EDITOR'S PREFACE

Violations are central parameters of social systems. They not only drive enforcement mechanisms of detection and punishment, but they comprise an operational definition and measure of the law or norm that is being violated. In the long run they change or redefine the norms themselves. Examples treated in this book include tax evasion, cohabitation, factory regulation, and draft dodging.

These disparate issues are treated by a simulation model of violation behavior, in which real longitudinal data is replicated and explained by a combination of initial conditions and dynamic assumptions. This is not a book for the voyeuristic layman. Even the "good parts" are surrounded by a technician's appropriate preoccupation with detail and a professional's diffidence in jumping to conclusions. The book should be regarded more as an invitation -- an invitation to the operations research community to build a real theory of violations on the outlines suggested by the model in the book, an invitation to the "user communities" to encourage operations research on their respective norms.

This book is part of a series of "softback" books published by the Operations Research Society of America. The referee for this particular book has been Peter G. Malpass, in his capacity as Chairman of the Special Interest Group on Social Science Applications.

Readers should be aware of some aspects of our editorial policy. First, we get these books reviewed (voluntarily) by top flight specialists. We ask them to verify the broad technical soundness of the work. We have no budget for a detailed technical editing, such as careless errors in equations or incorrect answers to problems. Lack of such mistakes in the first edition will be purely to the credit of the author.

John D. Kettelle
Editor-in-Chief
November 1985
Sociologists have long needed a practicable method for validating theory and conducting controlled experiments with replications on large populations. In this book, we present such a procedure based on computer simulation.

Computer simulations are used in a variety of fields to analyze problems and support decision making. By 1970, J.R. Emshoff and R.L. Sisson in their book DESIGN AND USE OF COMPUTER SIMULATION MODELS could list over ninety areas in which computer simulation had made important contributions. In the social sciences, computer simulations have long been a mainstay of economic analysis. They have also had great impact in determining consumer preferences in brand selection and have been used widely over the last fifteen years in all areas of corporate management decision making.

Social theory, however, is one area that has remained impervious to the advantages of computer simulation. Until now. In principle, there is no reason why computer simulation cannot assist research in macro-sociology with the same success it has experienced in other fields. We strongly believe it can, and in this book we demonstrate one such utilization.

The material in this book and the methodology it describes are truly interdisciplinary. As the title suggests, we have combined the fields of sociology and simulation to achieve results that would have been impossible to obtain separately. Our collaborative efforts have taught us the necessity of explicitness and patience on both sides and have rewarded us with enhanced knowledge in both fields. Throughout this project, the sociologist has learned much about simulation and the simulationist has gained many sociological insights.

The intended audience for this book is also an interdisciplinary one. Writing for such an audience, however, has its dangers. What is redundant to readers from one discipline may be new to others. A style consistent with the great social theorists would have prompted most simulationists to quickly dismiss our work as incomprehensible, while adopting the neat, concise style of technical presentations would have resulted in a work many sociologists would find unnecessarily difficult. In style, therefore, we have opted for the middle ground which we ourselves have found useful in our own discussions. We also have included as much of the rudimentary material from each discipline as we thought essential.
Chapters 2 through 4 contain material that will be familiar to knowledgeable sociologists, while the introduction to system dynamics, Chapters 5 and 6, will be familiar to many simulationists. We urge each camp to skim respective sections and concentrate on the rest. The major contribution of this book is in Chapters 7 through 11. There we use the techniques of system dynamics to model a social theory (which is summarized at the end of Chapter 4), and then validate the theory with computer simulation.

We are indebted to a number of individuals who have assisted us in our research, and we want to thank them for their efforts. Professor Hubert Law-Yone of the Technion contributed to an early computer model of the theory considered in this book, and we leaned heavily on his work in beginning ours. Professor Paul Feigin of the Technion first suggested a workable statistic for comparing model output with time series data, a statistic that was later refined with the help of Dr. Michael Jacobsen of the Institute of Occupational Medicine in Edinburgh to the trend fit statistic we ultimately used. Ms. Michal Blumenstyk read and criticized much of our early work and later produced a test case of her own which is presented in the Appendix to this book.

We also owe a debt of gratitude to Professor Robert K. Merton whose work provided the foundation for the theory we present in Part I, and who graciously arranged a seminar at Columbia University which provided a forum for articulating our early thoughts. Dr. JoAnn Gora arranged a similar seminar for us at Fairleigh Dickinson University, and her insights led to some elaborations appearing in Chapter 12. The artwork in this book is due to Ms. Ingrid Salomon, and we thank her for them. We are also indebted to both Mishpachah Maayan and Zeev Barzilai for bringing us together, and our respective universitites for providing support services. Finally, we publicly acknowledge the patience, understanding, and support of our wives who have borne the frustrations of our preoccupation with this book gracefully and with good humor.

Chanoch Jacobsen
Richard Bronson
FOREWORD

One of the major missing elements of comprehensive, global modeling has been the social dynamics that accompany economic, technological and political changes. A detailed theory of the dynamics of social systems has existed for some time, but the formal capability to test its predictive capability or to validate its success fitting forecasts to historical data has been lacking. The authors have done an impressive job compiling and reducing the social dynamics theory to state diagrams with paths of flow that can be modeled. They have then performed the equally impressive task of explaining intuitively the translation of the states and flows into a modularized system simulation model. Finally, for three diverse examples of facets of the theory, the authors have laboriously detailed the translation of historical data into model parameters, and verified that the model provides excellent fits to observed behavior.

This book meets a variety of needs. It provides a readable and intuitive explanation of normative social dynamics. It also presents the DYNAMO simulation language, its features and usage for non-technical readers. The outstanding component contribution of the book is the workload characterization for the applications. The construction of probability distributions from historical data and its modification by social theory provides a real insight into the substantive details for modelers, the "how-to" for future users and the nuts and bolts of modeling for social applications readers.

This work should have value in three areas: stimulation of research in the prediction of social effects, providing social scientists with an example of methods available for verifying theory, and publicizing the usefulness of higher level modeling languages like DYNAMO to operations researchers who tend to get locked into assumption heavy stochastic and deterministic techniques. The book can easily be used as a support
text for a graduate course in modeling for the social sciences, business, operations research or any combination. It would certainly lead to a cross-fertilization of ideas, needs and methods. It should also provide a tool for politically sensitive agencies or groups as to possible social ramifications of policy or other actions.

I enjoyed reading the book partly because the methods were different than the queueing performance models and PERT methods that are so heavily emphasized in typical OR coursework. The system is the subject, with all its components, relationships and feedbacks. Many times, we tend to get so tied up in aspects of a system that we lose sight of the big picture. Part of the reason for "specializing" our interests is the difficulty in picking up substantive area concepts easily. Not only are the scope and methods employed by the authors refreshingly complete, but the text is also well written for a general audience. As a result, it is easy for me to recommend the work highly for its originality, thoroughness and readability.

Peter G. Malpass
Performance Analyst
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Fairfax, Virginia
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CHAPTER 1

INTRODUCTION

1.1 THE PROBLEM

Sociology needs a realistic method to test and validate theory. This is its most fundamental problem as an empirical science. The accumulation of verified sociological theory is painfully slow, while scientific technologies for dealing with social problems are virtually nonexistent. Although library shelves are filled with scholarly works on theoretical sociology, sociological theories that have been tested and proven by repeated and controlled experimentation are hard to find.

The main purpose of this book is to describe and demonstrate a practical procedure for validating sociological theory. The procedure is based on computer simulation and allows for replication under truly comparable conditions as well as for controlled experimentation. Thus, sociologists will be able to subject theory to the complete regimen of the scientific method and to do it in a reasonable time period.

The scientific method is an iterative process involving observation, measurement, inference, generalization, theory building, and experimentation leading to more observations, measurements and experiments to test the emerging propositions and hypotheses. With each additional cycle of theoretical reasoning and empirical verification, the theory is refined until invariant relationships are established beyond reasonable doubt and integrated into scientific laws. This method has proven itself in many fields, primarily the physical sciences.

Sociology has not fared so well. Not only was the scientific study of society off to a relatively late start, but there were and are some formidable methodological problems that hinder its pursuit along strictly scientific lines. First, it is difficult to devise valid operationalizations of social phenomena and to measure them reliably. Observable indicators often measure the symptoms of a social event or process rather than the underlying condition itself, and these symptoms frequently vary between societies and over time. Secondly, societies, just like the individuals who constitute them, can learn from experience. They can learn about the observed regularities in their behavior and, if those regularities are not to their liking, they can, at times, change their behavior so that the previous observations become useless for prediction. Thirdly, and crucially, societies do not lend themselves very well to controlled experimentation.
and practically never to the exact replication of experimental conditions and procedures that the scientific method demands.

In the past, methodologists saw no solution to this third problem, so they focused their efforts on honing the techniques of observation and measurement and on increasing the rigor of the methods of statistical inference. In practice this has led to an enormous amount of research time being spent on questionnaire construction and an inordinate proportion of journal space being devoted to the theoretical justification of operational indicators. Unfortunately, many of these carefully calibrated instruments of measurement are used only once or twice and still more remain unpublished. Also, though huge amounts of descriptive data have been collected and are increasingly available in centralized data banks, it is not often that one can juxtapose them with truly comparable data sets from other social situations. Thus, the greater part of sociological research is not cumulative but remains a collection of disparate findings which do not increase confidence in the propositions they set out to verify.

The need for a research strategy to make sociological theory amenable to empirical verification has been recognized for many years. From the inception of sociology as a scientific discipline, this problem has exercised some of the greatest minds in the field. Durkheim proposed what he called the 'indirect experiment' of comparative analysis [1], and in Suicide (1897) he demonstrated its utility in providing sociological rather than psychological explanations for social facts. His advice and example have been widely followed [2], and yet we find ourselves today in the very predicament which Durkheim warned against and thought could be avoided by his method. We have "assembled in vain a considerable number of facts, but not been able to obtain precise laws or determinate relations of causality" [3].

Perhaps the reason for our slow progress is because, by this method, we cannot introduce enough control variables to justify causal inferences. Durkheim clearly overrated the robustness of his indirect experimental strategy for deducing causal relationships from empirical covariations. Perhaps also we have become more demanding in our requirements for what he rather facetiously called 'proof'. For all that, there can be little doubt that Durkheim identified the basic problem of sociological methodology almost a hundred years ago, and even if his proposed solution did not live up to his own expectations, he has shown us the direction where more satisfactory solutions can be sought.

Weber [4] had another axe to grind on behalf of the scientific method in sociology. His abiding concern was to disentangle sociology as a scientific enterprise from social action and politics. While granting the legitimacy and even the obligation of sociologists to engage in these activities, he argued that for sociology to attain the authority of a science, it must be kept free of value judgements. Weber's major contribution to sociological methodology was his insistence that if sociological research findings are to be given scientific credence, they must be free of all systematic bias, no matter whether the bias derives from inappropriate sampling procedures, insufficient controls, or ideological and moral convictions.
Thus, the call for an ever more scientific sociology is an old one, and in pressing for a fresh approach to the problems of validation we are following in the footsteps of sociology's great masters. Controlled experimentation can expedite our search for verified sociological theory. This should be obvious not only from the example of the physical sciences but also from the history of social psychology in the last fifty years.

At the turn of the century Durkheim could still write with some justification that "social psychology ... is scarcely more than a name, without a definite subject matter, and including all sorts of generalities, diverse and inexact" [5]. Today it is arguably the most solidly grounded branch of all the social sciences, really a discipline in itself, with established theories and an enviable array of practical applications in management, education, public relations, and other fields, which puts macro-sociology to shame. What has made this impressive achievement possible if not the experimental approach? Social psychology has had no perceptibly easier access to brain power or research funds than the other social sciences, but once pioneers like Lewin, Sherif, and Asch had shown the way to study social interaction under experimentally controlled conditions [6], replication could begin on a serious scale and comparable data sets could be obtained within reasonable time limits. This, we submit, is the single most important factor that accounts for the spectacular progress of social psychology in the last half century. As Gordon Allport said, Lewin had brought about a "revolution in the scientific study of man in society" [7]. With the advent of the computer age, we believe the time has come for a similar revolution in macro-sociology.

1.2 COMPUTER SIMULATION

Shannon [8] defines simulation as "the process of designing a model of a real system and conducting experiments with this model for the purpose either of understanding the behavior of the system or of evaluating various strategies for the operation of the system." Thus, computer simulation is basically a twofold process: constructing a model that represents a system of interest, and then running the model on a computer. The objective is to know how the real system will behave under a given set of conditions by observing the model's responses under analogous inputs.

There is, of course, only one absolutely sure way of determining how a given system will react to a proposed set of conditions and that is to subject the real system to those conditions and observe the outcome. Such an approach is not practicable when dealing with large social systems. Once a system is subjected to a set of stimuli it will react to those stimuli and change. It will never return to the exact state in which it had been prior to the introduction of the stimuli. As Heraclitus noted 2500 years ago, "upon those who step into the same river, different and ever different waters flow down". Although this is true of all life-systems, it has not prevented quite rigorously controlled experiments in biology because it was
possible to study other systems of the same species, so alike that any remaining difference could be disregarded. Even small group research proceeded successfully under such an assumption of ceteris paribus, though with human groups it is much more questionable.

For real-life large social systems the possibility of replicated experiments must be ruled out. We cannot apply a second set of stimuli to the same macro-system under identical circumstances nor can we use an 'identical twin' system for subsequent trials because such systems do not exist. A computer model of a large social system, however, can be rerun unchanged any number of times and the effects of variations in the stimuli can be observed and reliably recorded. Moreover, there is the important practical consideration that such a computer run rarely takes longer than a few minutes.

Mathematical model building is not new to the social sciences. Mathematical sociologists have been developing such models for at least forty years, yet the cumulative impact of this activity on social theory has not been great. Sørensen [9] writes that "the construction of models implementing a theory about sociological phenomena would be considered a central activity of mathematical sociology. It is, however, not the activity that dominates mathematical sociology. Rather, most contributions to the literature apply mathematical models already existing and usually borrowed from other disciplines to sociological phenomena." Even so, some of the work that has been done in this area [10] can be put to good use in the kind of modeling we propose to do. What we propose, however, involves a different approach.

Our aim is to test sociological theory. To that end we want to construct mathematical models which are specifically designed to represent theories. Thus, all variables and processes that are postulated or only implicit in the theory must have their counterpart in the model. Functionally, of course, the model must behave as the theory predicts it should, but this is only the beginning. Once the model is congruent with the theory, we use the model to validate the theory by running the model against real data sets and checking to what degree they agree or differ. This is what Leik and Meeker [11] call the 'empirical adequacy' of a model. If the theory and model pass the test of real data sets, controlled experimentation may be conducted in which the input variables are systematically varied so that the effects on model behavior can be observed in the simulation.

The particular simulation technique we shall use is called System Dynamics, developed along with a growing family of software packages known as DYNAMO by J.W. Forrester and his collaborators at M.I.T. The details of the technique necessary for understanding our model will be presented in chapters 5 and 6. At this point we only want to explain why we prefer this technique over others that are available.

Simulation may be either discrete or continuous. Discrete simulation deals primarily with queueing problems—systems that involve customers arriving at a service facility, waiting in line if all servers are busy, eventually receiving service, and finally departing from the facility. Since customer arrival
times and the time required to complete the service of individual customers are events with known or assumed probabilities, the mathematical models of such systems are anchored in probability theory and statistics. The dominant characteristic of such systems is large blocks of time during which the variables do not change.

In contrast, continuous simulation deals with systems that are conceptualized as changing continuously over time, and mathematical models for such systems are described by sets of differential equations. This type of simulation is more suitable for our purposes because macro-sociology is primarily concerned with processes and trends and does indeed assume that the social system is always changing.

System dynamics is a continuous simulation approach designed from the start with social structures and sociological variables in mind. Forrester called the first book he published on the subject "INDUSTRIAL DYNAMICS" [12] because in it he proposed a strategy for handling problems of executive decision making in the highly complex organizational structures of modern industry. Thus, there is no need to adapt the technique to make it appropriate for the concepts of macro-sociological theory. For sociologists it is ready-made.

Furthermore, the system dynamics approach is geared to reveal and clarify general trends and fluctuations rather than specific events. Model output tends to be robust rather than precise. Given the crudeness of so many measures in the social sciences, this seems to us a distinct advantage. Misplaced precision in the analysis of approximate data is one of the temptations which sociologists face repeatedly.

In addition, the DYNAMO programs provide a simple but entirely effective method for modeling nonlinear relationships between variables. We are freed from the necessity of making the frequently tenuous assumption of linearity in our data as we must, for instance, when using Pearson's product moment correlation coefficient. But we need not content ourselves with rank order correlations or general measures of association. We can express any relationship as it is posited in the theory.

Finally, and perhaps most importantly for many sociologists, the differential equations that express the rates of change in the variables do not have to be written or solved but are implicit in the syntax of DYNAMO itself. Consequently, DYNAMO does not require a more sophisticated mathematical background from the user than that which most sociologists possess.

In citing these advantages of system dynamics and DYNAMO we do not wish to overstate the case. Computer simulation still requires the expertise of a specialist, even with DYNAMO, and we are not advocating that sociologists become specialists in simulation. What is called for is the kind of cross-disciplinary collaboration between a simulation specialist and a sociologist which we have found possible and productive in doing this research and writing this book. For such a collaboration to succeed, a sociologist must master the basics of simulation and a simulationist must understand the sociology being modeled.
1.3 STRATEGY

Our proposed strategy for verifying sociological theory involves four fairly distinct phases: exposition, transposition, validation, and experimentation. Each phase requires constant iteration between theory and model so that the two can move in tandem from the conceptual stage to the drawing of inferences from the experiments.

Exposition: At a minimum the theory should be logically sound and based on some empirical evidence, however impressionistic such evidence may be. If the theory cannot satisfy these two preliminary requirements it is probably not worth testing in the first place. Beyond that, the theory must be stated in such a way that all hypothesized and assumed causal relationships are made explicit. This is very important and not quite as simple as it sounds. Sociologists tend to take many causal relationships for granted, for example, the effect of early socialization on later behavior patterns, or that of western cultural contact on family size in traditional societies. No doubt this is because they are so familiar with these phenomena that it seems redundant to set them down in writing. But system dynamics simulations will not recognize such influences unless they are explicitly stated in equations, and equations cannot be formulated unless the relationships are specified in expository statements.

System dynamics methodology includes a fine heuristic device for expressing the posited causal relationships which the model is supposed to represent. The device is called a 'causal-loop diagram'. It provides a readily accessible check for any logical lapses or hidden contradictions in the theoretical argument (see Chapter 5) and is also very useful as a concise graphic summary of the theory.

Transposition: In this phase we must build the vital bridge between the verbal and the mathematical formulation of the theory. Again system dynamics provides such a bridge in the form of a 'rate-level diagram' (also explained in Chapter 5). The bridge must remain open at all times in both directions because the mathematical model must always be congruent with the theory, and that can require elaboration of the theory as well as the model. An apparently trivial change in wording may need a different set of equations to express the nuance mathematically. On the other hand, not every statement that is mathematically correct is theoretically sound. Therefore, the possibility for adjustment of either theory or model must be left open always.

Congruence between theory and model means interchangeability in structure as well as in function. Both must be assured and both must be tested. Testing for structural congruence requires careful scrutiny of each equation in the model to make sure the mathematical logic makes theoretical sense. Skillful modelers can formulate algebraic expressions that do exactly what the theory demands but have no recognizable counterpart in the theory as stated. If that happens, one of the two must be changed and it is not necessarily the equation. It
may be the theory. In our experience, aggregating or
disaggregating variables to maintain structural congruence can
have a salutary effect on the formulation of the theory. It may
make for a tighter argument, more explicit reasoning, or a more
precise style. On the other hand, the tail should not wag the
dog. Sociologists should resist the understandable tendency to
leave the algebra to the expert; modelers, for their part, might
do well to approach sociological theory with the advice of one
cleric who cautioned others in the study of Scripture to take it
seriously but not too literally.

The test for functional congruence involves running the
model and checking whether it behaves in the simulation as the
theory predicts it should. If it does, the transposition from the
verbal to the mathematical statement may be considered adequate.
If it does not, further analysis of the model as well as the
theory is necessary so that adjustments can be made to either of
them. This test, of course, is not a validation of the theory
or the model, but it is evidence that the theory is being modeled
as intended.

Validation: When the congruence between theory and model
has been satisfactorily established, the model is used to
empirically validate the theory. This is done by setting
parameters in the model equal to their counterparts in the real
system, running the model on a computer, and comparing model
output with known time series of relevant data sets from the real
system. If the theory is valid and if congruence between theory
and model is good then the model should reproduce the major
trends and fluctuations as they appear in the data.

Validation requires successful comparisons with more than
one data set although the exact number of different data sets
needed for credibility remains an open question. Here the social
scientist is in the same position as his peers in the physical
sciences and must content himself with the same criterion:
validity is established when agreement is found in enough cases
to convince both the modeler and his colleagues beyond
reasonable doubt that the theory is correct. The more data sets,
the better.

If the model cannot replicate real data then either the
model is not congruent with the theory or the theory is not
congruent with reality. The model may be adjusted to conform
more closely with the theory if that is the problem, but if the
model continues to give output that is inconsistent with data
then one must conclude that the theory is invalid or, at best,
incomplete. It is this very real possibility of rejecting the
theory, a basic demand of the scientific method, that stamps
successful models as empirically valid.

Experimentation: With an empirically validated theory in
hand, one can design and conduct controlled experiments to test
specific hypotheses. As far as we know, the scientific adequacy
of controlled experimentation has never been in question, but it
was widely assumed that for ethical as well as practical reasons
it just could not be done in sociology. While this was probably
true until recently, it is not so any longer. If sociological
experiments are conducted by computer simulation, we see neither ethical objections nor any serious practical limitation. There would be no need to experimentally manipulate people, groups, or organizations since all the necessary manipulation can be done easily, quickly, and without moral qualms on a mathematical model. The simulation runs would generate output sets that are both comparable and accessible so that experimental control will be much easier to achieve than in real life.

The kind of alternative hypotheses we might wish to test, or indeed should test, will depend on the substantive content area as well as the postulates of a particular theory, and on existing alternative theories. One important series of experiments is appropriate to almost any theory and, therefore, should be included in the research strategy, namely experiments to establish the parametric limits of a theory. Since it is unlikely that any social theory will hold true for all social conditions, the specification of the boundaries within which it remains valid should actually be part of the theory itself.

The values in every data set are almost certainly affected by both the causal variables posited in the theory as well as the general social conditions at the time the data were produced. Such general conditions should be specified in the expository statements and incorporated into the model either as constants or as exogenous variables. If that has been done we can systematically vary each of these constants and exogenous variables and observe the effect on the simulation run. As long as these changes do not reduce the fit between model output and data to an appreciable degree, we know the model remains valid. When model output begins to diverge consistently from the data, it signifies that a boundary post has been reached for the value of that parameter. By locating a second boundary post in the opposite direction, we can establish the range of that parameter within which the theory holds.

The complete strategy is summarized schematically in Figure 1.1.

1.4 THE PLAN OF THE BOOK

This book is divided into three main parts. Part I, directly following this introductory chapter, presents a sociological theory of the dynamics of norm evasions and norm change in contemporary industrialized societies, particularly those in the western world. Preliminary ideas for the theory were presented in 1974 [13]. A more developed version [14] appeared five years later but even this was still limited to the etiology of norm evasions and their institutionalization and left the general issue of change in normative systems practically untouched. The greater detail and precision appearing here is due not only to having more space for its presentation but also to the necessity for having maximum clarity together with a minimum of assumed reasoning when transposing a verbal statement into a mathematical one.

While it would please us to see the theory used, the primary purpose of this book is methodological. Parts II and III are
Figure 1.1 The Strategy
both devoted to explaining our proposed approach, and the theory is only a vehicle for illustration. Many another theory would have done equally well, for example, Smelser's theory of collective behavior [15] which, in fact, served as the prototype structure of our theory, or Blau's theory of differentiation in organizations [16], or Wirth's classic theory of urbanization [17]. Other less felicitously formulated theoretical contributions found in the sociological literature would have to be rewritten carefully before they can be modeled adequately, although, in principle, there is no reason why this could not done.

Part II deals with the modeling process. Chapter 5 explains the system dynamics approach from the choice of variables through the causal-loop diagram to the rate-level diagram. Chapter 6 presents the DYNAMO language including the conventions and syntax that enable a computer to run a given model. In Chapters 7 and 8 we show the actual transposition from the verbal statement of the theory presented in chapters two through four into DYNAMO code ready for simulation. Without doubt, Chapters 7 and 8 are the core of this book, for in them we describe in detail how each variable and relationship posited by the theory gets expressed in the model.

The three chapters of Part III, Chapters 9, 10, and 11, deal with validation of the theory and establishing the limits of its applicability by controlled experimentation. Each chapter presents the data and the results of a separate validation study. For this purpose we have used three sets of previously published data. The data on income tax evasion in the United States were drawn from the Annual Reports of the Commissioner of Internal Revenue. Data on violations of factory regulations in Great Britain are taken from the Annual Reports of H.M. Chief Inspector of Factories, while those on unmarried cohabitation are found in the Current Population Reports published by the United States Bureau of the Census. Full and precise references for these sources are given in the respective chapters.

There is an important practical point to be made here, namely that only a small fraction of our research time had to be devoted to collecting data. Compared to the effort usually associated with questionnaire construction, pretesting, data collection, and coding, the time we spent on obtaining our data sets and preparing them for analysis is indeed negligible. This is an obvious and immediate advantage of our research strategy and goes to ameliorate the conditions of sociological research we described earlier in this chapter.

We close the book with a short final chapter in which we present some conclusions based on our experiences and venture into some cautious speculation about theoretical issues that are as yet unexplored.
NOTES AND REFERENCES


2. See, for example, EXPERIMENTAL DESIGNS IN SOCIOLOGICAL RESEARCH by F. Stuart Chapin, Harper & Row, New York, 1947.

3. This is Durkheim's criticism, slightly paraphrased, of John Stuart Mill's principle of multiple causality as given in Durkheim, op. cit.


See also: "Value and Social Science: The Value Dispute in Perspective", by Ralf Dahrendorf, ESSAYS IN THE THEORY OF SOCIETY, Stanford University Press, Palo Alto, California, 1968, pp. 1-18.

5. Emile Durkheim, op. cit.


