

NetLogo Tutorial

Center for Connected Learning and Computer-Based Modeling Northwestern University

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Introduction: What is NetLogo?

NetLogo is a programmable modeling environment for simulating complex scientific phenomena, both natural and social. It is one of the most widely used multi-agent modeling tools today, with a community of thousands of users worldwide. Its “low-threshold, no-ceiling” design philosophy is inherited from Logo. NetLogo is simple enough that students and teachers can easily design and run simulations, and advanced enough to serve as a powerful tool for researchers in many disciplines. Novices will find an easy-to-learn, intuitive, and well-documented programming language with an elegant graphical interface. Experts and researchers can take advantage of NetLogo’s advanced features, such as automated running of experiments, 3-D support, and user extensibility. NetLogo also includes HubNet, which enables a network of learners to collaboratively explore and control a simulation; NetLogoLab, which connects NetLogo to external physical devices using the serial port; and a System Dynamics Modeler that enables mixing agent-based and aggregate representations. NetLogo comes with extensive documentation, including a library with over 150 sample models in a range of domains, tutorials, a primitives lexicon, and sample code examples. The software is free and works on all major computing platforms.

Objectives and topics

Participants in this tutorial will:

- 1)** Understand the cognitive benefits of multi-agent simulation for learning;
- 2)** Explore NetLogo’s Models Library, which covers biology, chemistry, physics, earth science, economics, sociology, business, and other fields. These models support model-based inquiry in middle, secondary, and undergraduate classrooms as well as serving as the basis for research in more advanced settings;
- 3)** Get in touch with NetLogo’s new features, such as 3D worlds, Systems Dynamics Modeler and Robotics Extension;
- 4)** Learn how to build a NetLogo model;
- 5)** Find out how to get support in building models (users mailing list etc.)
- 6)** Discuss classroom implementation of NetLogo (and HubNet).

Justification for tutorial inclusion in IDC2005

A considerable body of research has demonstrated the benefits of learning a wide variety of scientific phenomena via the multi-agent approach, in fields such as biology, sociology, chemistry, physics, economics, psychology, and engineering. Multi-agent modeling environments such as NetLogo are revolutionizing scientists' methods of practice, and have the potential to radically change the ways by which traditional disciplines, such as Mathematics and Science, are taught in schools. Particularly, as complex systems perspectives and multi-agent simulation methods gain importance in K-12 education, educators are increasingly turning their attention to new technological tools, such as NetLogo, to leverage change in schools.

Schedule

1:00	1:20	General Introduction to NetLogo & Sample Models
1:20	1:40	New features: NetLogo3D, Systems Dynamic Modeler, Robotics Extension
1:40	1:50	Break (and imagine a NetLogo project to implement)
1:50	3:30	Hands-on: Creating your first NetLogo model
3:30	4:00	Projects' presentation & final discussion

Tutorial requirements

- Computer projector
- White board
- Hardware: one computer for each participant (who could also use their own hardware, in which case they should arrange with the facilitators a brief software setup time prior to the workshop). If computers are in short supply, we could make do with one computer for every pair of people.
- Software: NetLogo, which can be downloaded for free at <http://ccl.northwestern.edu/netlogo>.

Bios

Uri Wilensky is the founder and director of the Center for Connected Learning and Computer-Based Modeling (CCL) at Northwestern University, where he is also Associate Professor of Learning Sciences, Computer Science and Cognitive Science. Prior to coming to Northwestern, he taught at Tufts University and MIT and was a research scientist at Thinking Machines Corporation. He is a founder and editor-in-chief of the International Journal of Computers for Mathematical Learning. Professor Wilensky received undergraduate and graduate degrees in mathematics, philosophy and computer science and received his Ph.D. from the MIT Media Lab under the supervision of Seymour Papert. He is a recipient of the National Science Foundation's Career Award as well as the Spencer Foundation's Post-Doctoral Award. His primary research interests include computer-based modeling and agent-based modeling, STEM education, mathematics in the context of computation, systems theory and complex systems and education. Professor Wilensky has directed several NSF research projects focused on developing tools and curricula that enable learners to make sense of complexity

in the world. Among these tools are multi-agent modeling languages, such as StarLogoT and NetLogo, Extensible Domain toolkits such as Connected Models, GasLab and ProbLab, and Participatory Simulation toolkits such as Calc-HubNet, Computer-HubNet and VBOT. All of these tools are designed to enable learners to create embodied simulations of complex phenomena across many domains of natural and social science and, through creating and exploring such simulations, deepening their understanding of core scientific concepts. Many of these tools are also in use by researchers across a wide variety of domains including the natural sciences, social sciences, business and medicine. By providing an easy to learn language for constructing models, Professor Wilensky hopes to promote the sharing and critiquing of “glass-box” models in the scientific community.

Dr. Dor Abrahamson (Ph.D. in Learning Sciences, Northwestern University; MA in Cognitive Psychology, Tel Aviv University) is a postdoctoral fellow at the Center for Connected Learning and Computer-Based Modeling at Northwestern University. Dor researches student mathematical cognition and social contexts of learning through designing learning supports in mixed-media – including NetLogo and HubNet – and implementing these designs in classrooms as experimental units. These units are aimed at helping students tap their perceptual-dynamic and situational intuitions and mathematical knowledge. Students ground their intuitions and knowledge in *bridging tools* that enable them to sustain, articulate, and coordinate these personal resources toward informed use of accepted mathematical representations and vocabulary. Recently, Dor accepted a faculty position at UC Berkeley's Graduate School of Education, beginning this fall. Dor is a recipient of the National Academy of Education/Spencer postdoctoral award 2005-6.

Paulo Blikstein (BA Metallurgical Engineering, University of São Paulo; M.Eng. Electronic Systems, University of São Paulo, MSc. Media Arts & Sciences, MIT Media Lab), a PhD. student working with Prof. Uri Wilensky at the Center for Connected Learning and Computer-Based Modeling at Northwestern University. Paulo's research focuses on developing novel technological construction kits to enable children's exploration of complex scientific phenomena. One of his projects, NetLogoLab, aims at connecting agent-based simulation and the physical world, using sensor arrays, micro-actuators and rapid prototyping equipment, such as 3D printers. He has also been developing MaterialSim, an agent-based simulation microworld for undergraduate students in Engineering. While at MIT, Paulo worked on another of his passions: bringing advanced technologies to public schools in the developing world. He was part of the team that implemented a radical project for introducing technology in public schools in Brazil, which involved more than 3,000 students. Prior to his graduate studies in the United States, Paulo was the CEO of a distance learning company, taught undergraduate courses at the leading business school in Brazil, directed two scientific documentaries and wrote a TV sitcom.