

Book Reviews

Peter G.W. KEEN and Michael S. SCOTT MORTON
Decision Support Systems: An Organizational Perspective

Addison-Wesley, Reading, MA, 1978, 264 pages

Early computer systems were designed to replace punched card operations and well-defined manual processes. Later systems provided computer based processing of increasingly complex business procedures such as credit card billing, airline reservation, on-line order entry or manufacturing process control. With these automated systems in place and with increasing availability of sophisticated tools such as database management systems and time-sharing operating systems, it is becoming possible to provide decision makers with computer based tools known as decision support systems (DSS). A DSS is a natural evolutionary development. Simple DSS's were available years ago for narrowly constrained domains, but as the hardware and software mature and as data is available directly from operational systems, more complex, general and powerful DSS's are appearing.

The authors of "Decision Support Systems: An Organizational Perspective" go to great lengths to distinguish DSS's from Management Information Systems. The distinctions often seem artificial and MIS's are set up as unappealing 'straw men' which make DSS's look good by comparison. The overdone descriptive framework includes six viewpoints of DSS's (computer science, information economics, management science, behavioral science and data processing professionals), five concepts of the decision process (rational manager, satisficing process-oriented, organizational procedures, political and individual differences), Anthony's three categories of managerial activity (strategic planning, management control and operational control) and three types of decision tasks (structured, unstructured, and semi-structured). Although the authors promise a formal description of DSS's we are left with a lengthy informal stew peppered with appealing examples. The section with six detailed descriptions of working DSS's is probably the

most helpful to practitioners looking for new ideas. These case studies offer clear goals and suggest reasonable expectations.

Although the title clearly shows this book's emphasis on the organizational perspective, I would have felt more reassured about the realizability of DSS's if greater attention had been paid to human cognitive processes during decision making, to the need for psychological testing during research and development and to the availability of tools for creating general purpose DSS's. For wide-spread use of DSS's to occur general rules or tools are necessary to guide developers, or else they may repeat the errors of their predecessors.

The writing style is often wordy, pompous, and imprecise. Frequent use of 'clearly' or 'obviously' and of false connectives such as 'Moreover', 'Furthermore', 'Of course' or 'Given that' are not necessary if the arguments follow naturally. Excessive use of qualifiers such as 'many', 'most', 'very' or 'some' only obscure the presentation. The lengthy descriptions of what follows in a chapter, or what has been just covered seem tedious rather than clarifying.

In spite of these reservations, this book provides a useful review of work on DSS's, more than enough references, interesting case studies and occasional insights into organizational issues on developing decision making tools for managers.

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Walter J.M. KICKERT

Fuzzy Theories on Decision Making

Martinus Nijhoff Social Sciences Division, Leiden,
Boston, London, 1978, 182 pages

This is Volume 3 in "Frontiers in Systems Research", a series edited by George Klir, Stein Braten, and John Casti. The objective of the series is to develop a rich resource of advanced literature devoted to the implications of systems research for the social sciences. The purpose of this volume is to evaluate a

compendium of results which have wide occurrence notably in management sciences. The author confesses that it is the urgent need for a realistic sober assessment of the theory's usefulness that has induced him to write the book.

Scattered bits of isolated knowledge have been organized in this book into a unified theory of decision making in fuzzy environment. Fuzzy theories on decision making naturally hold great interest for the practical professions of engineering, economics, sociology and operations research. Their development over the last five years has a colorful history and a claim to be considered a branch of so-called fuzzy mathematics. Management scientists have paid some attention in recent years to the nature of models especially in discussions warning against confusion between probability and possibility, and perhaps even more attention to the proper interpretation of vagueness. With its foundation identified and its framework strengthened, fuzzy set theory should be able to support even greater achievements in the future.

The book, arranged in two parts, constitutes the lengthiest text to date on fuzzy set technology in decision making. Many results are assembled here for the first time in book form. The author has also attempted to place the subject in historical perspective in order to help the reader to understand the motives and accomplishments of the pioneers. Part 1 comprises four chapters: individual decision making, decision-making under constraints, multi-person decision-making, multi-criteria decision-making. Part 2 follows with three further chapters: dynamic programming, dynamic systems, linguistic models.

The text's strong point is its exposition of topics relatively lightly treated in earlier books as fuzzy linear programming and fuzzy logic control.

The book ends with an epilogue. The author considers two questions as fundamental to the whole of fuzzy set theory: how to ensure that the fuzzy sets used really represent the meaning that people attach to them, and what the methodology of science has to say about this new, rapidly advancing language. The author stresses that it is a mistake to see reality as fuzzy; it is the theories about reality that are fuzzy. He says that social sciences are not soft because their objects and fuzzy, but because their theories are less precise than in the hard sciences. For more details about this fundamental question I send the reader to the Proceedings of the Fourth International Congress of Cybernetics and Systems held in Amsterdam (August 1978). These are published by Springer-Verlag,

Berlin (1978) under the title "Current Topics in Cybernetics and Systems", J. Rose (editor). Milan Zeleny in a paper on "Membership Functions and Their Assessment", and the reviewer in a paper "On Fuzzy Systems" try to get an insight into modelling with fuzzy sets.

It should be said, in conclusion, that this is a very timely book and hence it cannot be a timeless book. It has appeared as the threshold of a vigorous change of the methodology of science, the objectives of which are joined with those of coping with social complexity or human system management.

There is evidence of widespread concern over the challenge to theorizing posed by the introduction of vagueness into the models. Prompted by a share in that concern I want to consider this challenge. Fuzzy theories for producing decision models have been with us now long enough to quiet critics who once prophesied their failure, and long enough to warrant our serious philosophical concern. Such concern has not been wholly absent. An example is a paper "On a Generalized Fuzzy Set Theory" published by Watanabe in IEEE Trans. on Systems, Man, and Cybernetics, Oct. 1978. He says that the fuzzy set theory is beset with a strange dilemma: on one hand the theory is supposed to give expression to natural fuzziness of human reasoning but on the other hand the entire theoretic scheme requires a very precise determination. Kickert in his book finds himself reacting with somewhat less alarm to this apparent challenge. It seems that we must insist on crediting the employers of fuzzy techniques for the content of their production, for the nihilistic desire to vanish gracefully from the scene is logically unattainable.

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Nicholas GEORGESCU-ROEGEN

The Entropy Law and the Economic Process
Harvard University Press, Cambridge, MA, 1971

It is said that the best books are not the ones that give all the answers but those that are full of provocative points of view, rich examples and inconclusive discussions, for to those books you must return again and again, and this very inconclusiveness makes them take a new aspect every time you return to them with

your own new background, and they will always be generous in giving stuff for new considerations. Georgescu-Roegen has written such a book. Among the theses that he defends is the claim that the undeniably difficult problem of describing qualitative change stems from the arithmomorphic schematization.

The antinomy between One and Many with which Plato, in particular, struggled is well known. One of its roots resides in the fact that the quality of discrete distinction does not necessarily pass from the arithmomorphic concept to its concrete denotations. There are cases where the transfer operates. Four pencils are an 'even number', of pencils; a concrete triangle is not a square. Nor is there any great difficulty in deciding that Louis XIV constitutes a denotation of 'king'. But we can never be absolutely sure whether a concrete quadrangle is a square. In the world of ideas 'square' is One, but in the world of the senses is Many. On the other hand, if we are apt to debate endlessly whether a particular country is a 'democracy', it is above all because the concept itself appears as Many, that is, it is not discretely distinct. If this is true, all the more the concrete cannot be One. A vast number of concepts belong to this very category; among them are the most vital concepts for human judgements, like 'good', 'justice', etc. They have no arithmomorphic boundaries; instead they are surrounded by a penumbra within which they overlap with their opposites. At a particular historical moment, he notes, a nation may be both a democracy and a nondemocracy just as there is an age when a man is both young and old. To the category of concepts we cannot apply the fundamental law of logic, the principle of contradiction 'B cannot be both A and nonA'. On the contrary, we must accept that in certain cases 'B is both A and nonA' is the real statement. Since the latter principle is one cornerstone in dialectics, Georgescu-Roegen refers to the concepts that violate the principle of contradiction as dialectical. Though they are not discretely distinct, dialectical concepts are nevertheless distinct. The difference is this. A penumbra separates a dialectical concept from its opposites. The separating penumbra itself is a dialectical concept.

Like all inventions, that of the arithmomorphic concept too has its good and bad features. Although it has speeded the advance of knowledge in the domain of inert matter, no process of change can be

explained by it. Human propensities, which are the main vehicle of economic change, are not arithmomorphic concepts. The obvious conclusion is that if economics is to be a science not only of observable quantities but also of man, it must rely extensively on dialectical reasoning which cannot be exact. Georgescu-Roegen quotes Whitehead when he warns us that as soon as you leave the beaten track of vague clarity, and trust to exactness, you will meet difficulties.

Perhaps the most obvious merit of an arithmomorphic model is that which is acknowledged by almost every criticism of mathematical economics, the merit of bringing to light important errors in the works of literary economists who reasoned dialectically. Further, Georgescu-Roegen notes that the essence of development consists of the flexible power to produce new processes rather than commodities by crystallized plants. As far as one may search to economic literature, all dynamic models, including those concerned with growth, allow for the production of commodities but not for that of processes. The omission is not inconsequential. A dynamic model is useless for throwing light on the problem of how growth comes about, how growth itself may grow faster.

All these thoughts seem prophetic, for they concur with the recently ventilated hypothesis that vague concepts must be represented as fuzzy sets, and human reasoning means approximate reasoning following a fuzzy logic, which is infinite-valued.

In summary, the reviewer recommends this excellent book to all those who have something to do with human systems. Each chapter, each section is part of a continuing argument for a change in the methodology of science. Georgescu-Roegen is the one who observed that risk describes the situations where the exact outcome is not known, but the outcome does not represent a novelty, and uncertainty applies to cases where the reason we cannot predict the outcome is that the same event has never occurred in the past, and, hence, it may involve a novelty. And this is a crucial observation.

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