Agent-Based Modelling in NetLogo

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What is ABM?

- Modelling of systems with many agents
- Agents are individuals that follow rules, take actions, interact, and possibly learn / adapt
- Represented using computer programs
- Agents may be simple or complex
- Contrast with equations or statistics

What is NetLogo?

- Programming language for doing ABM
- Widely used in teaching and research
- Simple to start using
- Integrated development environment
- Runs on java virtual machine
- Open source

What is NetLogo

- It has limited general functions:
  - It is not object orientated
  - No user defined data types
  - Extensive use of global variables
  - No library management (no includes etc)
- It is meant for creating simple, short and easy to communicate / share ABM's

How will this course work?

- The course aims to introduce NetLogo
- This will be done through:
  - Working on some exercises
  - Looking at some existing ABM NetLogo models
  - Working on your own ABM model in NetLogo
- www.davidhales.com/abm-netlogo will contain links to materials related to the course

How will this course work?

- The course page links to exercises (pdfs) which can be worked through at your own pace
- I will introduce exercises and models as we go along in the labs and help with problems
- When you finish the exercises you can work on your own model
- I will spend some time discussing your model ideas with each of you

Your model

- Try to find something related to your interests
- The models we will look at and your model should be simple
- I will send out some ideas later in the course if people are still unsure
- Could involve replicating an existing published ABM that is not currently implemented in NetLogo

How will the course be assessed?

- In the final lab sessions each student will present to the group their model
- PhD students will submit a technical report / scientific paper describing their model and experiments with it (some months after the end of the course)

Some Terminology – that will make sense to computer people..

Types

NetLogo has the following types:

- Number (a floating point value: e.g. 5, 5.5, 0.01)
- String (sting of characters: e.g. “hello”, “bye”, “”)
- Agent (of type patch, turtle or link)
- Agentset (unordered set of agents of same type)
- List (ordered list of any type including lists: e.g. [1 2], [1 “hello” [2 3]])

Agent types

NetLogo has the following agent types:

- Turtles – agents that that are located and move in a 2D environment
- Patches – grid locations (or “tiles”) within the environment
- Links – links between turtles (like edges in a graph)
- Observer – a global agent that can see and control everything else

Functions

NetLogo has two kinds of functions:

- Commands (perform some action: e.g. print “hello”)
- Reporters (return some value: e.g. sum [1 2])

There are many built-in commands and reporters (primitives) and the user can define their own by creating procedures.

Useful NetLogo Resources

- Built-in NetLogo resources:
  - Manual and Dictionary (select Help from the menu bar)
  - Example models (select Files > Models Library from menu bar)
- Online NetLogo resources:
  - Netlogo website: https://ccl.northwestern.edu/netlogo
  - Other online resources: https://ccl.northwestern.edu/netlogo/resources.shtml
  - Brief quick guide: http://luis.izqui.org/resources/NetLogo-5-0-QuickGuide.pdf