2-Day Introduction to Agent-Based Modelling

Day 1: Session 4

Networks

"Confessions" of a social scientist who is learning NetLogo

Interaction Structures

There are a number of possible ways of structuring agent interactions, including:

- Randomly – others are chosen from population at random

- Via space – those within a certain distance or in nearby/the same space

- Via a social network of links

- Only indirectly via the environment

All of these are relatively simple in NetLogo

Making & using a network in NetLogo

ask turtles [
  create-links-with n-of number-links-each other turtles
  ]

- For each node: make links with the set number of others, but not oneself (hence the "other")
- n-of returns that number of the set provided it (at random)
- Later any node can be asked to do something with all its "link-neighbours" – a set of all those it is connected with, e.g.:

 if any? link-neighbors with [color = red] [

   …*do something or other…*

   ]

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Load and run the "infection" ABM

- Load the model "4-infection-begin.nlogo"
1. Set the "population" and "number-of-links-each" sliders
2. Initialise the simulation
3. Press "infect" to infect an initial node
4. The either "step" (repeatedly) or "go" to see what happens
5. If they all go to grey you might want to infect another node
6. To see what is happening it might be easier if you slow down the simulation using the slider at the top-centre of the Interface

Adding a choice of network I

- Right-click (or ctrl-click) on some empty space and choose "Chooser"
- In the dialogue that appears, enter
  network-type for "Global Variable" and…
  "random"
  "nearest"
- …in the "Choices" box, then press "OK"
- In the **setup** procedure change:
  ask turtles [
      create-links-with n-of number-links-each other turtles
      ]
- to:
  if network-type = "random" [
    ask turtles [
      create-links-with n-of number-links-each other turtles
      ]
    ]
- Now this method is only used to make the network if "random" is chosen in the Chooser dialogue

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Adding a choice of network II

- Add the following into the setup procedure (immediately above or below the last bit of code we messed with):

    ```
    if network-type = "nearest" [
      ask turtles [
        create-links-with min-n-of number-links-each other turtles
                [distance myself]
      ]
    ]
    ```

- If the *nearest* choice is made, for each node this links to the set number of nodes with smallest distance to itself (closest)

- Go back to the interface and try the simulation with this kind of network, evaluate the difference

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To spread the graph display out a bit

- Add the command:

  repeat 100 [layout-spring turtles links 0.2 5 2]

- Just before the "reset-ticks" command in the setup procedure

- "layout-spring" just adjusts the gaps between nodes as if they were connected with certain kinds of spring – doing this 100 times

- This just makes the network easier to see – NetLogo provides a number of varieties of these for different network display styles

Add a plot

- Right-Click on some empty space and choose "Plot", then enter the following information before pressing "OK"

To add a new plot line, press the "**Add Pen**" button. To change the pen name click on the name, delete the existing name and type your own. To change the colour, click on the colour, choose a colour and then "**OK**".

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Your simulation should look *something* like this…
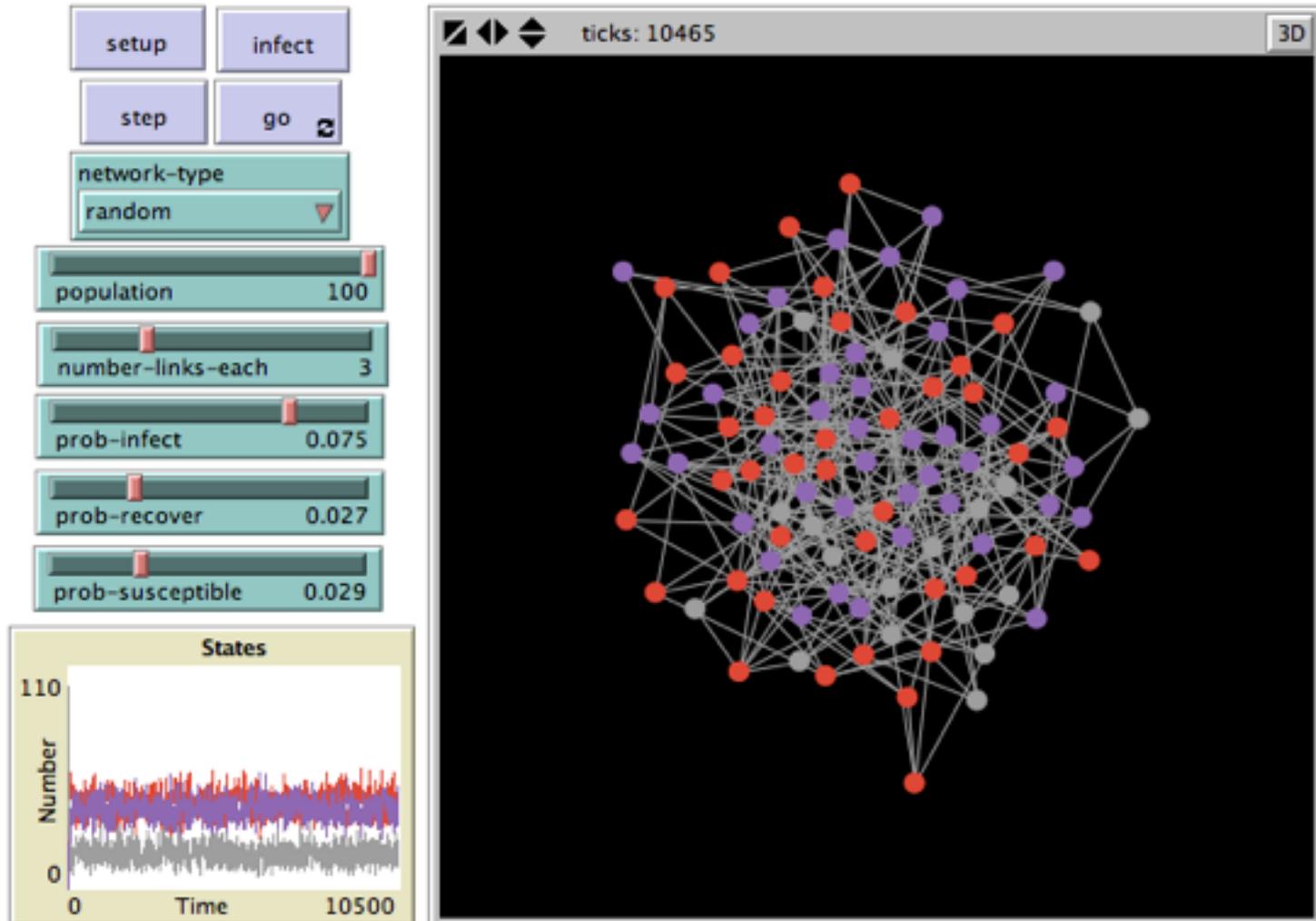
Things you might try…

- Look at all the code, make sure you understand what everything does, if there is a bit you do not understand, ask someone!

- Can you change the code so some random links are added at the start using "ask" "one-of" and "create-links-with"

- Using the command "ask one-of my-links [die]" see if you can alter the code so that a node drops links if it is infected

The End

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http://cfpm.org/simulationcourse