Mankind at the Turning Point

Article *in* IEEE Transactions on Systems Man and Cybernetics · February 1977

DOI: 10.1109/TSMC.1977.4309596 · Source: IEEE Xplore

Mihjalo Mesarovic
Case Western Reserve University

approaches to two-person interviewing and game-type situations and presenting it in such a clear, simple, and didatic fashion as so ably done in this work by Bellman and Smith.

The book's primary objective of exemplifying the use of mathematics, systems analysis, and simulation in modeling systems characterized by highly qualitative and soft variables and presented in a nonmathematical manner is its main forte. The other objectives, which include showing how simulation and computers can be profitably used in educating students involved in interviewing systems, particularly those occurring in psychotherapy, are very articulately treated. No assumptions of background both in the theory and practice of psychotherapy or adaptive decision process and simulation are made. Each concept is first simply and concisely introduced and then subsequently discussed in an almost exhaustive set of notes and references following each chapter. The notes, broken down by section numbers corresponding to topics discussed within each chapter, should be of particular appeal to students of psychotherapy and others involved in the use of the scientific method and philosophy to model human interactions.

The work reported here essentially began over a decade ago, while the principal author was at the Rand Corporation, and was continued at USC. By intimately involving practicing psychiatrists, it exemplifies the appropriate use of systems methodology in real-life sociotechnical systems situations. The contents are very systematically arranged and each concept numbered. Diagrams illustrating certain key concepts are ample; but although they are appropriately referenced in the text, they could have benefited from being titled. With the exception of Fig. 4.3, which was inverted, the quality of typesetting and reproduction is excellent.

The book, divided into ten chapters, is made considerably easy to follow by the inclusion of a detailed table of contents, author and subject index, preface, and a prologue containing a sample computer generated simulation of a dialogue between a patient and his psychiatrist. The first chapter discusses the aim and objectives of the book and a brief exposition of a number of basic ideas important to the two diverse domains, mathematics and psychotherapy. Chapter 2 is a brief introduction to the art and science of psychotherapy and is viewed as an adaptive problem-solving situation. This rather short chapter, which is complemented by an illuminating set of notes and references, is followed by Chapter 3, whose emphasis is on the initial interview. Chapter 4 discusses various important aspects of the concept of a system, while chapter 5 considers decision processes, particularly those of the multistage type. The important concepts in dynamic programming are very clearly explained without recourse to mathematical symbology—an impressive feat indeed. Chapter 6 employs the mathematical concepts of Chapters 4 and 5 in examining various aspects of the therapy process considered earlier in Chapters 2 and 3 and lays the groundwork for the presentation of Chapter 7. In this chapter, the efficient use of computers and mathematical concepts in simulation is discussed. The connection with various aspects of game theory and ways to minimize difficulties are presented. Principles for constructing simulation of various patient-psychiatrist interactions together with sample printouts of such computer-generated dialogues, dubbed computer vignettes, are given in Chapter 2. Chapter 10 concludes the book with a discussion of how computer simulation and related mathematical concepts can be used to obtain better understanding of the initial psychotherapy interview as well as in teaching, training, and research. Important questions of simulation validity and the limitations of the effort are clearly discussed, and some directions for future research are indicated. This is a real asset to the volume which clearly points out the limitations of the effort.

This book is very timely and should be an important reference work for engineers, operations researchers, computer and system scientists, and applied mathematicians interested in sociotechnical systems modeling, particularly the health field and systems with a high behavioral component. Other readers who will find the book useful and readable include clinicians, psychotherapists, psychologists, and other behavioral scientists possessing limited mathematical competence but who are interested in learning what systems science can contribute to their work. The only other closely related volume in existence is the book edited by Dulton and Starbuck, which contains only one chapter devoted to the modeling of human behavior.

Mankind at the Turning Point—Mihajlo Mesarovic and Eduard Pestel (New York: E. P. Dutton & Co., 1974, xiii + 210 pp.). *Reviewed by G. Arthur Mihram, P.O. Box 234, Haverford, PA 19041.*

The book's subtitle, "The Second Report to the Club of Rome," places the title in its perspective between the first report (*The Limits to Growth*, D. H. Meadows *et al.*, 1972) and the forthcoming third (*Global Goals for Global Societies*, E. Laszlo *et al.*, autumn 1976). As such, its eleven chapters, four appendices, and concluding commentary (by Aurelio Peccei and Alexander King, pp. 200–208) might be anticipated to include for the reader a listing of an improved, "second-generation," world model.

However, the book provides only one chapter (the longest, Chapter 4, pp. 32–55) as a brief *description* of the actual second-generation model. The described model represents the Earth as ten mutually exclusive and exhaustive land areas, each represented by a submodel comprizing the same six "strata in a hierarchical arrangement."

Chapter 1 attempts to distinguish between what the authors term "undifferentiated growth" and "organic growth" (growth with differentiation, or with a properly controlled balance of subsystems), concluding that the world system requires a "blueprint" for its organic growth, using for this conclusion the chromosomal message which guides each living organism's survival. One presumes that the world model would be this blueprint for the organic growth of the world.

Chapter 2 deals with "crises," the fashionable journalistic term of the day. Perhaps we can term the impending incompatibility of human population and food supply as a "crisis," but one could more properly view the situation as the scientific confirmation ("validation") of Malthus's earlier "model." Thus the authors lay the blame for crises on the noble values of Man rather than on our failure to employ science (to wit: Malthus) in its essential role: to ensure the survival of Life on Earth [1]. Indeed, the authors employ the term "progress" in a quite technological sense ("man's triumphs over nature") rather than in its more proper sense: the acquisition and accumulation of credible (scrutinized and confirmed: "verified and validated") knowledge for the purpose of ensuring the continuation of life on Earth.

Chapter 3 reveals this distinction more clearly. The authors present a résumé of the attitude of the technocrat: we should organize transportation services worldwide so as to distribute raw materials (energy and matter) to all.

Chapter 4, describing the implementation of this attitude in the Club's "multilevel model," terminates with a "Brief on Effect of World Model Structure on Prognosis for Future Developments," distinguishing therein between the authors' view of the theses of Forrester–Meadows and their own theses. Whereas the Club's first report (Forrester–Meadows) suggested that immediate control must be exercised in order to slow economic growth, the present report suggests that a prompt restructuring of human society worldwide is required: somehow doing away with "vertical" societal structures and constructing a worldwide "horizontal" social system. Unfortunately, the authors seem to have missed a point: Who will *control* the "horizontal" structure? Who will allocate the transportation resources for distributing raw materials among societies, particularly among societies (cultures) who have for generations ranked their values for survival differently [2]? Who, other than a "Chosen Person," will decide that any self-anointed "Chosen People" are not so special with respect to this month's limited shipments of grain?

Chapter 5 then describes experimentation with the computerized mathematical model by comparing four "scenarios" for reducing the "economic gap(s)" among societies on Earth. So revealed is a prime underlying motivation of the Club's model: to mime extant technology in an effort to achieve near-zero economic gaps among the model's ten regions.

Chapter 6 deals with the "population crisis," by discussing briefly seven scenarios dealing with both the timing and the degree of a population policy. Again, the ultimate question seems to have been sent begging elsewhere for recognition: Who, other than a "Chosen Person," will decide that any self-anointed "Chosen People" are not so special with respect to this year's limited technocratic allocation of babies [3]?

Chapters 7–9 deal with questions on alternative systems of dominance or partnership, of confrontation or cooperation. The two alternatives are those resulting from the fundamental conflict of life: competition for extant resources for survival. The authors conclude that the "*only* feasible solution to the world food situation requires": 1) a global approach; 2) investment aid rather than commodity aid (food excepted); 3) a balanced economic development; 4) an effective population policy; and 5) a worldwide diversification of industry so as to have one "global economic system."

Chapter 10 deals with the "energy crisis" and labels the proposal to harness nuclear energy a "Faustian bargain" (the pleasures of energy today, yet the effects of nuclear wastes tomorrow). The authors opt for directly-derived solar energy.

Chapter 11 (Epilogue) tends to create in the nonreflective reader a certain tension. The "*problématique humaine*" (the art of posing problems) is described in terms of the ever-widening gap between "North" (more developed technologically) and "South" (less technological development), including fright-inducing "briefs" on irrigation and oil spills. One does wonder whether we need a "détente" (relaxation of tensions) applied to the authors' "problématique": a more conscientious, scientifically-based world modeling effort could thereby result.

What, then, should one conclude, from the book's eleven chapters, about the credibility of the Club's world modeling efforts?

The book's concluding commentary (by Drs. Peccei and King) raises the issue of political decisionmaking. However, as in Chapter 4, *decisionmaking is related in terms of an analyst (modeler) deciding which inputs to use for an encounter (run) of the computerized model.*

The Club of Rome hopefully seeks to construct a world model which will: a) be deemed credible, and b) assure the survival of life on Earth. *Yet, the dynamics of societal "variables" depend upon the society's deciders—more importantly, on each decision that each makes.*

Consequently, if we are to construct a model describing the dynamics of social systems, we must have a model which provides *mimicries* of deciders and the effects of their individual decisions [4].

The ability to mime decisionmaking rests on the *algorithm.* One commonplace example of the algorithm is the cook's recipe, which gives second-person instructions for examining a set of conditions and deciding which controllable variates to alter while producing a credible result: an edible culinary masterpiece.

One is therefore quite concerned that the current and apparently projected world models of the Club of Rome are not exploiting *fully* the algorithm to produce *credible* models of societal dynamics. With scientifically credible models, we can ensure the survival of Life on Earth by the very modeling process which has produced the survival of Life on Earth to date [1].

The forthcoming third report of the Club of Rome shall apparently list as primary goals of global societies: the constraining of armaments worldwide; the necessity for the control of population growth; and, the feeling that there is a need for distributing food worldwide. All three of these are a reflection, one presumes, of a desire for the survival of life on Earth.

Yet, the very process of the survival of Life on Earth is one of modeling: *genetic models* for the survival of a species; then, as higher animals evolved, neural systems for building *mental models* for the survival of the individual; and, now, Man builds *models* (e.g., statues and writings) for bettering his society's chances of survival over generations.

Thus a credible model is one which assures survival and is based on *all* the recallable past.

One of man's earliest efforts to model nature credibly dealt with finding the explication for the "incredible" behavior of those stellar bodies (planets) which moved "erratically" among the constellations. The medieval effort to mime (and to predict) their behavior by epicycles on epicycles on epicycles (etc.), all the while collecting and recording observations of their relative positions, led to an eventual understanding that there is indeed a cyclic nature regarding their "decisions" to move about as they do [5]. However, a considerable amount of recorded data was required in order to understand the heliocentric universe via Newton's laws.

The present-day efforts to understand the dynamics of socio-politico-economic systems are quite similar. We possess a considerable recorded history (data) from which we can endeavor to isolate any cyclic effects. Yet, we possess a methodology not available to the Middle Ages: algorithmic, but not strictly mathematical, models (simulations). By constructing models of the dynamics of observed societal and/or ecological systems, including an algorithm for each of a decider's decisions (when and if required), we should be able more readily to understand the dynamics of such systems.

The process of attempting to fit curves (or parameterized differential equations) to measured social or economic variables is not likely to succeed, just as the attempt to place another epicycle on the most recently applied epicycle for Mars was not successful. One can fit *perfectly* n successive time-dependent observations with a polynomial of degree $(n - 1)$: similarly, one requires as many data points as parameters in order to fit perfectly a cyclic curve. Yet, just like the medieval man, what are we to do when the next [the $(n + 1)$st] data point is not on the fitted curve (on the most recent epicycle)? Have we gained *the* model of (i.e., Do we understand) the observed phenomenon by fitting a function with $(n + 1)$ parameters (by adding a new epicycle) to the most recent one?

Newton's laws have proved particularly useful to technologists. However, they did not originate because Newton fitted curves (epicycles) to recorded data; rather, they resulted because Newton *mentally reflected* on the historically recorded data. Similarly, Darwin understood the nature of evolution by reflecting on the geological and geographical record (data) available to him. (cf. Konrad Lorenz [6].)

The process of constructing scientifically credible, computerized, and algorithmic models of various social systems can also provide an immense amount of "data" for reflexion. The "laws" which social scientists seek will then likely become evident.

World modeling efforts need to examine much more carefully the responses (outputs) of truly algorithmic (i.e., not strictly mathematical) models of socio-politico-economic and ecologico-environmental systems. The patterns of their dynamics will then more likely emerge—and will likely emerge quite rapidly, given the present number of computers and discrete-event (*and* continuous-discrete) simulationists.

Perhaps the fourth report of the Club of Rome will provide a model with a chance of being deemed scientifically credible—miming societal dynamics by appropriate algorithms which include the deciders' parental, cultural, and religious upbringings.

References

[1] G. A. Mihram, "A critique of world models," in *Systems Thinking and the Quality of Life*, Clair K. Blong (Ed.), pp. 464–473, Society for General Systems Research, 2023 G St., NW, Washington, DC 20006, 1975.

[2] ——, "Simulation: Methodology for decision theorists," in *The Role and Effectiveness of Theories of Decision in Practice*, D. J. White and K. C. Bowen (Eds.), pp. 320–327, Crane, Russak & Co., New York, 1975 (1973).

[3] ——, *An Epistle to Dr. Benjamin Franklin.* New York: Exposition-University Press, 1975.

[4] ——, "Models in the social sciences: Simular or mathematical?," in *Contributions Libres*, pp. 596–602, 40e Session de l'Institut International de Statistique, 1975.

[5] ——, "The scientific method and statistics in simulation," *Simulation*, vol. 24, pp. 14–16, 1975.

[6] K. Z. Lorenz, "The fashionable fallacy of dispensing with description," *Naturwissenschaften*, vol. 60, pp. 1–9, 1973.