parametric assumptions the resultant behavior of all the variables over time. Numerous alternative assumptions can be made and tested. Throughout this process the modeler assesses the model's behavior, by comparing it with his knowledge of the real-world system's characteristics, to decide whether he has sufficient confidence in the model to use it as an input to policy decisions.

Confidence in a model can be established by many different tests or measures. Models constructed for precise prediction are often judged by their ability to reproduce past time-series data accurately, on the assumption that a close fit to past system behavior will increase the likelihood of an accurate prediction of future behavior.

Such a test is not appropriate for a model like World3, which was not constructed for quantitative accuracy. As noted earlier, many short-term factors that have influenced the real-world system historically were deliberately omitted from our model as irrelevant to the long-term development of the system. Furthermore, since World3 was designed to answer questions about aspects of system behavior that have not been manifested in the past, even a fair fit to historical data would not guarantee its utility in producing statements about the future. We certainly expected World3 to reproduce all qualitative behavior modes exhibited by the system in the past, but we did not consider that a sufficient test of the model's utility. Our test for World3 is related, instead, to the way it is supposed to assist decision makers.

Models of social systems can be used as policy tools in several different ways. An extremely complex model can be used only as a black box. The user gives it some information on current conditions or trends, and the model produces a description of an appropriate course of action. The user must take the underlying assumptions and logical processes of the model on faith, and his own understanding of the system's structure is not improved by working with the model.

A model can also be used as a learning tool by which the user can enlarge and clarify his own mental model of the system. His understanding of the system will increase when he is forced to state his own assumptions explicitly and precisely and when he can observe exactly how those assumptions fit together, interact, and result in a complex, long-term behavior pattern. As he observes how and why alternative assumptions change the system's behavior, he can begin to derive the general principles by which the system is guided. Used in this fashion, a computer model can lead its user to structure and analyze intuitively much more information than was previously accommodated in his mental model.

World3 was intended to be used in this second way, on the assumption that mental models, rather than black-box computer models, are and should continue to be the primary basis for social policy. Therefore, our criteria for judging the usefulness of the model were the following:

1. Each assumption in the model should be consistent with direct measurements or observations of the real-world system; no assumption or parameter without real-world meaning should be added merely to improve mathematical convenience or historical fit.
2. When the total model is used to simulate historical time periods, the behavior of each variable should resemble the historical behavior modes of corresponding elements in the real world. When the system is simulated into the future, each variable should follow an understandable path within a reasonable range of values.
3. The model should be sufficiently simple so that the reasons for its behavior can be comprehended and abstracted as generally applicable principles for dealing with the real-world system. Ultimately, the model should no longer be needed because its basic constituent relationships should become part of the mental models of its users.

A model that meets these three criteria will not be a perfect representation of the real world. It will not be able to answer all possible questions about the world, nor will it be able to make accurate predictions. But no social decision maker has the luxury of delaying his actions until a perfect model of social systems has been constructed, if indeed one ever becomes available. From the range of current models, mental or formal, he must choose the one in which he has the most confidence, and use that model to make his decision.

World3 was developed through an exercise in assembling information from many sources, summarizing it explicitly, exploring its implications, and generalizing from the process a little understanding about the future of the complex human socioeconomic system. This type of exercise can be valuable, even though the information it yields is incomplete. For example, it may bring about a critical reexamination of the underlying assumptions of current mental models and a more open discussion of the bases of social decision making. It may stimulate further attempts to improve the process of model making and the theories of social systems upon which all models depend. It may provide an interim model, until better models are made, as an input to long-term policy formulation. World3 is not *the* world model; it is *a* world model, one made at a rather primitive stage in the development of systems understanding. It is both a demonstration of what can be done and a challenge to do better.

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