

In the fall of 1999, Professor Jay W. Forrester led a seminar series for Ph.D. students in system dynamics at the Sloan School of Management at MIT. The series was videotaped and is now available for purchase.

Each session is devoted to a different stand-alone topic that should be of interest and benefit to any student or practitioner in the field. Those who are applying system dynamics in business and social situations will find the series useful in broadening and deepening their understanding of the field.

In an educational setting, the eleven three-hour sessions can be used as assignments, to be viewed in preparation for a follow-up class discussion. The series is not a progressive tutorial for learning system dynamics, but addresses related concepts and philosophy. An accompanying CD contains suggested readings for each session.

Session A What is System Dynamics?

Professor Forrester discusses how system dynamics started with a history beginning just before World War II. The students ask about mental models, kinds of feedback, and the relationship between system dynamics and cybernetics.

Session B World Dynamics

A discussion based on Forrester's 1971 book, *World Dynamics*. Some questions: When will growth stop, what will then be the condition of the world, how did the Club of Rome meetings lead to the World Model, and what is equilibrium? Topics include current conditions around the world, and the history of *The Limits to Growth*.

Session C Corporate Growth

Professor Forrester tells the story of his "Market Growth as Influenced by Capital Investment" article and discusses the three control loops in the model, the use of a floating goal, how to relate goals to company policies, the effect of long delivery delays, the growth of a local high-technology company, the characteristics of information channels, and the role of forecasting and the problems it can cause.

Session D Non-linearity

Participants focus on linearity versus non-linearity, when non-linearity is important, how computers and

simulation can play a part in better understanding, how a person can test a computer model, the importance of simplicity in a model, how to look for the high-leverage policies in a model, whether bigger models are better, and the importance of generic structures and how to use them.

Session E Theory Underlying Modeling

Considering system dynamics as a meta-discipline, how does it compare to the social sciences and other fields? Professor Forrester suggests four categories of theory: structural, methodological, behavioral, and principles of good practice in modeling.

Session F Group Model Building

What is group model building and why do we do it? Guest speaker Professor George P. Richardson opens the session with a description of the various roles that people can play in the group model building process. Richardson stresses that the model is a tool to enable deep conversation among the participants. He discusses different stages in building a system dynamics model as a group. The ultimate goal, according to Richardson, is to develop great conversations as a step toward insightful models.

Session G Confidence in Models

A user's faith in a system dynamics model comes from the degree of correspondence between the model and the real world. Because users cannot have proof of validity, only some level of confidence can be attained. Professor Forrester suggests eight tests of system dynamics models for comparison with the real world. Some of the questions include: is more testing better, how much testing is enough, and can we model mental models? Professor Forrester believes that the final test should be, "Is the model persuasive?"

Session H The National Model

Professor Forrester relates the history of the National Model Project, explaining that although the model draws heavily on United States information, it should be considered a general theory of behavior in an industrial nation. The National Model is an endogenous model of an economy based on local short-term policies in business, government, the monetary authority, households, and banking. Among other insights, the model provides a theory for the controversial Kondratieff

long wave (45-70 years between peaks). Professor Forrester reminds the students that the large National Model can lead to important future work with smaller models.

Session I Ethics in Modeling

Questions discussed include: what are ethical considerations for modelers, should the field of system dynamics have a certification test, what is good research, will the client use the model properly, are system dynamics models useful for forecasting, what are the ethics of larger models versus smaller models, and does every model involve an ethical compromise?

Session J System Dynamics in Management Education

This session looks at ways to use system dynamics to improve management education, not only for system dynamics majors but also for operating managers and corporate designers. Professor Forrester and the students discuss models that could be used for teaching: bankruptcy from too much success, faltering from influx of untrained employees, excess debt, problems with traditional forecasting, understanding commodity markets, maintaining balance in corporate growth, rapid innovation versus reputation for quality, and maintaining company leadership and vitality. Professor Forrester believes that there is a vast amount of available material, not yet explored in detail, which could be coupled with a new kind of education in management.

Session K The Future of System Dynamics

The group discusses the successes and shortcomings of the field of system dynamics. There are questions about how the field can be expanded successfully, how good work in system dynamics can be distinguished from less competent efforts, and how system dynamics can help evaluate data in a time of "information pollution." Professor Forrester talks about change as a slow process. System dynamics as a foundation for pre-college education is discussed as a high-leverage, long-term approach to creating a public that better understands social and economic systems. Using system dynamics to clarify public issues such as social security, imbalances of foreign trade, world free trade, and the size of government versus our standard of living are areas where system dynamics should improve public understanding of complex situations.

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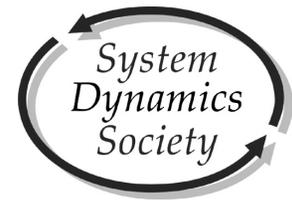
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The Forrester Seminar Series on System Dynamics

Discussions with the founder of the field



Professor Jay W. Forrester

Jay W. Forrester is Professor of Management at the Sloan School of the Massachusetts Institute of Technology. He is the founder of the field of system dynamics.



Beginning in 1946, Dr. Forrester directed the MIT Digital Computer Laboratory, which built Whirlwind, the first digital computer, at MIT. There he invented random-access, coincident-current, magnetic memory, which launched the era of reliable digital computers. Later, at MIT's Lincoln Laboratory, he directed development and installation of the SAGE system for North American air defense.

Dr. Forrester pioneered system dynamics in management education and applications to social systems and, most recently, has contributed to its use as a more relevant pre-college education from kindergarten through twelfth grade.