# Reviews

**A challenge: can we improve book reviews?**

Can we take seriously M. Zeleny's (*HSM* 2 (3) (1982)) challenge: "Can we do book reviews better?" I would like to encourage readers to either send me completed reviews or the names of books which are worth reviewing. Reviews can only improve to the extent that books are shared with others. Therefore I reiterate my request and hope that you will work with me to improve book reviews.

J.P. van GIGCH

Constantin Virgil NEGOIŢĂ
**Management Applications of Systems Theory**
Birkhäuser Verlag, Basel, 1979, 155 pages

Peter CHECKLAND
**Systems Thinking, Systems Practice**
Wiley, New York and Chichester, England, 1981, 330 pages

Robert M. KRONE
**Systems Analysis and Policy Making**
Wiley, New York, 1980, 216 pages.

While reading the current literature and reviews thereof, one cannot help to be struck by the diversity of opinions which purport to have a solution for the U.S. productivity problem. This problem is concerned with the decline in productivity of the U.S. industry vis a vis other industrialized countries such as Japan. Some even venture to state that the decline in U.S. productivity follows the pattern of an even worse decline in Great Britain. Fortunately, systems scientists are sanguine about their chance to straighten out what has gone wrong with the world, including the avowed objective to improve the operations of production processes. As Negoiţă notes, "better planning makes possible improved productivity", and to the extent that the application of the methods of systems theory and, in particular of fuzzy systems theory, can complement classical planning theory, improvement of production process will occur. Of this conclusion I am not convinced. Planners and managers steeped in the European educational tradition have always claimed superiority over their American counterparts. In their education, the former emphasize theory over practice. Americans emphasize practice over theory. Who is right? While the U.S. undisputably held industrial superiority, one could not argue with the American managers' adage that "the solution of problems does not involve fancy theories or formulas, but is merely the application of good entrepreneurial common sense". However, with the U.S. productivity in decline on the horizon, one is set to wonder? Could some of Negoiţă's formulations hold the key to U.S.' survival? His book is a revision of notes presented for an introductory course in systems theory, given between 1971–1976 at the Faculty of Economic Cybernetics in Bucharest. The object of his book is to explain how ideas in modern systems theory can be applied to solve certain problems in managerial science. That the content of the book can help managers is questionable. That it can help systems designers to improve the design of organizations can also be open to question. My attitude is not that I am against systems theory or against systems thinking (my own writing attests to my faith) but I question whether U.S. educated planners and managers could ever consider the application of such mathematical theory to their organizations. That they would not, may be their downfall and failure. It is certainly not Negoiţă's fault. The book presents the principles of systems dynamics and behavior and develops criteria for systems optimization. Unfortunately, the author deals with such well known problems as aggregate planning, the scheduling problem, and linear programming in "heavy" mathematical terms, of the kind that are not in the everyday language of most managers I know. The book may be of interest to systems engineers and to operations researchers who will find in it how mathematical systems theory applies

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to certain economic problems. However, the connotation of management orientation is certainly a misnomer.

It is interesting to note that the other two books reviewed here also pretend to bridge the gap between theory and practice. In this attempt, Checkland is the more successful. His book is the crowning effort of many years of struggling with the problem of how to develop a soft systems methodology for "soft systems problems". The second half of the text is a formalization of previous publications in which he and his colleagues, at the University of Lancaster, England, developed a systems methodology to implement feasible and desirable changes in real world systems. The first half of the book is more innovative because it reflects the man and his liberal arts education. We are thus led through the subject of systems and the methodological problems of traditional science which is unable to cope with the emergent properties of systems of organized complexity. We find a discussion of science, its history (Greek Science, Medieval Science, Modern Science), and in particular the problems of science created by complexity. I regret that Checkland omitted a survey of Asian Philosophy and its contribution to systems thinking. I obviously prefer Checkland's concept of management to Negoiţă's. I relate to Checkland when he refers to the management process as being:

"concerned with deciding to do or not to do something, with planning, with considering alternatives, with monitoring performance, with collaborating with other people or achieving ends through others; it is the process of taking decisions in systems in the face of problems which may not be selfgenerated." (p. 72)

Checkland singles out the failure of operations research and quantitative methods whose practitioners insist that:

"although problems tend to differ in practice this difference often derives from their *content* rather than from their *form*...." (emphasis mine)

On the other hand, Negoiţă would probably agree with the philosophy that problems exist in fairly generally recognizable problem forms. I would rather side with Checkland who states that a problem is to be defined as such

"because of its *content* details which make it unique rather than because of the *form* which makes it general." (p. 74) (emphasis mine)

I can better associate with Checkland's approach whose methodology can indeed be applied to the real-world problems and, hopefully, to improve the productivity riddle of the U.S. economy.

Krone's text also follows the pattern to present a section on theory and another one on practice. This book is not as erudite as Checkland's and is not as personal. It reflects the composite thinking of many systems theorists and contributors. Unlike Checkland's book which represents an individual's statement, Krone brings together the variety of tools and techniques and ways of thinking which a systems designer should consider in his design. Whereas Krone's text is addressed to the Policy Sciences and has an introduction written by Yehezkel Dror, like Checkland, it addresses the general audience of managers and planners who deal with complexity of organizations. Krone's book represents cases of applications of the systems approach to management problems. I prefer Checkland's "hands-on" methodology to a description of past cases, but both are needed to illustrate how the conceptionalization of systems models can be applied to real-world complex problems.

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**Editor's Comments**

We present below two reviews of the same book which appeared in the French daily *Le Monde* (December 19, 1980), used and translated with permission of the authors and of the publisher. These reviews signal the beginning of a 'transatlantic effort' to acquaint readers with important works in many languages.

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Edgar MORIN
**La Méthode, Volume II: La Vie de la Vie**
Le Seuil, Paris, 1980, 428 pages

## To praise ecology and complexity

Ecology is not political philosophy but a branch of biology. It studies the relations of living systems and their environment. Founded by Haeckel at the end of the nineteenth century, ecology was, until 1970, a modest and parochial science. With beakers in one hand and manuals in the other, its adepts confined themselves to ecosystems of modest size such as frog ponds and cabbage patches. A few lovers of nature surveyed the tender and grandiose landscapes in search of their admirable taxonomies. However, starting in 1970, the science of ecology comes out of its dormant stage: economists, systems analysts, even electronic engineers find in it a useful language to describe relations and interrelations, in a word, to describe 'complexity'. The first attempts by ecologists were timid. However with E. Morin, the science of ecology finally finds it philosopher and mentor. *La Vie de la Vie,* the second volume, of a brilliant cosmogony whose full title is *La Méthode*, thrusts ecology into the world of scientific disciplines.

Edgar Morin was immediately taken by the warmth of this science. Instead of cold evolutionism for which Nature only offers struggle, distress, and selection, ecology emphasizes diversity and solidarity among creatures. Where Darwin made those best adapted to triumph over all others, ecology predicates that the most complex and diversified systems are also the most stable due to the infinity of controls, actions, and reactions by which they are regulated. The author relishes in the description of this profusion of functions and proves his scientific gift. He uses ecology to think about complexity and hence about life.

Heretofore, 'method' meant simplification, schema, reductionism. To think clearly meant to categorize, to abstract, and to seek causality. It also meant to blur differences. Many modern scholars have discounted complexity as a response to historical philosophies which, until recently, dominated the intellectual scene. Many of us have suffered ad nauseum to see certain disciplines explain everything through oversimplification. To think about complexity is, on the contrary, all the opposite.

In complexity, E. Morin discovers the universal and nonpolluting propellant of biological, 'mental', and 'cultural' ecologies. Instead of becoming sclerotized and deregulated through simplification, one must not cease to add complexity to ideas, theories, and accomplishments. Complexity is not chaos, but on the contrary, organization, 'eco-organization' at three levels of recursion: that of the individual cell, of multicellular organisms, and finally of societies.

In the tradition of the great ethologists (such as founding fathers like Julian Huxley or Lorentz or as young gurus like Kummer, Eibl-Eibesfeld or Altmann), Morin refuses to connect nature and culture. In the same brush of the pen, he describes the social existence of the *Escherichia coli,* the minuscule host of our intenstines, as well as the metabolism and hiccups of philosophers.

However, Morin butts against the insurmountable obstacle which he had already experienced in the first volume of his work: the French language is much too simple and linear to explain loops, circularities, and circuits. Information scientists invented decision trees to explain the latter. Without resorting to such tools, Morin expresses "macroconcepts" and their corresponding relationships by using schematic diagrams to replace words and to convey several meanings simultaneously.

Moreover, it is not enough to break away from the linearity of common language. One must find new meaning in old words, extract complexity from their apparent simplicity, and reorganize them. Morin excels in this task. Sometimes he combines old terms (such as 'bioparadigm', 'negentropophagy'). Sometimes he invents new ones.

Except for biology itself—the main topic of the book—words, grammar, language, methods, thought, and identity are all subject to scrutiny and question. Morin believes quite strongly in the operational concepts of ecologic-ecosystem, biocenosis, sere, ecotone, and climax; he transposes them to all domains and thus fashions an axiomatic form of ecology. Ecology is only, after all, a particular view of Nature. At the time of atomistic capitalism, Spencer and Darwin described the struggle for survival. Isn't the tendency nowadays to characterize the complexity of nature in the same vein as we conceive the individual's plight in post-industrial society?

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## The paradox of autonomy

*'The eco-system is not the eco-system less the individuals, but the eco-system with the individuals in it.'* (E. Morin, *La Méthode*, Volume II, p. 67): it is the impossible separation of object from subject which constitutes without a doubt the most necessary axiom of a legitimate science of ecology. A necessary axiom, but rarely taken into account in all its consequences either by ecology as a science or by ecology as a conscience. It is one of the Edgar Morin's numerous merits to tackle head-on this paradox of classical logic: to consider at the same time the individual *and* the eco- and auto-organizing relationship to which the individual is tied. *"It is not a question of adjusting or integrating two concepts (individual/environment) but rather to consider a double mutually necessary conceptualization whereby each concept is contrasted to the other while defining their congeneric nature"* (page 67).

The attempt is bold: whereas the relationship between ecology and biology is old, the concept of autonomy has only recently gained scientific status. Biology has ignored autonomy by reducing it to the molecular or the elementary, and ignoring the fantastic and vibrant complexity of *"this sphinx-like concept which postulates one of the greatest enigmas of life"* (p. 108). To conceive and to interpret the eco-system (and the eco-organization), they had to be discussed in unison with autonomy and auto-organization. Edgar Morin confidently relies on the auto-organizing virtues of his *Méthode* and takes up the challenge: two out of five sections of his *Vie de la Vie* are dedicated to the concept of 'fundamental autonomy' and to 'auto-organization of living activities'.

With the touch of a great scientist, he knows how to discover the raw material for a subject which has been in the making for 20 years (p. 108) and which little by little constitutes a theory of the autonomous system or a theory of auto-organization (a theory itself paradoxical, as noted by H. von Foerster, as early as 1959, because it can only be applied to open heterogeneous systems which depend from one another!): from automata theory (von Neuman) to autopoiesis (the capacity of a system to produce itself, formulated by Maturana and Varela) and from the theory of auto-organization and that of man as a unique autonomous entity (proposed by H. Atlan and P. Vendryés, respectively) to the logic of auto-reference (formalized by F. Varela), Morin's conceptualization is vast and ambitious.

The genius of E. Morin is to propose a reorganization of *"all these still separate and ill-related concepts: auto-organization, auto-reorganization, auto-production, auto-reference"* (p. 109) and to build a theory of autonomy which is also—necessarily—a theory of the eco-auto-organization. Morin applies the theory in his favorite domain—that of the living—where, at the same time, it reveals itself extremely prolific but economical: there is no need to simplify—or to mutilate—complexity in order to understand it. (The ease with which the hypothesis of the "computo" is used to account for a cell's aptitude to recognize itself, is one of the most fascinating demonstrations of how *La Méthode* can successfully explain 'hypercomplexity'.)

In this brief synopsis one can only state without describing the scientific framework—at the same time theory and paradigm—which postulates the concept of autonomy (or auto-organization) in the work of the researcher as well as that of the politician. E. Morin's masterful synthesis is already leading to developments which assure its rapid diffusion.

The speed of progression is certainly due to the elaboration of a new logic; the eco-auto-organization implies reorganization and can only be formalized in this recursion by auto-reference: the observer's reference becomes that of observed, the program of observation is built as a function of its result, the observation instrument becomes a third party which intervenes in the observer-observed relationship and, there, propositions which are either only true or false may not exist any longer: we will always find the recursion ('generation-production', p. 338) at the heart of all complexity modeling attempts.

The substitution of a logic which replaces the principle of the excluded middle by a self-generating axiom of recursiveness might offend the classical logician. *"Is everything which is perceptible at the same time process and the result of that process?"* This is E. Morin's prudent question and how he concludes Volume II of *La Méthode*. He remains cautious because he envisions the expansion of his theory in Volume III (Knowledge of Knowledge). To meet this challenge *requires "intelligence, more intelligence, and still more intelligence to recognize and avoid error, illusion, and lies."*

Isn't *La Méthode* a project in which intelligence is brought about to reflect and to act upon itself?

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R.C. SCHWING and W.A. ALBERS, Jr., (Eds.)
**Societal Risk Assessment: How Safe is Safe Enough?**
Plenum Press, New York, London, 1980, 363 pages

I.I. MITROFF and R.O. MASON
**Creating a Dialectical Social Science**
Reidel, Dordrecht, Holland, Boston, U.S.A., London, England, 1981, 189 pages

C.V. NEGOITA
**Fuzzy Systems**
Abacus Press, Turnbridge Wells, Kent, 1981, 111 pages

Increasingly, 'hard science' and 'soft science' advocates clash concerning who holds the truth. By hard science advocates I mean scientists and engineers who claim that their calculations and quantitative analyses hold incontrovertible proof that, in any controversy involving public debate, they are correct. By soft science I mean all the 'other experts' in behavioral and social sciences who contend that 'truth' is not necessarily quantitative, and that numbers must be tempered with qualitative judgment.

This debate becomes particularly acrimonious when the subject involves the assessment of technological risk. The book edited by Schwing and Albers focuses on this issue well. It reports on the proceedings of a symposium on "Societal Risk Assessment: How Safe is Safe Enough?" held at the General Motors Research Laboratories, Warren, Michigan, in October 1979.

Some readers may be interested in the technical calculations by which the value to life can be estimated (Howard, p. 89), or the value of the tradeoffs between the number of lives saved and the number of years of travel or time wasted as a result of the imposition of the 55 m.p.h. speed limit on the interstate highway system (Schwing, p. 129).

Others will be taken more by the report of results of discussions between those who support hard scientific data and those who uphold giving credit to 'subjective', 'intuitive', and 'perceived', inarticulated data. Of course, neither the debate nor the evidence are new. We have read before about the differences between 'real' calculated and 'perceived' estimated risks (Slovic, Fischhoff and Lichtenstein, p. 81), and about differences in judgments of the probability of occurrence and of the magnitude and severity of damage which people assign to various hazards (Kasper, p. 71). It is the discussions between the participants reported at the end of each paper which makes fascinating reading. While some are willing to concede that the determination of the probability of occurrence is not a totally 'scientific objective' matter, others, in the same page, argue that to question their calculations is accusing them of not being professional (Wiggins, p. 83). Fortunately, C.W. Churchman (p. 343) was in the audience and saved the day. "No," he stated, "What we need is to apply a modified version of Kant's categorical imperative: 'You ought to act so as to treat humanity, either in yourself or in another, never as means only but as an end withal.'" It is not a question of opposing hard to soft scientists, engineers to psychologists, analysts vs. the public, but to consider that, when the question of the planet's safety is at stake, "everyone shares in each other's humanity." As Churchman (p. 343) adds, it is only when the various parties understand and view how to interpret "humanity in yourself or another" that we will make any progress in solving the riddle of reducing technological risks.

The dialectical debate between 'hard' and 'soft' science is formalized in Mitroff and Mason's *Creating a Dialectical Social Science.* They believe that "the best method for overcoming conflicts between different schools in the social sciences is not by ignoring or trivializing them, but by creating a synthesis; namely, a dialectical social science." The material gathered in this book is not entirely new. Except for one chapter, it has appeared before. However, this material gains a great deal, by integration in one single volume. What appeared as single disparate forays takes a com-

pletely different form when put together. They turn the '*abstract principle*' of dialectic debate into an '*operational methodology* of social science'. In nine successive chapters they use the dialectic approach:

(1) To offer formulations of the dialectical inquirer which may be amenable to empirical scrutiny. In this regard, the authors offer what they call the Ackoff formulation which "is most appropriate for those situations in which we want to calculate the information behavior of given or existent systems and to design systems from an information-theoretic point of view." In contrast, the Brunswik formulation "allows us to engage in experimental design" and discuss the range of experimental designs that are possible with regard to the DIS (Dialectical Inquiring System) (Chapters 2 and 3).

(2) To illustrate how individuals can be taught to think dialectically and how a suitable research environment can be configured by using a simple minicomputer and game/tutorial package to "portray the drama and emotion present in DIS." (Chapter 4)

(3) To develop both qualitative and quantitative models of the dialectic. The qualitative aspects deal with the conceptual framework to capture the underlying structure of complex arguments and to show how the components of an argument enter into its overall structure. The quantitative aspects deal with a procedure to assign plausibilities to the component parts of an argument and to the overall argument itself. It allows us to deal with the issue of assigning meaning to the joint plausibility of a proposition and its negation. (Chapter 6)

(4) To focus on the process of science. In one chapter (Chapter 7) they focus on peer review as an evaluative mechanism. They review the evidence emanating from two studies of peers reviewed at the U.S. National Science Foundation to suggest the promise of a "dialectical policy analysis which could better prescribe changes of policy into practice." In Chapter 8 they study the norms and counter-norms which dominate science. They contrast 'the sociology' of the scientists who work on well defined problems (like the chemical composition of the Apollo lunar sampler) against those who dwell on ill-defined ones (like the origin of the moon).

Finally, in Chapter 9, they discuss the preferred methods that are characteristic of four different types of scientists – the Analytic Scientist, the Conceptional Theorist, the Global Humanist, and the Particular Humanist. Rightly so, they conclude that what is needed is a "meta-perspective which transcends each of the four acting separately" and which offers "prospects for unification." In a social science *systemically* conceived, the four perspectives are but components of the entire process of inquiry. Whereas in the past "we have used a method to study psychological and sociological factors," the authors feel that now "we can use knowledge of psychological and sociological factors to study methodology." "The purpose is not only to gain a unique perspective on some old (i.e., traditional) methods of social science but to gain a glimmer (however tentative) on some newly emerging method."

Mitroff and Mason's book trailblazes new patterns for the social sciences. They do not merely speculate on which direction we are headed, but offer solid proof of their scholarly application to improve the ability of the social sciences to be identified with control, quantification, and measurement – the hallmark of a scientific method.

Whereas the first volume reviewed here must be considered in the realm of 'established' and 'conventional' science, and whereas Mitroff and Mason's treatise discusses applications of well-known paradigms to uncharted territory, it is the third volume which must be considered the most innovative of the three reviewed here.

In *Fuzzy Systems*, Negoita attempts to embrace the whole growing field of fuzzy sets and its applications. He defines fuzzy systems as "systems of systems" or "systems of logical objects," where the field is said to embrace "the whole field of imprecisely described systems" or "of inexact descriptions."

For those not initiated in the area, the above statement may be confusing. Fuzzy Sets or Fuzzy Set Theory is a newly emerging discipline which attempts to deal with vagueness, imprecision, and ambiguity in a highly mathematical and formalized manner. Herein lies a puzzle and a paradox. Is fuzziness an inherent property of social systems domains that will resist 'exact' formulation, or can ambiguity and imprecision be the subject of more 'precise' formulation without omitting the essence of its most distinguishable and intractable attribute – fuzziness? It is too early in the history of the field to provide an answer to the above ques-

tion. In the modest opinion of the present reviewer, in spite of valorous attempts to reduce ambiguity and vagueness to more formalized language, there will always remain a substantial residual that will stay outside the realm of formalized logic. [1,2,3]

Regardless of how the above debate is resolved, workers like Negoita should be commended for their ambitious goal. Their quest is to attempt to apply the language of fuzzy set theory to represent human systems. Negoita gets a little carried away when suggesting that General Systems Research and fuzzy systems will unlock the secrets of *transcedence,* where the latter "signifies a trend towards totality, completeness, and wholeness:"

> As such we are speaking of timeless and universal concepts or criteria that clarify everything and establish relationships. Transcendence seeks a unification of particular existence in such a way that every detail would be a unit of totality. There is, indeed, a sense in which transcendence expresses the synthesis of empirical existence. If we accept that transcendence discloses a constant openess in which man grasps freedom, then it is high time to obtain a deep insight into this natural phenomenon.

Negoita offers theorems and proofs that fuzzy problems can be replaced by families of classical concepts and, thus, be solved by conventional methods (The Representation Theorem). We are introduced to such notions as 'pullback', taken from Category Theory to establish sets in terms of functions and their compositions; 'synthesis', which is used to characterize the "increasing elaboration of external description;" and 'robustness', which means the ability to work with models having fuzzy parameters. Throughout this text, Negoita provides an excellent balance between the mathematical formulation and the epistemological justification for the application of fuzzy set theory to the heretofore intractable world of imprecision. He is striving for a new conceptualization of knowledge which captures the properties of the fuzzy environment. He is looking for new approaches by which redundant information can be compressed – "the ability to encode information at the concept level." As an example, when we speak about "a category of fuzzy sets," "it allows us to study relations between and operations upon inexact concepts without committing ourselves about their internal structure."

This short book is one of the series *Cybernetics and Systems* which the same publisher has produced. As usual, it is difficult to be at the same time comprehensive and to cover a subject in about 100 pages. A neophyte who has never studied fuzzy sets will benefit from this treatise because it provides good introductory material to explain and justify this new approach. For the intermediate reader, the book may offer an integrative view of the topic, where it is headed, and what progress it has made from its inception in 1965. The book is not meant for the advanced reader.

Knowing that Negoita's mother tongue is probably Rumanian, I would like to congratulate him for his effort to present these ideas in the English language. It is obvious that some difficulties in translation or transduction arise, as exemplified by the following paragraph which I provide, pleading ignorance and the author's forgiveness:

> Now it is easy to see that if gathering partial descriptors is an indication of positive time, then fuzziness is perpendicular to the flow of registered items. This seems to be the Bergsonian time, that inner duration, perceived consciousness, which is nothing else but the melting of states of consciousness into one another and the gradual growth of the ego. It can be said that the learning process is one that proceeds to alter the synthesis, and the direction of development is associated with the rise of synthesis.

I assure our readers that the above paragraph is only an exception in an overall well written, readable, and understandable book.

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[2] L.L. Pipino, J.P. van Gigch and G. Tom, Experiments in the representation and manipulation of labels of fuzzy sets, *Behavioral Sci. 26* (1981) 216–228.
[3] J.P. van Gigch and L.L. Pipino, From absolute to probable and fuzzy in decision making, *Kybernetes 9* (1980) 47–55.

Milan ZELENY
**Multiple Criteria Decision Making**
McGraw-Hill, New York, 1982, xxii + 563 pages

Zeleny covers a broad collection of topics on multiple criteria decision making in his new book. The chapter headings are

1. Multiple Objectives of Individuals and Organizations
2. MCDM in the Management Sciences and Operations Research
3. The Decision Process and Its Stages
4. Invention of Alternatives and Conflict Dissolution
5. Theory of the Displaced Ideal
6. Displaced Ideal: An Operational Model
7. Measuring Attribute Importance
8. Linear Multiobjective Programming
9. Goal Programming
10. Compromise Programming
11. Multidimensional Measure of Risk
12. Multiattribute Utility Measurement
13. Regression Analysis of Human Judgment
14. Decision Making is a Very Human Business

The book is intended for use in conjunction with "any standard textbook on operations research, management science, or decision analysis". Its eclectic approach continually challenges the reader.

Chapter 1 opens with several illustrative problems in multiple criteria decision making. Chapter 2 then traces the history of MCDM from early research in operations research to the present. These two chapters provide a background for later discussions in the book.

Chapter 3 emphasizes the dynamic nature of the decision making process. Following Janis and Mann, Zeleny presents a description of several stages in the decision process. Chapter 4 examines the predecisional stage of identifying alternatives in a decision problem. Although this topic is a crucial one for decision makers, the book is not entirely specific about ways of generating viable alternatives. Arthur Van Gundy's book, *Techniques of Structured Problem Solving* (Van Nostrand-Reinhold, New York, 1981), is a much better source on this topic.

Chapters 5 and 6 contain Zeleny's research on the adaptive nature of preference vis-a-vis an ideal alternative. Zeleny challenges many traditional theories of choice by considering the role of 'irrelevant alternatives' in affecting the decision process through cognitive dissonance and other means. Several methods, including the 'compromise solution', are discussed here.

Chapter 7 briefly discusses Zeleny's entropy-based method and some other methods for weighting attribute importances. The chapter is somewhat imprecise in defining 'attribute importance' and neglects much of the measurement literature on explicating weights. Other sections of the book, however, do better in explaining and using attribute importance weights with specific methods.

Chapter 8, 9, and 10 are more technical and less diffuse than the previous chapters, although "no mathematical theorems and few algorithms are used". Zeleny gives a good introduction to linear multiobjective programming, goal programming and compromise programming, respectively. Many readers may want to go beyond the introduction to these subjects and will find Zeleny's bibliography very helpful. The book *Multiobjective Programming and Planning* by Jared L. Cohon (Academic Press, New York, 1978) is also recommended.

Chapter 11 examines a different topic from others in the book. Zeleny presents some of his research on the 'prospect ranking vector' for measuring risk in a multidimensional way. The chapter is probably too short for the material it tries to develop; interested readers will need to consult the original papers by Zeleny and others, and the book *Uncertain Prospects Ranking and Portfolio Analysis under Conditions of Partial Information* by Gerard Colson and Milan Zeleny (Oelgeschlager, Gunn, and Hain Publishers, Cambridge, MA, 1979) for further details.

Chapter 12 is a description of certain areas of multiattribute utility measurement. Although Zeleny is constantly critical of this approach throughout the book, much of his criticism is directed at the early work in this field as described in Ralph L. Keeney and Howard Raiffa's book *Decisions with Multiple Objectives* (Wiley, New York, 1976). Many of the recent advances in decision structuring, elicitation protocols, heuristics and biases, approximation methods, adaptive utility, multivalent preferences, nontransitive utility, marginal value and relative risk, interactive decision aids, and practical applications are not discussed by Zeleny. These research developments in multiattribute utility measurement accommodate a large share of the objections described in Chapter 12 and elsewhere in the book.

Chapter 13 briefly examines aspects of social judgment theory. The chapter misses some of the recent work on policy capturing and preference regression techniques (see Kenneth R. Hammond,

Gary H. McClelland, and Jeryl Mumpower, *Human Judgment and Decision Making* (Praeger, New York, 1980); related research in behavioral decision theory (see Daniel Kahneman, Paul Slovic, and Amos Tversky (eds.), *Judgment under Uncertainty: Heuristics and Biases* (Cambridge, 1982); and the psychology of decisions (see Robin M. Hogarth, *Judgement and Choice* (Wiley, New York, 1980). In all fairness, however, Zeleny points out, "The literature dealing with 'human judgment' is voluminous, and one simply cannot do justice to it.... Nevertheless, we shall make some inroads into it and leave the matter of 'doing justice' to the reader."

Chapter 14 concludes the book with a discussion of fields related to MCDM, such as management information systems, human systems management, and decision support systems. There is a selective, but highly useful, bibliography on MCDM at the end.

The major strengths of Zeleny's book are its broad coverage and literature citations, its extensive problem sets for students (and solution manual for the instructor), and its challenging, nontraditional style. Its major weaknesses lie in Chapters 3, 4, 7, 11, 12, and 13, where the coverage is perhaps inadequately developed and occasionally somewhat misdirected. *Multiple Criteria Decision Making* is an unusual book in stimulating new ideas for research and in providing unresolved issues for classroom instruction; I believe it will fill a useful role for both research and instruction in MCDM.

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