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THE HUMAN ACTOR IN ECOLOGICAL-ECONOMIC MODELS

Policy assessment and simulation of actor orientation for sustainable development

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Abstract

Understanding, assessing, and simulating behavior requires knowledge of the precepts that are explicitly or implicitly orienting behavior. Human actors can be viewed as (conscious) self-organizing systems attempting to remain viable in a diverse environment containing other self-organizing systems (other human actors, organisms, ecosystems, etc.), all driven by their own viability (sustainability) interests. These fundamental system interests, or basic orientors, have emerged in response to general environmental properties and are therefore identical across self-organizing systems: existence, effectiveness, freedom of action, security, adaptability, coexistence. Even in simulated actors learning to 'survive' in a difficult environment, the basic orientors emerge in the (simulated) evolutionary process — but different actors may evolve into different 'cultural types' with different orientor emphasis. Since balanced attention to all basic orientors is crucial for viability, the set of orientors can be used to derive indicators that facilitate comprehensive viability and sustainability assessments. The paper outlines the theoretical approach of 'orientation theory' and its application to the assessment and simulation of sustainable development issues. The formal approach of mapping indicators on basic orientors and assessing sustainability dynamics is illustrated using Worldwatch indicator time series. In an actor simulation this approach is used to successfully guide a small global model onto a sustainable path with high 'quality of life'.

Keywords: Actor simulation; Orientation; Orientors; Sustainable development; System viability; Policy assessment

1. Introduction

Human behavior determines development and the future of the globe. The magnitude of this influence has increased enormously in recent human history. Considering what is at stake, it is essential that we should have a better understanding of the motives of human actors and their impact on decisions and actions. This is necessary for: (1) understanding what our options are; (2) analyzing possible developments and their conse-

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quences by including valid simulations of actors and their interactions; and (3) locating cognitive and/or normative deficiencies that might lead to unsustainable development and ultimately destructive behavior of human actors. The model of the rational economic actor maximizing profit or utility is totally inadequate for this purpose, since the scope of his/her attention only covers a minute portion of the total — environmental, cultural, social, political, technological, economic — spectrum of concerns that determine the decisions, actions, and interactions of important actors in the real world. A more complex, and at the same time more realistic, approach is in order.

In the present paper, I will report results that seem to indicate that comprehensive and valid representation and simulation of human actors in realistic decision contexts is possible. The article summarizes work conducted and directed by the author in several research programs extending over many years, beginning with actor simulation as part of the Mesarovic–Pestel world model (Bossel and Hughes, 1974). For this reason, the author's name appears embarrassingly often in the list of references; for this I apologize. Extensive lists of references to other authors' publications on which the current work is based are given in particular in Bossel (1977a, 1996, 1998a, 1999), Bossel et al. (1989); see also Eden (1978).

There are two kinds of concepts that orient decisions and behavior of human actors: factual knowledge (correct or incorrect) about the world, and normative orientations (goals, values, social norms, etc.). In nonroutine decision-making, i.e. considered choice, the two kinds of concepts are processed and linked in complex information processing (Kirsch 1970/1971; Bossel, 1977b,d). Only in trivial cases can this process be modeled by approaches such as maximization of profit or utility. For more reliable policy assessments, in particular for dealing with complex issues such as sustainable development, it is necessary to include the following three components in all necessary detail: (1) the normative concepts of the actor; (2) his/her world knowledge; (3) the information processing itself.

Societies and their environments change, technologies and cultures change, knowledge changes, values and aspirations change, and a sustainable society in particular must allow and sustain such change, i.e. it must allow continuous and viable adaptations, which is what we mean by sustainable development. The result of this process, which includes actors making choices from a wide range of possibilities, cannot be foretold. Even though the factors constraining the development process and the processes driving it are known, the path of sustainable development is therefore still the unpredictable result of interactions of coevolving systems and self-conscious actors.

Sustainable development is not arbitrary, however. It has to remain within the strict boundaries of an accessibility space that is defined by physical constraints (laws of nature, causal relationships, physical environment, solar energy flow, material resource stocks, carrying capacity), by constraints of time and system laws (delays, inertia, permissible rates of change, feedback, and self-organization), and by the constraints of human actors (intellectual and organizational ability, culture, ethics and values, technology, social and political system) (Bossel 1998a, 1999). Behavior is shaped by the perceptions of these constraints by the human actors, not by their actual state. These perceptions — the cognitions of actors — are therefore powerful determinants of future development, and must be properly accounted for in policy assessments and development studies.

Because of their crucial influence on decision outcomes, the present paper focuses on origin and content of normative constraints ('orientors'). At their most basic level, they reflect 'fundamental interests' of viable systems, and therefore shape decisions and actions of the human actor decisively. These concepts can be employed in a coherent formal approach for representation of cognitions and for simulation of the decision-making of human actors. Although trying to explain the concepts in an understandable way, I refer the reader to the original publications for details, derivations, and further substantiation. In this paper, the term 'system' usually refers to a self-organizing system responding to challenges from its system environment, i.e. an actor or actor system.