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CITIES AND REGIONS AS NONLINEAR DECISION SYSTEMS

ROBERT W. CROSBY, Ed.

Boulder, CO: Westview Press. 1983. Pp. xvi + 210. \$26.00.

Divergence between social goals and individual reward structures is a fundamental problem in both natural resource management and urban administration. The authors of the papers in this volume hope to improve our abilities to understand the dynamics of this divergence and to design interventions or structural changes that will reduce it. Conclusions include the finding that models based on these approaches are able to assist in identifying critical points where interventions will have the greatest success in influencing the decisions of the many actors in urban systems.

These authors recognize, as do most policy makers, that urban systems do not operate under the equilibrium conditions that most simple urban models assume. They see instead a complex historical evolution which results in disequilibrium forces including imperfect information, finite reasoning abilities of decision makers, limited foresight, and changing preferences. So, for instance, urban growth and development models, to be accurate, would need to account for changes over time in heating fuels, goods distribution transportation methods, and human travel methods. The difficulty is in anticipating changes that will occur in the future. Presumably, the system dynamics models under development and described in this volume are intended to do just that: identify points at which major components of the system will change creating opportunities for effectively influencing individual behaviors. These points are referred to as bifurcations.

The various authors use different approaches in examining the problem. These are non-linear dynamics, catastrophe theory, cognitive science, and evolutionary theory. Non-linear dynamics is based upon the presumptions that behavior is goal adaptive, that response to environmental changes often involves thresholds, and that nonlinearities pervade economic systems. Catastrophe theory is never given a straightforward definition, but appears to be concerned with the occurrence of major disturbances that change the course of human systems. Cognitive science represents the modification of rational action theories based upon the notion that decision makers have limited reasoning powers. Evolutionary theory is the application of biological or Darwinian ideas to social systems development.

Individual papers apply these concepts to urban spatial development, housing, transportation, and electric energy generation. Understanding the particulars of the models employed requires considerable patience

and methodological sophistication. One finding, however, is repeated throughout the volume. Interventions introduced away from bifurcations have only minor effects on the system. Interventions introduced at, or near, bifurcations are effective in transforming individual behaviors.

The papers in this volume were prepared for a symposium held at the 1981 annual meeting of the American Association for the Advancement of Science, and sponsored by AAAS, the Institute of Electrical and Electronic Engineers, and the Operations Research Society of America. While the approaches and findings of each paper concern separate aspects of urban systems and introduce different modeling innovations, the editor wishes us to believe that there is an approaching convergence in the field: "... we are rapidly approaching a formal description of the human decision process which can be embedded in models such as those of urban and regional systems" (p. 20). This would be a welcome achievement. For now, non-linear dynamics models are a thought provoking stimulus for those who concern themselves with urban systems, but of limited utility to decision makers.

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