Books

CURE FOR CHAOS
By Simon Ramo
David McKay Company, Inc. . . . $3.95

Reviewed by Roger G. Noll, associate professor of economics.

Three times during the 1960's an American President established (and Congress later ratified) a major national goal. In 1961 President Kennedy proposed that the United States land a man on the moon during this decade. In 1964 President Johnson declared a War on Poverty that would eliminate poverty by the nation's 200th anniversary. And two years ago President Johnson proclaimed the national goal of building 26 million housing units in ten years, thereby eliminating all substandard dwellings.

America's performance in reaching its national goals is not spectacular. While in this, the year of Apollo, we have achieved a most demanding technological objective, nevertheless no one seriously believes that the two social goals will be reached, or even closely approached. What must we do to make the progress toward solving the nation's social problems match our technological progress?

Simon Ramo's answer to this vexing question is rather simple: We can find "Fresh Solutions to Social Problems through the Systems Approach" (the subtitle of Ramo's short book). According to Ramo, complex technical problems and social problems are sufficiently similar that analytical techniques useful in solving the former can be successfully applied to the latter. Ramo's book, a discourse on the methodology of social problem solving, advocates the application of systems analysis in such diverse areas as public education, medical care services, transportation, economic policy, and environmental quality.

By systems analysis Ramo means at least two things. On one level systems analysis suggests an orderly, objective formulation of a problem, considering all relevant factors. According to Ramo, "We want 'human' problems approached by the careful setting down of clear goals, the articulating of available alternatives, and the comparing of conceivable paths for satisfactoriness against equally carefully laid out criteria."

Ramo contrasts systems analysis with the "piecemeal" approach, which is characterized by attacking subcomponents of a problem without considering the interactions of the subcomponents. To illustrate his point, Ramo contrasts the efficiency of the telecommunications system with the inefficiency of the transportation system.

Simply to consider objectively all relevant factors is no more than to adopt a rational approach to problem solving. Systems analysis is more than this. It involves employing professionals from several disciplines, accumulating and manipulating significant amounts of data, constructing and using complex mathematical models based upon sound theory, developing and applying technological gadgets, extensively using computers, and deriving an "optimal" solution.

Certainly the logic of the systems approach is unassailable: Who could eschew sound theory, good data, appropriately constructed mathematical models, or any of the other components of systems analysis? But on a more practical level, systems analysis will still prove of little use in attacking social problems if we are unable to supply it with the inputs required for its effective operation.

As Ramo suggests, systems analysis must be based upon a sound theoretical foundation, in the same sense that good engineering is based upon sound physics and chemistry. Unfortunately, social science theory is as yet too underdeveloped to be useful in many social problem areas. With the exception of economics, where reasonable theoretical models now do a tolerably good job of predicting some types of economic phenomena, most areas of social science are only beginning to develop useful theoretical tools. Researchers in some disciplines, such as psychology, sociology, and cultural anthropology, are still in the prescientific stage of gathering and categorizing data, while making little or no attempt at building theoretical models.

While systems analysis seeks "optimum" solutions, it does not determine the values to be optimized. Systems analysts themselves are not responsible for establishing the objectives of their analytical models; in fact, as Ramo points out, a precondition to good systems analysis is that the goals be clearly specified for them.

In military and space programs the government has been able to specify its goals clearly, but this has not been the case in social areas. Citizens do not generally regard themselves as experts in military tactics, international relations, or science and engineering policy, but they do have strong feelings about social issues.

Perhaps this difference is partly the consequence of the underdeveloped state of social science theory, but it goes far beyond that. Social programs by their nature touch the lives of citizens in ways a space program never can, involving a full array of personal attitudes, experiences, and prejudices. Consequently, the objectives of social programs, being the result of compromise, are normally fuzzy and often mutually contradictory: e.g., maintain both full employment and price stability, or give every child the opportunity to reach his full intellectual potential (which probably implies racial and social integration for poor kids but segregation for rich, white kids).

Under the far less than perfect conditions of social policy formulation, systems analysis is not only less effective, but can actually do positive harm. Because the technical aspects of social problems have better theory, are supported by better data, and are amenable to the establishment of more specific and less controversial objectives, the incentives are strong for systems analysts to overemphasize the technical side of social problems. Ramo slips into this trap in his illustration of a systems approach to improving educational

---

Simon Ramo, vice chairman of the board of TRW Inc., is a Caltech alumnus (PhD '36) and has been on the Institute's board of trustees since 1964.

performance. His "solution" emphasizes computers, closed-circuit TV, and other gadgets, while ignoring the critical motivational aspects of education (the social environment, the student-teacher relationship, etc.).

Even if all these difficulties could magically be swept away, there remains one further, perhaps insurmountable, barrier to systems analysis solving our social problems. During the 1960's most everyone agreed that it would be a "good thing" if we ended poverty, provided better education, improved the transportation network, and cleaned up our deteriorating natural environment, as well as go to the moon. But the last item on the list was backed up by a multibillion dollar annual appropriation during the entire decade. While American society may well believe that solving our social problems is a "good thing," it may not be willing to underwrite the cost. The problem is further complicated by the fact that while no space-monster lobby developed to oppose solar system exploration, there are groups in our society who benefit (or believe they benefit) from many of our social problems, and who will fight very hard against solving them. As long as a political majority can be maintained by a government professing support for "good things" but unwilling to pay for them, systems analysis is not going to solve our social problems.

Book Notes

SUPERCONDUCTIVITY IN SCIENCE AND TECHNOLOGY
Edited by Morrel H. Cohen
University of Chicago Press $5.95

This book contains the edited proceedings of a 1966 conference on superconductivity held at the University of Chicago. Among the seven contributions is one on "Quantum Engineering" by James Mercereau, PhD '59, research associate in physics at Caltech. What this and the other papers attempt to answer is whether large-scale technological applications of superconductivity can be expected, and if so, when. Cohen is professor of physics at the University of Chicago.

SCIENCE NEWS YEARBOOK 1969/1970
Compiled and edited by Science Service
Charles Scribner's Sons $9.95

As Lee DuBridge points out in his introduction, communication between the scientist and layman is of critical importance in our increasingly technological society. This yearbook, based on material originally published in *Science News,* brings together in layman's terms the latest information in various fields of scientific endeavor, breaking it down into nine parts: Biomedicine, Space, Astronomy, Physics and Chemistry, Earth, Engineering and Technology, Environment and Ecology, Behavioral and Social Sciences, and Science Policy.

FULL HOUSE
By C. C. Cawley, '32
A. S. Barnes and Company $3.95

Here's the latest challenge for puzzle addicts. These 100 puzzles are all based on card games, although, the author claims, no knowledge of the games themselves is necessary—"The only thing you really need is your brain." And for those who find even that unreliable, the answers are in the back of the book.

SCIENCE, ART AND COMMUNICATION
By John R. Pierce, '33, PhD '36
Clarkson N. Potter, Inc. $6.00

In this latest collection of his writings, John Pierce, one of the country's most distinguished scientists and inventors, looks into our future as a technological society. Pierce is executive director, research, communications sciences division, Bell Telephone Laboratories.

COHOMOLOGY OPERATIONS AND APPLICATIONS IN HOMOTOPY THEORY
By Robert E. Mosher and Martin C. Tangora, '57
Harper & Row $12.95

This book, intended for the advanced topology student, explores the interaction between cohomology and homotopy and traces the development of these two topics into higher constructions, the secondary operations and compositions, and the Adams spectral sequence. Mosher is associate professor of mathematics at California State College at Long Beach; Tangora is instructor in mathematics at the University of Chicago.

Statement of ownership, management, and circulation (Act of October 23, 1962; Section 4369, Title 39, United States Code)

1. Date of filing: Sept. 17, 1969.
2. Title of publication: Engineering and Science.
3. Frequency of issue: 7 issues per year.
4. Location of known office of publication: 1201 E. California Blvd., Pasadena, Calif. 91109.
5. Location of the headquarters of the publishers: 1201 E. California Blvd., Pasadena, Calif. 91109.
6. Names and addresses of publisher, editor, and managing editor: Publisher: California Institute of Technology, Alumni Association. Editor: Edward Hutchings Jr., 1201 E. California Blvd., Pasadena, Calif. 91109. Managing editor: Bruce Abell, 1201 E. California Blvd., Pasadena 91109.
7. Owner: California Institute of Technology, Alumni Association, 1201 E. California Blvd., Pasadena, Calif. 91109.
8. Known bondholders, mortgagees, and other security holders: none.
9. The purpose, function, and nonprofit status of this organization and the exempt status for Federal income tax purposes have not changed during preceding 12 months.
10. Extent and nature of circulation:

	Average no. copies each issue during preceding 12 months	Actual number of copies of single issue published nearest to filing date
A. Total no. copies printed *(Net Press Run)*	7,824	7,740
B. Paid circulation		
1. Sales through dealers and carriers, street vendors and counter sales	20	30
2. Mail subscriptions	6,137	6,258
C. Total paid circulation	6,157	6,288
D. Free distribution *(including samples)* by mail, carrier or other means	1,163	1,164
E. Total distribution *(Sum of C and D)*	7,320	7,452
F. Office use, left-over, unaccounted, spoiled after printing	504	288
G. Total *(Sum of E & F—should equal net press run shown in A)*	7,824	7,740

I certify that the statements made by me are correct and complete.
—Edward Hutchings Jr.