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Book Reviews

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BOOK REVIEWS

Human Relations in Industrial Research Management, ROBERT T. LIVINGSTON, AND STANLEY H. MILBERG, (eds.). Including Papers from the Sixth and Seventh Annual Conferences on Industrial Research, Columbia University, 1955 and 1956. New York: Columbia University Press, 1957, 418 pp., \$8.50.

This collection of conference presentations and reprints of research articles accurately reflects the state of contemporary knowledge about the human aspects of research management. Practitioners from the industrial laboratories of such firms as Eastman, General Electric and Monsanto made observations which emphasized the relation of the individual in his research job. The academic researchers stressed organizational problems, indicating vividly how conflicts are induced by attempts to utilize managerial technologies in the handling of scientific enterprises.

Even at this early stage in the development of scientific knowledge about the behavior of humans, the practitioners are making use of such research findings. Shepard of American Cyanamid presents a synthesis of current management theory about industrial research. Pease of Mead Johnson makes use of the psychological findings of such workers as Roe and Humphrey and Roe. Engstrom of RCA even conducted researches on attitudes of the research worker in his own company.

Yet, some of the practitioners write anecdotally as though there was no reliable knowledge upon which they might draw. For example, although almost all of the practitioners talk about creativity, little of their speculation is based upon the underlying knowledge which such workers as Guilford and Stein have generated in their studies, even though the work of one of these researchers is listed in the book's bibliography. One wonders why these scientist-practitioners neglect the findings of the social sciences in their managerial tasks. They would hardly be guilty of such ignorance of the sciences underlying the technologies of their particular industries.

Just as the book reflects a contemporary lack of communication between practitioner and social scientist, so it mirrors the fragmental nature of our knowledge about human relations problems in research management. Moore and Renck report their work on attitudes of scientists in industry, while Shapiro reports on attitudes of scientists in government. Herbert Shepard's work on the social structure of the laboratory examines the way in which project and functional organizations have differential consequences upon the problems of power and personal security. The case studies of Paula Brown and Clovis Sheperd of the development of a government laboratory are gems. But no one has funded the knowledge gathered to date. Should this task have been performed by the editors in a summary chapter, so that the book would not have remained a series of discrete contributions?

This is the third volume emanating from the Industrial Research Conferences sponsored by the Department of Industrial and Management Engineering of

Columbia University.* The weakest chapters by the social scientists were those written by scholars from Columbia University itself. One knows these particular scholars are capable of much higher quality contributions. Although another volume again serves a usefulness in sharing widely the insightful presentation of the practitioners and in reprinting significant research already published elsewhere, one wonders whether as great an institution of higher learning as Columbia should not now be putting its resources of manpower and press to more rigorous and more integrated efforts worthy of its scholarly traditions.

HAROLD GUETZKOW
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Handbook of Automation, Computation, and Control, Volume 1, Edited by EUGENE M. GRABBE, SIMON RAMO, AND DEAN E. WOOLDRIDGE. New York: John Wiley & Sons, Inc., 1958. \$17.00.

This Handbook will undoubtedly prove to be of great value to management scientists, operations researchers, and system engineers. This first volume, of the three to be published, should be the one most directly useful to individuals primarily interested in operations research.

Volume 1 is divided into five Parts headed: A. General Mathematics, B. Numerical Analysis, C. Operations Research, D. Information Theory and Transmission, and E. Feedback Control. Volume 2 is to cover "Computers and Data Processing". Volume 3 will treat "Systems and Components". Parts A, D, and E of Volume 1 lay the groundwork also for the topics of Volumes 2 and 3.

The choice of mathematical topics for Part A is good, and the treatment of each topic is excellent though necessarily only introductory in scope. Part A contains Chapters on: sets and relations, algebraic equations, matrix theory, finite difference equations, differential equations, integral equations, complex variables, operational mathematics, Laplace transforms, conformal mapping, Boolean algebra, probability, and statistics.

Part C is a 125 page Chapter (by E. L. Arnoff) that includes discussions of: inventory models, allocation models, waiting time models, replacement models, and competitive problems. Only a few very simple inventory examples are included. The discussion of allocation models is a 40 page exposition of the simplex technique for solving linear programming problems. A few of the most familiar queueing models are listed, together with their steady-state solutions; the problem of production sequencing is illustrated by a few examples. The min-max theorem of game theory is stated, and a few simple 2-person matrix games are solved to provide examples. All of these topics are treated as problem-

* Rubenstein, A. H. (ed.), *Coordination, Control and Financing of Industrial Research: Proceedings of Fifth Industrial Research Conference with Selected Papers from Fourth Conference*. New York: King's Crown Press, 1955.

Hertz, D. B. (ed.), *Research Operations in Industry; Proceedings of the Third Conference on Industrial Research*. New York: King's Crown Press, 1953.

solving techniques, and very little hint is given as to the wide range of applications already made, or possible, with these techniques. Rather, the treatment is adequate only to identify the topic for further study by way of the 118 references included in the bibliography. This limitation to problem-solving techniques is characteristic of the other Parts of Volume 1, and may be wise since applications are often both hard to describe and fleeting in their importance.

Part E, on "Feedback Control", is a 350 page treatment of this important topic that may prove most useful to management scientists, and especially to those who wish to make use of these powerful techniques for system analysis but do not have the opportunity to go still more deeply into this topic.

The Editors, and the Authors of the various Chapters of Volume 1 are certainly to be commended for their work. If the other two Volumes match Volume 1 in quality, this Handbook will fill the great need there has been until now for just such a publication.

MERRILL FLOOD

University of Michigan

The Theory of Games and Linear Programming, S. VAJDA. New York: John Wiley & Sons, Inc., London: Methuen, 1956. \$1.75.

Readings in Linear Programming. S. VAJDA. New York: John Wiley & Sons, Inc., 1958. \$3.00.

These small but excellent volumes contain a surprising amount of information. The first booklet can be put into your pocket, but it contains a very good introduction into the Theory of Games and Linear Programming. Both graphical and algebraic methods are treated, and even such topics as degeneracy and duality are covered. The treatment is essentially elementary, but it is quite scholarly. Whatever is in the booklet is clearly stated and well-explained.

The second book is almost full-sized, but quite thin. It presents examples of applications, and the stress is on the practical point of view. In spite of the fact that there are less than a hundred pages in this book, a wide variety of topics are discussed, such as the transportation problem, caterer problem, production scheduling, transshipment, bid evaluation, flow through a network, transportation with restrictions, ship scheduling, personnel assignment, routing aircraft, investment, nutrition problem, airlift, blending of aviation gasolines, smooth patterns of production, selection of products, trim loss reduction, attendants' rota, warehousing, and games. There are also three theoretical chapters included to make the work complete.

These delightful volumes demonstrate that books do not go by the pound, but by the content. The reviewer only wishes that books of this brevity, but high content and excellent presentation, existed in other fields.

A. VAZSONYI

Scientific Advisor

Ramo-Wooldridge, Los Angeles

Statistics of Deadly Quarrels, LEWIS FRY RICHARDSON. Boxwood Press, Pittsburgh, Pa., 1959.

Arms and Insecurity: The Theory of Arms Races, LEWIS FRY RICHARDSON.
Boxwood Press, Pittsburgh, Pa., 1959.

The Arms Race, PHILIP NOEL-BAKER. Oceana Press, New York, 1958.

Inspection for Disarmament, S. MELMAN AND 73 Contributors. Columbia University Press, New York, 1958.

The Books

These four volumes present a unique and formidable record of scientific cooperation. They are concerned with the history, the deaths in 150 years of wars, the theory and history of Twentieth Century Arms Races, the present position of The Arms Race, scientific means for annihilation and some estimates of our chances and choices for survival with and without further improvements in the science of arms race management. They should be read together.

The Makers

The first two volumes listed above were completed just before his death by Lewis Fry Richardson (1882–1953). Their publication late this year is owed to notable interdisciplinary cooperation, contributions of time and money, by many people in the United States and Britain since Richardson's death in 1953.

Philip Noel-Baker's foreword to *The Arms Race* acknowledges material and secretarial assistance by the Rockefeller Foundation, the hospitality of Cambridge University's King's College, and his intellectual debt to an international Who's Who of scholars, scientists and politicians—with the curious exception of Richardson.

Richardson and Noel-Baker, as Friends, went to the Quakers' Bootham School and King's College, Cambridge. Noel-Baker was chief organizer of the Friends' Ambulance Unit which he commanded in Belgium and France, in 1914–15, where Richardson served in the line as one of the drivers. Richardson relates that ambulance drivers, like soldiers they carried were at that time "not supposed to think" and that he therefore had plenty of time to begin his four decades of thinking about the causation of war. This eventually became a full-time occupation. As a physicist of distinction he returned to his prewar job in meteorology, while Noel-Baker went on to a prominent public career in British national and League of Nations politics. Richardson was not reclusive but pursued his odd mathematical historical and statistical research ways on wars, almost necessarily in solitude. Meanwhile Noel-Baker was pursuing the causes of war through Versailles, the League of Nations, under various academic auspices, in Parliament, the Ministries, Cabinet and is now in the Shadow Cabinet.

Both men thus dedicated their lives to the same quest, one mainly alone, the other in active and scholarly public service. It is interesting to quote from Noel-Baker's response to a recent inquiry about communications he may be thought to have had with Richardson, and how he now thinks of their convergent work on THE arms race: "I only knew L. F. Richardson very slightly, and that because he was a Quaker, and had been at my school, Bootham in York, before he subsequently went to King's College Cambridge, as I did. There was a legend

that he failed to get a scholarship there because he would insist on going to Chapel in yellow shoes. His brother, Hugh Richardson, was for many years my science master at school. He also was an odd, but very able man. I think it more than likely that if Richardson had been elected to a Fellowship at King's, Britain might have been in the forefront of Hydrological research . . . I regard the stopping of the Arms Race very soon as the only hope for humanity. But it means Disarmament on a large scale; stopping Tests is not going to help us much!" *Inspection for Disarmament* is, seen superficially, the distributive work of an international group of 21 authors, "collected" as contributed essays by a "managing editor", Seymour Melman. However, he acknowledges the critical and editorial aid of 73 variously specialized professional people here and abroad in bringing together this urgently made design survey of the means needed, and held feasible, to the end described by the title.

Noel-Baker is alphabetically among the listed 73. Yet he and Richardson are either unknown or their works considered insufficiently relevant by the authors to be included among six score references to the literature of weapon technology, management, and lethal economics of 7 decades and three arms races including the current one. Here are indirectly brought into communication with the reader uncounted weapon designers, physicists, economists, geneticists, chemists, electrical engineers, mechanical engineers, civil engineers, chemical engineers, mathematicians, statisticians, biologists, physicians, soldiers, industrial engineers, sociologists and psychiatrists—a round hundred cooperating on the first and momentous design for inspection and management of disarmament. All of us can now see, but especially clearly do the hundred odd see, the feasibility of means for holding in check the Third Arms Race. They did it without much apparent help from Noel-Baker or Richardson.

Pathometry of War

We may put the matter differently. Doctors of preventive medicine need know, and know little, about the history of discovery in science and preventive medicine to see the plight of all of us and confidently to recognize a plague when they see one. How many doctors need know of the contribution to epidemiology made by equations of malaria propagation constructed by Sir Ronald Ross in his "odd" book *A Priori Pathometry*, or of his death in India? Malaria is now prophylactically held in check, and we can move on to control the next plagues in order.

There have, since 1900, been three major arms races 1907–1914, 1932–9, 1949– and two post-war disarmaments, 1919– 1946–. Richardson's last paper about their relaxation oscillatory development, statistical psychology and economics, appeared in *Sankhya: Three Arms Races and Two Disarmaments* (1953). Richardson should, one may suppose, be turning content in his grave at the thought that his pathometry of arms and arms races was not much more needed by the new and determined band of arms race managers who prepared *Disarmament for Inspection*, than doctors now need Ross' malaria equations.

The parallel with preventive medicine is close, for Ross and Richardson worked with formally rather similar differential equations. The general context

of the Richardson and Ross equations is that of inter- and intra-group biological or biosocial competition. There is of course a half century of tradition for such investigation, which can be traced forward from 1907 through A. J. Lotka, L. F. Richardson, Volterra, Kostitsin, N. Rashevsky, and H. Simon (1957) and to many others. With the exception of Ross and Simon those named came to their quantitative biological and social considerations by way of physical chemistry, physics and mathematics or statistics. The disdain lightly accorded the imperfect work of such renegades, by those who remain more rigorous and faithful to the 19th century image of a well-pruned tree of scientific method and knowledge, is still heard in invidious references to the "hard" sciences and the "soft" or "life" sciences. In fact it is only recently that a hitherto unwelcome social science camel has been permitted to get a soft nose into the tent of the U.S. National Science Foundation. Space medicine is, it seems, shortly to be followed by Space Psychology, Space Sociology and Intercultural Relations in *The Race for Space*. Our anthropocentric units of value and measurement in the supporting risk calculations have become Richardson's war finance-per-salary, (warfinpersal). One optimizing criterion for space vehicle systems is destruction per dollar. Others are destruction per ruble, or man-hour.

Readers of this essay who find that they "have the time", the wish, and possibly the stomach, to read these books together, but cannot spend \$30.00 all at once, are invited to write this journal for the loan of a set. The "newer fresher blood thus circulating may make one furious such things beholding, but [may] also break forth and grow into a thousand beneficial germs". The dust jacket of *Inspection for Disarmament* is a shocking bloodstained affair, somehow not recognized for what it is seen to be at a glance. *The Arms Race* has an off-red jacket. The jackets for Richardson's volumes, which are to be bound in maroon cloth, have not yet been designed.

Richardson: Previews of content, and critiques of his work

A preview of the last two volumes and the long series of research papers by Richardson on war and arms races is their author's own abstract, published in 1950. This was abridged in 1956 by James Newman from T. H. Pears' collection of essays on *The Psychological Factors of War and Peace*, for Volume 2 of *The World of Mathematics*. Anatol Rapoport has since written a critical analysis of Richardson's fundamental metaphysical ideas and scientific methods. This appeared in the new journal *Conflict Resolution* (1957) in an issue devoted to Richardson's life and work. Herbert Simon in 1957 acknowledges his debt to an "F.W." Richardson among others in his *Models of Man*.

To distinguish L. F. Richardson clearly from the numerous distinguished Richardsons, the content of his life in physical and behavioral research deserve a definitive volume by a competent scientist-biographer who will also separate legends from facts in the life and violent times of a remarkable pioneer. I personally felt that Richardson had earned the Nobel Peace Prize but doubt that the trustees ever heard of him favorably during his life time. His Royal Society vita can now be read in *The Statistics of Deadly Quarrels*.

In 1950 Richardson had written an expository essay on arms races for a co-

operative volume on organization then being assembled by the Columbia University Seminar on Organization. This Seminar was then a curiously unmanageable confederation of interdisciplinary, not to say undisciplined scholars and engineers seemingly interested in everything, horse and arms races included. Richardson's last letter to the Seminar in September 1953 enclosed a reprint of his Sankhya paper. The acknowledgment was answered by Dorothy Richardson, his wife, in October, reporting his death.

Mrs. Richardson was subsequently convinced by friends in the United States that early publication of his last work might be possible in the United States. This was on the assumption that there were ample funds for all sorts of publication here and, as much interest in the work had already been expressed, this would surely lead to earlier appearance than could be expected in Britain. There Richardson's work on war had been treated with indulgence and somewhat less honor than his ethically more neutral and well known work on the physics of the atmosphere. The motivating assumption seems now to have been naive. The American publisher finally called upon John Clowes of London to do the printing, a difficult piece of work in any case.

Chance and Choice

It has lately become more fashionable to see Richardson's pioneering as "classic". This may mean that even fewer people read him now that the odd and disturbing man is out of the way. But it remains a doubtful honor to "study war" as Richardson tried to do it, "scientifically", patiently, but with no evident love for war. This is held to be impossible and it becomes so by requiring of the aspirant the achievement of ideal ethical neutrality and Olympian objectivity of judgment. What Richardson managed to make of war, as a Friend, and as a scientist of severe standards, future arms race managers and the more general reader will now be able to learn for themselves.

Standards of ethical neutrality, or simple indifference have perhaps been applied more successfully by scientific managers of military technology or science, and to the prosecution of war itself. Machiavelli and Clausewitz are usually quoted when examples of cynicism or high scientific competence or detachment from ordinary sentiment or humane ends are needed. I have recently helped to edit *Deadly Quarrels*. Views expressed on Richardson's aims, the effect of his ethical bias on his choice of technical methods and his results, when I wrote part of the editors' introduction in 1957 have not changed essentially. They need not be repeated, being sufficiently explicit here.

The scientist, the scientific manager, or the citizen, may now ask, very well, what are the posterior chances of the feared nuclear-biological war within any specified period of time. Given such an ultimate "quarrel", what are the contingent expectations of the promised death and destruction in its various kinds and degrees? Does not the unique and ultimate character of war with nuclear explosives and bacteriological poisons deprive us of all hope of rational calculations of what to do for survival in such a war, apart from the question of finding sufficient untroubled time off from enveloping demands of the arms race for any

useful "scientific" findings to emerge from the more disastrous questions? Richardson still had, or took, time patiently to consider many prior questions between 1917 to 1953. Since then a number of urgent, (not to say desperate) volumes have been written, "finally" answering Richardson's questions. Richardson, Noel-Baker and the hundred odd contributors and authors of *Inspection for Disarmament* may now be consulted for an account of choices, chances and methods available for taking the calculated risks.

Noel-Baker did not get much help from Richardson for his own *The Arms Race*. His is a thorough study of the recent and current history of such races and the present political means and outlook to disarmament. His book is historical and incidentally statistical, but is not concerned with mathematical "models" or postulational types of arms races analyzed in Richardson's THEORY. It is concerned with political management of the most frantic race of the era. Richardson's study was statistical-historical to 1953, and is more coolly inductive and predictive of trends in its spirit than is Noel-Baker's. Neither could adequately consider the management of the world tensions, the deadly intent and the abrupt explosion of this race into interplanetary space, except as Wellsian anticipations or gray parametric extrapolations. Richardson was 72 when his death ended his studies. He had begun his study of war much as Noel-Baker had, managing or driving ambulances in France. Beginning with Bertrand Russel's concept of nations that "prepare and prepare", Richardson is now known for his pathometry of war, his postulational concept of the race, the circular processes of mutual threat, deterrence, and the general analyses of pacifying factors.

The story of the yellow shoes is consistent with the image obtained from reading Richardson's work and letters: this wise, humorous, humane and "odd" man walked very much alone. It would therefore seem an appropriate memorial to Richardson should a venturesome foundation establish annual Richardson traveling fellowships. Apart from his travels in Flanders by ambulance, and walking tours in England, Richardson did not travel very much. Such a traveling enterprise could become an exercise for future statisticians of humane scientific endeavor, who would try to follow the Richardson shoes to see how they fitted and what their wearers shall have accomplished.

Inspection for (Management of) Disarmament seen in this light, was created by 21 candidates for the Richardson shoes. They have already, actively, gone far beyond anything the scholar imagined. In all, a group award would total \$100,000, plus some trivial minimum of "scientific management" on say Guggenheim Foundation standards of economically permissive administration.

The sum is three times as large as the \$35,000 budget on which the study was planned, prepared and published in 18 months. In the era of scientific management of \$10⁹ solarprobe budgets the effect of such a sum may be dismissed as that of an urchin, who may be permitted to precede but cannot lead the parade of events.

This loose confederation of contributors to a uniquely necessary piece of scientific cooperation for survival was certainly not "managed" by Dr. Melman.

The editorial file of the "project" was only an inch thick. Melman appears to understand the nature of freedom within scientific organization, perhaps because he was one of the mavericks who chanced to pass through the interdisciplinary Columbia Seminar on Organization and Management. If that group investigation into choice and chance taught him nothing else it has justified its existence. The book should stand on the same shelf with the Richardson and Noel-Baker books.

C. C. LIENAU
*Columbia University Seminar
 on Organization and Management
 New York*

BOOKS RECEIVED

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

Economic Forecasts and Policy by H. THEIL. Contributions to Economic Analysis, XV. (Amsterdam: North-Holland Publishing Company) 1958.

Quality Control and Industrial Statistics by ACHESON J. DUNCAN (Revised Edition) Richard D. Irwin, Inc., \$9.00, January 1959.

Men Who Manage by MELVILLE DALTON. John Wiley and Sons, Inc., \$6.75, May 6, 1959.

Strategy and Market Structure by MARTIN SHUBIK. John Wiley and Sons, Inc., \$8.00, March 30, 1959.

Studies in Linear and Non-Linear Programming by KENNETH J. ARROW, LEONID HURWICZ and HIROFUMI UZAWA. Stanford Mathematical Studies in the Social Sciences, II. (California: Stanford University Press), \$7.50, 1958.

Wage Incentives by J. KEITH LOUDEN AND J. WAYNE DEEGAN. John Wiley and Sons, Inc., \$7.00, March 1959.

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