AN EXPLORATORY RESEARCH PROCESS MODEL

A DISSERTATION
SUBMITTED TO THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

for the degree

DOCTOR OF PHILOSOPHY
Field of Industrial Engineering
and Management Sciences

by

Jo Ann Roseman

Evanston, Illinois
June, 1977

NORTHWESTERN UNIVERSITY

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ABSTRACT

Oftentimes it is for problems when there exists a lack of information or prior experience, a lack of ability or resources to locate relevant facts because of the diffuse nature of the problem, or our need to know is not great that we do exploratory research. However, there needs to be some system devised to optimize the researcher's effort in achieving the purpose of his research. Much of the uncertainty which exists about selecting the problem, well formulating the problem, and appropriate techniques have either been grossly overlooked or the researcher assumes or follows certain methods which do not provide the necessary conditions for achieving the desired results.

This dissertation describes the steps in the exploratory process and provides some possible framework for attacking problems of selection, formulation, technique and objectives. A checklist of things to consider in order to enhance the credibility of the research effort is included. Components of the checklist include the research activities during the early, middle and late stages of exploratory research.

The early stage of exploratory research is the teasing out of any relationship.

The middle stage of exploratory research is to examine selectively some specific relationships.

The late stage of exploratory research is the direct preparation for a priori proposition testing.

These steps are built into the process model emphasizing diagnosis, research purposes or objectives, surveys, refinement techniques and how to

report results so that we are adding bits or pieces of information to our knowledge of the problem.

There is a modest methodological examination of the TRUST's interactive media project on the subsequent effects of behavior on participants. Pointing out how one might have approached the problem of impact, the initial approach of identifying participants and their reasons for participating in the project and locating relevant decision makers with respect to some specific problem of interest (the criminal justice system) are addressed.

The dissertation is organized into six chapters. Chapter I is the introduction. Chapter II is a literature review on exploratory research, models of processes, forms of inquiries, problem selection and formulation, and a modest discussion on a priori proposition testing in terms of apparent differences between exploratory research and a priori proposition testing are discussed. Chapter III is a more specific discussion and literature review on the exploratory process components. Chapter IV is the proposed model of the process and appropriate questions to be answered if one is doing exploratory research. Chapter V is a discussion of the impact of the TRUST project emphasizing what might have been accomplished. Chapter VI summarizes the purpose of the research effort and future implications for the model.

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CHAPTER I

INTRODUCTION

1.0 Introduction to Chapter

In this chapter the emphases are on why we do exploratory research, under what conditions, the problems involved in such an effort, apparent differences between a priori proposition testing and exploratory research. Our discussion also includes our initial method for attacking the problem, a brief description of what was done and an outline of the dissertation.

1.1 Purpose of This Research

This research effort proposes to develop and to characterize the exploratory research process, the feeling being that the subject area has been long neglected in the sense of systematically inquiring into the process. Too much of the exploratory process has been left to chance. Apparently there exists no guideline or a checklist to deal with the problems of exploratory research. Usually one thinks of exploratory research as an unstructured or ill-defined process. It is our purpose to examine it and to see how it might be ordered.

For most problems where there exists a lack of information and prior experience, a lack of resources, a lack of ability to locate relevant information on a subject matter that is diffuse that we prepare to examine the phenomenon of interest in an exploratory fashion.

1.2 Initial Method of Attacking the Problem

Initially, the writer's purpose had two main emphases which were:

(a) extracting the process by which experienced researchers, entrepreneurs and other attacked structured and unstructured problem-solving endeavors in research where little is known about the terrain;

(b) devising and systematically gathering the process; disclosing the commonalities of the finite set of relationships involved in the process.

The writer proposed to examine knowledge processes, pattern recognition theory, path analysis, backward and forward tracing techniques; surveying the wisdom literature; interviewing experienced researchers and entrepreneurs and others who were considered experienced in working with unstructured problems.

The writer felt the appropriate approach to take in developing and characterizing exploratory research consisted of:

(a) systematically extrapolating from the above problem-solving process;

(b) systematically exploring how insights and discoveries were made with respect to the unknown or lack of prior experience or information about the complex relationships which are involved;

(c) listing and combining those consistent selection processes which are retained from trial-and-error, blind selection and intuitive hunches in order to solve unstructured problems; and,

(d) if possible, to determine how information from prior problem-solving experiences were chunked or stored in the brain processing unit to aid one in better structuring unstructured problems.

The above problem-solving process is a process of deciding on a procedure which would enhance one's ability in selecting relevant information with respect to a particular problem of interest. If we consider the vast amount

of all information in the storage unit of the brain, an exhaustive test of all relevant information is prohibited; therefore, the brain organizes information into large chunks in order to locate relevant information more readily (Rubinstein, 1975).

1.3 Apparent Differences Between the Exploratory and A Priori Proposition Testing Processes

One apparent difference between exploratory and a priori proposition testing is the issue of uncertainty with respect to data gathering and imperfect information. For the exploratory process, we cannot avoid the uncertainty which exists in terms of identifying the independent and dependent variables. Thompson (1976, p. 178) states:

> Where uncertainty (of various kinds) makes unlikely (or difficult) the identification of what, in research terms, might be referred to as the dominant independent variable (or "summing independent variable"), the set of parameters (plausible rival hypotheses) are surrogate independent variables.

He further states that

> . . .uncertainty be faced and not avoided, that where we know a lot about what we want that we use that knowledge and where we are not sure or do not know that we disclose the state of our knowledge and try to develop the "best" description (which is likely to be a process rather than end product description) we can. (1976, p. 6)

Hill (1966, p. 4) says that "uncertainty, of course, involves conditions ranging from considerable confidence on the one hand to extreme uncertainty on the other."

In exploratory research there are several kinds of uncertainty: information, confidence, credibility and utility. Usually, when doing exploratory

research where our level of confidence is relatively high that we can achieve the research objective is the direct preparation to do a priori proposition testing. However, when we have a high level of confidence that we cannot do any better than be descriptive that we do exploratory research. We do this because:

(a) lack of resources to do a priori proposition testing;

(b) not interested in doing a priori proposition testing.

In some instances, for a new situation where little prior knowledge is available, or for an unstructured problem where exploratory information is desired, it is useful to have a procedure to handle such problems. How structured a problem is depends upon the eyes of the beholder, not necessarily on the intrinsic characteristics of the phenomenon you are looking at (i.e., the contrasting views of a chess board for a beginner and a grand master).

The problem formulation phase of the exploratory process takes into consideration parameters and methods of data collection. With respect to a priori proposition testing, a parameter is some variable that leads to the rival hypothesis that lowers the credibility of your results. Whether or not a certain variable should be classified as a parameter is strictly up to the researcher and is totally dependent on what his proposition is and what he is trying to do. The data to be collected in regard to a particular proposition depend on the answer to the question, "What do I need?"

1.4 Rigorous Control Issues

Thompson (Note 3, 1975) says that,

> The often well-intended, but naive, assumption that all research, all demonstration programs, all experiments can and

> should be expected to be subject to the rigorous control characteristics of the specialized scientific process of proposition testing does not agree with the methods which science itself follows.

The basis for application of "rigorous" control methods is that the proposed program or experiment concerns a problem about which we know quite a lot (usually in terms of prior research) and for which we can design an experiment with essentially "one" unknown--the relation between the intervention and some desired outcome. This kind of problem and approach is called "a priori proposition testing." However, for many problems, we do not know this much about them, and it is necessary to increase our understanding of what happens and what alternative explanations for what happens are present. This is the "exploratory" phase and a necessary prelude to "proposition testing."

The emphasis on exploratory and a priori proposition testing research centers on the issue of "rigorous" control methods. Exploratory research is considered less "rigorous" than a priori proposition testing because we do not know much about the orderliness of the phenomenon under investigation. However, we observe certain relationships of the phenomenon in order to have a better understanding of what happens and why. From a process description of what happens (the occurrence and non-occurrence of some event) that we are able to use more "rigorous" control methods in the future.

Generally speaking, before attempting rigorous controlled experiments, programs, or projects, in terms of proposition testing, the researcher engages in some form of the exploratory process procedure. It may be in the form of participant observations, or a pilot test to determine if the procedure was well formulated and to be aware of possible flaws in the design.

Northrop (1952, p. 1) says that

> . . . one may have the most rigorous of methods during the later stages of investigation, but if a false or superficial beginning has been made, rigor later on will never retrieve the situation. . . Again and again investigators have plunged into a subject matter, sending out questionnaires, gathering a tremendous amount of data, even performing experiments, only to come out at the end wondering what it all proves, and realizing after years of industry and effort that the real difficulty has slipped through their fingers.

He further states:

> . . . others noting the success of a given scientific method in one field, have carried this method hastily and uncritically into their own, only to end later on in a similar disillusionment. All such experiences are a sign that the initiation of inquiry has been glossed over too hastily, without any appreciation of its importance or its difficulty. . .the capacity to find the heart of the problem to which the well-known methods are to be applied is a part of inquiry that must precede the actual understanding or application of the methods. It is what comes at the beginning which is the key to success, since it is the effectiveness with which one initiates inquiry that directs one to the key facts and designates the appropriate methods. (Ibid., p. 2)

The writer contends that the research process for doing proposition testing and exploratory research are the same. It is the problem formulation phase, available measurement technique, and prior knowledge of the problem, which governs whether a study is labeled proposition testing or exploratory. Another issue to be aware of is the specific or general use of the results and the newness or lack of activity on the subject matter of interest.

The writer further contends that proposition testing and the exploratory research process are extreme points on the same dimension with the phenomenon under investigation determining the procedure. The emphasis and difference are that the problem determines the method and procedure for data

collection and data analysis. This makes it imperative that the problem inquiry phase be well formulated. The problem also determines the measurement procedure which is to produce reliable information that is valid and relevant to the questions being asked (Jahoda, et al., 1951). A measurement procedure is considered reliable when repeated measurements using the same technique yield dependable, consistent, or stable data (Guilford, 1954; Nunnally, 1967). A measurement procedure is valid when it measures what it is intended to measure (Nunnally, 1967), i.e., the procedure produces relevant information about the object under investigation (Jahoda, et al., 1951). However, achieving this purpose is difficult in exploratory research.

It is the writer's belief that the crucial element of the process consists of stating in advance what are the relevant, possible, salient things you need to know and/or want to know with respect to the specific or general problem that is formulated in regard to one's research. One also has to consider:

(a) possible relations of the phenomenon to the proposed hypothesis;

(b) what measures are required to obtain the desired result, if indeed it exists; and

(c) the proposed method of data collection and analysis.

These are essential, irrespective of the exploratory and/or a priori proposition testing endeavors.

It is felt that the level of specificity of the problem determines the research mode in the process of handling problems of uncertainty or ill-defined structures of interest. With these things in mind, the first and foremost in magnitude and/or importance was developing strategies and procedures for dealing with these issues.

1.5 What Was Done

The writer proposed method for attacking the problem was changed or modified slightly in terms of extrapolating the problem-solving process. However, an extensive literature review, personal interviews and a modest involvement with the TRUST project* provided a modest examination of the problems involved in doing exploratory research. The TRUST organization was seen as a fruitful place to gather information on its process and to provide the writer with a useful reference point for the research activities.

1.6 A Brief Outline of the Dissertation

Chapter I discusses our research purpose, our initial method of attacking the problem, apparent differences between exploratory and a priori proposition testing processes, rigorous control issues and what was done in terms of the research objective.

Chapter II is a general literature review on exploratory research, alternate forms of the exploratory process and methods for addressing the exploratory concerns.

Chapter III discusses the components of the process with respect to data analysis, analogous models, processes and models.

Chapter IV is the exploratory research process model detailing important questions and key components to be considered and how to deal with the problems involved.

Chapter V is a methodological examination of the TRUST project. The emphasis is on the subsequent effects on the behavior of participants. The

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*The TRUST Project (see Chapter V, Section 5.1, for a more detailed discussion).

issues of impact, the effects of the program, and the effects of the interactive media intervention are addressed.

Chapter VI is the summary, conclusion and future implications of the model.

CHAPTER II

LITERATURE REVIEW

2.0 Introduction

This chapter is an attempt to provide the necessary background information on exploratory research. In addition to this, to provide alternate forms of exploratory research including various models of processes and problem-solving issues.

2.1 General Discussion of Exploratory Research

There appear to be three central issues in the literature on exploratory research, which are: (1) kinds of situations; (2) kinds of objectives; and (3) kinds of techniques.

Delbecq and Van de Ven (1972, p. 109) say that "exploratory or pilot research is concerned with the investigation of complex problems whose qualitative and quantitative parameters are unknown."

Blalock (1969, p. 35) states:

> . . . exploratory research is that of selecting out a relatively small number of possible variables, or categories, from the extremely large number that can be developed. To do this, the investigator must become immersed in the data, and he must rely very heavily on his own insights and intuition, without benefit of any well-defined scientific principles as guidelines. . .exploratory studies are literally just that. They are beginnings, not ends in themselves.

Festinger and Katz (1966, pp. 74-75) say that the exploratory study attempts to see what is there rather than to predict the relationship that will be found. It represents the earlier stage of a science. From its

findings may come knowledge about important relationships between variables, but the more definite proof of these relationships comes from hypothesis testing. They further state:

> There are at least two levels of exploratory studies. At the first level is the discovery of the significant variable in the situation; at the second level, the discovery of relationships between variables. Even at the first level, it is important to delimit the area to be studied and to introduce controls into the data-collection process. Exploratory studies which do not set limits for themselves have limits imposed by various practical matters, some of which are not realized by the investigators.

Sellitz, Jahoda and Deutsch (1959, p. 50) say that the research purpose of formulative or exploratory studies is to gain familiarity with a phenomenon or to achieve new insights into it, often in order to formulate a more precise research problem or to develop hypotheses. They further state that exploratory studies may have other functions: increasing the investigator's familiarity with the phenomenon he wishes to investigate in a subsequent, more highly structured study or with the setting in which he plans to carry out such a study; clarifying concepts; establishing priorities for further research; gathering information about practical possibilities for carrying out research in real-life settings; providing a census of problems regarded as urgent by people working in a given field of social relations.

Katz (1973, p. 406) says that exploratory studies have three purposes: to discover significant variables in the field situation; to discover relations among variables; and to lay groundwork for later, more systematic and rigorous testing of hypotheses.

Ackoff (1953, p. 338) says that whether exploration is of a probing or of a searching character, it should be systematized so as to assure its

exhaustiveness and its non-repetitiveness. Exploratory or pilot studies may be divided into studies designed to expose alternatives and to determine the pertinent characteristics of alternatives, estimative studies.

Young (1966, p. 19) defines working or exploratory hypotheses as shrewd guesses or profound hunches which the researcher tries to establish causal relations between various sets of facts at hand. This penetrating hunch, this provisional explanation which becomes the basis for a systematic investigation, is known as a working or exploratory hypothesis.

Thompson and Rath (1973) say that exploratory research is appropriate when one is trying to sort out the independent and dependent variables. One should be concerned about the various hypotheses or theories which explain how these are connected, and the parameters which affect them (p. 13).

Thompson (1975, Note 2, p. 3) states that "if the credibility is low, an exploratory design should be examined as an alternative to increase our understanding of what happened."

Usually, exploratory research is done when you cannot do any better because of time, cost, manpower, commitment, etc. In such a case, you search for items that are easiest to measure and lowest in measurement cost (Hage, 1971).

Kahn (1960, p. 51) says that the early step in the development of knowledge--the systematic exploration or formulative study--has the objective of the following: (1) identifying sound questions, promising concepts and preliminary hypotheses in a field which as yet has had limited development and, therefore, is not prepared for elaborate experimental designs to test complex, abstract hypotheses.

Wilson (1952, p. 37) states that the. . .

> aim of experiment . . . purely exploratory experiments are necessary in a new field, and such preliminary searches are of great importance. . . It is safest to go right back to the origin of the inquiry and ask at every stage: "Why am I doing this particular thing? Will it really tell me what I want to know?"

What you want to know depends upon the purpose of the study.

The exploratory process seeks to do the following:

(a) attempts to see what is there rather than to predict the relationship that will be found (Festinger, 1966);

(b) to discover the significant variable in the situation;

(c) to discover relationship (Festinger and Katz, 1966);

(d) to gain familiarity with the phenomenon or to achieve new insights into it;

(e) the emphasis is seeking rather than testing (Sellitz, et al., 1959).

2.2 Stages of the Exploratory Process

The stages are:

(a) very early exploratory is the teasing out of any relationship;

(b) middle exploratory is to examine selectively some relationship;

(c) late exploratory is the direct preparation for a priori proposition testing (Thompson and Roseman, Note 12, 1976)

2.3 Exploratory Research Purposes

The purpose of doing exploratory research consists of the following:

(1) to gain information on the phenomenon where there exists a lack of information;

(2) to increase one's ability to do a priori proposition testing in

the future;

(3) to increase one's ability to predict;

(4) allocation of resources (time, money and manpower) are lacking in order to do a priori proposition testing;

(5) self-learning about the phenomena;

(6) when there exists a lack of theory, propositions and facts on the phenomenon;

(7) to disclose the path of information and to communicate flow and points of action;

(8) to determine the relative importance of relationships among variables and theory;

(9) to differentiate the sorting processes for relevancy, feasibility and practicability;

(10) to develop theory and hypothesis.

Exploratory investigations can be described as an intermediate form between descriptive studies and hypotheses testing investigations. Characteristically, however, exploration-oriented research is expressly directed, from the start, to the articulation or elaboration of a theory or of isolated hypotheses. The objective is not so much "fact finding," nor a survey of "what is on hand," but rather the articulation of expected and newly discoverable relationships that are considered relevant to a given theoretical or practical purpose. The characteristic element of "trying out whether . . ." is present, but in such a way that the researcher's attitude in fact boils down to "let us see what we can find." Now what is "found"--that is, selected --cannot also be tested on the same material (DeGroot, 1969).

The investigation may, for instance, make fresh observations to "explore" his subject in search of significant connections. If empirical

materials are collected with the express aim of "wresting ideas" from the factual data, or of finding out whether certain ideas will "work out," we designate such operations as empirical explorations, or as exploratory investigations. The explorations are distinguished from regular empirical testing by the fact that they are not conducted to test pre-stated, precisely formulated hypotheses. This does not necessarily mean that there are no hypotheses or theories involved, and particularly not that the investigation will not in fact have certain ideas and viewpoints. What it does mean is that data which have been collected in an exploratory fashion are neither intended nor suitable to serve the purpose of strict, scientific, hypothesis testing.

Empirical explorations will vary a good deal in the degree to which the empirical data sought are clearly specified. The investigator may want to avoid all bias in surveying his field, that is, he may start his observations without any preconceived notions about the type of data and variables he is going to collect. Armed with no more than a general idea of what he wants to investigate and, naturally, with his scientific acumen, he will first let the materials "speak for themselves." That is to say, he will scan them for concrete data that may help him formulate his problem. Naturally, this approach again involves the risk that he will be confused rather than enlightened by the multifarious impressions received . . . therefore, he will often make a stringent advanced decision as to what variables are to be measured and what structural relationships are to be determined. This is where exploratory investigations assume the character of systematic inquiry. However, so long as they are not aimed at testing hypotheses or testing pre-stated, precisely formulated hypotheses or theories, they retain their "exploratory" nature.

Finally, we will give excerpts from Sellitz's discussion of exploratory research. Exploratory research methods include: (1) a review of the related social science and other pertinent literature; (2) a survey of people who have had practical experience with the problem to be studied; and (3) an analysis of "insight-stimulating" examples. Most exploratory studies utilize one or more of these approaches.

We think of research purposes as falling into a number of broad groupings: (1) to gain familiarity with a phenomena or to achieve new insight into it, often in order to formulate a more precise research problem or develop hypotheses; (2) to portray accurately the characteristics of a particular individual, situation, or group (with or without specific initial hypotheses about the nature of these characteristics); (3) determine the frequency with which something occurs or with which it is associated with something else (usually, but not always, with specific initial hypotheses); and (4) to test a hypothesis of a causal relationship between variables.

In studies that have the first purpose listed above--generally called formulative or exploratory studies--the major emphasis is on discovery of ideas and insights.

2.4 Alternate Forms of Exploratory Research

2.4.1 Case Study

As a strategy for generating insights and propositions, the case study is invaluable. It is not, however, a method of testing propositions; nor does it provide a basis for generalizing particular findings to a class of organizations or to organizations in general. Moreover, the case study does not lend itself to a systematic investigation of the antecedents and consequences of organizational structures.

The case study method enables the researcher to explore the relationships among a large number of variables in the context of a sample of organizations. A case study or field study of an organization can identify one or more salient variables or relationships which a researcher may then wish to investigate by means of a sample survey. The major relationships uncovered in the survey will probably leave unanswered questions concerning their dynamics.

There are two types of exploratory studies which are characterized by very different kinds of data collection techniques. The first is that of participant observation; the second, that of descriptive sample survey.

2.4.2 Participant Observation

A consideration of participant observation as an exploratory approach to the formulation of new concepts, measurement, and preliminary hypotheses can be valuable. Suppose a social scientist wishes to study something about which he knows practically nothing or about which there seem to be numerous misconceptions; or perhaps the phenomena are so familiar, so close to home, that there are aspects of them that everyone is likely to miss. How can he proceed? Clearly, the research must be highly exploratory. It cannot rely on specific hypotheses or a relatively small list of variables that are likely to be significant. The investigator must immerse himself in the data, and obtain general information rather than data limited to the rather narrow focus. The general label which exploratory research of this nature has been given that of "participant observation" (Blalock, 1970, p. 41). It is the piecing together of information to get a complete picture of the phenomenon. Blalock further states that participant observation is extremely useful in providing initial insights and hunches that can lead to

more careful formulation of the problem and explicit hypotheses . . . the need to spell out the implication more explicitly in order to investigate hypotheses more systematically but there do not exist guidelines for moving from exploratory research to more systematic and standardized approaches.

2.4.3 Pilot Study

The purposes of a pilot study are to rectify, clarify, and identify problems in the design conception. As a result of examining the procedure or process on a small scale, the researcher is more able or likely to refine and formulate hypothesis testing endeavors.

2.4.4 Descriptive Study

The purposes of descriptive study are: (1) to portray accurately the characteristics of a particular individual, situation or group (with specific initial hypotheses) about the nature of these characteristics; and (2) to determine the frequency with which something occurs or with which it is associated with something else (usually, but not always, with a specific initial hypothesis). A design is needed that will minimize bias and maximize the reliability of the evidence collected. (Bias results from the collection of evidence in such a way that one alternative answer to a research question is favored.) Evidence is reliable to the extent that we can assert confidently that similar findings would be obtained if the collection of evidence were repeated (Sellitz, et al., 1959, pp. 49-50).

2.5 Research Design, Procedure, Method and/or Process

Suchman (1954, p. 91) states that all research design represents a compromise dictated by the many practical considerations that go into social

research. Labovitz and Hagedorn (1971, p. 93) further state the nature of the problems and how the problem is conceptualized are major factors in the selection of a research design. To illustrate, if the problem is in a relatively unexplored area (where little is known), an intensive case study may be the most appropriate choice for a particular study.

Many variations of research design determine if the needs of the study, experiment or project are being met. Young (1966, p. 6) states that the social researcher, guided either by desire to gain knowledge or by an urgency to solve a problem scientifically, work out a plan of study. At the beginning, this plan is generally vague and tentative. It undergoes many modifications and changes, as the study progresses and insights into it deepen. The working out of the plan consists in reality of making certain decisions with respect to:

(1) what the study is about and the type of data that are needed;

(2) why the study is being made;

(3) where the needed data can be found;

(4) where, or in what area, the study will be carried out;

(5) when, or what period of time, the study will include;

(6) how much material or how many cases will be needed;

(7) what bases of selection will be used;

(8) what techniques of gathering data will be adopted.

Young further states that a study design include at least the following component parts, which are interdependent and not mutually exclusive:

(1) sources of information to be tapped;

(2) nature of study;

(3) objective of study;

(4) socio-cultural context of study;

(5) geographical area to be covered by the study;

(6) periods of time to be encompassed;

(7) dimensions of the study;

(8) the bases for selecting the data; and

(9) techniques to be used in gathering data (Ibid., p. 12).

Thompson (1966, p. 10) (discussion of the research process, the research and development process, production and marketing processes and scientific methods processes) states that:

> . . . all of these processes are essentially the same, that the research process may be distinguished only in that it assigns a higher utility to the increase in knowledge rather than the use of the increase for some other purpose. This may be the distinctive goal or purpose of research and development. It may be that the characteristic goal is to increase either one's own confidence that something else can be done or someone else's confidence, allowing him to do something else.

Hillway (1956, p. 12) suggests that the [research] process consists of several very definite steps. These are: (1) identification of the problem to be investigated; (2) collection of essential facts pertaining to the problem; (3) selection of one or more tentative solutions of the problem; (4) evaluation of these alternative solutions to determine which of them is in accord with all the facts; and (5) the final selection of the most likely solution (see Figure 9, p. 48).

Moranian (1963, p. 4) describes steps in the research process: "Based on the immediately preceding results, each experiment is improvised and changed until 'success' is reached."

2.6 Empirical Research

Simon (1969, p. 177) states that the steps in an empirical research

study include:

(1) ask "What do I want to find out?"

(2) establish the purpose of the project;

(3) determine the value of the research;

(4) choose empirical variables;

(5) calculate the values of accuracy and the cost of error;

(6) saturate yourself in the problem;

(7) determine the most important research obstacles;

(8) choose methods;

(9) prepare a detailed design of the method;

(10) collect the data;

(11) analyze the data; and

(12) write up the research.

Batten (1971, p. 86) states what to do with what you have include:

(1) locate what is known

(2) evaluate what is known

(3) begin planning for investigation

which is a technique that will help evaluate, locate and use what is already known.

Batten (1971, p. 83) further states:

> Determining what you want to know about which units and how accurately you want to know it, what information you will need to find out, how you plan to obtain that information, and what you plan to do with it, is the first main thinking stage in the overall process. Making sense of your observations once they are obtained and determining their broader implication is the other main reasoning stage. It is these thinking stages that are the most absorbing and enjoyable in the game of science.

Hinchen (1966, p. 115) says:

> The best foundation I can think of is that we make use of every bit of a priori knowledge that is available before a single experiment is run.

2.7 Scientific Research

Freeman (1960, p. 6) states that scientific research is essentially compounded by two elements--observations, by which knowledge of certain facts is obtained through sense--perceptions (including experimentation which produces new data for observation), and reasoning, by which the meaning of these facts, their interrelation, and their relation to the existing body of scientific knowledge, are ascertained as far as the existing state of knowledge and the investigator's ability permit.

Campbell (1971, p. 40) contends the demarkation of science from other speculations is that the knowledge claims be testable, and that there be available mechanisms for testing or selecting which are more than social.

Welton (1919, p. 137) states the scientific thinking process as being:

(1) a preliminary observation of facts

(2) the formulation of an hypothesis

(3) the testing of hypothesis by comparison of its consequences with the results of a careful analysis of the phenomena under consideration.

2.8 Social Research Process

Slessinger and Stevenson (1930, p. 330) emphasize that social research may be defined as a systematic method of exploring, analyzing, and conceptualizing social life in order to "extend, correct, or verify knowledge,

what that knowledge aids in the construction of a theory or in the practice of an art." Young (1966, p. 30) defines social research as a scientific undertaking which, by means of logical and systematized techniques, aims to: (1) discover new facts or verify and test old facts; (2) analyze their sequences, interrelationship and causal explanations which were derived with an appropriate theoretical frame of reference; (3) develop new scientific tools, concepts, and theories which would facilitate reliable and valid study of human behavior. George Lundberg, experienced social researcher and theorist, observes: the only difference between gathering data without an hypothesis and gathering them with one is that in the latter case we deliberately recognize the limitations of our senses and attempt to reduce their fallibility by limiting our field of investigations so as to permit a greater concentration of attention on the particular aspects which past experience leads us to believe are significant for our purpose (see Figures 6-8, pp. 41-44).

2.9 Purpose of Theory and Hypothesis

Goode and Hatte (1962, p. 8) state that a fact is regarded as an empirically verifiable observation. From the facts come theory. A theory refers to the relationships between facts, or to the ordering of them in some meaningful way.

Theory is a tool of science in these ways: (1) it defines the major orientation of a science by defining the kind of data which are to be abstracted; (2) it offers a conceptual scheme by which the relevant phenomena are systematized, classified, and interrelated; (3) it summarizes facts into (a) empirical generalizations, and (b) systems of generalizations; (4) it predicts facts; and (5) it points to gaps in our knowledge.

On the other hand, facts are also productive of theory, in these ways:

Figure 1

Differentiating Characteristics of Research[a]

Characteristics	Levels of Research	
	Random Observation (Pre-research)	Formulative-Exploratory Study
Study aim	No aim formulated	To derive hypotheses for further testing or to develop research strategy and priorities.
Prior knowledge of variables	Variables not conceptualized	Generally sensitivity to variables. Largely not known but sought
Explicitness of hypotheses	Neither formulated nor sought	Generally not formulated (or on concrete levels) but sensitivity to emerging hypotheses which are sought
Sampling Requirements	Not considered	Informally considered for range of cases rather than representatives of size
Control of variables	Variables not known, not controlled	Variables are sought for, not controlled
Flexibility Rigidity of design	No methods; completely without form	Method flexible; focus shifting with insights, regulated by characteristics of objects. Some structuring may be involved

Figure 1 (continued)

Characteristics	Levels of Research	
	Diagnostic-Descriptive Study	Experimental Study
Study aim	To assess characteristics of phenomenon or to describe relationships between variables	To test hypotheses of varying degrees of abstraction and complexity; causality involved
Prior knowledge of variables	Descriptive variables are assumed as known; some degree of conceptualization essential	All important variables assumed known
Explicitness of hypotheses	Implicitly or explicitly formulated at the level of statistical regularities, descriptively	Explicitly formulated as hypotheses to be tested as to cause-effect relationships.
Sampling Requirements	Rigorous consideration of representativeness and sample size	Rigorous sampling, design-defined universe, ratio, statistically demonstrated size, logically justified representativeness
Control of variables	Control is not involved	Rigorously controlled
Flexibility Rigidity of design	Method formal statistically; reliability and validity are crucial. Statistically tested for significance	Rigorous experimental various degrees of complexity and levels of abstractions possible

[a]Table developed by Samuel Finestone, modified for present purposes by Alfred J. Kahn.

(1) facts help to initiate theories; (2) they lead to the reformulation of existing theory; (3) they cause the rejection of theories which do not fit the facts; (4) they change the focus and orientation of theory; and (5) they clarify and redefine theory.

According to DeGroot (1969, p. 18), the man of science characteristically processes his experiences of the phenomena encountered in his specific sector in one or more of the following ways: he endeavors to describe, to order, to record (measure) them, to understand and to explain them; in these activities he is motivated particularly by a desire to be able to predict new phenomena, so that their predictability shall enable him to control his sector by influencing the phenomena.

Anyone who seeks systematically for factual truth and certainty is compelled to develop empirical criteria by which he can determine to what extent statements relating to reality are true and/or provide certainty (Ibid., p. 20).

The identification and formulation of a problem may in itself be a herculean task. Extreme cases will be found chiefly in relatively unexplored, complex fields, where the investigator has great difficulty in reducing his problem to a form which is both adequate and amenable to strict empirical treatment. A whole lifetime may be taken up by exploratory investigation, partial testing procedures, and reformulation of a basically constant problem (Ibid., p. 34).

2.10 General Purpose of Models

The concept of a model is so fundamental to problem-solving in that it is present at all stages, from problem definition to solution. It is a concept characterized by ubiquity; the words and symbols we use, the

responses recorded by our senses are all models. A model is an abstract description of the real world; it is a simple representation of more complex forms, processes, and functions of physical phenomena or ideas. A model is constructed to facilitate understanding and enhance prediction.

Models serve a variety of purposes which are:

(1) Prediction--a mathematical model establishing functional relationships between the dependent and independent variables is often predictive.

(2) Explanatory models can be an aid to understanding the system they purport to represent simply by their greater familiarity. They can be used to express the quantitative structure of relationships, recognizing that prediction is limited until specific values can be put on the relationships.

(3) Heuristic models can be an aid to self-discovery. Thus one may manipulate a model to find out what would happen if such and such a relationship were changed; e.g., different inputs or advertising. This is a "simulation." If alternative input and structural relationships are tested, this is regarded as exhaustive testing or enumeration, not as simulation.

The above model, according to O'Shaughnessy (1972, p. 134), proceeds somewhat as follows:

(1) Summary of observations constituting the phenomena to be explained and a tentative selection of relevant variables.

(2) Analysis of the data to establish interconnections between the variables, and rearrangement of the data into various possible models that might explain the changes constituting the problem.

(3) Analysis of each model for internal consistency, realism and

relationship to existing knowledge.

(4) Selection of one of the models and the prediction of consequences that will stem from it.

(5) Verification by confirming the predicted consequences.

Ackoff (1968, pp. 139-140) sums up the ways a model may be in error as:

1. The model may contain variables which are not relevant; that is, have no effect on the outcome. Their inclusion in the model, then, made the predicted outcome depend on factors on which it has no dependence in reality.
2. The model may not include variables which are relevant; that is, ones that do affect the outcome.
3. The function, f, which relates the controllable and uncontrollable variable to the outcome may be incorrect.
4. The numerical values assigned to the variables may be inaccurate.

The modeling process at the early stage, to achieve a simple high level of abstractions, consists of the fundamental steps:

(1) Establish the purpose of the model.

(2) List the possible elements (observations, measurement, ideas) which may relate to the purpose, however remote.

(3) Aggregate elements which can be chunked together by virtue of the strong structural, functional, or interactive connections between them. This is a process of classification in a sense.

(5) Repeat step 4 several times until a model consisting of seven, plus or minus two, chunks emerge.

This is Rubenstein's procedure for developing a model (Rubenstein, 1975).

2.11 Models of Processes

2.11.1 Bross' Discussion of Models

Bross (1965, p. 161) lists the various kinds of models: (1) symbolic or statistical; (2) physical; (3) abstract; and (4) mathematical. The purpose of a model is to bridge the informational gap which is not immediately apparent and consequently suggests fruitful lines for action. The actual construction of a model for data will depend on three key factors: (1) what we know from past experience (or are willing to assume) about the population sampled; i.e., our previous information concerning the subject field of the particular data; (2) what we know (or are willing to assume) about the sampling method; i.e., the way in which we obtained the data; and (3) what we want to decide from the data, what we want to say or do on the basis of the data.

2.11.2 Nagel's Discussion of Process Model

Nagel (1975, p. 61) contends that a process model is a useful framework for organizing knowledge. A process model is one that is open; one can introduce additional steps without violating logical assumptions. However, Braybrooke and Lindblom argue against such a model because the model assumes in advance of research that one can scan a very wide field of knowledge and know what to put in and what to leave out.

2.11.3 Smith's Discussion of Scientific Process Model

Smith (1975, p. 26) states that the utility of any paradigm (or theory for that matter) is a function of its (1) efficacy of prediction; (2) explanatory power; and (3) productivity in generating new theory.

Smith (1975, p. 27) uses Wallace's model of the scientific process to

show the ideal relations existing between five major components of any science: methods, observations, empirical generalizations, hypotheses, and theories.

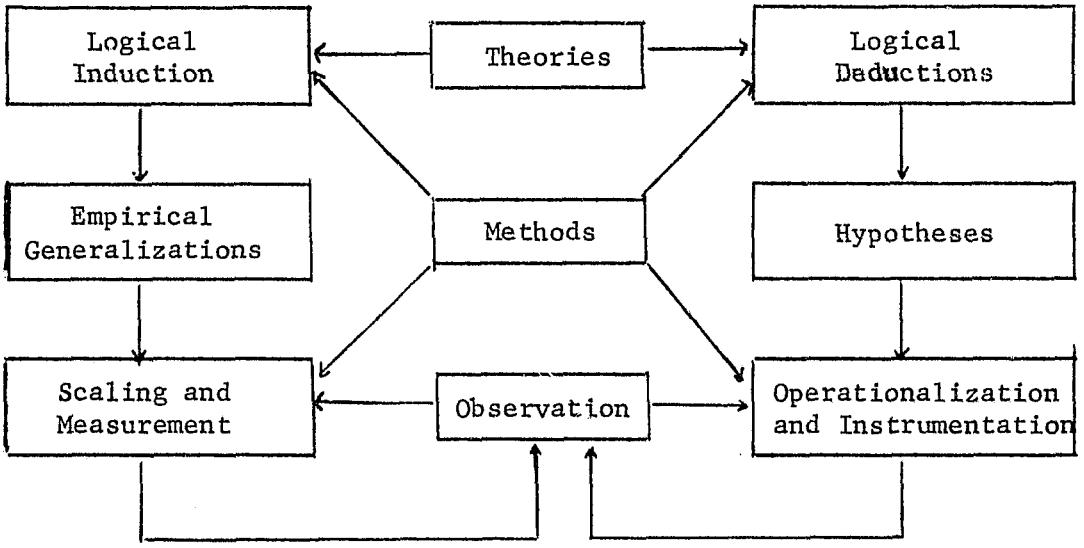


Figure 2

Scientific Process

2.11.4 Pattern Recognition

Sebestyen (1962) states that pattern recognition is a process of decision making in which a new input is recognized as a member of a given class by a comparison of its attribute with the already known pattern of common attributes of members of that class. He further states that the pattern recognition process consists of detecting and identifying the common pattern of inputs that belong to the same class, and recognizing that pattern in any new input to classify it as a member of one of several classes.

2.11.5 Policy Process Model

One feature of a process model is that it emphasizes relationships between political phenomena, and not the mere cataloging of information or proliferation of taxonomies. A process model is open and, at any additional stage, can be introduced only if the researcher specifies where it fits into the process, how it is influenced by previous stages in the process, and how it influences subsequent stages (Nagel, 1970, p. 62).

Nagel also states that a process model is dynamic because, explicitly or implicitly, one is moving through time. Dynamic properties are of crucial importance because policies are not advocated at one moment of time. He addresses the issue of process from a policy-making perspective because the flow of information of those who initiate and maintain the process.

Suchman (1967, p. 67) speaks of process in terms of evaluation. He states that:

> . . . the analysis of a process may be made according to four main dimensions dealing with: 1) the attributes of the program itself; 2) the population exposed to the program; 3) the situational context within which the program takes place; and 4) the different kinds of effects produced by the program.

2.11.6 Triangulation Method

Smith (1975, p. 75) states that operationalization is the bridge between method and theory. The emphasis being on the question of what one wants to measure brings up the problem of operationalization. This refers to the position of assuming that what one is measuring is the same as that which one is trying to measure.

Smith further contends that the multi-method approach of data triangulation is a necessity. Denzin (1970, p. 301) extended the view of triangu-

lation as "the use of multiple methods in the study of the same object," to include several other types of triangulation.

I. Data Triangulation

   A. Time
   B. Space
   C. Level of Triangulation

      1. Aggregate of persons
      2. Interaction of persons
      3. Collectivities of persons

II. Investigation Triangulation

   (Multiple vs. single observers of the same object)

III. Theory Triangulation

   (Multiple vs. single perspectives in relation to the same set of objects)

IV. Methodological Triangulation

   A. Within-Method
   B. Between-Method

2.11.7 Legal and Medical Processes

The exploratory process is analogous to (1) the legal process in that "the kind of reasoning involved in the legal process is one in which the classification changes as the classification is made. The rules change as the rules are applied . . . The rules arise out of a process which, while comparing fact situations, creates the rules and then applies them" (Levi, 1970, p. 3). However, in the exploratory process, the classifications or the procedure are not well defined in the beginning, partly because of the nature of the research design itself. 2) Medical diagnostic process is the integration of information from the patient, other sources (medical records, library) and from the physician's education and experience (Greenberg, 1972, p. 31). The diagnostic process is an iterative process in that the key

decisions of the physician include:

(1) deriving information to use in formulating his impression;

(2) determining the extent of the deviation and its probable causes;

(3) deciding how to restore the state of health or prevent its further deterioration; and

(4) the systems approach to problem-solving (see Figure 3, p. 34).

2.11.8 Procurement Process

Thompson explores a process of procurement which deals with exploratory (descriptive) and a priori proposition testing issues:

(1) How did a specific experiment get started, what happened, what are the more significant secondary effects?

(2) How to proceed from post hoc evaluation to be completed through evaluation of ongoing experiments, to planning and design of future experiments.

(3) To what extent would an overall process improve ability to perform individual steps in the design.

(4) To what extent can one anticipate variables of interest which will be of ongoing importance such as key variables, parameters, or descriptive (exploratory) variables which would affect your planning phases throughout the program.

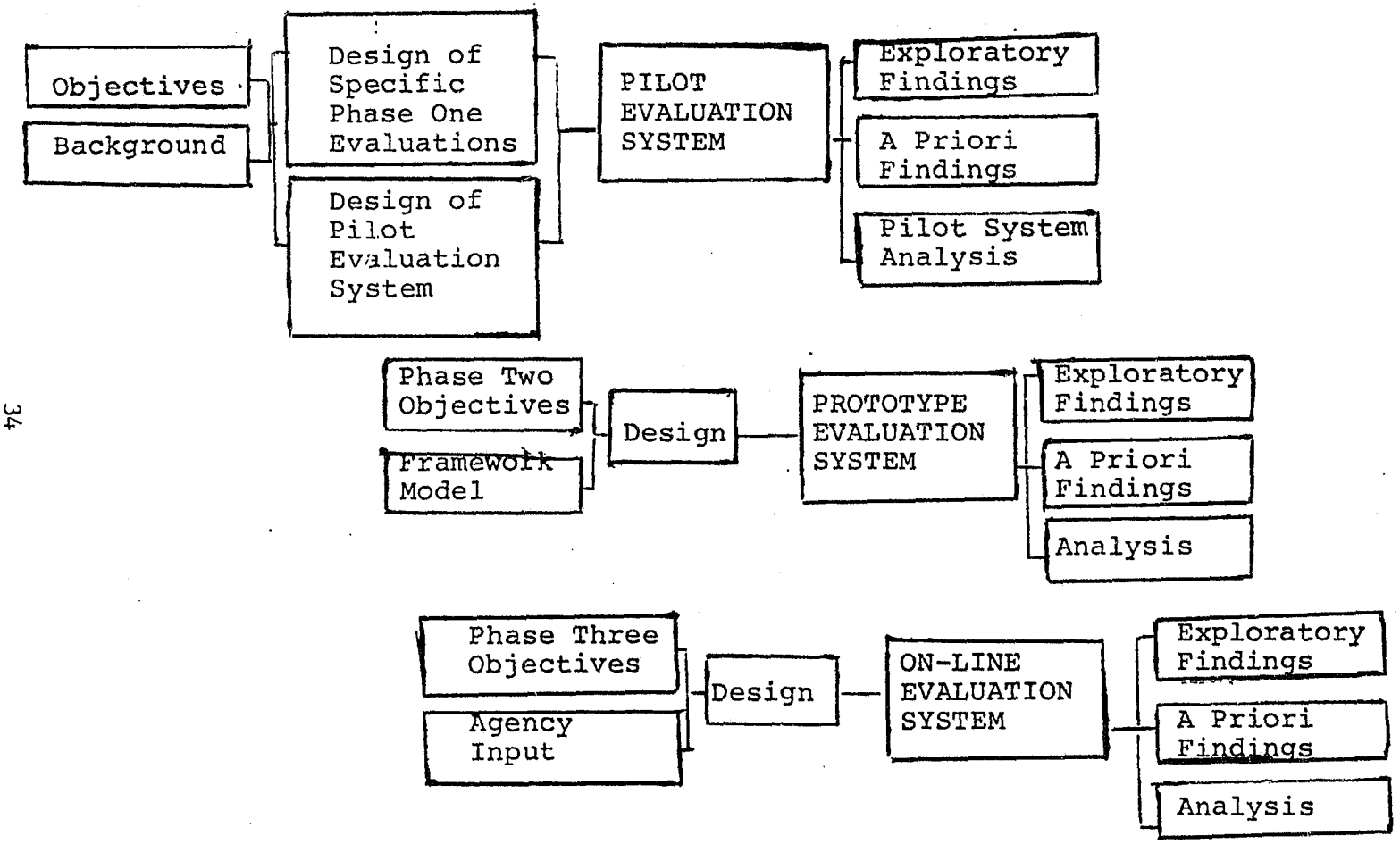
(5) To what extent is it your responsibility to re-examined cases where it appears that a priori proposition testing is possible even though you are doing exploratory research?

(6) Under what circumstances and for what purposes will you conduct pilot tests such as validation tests in doing exploratory research?

(7) How will you handle parametric information which may be available

Figure3

Evaluation System Design Process
(Including relation to evaluations of specific experiments)



Thompson, 1976

in some form, in existing records which have been collected for some other purpose; how will you identify advantages and disadvantages that are present?

2.11.9 Paradigm Processes

Three possible paradigms for approaching problem-solving activities are:

(1) a systems analysis paradigm

(2) evaluation paradigm

(3) research paradigm.

2.11.9.1 Systems Analysis

A systems analysis paradigm consists of:

(1) problem formulation--a statement of the problem

(2) objectives--things you want to get done

(3) criteria--the measure of effectiveness

(4) resources and constraints--the availability or lack of resources

(5) alternatives--choosing between possibilities

(6) model--a mechanism which looks at the other parts of the system

(7) the decision maker--the person who controls the acceptance or rejection for implementing the result.

The problem formulation is a process of defining a subset of events on the cloud of variables network (see Figure 10, p.59).

The objectives correspond to an examination of the subset of events at a specific time relative to the network of events (see Figure 4, p. 39).

The criteria are the resources and constraints which you choose to consider.

Resources and constraints are events outside the subset which already exist in the network and provide descriptions of alternate paths between events.

The model becomes the picture the evaluator superimposes on the network. It describes where one is, where one wants to be and how to get there. It gives a theoretical basis for formulating the path and results in the tools needed to construct the path. The choice of the model should not depend on a specific discipline. A systems model is discipline-independent; thus the prime concern is: is the model helpful.

Who the decision maker is depends on the point the evaluator is in the subset network. The decision maker could change for various events and points in the subset; the decision as to who is the decision maker is put in the evaluation process.

The characteristics of what is the subset in the cloud of variables is a general overall view of which systems analysis provides a specific method of attack (see Section 3.4.1).

The complexity of the problem depends on how many variables are involved and how they are interrelated, not how many variables are in the universe; your abstraction of the problem and how you define the subset in the cloud of variables.

What distinguishes systems analysis from evaluation is the point in time. Usually, systems analysis takes place before an event occurs and the evaluation takes place after an event has occurred. There are two ways to evaluate:

(1) the absolute standard. You compare the data against the "ideal."

(2) internal evaluation. You determine what you actually do.

The above discussion is based upon notes from a Theory and Evaluation course taught by Rath and Thompson.

2.11.9.2 Evaluation

Prescriptive steps (or points to consider) in doing evaluation. This discussion is based upon notes from the course mentioned above.

Questions to be asked (see Figure 5, p. 40):

(1) Is there a set of objectives or goals for the thing to be evaluated? (See Figures 4-5, pp. 39-40.)

(a) explicit--written

(b) implicit--inferred from observation, interview, etc.

(2) Coherence between program and objectives. Do the activities relate to the objectives. No value judgments implied--just ask questions.

(3) Is the program working? Is it effective?

(4) Side effects or spillover--good or bad?

(5) Is there an existing evaluation system? Is the client doing anything to gather evaluative data?

(6) What are the effects of the existing evaluation system? Are the mechanics of the evaluation system affecting performance?

(7) Quality of the data system? To evaluate, look at the data; i.e., source of data, data gathering procedures, data gathered. Quantity of data is frequently a substitute for quality in many institutions.

(8) Data analysis system. Have you planned and done things well?

(9) Dissemination--to whom the final report is to be addressed.

Where you start is not always important--but these are the prescriptive

steps. For a more detailed discussion of evaluation, see Hyman, Wright and Hopkins (1962), Suchman (1967), Weiss and Rein (1971), O'Toole (1975), Weiss (1972), Provus (1971), Thompson and Rath (1974).

2.11.9.3 Research Paradigm

Rubenstein and Thompson's (1973) research paradigm consists of the following stages:

(1) selecting the research area of interest

(2) selecting potentially researchable questions

(3) selecting potentially testable propositions

(4) defining the variables

(5) providing indicators to measure variables

(6) developing the research instrument

(7) developing the field study design

(8) conducting the field design

(9) testing the propositions.

Also see Glaser and Strauss (1967).

2.12 A General Discussion on Problem-Solving

Young (1966, p. 6) states:

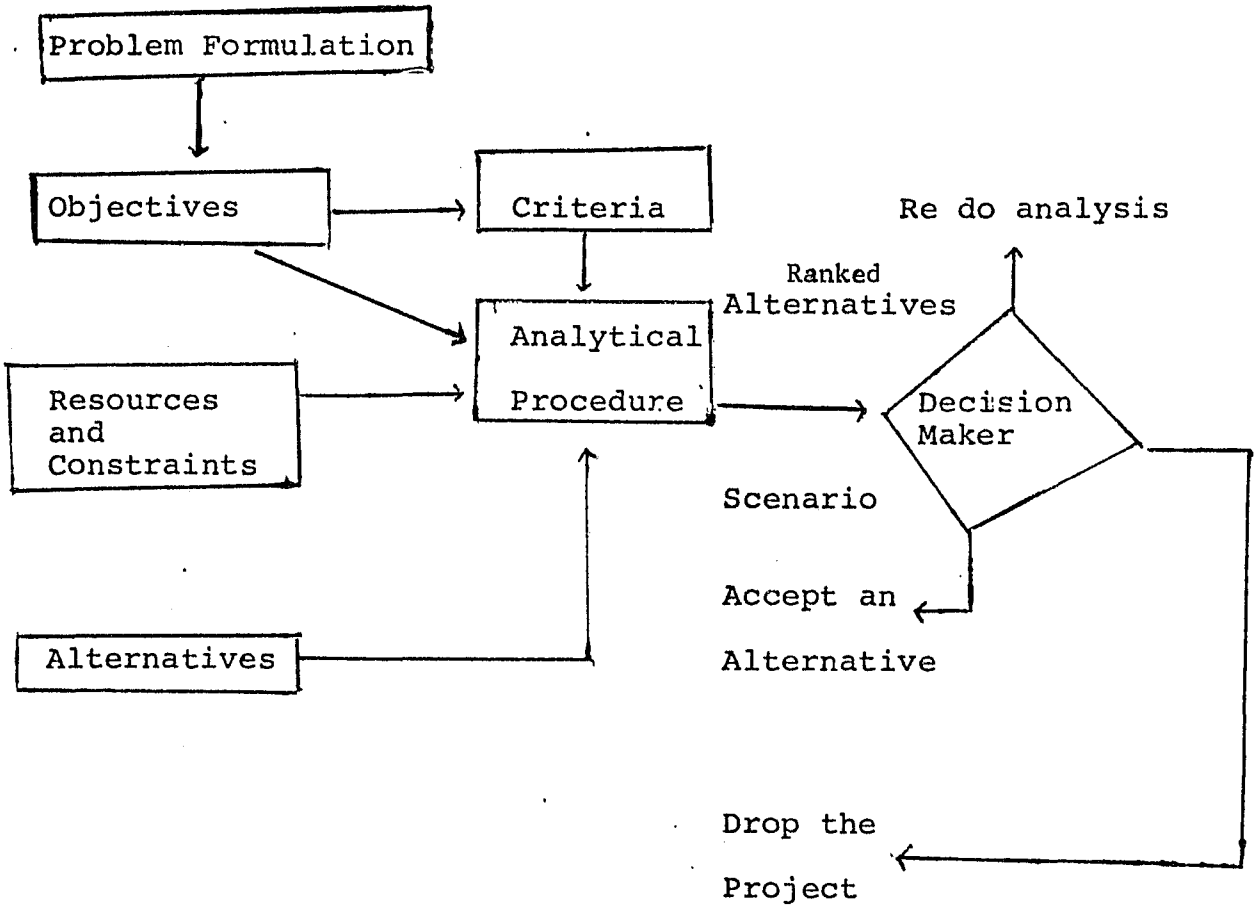
> If one does not first start with a "search for facts," in . . . the field, then one should "think-through" and branch out into several directions and assume different forms.

Einstein says in his evolution of Physics: "The formulation of a problem is often more essential than its solutions, which may be merely a matter of mathematics or experimental skill."

Simon (1969, p. 95) states that the more difficult and novel the problem,

Figure 4

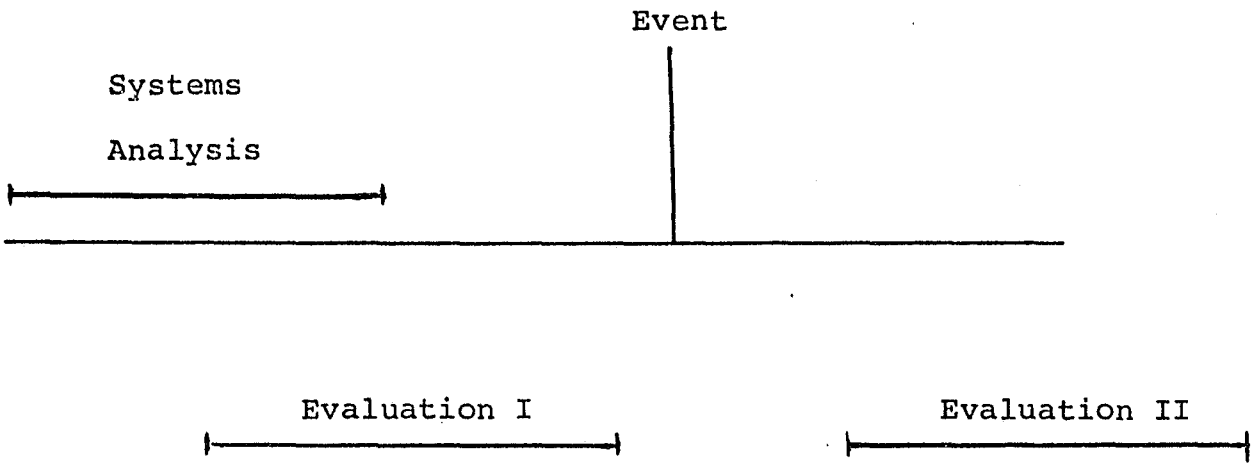
The Systems Analysis Procedure



Thompson and Rath, 1973

Figure 5

Time Phasing of Systems Analysis and Evaluation



Thompson and Rath, 1973

Figure 6

Social Science Research Procedure:
A Linear Model

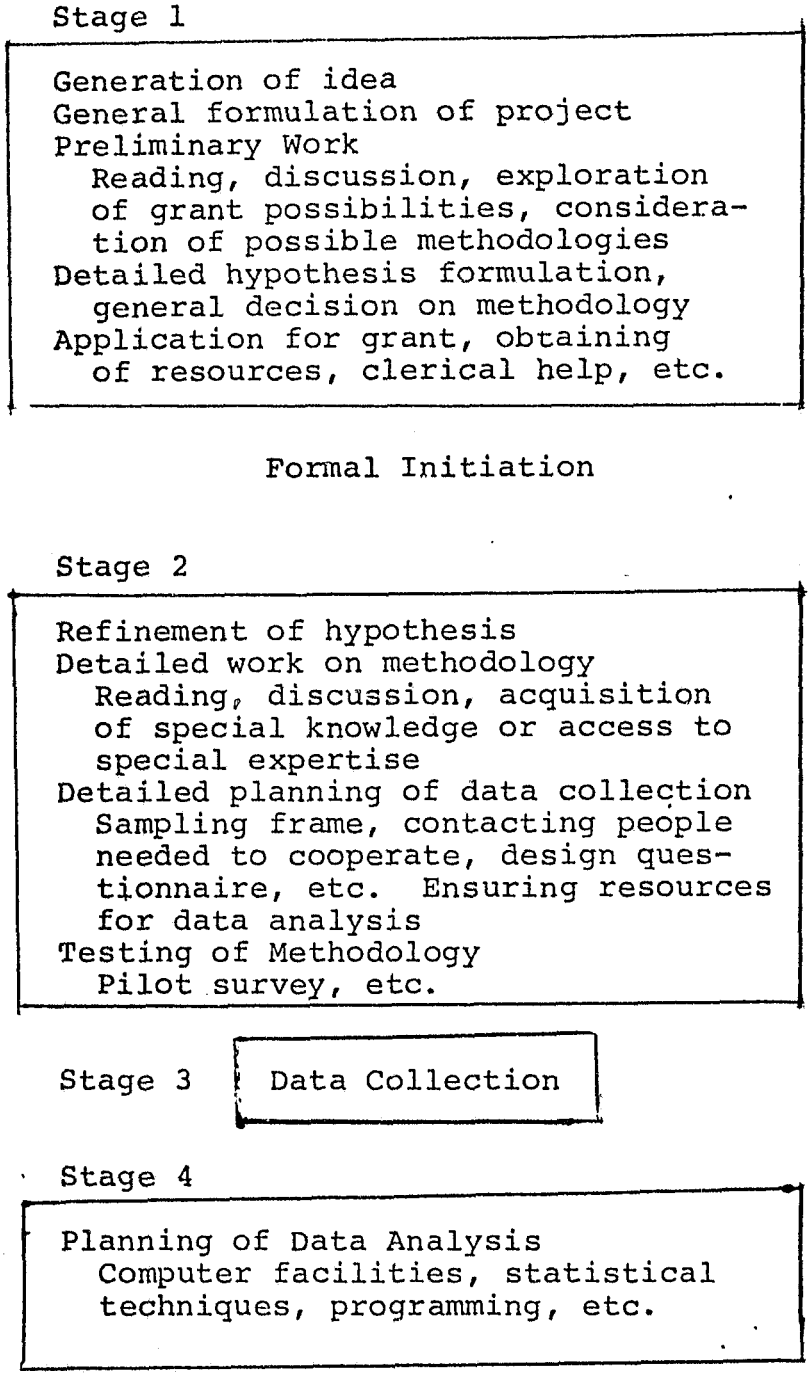


Figure 6 (continued)

Stage 5

Drafting of Report
Discussion with colleagues, etc.
Writing up of report (depends on purpose and sponsor)
Further Writing Up
(e.g., as periodical article)

Figure 7

Social Science Research Procedure:
A Cyclic Model

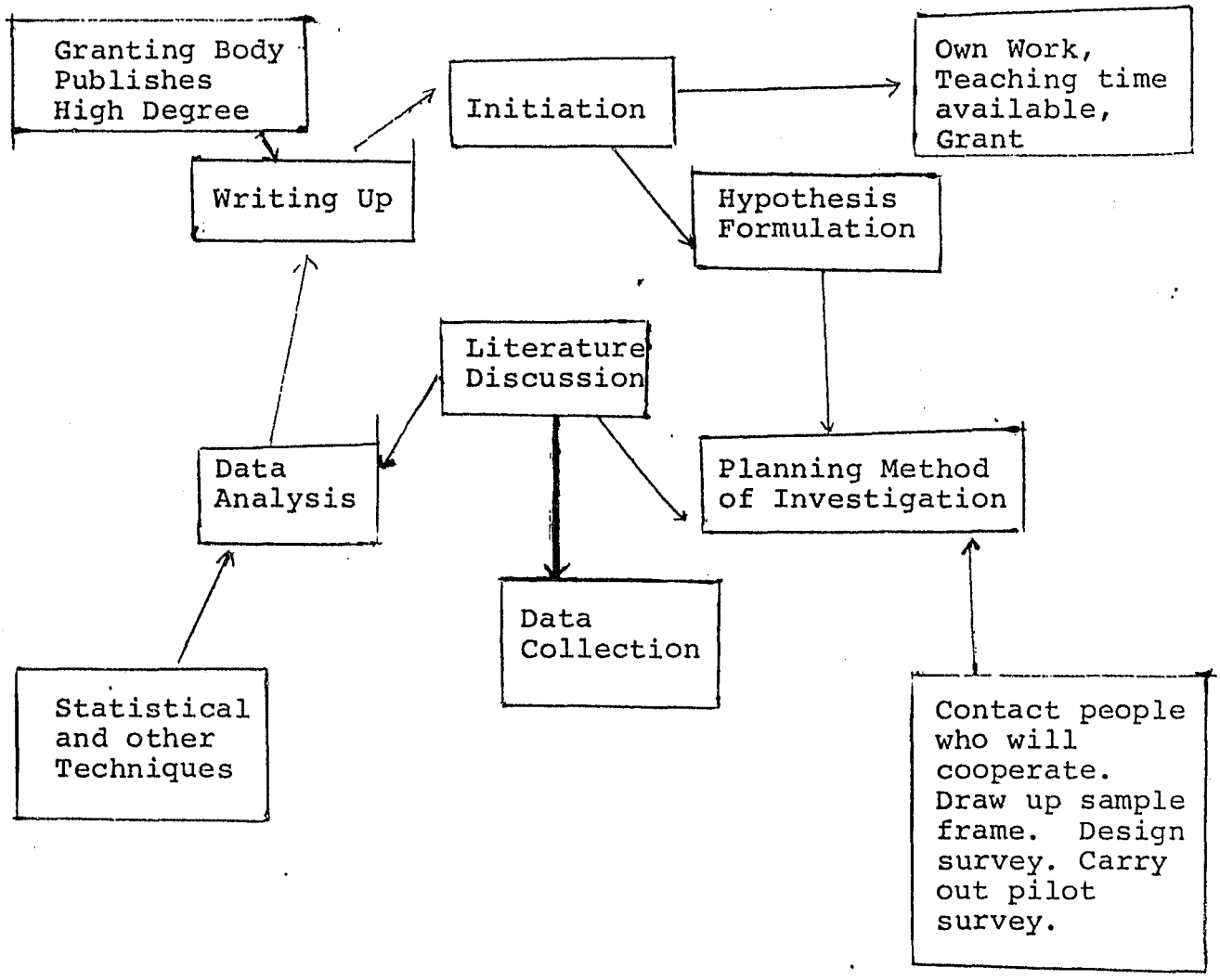
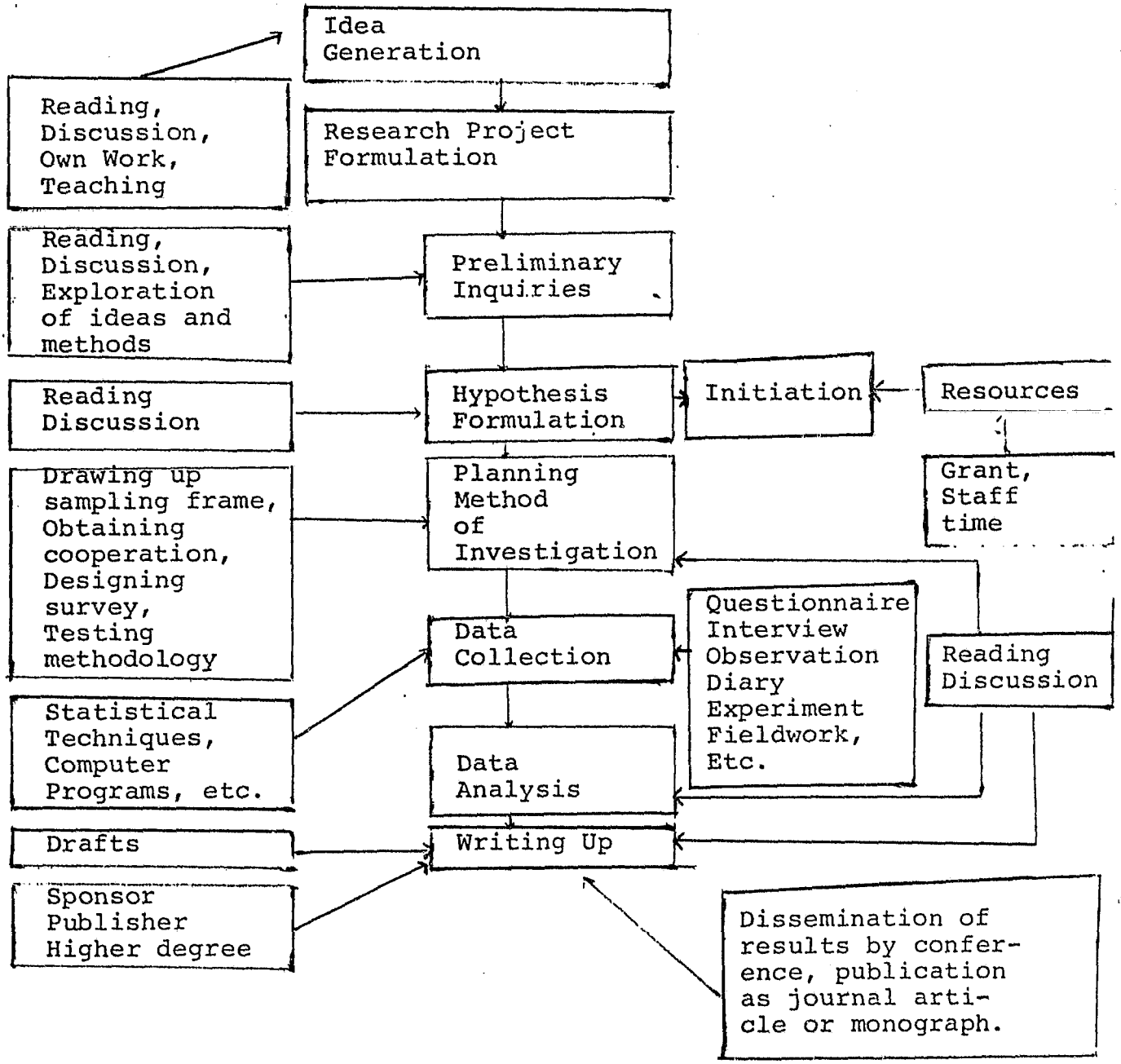


Figure 8

Social Science Research Procedure:
A Generalized Model



Figures 6-8 are from Bath University Library. Report No. 5, November 1971.

the greater it is likely to be the amount of trial and error required to find a solution. At the same time, the trial and error is not completely random or blind; it is, in fact, highly selective.

Thompson (1966, p. 14) states that "The extent that a proposition says something about the research process, it is saying something about the beginning and (or) ending of an activity."

Sullivan (1970, p. 3) says that a problem is the difference between the actual state of a system and a desired state--that is, between the actual state and goal . . . What may be a problem from the point of view of one person may not be a problem from another's viewpoint.

Kelaja (1968, p. 70) states that the:

> Perspective [of participation in decision making] consists of our looking at the present process of decision making from the viewpoint of the decision in question. The structure of the problem is conceived as being in the future because the resolution or implementation of the decision is by necessity always in the future. Consequently, this is the structure of the future process that exercises influence upon the present process. The decision making itself is not or should not therefore be present-bound . . . It is an intellectual unrolling of future alternatives--the . . . future time--for which the present time and its concommitant elements should serve only as vehicles.

Ligomenides (1967, p. 67) offers:

> An observation made on a physical system provides the observer with a certain amount of information about the system. The amount of information received is limited by any uncertainties above the values of the measured parameters . . . If P_o is the number of all possible and equally probable elementary complexions of a system or of a measuiable physical quantity before the measurement and P_1 is such a number after the measurement, the the amount $\triangle I$ of information that is gained by the measurement is defined by the relation. . .

Young (1966, p. 22) states that observation is most meaningful when it is planned in terms of the formulated hypotheses and of the general scheme of the study. But accurate observation is difficult because: (1) what we observe is complex; (2) we have to keep in mind a number of interrelated factors; (3) our sense organs are not exempt from liability to error; (4) it is necessary to keep fact and inference apart, especially when one is engrossed in the study.

Cohen and Nagel (1934) say that the function of an hypothesis is to direct our search for the order among facts, and it is of considerable advantage if a systematic inquiry is begun with a suggested explanation or solution of the difficulty which originated it. Such tentative explanations are suggested to us by something in the subject matter and our previous knowledge.

Campbell (1971, p. 11) states:

> Problem solving always proceeds by the method of trial and error: new reactions, new forms, new organs, new modes of behavior, new hypotheses, are tentatively put forward and controlled by error-elimination.

No uniformly successful approach has been found, and it may be expected that some of the entries into the problem will draw a blank. The first few questions approach the problem in an opened manner, from several diverse starting points. Later questions are more specific and directive. If earlier questions have elicited partial or complete answers to subsequent ones, the questioning should be modified accordingly (Campbell, 1971; Wertheimer, 1945).

2.13 A Problem-Solving Process

The problem-solving process described by Simon (1965, pp. 83-84) states:

> Problem solving proceeds by erecting goals, detecting differences between present situation and goal, finding in memory or by search tools or processes that are relevant to reducing differences of these particular kinds, and applying these tools and/or processes. Each process and/or problem generates subproblems until we have a subproblem we can solve--for which we already have a program stored in memory. We proceed until by successive solution of such subproblems we eventually achieve our overall goal--or give up.

Compton and Galaway (1975, p. 256) state the essential steps of the problem-solving process may be outlined as follows:

(1) statement of the problem

(2) identification of causal factors

(3) development of a plan of action:

  (a) identification of needs

  (b) determination of objectives

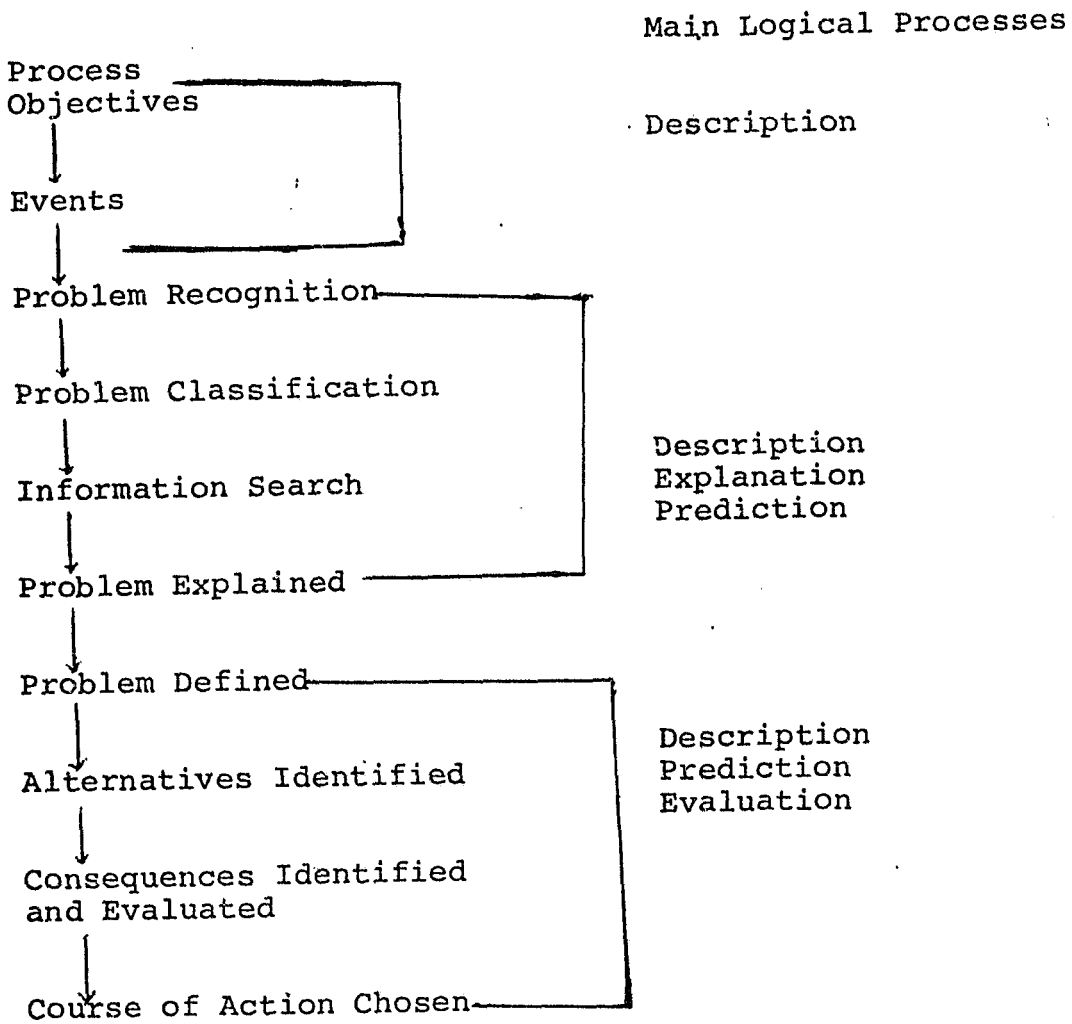
  (c) selection of intervention procedure and tools

(4) evaluation and feedback.

Dewey holds that effective problem-solving demands the active pursuit of a set of procedural steps in a well-defined and orderly sequence. These steps, referred to as the "five phases of reflective thinking," include: recognizing the difficulty; defining or specifying the difficulty; raising suggestions for possible solution and rationally explaining the suggestion; selecting an optimal solution from many proposals; and carrying out the solution (Compton and Galaway, 1975, p. 235; also see Hulfish and Smith, 1961).

Figure 9

Process of Prescriptive Decision



O'Shaughnessy (1972, p. 184).

2.13.1 Scientific Thinking Process

Good, Barr, and Scates (1935, p. 7) enumerate the steps involved in scientific thinking, which may be stated as follows:

(1) the location and definition of a problem

(2) survey of past experiences with the problem under consideration, previous investigations, and the already available data to get ideas and suggested solutions

(3) the formulation of an hypothesis representing a tentative solution of the problem under investigation, to be employed by the investigator as a guide in the collection of additional data which may lead to a solution of the problem or to the formulation of a new hypothesis that may be employed in the collection of more data, etc.

(4) the mental elaboration of the hypothesis, checking for agreement with fact, logical consistency, etc. (The mental elaborations here referred to may end in a belief that the solution is correct or in the formulation of new hypotheses to guide in the collection of new data, etc.)

(5) the collection of additional data by means of measurement, observation, and experimentation. (The already available data may be incomplete, or collected under conditions that throw doubt upon their trustworthiness or recorded in terms that are ambiguous and subject to many interpretations or misinterpretations.)

(6) the analysis, classification, and summarization of the data collected

(7) the formulation of new generalizations representing observed uniformities, explanatory principles, or scientific law.

2.13.2 Diagnostic Thinking Process

Good, Barr and Scates (1935, p. 223) listed the mental steps included in diagnostic thinking--if diagnoses are to be validated, they must take their departure from the measurement of the phenomenon under investigation and return again to a rechecking of the phenomenon after the accompanying circumstances have been modified in some significant respect. The steps in diagnostic thinking are ordinarily given as follows: first, the status of the phenomenon under investigation is determined, which require measurement. The second step pertains to the formation of a judgment concerning the probable antecedents of the situation observed. The third step involves checking for the presence or the absence of the antecedent thought to be present in the situation under investigation. The fourth step is the adjustment of the circumstances accompanying the object of the study. The fifth and final step involves the re-measurement of the phenomenon under investigation to ascertain what changes, if any, have been produced in its status by the modifications made.

Similar to the diagnostic thinking process is diagnosis of organizational problems. Lorsch and Lawrence state:

> . . . that there are two aspects to the diagnosis of organizational problems: first the question of what data are gathered and second the manner in which the data are interpreted and presented to members of the organization. The diagnostic data gathering preceding change efforts seems to be typically carried out through interviews.

Webster defines diagnosis as the "investigation or analysis of the cause or nature of a condition, situation, or problem; a statement or conclusion concerning the nature or cause of some phenomenon."

2.13.3 Six Points in Formulating Problems

Sullivan lists six points in formulating problems (1970, p. 28, which are:

(1) the formulation of a problem controls the possible outcomes

(2) there is usually no "best" way of formulating a particular problem; but some ways are better than others.

(3) . . . there is always at least an implicit formulation that takes place in the mind of the one who deals with the problem or makes the decision.

(4) to produce "better" formulations, explicit and conscious attention should be given to formulating the problem or decision

(5) formulation is an open-ended process, and the option should always be kept open to reformulate the problem when new insight or understanding is obtained, to get a better formulation

(6) although someone else can assist by devoting the attention required to formulate the problem in a better way, in the final analysis the better formulation must exist in the mind of the person who will take action or it is useless.

John Dewey states "a problem well put is half solved. To mistake the problem involved is to cause subsequent inquiry to go astray."

2.13.4 Polya's Method

Polya (1957) provides a framework for problem-solving which consists of:

I. Understanding the Problem

FIRST.

You have to understand the problem.

1. What is the unknown? What are the data? What is the condition?

II. Devising a Plan

SECOND.

Find the connection between the data and the unknown. You may be obliged to consider auxiliary problems if an immediate connection cannot be found. You should eventually obtain a plan of the solution.

2. Have you seen it before? Or have you seen the same problem in a slightly different form? Do you know a theory that could be useful? Look at the Unknown! And try to think of a familiar problem having the same or a similar unknown. An adjacent discipline. Here is a problem related to yours and solved before. Could you use it? Could you use its result? Could you use its method? Should you introduce some auxiliary element in order to make its use possible? Could you restate the problem? Could you restate it still differently? Go back to operational definition.

If you cannot solve the proposed problem, try to solve first some related problem. Could you imagine a more accessible related problem? A more general problem? A more special problem? An analogous problem? Could you solve a part of the problem? Keep only a part of the condition, drop the other part: how far is the unknown then determined; how can it vary? Could you derive something useful from the data? Could you think of other data appropriate to determine the unknown? Could you change the unknown or the data, or both if necessary, so that the new unknown and the new data are neared to each other? Did you use all the data? Did you use the whole

condition? Have you taken into account all essential notions involved in the problem?

III. Carrying out the Plan

THIRD.

Carry out your plan.

3. Carry out your plan of the solution; check each step. Can you see clearly that the step is correct or logical? Can you prove that it is correct or no rival hypotheses exist? Was the plan carried out in a way a reasonable person would have followed and are the results credible?

IV. Looking Back

FOURTH.

Examine the solution obtained.

4. Can you check the result? Can it be replicated? Can you check the argument, or is it logical? Can you derive the results differently by looking at rival hypotheses (parameters)? Can you see it at close examination? Is the methodology reasonable with respect to the problem and data or were certain things overlooked? Can you use the result, or the method, for some other problem? Can the results or method be applied to another situation, or is the result credible?

CHAPTER III

IDENTIFYING CHARACTERISTICS OF THE EXPLORATORY PROCESS

3.0 Introduction

In this chapter, it is our proposed purpose to discuss the issues involved in the process and provide useful frameworks for handling such concerns. Also, various techniques and classification schemes are discussed, in hopes that this information will facilitate your understanding of the model in Chapter IV.

3.1 Choosing the Problem

The literature search revealed an enormous amount of information on how to select a problem, the things to include, what should be considered and what is needed in order to select a problem. However, the writer will only mention a few of the ways in choosing a problem.

Thompson (1974, p. 249) states that the research problem selected should not be trivial in the sense that

> . . . everyone already knows the answer, or in the sense that the effect is so minor or unimportant that no one will care to know the results . . . It should not be so large and complex (cosmic) that a credible solution cannot be achieved within a reasonable time and with reasonable resources.

3.2 Problem Formulation

O'Toole (1975, p. 200) states that

> Problem formulation as a prelude to design is a stage which is often overlooked or perhaps assumed to have occurred when it has not. Borgatta's emphasis on design without reference to this necessary prior step may be a case in point. In any event, failure or inadequate problem specification is a root source of many mishaps in later research stages. Since problem formulation is a process which calls upon the researcher's body of theoretical and methodological knowledge and requires autonomous decision making on his part, it is the prototype of the professional portion of the research role.

Ferguson (1968, p. 414) speaks of diagnostic formulation in terms of the consultant's role in problem-solving. He states that

> Often many successive formulations are required before interpersonal issues can be adequately stated. . . . the diagnostic process by searching for greater clarity of the issue surrounded, as it often is, by emotional smoke, and tentatively stating his understanding of it.

He further states that

> . . . even if his understanding is incorrect a tentative statement of his understanding will likely lead to closer reformulation and so on until the issue is stated with sufficient clarity and understanding, so that proposal for solution can follow.

3.3 Methods of Problem-Solving

The basic procedure for problem-solving consists of initiation of inquiry, problem formulation and selection, feasible alternatives, basis for generalizing the data to be collected, and some possible solution.

3.3.1 Northrop's Method

Northrop (1966, p. 28) emphasizes the problem initiation:

> . . . the consequences of initiating inquiry by analyzing the problems which one has at the beginning of inquiry and

> by allowing the analysis of this problem to guide step by step to its solution. It appears that this step by step procedure can be divided into the following explicit stages: First, the discovery by analysis of the basic theoretical root of the problem; second, the selection of the simplest phenomenon exhibiting the factors involved in the difficulty; third, the inductive observation of these relevant factors; fourth, the projection of relevant hypotheses suggested by these relevant facts; fifth, the deduction of logical consequences from each hypothesis, thereby permitting it to be put to an experimental test; sixth, the clarification of one's initial problem in the light of the verified hypothesis; and seventh, the generalization of one's solution by means of a pursuit of the logical implications of the new concepts and theory with respect to other subject matter and applications.

3.3.2 Bloom and Broder's Method

Bloom and Broder (1950, p. 25) list the problem-solving process as:

(1) understanding the nature of the problem

(2) understanding the ideas contained in the problem

(3) general approach to the solution of the problem

(4) attitude toward the solution of the problem.

3.3.3 Simon's Method

Simon (1969, pp. 177-181) addresses the issue of problem formulation in terms of an empirical research study whose steps are:

(1) Ask "what do I want to find out?" [That is the problem]

(2) Establish the purpose of the project

(3) Determine the value of the research

(4) Choose empirical variables

(5) Calculate the values of accuracy and the cost of error

(6) Saturate yourself in the problem

(7) Determine the most important research obstacles

(8) Choose methods [the method is dictated by the problem formulated]

(9) Prepare a detailed design of the method

(10) Collect the data

(11) Analyze the data

(12) Write up the research

3.4 The Research Aspect of Choosing the Problem

The kind or type of problem selected dictates throughout the research process. The hypothesis, the independent, dependent and parametric variables, methods, and solutions are derived from the research problem. If the problem has not been well formulated, then the chance of producing credible, reliable, valuable results is very unlikely. Northrop (1952, p. 1) says that a very slight erroneous deviation in taking one's bearing at the beginning may result in entirely missing one's mark at the end. It is only an analysis of the problem confronting one which can answer the question.

3.4.1 "Cloud of Variable" Framework

This is a conceptual framework whose primary value is that all possible variables of potential interest can be aggregated in a conceptual scheme without introducing problems of definitions, of classification, of inclusivity or exclusivity or of hierarchies, and each variable may then be further tested for relevance on the simple basis of its presence (Thompson and Rath, 1973, p. 12).

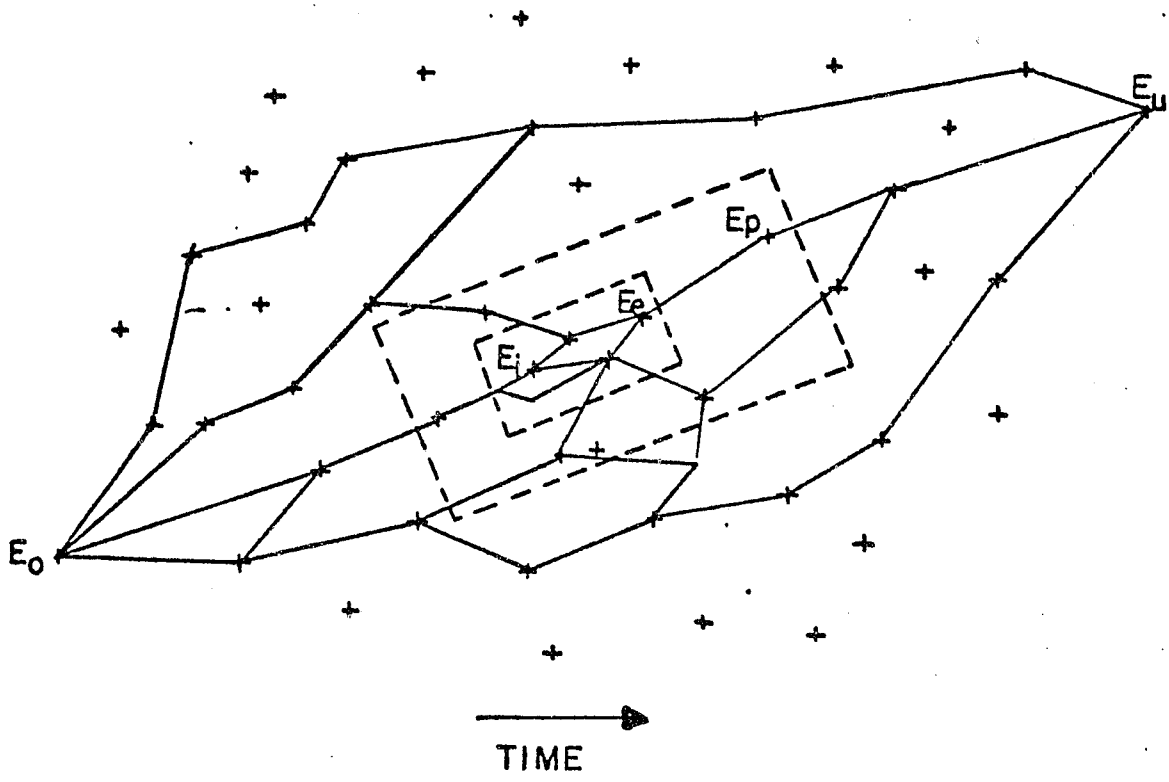
Using a cloud of variables approach one can consider a priori experimentation when one has a very definite set of independent and dependent variables connected by propositions and a known set of parameters. Explora-

tory research, in contrast, is appropriate when one is trying to sort out the independent and dependent variables one should be concerned about, the various hypotheses or theories which explain how these are connected, and the parameters which affect them (Thompson and Rath, 1973, p. 13).

The "cloud of variables" framework is just one of the ways of conceptually looking at problems. Many times the problems are so complex that it is impossible to get a handle on it. But, by reducing the problem conceptually, we are able to chip off a piece of a huge problem which calls for an immediate or partial solution (see Figure 10, p. 59).

3.4.2 A Priori Framework

This framework is an additional way of conceptually considering many variables, which proposes that all variables of interest be described not only in terms of their relation to the problem of interest but also in their relation to the person (decision point, or decision maker) who is identified as having the information on the variable. That information which is available, without significant mediating prior to a decision of interest is identified as a part of that person's a priori. All of the variables can be described in terms of the information in the a priori of one or more persons (decision makers) and the problem of analysis and synthesis can be treated directly, with recognition of the "potential" necessity for a transform whenever there is a change in the decision of interest or the decision maker (Thompson and Rath, 1973, p. 14). The primary value of this concept is that all of the variables can be translated into a single kind of variable, and two major contributors to the instability of variables are made explicit (Ibid., p. 15) (see Figure 11, p. 60).



Notes:

1. Variables (changes in state in the sense of events or objects) are denoted by X's, and the connecting lines represent relationships in the sense of "causal".

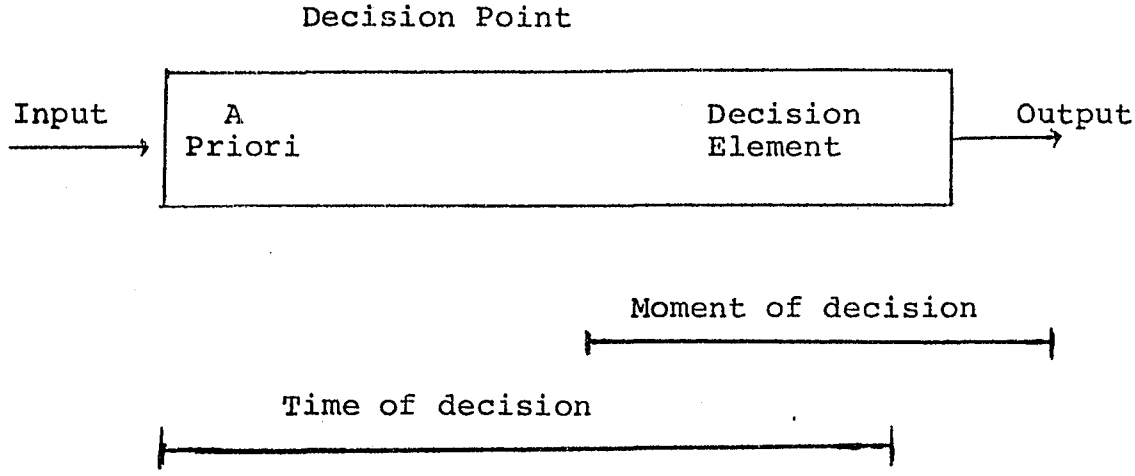
2. The smaller rectangle is the system under consideration; the larger rectangle includes the related parameters.

3. The captioned X's represent the following:
   E_o - the earliest event of interest, i.e., the origin event
   E_i - the first event in the system under consideration, i.e., the idea event
   E_e - the last event in the system under consideration, i.e., the end event
   E_p - the next event (of future interest), i.e., the product or payoff event
   E_u - the last event of interest, i.e., the ultimate event

Figure 10 Partial View of "Cloud of Variables"

Figure 11

A Decision Point or A Priori Model



Notes:

1. Decision--any conceptual held input-output statement which includes change.
2. Decision Point--the person, or element, making the decision.
3. A Priori information--information the decision element already had or could obtain from the environment under his immediate control.
4. Decision Point--2) and 3) above, together.
5. Input information--information which is "new," as distinguished from 3) above.
6. Output information--information describing the decision conveyed outside the decision point.
7. Moment of Decision--interval when the decision is made.
8. Time of Decision--interval between receipt and sending of information by the decision point.
9. Noise--element added to "message" altering the message.

Thompson and Rath, 1974b

The concept a priori embraces the set of conditions existing prior to a particular decision. As a matter of usefulness, it will ordinarily be largely constrained by the general unit of relevancy, and, as in the case of the definition of decision, it is limited to that which can be conceptually held (Thompson, 1956, p. 75).

3.4.3 Confidence/Utility Framework

The primary value of this concept is that the purposeful variables in a system can be described in terms of a simple two-dimensional metric-change in state of confidence, with respect to some variable, we have achieved a "fact," to the extent we have diverging states of confidence (or different utilities) we must recognize that we are dealing with a "value" (Thompson and Rath, 1973, p. 17).

The three conceptual approaches to problem selection, according to Thompson and Rath (1973, p. 18), provide a more stable and traceable conceptual base for dealing with complex problems associated with [complex systems].

Thompson and Rath (1973, p. 12) state that it is possible to conceptualize all projects as having some relationship between an independent and a dependent variable which is established by a proposition with parameters that affect the outcome and other background variables which exist but do not affect it.

The point the writer wants the reader to keep in mind is that regardless of the terms you use to express a relation between independent and dependent variables, it is the phenomenon or the problem that determines the design or approach for handling or finding the solution.

3.4.4 A Priori Proposition Testing Framework

As a concept for relating independent, dependent and parametric variables to and/or some propositions, it is applicable to "rigorous" control methods. The basis for application of "rigorous" control methods is that the proposed program or experiment concerns a problem about which we know quite a lot (usually in terms of prior research) and for which we can design an experiment with essentially "one" unknown--the relation between the intervention and some desired outcome. This kind of problem, and approach, is called "a priori proposition" testing, and is a common form in laboratory experimentation, qualification or pre-production testing, and some limited, controlled field experiment. For many problems we do not know this much, and it is necessary to increase our understanding of what happened and what alternative explanations for what happened are present. This "exploratory" phase is a necessary prelude to "proposition testing" and, in some cases, may be valuable in and of itself where we do not need the higher standard of "proof" characteristics of proposition testing. This kind of problem is a common form in all (or nearly all) research areas, in the early stages of design and engineering, and in systems design (Thompson, Note 8, 1975, pp. 1-2).

Thompson (1974, p. 249) states that:

> There are several methods for dealing with problems which may be too complex in terms of desired dependent variables or undesired parameters. One method is to narrow the problem by limiting the number of different changes (independent variables) which will be manipulated at one time. Another method is to "shorten the chain" between the independent and dependent variables by choosing a dependent variable closer in the "causal chain" to the independent variable; this is often possible where the relation between the proximal (near) dependent variable and the desired (distal, or more distant) dependent variable is one that is considered "known" for some practical purpose. A third method is to isolate, as a sub-experi-

> ment, that part of a larger experiment which can be defined more clearly and for which the control necessary for hypothesis testing can be realized.

In order to label a research effort as a priori proposition testing or exploratory research, one has to be able to specify the research design which is derived from the problem selected.

The ease or difficulty in specifying in advance your research procedure will determine your design. Generally, characteristics of proposition testing include specific, stable, traceable and knowable evidence of the phenomena; however, you will find general, unstable and intangible traces and unknown evidence about a phenomena which is handled through indirect observations and inferences. Usually, the latter characteristic is considered as exploratory because of the uncertainty about the phenomenon. The more certain you are about the phenomena, the more it is considered as a priori proposition testing. Because, if your design is to ensure "that where a program can achieve proposition testing results that the proposer recognizes this and incorporates the proper evaluation in his planning and in his commitment, increasing the likelihood that the results will be achieved." However, "if only exploratory results are met, [that it will] be of value to the sponsor either in and of themselves or as the basis for future proposition testing." According to Thompson, "if it is possible, based on a preliminary analysis and/or some modest examination of alternative designs to classify a proposed program (or project) as either exploratory or a priori, we can then ask (and answer) the following kinds of questions. If the proposed program is amenable only to exploratory evaluation:

(a) Do the evaluation objectives describe exploratory (as distinguished

from proposition testing) results?

(b) Is the proposed evaluation program well designed to provide an exploratory description of what happened and of alternative explanations?

(c) Is the proposer capable of carrying this out?

(d) If only exploratory results are met, will they be of value to the sponsor, either in and of themselves, or as the basis for future proposition testing?

The writer is not only interested in the design but also how well it is implemented. Thompson (1975, Note 2, p. 2) states that:

> Where the nature of the program does not allow for a priori proposition testing, the evaluation should be limited to a description of what happened, plus where appropriate, an exploratory evaluation of the effects [should be employed to enhance the usefulness of the program, or project, etc.].

3.5 Techniques of Analysis

De Francesco discusses the role of the analyst with respect to data analysis. The writer contends that the researcher has the same role of the analyst in disclosing his data analysis process. De Francesco (1975, p. 1) states that:

> . . . the primary responsibility of an analyst is to examine information, make assessments and predictions, and communicate findings on the possible manifestations of the substantive content of the information. An analyst is concerned with questions of substantive content and with analytic processes performed on the content . . . He assesses his substantive information by employing analytical tools which include elements of the deductive, inductive, and plausible reasoning processes. The methods and techniques of analysis employed by the analyst normally determine the accuracy, reliability and completeness of his findings.

Some of the analyses which De Francesco (1975, pp. 2-60) discusses are as follows.

3.5.1 Descriptive Analyses

Descriptive Analysis--the objective is to describe the characteristics of things, statements, or events on the basis of historical or current observations. A description usually consists of two components: one describes the event, statement, or thing; the other rationalizes the existences of the thing, the truthhood of the statement, or the occurrence of the event. Descriptive analysis normally takes the forms of verbal description, a statistical, or a combination of the two.

3.5.2 Predictive Analysis

Predictive Analysis--descriptions of things or events as they existed in the past, and as they currently exist, and the rate of change as key properties from the past to the present guides the analyst in deciding whether the same rate of change will continue into the future. Most of this analysis is descriptive and yet it does possess a predictive component. In some instances it is difficult to separate the descriptive analysis component from the predictive component. In other instances, the predictive components are utilized to test the value and efficacy of the descriptive component and methods of prediction.

3.5.3 Normative Analysis

Normative Analysis--it is analysis based on one's own value system. In normative analysis, explicit or implicit judgments are formed from one's personal view of what exists or what will exist. Normative analysis reflects

in varying degrees personal preferences be they legal, moral, political, or social. Normative analysis reflects an individual's view of reality tempered by his notions of right and wrong, good and bad, or acceptable or unacceptable. These notions become the main theme of his or her reasoning processes.

3.5.4 Prescriptive Analysis

Prescriptive Analysis is used to demonstrate how and why future goals, policies, values, and strategies should assume the forms that the analyst considers to be desirable. Normally, prescriptive analysis includes a suggested plan of action on how to accomplish the analyst's normative and predictive analytic components are also present in the plan and analysis to indicate why these forms are desirable and should be sought.

3.5.5 Causal Analysis

Freeman and Sherwood (1970, p. 36) discuss causal analysis, which is the process of understanding the linkages among phenomena. A causal study requires that changes occur in one or more variables--either through purposeful manipulation or in the course of natural events--and that an assessment be made of the impact of the changes on one or more differentiated phenomena. Causal analysis usually includes not only descriptive statements of the concommitant variation among variables and of the way one phenomenon can be modified by change in another, but also an explanation or theory to account for the causal linkages.

3.5.6 Rubenstein and Schroder's Discussion on Technique Analyses

Rubenstein and Schroder (1970) discuss the following analysis.

(1) Sensitivity analysis serves to assess the behavior of the evaluation results if the uncertain parameters are varied.

(2) Contingency analysis studies the effect of changes in the environment on the evaluation results.

(3) A fortiori analysis facilitates the study of the behavior of the project rankings if those uncertain parameters are changed which handicap the high ranked alternatives.

(4) Break-even analyses determine the values of uncertain parameters which lead to equal desirability of different projects.

(5) Relevance-true analysis can be characterized as a methodology to structure ill-structured problems by the use of graphs or true diagrams (p. 9).

(6) Systems analysis may be defined as a methodology to analyze ill-structured decision problems and to assist decision makers by identifying preferred causes of action (Quade, 1966). It aims at sharpening the intuition and judgment of decision makers "through the more precise statement of problems, the discovery and outlining of alternatives," etc. (Fisher, 1966).

(7) "Cost benefit analysis is more than a model in which the inputs have been priced but the outputs have not" (Hovey, 1968). The decision maker is presented not a single number for each alternative, but its costs and level of achievement for each specified objective. The trade-off between these levels and final decisions is left completely to the discretion of the decision maker.

3.5.7 Other Processes, Analyses, Models and Theories

Other processes which are applicable to the exploratory process include:

1. Medical process
2. Legal process
3. Research process
4. Scientific thinking process
5. Diagnostic thinking process
6. Social research process
7. Pattern recognition process
8. Selective-retention process
9. System analysis process
10. Evaluation process of programs or projects
11. Planning process
12. Searching process
13. Problem formulation process
14. Implementation process
15. Descriptive process
16. Alternative design process

Methods of analysis consist of:

1. Descriptive analysis
2. Content analysis
3. Factor analysis
4. Predictive analysis
5. Prescriptive analysis
6. Normative analysis
7. Causal analysis
8. Correlative analysis
9. Empirical analysis
10. Sequential analysis

11. Discrete analysis
12. Continuous analysis
13. Graphic analysis
14. Network analysis

Various models for dealing with processes include the following:

1. Symbolic or statistical models
2. Physical models
3. Abstract models
4. Mathematical models
5. Decision making models
6. Input-output models
7. Corporate models
8. Mental models
9. Heuristic models
10. Algorithmic models
11. Explanatory models
12. Predictive models

Theories which could be used include:

1. Game theory
2. Probability theory
3. Queuing theory
4. Search and detection theories
5. Information theory
6. Value theory
7. Learning theory
8. Utility theory
9. Decision theory

10. a. Decision making under uncertainty

    b. Decision making under risk

    c. Decision making under certainty

    d. Decision making under conflict

3.6 Pattern of Inquiry

Dewey states the pattern of inquiry involves the following four phases: (1) obtaining facts-of-the-case through sensation; (2) the presentation of suggested solutions by intuition (or hunch); (3) the evaluation of the suggestions in light of the facts-of-the-case by thinking; and (4) the solution of an objective by feeling with respect to which the suggestions are evaluated. Each process is subject to check by the others, including the feeling process of evaluating ends.

He also states (1910, p. 1) that one must begin inquiry with what one has at the beginning, namely, the problem. It is the problem and its characteristics revealed by analysis which guides one first to the relevant facts and then, once the relevant facts are known, to the relevant hypotheses.

Freeman and Sherwood (1970, p. 34) discuss the three basic functions of scientific inquiry and thereby of social research as well, which are: description, prediction and causal analysis.

> Description is basic to all scientific inquiry; it refers to the identification of phenomena and to communications concerning their characteristics in ways that permit a sensitivity of their existence. Descriptive science deals with matters of facts, with distinctions among phenomena, and with counting and measuring them. Definitions, observations, and classification are fundamental to the descriptive enterprise. (Ibid., p. 35)

Generally, two basic descriptive tasks may be distinguished: the description of the static or momentary aspects of phenomena, and the description of their dynamic or changing aspects. Static description deals with the reporting of observations of conditions, events, and the properties in describing behavior which are contrary to norms or standards of a given community. Dynamic description "is the summary of interpretation of a series of two or more static descriptions relating changes that are taking place in conditions, events, or the properties of things."

Prediction. Scientific predictions are made either on the basis of theories (deductive prediction) or on the basis of observed relationships among variables (inductive prediction)(Ibid., p. 35).

Inductive prediction is based on information. One type of prediction is based on rates, that is, on the relative frequency of occurrence of the phenomenon during some specified period; the other type is a statement about each individual case (Ibid., p. 36). They go on to say that research methodology can be received as consisting of two highly interrelated but nevertheless distinct components: gathering data and analyzing data. A primary function of social policy research is to obtain information and to draw inferences from it as an aid to the decision making process. It should be apparent that the validity of the inferences is highly dependent upon the quality of the data utilized, but the interdependence is in fact even greater than it seems; ideally, the data gathering procedures should be designed from the point of view of the kinds of inferences desired (Ibid., p. 84).

3.7 Dimensions for Classifications

However, there are other ways of classifying your phenomenon based on

your observation. These dimensions include (see Figures 12-14, pp. 73-75):

(1) Exploratory versus a priori: variations in "the degree to which the researcher (tester, evaluator) predetermines the effect of new data (obtained from the phenomena) on his results."

(2) Normative versus empirical: variations in "the degree to which the researcher (tester, evaluator) obtains new data directly from the phenomena."

(3) Study versus experiment: variations in "the degree to which the researcher manipulates the phenomena under observation."

Depending on the phenomena and the design selected, all problems can be classified within one or more of the dimensions listed.

Church and Ackoff (1950, p. 221) state that:

> . . . we must approach the task of gathering observations equipped with a criteria that tells us how to gather our data. Otherwise we will merely accumulate a chaotic mass of fact.

Young (1966, p. 12) says "the considerations which enter into making the decision regarding the what, where, when, how much, by what means, constitute a plan [of action]."

Cohen and Nagel (1934) state that "it is of considerable advantage if a systematic inquiry is begun with a suggested explanation or solution of the difficulty which originates it." However, the researcher must be aware that preoccupation of a solution may indeed bias or prevent his awareness of the phenomena as they are present.

3.8 Planned Observations

Young (1966, p. 22) states that observation is most meaningful when

Figure 12

The Degree to which the Researcher Predetermines the Effect of New Data on His Results

Not at all ⟵ Completely

Exploratory Research | Serendipity | Action Research | Evaluation Research | Descriptive and Explanatory Research

Hypothesis Testing | Replication

Systems Design | System Demonstration or Evaluation (Pilot or Field Testing)

Breadboard Testing | Development Testing | Acceptance Testing

Trial and Error | Rate Learning | Conditioned Reflex | Imprinting

---

Flash of insight | Heuristic Models | Preliminary Hypotheses | Mathematical Models | Algorithmic Models

(May appear anywhere: Evaluation, Field Testing, Field Studies and Experiments, Basic Research, Applied Research, Simulation)

(Data from external stimuli)

(Data from reflection)

Exploratory ⟵⟶ A Priori Dimension

Figure 13

The Degree to which the Researcher Obtains New Data Directly from the Phenomena

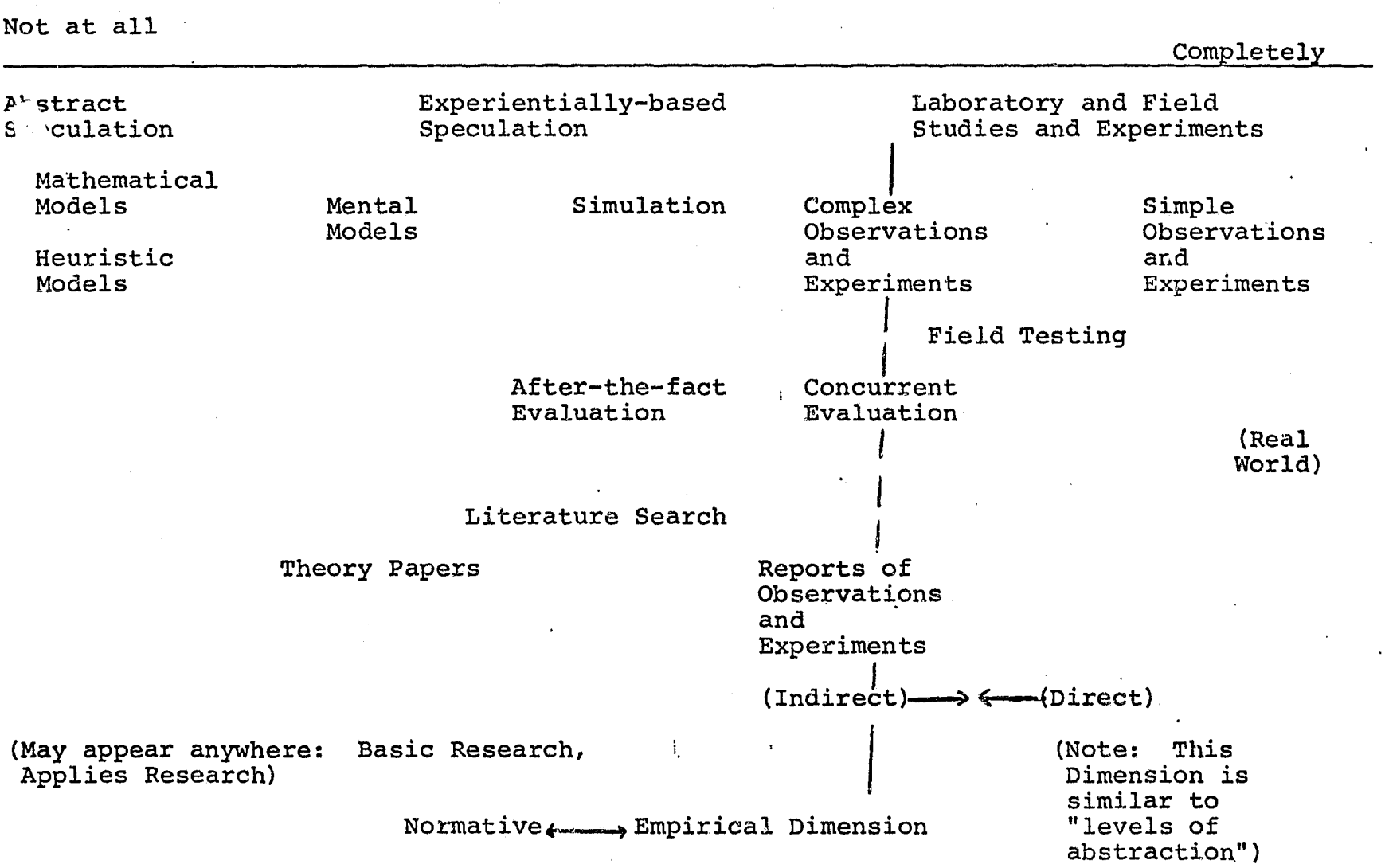
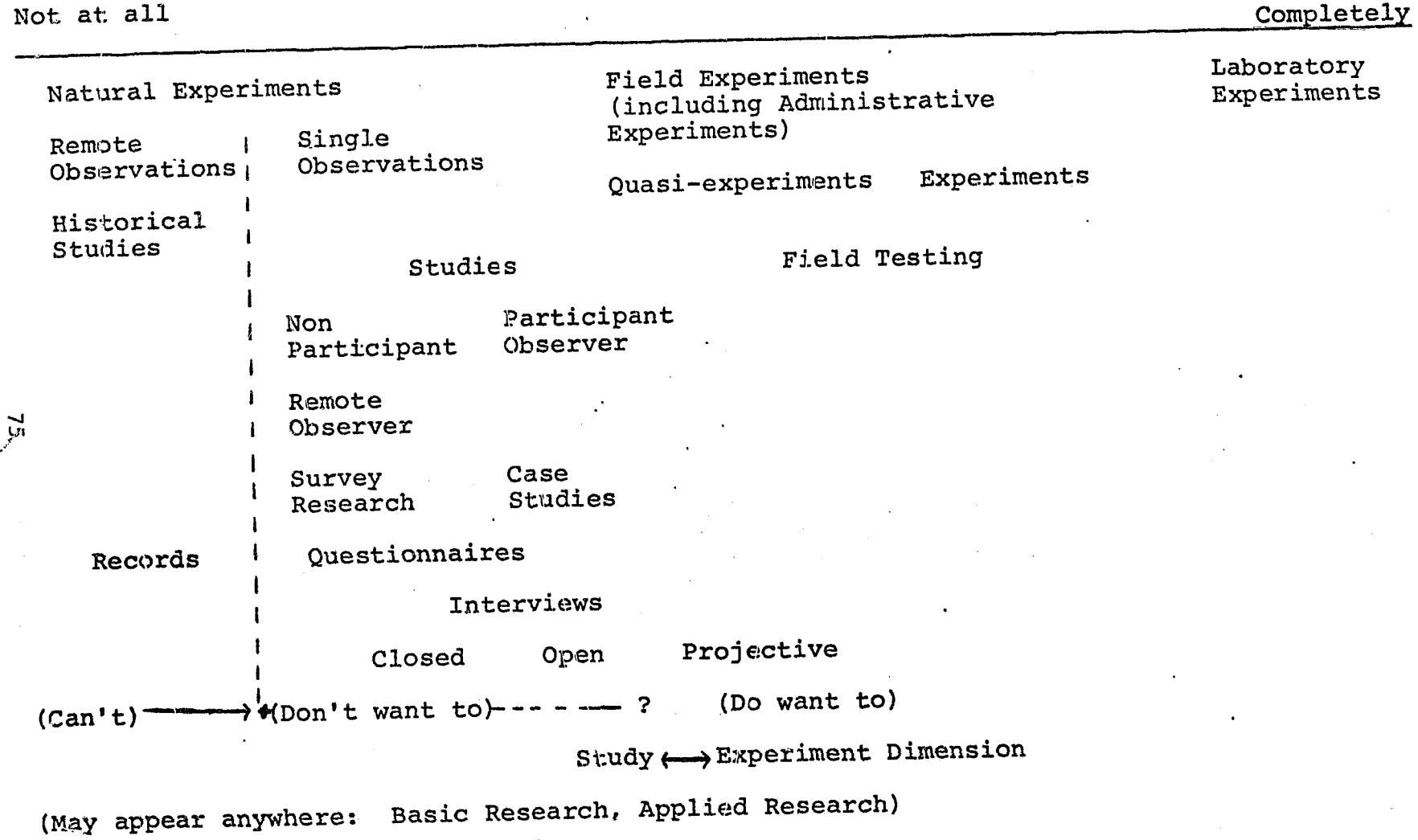


Figure 14

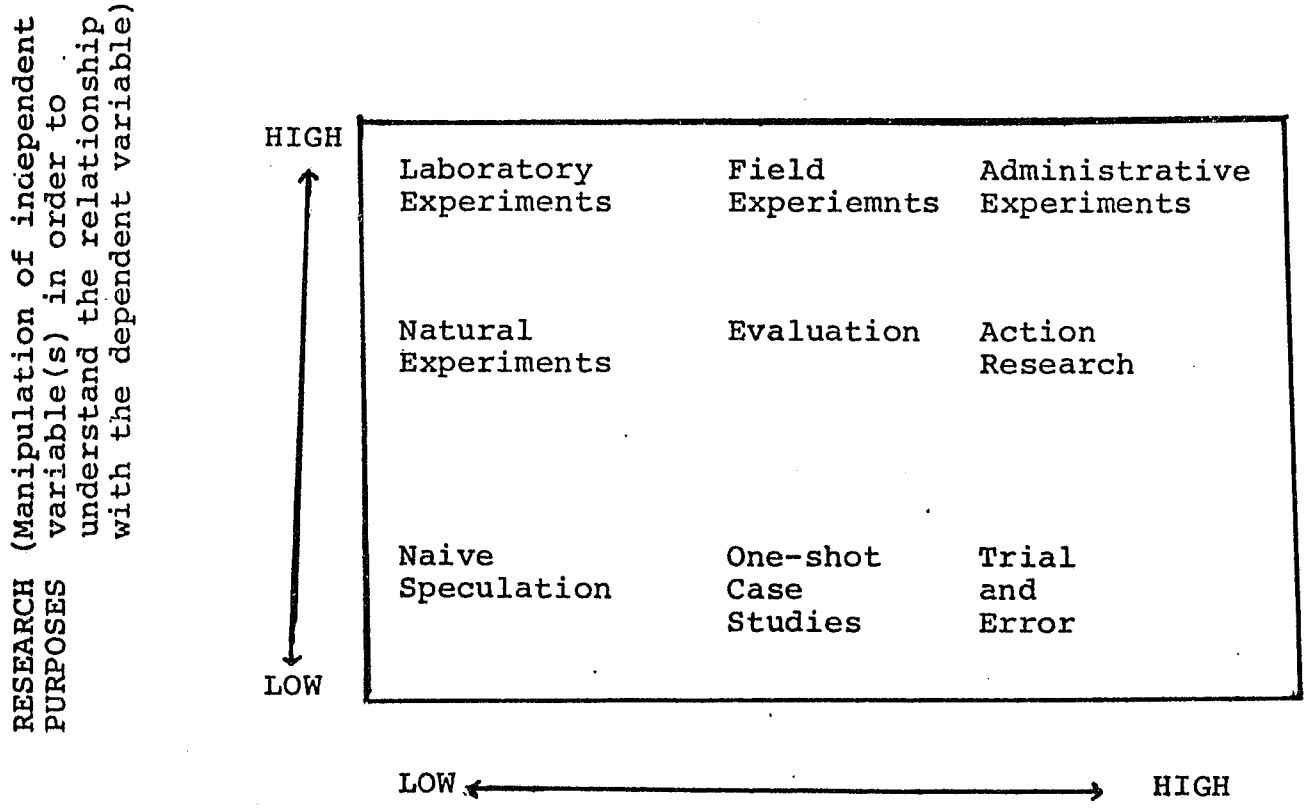
The Degree to which the Researcher Manipulates the Phenomena Under Observation



Figures 12-14 are Thompson and Rath, 1974A

Figure 15

Interrelationship of Administrative and Experimental Purposes



Thompson and Rath, 1974A

it is planned in terms of the formulated hypotheses and of the general scheme of the study. But accurate observation is difficult because: (1) what we observe is complex; (2) we have to keep in mind a number of inter-related factors; (3) our sense organs are not exempt from liability to error; (4) it is necessary to keep fact and inference apart, especially when one is engrossed in the study.

Lundberg (1942) states that:

> . . . the only difference between gathering data without an hypothesis and gathering them with one is that in the latter case we deliberately recognize the limitations of our senses and attempt to reduce their fallibility by limiting our field of investigations so as to permit a greater concentration of attention on the particular aspects which past experience leads us to believe are significant for our purpose.

3.9 Validation of Conclusion Method

Freeman (1960, p. 170) addresses the issue of valid conclusions. He states that:

> Scientific conclusions based upon experiments or upon observations involving no experimentation can be regarded as valid only if (a) the work has been correctly planned, (b) if the plan has been correctly carried out, (c) if the conclusions are in conformity with the results, and (d) if no adequate alternative explanation of the results appear possible.

He further states:

> There are many cases where the research conducted cannot be put into such convenient form, because the results are quite unpredictable; nevertheless, in such cases an effort must be made to form final conclusions. Conclusions formed under such unfavorable conditions may prove to be demonstrably valid, or may be merely those most likely to be correct. In the latter event it is still desirable to examine the

> validity of the conclusions, not in order to establish such validity, but to establish whether validity may be regarded as highly likely. (p. 171)

Your E's (observations) at the initial, interim, and the final stage require stable measures. However, if t's are difficult to measure, then it may be appropriate to change the relationship by shortening the "chain of events" of the desired phenomenon. For examples of simplifying process, Planek (1970) is a good source.

3.10 Planning Sequence Algorithm

Mullins (1971, p. 141) states some rules to follow in sequence planning which are:

- Rule 8.1 Formulate your problem
- Rule 8.2 Systematize your problem
- Rule 8.3 Gather information about your problem and possible solutions during your planning time
- Rule 8.4 After your initial study, determine your alternative solutions, propose at least two alternative routes to solving your problem
- Rule 8.5 Identify those concept-variable units in your proto-theory on which you can have an effect. Estimate (1) the length of time necessary to effect desired changes and (2) how large those changes will be
- Rule 8.6 For variables over which you have no control, (1) predict their future levels, (2) monitor the important ones, and/or (3) do research for better predictors and possible tools for manipulation
- Rule 8.7 Implement your plan
- Rule 8.8 Evaluate your implementation, using the following steps:
  - a) Determine the goals to be assessed
  - b) Determine the content and size of change desired
  - c) Identify the affected population
  - d) Assess the specific problems with the project

e) Determine the means you will use for producing change, describe it, and standardize the description
f) Select the kind of information you need

Rule 8.9 Establish a control group for testing programs or plans

(Note: Rule 8.9 is not always possible when doing exploratory research.)

Rule 8.10 a) Use concepts from more than one discipline
b) Assure public access to the entire operation.

Mullins (1971, p. 117) states with respect to measurement that it is particularly difficult to state a set of hard and fast rules for the quantification of measurement. As Ackoff (1962, p. 179) has pointed out,

> We can spend an indefinite amount of time trying to specify a set of operations which define measurement. History has shown that such efforts are fruitless, since the operations of measurement are changing and developing progressively as are all other types of scientific operations . . . We can define [measurement] as a process whose output can be used in a particular way . . . it is a way of obtaining symbols to represent the properties of objects, events, or states, which symbols have the same relevant relationship to each other as do the things which are represented.

Mullins (1971, p. 118) further points out,

> (1) Different theories need different levels of measurement. If a measurement technique's sole value is to distinguish among two kinds of items (e.g., it acts as an on-off switch), then it can be used only for dichotonomous variables. If two or more ordered subconcepts exist, then the classifications composing the associated variable must be ordered, and ordinal statistics must be used for functions. (2) Different measurements are sensitive to different situations. Rules developed by methodologists for use with certain measurement techniques reflect a theory about how those techniques work. Major disturbing influences should be avoided.

Rule 7.5 states that:

[A] proper statement of a measure should include: a) what

> is to be observed; b) conditions under which it should be observed; c) what measurement operations, if any, should be made; d) what instruments and metrics are to be used.

Rule 7.6 states, "Describe the capabilities you are demanding of each measure; see to it that the measure fulfills them."

He further states that these criteria do not guarantee that your measurement will measure only one property and in an appropriate fashion, but they do guarantee that another investigator looking at your results can discern what you did.

The main consideration is the unit of measure. According to Feinstein (1967, p. 43) that

> . . . every time the unit of observations is changed, the forms and functions of the new unit are different from those present before. If an investigator wants to study the forms and functions of that new unit, he must correspondingly change his techniques of observation.

He goes further to illustrate this point by discussing the observation of studying patients' illnesses.

> . . . by observing the illness of his patients, by categorizing the observations, by analyzing the content of the categories, by storing information in his memory, and by later retrieving the data selectively when he engages in the reasoning processes of judgment.

According to the phenomena under observation, our method or technique for observing differs from one phenomenon to another.

3.11 Search Principles

Wilson (1957, pp. 140-142) states that search principles include the following:

1. Know as much as possible about the object of the search.
2. Prove, if possible, that the object exists in the area to be searched.
3. Use of the most efficient method of detection. The first principle of search--know the properties of the object--provides the basis on which to choose the method of detection.
4. Be sure you would see the object if it were encountered.
5. Be sure you would not see the object when it is not there.
6. Search systematically instead of haphazardly. The path of the search should be planned in advance, although the plan should be sufficiently flexible to allow for modification in the light of later knowledge. Those with power to alter the plan should be well aware of the reason for the original choice.
7. If possible, devise a way of determining the approximate direction and distance of the object at every point of search.
8. In many-dimensional problems it is usually necessary to devise a one-dimensional path.
9. If possible, mark the starting point, and record the path actually followed.
10. Use convergent procedures.
11. Search the most probable place first.
12. Distribute the available time, facilities, or report in reasonable proportions in different regions.
13. Take into account the finite probability of missing the object or passing by it.
14. Consider any effect the search procedure might have on the search object.

CONTINUED

1 OF 2

CHAPTER IV

AN EXPLORATORY RESEARCH PROCESS MODEL

4.0 Introduction

In this chapter we attempt to lay out the issues and concerns which are crucial in understanding the process; providing ways to handle these issues and a checklist as a guide. Attention is given to the development stages of the process and our proposed model of exploratory research.

4.1 Common Elements of the Process

Tying together the components of the process, the exploratory process consists of:

(1) Problem formulation and selection

(2) Objective of the research purpose

(3) Purpose of data to be collected and techniques.

4.1.2 Problem Formulation

Problem formulation is crucial to the process. By this I mean, you have to have some intuitive hunches, insights, or experience (prior or indirect, or direct) with the problem selected. This prior knowledge, however limited, sets the stage for the continuous process of exploratory research. At time E_i several questions have to be answered or should be answered.

A. What are the possible critical independent, dependent, and parametric variables for the problem selected?

B. Among the probable variables which are "significant" with regard to the problem?

C. For a combination of scenarios along the exploratory⟷ a priori dimension, what is the basis for choice?

Now that the problem formulation phase has been discussed and various frameworks for conceptually dealing with many kinds of phenomena, what is the next step to consider? The writer is interested in dealing with the following kinds of problems:

(1) How does one face a low confidence initial position with a need to make giant steps towards a specified E_e, e.g., what went on? What is going on? What are the critical independent variables and dependent variables (variables, parameters)? What are the (probable) relations? Which are "significant?" The concern is that we may have no choice, and may not have the time and resources to leisurely approach a priori proposition testing.

(2) You have a number of epistemological scenarios, some of which are spread along exploratory⟷ a priori dimensions; what is the strategy for operationalizing these; what is the basis for choice? Some considerations may be based on:

(a) what confidence you want or need

(b) what confidence you start with and/or available resources in time and dollars.

Note all of these are in relation to E_e and/or E_i, which are respectively the end event of the problem and/or initial event of the problem.

For example, a search problem. What kinds of information will you need in order to make a rational decision about a problem? Such questions relate to the quality of your theory about a given problem because if you know how things fit together, you should be

able to determine what data you will need to predict outcomes. Search questions are very difficult when you know that your theory is not quite right and your available data somewhat inaccurate.

(3) Is it a one-stage or two-stage process required to formulate the problem?

Note: We do not know enough to do a priori research; therefore we need to:

(a) restate the state-of-the-art

(b) explain how our research will improve our ability to do a priori research.

(4) Do we change perspective as we do exploratory research?

Note: Is it a "new" phenomenon, such as undiscovered island, or the far side of the moon, or a "breakthrough" in science?

(5) Does our level of confidence need changing?

Note: Do we have an absence of "theory"--thus use a random walk approach?

(6) Problem to be considered separately:

(a) preoccupied with "gathering data" therefore one needs a preliminary or problem defining stage:

i) review the state-of-the-art

ii) get familiar with the territory

iii) have some preliminary strategy

iv) have some idea of where you want to go, and/or why

v) have some sense of time and available resources

(b) preoccupied with building large piles of findings

Note: Probably need monograph relating the number of variables and parameters to data needs (information of theoretical

models for reducing uncertainty). However, if the information could be characterized as exploratory, then proceed to reiterate through the above steps until some possible, feasible problem is identified.

(7) Does a systematic framework exist for different phenomena?

Note: Systematically different phenomena have the following characteristics:

(a) has previously been traced (so that you have fact experience and possible correlation of success)

(b) others interested in parts of the stages which include program and available records

(c) does the phenomena leave hard traces?

i) direct

ii) indirect

(d) different phenomena may be considered as unique to:

i) misprinted stamps

ii) gossip or rumor

iii) intelligence data gathering

Additional questions to be answered:

i) is there a "better" framework to characterize the phenomena?

ii) is there one (or more) strategy(ies) given you can categorize the problem within the framework?

iii) are there techniques for analysis of "samples"--"neighborliness," "pattern recognition," joint inclusion and/or exclusion, trace elements, etc., to use (or inventory of tools).

The above lists consist of the relevant components of the exploratory process. These are the kinds of things which are pertinent to the exploratory←→a priori research process.

4.2 Kinds of Things to Consider

Below you will see a list of things which characterize the exploratory a priori research process. From each case, you have the essential components of the process. It provides or proposes ways for looking at different phenomenological problems.

Case (a)--Looking for a very specific thing (i.e., "a priori," but a) have trouble with identifying the independent and/or dependent variable; b) have trouble with parameters.

Case (b)--Looking for a very specific thing and know a priori so that you have an (a) problem.

Case (c)--Looking for a lot of very specific things (and expect to do superficial job because of time, cost, etc.).

Case (d)--Looking for things in general and/or may go to the above mode which includes the "specific thing" called "something new."

Case (e)--Combinations of (a), (b), (c) and (d).

The above cases are specific ways of approaching exploratory and a priori proposition testing. The case description is an attempt to provide a conceptual framework for designing what information is needed, which research design is most appropriate, and what you can expect with respect to clues and some possible advantages and disadvantages that there are with the process.

Below are characteristics of the cases in terms of observations and referent. The problem is going from the referent to the observation in

the "real" world or going from the observation to the referent.

Bross's model portrays the phenomenon of measuring the referent and the observation in which you may or may not be measuring what you think you are measuring. You are attempting to make a one-to-one correspondance between observation and referent.

4.3 Observation of Comparisons

This reflects Section 4.1 in terms of observations and referents. Case (a) comparison of observation to the referent. You are looking for stable, systematic relationships which in themselves are a priori, so it is looking at prior observations in X, Y, Z where E_i is some information on a specific phenomenon. It is descriptive because you compare against your a priori (which is a standard). It is also comparing observations in general to your a priori.

Case (b) comparison of referent to the observation. You are looking for "related phenomena"--comparing it with other observations (at this point, independent variables and parameters merge or are indistinguishable, or of equal value--i.e., can treat any phenomenon as either).

(1) E_i is information in your a priori on the phenomenon and you want to find observations to be the same in X, Y, Z at time t_1.

Also, you may be comparing observations against and/or to observations, but here we are looking for stable systematic relationships, which are themselves a priori, so would be a 1).

So with 1), first examine your E's in time and space and find tools to "measure" record, etc. Second, examine your a priori for "sets" within the range of the above to suggest referent, additional measures, which E's are critical, adjacent observations (possible parameters, etc.). Third, reiterate.

The above 1) may be considered as the diagnostic step or background step. If time and space are critical, you have to have some provision for fragile data which are a pre-study or observation step for a problem.

The pre-steps do this:

(1) Determine if the data are fragile; e.g., need to get in fast and not contaminate the phenomenon

(2) Determine kind of tools and/or preparation one needs to reach the first step effectively, efficiently, etc.

(3) Determine what information one needs for the step that follows, and the next.

The above 2) allows one to do the following:

(1) First examine the "set" in your a priori ranges of acceptable (or expected) measurements (and induction, etc.) and possible adjacent observations; e.g., outtrapping parameters. Second, observe E's in time and space (have X, Y, Z, t uncertainty, so you may have to look for other search techniques or processes).

4.4 Objective of the Research Program

The objective of the research purpose may include:

(a) identifying systematic relationships between independent variable and dependent variable

(b) closing the gap between what is desired and what is available

(c) obtaining accurate observation of the phenomena, etc.

The sequence of observing and defining how to measure the phenomenon of interest hinges on the characteristics of that phenomenon. One's intuitive hunches, literature review, experience survey and level of confidence provide the necessary preliminary step in approaching the exploratory

a priori research.

4.5 Characteristic Descriptions of the Phenomenon

Description 1. E_1 is information in your a priori on the phenomenon and you want to find observations which are the same in X, Y, Z at time t_1. Here you are looking for any other phenomenon that looks, or has the characteristics of, the phenomenon of interest.

Description 2. E_i and t_i are observations that are stable. Looking for systematic relationships which reflect your a priori where you are comparing the observations against prior observations of the phenomenon of interest.

Your a priori on the phenomenon in terms of prior observations or research indicate some salient relationships; you know what you can expect to find; you have clues as to what are the relevant variables, hypotheses, theories, etc. Because of this prior information, you are able either to do "rigorous" experimentation or to do "less rigorous" experimentation. In the first case you are strictly confident based upon what you know about the phenomenon in the initial stage and in the second case your initial stage of the inquiry may aid you in approaching a higher level of confidence about the phenomenon of interest.

4.6 The Exploratory Approach

The exploratory approach is a prelude to proposition testing; however, proposition testing with a low level of confidence is late exploratory research. The level of confidence, prior information on the state of the art, the stability of the phenomenon under observation, the ease or difficulty in measurement, and the need to accurately know the relevant relation-

ship are ways of oscillating from the referent to the observation and observation of the referent. The process of oscillating from the referent to observation or vice versa determines to some extent your research mode. Within the exploratory or a priori mode, the researcher continues to be in both modes simultaneously but at different stages in the research process.

4.7 Process Considerations

In order to include the relevant element of the process for exploratory a priori research, one must take into consideration the following:

(1) what to look for

(2) is the object or observation stable?

(3) are there traceable measures?

(4) does the phenomenon of interest behave in a normal fashion?

(5) is the thing you are looking for or at "specific," "general" or "something new?"

The critical observations must take into account the stability, instability, the specific and the general thing you are looking for. Your measurement instrument should be capable of handling or measuring those crucial, critical observations of that phenomenon.

The approach in looking for something specific can be reiterated to include the very general thing of interest. If a multi-trait method is used, then it can be subdivided into stages so as to capture the "specific" or "general" thing of interest.

For those observations where the measure can contaminate the object, then you will need fast, quick measurements which will change the behavior of the phenomenon. In other instances you have to plan in advance how to measure those variables which will slip away with the passage of time and

are lost. You can only do this if you know that it is a fragile observation or less stable in the sense it will not be present in some recognizable form in the future.

Therefore, whether you are controlling for plausible rival hypotheses or measuring those fragile and less stable events, planning for the events and providing the necessary measurement technique is a must.

4.8 The Exploratory Process

The exploratory process is concerned with three types of things:

(1) Kinds of Situations

(2) Kinds of Techniques

(3) Kinds of Objectives

The researcher's ability to operationalize the three things above is based upon his prior successful experience with them. For certain unstructured problems, he may have dealt with some specific techniques which were appropriate for a particular kind of situation or problem. His successful experience may be indirect in that some one else tried a certain procedure, technique or method and found it to be appropriate for problem "X". This provides the researcher with prior information on problem "X" which may be useful. However, the present state-of-the-art on exploratory research is very normative in that the method, technique or procedure may be considered "good" or "bad" depending upon the researcher's "value" or confidence of what is good and what is not an acceptable method or practice in research. The exploratory process may be thought of as an undefined process based upon a prior review of the literature. Each researcher has his or her own way of defining, formulating, conceptualizing and designing the research effort. This is to be expected. But the exploratory process does not

stand alone. It is a continuous process in that it is a prelude to rigorous control designs.

At this time, a proposed model of the exploratory research process will be presented. The components of the process are diagnostic, refinement or reformulation, applicable methods and results reporting.

4.9 Definitions of the Components of the Process

An exploratory research process may be defined as a decision process in that we estimate or predict, in advance, the kind of information we will need in order to arrive at some specified desired end point. It is a search strategy for optimizing our effort to achieve the research objective; knowing in advance that our search for feasible alternatives is sub-optimal. In order for the information search to be useful, it must aid us in determining alternative courses of action based upon our research objectives.

The purpose of an exploratory research process is to provide the researcher with a possible plan of action which will minimize the amount of time and energy wasted in unfruitful searches.

Components of the exploratory research process are (1) diagnosis, (2) refinement and/or reformulation, (3) applicable methods, and (4) results reporting.

The research diagnosis process may be defined as formulating, selecting, designing and implementing the research objective. We stress, stating in advance, as much as possible, all of the relevant components of the research effort; looking at where you are and where you would like to be with respect to the specified desired end point. By working from the specified or desired end point, you are able to determine the appropriate data collection and analysis techniques, a proper plan of action for

concisely operationalizing important concepts from the problem chosen and formulated. Also, deciding upon what aspect of the problem you want to address and the feasibility of achieving results.

The research refinement or reformulation process may be defined as those necessary changes which will improve upon the researcher's ability to enhance the research design. These changes are based upon new relevant information, insight, and intuitive or normative judgment from some other source. The purpose of the refinement or reformulation process is to identify those techniques which are appropriate for certain kinds of unstructured or structured problems of interest.

The applicable method process may be defined as those parametric or non-parametric statistical analyses which are appropriate for particular kinds of research design concerns. We stress that the research method and the statistical underlying assumption should not violate one another. Oftentimes, the researcher violates certain underlying statistical assumptions which results in non-sense as far as interpreting the data collected.

The results reporting process may be defined as those methods which maximize the amount of new information added as a result of examining certain aspects of the problem formulated. The purpose of the results reporting process is to provide clues to appropriate methods for specific unstructured problems (see Figure 16, p. 104).

4.10 Developmental Stages of the Process

Fundamentally, there are three stages: early, middle and late.

Stage I - The early exploratory stage: Is the teasing out of any relationships.

Stage II - The middle exploratory stage: Is to examine selectively some specific relationships.

Stage III - The late exploratory stage: Is the direct preparation for a priori proposition testing.

Within the stages is the decision to select among various alternative courses of action for the research design. In order to decide upon the research design, several things are to be considered:

(1) setting out the objective to be pursued

(2) attempting to discover what are the relevant alternatives

(3) ascertaining the consequences that will arise if a course of action is adopted and discovering the relationships between selected courses of action and outcomes

(4) evaluating outcomes in terms of objectives to be achieved

(5) the decision to pursue one course of action in terms of alternative designs over another.

4.11 Some Possible Characteristics of Exploratory⟷A Priori Proposition Testing

Exploratory Research⟷A Priori Proposition Testing

(1) Information with respect to phenomena of interest

Little prior knowledge ⟷ much prior knowledge

No prior experience ⟷ some prior experience

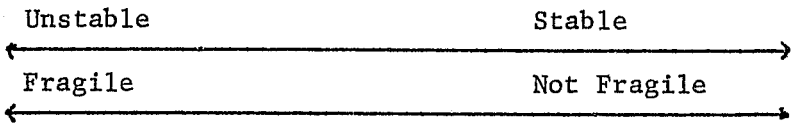
(2) Research objective with respect to phenomena of interest

Implicit ⟷ Explicit

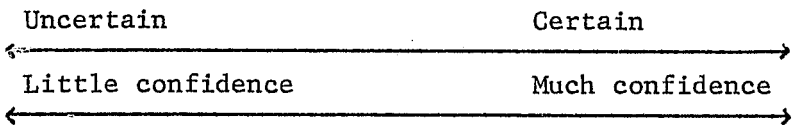
General ⟷ Specific

Abstract ⟷ Concrete

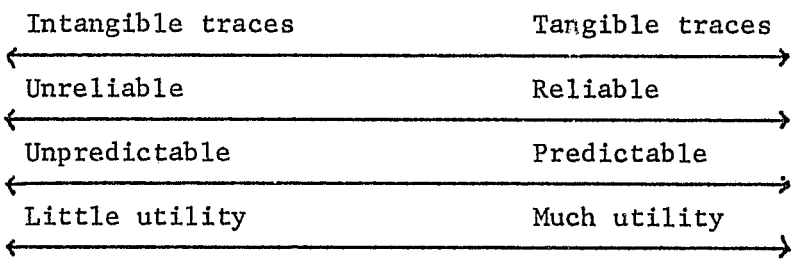
(3) Observation with respect to phenomena of interest



(4) Appropriate method with respect to phenomena of interest



(5) Sensitivity with respect to measurement instrument



The sequence of observing and determining the appropriate method for measuring the phenomenon of interest hinges on the characteristics of the phenomenon and how the problem is formulated and operationalized with respect to the research objective.

The preliminary steps for determining specific issues of concern are based upon one's intuitive hunches, literature review, experience survey and our level of confidence that we can achieve the desired end result of the research effort.

4.12 Exploratory or Pre-Experimental Designs

Exploratory or pre-experimental designs may be considered as (1) One-Shot Case Study, (2) One Group Pretest-Posttest Design, and (3) Static Group Comparison. For these kinds of designs we are not overly concerned about internal and external validity issues such as: History, Maturation, Testing, Instrumentation, Statistical Regression, Biases resulting in

differential selection of respondents for the comparison group, experimental mortality, reactive or interactive effect of teasing, the interactive effect of selection biases and the experimental variable, reactive effects of experimental arrangement, or multiple-treatment interferences. (For discussion of internal-external validity issues, see Campbell and Stanley, 1966.) However, for true experimental designs these are crucial in our consideration of control issues, statistical analyses and credible results. Also see our discussion on rigorous control issues, Section 1.4.

Before designing an exploratory study, the researcher should attempt to determine from Tables 1 to 4 which stage he is operating in, in order to identify trouble spots in the design more readily and to improve upon the method or strategy for carrying out the research effort.

If your E's (observations) at the initial, interim, and the final stage require stable measures and if the E's are difficult to measure, then it may be appropriate to change the relationship by shortening the chain of events of the desired phenomenon (see Planek, 1970).

4.13 A Checklist of Things to Consider When Doing Exploratory Research

(1) Predetermining the effect of new data on your results (Thompson).

(2) State plausible rival hypotheses (parameters) with respect to the problem formulated.

(3) State relevant events or variables with respect to the problem, if possible.

(4) Determine how data on the phenomena are to be collected.

(a) Does anyone or thing have the information with respect to the variables you want to get information about

(b) Decide on the data which need to be collected based upon

TABLE 1

STAGES AND SITUATIONS

Stages	Kinds of Situations	Kinds of Techniques	Kinds of Objectives
STAGE I (Is the teasing out of any relationships)	Diagnosis - Problem selected - Problem formulated - Operationalizing concepts - Specify plan of action	Applicable methods	Specify objectives
STAGE II (Is to examine selectively some specific relationships)	- Determine what you need to know with respect to the problem		
STAGE III (Is direct preparation for a priori proposition testing)	Same as above	Same as above	Same as above

TABLE 2

STAGES AND PROCESS

Stage	PROCESS	Kinds of Objectives	Kinds of Techniques	Kinds of Situations
Stage I	RESULTS REPORTING	Normative	Normative	Normative
	APPLICABLE METHODS	Systems analysis	Non-parametric statistics	Systems analysis
	REFINEMENT OR REFORMULATION	Systems analysis	Contingency analysis	Systems analysis
	DIAGNOSIS	General abstract	Descriptive prescriptive	Unstable and intangible
Stage II	RESULTS REPORTING	Subjective	Subjective	Subjective
	APPLICABLE METHODS	Systems analysis	Correlation analysis	Systems analysis
	REFINEMENT OR REFORMULATION	Systems analysis	Systems analysis	Systems analysis
	DIAGNOSIS	Systems analysis	Systems analysis	Interaction and reactive
Stage III	RESULTS REPORTING	Objective	Objective	Objective
	APPLICABLE METHODS	Concrete	Parametric statistics	Systems analysis
	REFINEMENT OR REFORMULATION	Systems analysis	Cost benefit analysis	Systems analysis
	DIAGNOSIS	Systems analysis	Systems analysis	Causal relationship

TABLE 3

PROCESS AND STAGES

DIAGNOSIS	Problem is formulated based upon your intuitive hunches, trial and error, or experience survey.	From a preliminary of stage one, some specifics have been identified; therefore, follow through in redefining the problem.	The problem is formulated from the feasible choices found in stage two.
REFINEMENT OR REFORMULATION	Apply the Systems Analysis Paradigm	Apply the Systems Analysis Paradigm	Apply the Systems Analysis Paradigm to the research design.
APPLICABLE METHODS*	One-Shot Case Study; One Group Pretest-Posttest; Static Group Comparison	Ex post facto; correlational counter-balance design	Pretest-Posttest Control Group; Posttest-Only Control Group; Solomon Four Group Design "Patched-Up" Design
RESULTS REPORTING	Descriptive	Descriptive	Objective
	Stage I (is the teasing out of any relationships)	Stage II (is examining selectively some specific relationships)	Stage III (is the direct preparation for a priori proposition testing)

*See Campbell and Stanley, 1966, for their discussion on the above designs.

TABLE 4

GENERAL FORM OF THE PROCESS

	Data Concerns	Data Analysis Techniques	Data Collection Techniques
Stage I	Do not know what to measure or how.	Generally, the techniques used are narrative or summaries of what was collected.	Interviews; participants observation; institutional records; informants; open-ended questionnaires
Stage II	Have some idea of what to measure and how; but have difficulties in doing it	Prescriptive analysis	Subjective approaches to data collection
Stage III	Know what to measure and have some possible available appropriate methods	Inductive and/or deductive inferences are used by applying parametric statistics	Normative and/or subjective approaches to data collection

what you are looking for.

(c) Once you have decided on the type of data to be collected, then determine how you will get the information.

(d) What insights do you have with respect to the potential data that is to be collected or could you get by discussing the potential data with someone else and decide how you will connect the information together with respect to the problem.

(e) The quality of data to be collected will be predetermined by the problem.

(f) Decide upon the usefulness of the data to you or the person(s) who will use your results.

(g) Predetermine the gap between the starting point and where you would like to be or claim as a result of the investigation will determine the quality of the data needed even though you are exploring the phenomena.

(5) What do you perceive that you will need to know about the problem with respect to some end point.

(a) What is known about the problem at the present time?

(b) What type of results would be useful to know about the problem: how different variables relate to specific insights into the problem?

(c) What are potentially useful or interesting variables that are of concern with respect to the problem?

(d) What potential relationships would be useful to learn from exploring the problem?

(e) Review of the related discipline literature with respect to the problem or other pertinent literature or adjacent

disciplines.

(f) Survey people who have had practical experience with the problem or study.

(g) Determine from the search or discussion the frequency with which some things occur or with which it is associated with something else.

(h) What are the characteristics of the problem, are there overlaps, what things can be chunked together for purposes of showing relationships?

(i) As a consequence of the reviewing the literature and other person, how familiar are you with the phenomena now or do you feel that you need to explore the relationships of the problem with someone else who is not familiar with the problem to determine if the relationships developed seem logical which may give insight as to how the things are related?

(6) Identify sound questions, promising concepts, and preliminary hypotheses that have not been developed (Festinger).

(7) Determine how to gain insights and propositions from a case, which had similar problems related to the phenomena.

(8) Narrow down and explore the relationship among the variables of interest (see Tables 1-4, pp. 97-100).

(9) Determine the salient variables or relationships among the ones already selected.

(10) Go over the elements of the problem and study the relationship.

(11) From #10, do you see any potential solution or way to investigate the relationship with respect to the problem formulated?

(12) Do you see any flaws in the relationships with potential variables of interest?

(13) Begin to chunk various relationships together.

(14) Articulate all the above into possible theory, hypotheses, and what you expect to find out as a result of the investigation of the phenomena.

(15) State your hypotheses, if that is your purpose.

(16) State your theory of the relationships, if that is of interest.

(17) Restate the problem in at least three different forms.

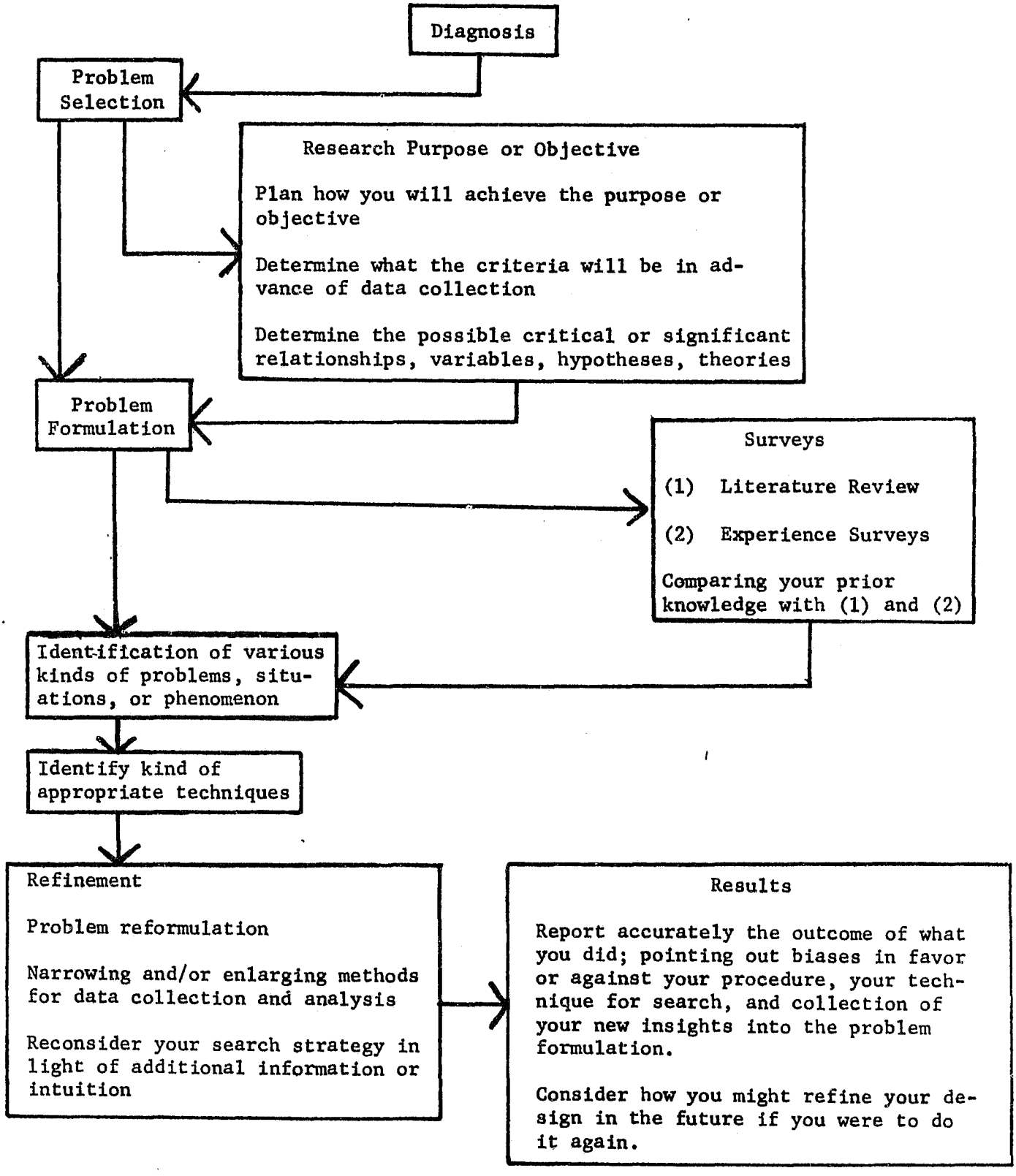
(18) From #17, does the restating of the problem alter your hypotheses, theory or change your confidence in your understanding of the relationship?

(19) Want to list all variables of interest with respect to problem.

(20) What is the structure of the relationship?

(21) Fully lay out your plans as much as possible. This will enable you to keep track of what happened, what changes were made and why. You will get clues as to where you need to alter, drop, or see potential trouble spots.

Figure 16



An Exploratory Research Process Model

CHAPTER V

THE TRUST PROJECT

5.0 Introduction

In this chapter we address the problem of applying the exploratory research process model to the TRUST effort. What we propose to do is to describe the stages and the components of the process in terms of the TRUST project, followed by a discussion of what happened.

5.1 Background Information

Browne (1976, p. 3) states that the

> Council on Population and Environment (referred to as COPE) was organized in 1969 to convene the First National Congress on Optimum Population and Environment. The Congress was held in Chicago in 1970 with about one thousand persons from all walks of life in attendance. . . . several factors helped determine the nature of COPE's next undertaking with interactive media which was the TRUST project. Because of the experience with the RTA program, COPE saw the possibilities of using the interactive media process as a catalyst for effecting citizen participation in public policy decision making.

In 1974 TRUST developed a Criminal Justice Project on crime, personal safety, and the criminal justice system. Their approach was to involve citizens in discussing public policy issues that concerned them. The use of the media was seen as an appropriate tool to stimulate such discussions.

The Chicago area was confronted with an alarming increase in crime as were other metropolitan areas. The criminal justice manpower and technology had been repeatedly beefed-up but to little avail. Therefore, in response to this situation the project was funded. The writer's interest in the

project was based upon its exploratory approach to the problem and tracing "the impact of a specific program on large and/or diffuse systems [which] present considerable problem [to that] specific program." In the initial planning, one approach which was considered included:

(1) To concentrate attention on the decision making process in terms of the decision makers and the information they received (see Weiss' dissertation, 1976).

(2) Depending upon the proposed change, the "decision makers" could possibly include: (a) the participants themselves; neighbors or others with whom they have pre-existing or "new" formal associations; officers or leaders of pre-existing or "new" formal groups with which the participants may (or may not) be associated.

The process of identification is iterative: initial identification through participants or other sources of information; progressive weighting and evaluation; and recycle (Note 10, p. 3).

TRUST (To Reshape Urban Systems Together), formerly known as COPE (Council on Population and Environment), first interactive media project was organized in cooperation with WTTW-Channel 11, Chicago's public broadcasting television station. WTTW produced a special entitled, "You Can Get There From Here," which was an hour-long program that focused on issues related to the proposed Regional Transportation Authority (RTA). The Council coordinated numerous community organizations that assisted in selecting the issues, designing a ballot, and distributing copies of it throughout the metropolitan Chicago area. (For more information on the history of TRUST, see Browne's dissertation, 1976).

Their second interactive media project was funded by the Law Enforcement Assistance Administration. The project involved local community members

who were recruited by COPE to form viewer discussion groups; these groups watching four half-hour shows, one per week, and then discussing them afterwards.

The purpose of the proposal to LEAA was to describe the process in organizing citizen participation groups in order to facilitate similar groups in the future in communities' issues, improve communication between citizens, experts, and professionals so as to bring about constructive results, and strengthen support for cooperating organizations and their programs (Quarterly Report, p. 2, 1976).

5.2 Stage I (The teasing out of any relationships)

The TRUST effort in terms of the components of the process.

(1) Diagnosis consists of

(a) Purpose of the project was to describe the process of organizing citizen participation groups in order to facilitate similar groups in the future in community issues, improve communication between citizens, experts, and professionals so as to bring about constructive results, and strengthen support for cooperating organizations and their programs.

(b) Objective of the project was to conduct an evaluation of the above purpose. This effort was divided into three tasks: program evaluation, impact on subsequent behavior of participants, and impact on the criminal justice system.

(c) Formulation of the problem which was identifying decision makers in the criminal justice system who generated change in that system; identifying those relevant or those reasons

why participants participated in the project; and evaluating the intervention: a four-part documentary film, "And Justice For All."

(d) The problem selected was citizen participation groups with respect to the use of the media to conduce change in their behavior towards the criminal justice system.

(2) Refinement and/or reformulation involved using information that was already in existence about community groups in order to organize groups with viewer discussion leaders. The viewer discussion leaders and the participants were followed up on by using questionnaires designed to measure some of the consequences of the intervention (see Browne, 1976). From the questionnaires, subsequent activities of groups could be identified with respect to the criminal justice system (see Weiss, 1976).

(3) Applicable methods for the interactive media project included telephone interviews, open-ended questionnaires, and personal interviews. Frequency distributions summarized the data collected. There were pretest-posttest questions designed to evaluate how well the program was carried out.

(4) Results reporting included a descriptive evaluation of the interactive media project and how to most effectively organize citizen groups.

In each additional stage, the process may be intensified by narrowing down the chain of events which followed the intervention.

5.3 Stage II (Is examining selectively some specific relationship)

(1) Diagnosis consisted of following through on those groups which

were identified as having some activity which could be contributed to the efforts of the project.

(2) Refinement consisted of narrowing down of the specific groups of interest with respect to particular activity.

(3) Applicable methods consisted of trial-and-error, intuitive hunches and using the knowledge of the experts in an attempt to address the unstructured aspect of the problem in order to develop theory on the process and provide some methods for future groups who might be interested in running a project like the interactive media mentioned earlier.

(4) Results reporting consisted of descriptive statements on how to locate subsequent effects on participants.

5.4 State III (Is the direct preparation for a priori proposition testing)

(1) Diagnosis in Stage III would have consisted of testing the relationship between the independent variable and the dependent variable.

(2) Refinement could have consisted of shortening the chain of events by specifying some feasible or tangible problem that could be related to the subsequent effects on participants.

(3) Applicable methods would have included control groups with before and after measures to evaluate the effects of viewer discussion groups.

(4) Results reporting would have consisted of significant statistical reporting.

The remaining discussion will depict some of the prior planning which went into the design of the intervention and what was captured or lost in

the process of implementing the plan.

Thompson suggested in the early stages of the project how to identify potential groups which, in a broader sense, include more than groups which were in existence prior to or at the time of the interactive media project and which could be identified by records of individual activity during one or more of the phases of the program. Other "participants" may have included the following:

(a) Pre-existing groups whose participation were not reported in the several project records.

(b) Individuals who participated but did not report their membership in a pre-existing group.

(c) Individuals who participated who subsequently joined or became active in pre-existing groups which have not been identified.

(d) Individuals who participated who subsequently joined newly created groups.

(e) Individuals who participated whose subsequent activities were individual rather than group based.

(f) Individuals and groups whose "participation" were less direct.

Another dimension of "subsequent behavior" may have included activities which could have been traced to the interactive media project but not necessarily from the group or direct participation. For example, the films and the supporting materials have been used by groups subsequent to the main showing. In addition to subsequent behavior as a result of this use of the products, other potential areas of follow-up may have included:

(a) Effects on individuals and groups who were active in the initiation and planning of the interactive media project; e.g., planning or carrying out of related activities.

(b) Effects on individuals and groups who were active in the review and approval process; e.g., ILEC, CCCCJS, etc.

(c) Effects on non-participating individuals and groups who have subsequently observed the "effects" of the interactive project.

This listing of potential "subsequent effects" suggests that not only the direct impact upon participants but also the progressively diffuse effects, some derived from secondary characteristics of the project, present a complex and difficult problem in identification and evaluation. It would seem clear that something more than self-serving assertions of "success" and opportunistic anecdotal sampling would be desirable, and something less than a comprehensive historical inventory can be accomplished. One possibility is to prepare a formal model of the set of possible non-trivial effects, and to identify the potential sources for systematic sampling, both through tracing forward and backward, within the context of a planned exploratory research approach, drawing upon methods used in diffusion research, and related areas (Progress Report 2, 1975, p. 5).

In attempting to know what are the relevant or critical subsequent effects of a program, intervention, or impact on participants, strategic planning for capturing those effects are crucial. But how does one map out such a plan and what are the appropriate methods or procedures for accomplishing such an effort? First, one needs to know what type of effect to look for; second, how to measure the effects, if in fact such effects exist; third, what can one reasonably expect to find based upon objectives and criteria of a program, project, or intervention; fourth, how to locate data points from the initial phase throughout the program or project; fifth, how will those responsible for gathering the data be monitored to determine if the procedure that was developed is being used if it is a

critical measure of effectiveness; sixth, what standardized procedures for recording events will be used which will provide explanations of why certain procedures failed or were successful; seventh, how to handle inconsistencies, or new information, corrective steps, with respect to the reliability of the data collected.

These are some of the types of questions which have to be answered when dealing with programs of this type.

According to Thompson (Note 3, 1975), the problem of progressively identifying subsequent effects has opened the more general, and critical, question, of how one can assess the diffuse impacts of a social intervention and, in turn, the broader question of how one can distinguish, beforehand, the program, or parts of a program, which are amenable to formal, rigorous research methods from the program which provides a basis for exploratory (and/or descriptive) evaluation only.

He further states that the evaluation objectives, and requirements, for a proposed program can, and should, reflect the nature of the program and a realistic assessment of the methodologies available to carry out an evaluation. Where there are available methodologies and/or credible evaluation of the direct (or even subsequent effects) of the intervention which can be expected with reasonable expenditures which the grantee should be expected to include in his program. If he does not, information should be available to allow him to assess what can be done and, if necessary, acquire the specialized consultation necessary to provide for it. In contrast, where the nature of the program does not allow for a priori proposition testing, the evaluation should be limited to a description of what happened, plus, where appropriate, an exploratory evalustion of the effects.

It seems clear that it should be possible to distinguish the above

two cases, based upon the initial description of a proposed program. By examining the intervention and the desired impact, the nature of the parametric conditions should be roughly identified. The kinds of measures, the range of sources from which to obtain measures, and the ease or difficulty of obtaining information should provide a rough basis for estimating the likelihood of achieving credible results. If the credibility is low, an exploratory design should be examined as an alternative to increase our understanding of what happened. These questions, based upon our modeling of the process, appear to be not only important but possible subjects to useful answers (Note 2, 1976).

Thompson and Rath (1973, p. 5) say that a well-formulated problem is one in which one can tell when the problem is solved and if one has some hope of solving it. Objectives are established for the well-formulated problem. These objectives have to have some amount of measurability. The criteria are the series of measures which establish how one will tell if the objective is met. This also may include other measures dealing with spillover, with side effects which may be desirable or undesirable if one wants to evaluate making one's decision.

They also state that:

> . . . very often evaluations in the early life of a project after an event occurs can be used for corrective action. Other evaluations are made a long time after a project is finished to make an historical assessment of the quality of a project. . . That is, one should be able to use evaluation procedure on itself and the outcomes of an evaluation must be amenable to evaluation. (p. 8)

Planning involves looking at skills, tasks, organizations, and interpersonal relationships to achieve the desired future end. Control is very similar, and it involves knowing where one expects to be and where one is,

then one develops a set of changes in skills, tasks, organizational structure, and interpersonal relationships to there (Ibid., p. 8). Bennis (1968, p. 64) speaks of the above concept as involving planned change which "can be viewed as a linkage between theory and practice, between knowledge and action." It plays this role by converting variables from the basic discipline into strategic instrumentation and programs.

5.5 Subsequent Effects of the TRUST Project

The "Impact on Subsequent Behavior of Participants" was one of three tasks included in the proposal by TRUST. The purpose of this task was to determine the effect on the subsequent behavior of the participants. Potential questions of interest included whether groups were able to achieve the results which caused them to be interested in participating, whether their organizations were strengthened, whether they were able to develop bases for increasing participation, and whether they were working for change in the criminal justice system (Quarterly Report, 1975, p. 3).

To trace subsequent effects of a program required sampling of participants at different points in time: at the beginning, during and after the intervention. Some desired activity may occur immediately after the intervention for only a short duration. These activities which were started may cease shortly after only to be begun some time in the future. This occurs or may be explained in terms of the nature of a group. The initiator of the activity may be new to the organization or the initiators become heavily involved in survival issues of the organization. Once critical issues are taken care of, the initiator goes back to continue the activity started if it is purposeful to the image or need of that organization.

Another concern when addressing the issue of impact on participants

and/or their activities is the rate of turnover and commitment of its members to a specific activity.

Therefore, one cannot conclusively say that one group or organization has been inactive because the point of entry for one's measurement may not reflect present, past or future activity which may have been stimulated by an intervention. However, the more reliable the measures, the more planning put into the intervention and reliable personnel to do the work, the more one can directly or indirectly assess the effects on participants and/or organizations.

5.6 Did We Miss Anything?

From Browne's (1976) evaluation of the interactive media project and her raw data, some of the groups which had some activity could be identified. Those groups which warranted further inquiry with respect to criminal justice systems were identified and followed up on by Weiss (1976 dissertation).

Sources for identifying these particular groups included: (1) interviewing COPE's staff; (2) interviewing individual participants who gave informal feedback to the director of COPE; (3) news clips about other groups which participated in the project.

5.7 The One We Captured

There were groups which had some activity after the intervention took place. It should bé noted that these groups could not say specifically that their activity was due to the TRUST project. However, indirectly, the project provided ground for that activity (see Appendix A).

More groups became aware of groups which had interests that were

similar to their own.

The TRUST project helped organizations to become more familiar and/or active with other organizations working on criminal justice problems in that:

(1) Organizations contacted many of the agencies that were involved in the TRUST project

(2) Organizations learned about community groups working in the area of criminal justice

(3) Useful contacts were made

(4) Stimulated efforts to seek possible sources for funding

(5) Provided helpful hints to organizations on possible sources for funding

(6) Private organizations were identified which were concerned about criminal justice issues.

5.8 The Ones That Got Away

For programs like the TRUST intervention, it is difficult to measure the short-term impact on the criminal justice system. To be realistic, a small change in such a big system as the criminal justice system is difficult to measure. The only things which would make a drastic difference in the system would be that some revolutionary changes took place.

The impact of the intervention on citizen participation is also difficult to measure. If the impact is only defined for the target group which participated, then that target group would consist of long- and short-term participation. Here again, the behavior of citizens fluctuates over time. If you measure their participation at one point in time, then it is necessary to take later measures long after an intervention has taken place.

Most of the time, when that critical measure should be taken, the project has ended and no money exists to measure such subsequent behavior changes.

CHAPTER VI

SUMMARY AND CONCLUSIONS

6.1 Tying Together Loose Ends

The components of the process taken separately are not unique. All research procedures consist of these components in varying degrees depending upon the researcher's understanding, purpose, interest, and problem formulation activities. The general components of the process included:

(1) research purpose

(2) phenomenological concerns

(3) techniques (data collection, analysis and search) activities

(4) classification schemes

However, we stress the need for critically applying methods with proper understanding of the underlying theory as most useful to the process.

6.2 Summary

Our discussion and examination of exploratory research emphasized how crucial the problem formulation, choosing the problem and available techniques are to the process.

Other processes such as diagnostic, scientific, legal, medical and research processes are emphasized to show the interrelationships which exist.

Frameworks for handling complex problems were stressed such as the "cloud of variables," decision points, a priori proposition testing, confidence/utility, and systems procedures.

Alternate forms of discussing exploratory research were discussed such as pilot study, descriptive study, case study, participant observation, and

experience survey.

More important were the discussions on the various stages of exploratory research. The early, middle and late stages of the exploratory process emphasize the uniqueness of the model. It was pointed out that the early stage was the teasing out of any relationship; the middle stage was to examine selectively some relationship; and the late stage was the direct preparation for a priori proposition testing.

A checklist of things to consider when doing exploratory research was provided as a proposed procedure which would facilitate the research process.

Various models on processes, technique analyses and paradigms, and measurement procedures were presented to enhance our understanding of the problems involved in developing the process model.

6.3 Conclusion

We feel that this initial examination of exploratory research assumes that we will more critically evaluate the usefulness of exploratory studies in the future. Just as other research designs include guidelines to direct the researcher's effort, the same thing should be true for exploratory research. Partially, over my concern about the lack of activity on this issue, I felt this research effort was needed.

We are in hope that this research effort will provide more interest about this subject area; also, that stable dimensions for exploratory research will be developed. We foresee some of the advantages or long-term benefits of some stable dimensions which actually describe certain aspects of the exploratory process.

We are looking forward to the mathematical examination of the process

using pattern recognition, factor analysis and other theories in developing a mathematical model of the behavioral process of exploratory research.

BIBLIOGRAPHY

Achinstein, P. Models, analogies and theories. Philosophy of Science 31 1964: 328-350.

Ackoff, R.L. The Design of Social Research. Chicago: University of Chicago Press, 1953.

Ackoff, R.L. Scientific Methods. New York: John Wiley and Sons, Inc., 1968.

Adams, R.N., and Preiss, J.J. Human Organization Research: Field Relations and Techniques. Homewood, Ill.: Dorsey, 1960.

Alder, M.D. On theories. Philosophy of Science 40 (2), June 1973: 213-226.

Almeder, R.D. Science and idealism. Philosophy of Science 40 (2), June 1973: 242-254.

Allport, G.W., and Posman, L. The Psychology of Rumor. New York: Henry Holt and Company, 1947.

Argyris, C. Some unintended consequences of rigorous research. Psychological Bulletin 70 (3), 1968: 185-197.

Backstrom, C.M., and Hursh, G. Survey Research. Evanston, Ill.: Northwestern University Press, 1963.

Bales, R.F. Interaction Process Analysis. Reading, Mass.: Addison Wesley Publishing Company, Inc., 1950.

Barber, B., and Hirsch, W. (eds.). The Sociology of Science. New York: The Free Press of Glencoe, 1962.

Barkun, M. Law Without Sanction. New Haven: Yale University Press, 1968.

Bath University Library. Investigation into Information Requirements of the Social Sciences. Research Report No. 5. The Research Procedures of Social Scientists, November 1971.

Batten, T.F. Reasoning and Research: A Guide for Social Science Methods. Boston: Little, Brown and Company, 1971.

Bauer, R.A. Social Indicators. Cambridge, Mass.: The M.I.T. Press, 1966.

Ben-David, J. How to organize research in the social sciences. Daedalus 102, Spring 1973: 39-51.

Bender, A.A., et al. Delphic study examines developments in medicine. Future, June 1967..

Bennis, W.G., et al. The Planning of Change. New York: Holt, Rinehart and Winston, 1961.

Berelson, B., and Steiner, G.A. Human Behavior. New York: Harcourt, Brace and World, 1964.

Berstein, S.N., and Freeman, H.E. Academic and Entrepreneurial Research. New York: Russell Sage Foundation, 1975.

Beveridge, W.I.B. The Art of Scientific Investigation. New York: Vintage, 1957.

Biderman, A.D., and Sharp, L.M. Evaluation research: Procurement methods. Social Science Information II (3-4) June-August 1973: 141-170.

Bohrnstedt, G.W. Observations on the measurement of change. In G.W. Bohrnstedt and E.F. Borgatta, Sociological Methodology, San Francisco: Jossey-Bass, Inc., 1969.

Borgatta, E.F., and Bohrnstedt, G.W. Sociological Methodology. San Francisco: Jossey-Bass, Inc., 1969.

Blalock, H.M., Jr. Causal Inferences in Non-Experimental Research. Chapel Hill, N.C.: University of North Carolina Press, 1964.

Blalock, H.M., Jr. Introduction to Social Research. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1970.

Blalock, H.M., Jr. Theory Construction. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1969.

Blalock, H.M., Jr. The measurement problem: A gap between the languages of theory and research. In H.M. Blalock, Jr., and A.B. Blalock, Methodology in Social Research, New York: McGraw-Hill, 1968.

Blalock, H.M., Jr., and Blalock, A.B. Methodology in Social Research. New York: McGraw-Hill, 1968.

Blau, P.M. The Dynamics of Bureaucracy. Chicago: University of Chicago Press, 1955.

Blau, P.M. The research process in the study of the dynamics of bureaucracy. In P.E. Hammond, Sociologists at Work, New York: Basic Books, 1964.

Blau, P.M., and Scott, W.R. Formal Organizations. New York: Chandler Publishing Company, 1962.

Bloom, B.S. Evaluative Research: Strategies and Methods. Pittsburgh: American Institute for Research, 1970.

Bloom, B.S., et al. Formative and Summative Evaluation of Student Learning. New York: McGraw-Hill, 1971.

Bloom, B.S., and Broder, L.J. Problem-Solving Processes of College Students. Chicago: The University of Chicago Press, 1950.

Brandenburg, R.G., and Stedry, A.G. Toward a multi-stage information conversion model of the research and development process. Naval Research Quarterly 13 (2), June 1966: 129-145.

Branscomb, L.M. Conducting and using research. Daedalus 102, Spring 1973: 145-152.

Braybrooke, D., and Lindblom, C.E. A Strategy of Decision. New York: Free Press, 1963.

Breiman, L. Stopping Rule Problems, Applied Combinatorial Mathematics. New York: John Wiley and Sons, Inc., 1964.

Bridgman, P.W. The Way Things Are. Cambridge: Harvard University Press, 1959.

Brillouin, L. Scientific Uncertainty and Information. New York: Academic Press, 1964.

Bross, I.D.J. Designs for Decision. New York: The Free Press, 1965.

Brown, C.W., and Griselli, E.E. Scientific Method in Psychology. New York: McGraw-Hill, 1965.

Browne, J.M. An Evaluative Case Study of the TRUST Project (An Interactive Media Citizen Participation Program). Unpublished dissertation, Northwestern University, Evanston, Illinois, June 1976.

Buck, R.C. On the logic of general behavior systems theory. In Minnesota Studies Philosophy of Science 1: 223-238.

Bunge, M. Scientific Research II: The Search for Truth. New York: Springer-Verlag, 1968.

Cabot, R.C. Differential Diagnosis. Philadelphia: W.B. Saunders Company, 1917.

Campbell, D.T. Blind variation and selective retention in creative thought as in other knowledge processes. Psychological Review 67 (6), 1960: 380-400.

Campbell, D.T. Evolutionary epistemology. In Paul Schilpp, The Philosophy of Karl R. Popper, La Salle, Ill.: The Open Court Publishing Company, forthcoming. An undated version of the article.

Campbell, D.T. Unjustified variation and selection retention in scientific discovery. In T. Dobzhavsky and F.J. Ayala, The Problem of Reduction in Biology, London: Macmillan, forthcoming. An undated version of the article.

Campbell, D.T., and Fiske, D.W. Convergent and discriminant validation by the multitrait, multi-method matrix. Psychological Bulletin, 1959: 81-105.

Campbell, D.T., and Stanley, J. Experimental and Quasi-Experimental Designs for Research. Skokie, Ill.: Rand McNally, 1966.

Cannon, W.B. The Way of an Investigator. New York: Hafner Publishing Company, Inc., 1961.

Cantore, E. Humanistic significance of science: Some methodological considerations. Philsophy of Science 38, Spring 1971: 395-412.

Caporasa, J.A., and Roos, L.L., Jr. Quasi-Experimental Approaches: Testing Theory and Evaluating Policy. Evanston, Ill.: Northwestern University Press, 1973.

Caro, F.G. Reading in Evaluation Research. New York: Russell Sage Foundation, 1971.

Carroll, J.M. Secrets of Electronic Espionage. New York: E.P. Dutton, 1966.

Chernoff, H., and Moses, L.E. Elementary Decision Theory. New York: John Wiley and Sons, Inc., 1959.

Cherns, A.B. Models for the use of research. Human Relations 25, Fall 1972: 25-33.

Chin, R. Problems and prospects of applied research. In W.G. Bennis, et al., The Planning of Change, New York: Holt, Rinehart and Winston, 1962.

Churchill, L. Ethnomethodology and measurement. Social Forces 50 (2), December 1971: 182-191.

Churchman, C.W. The Design of Inquiring Systems: Basic Concepts of Systems and Organizations. New York: Basic Books, Inc., 1971.

Churchman, C.W., and Ackoff, R.L. Methods of Inquiry: An Introduction to Philosophy and Scientific Methods. St. Louis: Educational Publishers, Inc., 1950.

Cohen, M., and Nagel, E. An Introduction to Logic and Scientific Methods. New York: Harcourt and Brace, 1934.

Cole, S. The Sociological Method. Chicago: Markham Publishing Company, 1972.

Cole, S., and Cole, J.R. Scientific output and recognition: A study in the operation of the reward system in science. American Sociological Review 33, June 1968: 397-413.

Compton, B.R., and Galaway, R. Social Work Processes. Homewood, Ill.: The Dorsey Press, 1975.

Cook, D.L. Program Evaluation and Review Technique: Applications in Education. Washington, D.C.: U.S. Department of Health, Education, and Welfare, Office of Education, 1966.

Cooper, W.W., et al. New Perspectives in Organization Research. New York: John Wiley and Sons, Inc., 1964.

Costner, H.L. Sociological Methodology. San Francisco: Jossey-Bass, 1971.

Curtis, R.F., and Jackson, E.E. Multiple indicators in social research. American Journal of Sociology 68, September 1962: 195-204.

Davisson, W.I. Information Processing: Application in the Social and Behavior Sciences. New York: Appleton-Century-Crofts, 1970.

De Francesco, H.J. Quantitative Analysis Methods for Substantive Analysis. Los Angeles: Melville Publishing Company, 1975.

De Greene, K.B. Systems Psychology. New York: McGraw-Hill Book Company, 1970.

De Groot, A.D. Methodology: Foundation of Inference and Research in the Behavioral Sciences. Paris: Mouton-The Hague, 1969.

De Groot, A.D. Thought and Choice in Chess. Paris: Mouton-The Hague, 1965.

Delbecq, A.L., et al. Group Techniques for Program Planning: A Guide to Nominal Group and Delphi Processes. Glenview, Ill.: Scott, Foresman and Company, 1975.

Deming, W.E. Some Theory of Sampling. New York: John Wiley and Sons, Inc., 1950.

Denzin, N.K. Sociological Methods: A Source Book. Chicago: Aldine, 1970.

Deutscher, I. Looking backward: Case studies on the "progress" of methodology in sociological research. American Sociologist 4, February 1969: 35-41.

Dewey, J. How We Think. New York: D.C. Heath and Company, 1910.

Dewey, J. Logic: The Theory of Inquiry. New York: Holt and Company, 1938.

Diesing, P. Patterns of Discovery in the Social Sciences. Chicago: Aldine-Atherton, 1971.

Doby, J.T. An Introduction to Social Research. Second edition. New York: Appleton-Century-Crofts, 1967.

Dodd, S.C. Scient-scales for measuring methodology. American Behavioral Scientist 9, June 1966: 3-19.

Dohrenwend, B.S., and Dohrenwend, B.P. Sources of refusals in survey. Public Opinion Quarterly 32, Spring 1968: 74-83.

Dorsey, J.T., Jr. A communication model for administration. Administrative Science Quarterly 11 (3), December 1957: 307-324.

Dubin, R. Theory Building. New York: The Free Press, 1969.

Duda, R.O. Elements of pattern recognition. In J.M. Mendel and K.S. Fu, Adapters: Learning and Pattern Recognition System. New York: Academic Press, 1970.

Dufrevne, M. The Notion of the A Priori. Trans. E.S. Casy. Evanston, Ill.: Northwestern University Press, 1966.

Duncan, O.D. Path analysis: Sociological examples. American Journal of Sociology 72, July 1966: 1-16.

Duverger, M. An Introduction to the Social Sciences. New York: Fredrick A. Praeger, 1964.

Eberle, R.A. Replacing one theory by another under preservation of a given feature. Philosophy of Science 38, December 1971: 486-501.

Edie, J.M. Phenomenology in America: Studies in the Philosophy of Experience. Chicago: Quadrangle, 1967.

Eddington, A. The Philosophy of Physical Science. New York: Macmillan Company, 1939.

Edwards, W., and Tversky, A. Decision Making. Baltimore, Md.: Penguin Books, 1967.

Ehrlich, H.J., and Rinehart, J.W. A brief report on methodology of stereotype research. Social Forces 43, May 1965: 564-575.

Ellinson, J. Methods of sociomedical research. In H.E. Freeman, et al., Handbook of Medical Sociology, Englewood Cliffs, N.J.: Prentice-Hall, 1963.

Evans, W.M. Organizational Experiments. New York: Harper and Row, 1971.

Eyring, H.B. Some sources of uncertainty and their consequences in engineering design project. IEEEE Transactions on Engineering Management, EM-13 (4), December 1966: 167-180.

Feigl, H., and Scriven, M. The Foundations of Science and the Concepts of Psychology and Psychoanalysis. Minneapolis: University of Minnesota Press, Volume I, Fifth Printing, 1964.

Feinstein, A.D. Clinical Judgment. Baltimore: The Williams and Wilkins Company, 1967.

Fenton, J.H. People and Parties in Politics. Glencoe, Ill.: Scott, Foresman and Company, 1966.

Ferber, R., and Verdoorn, P.J. Research Methods in Economics and Business. New York: Macmillan, 1962.

Fergusion, C.K. Concerning the nature of human systems and the consultant's role. In Bennis, W.C., et al., The Planning of Change, New York: Holt, Rinehart and Winston, Inc., 1961.

Festinger, L., and Katz, D. Research Methods in the Behavioral Sciences. New York: Holt, Rinehart and Winston, 1966.

Fisher, G.H. Some Comments on System Analysis. Santa Monica, Calif.: The Rand Corporation, Paper P-3677, September 1967.

Fisher, R.A. The Design of Experiments. New York: Hafner Publishing Company, 1966.

Flesch, R. The Art of Clear Thinking. New York: Harper, 1961.

Frocese, D.P., and Richer, S. Stages of Social Research: Contemporary Perspectives. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1970.

Fowler, H. Curiosity and Exploratory Behavior. New York: The Macmillan Company, 1965.

Frankel, M. Inference from Survey Samples: An Empirical Investigation. Ann Arbor: University of Michigan Institute for Social Research, 1971.

Franklin, B., and Osborne, H. Research Methods: Issues and Insights. Belmont, Calif.: Wadsworth, 1971.

Freeman, H.E. The implementation of research investigations. In R. O'Toole, The Organization, Management, and Tactics of Research, Cambridge, Mass.: Schenkman Publishing Company, 1971.

Freeman, H.E. The strategy of social policy research. In The Social Welfare Forum, New York: Columbia University Press, 1963.

Freeman, H.E., and Sherwood, C.C. Research in large scale intervention programs. Journal of Social Issues 21, January 1965: 11-28.

Freeman, H.E., and Sherwood, C.C. Social Policy and Social Research. Englewood Cliffs, N.J.: Prentice-Hall, 1970.

Freeman, P. The Principles of Scientific Research. New York: Pergamon Press, 1960.

French, T.R.P., Jr. Experiments in field settings. In L. Festinger and D. Katz, Research Methods in the Behavioral Sciences, New York: Dryden Press, 1953.

Galtung, J. Theory and Methods of Social Research. New York: Columbia University Press, 1967.

Gibson, Q. The Logic of Social Inquiry. New York: The Humanities Press, 1963.

Gie, W. Social Science Research Methods. New York: Appleton-Century-Crofts, 1950.

Ginsberg, A.S., and Offsend, F.L. An application of decision theory to a medical-diagnosis treatment problem. IEEEE Transactions, SSC-4 (3), September 1968: 355-362.

Glaser, B.G., and Strauss, A.L. The Discovery of Grounded Theory: Strategies for Qualitative Research. Chicago: Aldine Publishing Company, 1967.

Glass, G.V. The growth of evaluating methodology. AERA Monograph Series on Curriculum Evaluation, No. 7, 1971.

Glymour, C. Some patterns of reduction. Philosophy of Science 37, Spring 1973: 340-353.

Glazer, M. The Research Adventure: Promise and Problems in Field Work. New York: Random House, 1972.

Glock, C. Survey Research in the Social Sciences. New York: Russell Sage Foundation, 1967.

Good, C., and Scates, D.E. Methods of Research. New York: Appleton-Century-Crofts, 1954.

Goode, W.J., and Hatt, P.K. Methods in Social Research. New York: McGraw-Hill, 1962.

Goldberg, L.R. Single models or simple processes: Some research on clinical judgment. American Psychological Journal 23 (7), 1968.

Gopal, M.H. An Introduction to Research Procedure in Social Sciences. Second revised and enlarged edition. New York: Asia Publishing House, 1970.

Gore, W.J. Administrative Decision Making: Heuristic Models. New York: John Wiley and Sons, Inc., 1964.

Greenburg, A.G. Medical Decision Modeling: A Concept of Information: Decision Structure from the Vantage of the Physician Decision Maker. Unpublished doctoral dissertation, Northwestern University, Evanston, Illinois, 1972.

Greenwood, E. The practice of science and the science of practice. In W.G. Bennis, et al., The Planning of Change, New York: Holt, Rinehart and Winston, Inc., 1961.

Greer, S. The Logic of Social Inquiry. Chicago: Aldine, 1969.

Guba, E.G., and Stufflebeam, D.R. Evaluation: The Process of Stimulating, Aiding and Ability Insightful Action. Monograph Series in Reading Education No. 1. Bloomington, Ind.: Indiana University, 1970.

Guilford, J.P. A factor analysis study of human interest. American Psychological Association, 68 (4), 1954.

Guilford, J.P. Psychometric Methods. New York: McGraw-Hill, 1936.

Guttman, L. An outline of some new methodology for social research. Public Opinion Quarterly 18, Winter 1955: 395-404.

Haberstein, R.W., and Becker, H.S. Field Methods for Studying Ongoing Social Organizations. Chicago: Aldine-Atherton, 1969.

Haberstein, R.W. Pathways to Data: Field Methods for Studying Ongoing Social Organizations. Chicago: Aldine-Atherton, 1971.

Hage, G. Techniques and Problems of Theory Construction in Sociology. New York: John Wiley and Sons, Inc., 1972.

Hall, A.D. A Methodology for Systems Engineering. New York: D. Van Nostrand, 1962.

Handy, R. Methodology of the Behavioral Sciences. Springfield, Ill.: Charles C. Thomas, 1964.

Hanna, W.J. Imagine making in field research. American Behavioral Scientist 8, January 1965: 15-20.

Hanson, N.R. Patterns of Discovery: An Inquiry into the Conceptual Foundation of Science. Cambridge, England: Cambridge University, 1958.

Hare, P.P., et al. Small Groups. New York: Alfred A. Knopf, 1955.

Harless, J.H. An analysis of front-end analysis. Improving Human Performance--A Research Quarterly, Winter 1973.

Harrison, R., and Hopkins, R. The design of cross-cultural training. In W.C. Bennis, et al., The Planning of Change, New York: Holt, Rinehart and Winston, Inc., 1961.

Harschburger, D. Investigation of structural model of a small group problem-solving. Human Relations 24, Fall 1971: 43-63.

Hart, H.L.A. The Concept of Law. Oxford: Oxford, 1961.

Hayes, D.P., et al. Substantive conclusions are dependent upon techniques of measurement. Behavioral Science 15 (3), May 1970: 265-268.

Herman, R.E. The A Priori Experimental Evaluation . . . The Practitioner-Oriented Periodical Literature. Unpublished master's thesis, Northwestern University, Evanston, Illinois, June 1976.

Herzog, E. Some Guidelines for Evaluative Research. Washington, D.C.: U.S. Department of Health, Education and Welfare, Social Security Administration, Children's Bureau, 1959.

Hess, M.B. Models and Analogies in Science. Notre Dame, Ind.: University of Notre Dame Press, 1966.

Hill, F.E., and Williams, W.E. Radio's Listening Groups: The United States and Great Britain. New York: Columbia University Press, 1941.

Hillway, T. Introduction to Research. Boston: Houghton-Mifflin Company, 1956.

Hinchen, J.D. From opinion to fact through sequential experimentation. Industrial Quality Control 23 (3), September 1966.

Hirsch, T., and Selvin, H.C. Delinquency Research: An Appraisal of Analytic Methods. New York: The Free Press, 1967.

Holt, R., and Turner, J. The Methodology of Component Research. New York: The Free Press, 1970.

Hornstein, H.A. Data based strategies of social intervention. In H.A. Hornstein, et al., Social Intervention: A Behavioral Science Approach,

Hovey, H.A. The Planning-Programming-Budgeting Approach to Government Decision Making. New York: Frederick A. Praeger, 1968.

Howard, J.A. Information processing model of executive decision. Management Science 14 (7), 1968: 416-428.

Hruska, A. Science forecasting and its limits. Future 4, April 1974: 153-160.

Huggins, W.H., and Entwistle, D.R. Introduction Systems and Design. Waltham, Mass.: Blaisdell Publishing Company, 1968.

Hulfish, H.G., and Smith, P.G. Reflective Thinking. New York: Dodd, 1961.

Hyman, H.H., et al. Applications of Methods of Evaluation: Four Studies of the Encampment for Citizenship. Berkeley: University of California Publications in Culture and Society, 1962.

Hyman, H.H., and Wright, C.R. Evaluating social action programs. In F. Caro, Readings in Evaluation Research, New York: Russell Sage Foundation, 1971.

Isaac, S., and Michael, W.B. Handbook in Research and Evaluation. San Diego, Calif.: Robert R. Krajep, 1971.

Jacquez, J.H. The Diagnostic Process. Ann Arbor: University of Michigan Press, 1964.

Jahoda, M., et al. Research in Social Relations. New York: Dryden Press, 1951.

Jeffrey, R.C. The Logic of Decision. New York: McGraw-Hill, 1965.

Jevons, W.S. The Principles of Science. London: Macmillan, 1900.

Jewkes, J., et al. The Sources of Invention. London: Macmillan and Company, Ltd., 1958.

Junker, B.H. Field Work: An Introduction to the Social Sciences. Chicago: University of Chicago Press, 1960.

Kahn, J.A. The design of research. In N.A. Polansky, Social Work Research, Chicago: University of Chicago Press, 1960.

Kant, I. Critique of Pure Reason. Trans. N.K. Smith. London: Macmillan and Company, Ltd., 1929.

Kaplan, A. The Conduct of Inquiry: Methodology for Behavioral Science. San Francisco: Chandler, 1964.

Kaufman, F. Methodology of the Social Sciences. New York: Oxford University Press, 1944.

Kerlinger, F.N. Foundations of Behavioral Research. New York: Holt, Rinehart and Winston, 1973.

Kolaja, J. Two processes: A new framework for the theory of participation in decision making. Behavioral Science 13 (1), January 1964: 66-70.

Kordig, C.R. Theory-ladenness of observation. Review of Metaphysics 24, March 1971: 448-484.

Kordig, C.R. The Justification of Scientific Change. Dordrecht, Holland: Reidel, 1971.

Krausz, E., and Miller, S.H. Social Research Design. New York: Longman Group Limited, 1974.

Krulee, G.K., et al. Error patterns in problem solving formulation. Psychology in the Schools 7, 1970: 93-99.

Krulee, G.K., and Manelski, D.M. A heuristic approach to natural language processing. Preprint 18, International Conference on Computational Linguistics. New York: May 1965.

Kuhn, T. The Structure of Scientific Revolution. Chicago: University of Chicago Press, 1962.

Labovitz, S., and Hagedorn, R. Introduction to Social Research. New York: McGraw-Hill Book Company, 1971.

Lasswell, H.D. The Future of Political Science. Chicago: Atherton Press, 1963.

Lastrucci, C.L. The Scientific Approach. Cambridge, Mass.: Schenkman, 1963.

Lazarsfeld, P.F., and Rosenberg, M. The Language of Social Research. New York: The Free Press, 1971.

Leavitt, J. Clinical Research Design and Analysis in the Behavioral Sciences. New York: Charles C. Thomas, 1961.

Ledley, R.J., and Lusted, L.B. Reasoning foundation of medical diagnosis. IRE Transactions Med. Election, ME-7, 1960: 255-258.

Lee, D.S. Analogy in scientific theory construction. Southern Journal of Philosophy 7, 1969: 107-125.

Leonard, R.C., et al. Small sample field experiments for evaluating patient care. Health Services Research 2, Spring 1967: 46-59.

Levi, E.H. An Introduction to Legal Reasoning. Chicago: The University of Chicago Press, 1970.

Levi, I. Truth, content, and ties. Journal of Philosophy 68, October 1971: 865-876.

Levine, M. Scientific method and the adversary model: Some preliminary thoughts (with reply by R.P. Yantz). American Psychologist 29, Spring 1974: 661-677, 714-716.

Liebow, E. Tally's Corner. Boston: Little, Brown and Company, 1967.

Ligomenides, P.A. Wave mechanical uncertainty and speed limitation. IEEEE Spectrum 4 (2), February 1967: 65-68.

Line, M.B. Information Requirements of Researchers in Social Sciences. 2 vols. Bath: Bath University of Technology Library, 1971.

Line, M.B., et al. Investigation into Information Requirements of Researchers in Social Sciences. Bath: Bath University Library, 1971.

Lindblom, C.E. The science of muddling through. Public Administration Review 19 (2), Spring 1959: 79-88.

Lipetz, B.A. The measurement of efficiency of scientific research. Intermedia, 1965.

Lonergan, B.J.F. Insights: A Study of Human Understanding. London: Longmans, 1964.

Louisell, D.W., and Harzard, G.C., Jr. Cases and Materials on Pleading and Procedure: State and Federal. New York: The Foundation Press, 1973.

Lundberg, G.A. Can Science Save Us? New York: Longman, Green and Company, 1947.

Lundberg, G.A. Social Research. New York: Longman, 1942.

Lundquist, J.L. Perspectives on Poverty: II: On Fighting Poverty: Perspectives from Experience. New York: Basic Books, Inc., 1969.

Luria, E. On research styles and allied matters. Daedalus, 102, Spring 1973: 75-84.

Lusted, L.B. Introduction to Medical Decision Making. Springfield, Ill.: Charles C. Thomas, 1968.

MacCrimmon, K.R. Description and Normative Implications of the Decision Theory Postulates. Los Angeles: Western Management Science Institute, University of California, 1966.

Madden, E.H. Scientific explanation. Review of Metaphysics 26, June 1973: 723-743.

Madge, J.H. The Tools of Social Science. London: Longmans and Green, 1953.

Madsen, K.B. The language of science. Theory and Decision 1 (2), December 1970: 138-154.

Mackie, R., and Christensen, P.R. Translation and application of psychological research. Technical Report 716-1. Human Factors Research, Inc., Santa Barbara: Research Park, Galeta, California, undated.

MacDonald, M.E. Social work research: A perspective. In N.A. Polansky, Social Work Research, Chicago: The University of Chicago Press, 1960.

MacMahon, B., et al. Epistemologic Methods. Boston: Little, Brown and Company, 1960.

MacQueen, J.B. Optimal policies for a class of search and evaluation problem. Management Science 10, July 1964.

Mann, P. Methods of Sociological Enquiry. Oxford: Basil Blackwell and Mott, 1968.

March, J.G. Handbook of Organizations. Chicago: Rand McNally, 1965.

March, J.G., and Simon, H.A. Organizations. New York: John Wiley and Sons, Inc., 1958.

Marshall, J. Law and Psychology in Conflict. Indianapolis, Ind.: The Bobbs-Merrill Company, 1966.

Marx, M.H. Psychological Theory: Contemporary Readings. New York: The Macmillan Company, 1951.

Massarik, F., and Ratoosh, P. Mathematical Explorations in Behavioral Science. Homewood, Ill.: Richard D. Irwin, 1965.

Maxwell, N. The rationality of scientific discovery. Part I: The traditional rationality problem. Philosophy of Science 41 (2), June 1974: 123-153.

McCall, G.J., and Simmons, J.L. Issues in Participant Observation: A Text and Reader. London: Addison Wesley, 1969.

McCall, W.A. How to Experiment in Education. New York: Macmillan Company, 1923.

McCormick, T.C., and Frances, R.G. Methods of Research in Behavioral Sciences. New York: Harper and Brothers, 1958.

McEwen, W.P. The Problem of Social Scientific Knowledge. Totowa, N.J.: The Bedminster Press, 1963.

McDaniel, C.O., Jr. Research Methodology: Some Issues in Social Science Research. Dubuque, Iowa: Kendall-Hunt Publishing Company, 1974.

McHugh, P., et al. On the Beginning of Social Inquiry. London: Routledge and K. Paul, 1974.

McLaughlin, A. Science, reason and values. Theory and Decision 1 (2), December 1970: 121-137.

Mendel, J.M., and Fu, K.S. Adaptive, Learning and Pattern Recognition Systems. New York: Academic Press, 1970.

Merton, R.K., and Deveraux, E.C., Jr. Practical problems and the uses of social science. Transaction 1, July 1964: 18-21.

Michils, J.W. Dating Methods in Archaeology. New York: Seminar Press, 1973.

Mill, J.S. System of Logic. New York: Longmans and Green, 1930.

Miller, G.A. The magical number seven, plus or minus two. Psychological Review 56, 1958: 485-491.

Miller, G.A., et al. Plans and the Structure of Behavior. New York: Holt, 1960.

Miller, J.G. Experiments in Social Process. New York: McGraw-Hill, 1950.

Mills, C.W. The Sociological Imagination. New York: Oxford University Press, 1959.

Moore, F.W. Readings in Cross-Cultural Methodology. New Haven: HRAF Press, 1966.

Moranian, T. The Research and Development Engineer as Manager. New York: Holt, Rinehart and Winston, 1963.

Morse, P.M., and Kimball, G.E. Methods of Operations Research Technology. New York: Wiley and Press, 1951.

Moser, C.A. Survey Methods in Social Investigation. London: Heinemann Educational Books, Ltd., 1968.

Mowrer, O.H. Learning Theory of the Symbolic Process. New York: John Wiley and Sons, Inc., 1960.

Mukherjie, R. On the mode of social research. The Indian Journal of Sociology 3 (1-2), March/September 1972: 55-68.

Mullins, N.C. The Art of Theory Construction and Use. New York: Harper and Row, 1971.

Nagel, E. Structure of Science: Problems in the Logic of Scientific Explanation. New York: Harcourt, Brace and World, Inc., 1961.

Nagel, E., and Brandt, R. Meaning and Knowledge: Systematic Readings in Epistemology. New York: Harcourt, Brace and World, Inc., 1965.

Nagel, S.F. The Theory of Social Structure. Glencoe: The Free Press, 1957.

Nagel, S.S. The Legal Process from a Behavioral Perspective. Homewood, Ill.: Dorsey Press, 1969.

Nagel, S.S. Policy Studies in America and Elsewhere. Lexington, Mass.: Lexington Books, D.C. Heath and Company, 1975.

Naroll, R., and Cohen, R. Handbook of Methods in Cultural Anthropology. New York: Natural History Press, 1970.

National Science Board. Increasing the Nation's Use of the Social Services. Special Commission on the Social Sciences, Washington, D.C.

Nettler, G. Values in scientific research. American Behavioral Science 17, Spring 1973: 5-143.

Noland, E.W. Report of the committee on research. American Sociological Review 23, December 1958: 704-711.

Northrop, F.S.C. The Logic of the Sciences and the Humanities. New York: Macmillan, 1952.

Nunnally, J.C. Psychometric Theory. New York: McGraw-Hill, 1967.

O'Toole, R. The Organization, Management and Tactics of Social Research. Cambridge, Mass.: Schenkman Publishing Company, Inc., 1971.

O'Shaughnessy, J. Inquiry and Decision. London: George Allen and Unwin, Ltd., 1972.

Paycha, F. Diagnoses, therapeutics, prognosis and compters. IRE Transactions Medical Electronics, MG-7255-258, 1960.

Pelto, P.J. Anthropological Research: The Structure of Inquiry. New York: Harper and Row, 1970.

Phillips, R.S. Social Research: Strategy and Tactics. New York: Macmillan, 1966.

Piaget, J. Main Trends in Inter-Disciplinary Research. New York: Harper and Row, 1970.

Pierce, R.C., et al. Bootstrap scaling technique. Human Organization 31, Winter 1972: 403-410.

Pilisuk, M. Fact and fiction in the utilization of social science knowledge. Journal of Social Issues 29 (1), 1975: 123-132.

Planek, T.W. Planning techniques for the evaluation of community support efficiency in safety. Human Factors 12 (1), 1970: 47-54.

Plutchik, R. Foundations of Behavioral Research. New York: Harper and Row, 1968.

Polansky, N.A. Social Work Research. Chicago: University of Chicago Press, 1960.

Polya, G. How to Solve It: A New Aspect of Mathematical Methods. Princeton: Princeton University Press, 1957.

Polya, G. Patterns of Plausible Inferences. Princeton: Princeton University Press, 1954.

Pondy, L.R. On the organization of inquiry: A comparison of some radically different approaches to policy analysis. Administrative Review 34, Spring 1974: 471-479.

Popper, K.R. The Logic of Scientific Discovery. New York: Science Edition, 1961.

Pospisil, R. Anthropology of Law: A Comparative Theory. New York: Harper, 1971.

Pressman, J.L., and Wildavsky, A. Implementation. Berkeley: University of California Press, 1973.

Price, D.L. Little Science, Big Science. New York: Columbia University Press, 1963.

Price, J.L. Handbook of Organizational Measurement. Toronto: D.C. Heath, 1972.

Provus, M. Discrepancy Evaluation. Berkeley: McCutchan, 1971.

Przeworski, A., and Teone, H. The Logic of Comparative Social Inquiry. New York: John Wiley and Sons, Inc., 1970.

Quade, E.S. Analysis for Military Decisions. Chicago: Rand McNally and Company, 1967.

Quade, E.S. Systems Analysis Techniques for Planning-Programming-Budgeting. Santa Monica, Calif.: The Rand Corporation, Paper P-3322, March 1966.

Raiffa, H. Decision Analysis. Reading, Mass.: Addison-Wesley, 1968.

Rath, C., and Rath, G. Evaluation is a process: Systems analysis in education. Educational Technology 13 (3), March 1973.

Riecken, H.W. The Volunteer Work Camp: A Psychological Evaluation. Cambridge, Mass.: Addison-Wesley, 1952.

Riehel, J.P. How to Write Reports, Papers, Theses and Articles. New York: ARCO, 1972.

Riley, M.W. Sociological Research. New York: Harcourt, Brace Jovanovich, 1963.

Rinaldo, J.A., et al. Symptom diagnosis: A mathematical analysis of epigostoic pain. Annals of Internal Medicine 59, 1963: 145054.

Rivlin, A.M. Systematic Thinking for Social Action. Washington, D.C.: Brookings Institution, 1971.

Rockwell, R.C. Continuities in methodological research. Social Forces 53 (2), December 1974: 166-253.

Roessner, J.D. Methodology for technology assessment. Technological Forecasting and Social Change (2), 1974: 163-169.

Rose, A. Theory and Method in the Social Sciences. Minneapolis: University of Minnesota Press, 1954.

Rose, R. Policy Making in Britain. London: Macmillan, 1969.

Rosenthal, R. Experimenter Effects in Behavioral Research. New York: Appleton-Century-Crofts, 1966.

Ross, S.D. The Scientific Process. The Hague: Martinus Nijhoff, 1971.

Rossi, P.H. Bootstraps and pitfalls in the evaluation of social action programs. Proceedings of the American Statistical Association, Social Statistics Section, 1966.

Rossi, P., and Williams, W. Evaluating Social Action Programs: Theory, Practice and Politics. New York: Seminar Press, 1972.

Rossi, P.H. Practice, methods and theory in evaluating social action programs. In J.L. Sundquist, On Fighting Poverty: Perspectives from Experience. New York: Basic Books, 1969.

Rossi, P.H. Researchers, scholars, and policy makers: The politics of large scale research. Daedalus 93, Fall 1964: 1142-1161.

Roth, J. Hired hand research. The American Sociologist 1, August 1966: 190-196.

Rubenstein, A.H., and Haberstroh, C.H. Some Theories of Organization. Homewood, Ill.: Richard D. Irwin, 1966.

Rubenstein, A.H., and Schroeder, H. Techniques for evaluating and selecting R&D projects for development. Paper No. 70/10 of the Program of Research on the Management of Research and Development. Industrial Engineering and Management Sciences, Northwestern University, Evanston, Illinois, March 1970.

Rubenstein, A.H., and Thompson, C.W.N. Researchable questions and experimental designs on the STI process. Document 73/122 (11/5/73). Department of Industrial Engineering and Management Sciences, Northwestern University, Evanston, Illinois, 1975.

Rubinstein, M.F. Patterns of Problem-Solving. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1975.

Rudner, R.S. Philosophy of Social Science. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1966.

Rudner, R.S., and Wolfson, R.J. Notes on a Constructional Framework for a Theory of Organization Decision Making. Michigan State University, 1958.

Sadofsky, S. Utilization of evaluation results: Feedback into the action program. In J.L. Shmelzer, Learning in Action, Washington, D.C.: Government Printing Office, 1966.

Salmon, W.C. The Foundations of Scientific Inference. Pittsburgh: University of Pittsburgh Press, 1966.

Sanders, W.B. The Sociologist as Detective: An Introduction to Research Methods. New York: Praeger, 1974.

Sax, G. Empirical Foundations of Educational Research. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1968.

Schacter, S. The Psychology of Affiliation. Stanford, Calif.: Stanford University Press, 1959.

Schlaifer, R. Analysis of Decisions Under Uncertainty. New York: McGraw-Hill, 1969.

Schuessler, K. Analyzing Social Data: A Statistical Orientation. Boston: Houghton Mifflin, 1971.

Scott, N.W. The Social Systems of Science. New York: Holt, Rinehart and Winston, 1966.

Scott, W.R. Field methods in the study of organizations. In J.G. March, Handbook of Organizations, Chicago: Rand McNally, 1965.

Scriven, M. The methodology of evaluation. In Perspectives on Curriculum Evaluation, AERA Monograph Series on Curriculum Evaluation, No. 1, Chicago: Rand McNally, 1967.

Seagle, W. The History of Law. New York: Tuder Publishing Company, 1946.

Sebestyen, G.S. Decision Making Processes in Pattern Recognition. New York: The Macmillan Company, 1962.

Selfridge, O.G. Pattern recognition and modern computers. Proceedings Western Print Computer Conference, IRE, 1953.

Sellitz, C., et al. Research Methods in Social Relations. New York: Holt, Rinehart and Winston, 1961.

Siegel, S. Non-Parametric Statistics for the Behavioral Sciences. New York: McGraw-Hill, 1956.

Simon, H.A. Scientific discovery and the psychology of problem solving. From Mind and Cosmos, Pittsburgh Series, Vol. 3, 1966.

Simon, H.A. The Science of the Artificial. Cambridge, Mass.: The MIT Press, 1969.

Simon, H.A., and Newell, A. Heuristic problem solving: The next advance in O.R. Operations Research 6, January/February 1958: 1-10.

Simon, H.A., and Newell, A. Models: Their uses and limitation. In L.D. White, The State of Social Sciences, Chicago: University of Chicago Press, 1956.

Simon, J. Basic Research Methods in Social Science. New York: Random House, Inc., 1969.

Sheldon, E., and Moore, W.E. Indicators of Social Change. New York: Russell Sage Foundation, 1968.

Sills, D.L. Evaluation research. International Encyclopedia of the Social Sciences, Vol. 5. New York: Macmillan and Free Press, 1968.

Sjoberg, G. Ethics, Politics, and Social Research. Cambridge, Mass.: Schenkman and Company, 1967.

Sjoberg, G., and Nett, R. A Methodology for Social Research. New York: Harper and Row, 1968.

Slagle, J.R. Artificial Intelligence: The Heuristic Programming Approach. New York: McGraw-Hill Book Company, 1971.

Slovic, P. Information processing, situation specificity, and the generality of risk taking behavior. Journal of Personality and Social Psychology 22 (1), April 1972: 128-134.

Smith, H.W. Strategies of Social Research: The Methodological Imagination. Englewood Cliffs, N.J.: Prentice-Hall, 1975.

Snow, C.P. The Two Cultures: And a Second Look. New York: Cambridge University Press, 1963.

Solomon, R.C. Reasons as causal explanations. Philosophy and Phenomenological Research 34 (3), March 1974: 415-428.

Spahr, W.E., and Swenson, R.J. Methods and Status of Scientific Research. New York: Harper and Row, 1930.

Spiegel, H.B.C. Citizen Participation in Urban Development. Washington, D.C.: National Institute for Applied Behavioral Sciences, 1969.

Stacey, M. Comparability in Social Research. London: Heineman Educational, 1969.

Stacey, M. Method of Social Research. New York: Pergamon Press, 1969.

Starr, M.K. Product Design and Decision Theory. Englewood Cliffs, N.J.: Prentice-Hall, 1963.

Steele, S. Contemporary Approaches to Program Evaluation and Their Implications for Evaluating Programs for Disadvantaged Adults. Syracuse: ERIC Clearinghouse on Adult Education, 1973.

Stein, I. System Theory, Science and Social Work. Metuchen, N.J.: The Scarecrow Press, Inc., 1974.

Stinchcombe, A.L. Constructing Social Theories. New York: Harcourt, Brace and World, Inc., 1968.

Sticker, L.J. The true deceiver. Psychological Bulletin 68, July 1967: 13-20.

Stouffer, S.A. Social Research to Test Ideas. New York: The Free Press, 1962.

Suchman, E.A. Action for what? A critique of evaluative research. In R. O'Toole, The Organization, Management, and Tactics of Social Research. Cambridge, Mass.: Schenkman Publishing Company, 1971.

Suchman, E.A. The principles of research design. In J.T. Doby, Introduction to Social Research, New York: The Stackpole Company, 1954.

Suchman, E.A. Principles and practices of evaluative research. In J.T. Doby, An Introduction to Sociological Research. New York: Appleton-Century-Crofts, 1967.

Sudman, S. Reducing the Cost of Surveys. Chicago: Aldine Publishing Company, 1967.

Sullivan, E. Prepare a statement for businessmen on problem formulation procedures. Qualifying Examination Question for Professor G.J. Rath, May 15, 1970.

Sussman, M.B., and Haug, M.R. Human and mechanical error--an unknown quantity in research. The American Behavioral Scientist II, November 1967: 55-56.

Szent-Cyorgyi, A. Dionysions and appollonion. Science 176, 1972: 966.

Tannenbaum, A.S. An event-structured approach to social power and to the problem of power comparability. Behavioral Science 7 (3), July 1962: 315-331.

Taylor, K.W. A paradigm for causal analysis. Sociology Quarterly 11 (2), 1970: 169-180.

Thrall, R.M., et al. Decision Process. New York: John Wiley and Sons, Inc., 1954.

Tippett, L. Technological Applications of Statistics. New York: John Wiley and Sons, Inc., 1950.

Thompson, C.W.N. Design for the Decision-Point: A Decision-Centered Conceptual Approach to the Procedural Problems of Structure in the Theory of Organization. Unpublished master's thesis, Ohio State University, 1956.

Thompson, C.W.N. The design and procurement of evaluation systems. In Proceedings of the 1976 International Conference on Procurement and Grant Management. Charlottesville, Virginia: University of Virginia, 1976, 169-183.

Thompson, C.W.N. Ideas and events: The central phenomenon of the research and development process. (Term paper for Behavior in Organization Systems Course.) Department of Industrial Engineering and Management Sciences, Northwestern University, Evanston, Illinois, Winter 1966-67.

Thompson, C.W.N. The Initial Screening of Technical Documents. Unpublished doctoral dissertation, Northwestern University, Evanston, Illinois, September 1970.

Thompson, C.W.N. Introduction to Organization Theory and Behavior: Course Description. Department of Industrial Engineering and Management Sciences, Northwestern University, Evanston, Illinois, September 1970.

Thompson, C.W.N., and Rath, G.J. Administrative experiment: A special case of field testing or evaluation. Human Factors 16 (3), June 1974A: 238-252.

Thompson, C.W.N., and Rath, G.J. Making health system work: A systems analysis approach. Presented at the Annual Meeting of American Academy of Pediatrics, Chicago, Illinois, October 20-24, 1973.

Thompson, C.W.N. Model of human performance reliability to health care systems. Annals of Assurance Sciences 7, January 1974.

Thompson, J.D. Approaches to Organizational Design. University of Pittsburgh Press, 1966.

Thompson, J.D. Organizations in Action. New York: McGraw-Hill, 1967.

Thompson, W.W. Operations Research Techniques. Columbus, Ohio: Charles E. Merrill Books, Inc., 1967.

Toda, M., and Shuford, E.H., Jr. Utility induced utilities, and small worlds. Behavioral Sciences 10 (3), July 1965: 238-254.

Torgerson, W. Theory and Method of Scaling. New York: John Wiley and Sons, Inc., 1958.

Travers, R.M.W. An Introduction to Educational Research. London: Macmillan, 1958.

Tryon, R.C. Reliability and behavior domain validity; reformulation and historical critique. Psychological Bulletin 54: 229-249.

Turner, V.W. The Ritual Process: Structures and Anti-Structures. Chicago: Aldine, 1969.

United States Department of Commerce, Experimental Technology Incentive Program. Proposal procedure. RFP 6-35756. February 1976.

Wakeford, J. The Strategy of Social Inquiry: A New Programmer in Methods and Measurements for the Students of Sociology. London: Macmillan, 1968.

Wallace, W. The Logic of Science in Sociology. Chicago: Aldine-Atherton, 1971.

Ware, U.C. Systems Analysis: A Diagnostic Approach. New York: Harcourt, Brace and World, 1967.

Wartofsky, M. Conceptual Foundation of Scientific Thought. New York: Macmillan, 1968.

Webb, E.J., et al. Unobtrusive Measures. Chicago: Rand McNally and Company, 1966.

Weber, M. The Methodology of the Social Sciences. Trans. E.A. Shile and A. Finch. Glencoe: The Free Press, 1949.

Weick, K. Systematic observation. In G. Lindsey and E. Aronson, Handbook of Social Psychology, Vol. II. Reading, Mass.: Addison-Wesley, 1968.

Weiss, C. Evaluation Research Methods for Assessing Program Effectiveness. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972.

Weiss, C. The politicization of evaluation research. Journal of Social Issues 26 (4), 1970: 57-68.

Weiss, R.G. Implementation Analysis for Experimental Social Systems with a Case Study of an Interactive Media Intervention. Dissertation, Northwestern University, Evanston, Illinois, August 1976.

Weiss, R., and Reim, M. The evaluation of broad aim programs: A cautionary case and a moral. In F.G. Caro, Readings in Evaluation Research, New York: Russell Sage Foundation, 1971.

Weisselberg, R.C., and Cowley, J.G. The Executive Strategist: An Armchair Guide to Scientific Decision Making. New York: McGraw-Hill Book Company, 1969.

Welton, J. The Logical Bases of Education. London: Macmillan and Company, Ltd., 1919.

Wertheimer, M. Productive Thinking. New York: Harper and Brothers, 1945.

Whitney, F.L. The Elements of Research. New York: Prentice-Hall, 1942.

Whitney, R., and Frost, P.A. The measurement of performance in research. Human Relations 24 (2), April 1971: 161-178.

Wildovsky, A. Evaluation as an Organization Problem. London: Centre for Environmental Studies, 1972.

Wilson, E.B., Jr. An Introduction to Scientific Research. New York: McGraw-Hill, 1952.

Wolf, A. Essentials of Scientific Methods. London: George Allen and Unwin, Ltd., 1925.

Wolkon, G.H. Perspectives and procedures of the Hill House Research Program. Paper presented at the National Institute of Halfway House, 1963.

Wright, C.R., and Hyman, H.H. The evaluation. In F.E. Hammon, Sociologists Work, New York: Basic Books, 1964.

Young, P.V. Social Surveys and Research. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1968.

Zelditch, M., Jr. Some methodological problems of field studies. American Journal of Sociology 67, March 1962: 566-576.

Zetterberg, H. Social Theory and Social Practice. New York: Bedminster Press, 1962.

Report

"A Call for Citizen Action: Crime Prevention and the Citizen." National Advisory Commission on Criminal Justice Standards and Goals. Washington, D.C.: Government Printing Office, 1974.

APPENDIX A

Interview Schedule - TRUST . Follow-up

Person called:_____

Interview date:_____

Interview duration:_____

Name of organization:_____

Hello, my name is Jo Ann Roseman and I am calling from Northwestern University. I am working on the subsequent effects of TRUST's citizen participation project that was conducted in 1974. As you recall, the project involved organizing groups of citizens who watched films concerning the criminal justice system that were shown on television.

I would like to ask you a few questions concerning any subsequent activities that you or your organization have been involved in; especially if TRUST has been helpful in motivating or initiating those activities. Could I call you back, or would now be all right?

1. How concerned are you about community problems?

2. How active are you or have been in community affairs?

3. Do you know of any activity that you or your organization has been involved in which TRUST provided some stimulus to?

4. Has the booklet entitled "Avenues to Involvement" been useful to you or your organization? If yes, how?

5. Are you aware of the four-part documentary film on "And Justice For All" is available on loan from TRUST?

6. How does one get citizens actively involved in volunteer programs; community based recognizance programs; community based probation and patrol support services and citizens to organize projects that require support and consultation from criminal justice agencies, from your experiences with groups?

7. Do you think that the things which were done by TRUST have had effect on any of the activities that you have become active in for a long or short time since the showing of the films and the Action Fair Conference?

8. What do you feel are the essential parts of a citizen participation program which will motivate groups to take action on things that are of interest to them?

9. From being a participant in the project, what do you think would have motivated the group that you were a part of to take action?

10. What do you see as the citizen's role in motivating or promoting support of programs which affect them?

11. How important is it for citizens to know the opinions of other citizens, experts, and officials in affecting the decision makers policies concerning community problems and/or projects?

12. The TRUST program covered a lot of different issues, such as the definition of what a crime is, issues concerning the courts, prisons and corrections, rehabilitation, and community support and involvement. Do you think that it would make a difference, in terms of groups taking action, if some issues were given greater emphasis, and others less? If yes, what issues, and why.

13. The program had a number of components, such as the films, the booklets, the discussion groups, and the follow-up Action Fair. Other parts were the planning of the program and now the evaluation of the subsequent effects. What do you think are the most important things as far as getting groups to take action?

14. Do you know of any one or organization which contributes some of their activities from and to the TRUST project such as providing visibility to other groups about their program or membership increased because others knew of their existence, etc.

VITA

JO ANN ROSEMAN

RESEARCH INTERESTS

Interested in formulating and providing structure to unstructured problems in the areas of organizational development and social research methodology.

PERSONAL

Date and Place of Birth: January 23, 1949
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EDUCATION

Ph.D. Industrial Engineering
Northwestern University
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M.S. Industrial Engineering
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B.S. Mathematics
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*Completed after the August deadline; to be awarded June 1977.

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