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Book Reviews

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BOOK REVIEWS

Administrative Theory in Education. Edited by ANDREW W. HALPIN, Chicago, Illinois. The Midwest Administration Center, 1958, $3.00. (Paper-covered)

During the past decade the volume of research into organizational behavior has increased at a phenomenal rate. The "portfolio" of this relatively new effort has included a large amount of work on small groups and a lesser amount on studies of whole organizations or classes or organizations.

One of the important, but less popular lines of investigation has been the comparative study of organizations such as hospitals, military units, schools, industrial firms, banks, social groups, etc. There is a substantial literature on administration in each of these classes of organization, going back over many years, but until recently there has not been much cross-over.

Among the early efforts to accomplish such comparative studies, were the programs at the Institute of Social Research (University of Michigan), the Ohio State Leadership Studies, and the Seminar in Theory of Organization and Management at Columbia University. The latter effort, which started in 1949[1] and still continues, was one of the earliest joint ventures by educational administrators and administrators from many other fields to examine the common elements of their experience and to undertake joint research.

Many meetings have been held of a cross-disciplinary nature to explore the possibilities of a marriage between the ideas, methods, theories and results of those disciplines active in the study of organizational behavior and the real problems that face organizational administrations of various kinds.

This book contains eight papers presented at one such meeting—a seminar on the role of theory in educational administration.

The stated purpose of the seminar (p. xiii) was to ". . . facilitate an exchange of ideas between social scientists and educational administrators. Representatives of these two fields sometimes have difficulty in communicating with one another."

This reviewer has participated in a number of such seminars and can heartily endorse the latter statement. He found, however, that this difficulty was seldom reduced in a few hours or days of listening or discussion around a table.

The key to better collaboration in research may be just that—active collaboration in research. Here the power of social science ideas and methods can be adopted to the realities of the administrator's position—the economic, political, and other constraints on his behavior that influence the degree to which he can bring about or support change.

Chapter I, an introductory paper by the editor, Andrew W. Halpin, sets the stage for the seminar. He sketches a number of recent efforts to encourage research in the field of educational administration which will help to build theory.

[1] Industrial Engineering Seminar I. E. 312. Special Topic 1949–50 "Measurement of Organizational Effectiveness."

So far, little theory has resulted, although he feels that communication between administrators and social scientists has been improved by some of these efforts. Halpin attributes difficulties in developing theories of educational administration to several problems: a lack of clear understanding of the nature and domain of theory, preoccupation with taxonomies, communication difficulties, and motivation.

His comments are reminiscent of similar statements made in many other fields of administration—e.g., hospitals, prisons, government, industry, social work, research and development. In all of these fields, people exhort administrators to be more theory-minded and researchers to be more interested in real problems.

Halpin's essay is very blunt in spots and includes two diatribes—one against the snares of the taxonomic method and the other against the impure motives of some theory-builders and theory-promotors.

James D. Thompson's paper discusses the purposes of administrative theory, its sources, criteria for evaluating it, and its present status. He concludes that progress is being made toward establishing a link between basic knowledge of human behavior and administration, analogous to the "life sciences—medicine" and "physical sciences—engineering" relationships.

Talcott Parsons' paper discusses three problem areas in organizational theory which have not received as much attention in the literature as the frequently-examined topics of line authority, staff organization, and decision-making. These closely related areas are: differences between levels in the hierarchy of control and responsibility in systems of organizations, external relations to the situations in which they function, and the variation in types of organization. He suggests some conceptual applications of these notions to the analysis of educational institutions. He also states that we are a long way from anything that deserves to be called a theory of formal organization.

John K. Hemphill outlines "a theory of administrative leadership in a framework of group problem-solving." Attention is focussed on "leadership acts" and upon the behavior, attitudes, and expectations of the members of groups. A member of "key concepts" are defined (e.g., a problem, interaction, structure, leadership acts, the group). In addition, several "key processes" are discussed (e.g., conformity to preestablished structures in interaction.)

Carroll L. Shartle discusses some work of the Ohio State Leadership Studies which covered a ten-year period. They were largely concerned with "describing individual and organizational behavior rather than with evaluating it." The studies illustrate the use of multi-disciplinary teams in the attack on a major problem in human behavior. A number of category systems are presented for describing various aspects of individual and group behavior in organizations.

Daniel E. Griffiths discusses "administration as decision-making." He is one of the few educational administrators with a chapter in this book and brings in a number of suggestive examples from the field to illustrate his points. He concludes with seven "propositions" about the relationships between decision-

making and administration. The first two are: "the decision-making process is the central process of administration" and "the decision-making process determines the structure of the organization." Most of his propositions do not appear to be subject to experimental or empirical test.

Jacob Getzels describes "administration as a social process." He presents a "model of social behavior" in psychological and sociological terms. Several illustrations are given of empirical results generated by the model and ideas for additional research.

Finally, Ronald F. Campbell, Director of the Midwest Administration Center (host to the seminar) discusses the "peculiarities of educational administration that make it a special case." He emphasizes, at the outset, the common elements running through all forms of administration, and then discusses the principle elements differentiating educational administration: the function of education in our society, the nature of the educational enterprise, the character of the school administrator's major reference groups, the semi-professionalism of educational administration, and the dual role of the educational administrator. Aspects of each of these, however, can be detected in the examination of many other institutions in the society where "administration" occurs—e.g., in nursing, military organizations, organized charity, etc.

For the readers of *Management Science* who are administrators in industrial or other organizations, several of these papers can offer some interesting insights into the general nature of organizations and the way they might be studied. There is very little, however, of an immediate practical nature that can be gleaned from them.

For readers who are attempting to solve real organization problems within, for example, an industrial setting, there is much of stimulational value, and some good suggestions on how to design studies in particular areas—e.g., leadership, decision-making, external relations. Not much of it is in how-to-do-it or handbook form.

For the serious student of organization, who hopes to contribute to theory, there is little in these papers that is not already available in the general literature.

Unfortunately, there is a major lack of even one good case example of how theory has been used in the study of an operating organization (i.e., a school or school system).

The major disappointing aspect of this collection of papers on administrative theory in education is that there appears to be little more to report on the subject (as applied to educational administration) than there was ten years ago when increased interest in the subject was reflected in the formation of the National Conference for Professors of Educational Administration (1947), followed by the Cooperative Program in Educational Administration (1950).

It does not appear that further conferences and organizations devoted to mutual stimulation can take the place of actual research into administration at all levels. In particular, at the level of good, valid descriptions of behavior in

communicable, reproducible terms that can serve to test propositions and contribute toward theory building.

ALBERT H. RUBENSTEIN
Department of Industrial Engineering
The Technological Institute
Northwestern University.

Handbook of Automation, Computation and Control, Volume 2, *"Computers and Data Processing"*, Edited by EUGENE M. GRABBE, SIMON RAMO, AND DEAN E. WOOLDRIDGE. New York: John Wiley & Sons, 1959. $17.50.

This volume, the second of the series, probably contains less material and details of immediate use to this journal's readers than the first volume. However, it does contain much of interest.

There are six sections, entitled, in order:

A. Computer Terminology
B. Digital Computer Programming
C. The Use of Digital Computers and Data Processors
D. Design of Digital Computers
E. Design and Application of Analog Computers
F. Unusual Computer Systems

Sections B, D, E and F are mainly directed toward computer programmers and designers. Section C has nine chapters: the first five deal with data processing operations and equipment, with the characteristics of data processing systems, and with considerations associated with the selection and installation of such equipment. Three chapters give some typical uses of computers and data processors in handling accounting problems, production control problems, and a small assortment of mathematical computations such as the solution of systems of linear and differential equations, and the determination of characteristic roots and vectors of a matrix.

All in all, despite the apparent high cost, this volume is, in the tradition of most good handbooks, a convenient and relatively inexpensive vehicle for the storage of a large quantity of descriptive and useful material.

MORTON KLEIN
Columbia University
New York City

Teoria Delle Code by G. AVONDO BODINO AND F. BRAMBILLA. Cisalpino Editoriale, Milan, 1959.

"Teoria Delle Code" is the first volume of the Mathematical and Statistical Section of the "Marketing and Business" series being issued under the auspices of the Commercial University L. Bocconi in Milan. This work on Waiting Line Theory is a very welcome addition to the small Operations Research literature in Italian and fills an important gap.

The first of the three parts into which the book is divided gives a resumé of probability theory stressing the Poisson, negative exponential and F-type dis-

tributions and generating functions. Continuous stochastic processes and Markov chains are also considered.

In the second section waiting lines are introduced with emphasis on Lindley's treatment of the single server problem. Differential equations and Markovian matrices method are also treated. Then follows a treatment of the m-server problem and suggestions for interesting applications.

One chapter is devoted to an interesting evaluation of distributions of observed waiting times in connection with which difference equations and simulating techniques are suggested.

In the third part of the book applications to machine interference and material storage problems are given. The volume closes with a selected bibliography.

Dott. Ing. UMBERTO TURELLO
c/o PIRELLI
Statistical Quality Control
Viale Abruzzi, 94
Milano, Italy

Finite Queuing Tables by L. G. PECK AND R. N. HAZELWOOD. Publications in Operations Research, No. 2, by Operations Research Society of America, Operations Research and Mathematics Group, Arthur D. Little, Inc., John Wiley and Sons, Inc., $8.50.

The book "Finite Queuing Tables" by L. G. Peck and R. N. Hazelwood, the second in a series sponsored by the Operations Research Society of America, pertains to delay systems of the following type:

N identical sources (e.g., telephone subscribers, machines, airplanes, etc.) present requests for service or facilities to a group of M servers (e.g., telephone lines, repairmen, landing strips, etc.). If a server is free when a request arrives, the latter is attended immediately. Otherwise it waits until a server becomes free. Concerning the input to the system, the assumption is made that the probability that a particular source known to be idle at time t (i.e., neither waiting nor in the process of being served) places a bid during the time interval $(t, t + \Delta t)$ tends to $\lambda \cdot \Delta t$ as Δt becomes small, the coefficient of proportionality λ being a positive constant which does not depend on the state of the system. Furthermore, the service times are independent of each other and exponentially distributed with mean T. All the requests are treated alike and the order in which they are served is independent of the length of the service times. (Since distributions of delays are not given in the tables, further assumptions concerning the service order are not needed here). Finally, the system is assumed to be in statistical equilibrium or, loosely speaking, both the number of arrivals and the number of service terminations during successive time intervals of equal length fluctuate at random about the same constant average value.

Delay systems as the one described above were first analyzed by engineers and mathematicians working on telephone problems. In the last two decades, however, their results were found to transcend the field of telephony, and delay theory—or queuing theory as it is now fashionable to call it—has received

wider attention and is today one of the main pillars of that growing collection of engineering techniques known as operations research.

The idea of using the theory of probabilities to describe the traffic flow in telephone exchanges is nearly as old as the telephone itself. But it was only with the pioneering work of A. K. Erlang, a scientific collaborator of the Copenhagen Telephone Company, that queuing theory had its beginning.

One of the main problems solved by Erlang is that of a delay system with exponential service times and random input. The precise meaning of this last term is that the probability that a bid for service be placed during the next time interval $(t, t + \Delta t)$ tends to $\alpha \cdot \Delta t$ as Δt becomes small, where α, a positive constant which does not depend on the state of the system, can be interpreted as the over-all arrival rate.

In the model considered by Peck and Hazelwood*, the over-all arrival rate is equal to $\lambda(N - n)$ when the system is in state n (n = number of sources either waiting or being served) and therefore depends on the latter. However, if λ and N tend respectively to zero and infinity in such a way that λN tends to a positive constant, the dependence of the arrival rate on n disappears. Erlang's model can therefore be considered as a limiting case of the more general situation considered in Peck and Hazelwood's tables. For this reason also, the random input is often considered as being generated by an infinite number of sources and has indeed very often been found to provide an accurate description of the input process when the number of sources is large.

In their tables, Peck and Hazelwood give the probability of delay D and a quantity F (called efficiency factor) which is defined as the proportion of sources which are not waiting. For given N, the quantities D and F are tabulated for various values of M and $X = \lambda T/(1 + \lambda T) = T/(T + U)$ where U is the average length of time during which a source is continuously idle.

The choice of X, M and N as independent parameters may be the natural one in some situations as, for example, in the case of machine breakdowns where estimates of T and U can probably be obtained easily. (Here T = average repair time, and U = average length of time a machine runs before breakdown). But in many other instances, in particular in traffic studies, the load H offered to the system is usually more readily available, and tabulation in terms of H, M and N would then be preferable. The computations using X as a main entry, rather than H, are much simpler and this may have had some bearing on the authors' choice.

Other quantities usually of interest in the study of delay systems can readily be computed from these tables. Indeed, the following relations hold:

a) $H = FNX$ = average load when expressed in erlangs = average number of busy servers.
b) $L = N(1 - F)$ = average number of sources waiting for service.
c) $W = (1 - F)T/FX$ = average delay.

* The basic delay formulae for this model when the service is in the order of the arrival, seem to have been published first by T. C. Fry in his book "Probability and its Engineering Uses" which appeared in 1928.

The ranges covered by the tables are (approximately) as follows:

Range N	ΔN
4–26	1
26–70	2
70–170	5
170–250	10

Range X	ΔX
0.001–0.026	0.001
0.026–0.070	0.002
0.070–0.170	0.005
0.170–0.340	0.010
0.340–0.600	0.020
0.600–0.950	0.050

For each N and X, the range of M is such as to cover all cases from maximum occupancy short of saturation to efficiencies, as measured by F, of about 0.999.

The quantities D and F are given to three decimal places. For most uses of the tables, the values of D are probably sufficiently accurate. But the values of F, especially when close to 1, might well have been carried to more places since the formulas for the average queue length $L = N(1 - F)$ and the average delay $W = LT/H$ involve $(1 - F)$ as a factor. Thus in important ranges of traffic loads, it is impossible to make satisfactory estimates of these parameters. For example, with $N = 50$ sources and $M = 5$ servers, reliable average delays are unavailable for server occupancies falling below 60 per cent.

Again the tables do not include the cases where the probabilities of delay are small, the most common cutoff point lying between 5 and 10 per cent. In commercial and military communication problems however, probabilities of delay are often required in the one per cent and lower ranges.

The tables are preceded by a preface which includes a brief mathematical description of the model. Surprisingly, however, the case of an infinite number of sources is treated in some detail but that of a finite number of sources with which the book is concerned is barely touched. And the formulas for the tabulated probabilities of delay and efficiency factor are not even stated.

A few examples showing the use of the tables are included along with some information concerning the machine program. The last illustration deals with average delays and their dependence on the number of servers is emphasized. Although no formula is explicitly given, the average delays are computed as if they were equal to the product of the average number of waiting sources by the average holding time. As a consequence, the values given at the top of page XV are incorrect. Since $W = LT/H = (1 - F)T/FX$, the average delays should read as follows ($N = 9$, $T = 9$, $U = 91$, $X = 0.09$):

$M = 1$; $F = 0.891$, average delay $W = 12.2$ sec. (instead of 8.82 sec.)

$M = 2$; $F = 0.989$, average delay $W = 1.1$ sec. (instead of 0.891 sec.)

$M = 3$; $F = 0.999$, average delay $W \cong 0.1$ sec. (instead of 0.081 sec.)

Also, the following corrections should be made on page IX:

Line 1—replace $\xi = \lambda$ by $\xi = \lambda T$.

Line 2—replace T by λT.

Delete line 3. (Note that the average number of incoming calls per unit time = average number of calls completed per unit time whence the fraction in line 3 is equal to M).

A few other inaccuracies and misprints occur but they are minor and unlikely to mislead the reader.

The tabular layout is pleasing; however, many entries in the D column throughout the book are poorly reproduced, at least in the reviewers' copy. This can be exceedingly annoying to the user who rightfully expects in this age of superior reproduction that the numbers should be easily readable.

Peck and Hazelwood's book is the latest substantial addition to the list† of available engineering tables and charts for delay systems in statistical equi-

† Several excellent bibliographies of papers on queuing are available, such as Alison Doig's in Biometrika *44* (Dec. 1957) pp. 490–514; and Vera Riley's in Operations Research in Management, Vol. II, J. F. McCloskey and J. M. Coppinger, Johns Hopkins Press, 1956. It may also be helpful to the recent entrant to the queuing field to indicate references where he can find information useful for problem solving, such as curves or tabulations of offered loads versus resultant delays. A selection of the more readily available of these is listed below:

Curves and Tables For Delay Engineering

Infinite Sources, First Come First Served, Exponential Service Times

1. E. Brockmeyer, H. L. Halstrom and A. Jensen: The Life and Works of A. K. Erlang, Copenhagen, 1948. (Table 7, p. 151; $P(\text{delay} > t)$, 1–40 servers).
2. E. C. Molina: "Application of the Theory of Probability to Telephone Trunking Problems," *Bell Sys. Tech. Jl.*, *6*, (1927). (Curves, pp. 461–494: $P(\text{delay} > t)$, 1–40 servers).
3. A. Jensen: Moe's Principle, Copenhagen, 1950. (Table III, pp. 73–85: $P(\text{delay} > 0)$, 1–139 servers).

Infinite Sources, First Come, First Served, Constant Service Times

4. E. Brockmeyer, H. L. Halstrom and A. Jensen: The Life and Works of A. K. Erlang, Copenhagen 1948. (Tables 4–6, pp. 149–150: $P(\text{delay} > t)$, 1–3 servers).
5. F. Pollaczek: "Kurven für die Gesprächsverluste im Vollkommenen Leitungsbündel," ENT, *10* (1933). (Curves: $P(\text{delay} > 0)$, 1–200 servers).
6. C. D. Crommelin: "Delay Probability Formulae," P.O.E.E. Jl., *26* (1934) pp. 266–274. (Curves: $P(\text{delay} > t)$, 1–20 servers).
7. I. Molnar: Delay Probability Charts for Telephone Traffic Where the Holding Times are Constant. ((Monograph) Engineering Notes 2032, Automatic Electric Co., Chicago, 1952). (Ref. 6 curves are reproduced, also plotted additional ways).

Infinite Sources, Random Service

8. R. I. Wilkinson: "Working Curves for Delayed Exponential Calls Served at Random." *Bell Sys. Tech. Jl.*, *32* (1953) pp. 360–383. (Curves: $P(\text{delay} > t)$, 1–100 servers).
9. P. J. Burke: "Equilibrium Delay Distribution for One Channel With Constant Holding Time, Poisson Input and Random Service." *Bell Sys. Tech. Jl.*, *38* (1959) pp. 1021–1031. (Curves: $P(\text{delay} > t)$, 1 server).

Finite Sources, Exponential Service Times

10. F. Benson and D. R. Cox: "The Productivity of Machines Requiring Attention at Random Intervals," J. Roy. St. Soc. B. 13 (1951, pp. 65–82). (Machine availability and efficiency tables, 1–15 sources, 1 server).
11. L. G. Peck and R. N. Hazelwood: Finite Queuing Tables, Wiley 1958. ($P(\text{delay} > 0)$ and Efficiency tables: 4–250 sources, 1–231 servers).

librium. Besides the tables reviewed here, this list now includes working curves and tables of delays for constant and exponentially distributed service times, random input and service in order of arrival. Corresponding engineering information has also been drawn up for random service and exponential service times and, in the case of one server, for constant service times. Further, a good start has been made in the recent book "Queues, Inventories and Maintenance" by P. M. Morse on suggesting the effect on the magnitudes of the delays when one departs from the above conditions of arrival and service time distributions. There remains however a need for tables and curves for ready engineering use in a wide variety of situations of practical interest.

While awaiting such assistance, the analyst will often have trouble deciding which of the limiting assumptions for which practical information is available, is the best to make, or whether any of them can safely be chosen. A frequent difficulty arises in estimating the effective number of sources at work in a particular problem. For example in telephony one end of a group of two-way paths may serve the demands of a quite limited number of subscribers. At the other end of the circuit group, however, is the very large population of telephones (conceivably many millions) who are free to make calls to these subscribers. Can this situation be described by the superposition of two load distributions, one generated by a finite and the other by an infinite number of sources? Or can the receipt of a call by a subscriber in the group be considered equivalent to the latter's originating an additional call, so the finite source model with increased load per source can be retained? Finally, contrary to an almost universal assumption made in theoretical treatments, the loads offered by the various sources in a group may be far from equal. Is there a nearly-equivalent system with equal source loads?

The machine breakdown problem with limited repair facilities provides one of the clearest examples of finite source systems since there is no question (usually) of their number, and it may often be reasonable to assume their failure rates to be substantially identical. Perhaps it is these circumstances which account for most of the practical work in the finite source field having come from analysts working in this area. Indeed, Peck and Hazelwood illustrate the use of their Finite Queuing Tables principally with examples of machine breakdown.

The publication of Peck and Hazelwood's tables is timely and in spite of the difficulties just mentioned, there is no doubt that they will prove to be a useful tool for all those engaged in traffic studies and operations analysis.

A. Descloux
R. I. Wilkinson
Bell Telephone Laboratories
New York City

Behavior of Industrial Work Groups: Prediction and Control. Leonard R. Sayles, New York: John Wiley and Sons, Inc., 1958, pp. 182, $4.75.

In spite of the renown of the research, of three decades ago, at the Hawthorne Works of Western Electric, relatively few sociological studies of industrial or-

ganizations have thus far been conducted. With some notable exceptions, much of past research is of a "case study" variety; in intensively studying particular organizations, it often does not deal with theoretically-derived or theoretically-relevant relationships among variables which are generalized to a class of phenomena. Moreover, as a result of the influence of the Western Electric study, considerable attention has been given to the informal work group, whose existence and behavior are unaccounted for by the organization chart. Extant studies have focused on communication processes, interaction patterns, clique formation, and group cohesion. The book under review represents a significant departure from past work in several respects.

It is not a "case study" of a particular organization. It is a comparative study based on data gathered from 300 work groups in 30 plants. And it does not deal with clique formations and friendship patterns but with "interest groups," i.e., social groupings which engage in actions designed to enhance their rewards, whether of a monetary or a non-monetary nature. "Interest groups" manifest behavior which is referred to as "grievance activity," a term used with a broader meaning than the one associated with the grievance procedure of a collective bargaining agreement. All protest actions, whether directed against management or the union, are called grievances. Nor is the work group used in the usual sense of a primary, face-to-face entity. Instead, it also includes an organizational unit, such as a department and an aggregate of individuals with the same level of skill or the same occupation.

A fourfold typology of the behavior of industrial work groups, vis-à-vis management and union, is constructed: (1) apathetic; (2) erratic; (3) strategic; and (4) conservative. Apparently the dimensions underlying this typology are frequency of grievance, frequency of spontaneous protest actions, degree of internal unity, participation in union activities, and management evaluation of the organizational contribution of work groups.

In an attempt to account for these different modes of group behavior, Sayles considers the effect of various intergroup and intragroup variables. Of special interest is the contrast in grievance activity between work groups performing heterogeneous and homogeneous tasks. Technological factors, according to the author, are considered as "enabling conditions" or as "intervening variables between organizational structure and group action" (p. 94). The mechanisms which account for different behavior patterns of work groups are intergroup comparisons of relative advantages, threat to security emanating from management and the union, and past success or failure in protest actions.

From a methodological and theoretical standpoint, this study has various deficiencies. The lack of quantification of evidence is troublesome, unless the study is viewed as a prelude to a more systematic and rigorous one, which Sayles has already inspired at G.E. The non-quantitative character of the results scarcely facilitates prediction and control, the avowed objective of the book as expressed in its subtitle. Furthermore, the data are based largely on testimony from management representatives since access to union leaders was refused in

about half of the cases. Another limitation of the data is that, though based on an exceptionally large number of work groups and plants, they are confined largely to the metal-processing industry, which may restrict the generalizability of findings.

These and other lacunae aside, Sayles' book calls attention to an important phenomenon: the effect of "interest groups" on management and union alike. With the increasing polarization of power in industry between labor—by which is ordinarily meant labor unions—and management, it is easy to overlook the dynamic function of informal work groups. Apart from the anticipated and profound effects of technological change on industrial and union organizations, the potential impact of spontaneous, bureaucratically unorganized work groups has been largely unanticipated and unappreciated. From this vantage point, Sayles' book is indeed significant. And, if the projected series of studies on organizational behavior at Columbia's Graduate School of Business were to follow up this line of inquiry, it would undoubtedly make an important contribution to our understanding of industrial and union organizations.

WILLIAM M. EVAN
Bell Telephone Laboratories
Murray Hill, New Jersey

Modern Organization Theory, by MASON HAIRE, Editor. John Wiley and Sons, Inc., 1959.

This book is a collection of eleven papers written by ten well-known academicians and read at a symposium held by the Foundation for Research on Human Relations at Ann Arbor in February 1959.

Although no new concepts are included in these papers, Haire's introductory chapter containing his editorial comments on the recurrent themes and general issues in organization theory is highly instructive and helpful in unifying the otherwise disjointed concepts and viewpoints. Each contributor has given an interpretation, based on research, of some element of the total problem. The papers cover a wide range in organization theory. At one extreme are concepts derived from evidence of empirical experiments exclusively relying on data so obtained; at the other extreme, are intellectual speculations in the form of abstract mathematical models. A collection of such interpretations in one volume is of great value to those interested in organization theory. (It is stated that representatives of industry also participated. If their viewpoints were included, the book would perhaps have been of greater value as it would have given a touch of "realism," indicating the practical usefulness—or not—of the concepts discussed.)

Bakke defines and uses the concept of social organization in discussing the activities and relationships basic to an understanding of organization behavior. Cyert and March attempt to relate organization behavior to the decisioning process involved in the determination of goals of the organization. Their opening sentence, "Organizations make decisions," may not be entirely acceptable; it is

perhaps truer to say that decisions are made enabling organizations to function rather than that organizations themselves make decisions. The experimental approach suggested by Rapaport indicates the benefits of laboratory studies when controlled manipulations and detailed scrutiny of organization variables are really possible. Using a possible behavior model, Argyris focuses attention on the internal whole of an organization. He omits the environment in his model so as to keep the conceptualization within limits of comprehension and logical reasoning. Whyte makes a plea for the study of organization behavior in terms of the activities and interactions involved in effective job performance. The motivational approach of Likert seeks to relate the organization's productive efficiency to the supportive experiences of individuals by which they feel a sense of their importance and personal growth. Dubin formulates the relationship between the type and number of communication linkages and their effect on decision making and the stability of human organizations. Cartwright indicates the relevance of the mathematical theory of linear graphs studying relationships among different operating units. By using a living organism as a model to correlate the biological processes that regulate its growth and development to that of an organization, Haire analyzes the predictable over-all growth patterns of industrial firms in the long term. A short, but perhaps the most interesting paper in the book by Marschak, demonstrates the value of well-conceived organization models in clarifying the lines of logic behind the solution of practical organizational problems which are amenable to formalization.

To attempt to seek a unifying theory of organization in the book will doubtless be met with disappointment. Organization theory is essentially a behavior theory and a unified behavior theory cannot be had by merely bringing together various pieces of information, much of which may not even be relevant. It can, at best, help in improving the intellectual ordering of the subject matter and in spotting the unmapped areas of the terrain. A study of this book, therefore, cannot help leaving an impression that we are yet to see the beginning of the development of an organization theory.

Almost every paper is couched in apologetic terms; the reader is warned of the limitations of the experiments or models on the one hand, and of the contributor, on the other. Despite the reporting on perhaps the most tentative concepts in narrow areas of the problem, a symposium of this nature has the merit of exposing the experts to the viewpoints of others. It is, indeed, a healthy sign that possible errors of viewpoint and analysis are opened to correction through the discussion, analysis and reasoning of others interested in organization theory. As Thomas Jefferson said: "Error of opinion may be tolerated where reason is left free to combat it." If only to have the effect of modifying a viewpoint toward a more and more realistic and fruitful one, this book is well worth reading.

H. N. NANJUNDIAH
Columbia University
New York City

Probability and Statistical Inference for Engineers by CYRUS DERMAN and MORTON KLEIN. Oxford University Press 1959.

This little book has the contents and looks of a one semester text. It is not completely described by these words, however, since its authors do not seem to believe that an engineer can learn all he needs of statistics in a one semester course. In fact they have omitted almost all of the usual content of an engineering statistics course, intending it, presumably, for further courses. There is barely a word on handling data; control charts are never mentioned; inspection sampling is discussed in an example or two; the word "tolerances" is not used, though confidence intervals are. The back of the book, usually a jungle of tables, has just three tables on three pages. It also lacks an index.

To discuss what the book does contain, there are three chapters. 1. Preliminaries (10 pages) introduces the terminology of set theory and functions and explains sum and product notation. The presentation is abstract, formal, and brief. 2. Elements of Probability Theory (82 pages) begins with sample spaces and ends with the Poisson and normal approximations to the binomial distribution. The usual topics are taken up, discrete and continuous distributions, conditional probability, random variables, expectation, binomial, Poisson and normal distributions. But also distributions of functions of random variables and joint distribution functions, logically indispensable topics, are discussed, used in problems, and appear in the mathematical development of later topics. The last chapter, 3, Decision Problems (49 pages), begins with a discussion of decisions in two examples, the first with known probability distributions, and the second with unknown distributions. There follows a short digression for a rather formal discussion of estimators. Then the usual Wald formulation of the decision problem is outlined and illustrated by simple examples. Of course the methods of finding minimax rules are not given, but the reader is taught clearly to compare given decision rules. The last two sections are on tests of hypotheses and confidence intervals.

The authors intend to instruct students in formulating and solving mathematical problems connected with probability and statistics. If a theorem is necessary whose proof will not further this instruction, it is stated without proof. Those proofs whose absence would destroy the logical framework necessary for problem solving are usually given. The actual framework is, however, presented in such concise form that the instructor will have much exercise in supplementing the text, and the student much use for his classroom notes. The sections on conditional probability and independence are especially brief and the connection of these mathematical ideas with observable phenomena is barely given.

The usual section begins with a brief and formal description of a topic, then several examples are worked in which the topic is applied. This is followed by a list of exercises for the student. The examples and exercises are mostly realistic and thus long in statement. The proportion of poorly stated problems is low for a book on statistics. The reviewer found only one exercise in the book which common sense would show to be unworkable. And of the ten exercises on testing

hypothesis there was only one of the classically ill stated variety which misleads the student into believing that it is all right to use data to decide on the question which will be tested statistically by the same data.

A student who takes a course with this book should be in a position to take a usual engineering statistics course and understand what it is about. Without further courses he may not be a good short order cook, but he will be able to concoct.

L. COTE
Syracuse University

Efficiency in Government through Systems Analysis with Emphasis on Water Resource Development, by RONALD N. MCKEAN. A RAND Corporation Research Study, Publications in Operations Research Number 3, xxi + 336 pages.

This book is one of the titles in the ORSA publications others of which have been on queues by Philip Morse, queuing tables by Peck and Hazelwood, and a bibliography on Operations Research by the OR Group at Case Institute. More important it is a member of the class of books concerned with OR methodology written by authors with origins in an array of disciplines: Morse and Kimball (origins in Physics and Chemistry); Churchman, Ackoff, and Arnoff (origins in Philosophy and Mathematics); Saaty (origins in Mathematics); Goode and Machol (origins in Engineering and Chemistry). It is interesting to note that each makes its contribution through the eyes of the subject matter in which the author had his origins. This book is no exception. McKean is obviously an economist and develops the methodology of operations research through the eyes of an economist.

In fact he notes that his objective is to help in applied economizing. It is aimed at an audience of cost-benefit analysts (in government work, cost-benefit analysis involves computing the costs of a project and the value of the benefits to be gained from the same project and using some function of these two as a measure of the desirability of the project), operations researchers, government personnel who evaluate alternative courses of action, those in academic circles interested in similar topics, and persons generally concerned with economy in government.

The book begins with an introduction to the problem, its scope and plan of study. It then goes on to give a general treatment of methodology in operations research. This treatment is quietly written (perhaps too quietly for avid reading) and develops the items of methodology listed in more detail below. In connection with the criterion problem it reproduces much of Hitch although it makes a further contribution in that it is done in an expository vein. The difference between this treatment of methodology and most others is the introduction of "time streams" (computations relating dollars at different points in time and thus affecting calculated money criteria). Such time streams have long been subject matter for economists, and for engineers applying economics to their studies, and I believe that their injection into the picture will be a gain for the methodology of operations researchers.

The book goes on to develop a section on special problems in the analysis of water resource projects. In the next part it applies what has been done in general methodology, and the special problems in water resources, to two specific water resource projects: "The Green River Water Shed," and the "Santa Maria Project." In a final section the author lists what he believes might be problems yielding to analysis in governmental areas other than water resource.

The best sections of the book (I suppose because they are the most generally applicable) are in pages 25 to 96. Much of this material is a redo of the operations research methodology picture but always with the mental set of the economist added. The section treats the criterion problem; the appropriate alternatives; intangibles, uncertainty, and criteria; and time streams. The best of the subsections, in this reviewers' opinion, is the one on time streams which adds to the bag of tricks of the operations researcher.

The style, in my opinion, was not attractive. It is clear that the author is thoughtful, but whether he has put his best foot forward toward writing an interesting exposition of the subject is in my mind questionable. As stated above the style is much too quiet, so much so that it makes getting through the book difficult. It is so easy to not listen and think about something else.

This book is probably a useful addition to the literature. Its major interest seems to me to be for the government worker who has not yet concerned himself with analytic techniques in the solution of governmental problems. Mr. McKean seems to think this is the majority of government workers. Secondarily, it is of interest to those of government who have already applied analytical methods and would like to see a detailed exposition of such methods. Finally it will be of interest to operations researchers who have not heard of, or dealt with, time streams. For the management scientist, it introduces little if anything new in the way of sciences for management except in so far as any treatment of the methodology always aids ones' re-thinking of the problem. The exception again for the management sciences is the notion of the time streams.

HARRY H. GOODE,
University of Michigan

Dynamic Management Decision Games. By JAY R. GREENE and ROGER L. SISSON. John Wiley and Sons, Inc., 1959, $2.95.

The growth of the use of business and management games both for training and research has created a considerable need for a book on decision games. Unfortunately, this particular publication falls far short of fulfilling this need.

This pamphlet contains several specific good games of limited but nevertheless important value. Otherwise it tends to be a potpourri of hortatory comments, cookbook suggestions and general statements concerning many different goals and uses for games.

Its most important flaw is its lack of other than very general discussion of the purposes of and uses for the playing of games. For example, in the introduction and first chapter it is noted that the instructor, himself, may be educated

by the game. There is a very important distinction to be made between the use of a game to teach principles and the use of a game for experimental purposes.

If a game is to be used to teach principles and to give experience to students, it is necessary to have some principles to teach. Given our state of knowledge of business and decision processes there are only limited areas in which we have a sufficient knowledge of principles to merit teaching them by gaming. Some of the games in this pamphlet provide good examples.

In general, if a game is to be used for experimentation different considerations must be given concerning its design and use. It is feasible to use a game for both teaching and experimental purposes, but this involves careful design and not conversational research.

It is this reviewer's belief that three, rather than two, different roles must be considered with respect to the design and utilization of a game. They are the roles of

1. model building,
2. utilizing the game for experimental purposes, and
3. utilizing the game for educational purposes.

The model builder does not necessarily have to be the same as the experimenter.

Another major flaw in this book is its total failure to discuss the relative merits of computer as opposed to non-computer business games. There is no discussion of costs or the amount of time involved in the construction of the different games. There is little doubt that if one wishes to design even a relatively complex game in which the structural relations will never change it is possible to construct a special slide rule, a set of tables or some other analog device which will make it feasible to play the game without a computer. As soon as one wishes to vary parameters or even wishes to make structural changes the amount of additional computation can become prohibitive.

The introduction to this pamphlet is almost entirely hortatory. It begins with an analogy between military and business games and asserts that games can be useful in business for the transmitting of knowledge. As has been noted above, it does not address itself to examining where we have knowledge worth transmitting.

As one exhortation to the playing of games the authors state that "dynamic games result in a high degree of player involvement." Furthermore, in Chapter 1 they assert that they will tend to act as if the game represents a real business situation. It is not immediately obvious that a high degree of player involvement is necessarily desirable. If it is, this reviewer suggests poker or the reading of the biographies of Messrs. Fiske, Gould, Drew and Vanderbilt as more than adequate alternatives for glorified monopoly. Whether or not the players act as though the situation is like "real business" requires more validation than is available at this time.

In Chapter 1 the authors commence with a strongly negatavistic statement. They say "It should not, of course, be expected that the specific parameters, structure, or even strategies used in the game will apply exactly to any particular firm." It is this reviewer's firm belief that eventually it will be highly desirable to build models of specific firms or other organizational structures.

The authors make an important point when they discuss the possibility of integrating the playing of a game into a course. They furthermore suggest that certain games can be of considerable use in the teaching of techniques, such as the use of Gantt charts, statistical inventory control, break-even charts and financial statements. The one strength in this manuscript comes in the discussion of such uses.

It is claimed that games will offer insight into the establishment of over-all policies. It is the fervent hope of all who have been interested in the development of games that this is so. This manuscript adds little to the substantiating of this hope unless one subscribes to the philosophy of The Bellman in "The Hunting of the Snark": "What I have said three times is true."

One difficulty which presents many problems is the effect of simulated time in these games. In many games 20 minutes is often used to formulate three months of play. In several instances this forces the individuals to cogitate as little as possible in order to be able to fill in the prerequisite forms during that period. The operating motto for such games may tend to be "Think or Thwim" more than it is think.

It is asserted that "there is no other educational device that permits the dynamic nature of business to be illustrated as effectively to the student" as the dynamic game. Although this reviewer is convinced that the considerable potentialities for the application of games have hardly been utilized, he cannot concur with this assertion. Perhaps it is old-fashioned in these days to read history or literature. However, even Mr. Gibbon had some concept of a dynamic process.

Chapter 2 is devoted to observations on how to construct games. In this chapter, less than 5% of the iceberg is visible. In two paragraphs (Steps 2 and 3), it is noted that model building is necessary. The modeler is advised "to select from among the many functions . . . those that *seem* to represent the key problems in the particular business. This is a judgment decision on the part of the game designer and depends upon what he is trying to teach and on his own background." If 30 pages or a book had been devoted to the expansion of these two sentences this work might have provided a highly useful contribution.

On page 5 the following paragraph appears:

> "In general, it is wise to leave out 'one-shot' decisions such as choosing a distribution channel or locating a new plant. These nondynamic decisions can be illustrated effectively by textbook or case presentations."

It is the belief of this reviewer that to build one-shot decisions into a game presents grave difficulties. The reason for this is that we know so little about these *highly dynamic decision processes*. The authors choose to regard major innovation and investment as nondynamic. This appears to be a considerable misinterpretation of the nature of the economy in which we live.

The third chapter deals with how to direct and modify a game. It is noted that it is important to explain the difference between the objectives of the game and the objectives of participating in the game. Insufficient discussion is given to the many problems involved in setting up a goal or an objective function for the game.

In particular, one technical but highly important feature of game design is

not even mentioned. In many cases if a game has a specific previously announced termination point many anomalies and paradoxes can be created by the utilization of this information. To make a "real business" analogy, it is like being able to guarantee the business community that the world will end on the 29th of December of 1961.

The latter half of Chapter 3 discusses some general areas in which modifications are possible. The authors note that it is possible to change parameters, goals, trends, functional forms, feed in wrong information, add or subtract coalition structures and so on and so forth. In King Henry IV, Part I, the following conversation takes place between two minor characters:

"I can call spirits from the vastly deep."

"Why, so can I, or so can any man;

But will they come when you do call for them?"

It has been the sad experience of this reviewer that a lifetime of work would hardly suffice to carry out the number of possible changes that can be suggested during one coffee break.

Chapters 4 to 7 provide the most useful part of this manuscript. Four examples of games employed to teach specific techniques or to illustrate specific problems are described. They involve a materials-inventory-management game, useful in a discussion of economic lot size; a personnel assignment game, useful for experimental material in the teaching of some simple linear programming; a retailing department management game; and a production scheduling game. Had they been preceded by a few chapters discussing the purposes and the uses of this type of tactical training game in detail they would have provided material for a useful, well-balanced pamphlet.

Chapters 8 and 9 present an industrial sales management game and a top operating management game. Both of these are probably better computerized. The complexity and the number of variables involved is such that if any change were to be made to these games a considerable amount of work would be called for which could be avoided easily. The authors note that for these two games there are many worthwhile discussion questions that are general in nature. Although they do not discuss them, these type of games lend themselves as aids to the teaching of economic theory and many other aspects of the theory of the firm.

In Chapter 9 on page 58, the authors state "the game starts off with a long period of market growth to illustrate the necessity for increasing plant capacity." It is not at all evident to this reviewer that increasing plant capacity is of necessity a good thing. Perhaps if there were instances of special change or adjustment it would be desirable to teach this principle. In the abstract, there is no particular reason to do so. It is highly dangerous to teach principles when you don't know what they are or why they should be.

Chapter 10 provides a market negotiation management game. It is the most structure-free of all the games presented and comes very close to the type of game used for small group studies where the experimenters are interested in observing the nature of bargaining processes. The authors comment upon the possibilities of mergers or coalitions.

In order to utilize such a structure, considerable analysis must be performed. This involves the combinatorics and the complementarities inherent in the coalition structures. It is noted that "advance students might wish to study the results of an actual play of this game from the theory of games approach." To the best knowledge of this reviewer, at this time there are approximately 20 alternative theories of solution for an n-person non-zero-sum game. It would have been desirable for the authors to have enlarged their comment to indicate what they had in mind.

The selected bibliography presented at the end of this manuscript appears to be quite eclectic, with many references (such as those to Samuelson and von Neumann and Morgenstern) hardly relevant to the subject except in a secondary manner and then only by intensive study. Many of the references would be of little use to those who are not relatively well acquainted with gaming, economics and gaming theory.

In summary, it is the firm belief of this reviewer that there are several important roles to be played by gaming both in teaching and research. Enough is known at this time and the general interest is sufficient at this time for a thoughtful, comprehensive publication to be of great use to Management Scientists, Operations Research workers, Economists, Psychologists and others. This pamphlet is of limited use to those interested in the construction of a few small tactical games. We must still await the publication of material of sufficient depth and perception to do justice to the several important topics included in gaming.

MARTIN SHUBIK
General Electric Company
New York City

BOOKS RECEIVED

(*Inclusion of books in this list does not preclude their subsequent review*)

Analise Da Interdependencia Estrutural by F. Araujo Gomes. Monografias 1 Finantec, Rio de Janeiro, Brasil, 1959.

Capital Interests and Profits by B. S. Keirstead. New York: John Wiley & Sons, Inc., $4.00, December 1959.

Creativity and its Cultivation by Harold H. Anderson, Editor. New York: Harper and Brothers. $5.50, 1959.

The Forest Ranger, A Study in Administrative Behavior by Herbert Kaufman. Johns Hopkins Press, $5.00, January 26, 1960.

Handbook of Industrial Research Management by Carl Heyel, Editor. New York: Reinhold Publishing Co., $12.00, November 30, 1959.

Industrial Complex Analysis and Regional Development by Walter Isard, Eugene W. Schooler and Thomas Vietorisz. The Technology Press (MIT) and John Wiley and Sons, Inc., $8.75, December 1959.

The Management of Corporate Capital by Ezra Solomon, Editor. Graduate School of Business, University of Chicago and The Free Press, Glencoe, Illinois, $7.50, December 1959.

Merger Movements in American Industry 1895–1956 by Ralph L. Nelson. Princeton University Press, $5.00.

Messen Und Regeln in Der Betriebswirtschaft by A. Adam. Physica Verlag: Wurzburg, 1959.

A Modern Dynamic Approach to Product Development by Sidney Sobelman. Picatinny Arsenal, Dover, N. J.

Organization and Methods, A Service to Management by G. E. Milward, Editor. New York: St. Martin's Press, Inc. $7.50, February 1960.

The Theory of Storage by P. A. P. Moran. Methuen's Monographs on Applied Probability and Statistics. Methuen and Co., Ltd. (London) and John Wiley and Sons, Inc., 1959.