

Modeling and Simulation

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Goals for this Presentation

- Introduce a number of simple modeling applications
- Take a deeper look at NetLogo and some of its specific capabilities
- Provide a jumping off point for your personal exploration

A Brief Tour of Modeling Tools

- Excel
- Agent Sheets
- Vensim
- NetLogo

Excel



- Widely available
- Graphing capability built in
- Cross platform (PC, Mac)
- Challenging programming environment
- Can be used as a cellular automata or system dynamics modeling tool
- Issues with Excel 2007 (use 2003 for an easier life)
- Examples: <http://www.shodor.org/talks/ncsi/excel/>

AgentSheets



- Accessible GUI based programming
- Easily modified agent representations
- Agent locations easily defined
- Available on PC or Mac
- Can export to a java applet for web based interaction
- \$100 per license for educators
- <http://www.agentsheets.com/>

Two Main Model Types

Agent Based

- The probabilities of an individual's behavior produce a system change
- Defined relationships with if/then/else programming

System Dynamics

- Rates of system change produce the probability of an overall system behavior
- Defined relationships with equations

Vensim



- System dynamics
- Each variable automatically has a plot
- Runs on Windows and Mac OS Classic only
- Examples: <http://www.shodor.org/talks/ncsi/vensim/>
- Free for personal, educational and academic use
- <http://www.vensim.com/>

NetLogo



- Strong language and interface primitives
- GUI and command line interaction
- Parallel agent interaction
- Cross platform (Windows, OS X, Linux)
- Only one model can be open at one time
- Free
- <http://ccl.northwestern.edu/netlogo/>

A Deeper Look at NetLogo

Documentation

- NetLogo User Manual

A group of html documents that include tutorials, reference documents and other resources

- NetLogo Dictionary

Useful for finding information about specific language primitives or for browsing

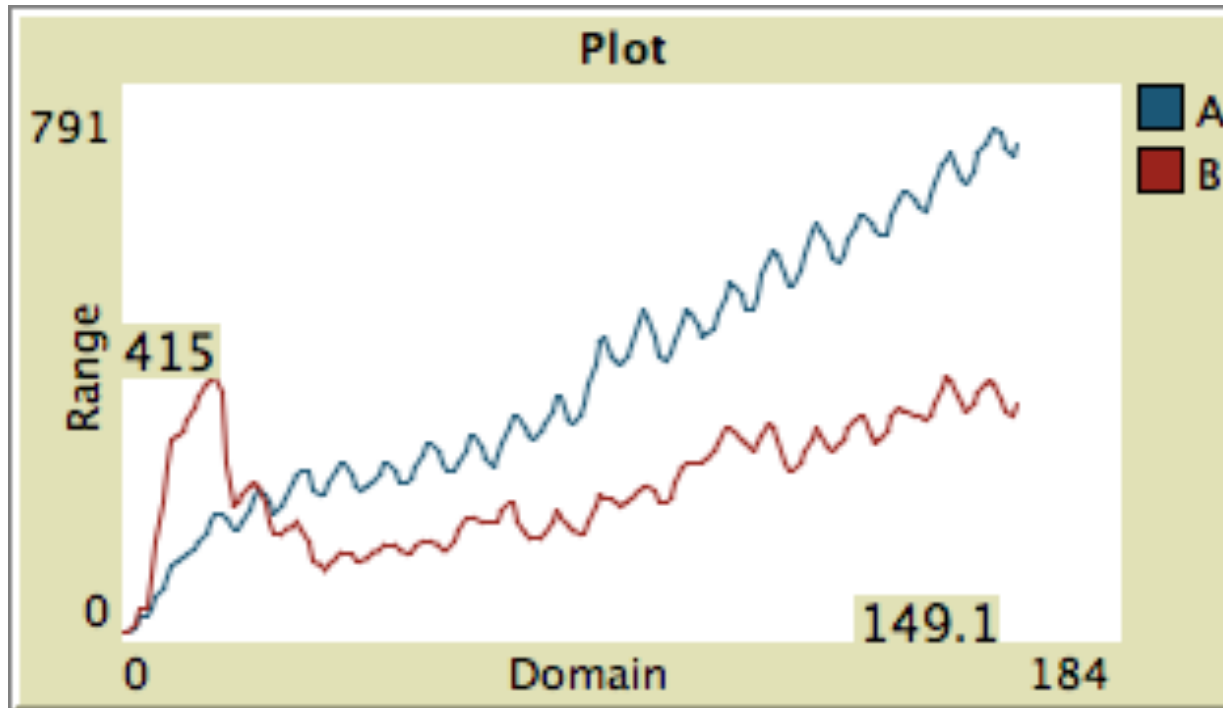
- Programming Guide

Useful for learning more about a general topic within the language (i.e. Math or File I/O)

Three Tabs

- Interface
- Information
- Procedures

Interface Primitives



Output

Monitor

Button

Slider

On Off Switch

Chooser

Input

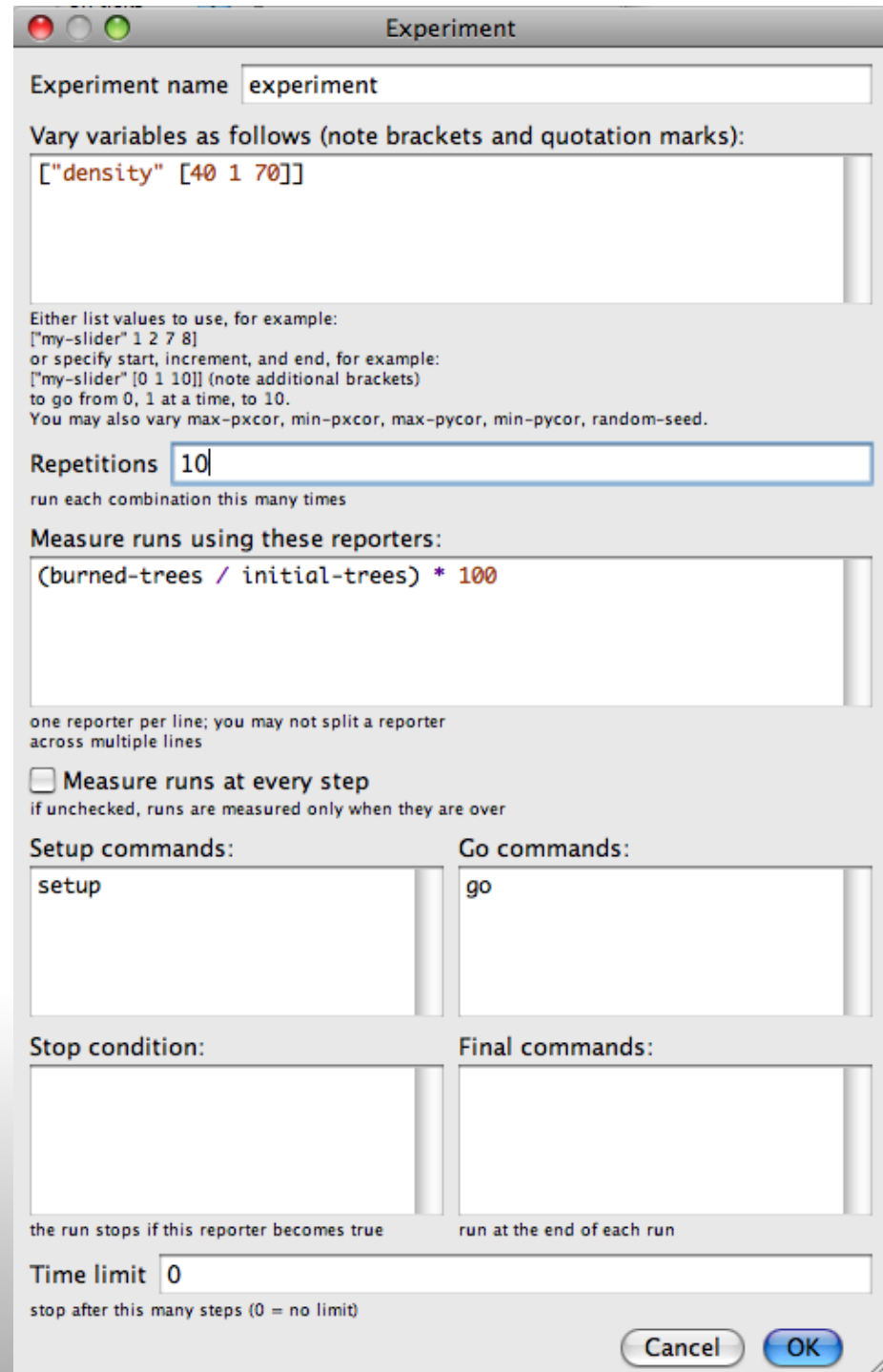
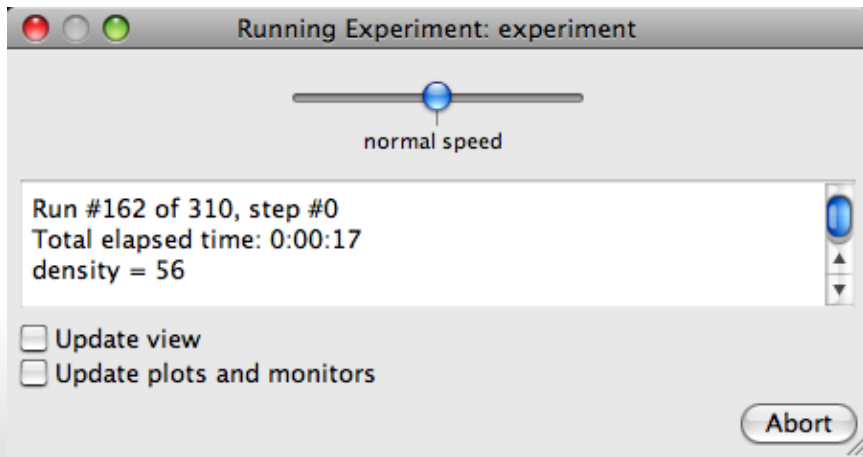
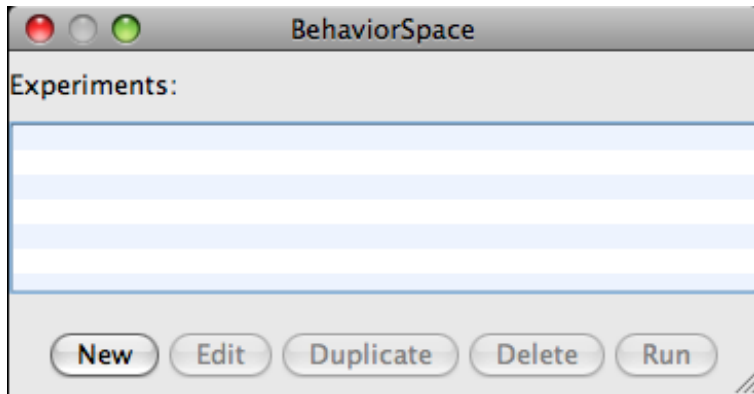
Models Library

- Variety of fields covered
- Verified and not verified
- Documentation provided

HubNet

- An interactive and engaging activity
- Participants act as agents
- Only tested for 25 participants

BehaviorSpace



Changing an Existing Model

What color is your fire?

Extending an Existing Model

Fire Resistance - Not all trees are created equal

Adding Fire-Resistance

- slider in interface defines a global variable
- *if condition [commands if true]*
- *random integer* - yields an integer between 0 and *integer*

```
to go
  if not any? turtles ;; either fires or embers
    [ stop ]
  ask fires
    [ ask neighbors4 with [pcolor = green]
      [ ignite ]
      set breed embers ]
  fade-embers
  tick
end
```

Adding Fire-Resistance

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```

```
to go
  if not any? turtles ;; either fires or embers
    [ stop ]
  ask fires
    [ ask neighbors4 with [pcolor = green]
      [ if (random 100) > fire_resistance [ignite ] ]
      set breed embers ]
  fade-embers
  tick
end
```

Thank you

<http://computationalscience.org/sc08/surveys>

<http://sc08.sc-education.org/materials/Monday/3:30-4:00/8C/>

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