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**An introduction to agent-based modeling : modeling natural, social, and
engineered complex systems with NetLogo**

Wilensky U., Rand W., The MIT Press, Cambridge, MA, 2015. 504 pp. Type: Book (978-0-262731-89-8)

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The NetLogo environment developed at Northwestern University [1] has become one of the most widely used tools for agent-based modeling. NetLogo's restricted dialect of LISP has proven much more accessible to users such as social scientists than a general-purpose language such as Java, required to work with other agent-based environments: for example, recursive porous agent simulation toolkit (REPAST) or multi-agent simulator of neighborhoods (MASON). The simplicity of the language is not surprising, since NetLogo is a direct descendant of the Logo language, originally developed to teach programming to children, and NetLogo is widely used as a teaching language. Remarkably, the architects of NetLogo have managed to provide the system with extensions that allow it to be used for real research as well, and NetLogo models are becoming more and more common in serious research papers, particularly in the social sciences.

NetLogo's motto is "Low Threshold, No Ceiling." The rich tutorial materials and examples available on the system's website are sufficient to enable most users to overcome the low threshold. This volume, written by the author of the NetLogo language and one of his associates, supplements those materials in two important ways. First, it clearly conveys the motivation for agent-based modeling and the constructivist philosophy that guides its practitioners. Second, it develops models incrementally, showing how a very simple initial model can grow to take advantage of sophisticated functions and extensions that justify the "no ceiling" part of the motto. Perhaps to reinforce the point that the authors are serious computer scientists, the book's chapters start with 0 rather than 1.

Chapters 0 and 1 motivate agent-based modeling (ABM) in the context of complex systems that demonstrate emergent behavior. They present alternative modeling paradigms and discuss the tradeoffs of ABM and when it is preferable to other approaches by reviewing the behavior of some simple models that are included in NetLogo's library (predator-prey, forest fires, ant foraging).

Chapters 2 to 4 show how to construct an ABM, illustrating the technique of starting with a very simple model and then extending it incrementally.

Chapter 5 backs away from individual models to examine the components of an agent-based model: the different kinds of agents one might use, the importance of their environment and interactions, and the user interface and scheduling mechanism.

The last three chapters are especially valuable to readers who wish to take advantage of NetLogo's "No Ceiling" capabilities. Chapter 6 discusses analyzing the behavior of an ABM, with guidelines on the kinds of data one can collect, how it can be analyzed, and the importance of running a model multiple times to explore the space of possible behaviors. Chapter 7 deals with three questions that are critical in applying models to the real world: verification (does the model meet the specification?), validation (does it match the real phenomena it is intended to represent?), and replication (can other researchers get the same results?). These topics are far too often neglected in the modeling community, and the discussion in this chapter is the best review of issues and methods currently available. Chapter 8, on advanced topics, shows how NetLogo can be integrated with other social and software systems to solve real-world problems.

An appendix gives more detail on the motivational and philosophical issues introduced in

chapters 0 and 1, with historical background on Logo and discussion of the computational roots from which ABM has grown.

The volume will be an excellent introductory textbook on agent-based modeling. Each chapter includes explorations on which students can test their understanding, and the examples in the textbook are included in the library of the latest NetLogo download (version 5.2). At the same time, the book's excellent discussions of model analysis and verification, validation, and replication, supported by NetLogo's extensible architecture, make this an essential reference for the professional modeler.

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Reviewer: H. Van Dyke Parunak   Review #: CR143531 (1509-0771)

 1) https://ccl.northwestern.edu/netlogo/ (06/14/2015).

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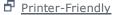Voter dissatisfaction in committee elections   Jun 30 2015
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