enter 0 in each space.)

	ENTER NUMBER IN EACH SPACE				
	Report directly to me as their supervisor		Report to my sub-ordinates		Total in my group
Professional scientists or engineers.....	____	+	____	=	____
Sub-professional assistants, technicians, clerical personnel.....	____	+	____	=	____

6. Do you have any college degrees?

Yes _____

No _____

Degrees	Year Earned	Institution
Bachelor's	_____	_____
Master's	_____	_____
Doctoral	_____	_____
Other	_____	_____

7. Over the past five years, about how many of the following have you had:

FILL EACH SPACE

	Approximate number
patents or patent applications.....	____
technical papers accepted by professional journals.....	____
technical books accepted for publication.....	____
unpublished technical manuscripts, reports, or formal talks (either inside or outside this organization.....	____

8. What is your present age? _____

9. People in R & D organizations typically find themselves engaging in several different types of work activities. Of your total work time for an average month, about what proportion do you normally spend on the following types of activities? Strike an average and enter nearest 5-10%. Fill in all spaces.

	Percent of time
a. Teaching and training (including preparation time)	___ %
b. Technical work, other than teaching.....	___ %
b-1. My own work (including technical reading and writing).....	___ %
b-2. Supervising technical work of others.....	___ %
b-3. Collaborating and discussing with colleagues.....	___ %
b-4. Consultation; giving technical service requested by someone else.....	___ %
b-5. Other technical: _____	___ %
TOTAL TECHNICAL (should equal item b).....	(___ %)
c. Administrative and other non-technical work.....	___ %
c-1. Internal administration: expediting services, etc.....	___ %
c-2. Communicating with higher-ups.....	___ %
c-3. Communicating with outside groups or clients.....	___ %
c-4. Other non-technical work: _____	___ %
TOTAL NON-TECHNICAL (should add to item c)..	(___ %)
TOTAL FOR ALL WORK (should add to 100%).....	___ %

10. Sometimes technical people are not entirely satisfied with the amounts of time being spent on various activities and would prefer to rearrange the time allocations to emphasize some activities and deemphasize others.

10a. In your situation how much time do you feel you should spend on each of the following activities relative to the amount of time you are now spending?

Check one in each line:	The amount of time I spend should: greatly increase	slightly increase	remain the same	slightly decrease	greatly decrease
A) Teaching and training.... →	___	___	___	___	___
B) My own work (including technical reading and writing)..... →	___	___	___	___	___
C) Supervising technical work of others..... →	___	___	___	___	___
D) Collaborating and discussing with colleagues..... →	___	___	___	___	___
E) Consultation: giving technical service requested by someone else..... →	___	___	___	___	___
F) Other technical..... →	___	___	___	___	___
G) Internal administration: expediting services, etc. →	___	___	___	___	___
H) Communicating with higher-ups..... →	___	___	___	___	___
I) Communicating with outside groups or clients..... →	___	___	___	___	___
J) Other non-technical work. →	___	___	___	___	___

10b. In your situation how much time do you feel <u>your supervisor wants</u> you to spend on each of the following activities relative to the amount of time <u>you are now spending</u>?

Check one in each line:	I feel my supervisor wants the amount of time I spend to: greatly increase	slightly increase	remain the same	slightly decrease	greatly decrease	I don't know how he feels about my time allocations
A) Teaching and training..... →	____	____	____	____	____	____
B) My own work, including technical reading and writing. →	____	____	____	____	____	____
C) Supervising technical work of others →	____	____	____	____	____	____
D) Collaborating and discussing with colleagues..... →	____	____	____	____	____	____
E) Consultation; giving technical service requested by someone else..... →	____	____	____	____	____	____
F) Other technical..... →	____	____	____	____	____	____
G) Internal administration: Expediting services, etc..... →	____	____	____	____	____	____
H) Communicating with higher-ups..... →	____	____	____	____	____	____
I) Communicating with outside groups or clients..... →	____	____	____	____	____	____
J) Other non-technical work..... →	____	____	____	____	____	____

10c. In your situation how much time do you feel <u>your subordinates</u> want you to spend on each of the following activities relative to the amount of time <u>you are now spending</u>?

<u>Check one in each line:</u>	I feel my subordinates generally want the amount of time I spend to:					
	<u>greatly increase</u>	<u>slightly increase</u>	<u>remain the same</u>	<u>slightly decrease</u>	<u>greatly decrease</u>	<u>I don't know how they feel about my time allocations</u>
A) Teaching and training..... →	___	___	___	___	___	___
B) My own work, including technical reading and writing..... →	___	___	___	___	___	___
C) Supervising technical work of others..... →	___	___	___	___	___	___
D) Collaborating and discussing with colleagues..... →	___	___	___	___	___	___
E) Consultation; giving technical service requested by someone else.. →	___	___	___	___	___	___
F) Other technical.. →	___	___	___	___	___	___
G) Internal administration; expediting services, etc..... →	___	___	___	___	___	___
H) Communicating with higher-ups.. →	___	___	___	___	___	___
I) Communicating with outside groups or clients →	___	___	___	___	___	___
J) Other non-technical work..... →	___	___	___	___	___	___

11. Listed below are several general objectives that R & D organizations try to achieve.

11a. In your opinion, how much emphasis is devoted to each of the following general objectives by the top level managers in your organization?

Check one in each line:	In my opinion the amount of emphasis is: None	Slight	Moderate	Large	Very Large
A) Discovering general knowledge relevant to a broad class of problems..... →	___	___	___	___	___
B) Discovering knowledge to solve particular problems..... →	___	___	___	___	___
C) Improvement of existing hardware, products, or processes..... →	___	___	___	___	___
D) Invention of new products or processes..... →	___	___	___	___	___
E) Testing; use standardized or special techniques to obtain data needed by others... .. →	___	___	___	___	___

11b. In your opinion how much emphasis should your organization devote to each of these objectives compared to the emphasis that is currently being devoted to each of them?

Check one in each line:	In my opinion the emphasis being devoted to this: should be greatly increased	should be slightly increased	is just about right	should be slightly decreased	should be greatly decreased	I have no opinion about this
A) Discovering general knowledge relevant to a broad class of problems..... →	___	___	___	___	___	___
B) Discovering knowledge to solve particular problems..... →	___	___	___	___	___	___
C) Improvement of existing hardware, products or processes..... →	___	___	___	___	___	___
D) Invention of new products or processes..... →	___	___	___	___	___	___
E) Testing; use standardized or special techniques to obtain data needed by others →	___	___	___	___	___	___

11c. In your opinion, how much emphasis does <u>your supervisor</u> feel your organization should devote to each of these objectives compared to the emphasis that is currently being devoted to each of them?

Check one in each line:	My supervisor feels the emphasis being devoted to this should be greatly increased	should be slightly increased	is just about right	should be slightly decreased	should be greatly decreased	I don't know how he feels
A) Discovering general knowledge relevant to a broad class of problems..... →	___	___	___	___	___	___
B) Discovering knowledge to solve particular problems..... →	___	___	___	___	___	___
C) Improvement of existing hardware, products, or processes..... →	___	___	___	___	___	___
D) Invention of new products or processes..... →	___	___	___	___	___	___
E) Testing; use standardized or special techniques to obtain data needed by others..... →	___	___	___	___	___	___

11d. In your opinion, how much emphasis do <u>your subordinates</u> feel your organization should devote to each of these objectives compared to the emphasis that is currently being devoted to each of them?

Check one in each line:	Generally my subordinates feel the emphasis being devoted to this: should be greatly increased	should be slightly increased	is just about right	should be slightly decreased	should be greatly decreased	I don't know how they feel
A) Discovering general knowledge relevant to a broad class of problems.....→	___	___	___	___	___	___
B) Discovering knowledge to solve particular problems.....→	___	___	___	___	___	___
C) Improvement of existing hardware, products, or processes...→	___	___	___	___	___	___
D) Invention of new products or processes.....→	___	___	___	___	___	___
E) Testing; use standardized or special techniques to obtain data needed by others.....→	___	___	___	___	___	___

11e. In <u>your</u> opinion, how well does your organization set and communicate the general organizational objectives?

we could do much better	we could do somewhat better	we are doing an adequate job now	we are doing a very good job now	we are doing an outstanding job now

11f. In your opinion, how does <u>your supervisor</u> feel about how well your organization is doing in setting and communicating general organizational objectives?

we could do much better	we could do somewhat better	we are doing an adequate job now	we are doing a very good job now	we are doing an outstanding job now	I don't know how he feels

11g. In your opinion, how do your subordinates generally feel about how well your organization is doing in setting and communicating general organizational objectives?

we could do much better	we could do somewhat better	we are doing an adequate job now	we are doing a very good job now	we are doing an outstanding job now	I don't know how they generally feel

12. Usually the general objectives of an organization are too broad to be of much help to particular individuals in their work. When this happens extra effort must be exerted by particular individuals to establish specific work objectives or goals that are meaningful to them in their departments or work areas within the organization.

12a. In your opinion, how much emphasis <u>should</u> be devoted to <u>setting specific</u> work objectives or goals compared to the emphasis that currently <u>is</u> being devoted to this activity?

it should be greatly increased	it should be slightly increased	it is just about right	it should be slightly decreased	it should be greatly decreased

12b. In your opinion, how much emphasis does your supervisor feel should be devoted to setting specific work objectives or goals compared to the emphasis that currently is being devoted to this activity?

it should be greatly increased	it should be slightly increased	it is just about right	it should be slightly decreased	it should be greatly decreased	I don't know how he feels

12c. In your opinion, generally how much emphasis do your subordinates feel should be devoted to setting specific work objectives or goals compared to the emphasis that currently is being devoted to this activity?

it should be greatly increased	it should be slightly increased	it is just about right	it should be slightly decreased	it should be greatly decreased	I don't know how they generally feel

12d. Regardless of the amount of emphasis being devoted to setting specific work objectives or goals, how far ahead can you map out a time-table of steps or phases for your work? Not only the main phases, but specifically what you will do in each phase, and when?

only next few days or week	for the next month	for the next two or three weeks	for the next four to six months	for the next six to twelve months	for the next year to two years

13. Consider the choice of specific goals or objectives of the various technical activities for which you are responsible (either your own work, or work which you supervise or coordinate). Who has weight in deciding on these goals and objectives? Estimate the relative percent of weight exerted by each of the following, to nearest 5-10%.

	Percent of weight in deciding goals
Myself	_____ %
Subordinates	_____ %
Colleagues -- other persons without supervisory authority over me	_____ %
My immediate chief	_____ %
Higher level technical supervisors in this organization	_____ %
Non-technical executives	_____ %
Clients or sponsors	_____ %
Other: _____	_____ %
TOTAL (should add to 100%)	_____ %

14. How much weight would you prefer different persons to have, in deciding the goals or objectives of your technical work? Fill in percents below indicating the situation which you feel would be most helpful or stimulating to you in performing your job well.

	Percent of weight in deciding goals
Myself	_____ %
Subordinates	
Colleagues -- other persons without supervisory authority over me	_____ %
My immediate chief	_____ %
Higher level technical supervisors in this organization	_____ %
Non-technical executives	_____ %
Clients or sponsors	_____ %
Other: _____	_____ %
TOTAL (should add to 100%)	_____ %

15. Scientists and engineers can be useful to each other in different ways. Here are some functions which R & D supervisors and subordinates can provide each other:

1) Technical know-how, sharing one's knowledge, skill or experience.
2) Original ideas, coming up with imaginative or unusual ways of looking at problems.
3) Picking out fruitful problems, good hunches as to promising objectives.
4) Critical evaluation, asking searching questions as to what is sound or realistic.
5) Enthusiasm for work, maintaining interest or sense of significance.
6) Neutral sounding-board, being an open-minded listener to the ideas of the other person.
7) Providing clear and explicit descriptions of what needs to be done.
8) Providing appreciation and encouragement for the work being done by the other person.
9) Accepting responsibility, can be depended on to carry out one's share of the work.

15a. In your opinion, which of these functions do you do best for your immediate supervisor? That is, in which of these ways are you most useful to him? Please write the number to indicate the function for each rank order choice.

Most useful function	Second most useful function	Third most useful function	Least useful function

15b. In your opinion, which of these functions does your supervisor do best for you? Again write the number to indicate the function.

Most useful function	Second most useful function	Third most useful function	Least useful function

15c. In your opinion, which of these functions do you <u>generally</u> do best for your subordinates? (Write the number to indicate the function.)

Most useful function	Second most useful function	Third most useful function	Least useful function
_____	_____	_____	_____

15d. In your opinion, which of these functions do your subordinates <u>generally</u> do best for you? (Write the number to indicate the function.)

Most useful function	Second most useful function	Third most useful function	Least useful function
_____	_____	_____	_____

16. R & D supervisors, managers, and directors have to make many decisions in the course of their work. In the following list of items we would like you to indicate how much authority you have to make decisions.

List of Decision Items: Check one in each line	My supervisor wants me to: Decide for myself without informing supervisor of my decision	Decide for myself and inform supervisor of my decision	Discuss the matter with supervisor before I decide for myself	Arrive at a mutual agreement with supervisor	Discuss the matter with supervisor but supervisor will decide	Wait until supervisor decides and informs me of decision
A) Amount and timing of salary increases for my subordinates... →	____	____	____	____	____	____
B) Promotions given to my subordinates... →	____	____	____	____	____	____
C) Assignment of personnel to specific jobs that need to be done..... →	____	____	____	____	____	____

16. Continued

List of Decision Items: Check one in each line	My supervisor wants me to: Decide for myself without informing supervisor of my decision	Decide for myself and inform supervisor of my decision	Discuss the matter with supervisor before I decide for myself	Arrive at a mutual agreement with supervisor	Discuss the matter with supervisor but supervisor will decide	Wait until supervisor decides and informs me of decision
D) Evaluation of performance of my subordinates →	____	____	____	____	____	____
E) Choice of work objectives or goals for myself..... →	____	____	____	____	____	____
F) Choice of work objectives or goals for my subordinates... →	____	____	____	____	____	____
G) Programming or scheduling of work..... →	____	____	____	____	____	____
H) Establishing contacts with potential clients or sponsors..... →	____	____	____	____	____	____
I) Scope and timing of new proposals..... →	____	____	____	____	____	____
J) Scope and timing of reports on work completed..... →	____	____	____	____	____	____
K) Choice of approach to a technical problem..... →	____	____	____	____	____	____

16. Continued

List of Decision Items: Check one in each line	My supervisor wants me to: Decide for myself without informing supervisor of my decision	Decide for myself and inform supervisor of my decision	Discuss the matter with supervisor before I decide for myself	Arrive at a mutual agreement with supervisor	Discuss the matter with supervisor but supervisor will decide	Wait until supervisor decides and informs me of decision
L) Choice of approach to a non-technical problem..... →	____	____	____	____	____	____
M) Timing and amount of purchases of new equipment..... →	____	____	____	____	____	____
N) Determining specifications for new equipment..... →	____	____	____	____	____	____
O) Timing and kinds of rewards (other than salary increases) to give to deserving subordinates..... →	____	____	____	____	____	____
P) Timing and kinds of disciplinary actions to be taken with subordinates when required..... →	____	____	____	____	____	____
Q) What the standards of performance should be for my subordinates.... →	____	____	____	____	____	____
R) What the standards of performance should be for me..... →	____	____	____	____	____	____

17. Now we would like you to review the list of decision items again and this time tell us how much authority you feel you need to do a good job.

List of Decision Items: Check one in each line	I feel my authority should be sufficient to allow me to: Decide for myself without informing supervisor of my decision	Decide for myself and inform supervisor of my decision	Discuss the matter with supervisor before I decide for myself	Arrive at a mutual agreement with supervisor	Discuss the matter with supervisor but supervisor will decide	Wait until supervisor decides and informs me of decision
A) Amount and timing of salary increases for my subordinates....→	___	___	___	___	___	___
B) Promotions given to my subordinates....→	___	___	___	___	___	___
C) Assignment of personnel to specific jobs that need to be done.....→	___	___	___	___	___	___
D) Evaluation of performance of my subordinates.→	___	___	___	___	___	___
E) Choice of work objectives or goals for myself.....→	___	___	___	___	___	___
F) Choice of work objectives or goals for my subordinates....→	___	___	___	___	___	___
G) Programming or scheduling of work.....→	___	___	___	___	___	___
H) Establishing contacts with potential clients or sponsors.....→	___	___	___	___	___	___

17. Continued

List of Decision Items: Check one in each line	I feel my authority should be sufficient to allow me to: Decide for myself without informing supervisor of my decision	Decide for myself and inform supervisor of my decision	Discuss the matter with supervisor before I decide for myself	Arrive at a mutual agreement with supervisor	Discuss the matter with supervisor but supervisor will decide	Wait until supervisor decides and informs me of decision
I) Scope and timing of new proposals... →	____	____	____	____	____	____
J) Scope and timing of reports on work completed... →	____	____	____	____	____	____
K) Choice of approach to a technical problem..... →	____	____	____	____	____	____
L) Choice of approach to a non-technical problem..... →	____	____	____	____	____	____
M) Timing and amount of purchases of new equipment... →	____	____	____	____	____	____
N) Determining specifications for new equipment..... →	____	____	____	____	____	____

17. Continued

List of Decision Items: Check one in each line	I feel my authority should be sufficient to allow me to: Decide for myself without informing supervisor of my decision	Decide for myself and inform supervisor of my decision	Discuss the matter with supervisor before I decide for myself	Arrive at a mutual agreement with supervisor	Discuss the matter with supervisor but supervisor will decide	Wait until supervisor decides and informs me of decision
O) Timing and kinds of rewards (other than salary increases) to give to deserving subordinates..... →	___	___	___	___	___	___
P) Timing and kinds of disciplinary actions to be taken with subordinates when required..... →	___	___	___	___	___	___
Q) What the standards of performance should be for my subordinates.... →	___	___	___	___	___	___
R) What the standards of performance should be for me..... →	___	___	___	___	___	___

18. Now we would like you to review the list of decision items one more time and this time tell us generally how much authority your subordinates would like you to have to make decisions.

List of Decision Items: Check one in each line	Generally my subordinates want me to: Decide for myself without informing them of my decision	Decide for myself and inform them of my decision	Discuss the matter with them before I decide for myself	Arrive at a mutual agreement with them	Discuss the matter with them but they will decide	Wait until they decide and inform me of their decision
A) Amount and timing of salary increases for my subordinates.....→	___	___	___	___	___	___
B) Promotions given to my subordinates.....→	___	___	___	___	___	___
C) Assignment of personnel to specific jobs that need to be done.....→	___	___	___	___	___	___
D) Evaluation of performance of my subordinates...→	___	___	___	___	___	___
E) Choice of work objectives or goals for myself.....→	___	___	___	___	___	___
F) Choice of work objectives or goals for my subordinates.....→	___	___	___	___	___	___
G) Programming or scheduling of work.....→	___	___	___	___	___	___

18. Continued

List of Decision Items: Check one in each line	Generally my subordinates want me to: Decide for myself without informing them of my decision	Decide for myself and inform them of my decision	Discuss the matter with them before I decide for myself	Arrive at a mutual agreement with them	Discuss the matter with them but they will decide	Wait until they decide and inform me of their decision
H) Establishing contacts with potential clients or sponsors..... →	____	____	____	____	____	____
I) Scope and timing of new proposals..... →	____	____	____	____	____	____
J) Scope and timing of reports on work completed..... →	____	____	____	____	____	____
K) Choice of approach to a technical problem..... →	____	____	____	____	____	____
L) Choice of approach to a non-technical problem..... →	____	____	____	____	____	____
M) Timing and amount of purchases of new equipment..... →	____	____	____	____	____	____
N) Determining specifications for new equipment..... →	____	____	____	____	____	____

18. Continued

List of Decision Items: Check one in each line	Generally my subordinates want me to: Decide for myself without informing them of my decision	Decide for myself and inform them of my decision	Discuss the matter with them before I decide for myself	Arrive at a mutual agreement with them	Discuss the matter with them but they will decide	Wait until they decide and inform me of their decision
O) Timing and kinds of rewards (other than salary increases) to give to deserving subordinates..... →	___	___	___	___	___	___
P) Timing and kinds of disciplinary actions to be taken with subordinates when required..... →	___	___	___	___	___	___
Q) What the standards of performance should be for my subordinates..... →	___	___	___	___	___	___
R) What the standards of performance should be for me..... →	___	___	___	___	___	___

19. Sometimes people find that they can perform better if they compete <u>against</u> something. How important do you feel each of the following types of competition is to you in terms of stimulating you to do your best work?

Check one for each type of competition	The amount of stimulation I get from this type of competition: None	Slight	Moderate	Great	Extreme
1) Against standards of performance I set for myself.....→	___	___	___	___	___
2) Against standards of performance set for me by my supervisor.....→	___	___	___	___	___
3) Against standards of performance that my supervisor and I mutually agree to→	___	___	___	___	___
4) Against standards of performance set for me by my subordinates.....→	___	___	___	___	___
5) Against standards of performance that my subordinates and I mutually agree to.....→	___	___	___	___	___
6) Against generally accepted professional standards of performance.....→	___	___	___	___	___
7) Against individual colleagues.....→	___	___	___	___	___
8) Between my immediate group and other groups within the organization.....→	___	___	___	___	___
9) Between my technical division and other organizations.....→	___	___	___	___	___
10) Between the U.S. and other countries.→	___	___	___	___	___

20. Now we would like you to consider again all of the types of competition listed in question 19 and use the number designation to indicate which one is

The <u>most</u> stimulating	Second most stimulating	Third most stimulating	The <u>least</u> stimulating
_____	_____	_____	_____

21. Some organizations require that the work performance of their employees be evaluated on a regular basis.

21a. Apart from the very frequent feedback that you may receive on how well things are going, how frequently is your work performance formally evaluated? Please indicate the time period that corresponds most closely with your situation.

once a month	once every six months	once a year	once every two years	never or almost never

21b. How frequently do you feel your work performance should be formally evaluated?

once a month	once every six months	once a year	once every two years	never or almost never

22. There are many different factors that could be considered when formally evaluating the work performance of an R & D manager or supervisor.

22a. When your work performance is being formally evaluated how much weight is given to each of the following factors?

Check one in each line:	Weight given: None	Slight	Moderate	Great	I don't know
A) technical ability (sound training, knowhow)..... →	___	___	___	___	___
B) creativity (imagination, originality, thinking of better ways to do the job)..... →	___	___	___	___	___
C) methodicalness (thoroughness, carefulness, precision)..... →	___	___	___	___	___
D) energy (hard work, drive, large output)..... →	___	___	___	___	___

22a. Continued

Check one in each line:	Weight given: None	Slight	Moderate	Great	I don't know
E) critical ability (sound evaluation of ideas; clear thinking)..... →	___	___	___	___	___
F) method of approach to problems (the way problems are handled)... →	___	___	___	___	___
G) keeping spending within the budget..... →	___	___	___	___	___
H) completing projects when promised..... →	___	___	___	___	___
I) adhering to set working hours.... →	___	___	___	___	___
J) number of publications in open literature..... →	___	___	___	___	___
K) number of unpublished or classified papers and reports..... →	___	___	___	___	___
L) number of lectures presented inside or outside the organization..... →	___	___	___	___	___
M) dollar size of your budget..... →	___	___	___	___	___
N) number of subordinates..... →	___	___	___	___	___
O) willingness to accept authority.. →	___	___	___	___	___
P) enthusiasm for the work..... →	___	___	___	___	___
Q) competence in handling administrative problems..... →	___	___	___	___	___
R) adhering to organization policies and procedures..... →	___	___	___	___	___
S) helping subordinates to grow and develop..... →	___	___	___	___	___
T) keeping up with the state of the art in your areas of specialization..... →	___	___	___	___	___
U) securing contracts or grants for new and/or continuing projects... →	___	___	___	___	___

22b. How much weight do you feel <u>should</u> be given to each of the following factors when your work performance is being formally evaluated?

Check one in each line:	Amount of weight I feel should be given: no weight is given and none should be	weight given should be somewhat decreased	weight given is just about right	weight given should be somewhat increased	no weight is given but some should be
A) technical ability (sound training, knowhow)..... →	___	___	___	___	___
B) creativity (imagination, originality, thinking of better ways to do the job)... →	___	___	___	___	___
C) methodicalness (thoroughness, carefulness, precision)..... →	___	___	___	___	___
D) energy (hard work, drive, large output)..... →	___	___	___	___	___
E) critical ability (sound evaluation of ideas; clear thinking)..... →	___	___	___	___	___
F) method of approach to problems (the way problems are handled)..... →	___	___	___	___	___
G) keeping spending within the budget..... →	___	___	___	___	___
H) completing projects when promised..... →	___	___	___	___	___
I) adhering to set working hours →	___	___	___	___	___
J) number of publications in open literature..... →	___	___	___	___	___
K) number of unpublished or classified papers and reports →	___	___	___	___	___
L) number of lectures presented inside or outside the organization..... →	___	___	___	___	___

22b. Continued

Check one in each line:	Amount of weight I feel should be given: no weight is given and none should be	weight given should be somewhat decreased	weight given is just about right	weight given should be somewhat increased	no weight is given but some should be
M) dollar size of your budget..... →	____	____	____	____	____
N) number of subordinates..... →	____	____	____	____	____
O) willingness to accept authority.. →	____	____	____	____	____
P) enthusiasm for work..... →	____	____	____	____	____
Q) competence in handling administrative problems..... →	____	____	____	____	____
R) adhering to organization policies and procedures..... →	____	____	____	____	____
S) helping subordinates to grow and develop..... →	____	____	____	____	____
T) keeping up with the state of the art in your areas of specialization..... →	____	____	____	____	____
U) securing contracts or grants for new and/or continuing projects... →	____	____	____	____	____

23. Below is a list of people who could conduct formal performance appraisals. In your opinion, who <u>should</u> conduct a formal appraisal of your work?

<u>Check only one</u>.

No one, it is impossible to evaluate my work..... _____

My supervisor alone..... _____

My supervisor and I together..... _____

Me alone..... _____

A committee <u>with</u> my supervisor as a member..... _____

A committee <u>without</u> my supervisor as a member..... _____

If you indicate a committee, who should serve as members? (Do not use personal names but use categories such as colleagues, subordinates, supervisors above my supervisor, supervisors on same level as my supervisor, high level management, etc.)

_____

_____

_____

24. How involved do you feel you should be in an actual formal evaluation of your work? <u>Check one</u>.

I <u>should</u> not be involved at all	The <u>evaluator</u> should be free to involve me if he so desires	I <u>should</u> be free to become involved if I desire	I <u>should</u> be required to be involved

25. Do you feel you should get any feedback from a formal evaluation of your work? <u>Check one</u>.

I <u>should</u> not be informed of the results	I <u>should</u> be informed of the results at the discretion of the evaluator	I <u>should</u> be informed of the results at my discretion	I <u>should</u> always be informed of the results

26. Listed below are some kinds of rewards a person might receive for a job well done. How much value would you personally attach to each of these?

Check one in each line:	Value I would attach: Slight or none	Moderate	Considerable	Great	Utmost
A) freedom to make full use of my present knowledge and skills..... →	___	___	___	___	___
B) freedom to grow and learn new knowledge and skills. →	___	___	___	___	___
C) significant increase in salary..... →	___	___	___	___	___
D) promotion in terms of administrative authority and status..... →	___	___	___	___	___
E) choice of colleagues to work with..... →	___	___	___	___	___
F) choice of supervisor to work under..... →	___	___	___	___	___
G) chance to associate more with top executives in the organization..... →	___	___	___	___	___
H) chance to build my professional reputation by attending meetings, having time off to write papers, etc..... →	___	___	___	___	___
I) chance to choose which projects I will work on.. →	___	___	___	___	___
J) more technicians to assist me in my work..... →	___	___	___	___	___
K) more time to follow up on some of my own ideas.. →	___	___	___	___	___
L) more clerical and editorial support..... →	___	___	___	___	___
M) better lab and/or office conditions..... →	___	___	___	___	___
N) more freedom in spending project money as I see fit.. →	___	___	___	___	___

26a. Among the preceding kinds of rewards which one, in your opinion, is: (Write letter designation on the line)

most important _____

next most important _____

third most important _____

And which are the three least important? _____ _____ _____

27. Now, to what extent is each of these kinds of rewards actually available to you in your present job?

	Availability in present job				
Check one in each line:	Slight or none	Moderate	Considerable	Great	Utmost
A) freedom to make full use of my present knowledge and skills..... →	___	___	___	___	___
B) freedom to grow and learn new knowledge and skills.... →	___	___	___	___	___
C) significant increase in salary..... →	___	___	___	___	___
D) promotion in terms of administrative authority and status..... →	___	___	___	___	___
E) choice of colleagues to work with..... →	___	___	___	___	___
F) choice of supervisor to work under..... →	___	___	___	___	___
G) chance to associate more with top executives in the organization..... →	___	___	___	___	___
H) chance to build my professional reputation by attending meetings, having time off to write papers, etc..... →	___	___	___	___	___

27. Continued

Check one in each line:	Availability in present job: Slight or none	Moderate	Considerable	Great	Utmost
I) chance to choose which projects I will work on... →	____	____	____	____	____
J) more technicians to assist me in my work..... →	____	____	____	____	____
K) more time to follow up on some of my own ideas..... →	____	____	____	____	____
L) more clerical and editorial support..... →	____	____	____	____	____
M) better lab and/or office conditions..... →	____	____	____	____	____
N) more freedom in spending project money as I see fit →	____	____	____	____	____

28. How important do you personally feel your present technical work is - that is, how much of a contribution is it likely to make, either to technical knowledge, or to practical application, or by any other standards? CHECK ONE answer.

_____ Of no importance either for knowledge or application

_____ Of slight importance

_____ Moderate

_____ Substantial

_____ Very substantial

_____ Utmost; one of the most important contributions of its type anywhere in the world today

29. What is the relative degree of obligation that you feel toward supporting the long range goals or objectives of your organization?

no _____ obligation

slight _____ obligation

moderate _____ obligation

strong _____ obligation

30. People occasionally feel bothered by certain kinds of things in their work. We would like you to indicate how frequently you are bothered by each thing in the following list.

	Frequency of being bothered				
Check one in each line:	Never	Rarely	Sometimes	Rather often	Nearly all of the time
A) Feeling that you have too little authority to carry out the responsibilities assigned to you..... →	___	___	___	___	___
B) Being unclear on just what the scope and responsibilities of your job are..... →	___	___	___	___	___
C) Not knowing what opportunities for advancement or promotion exist for you..... →	___	___	___	___	___
D) Feeling that you have too heavy a work load, one that you can't possibly finish during an ordinary work day..... →	___	___	___	___	___
E) Thinking that you'll not be able to satisfy the conflicting demands of various people over you..... →	___	___	___	___	___
F) Feeling that you're not fully qualified to handle your job... →	___	___	___	___	___
G) Not knowing what your supervisor thinks of you, how he evaluates your performance..... →	___	___	___	___	___
H) The fact that you can't get information needed to carry out your job..... →	___	___	___	___	___
I) Having to decide things that affect the lives of individuals, people that you don't know..... →	___	___	___	___	___

30. Continued

Check one in each line:	Frequency of being bothered: Never	Rarely	Sometimes	Rather often	Nearly all of the time
J) Feeling that you may not be liked and accepted by the people you work with..... →	___	___	___	___	___
K) Feeling unable to influence your immediate supervisor's decisions and actions that affect you..... →	___	___	___	___	___
L) Feeling that your progress on the job is not what it should be or could be..... →	___	___	___	___	___
M) Thinking that someone else may get the job above you, the one you are directly in line for.. →	___	___	___	___	___
N) Feeling that you have <u>too much</u> responsibility and authority delegated to you by your superiors..... →	___	___	___	___	___

30a. In your situation which of the above things is:

The most bothersome _____

The next most bothersome _____

The third most bothersome _____

Which are the three least bothersome? _____ _____ _____

31. Some individuals are completely involved in their technical work - absorbed by it night and day. For others, their work is simply one of several interests. How involved do you feel in your work? CHECK ONE answer.

_____ Not much involved
_____ Slightly involved
_____ Moderately
_____ Strongly
_____ Very strongly
_____ Completely; the most absorbing thing in my life

32. How interesting or exciting do you find your present work? CHECK ONE.

_____ Hardly interesting at all; pedestrian
_____ Mildly interesting
_____ Quite interesting; occasionally exciting
_____ Exciting much of the time
_____ Exciting most of the time
_____ Continually exciting

33. How challenging do you find your present work - in the sense of demanding concentration, intelligence or energy? CHECK ONE answer.

_____ Hardly challenging at all
_____ Occasionally somewhat challenging
_____ Moderately challenging most of the time
_____ Strongly challenging
_____ Extremely challenging; demands all that I can offer
_____ Completely over my head; I feel lost

Now that you have completed the questionnaire we would like to ask one final favor of you.

We would like you to sign your name to the questionnaire, but only if you want to. If you do not want to sign the questionnaire then please return it unsigned, but by all means return it.

We ask this favor for the following reasons:

1. We would like to be able to test several hypotheses that have existed for some time but have never been tested before. To make these tests we must insure that the sample of questionnaire respondents meets rather rigid research design specifications. We cannot insure that these rigid specifications are met unless we have your name so that we can identify your exact position and status in your organization. However, if you do not want to sign your name we will still be able to test many other hypotheses that require less rigid research design specifications.

2. In the second phase of our research we will want to contact a small number of the questionnaire respondents to ask them a few additional questions in an interview. We will not be able to decide which respondents should be contacted until a preliminary analysis of some of the questionnaire items has been completed. Obviously then, we will need some means of identifying the particular individuals we will want to interview. Your signature is the only means we have for establishing your identity.

Whether or not you sign your name to this questionnaire all responses will be kept in the strictest confidence. The identity of individuals will under no circumstances ever be revealed in any report or verbal communication. It is not the purpose of this study to investigate specific individuals. The highest of professional ethics will be maintained at all times.

Thank you for your cooperation and assistance in this study.

Signature _____

Appendix II Correlation Coefficient Matrix for Items of Question 30, Appendix I
(Coefficients in parentheses are based on data collected by Kahn, et. al.)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
A	1.00													
B	.45 (.70)	1.00												
C	.39 (.49)	.45 (.27)	1.00											
D	.36 (.27)	.10 (.37)	.14 (.21)	1.00										
E	.21 (.30)	.32 (.38)	.21 (-.06)	.26 (.33)	1.00									
F	-.07 (-.02)	.06 (.28)	-.03 (-.09)	.14 (.48)	.20 (.22)	1.00								
G	.28 (.46)	.46 (.45)	.40 (.14)	.11 (.29)	.23 (.29)	.17 (.26)	1.00							
H	.25 (.56)	.36 (.56)	.01 (.16)	.17 (.40)	.15 (.32)	.06 (.14)	.12 (.34)	1.00						
I	-.01 (.19)	.11 (.22)	.07 (.20)	-.07 (.27)	.05 (-.00)	-.03 (.45)	.06 (.29)	.13 (.16)	1.00					
J	.09 (.15)	.11 (.20)	.09 (.09)	-.02 (.29)	-.02 (.13)	.07 (.53)	.13 (.48)	.07 (.10)	.21 (.58)	1.00				
K	.34 (.38)	.43 (.42)	.38 (.30)	.27 (.20)	.14 (.25)	-.05 (.30)	.46 (.47)	.28 (.26)	-.02 (.19)	.21 (.43)	1.00			
L	.06 (.40)	.15 (.35)	.22 (.48)	.27 (.24)	.23 (.34)	.25 (.12)	.22 (.14)	.16 (.21)	.06 (.19)	.05 (.27)	.19 (.48)	1.00		
M	.19 (.19)	.26 (.20)	.33 (.30)	.06 (.18)	.26 (.22)	.17 (.20)	.19 (.46)	.04 (.10)	.07 (.30)	.18 (.26)	.30 (.57)	.20 (.38)	1.00	
N	-.06 (.25)	.16 (.40)	-.00 (-.11)	.12 (.50)	.22 (.50)	.37 (.25)	.15 (.32)	.04 (.43)	.16 (.07)	.21 (.22)	.20 (.19)	.14 (.07)	.22 (-.09)	1.00

Selected Bibliography

Books

Blood, Jerome W. (Ed.). The Management of Scientific Talent. New York: American Management Association, 1963.

Bright, James R. Research, Development, and Technical Innovation. Homewood, Illinois: Richard D. Irwin, Inc., 1964.

Collins, Barry E. and Harold Guetskow. A Social Psychology of Group Processes for Decision-Making. New York: John Wiley and Sons, Inc., 1964.

Danielson, Lee E. Characteristics of Engineers and Scientists. Ann Arbor, Michigan: Bureau of Industrial Relations, The University of Michigan, 1960, Second Printing 1961.

Dean, Burton V. (Ed.). Operations Research in Research and Development. New York: John Wiley and Sons, Inc., 1963.

Etzioni, Amitai. A Comparative Analysis of Complex Organizations. New York: The Free Press of Glencoe, Inc., 1961.

Fouraker, Lawrence E. and Sidney Siegel. Bargaining Behavior. United States: McGraw-Hill Book Company, 1963.

Fromm, Erich. The Sane Society. United States: Holt, Rinehart and Winston, 1955, twelfth printing 1964.

Glaser, Barney G. Organizational Scientists: Their Professional Careers. United States: Bobbs Merrill, Inc., 1964.

Grossman, Israel and Wilhelm Magnus. Groups and Their Graphs. New York: Random House, 1964.

Hajek, Victor G. Project Engineering Profitable Technical Program Management. United States: McGraw-Hill Book Company, 1965.

Harary, Frank, Robert Z. Norman and Dorwin Cartwright. Structural Models An Introduction to the Theory of Directed Graphs. United States: John Wiley and Sons, Inc., 1965.

Herzberg, Frederick. Work and the Nature of Man. Cleveland: World Publishing Company, 1966.

Hill, Karl. (Ed.). The Management of Scientists. Boston: Beacon Press, 1964.

Homans, George. The Human Group. New York: Harcourt, Brace and Company, 1950.

Hower, Ralph M. and Charles D. Orth 3rd. Managers and Scientists - Some Human Problems in Industrial Research Organizations. Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1963.

Jones, Sidney. The Application of Management Controls to Technical Research Employees. Unpublished Ph.D. dissertation, Stanford University, 1960.

Kahn, Robert and Elise Boulding. (Eds.). Power and Conflict in Organizations. New York: Basic Books, Inc., 1964.

_____, Donald M. Wofe, Robert P. Quinn, J. Diedrick Snoek, with Robert A. Rosenthal. Organizational Stress: Studies in Role Conflict and Ambiguity. New York: John Wiley and Sons, Inc., 1964.

Kanter, Herschel. Research and the Organization: A Decision - Making Approach. Berkley: Space Sciences Laboratory, Social Sciences Project, University of California, 1964.

Kast, Fremont E. and James E. Rosenzweig. (Eds.). Science, Technology and Management. United States: McGraw-Hill Book Company, Inc., 1963.

Katz, Daniel and Robert L. Kahn. The Social Psychology of Organizations. United States: John Wiley & Sons, Inc., 1966.

Lindsay, Franklin A. New Techniques for Management Decision Making. New York: McGraw-Hill, 1958.

Machol, Robert E. and Paul Gray. (Eds.). Recent Development in Information and Decision Processes. New York: The Macmillan Company, 1962.

Maier, Norman R. F. Frustration. Ann Arbor Paperbacks. Ann Arbor: The University of Michigan Press, 1961.

March, James G. (Ed.). Handbook of Organizations. Chicago: Rand Mc-Nally and Company, 1965.

Miller, Daniel and Guy Swanson. Inner Conflict and Defense. New York: Schocken Books, 1966.

Moranian, Thomas. The Research and Development Engineer as Manager. United States: Holt, Rinehart and Winston, 1963.

Newcomb, Theodore, Ralph Turner and Philip Converse. Social Psychology. New York: Holt, Rinehart and Winston, Inc., 1965.

Norden, P. V. Technical Report Manpower Utilization Patterns in Research and Development Projects. Poughkeepsie, New York: IBM, Data Systems Div., Development Laboratory, 1964.

Odiorne, George S. Management by Objectives A System of Managerial Leadership. New York: Pitman Publishing Corp., 1965.

Orth, Carles D. 3rd, Joseph C. Bailey and Francis W. Wolek. Administering Research and Development. Homewood, Illinois: Richard D. Irwin and Dorsey Press, 1964.

Pelz, Donald and Frank Andrews. Scientists in Organizations. New York: John Wiley and Sons, Inc., 1966.

Rapoport, Anatol. Fights, Games and Debates. Ann Arbor, Michigan: The University of Michigan Press, 1960, Second Printing 1961.

_____, and Albert Chammah. Prisoner's Dilemma: A Study in Conflict and Cooperation. Ann Arbor: The University of Michigan Press, 1965.

Raudsepp, Eugene. Managing Creative Scientists and Engineers. New York: The Macmillan Company, 1963.

Roberts, Edward B. The Dynamics of Research and Development. New York: Harper and Row, 1964.

Rubenstein, Albert H. and Chadwick J. Haberstroh. (Eds.). Some Theories of Organization. Homewood, Illinois: Richard D. Irwin, Inc. and the Dorsey Press, Revised Edition, 1966.

Simmel, George. Conflict. Free Press Paperback. Glencoe: The Free Press of Glencoe, 1964.

Spivey, W. Allen. Linear Programming An Introduction. New York: Macmillan, 1963.

Stagner, Ross. Psychological Aspects of International Conflict. Contemporary Psychology Series. Belmont: Brooks/Cole Publishing Company, 1967.

Strauss, Anselm L. and Lee Rainwater. The Professional Scientist. Chicago: Aldine Publishing Company, 1962.

Taylor, Calvin W. and Frank Barron. (Eds.). Scientific Creativity: Its Recognition and Development. New York: John Wiley and Sons, Inc., 1963.

Vollmer, Howard M. Work Activities and Attitudes of Scientists and Research Managers: Data from a National Survey. Menlo Park, California: Stanford Research Institute, 1965.

Yates, Aubrey. (Ed.). Frustration and Conflict. Insight Books. New York: D. Van Nostrand Company, Inc., 1965.

Yovits, M. C., D. M. Gilford, R. H. Wilcox, E. Stavely, and H. D. Lerner. (Eds.). Research Program Effectiveness. New York: Gordon and Breach, Science Publishers, Inc., 1966.

Articles

Chalupsky, Albert B. "Incentive Practices as Viewed by Scientists and Managers of Pharmaceutical Laboratories." Reprinted from Personnel Psychology, Vol. 17, No. 4, Winter, 1964.

Fishburn, Peter C. "Independence, Trade-Offs, and Transformations in Bivariate Utility Functions." Reprinted from Management Science, Vol. 11, No. 9, Series A, July 1965.

_____. "Methods of Measuring Additive Utilities Under Independence." Paper presented at 27th National Meeting of the Operations Research Society of America, May 6-7, 1965.

Folger, Anne and Gerald Gordon. "Scientific Accomplishment and Social Organization A Review of the Literature." The American Behavioral Scientist, Dec., 1962.

Friedlander, Frank. "Criteria for Research Performance." Paper presented before the American Psychological Association, Philadelphia, Pennsylvania, September 1963.

_____ and Eugene Walton. "Positive and Negative Motivations Toward Work." Reprinted from Administrative Science Quarterly, Vol. 9, No. 2, 1964.

Gordon, Gerald. "The Problem of Assessing Scientific Accomplishment: A Potential Solution." Reprinted from the IEEE Transactions of the Professional Technical Group on Engineering Management, Vol. EM-10, No. 4, December 1963.

_____ and Sue Marquis. "Resources and Scientific Innovation." Paper prepared for delivery at the Annual Meeting of the American Sociological Association, Montreal, Canada, Aug., 1964.

Klein, Burton. "A Radical Proposal for R. and D." Reprinted from Fortune, May 1958 issue.

_____. "The Decision Making Problem in Development." A reprint from The Rate and Direction of Inventive Activity, Economic and Social Factors, A Conference of the Universities-National Bureau Committee for Economic Research, A Report of the National Bureau of Economic Research, Published by Princeton University Press, Princeton, 1962.

La Porte, Todd R. "Conditions of Strain and Accommodation in Industrial Research Organizations." Reprinted from Administrative Science Quarterly, Vol. 10, No. 1, June 1965.

Linville, T. M. "Managing Research Laboratories." American Institute of Electrical Engineers, Conference Paper presented August 1958, CP 58-1031.

Rosenbloom, Richard S. "Observations on Choice and Uncertainty in Development Decisions." Presented at the Session on Research and Development Management, 1965 National Meeting. The Institute of Management Sciences, February 1965, San Francisco, California.

Suits, Guy. "Selectivity and Timing in Research." Industrial Research Institute, Colorado Springs, Colorado, May 15, 1962.

_____. "Selectivity - A Modern Research Necessity." An address given before the American Management Association at Chicago, Illinois, September 15, 1964.

_____. "The Manageability of Scientific Research." American Management Association, Pasadena, California, May 5, 1958.