# Reviews

Robert H. BONCZEK, Clyde W. HOLSAPPLE and Andrew B. WHINSTON
**Foundations of Decision Support Systems**
Academic Press, New York, 1981, 393 pages

Thomas H. NAYLOR and Michele H. MANN (Eds.)
**Computer Based Planning Systems**
Planning Executive Institute, Oxford, Ohio, 1982, 199 pages

The last quarter of this century has witnessed an explosive growth in human knowledge. This rapid growth has in turn led to the situation where many individuals acting in a decision-making capacity are unable to assimilate a significant past of the information in their field. The evidence is very convincing that in many situations the solutions produced by human decision makers acting alone are much less than the best that might be achieved.

For a number of years the idea has been advanced that decision support systems, DSS, might provide a solution to much of this problem. DSS can be defined to be an interactive computer system that directly assists executive decision makers in their task. Because of its information processing speed, DSS would appear to have the potential to form part of an effective man–machine problem-solving system.

DSSs are most appropriately oriented towards semistructured problems, i.e. towards problems where there is sufficient structure for computer and analytical aids to be of value but where human judgment in still essential.

There are two basic types of decision systems: procedural and definitional. In procedural systems one command the computer to do each step. Definitional systems fit into the category of problem oriented systems, sometimes called non-procedural systems, to separate them from procedural systems.

The name procedural is applied to design systems in which the user tell the computer exactly what procedures or set of computational steps to use in solving his problem.

Basically, you are not using the machine as some kind of intelligent being that is trying to help you, but rather as a tool that is to take your solution scheme and follow your detached list of instructions very rapidly.

In non-procedural modeling systems you do not try to figure out how to solve the problem you have, rather, you feed the problem itself into the computer, and rely on the computer to use its intelligence, to actually read and in some sense understand your problem, perhaps even as an expert, and solve it for you.

Over the past years, many of the artificial intelligenc techniques, and natural language processing have been applied in the form of expert systems, that is computer systems that can help solve complex, real-world problems in specific fields.

The authors of the first book explore the applicablity of techniques drawn from artificial intelligence and data base management to decision making in organizations. They have directed their attention primarly to integrating the data base and formal logic approaches to decision support.

In the preface to this book Herbert Simon confesses that, unfortunately, up to 1981, relatively few expert systems—with possible exception of the use of heuristic search in large combinatorial problems like scheduling problems—have been in the domain of management. This is true. But it is also true that 1982 presents a different situation.

The Planning Executives Institute is a professional association for the corporate planner. The second book is the latest work in its continuing monograph series. In this monograph, which is basd on a conference held at Duke University, executives of eight major software firms describe their specific planning and modeling software systems. They also offer their predictions for the future. In addition, the editors outline a number of considerations they believe to be of fundamental importance in the design of computer based plan-

North-Holland Publishing Company
Human Systems Management 3 (1982) 324–328

0167-2533/82/0000–0000/$02.75 

ning medols. They also provide a set of twelve criteria for selecting the ideal system. Application of these criteria to the eight software systems (CUFFS, EMPIRE, EXPRESS, FCS, IFPS, REVEAL, SIMPLAN: XSIM) is included.

The thesis defended by this book is that Management Information Systems (MIS) must be transformed in Intelligent Management Systems (IMS). A good example is REVEAL, the first system to provide for the inclusion of approximate reasoning based on fuzzy logic within a model. This significant innovation is designed to allow models to represent judgments, professional expertise, and experience of the company management group in conjunction with standard arithmetic definitions of the planning models.

It is well known that since the early 1960's it has been hoped that managerial problems might be directly addressed by computers and computer based-tools. Although later in the decade, Operations Research and Management Science began to promote mathematical modeling and simulation in decision-making, this movement semed to remain a mystery to most managers.

It is clear now that both MIS and or MS suffered from the major defect that they could not be applied without the aid of specialists. In fact, because of the difficulty of communicating with the computer's technical staff, managers and their support groups were isolated from the problem solving tools. What executives, financial analysts, planning analysts, and other intermediaries needed was direct access to computer-based tools in a kind of personal dialogue or symbiosis. A major shift in this direction began in about 1969 when the first of the financial planning languages appeared on the market. These languages aroused great expectations, and by 1980 at least 75 has been introduced. Many of this new packages were not true planning languages, they were just canned programs. However, the few that were truly language-based, removed much of the mistery that had discouraged managers from using computer-based tools for problem-solving. The possibility of an interactive relationship between executive and computer thus appeared to be feasible.

Out of the conceptual base underlying a few of these languages, a new and creative movement began to evolve: Decision Support Systems. DSS draws upon computer-based tools to provide direct support to the manager and his staff for planning and decision-making, without the assistance of programmers or other computer specialists. And DSS seem to be now a reality.

These books are new arguments for *Human Systems Management* which strives to forge a new paradigm for the managerial sciences, drawing fully on the ability, resources and experience of both practitioners and theorists.

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Friedrich RAPP
**Analytical Philosophy of Technology,**
Translated from German by S.R. Carpenter and T. Langenbruch, D. Reidel, Dordrecht, Holland/Boston, U.S.A., 1981

Robert F. RICH (Ed.)
**The Knowledge Cycle**
Sage Publications, Beverly Hills, California, 1981, 222 pages

Thomas NICKLES (Ed.)
**Scientific Discovery: Case Studies**
D. Reidel, Dordrecht, Holland/Boston, U.S.A., 1980

In *Analytical Philosophy of Technology,* Rapp attempts to develop a philosophy of technology. He laments that technology "has been devalued" as an object of inquiry. He deliberately adopts an "analytical approach" to present a "philosophical analysis of technology which takes into account the historical and systematic aspects of technological development". He claims that his work is "neither

(1) a metatheory of the engineering sciences, nor

(2) part of a separate discipline such as sociology or history, nor

(3) can it be reduced to a single philosophical specialty".

Rapp goes through the stages of the philosophy of technology. Starting with the Industrial Revolution he traces the "multidimensional and complex" structure of technology. He traces first the engineering perspective by focusing on the creative

art of invention and the role of the engineer. The fact that "the overpowering authority of technological civilization has transformed meaningful existence into a life of mediocrity, dullness and social role playing" is juxtaposed to those who assume "pre-established theoretical perfect solutions" with "theological interpretations" whereby "God avails himself of technological man to continue the Creation".

Rapp tries to show the essence of technology by recalling all the definitions by which the concept has been characterized. He examines the difficult models of technological developments: decision theory, social theory and action theory models. He rejects "the neutrality of technoligical means" and emphatically states that they are neither *factually neutral, psychologically neutral,* nor *socially neutral.* Thus, he sides with those of us who regard scientists and engineers responsible for the fruit of their inventions, in particular, responsible for the harm that they may cause to their recipients.

Rapp recognizes that the engineering sciences not only possess descriptive but prescriptive power in that they reflect *normatively defined goals* and desirable change. Because of *unavoidable side effects or secondary consequences,* certain technological actions must be abandoned. Thus, Rapp advises "self-restraint in the application of technological means".

For those of us who ask ourselves whether technology is a blessing or a curse, whether it is a force which is uncontrollable or can be controlled, Rapp attempts to chronicle the road to modern technology, its necessary and sufficient conditions, its ultimate causes. He notes the conflict between *democracy* and *technology:* "When these principles conflict, it is usually the technological and economic 'logic of things' that is given priority over the basic rights of individual freedom".

Rapp discusses the complex interconnections which explain "the impulse for technological creativity" where the "objectification" and the "mechanistic" view of Nature play preponderant roles. Does modern technology possess a built-in mechanism whereby our apparent irresistible process of "technologicalization" takes place? Rapp notes concrete progress and advances, but recognizes that "technology-related limitations on personal freedom and lifestyle options" have prompted justifiable complaints. There is a cry for measures of "control, planning and foreseeability".

Rapp calls for changes in our attitudes toward technology by renouncing *technological* values in favor of *human* values. Current innovations ought to be assessed in terms of their social desirability. Given that the intellectual prerequisite for modern technology are deeply rooted in our cultural and intellectual history, it appears very difficult to modify this tradition and to present an adequate critique which may begin to reverse these trends.

While this book does not offer earthshaking discoveries, it is a well-written, well-translated and cogent 'apologia' for the sorry state of our planet where, at the same time, material well being and negative externalities are brought about by our worship of one and the same god: technology.

Rich's book on *The Knowledge Cycle* is a natural follow-up to Rapp's treatise on technology. In his book, Rich is concerned with three subfields of knowledge namely, creation, diffusion and utilization.

Like Rapp, Rich raises the issue of the negative side of 'science' and lists the important fears expressed by statesmen and humanists alike:

(1) Science (as a branch of knowledge) "may succeed in undercutting common sense and be turned to purposes which endanger culture";

(2) Science "may be able to advance to a point where it could control human nature as well as physical nature";

(3) Scientists should feel responsible for how government and society apply the fruits of science.

These fears were quelled while the public was convinced that it was benefitting from the development of scientific applications. However, this socalled *legitimacy* has been called into question on several grounds. In particular, it became clear that the public has overestimated the ability of science and of technology to promote social programs. Thus, science policy debates were created to sensitize both, public officials and society at large, that there may be clear instances when one may want to counsel *deliberate nonutilization* of studies/information, due to the detrimental effects which they may bring about.

C.W. Churchman addressed this concern for values, in particular social value, where he referred to the issue of the *Morality of Systems.* Science and design have become value-oriented and must take into account the 'social imperative' which dictates that the best solution must also satisfy optimum social costs. Technological efficiency becomes sub-

ordinated to social efficiency.

Nelson contributes to Rich's edited text be considering the processes of knowledge creation. This treatment is descriptive rather than critical. He recalls provocative theories raised by scholars of knowledge such as Spiegel–Rosing who have indicated the major themes and directions which research in SSS and SPS should take. We recall that SSS means *social studies of science*—the sociology, psychology, history and philosophy of science—which investigates the material and internal dynamics and structure of science, and that SPS means *science policy studies* which seek knowledge that will guide the development, direction and control of science and technology.

I enjoyed Knott and Wildavsky's article which carries the catchy heading "If dissemination is the solution, which is the problem?" In it, they discuss conditions under which dissemination may be counter-productive due to the absence of knowledge. In this case, dissemination contributes to information overload rather than supplying a cure. They encourage 'delimiting" the role for dissemination. Preventing dissemination from doing harm while ensuring that it does some net good, it the task confronting us.

The final essay of Rich's book was written by Ganz who describes the linkages between knowledge creation, diffusion and utilization. She comments that we do not yet have a theoretical foundation of knowledge linkage, and she searches for selected clusters of research where these processes have been studied.

Rich's *The Knowledge Cycle* is disappointing because there is no in-depth treatment of any issue. Editor and authors merely proceed to review the literature and describe the work of previous scholars in the field. I suppose that the lengthy bibliographies may compensate for some the shallow nature of the discussion.

Nickles has most definitely performed a better job than Rich in his *Scientific Discovery: Case Studies.* This book is justified, according to its Preface, "by the recent revival of interest in the context of discovery, indeed in the acts of discovery, on the part of philosophers and historians of science". It focuses on the examination of the act of discovery or movement of discovery *in situ.* The volume thus concentrates attention on case studies from the history of science and on issues which relate philosophy of science to the history of science. In reality, the book is the result of papers presented at conferences where these issues were debated. The edited work is certainly outstanding, given the diversity of the topics treated in this volume, from the rationality of Copernicus to that of Darwin, from the use of the clock metaphor by psychological thinkers, to the Theory of Construction in early Genetics, and so on. I am forced to limit my comments to articles of my direct interest and peruse the others more superficially.

As an admirer of antique clocks, I was fascinated by McReynolds' account of the relation of the mechanical clock to the emergence of scientific psychology. According to this author:

> "The early history of the mechanical clock is exceedingly fascinating, and the importance of the clock technology in the course of civilization can scarcely be exaggerated. Clocks were the first great technological triumph, the paradigm for all later mechanical breakthroughs. For psychology, the influence of clocks as models was both profound and lasting. Most importantly, the clock-model strongly suggested for psychology, as for all sciences, the theories of regular, recurring, predictable, automatically controlled events, and hence broadened and hastened the acceptance of the conception of natural law. Further—of special significance for psychology—the amazing precision and complexity of clockwork suggested the possibility that living organisms might usefully be conceptionalized as machines."

In other words, McReynolds develops the thesis that the advent of the clock as a machine contributed to the birth and growth of the machine model in Psychology. Nowadays, the computer plays a similar role by "its metaphorical suggestiveness" which stimulates a new look at psychological processes. The historical development of this metaphor (model) throughout a scientific field "suggests an interaction in the process of scientific discovery, between the minds of individual scientists and the availability in the current (contemporary) culture of new sources of creative metaphors".

I was also taken by Gruber's evolving systems approach which treats Darwin's development as a series of systematic thought-stages, which evolve under the fairly steady pressure of new insights—the larger changes being transformations to a new thought-stage which preserves invariant certain structures of the old (from the Introduction). Gruber deals with intentionality, the relations between emotions and thought, scientific thinking as a series of structural transformations, metaphoric

thought as a part of the process of abstraction, differential uptake of complex ideational structures, and the place of insight in an evolving structure of ideas.

I found Gruber's study insightful because it shows how systems thinking works in the mind of a great thinker like Darwin. Probably, we can all benefit from such a lesson.

Darwin's route to discovery is also used in this collection of essays by three other authors (Ruse, Darden and Wimsatt) to discuss other related issues concerning discovery, logic and rationality.

The entire volume which is a companion to another one also edited by Nickles (*Scientific Discovery, Logic and Rationality*), is full of many interesting discussions concerning the methods of scientific discovery, productive reasoning and the structure of scientific research. It is well written, well composed and well presented. I recommend it. It is not merely a compendium of case studies but an in-depth scrutiny of how important minds reached their genial ideas. It provides practical insights for us, common mortals, concerning the approach that we might take to deal with our own more humble scientific endeavors.

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