From Animations To Science

EES 4760/5760

Agent-Based & Individual-Based Computational Modeling

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Class #6: Thurs. January 25 2018

Starting Up:

Download the following files
(see download page at https://ees4760.jgilligan.org/downloads/butterfly_terrain/):

- A butterfly model from Chapter 5:
  https://ees4760.jgilligan.org/models/class_06/butterfly_class_06a.nlogo
- A version of the butterfly model with modifications:
  https://ees4760.jgilligan.org/models/class_06/butterfly_class_06b.nlogo
- Versions of the butterfly model with code for testing:
  https://ees4760.jgilligan.org/models/class_06/butterfly_class_06c.nlogo and
  https://ees4760.jgilligan.org/models/class_06/butterfly_class_06c_testing.nlogo
- The NetLogo "Testing Is Fun" library
  https://ees4760.jgilligan.org/models/class_06/jg-tif.nls
- A digital elevation map of real hills
  https://ees4760.jgilligan.org/models/class_06/ElevationData.txt
- Start NetLogo and load `butterfly_class_06a.nlogo`

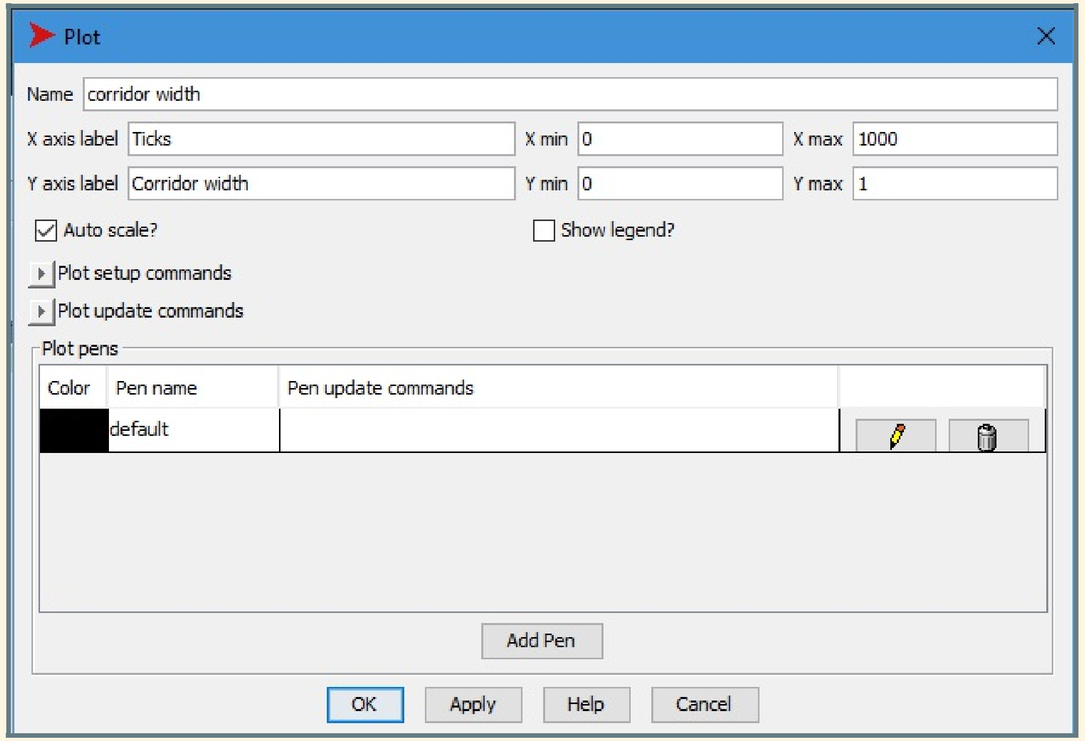
Planning

- Absence:
  - I will miss class Feb. 8, Mar. 13–15, and Apr. 10–12.
    - I will schedule make-up sessions for the classes I miss.
- Semester Project:
  - Fri. Feb. 9: Pick a model from one of the open-source repositories, or NetLogo “model library” that you want to work with.
    - One-page description of model and thoughts for extending it (post to Box)
  - Feb. 22: Examine ODD and code of your chosen model.
    - Short write-up of how model works and output from running it
  - Fri. Mar. 16: ODD for extending model
  - Apr. 17-19: Presentations on experiments with extended models
  - Apr. 24: Write-up of research project (around 10 pages)
- Team Project:
  - Each team (2–3 students) will code a model from an ODD in the textbook (Ch. 10 or Ch. 13)
  - Use model to do exercises from book
  - Make presentation about what you learned (Tues. Feb. 27)
- Detailed Assignments on Brightspace

Experiments with the Butterfly Model

Plot Corridor Width

- On the interface tab, add a plot



- On the code tab, add a line to `go` to plot the corridor width

```
plot corridor-width
```

Enhance Interface

- Add a button to export the plot to a file:

```
export-plot "Corridor-width" (word "corridor-output-for-q-" (precision q 2) ".csv")
```

- Add a button to increment *q* by 0.1

BehaviorSpace

- If your model is having problems, compare it to `butterfly_class_06b.nlogo`
- Open BehaviorSpace and create an experiment
  - Call it `experiment`
  - Vary `real-terrain` between `false` and `true`
  - Vary `q` from 0 to 1 in steps of 0.2
  - Run 20 repetitions for each value of q.
  - Measure `corridor-width` at the last tick only
  - Set time limit to 0 to let model run until it stops
- Run BehaviorSpace experiment
  - Save “table” output
  - Speed things up by unchecking “Update view” and “Update plots and monitors”
- Open the analyzeBehaviorspace app at https://analyze-behaviorspace.jgilligan.org and use it to compare the relationship between corridor width and q for each terrain

Practice

- Work together with a partner
- Add a button to erase the tracks of the turtles (Exercise 5.2)
- Using the realistic terrain, play with *q* and see what values do best at helping butterflies find mates near hilltops.

Testing Models

- Using monitors
- Unit testing resource “Testing Is Fun”
  - Open “butterfly_class_06a_testing.nlogo”
  - At beginning of code:

```
__includes ["jg-tif.nls"]
```

  - In `to_setup` add:

```
initialize-tests
```

  - In `to go` add:

```
set-context "Reporting corridor-width"
test-that "# visited patches should equal # yellow patches"
expect-that (count patches with [visited?]) equals (count patches with [pcolor = yellow])
...
if ticks >= 1000 or all? turtles [finished?]
[
  resume-all-tests
  stop
]
```

Emergence

- A tricky concept
- Early definition: *“stable macroscopic patterns arising from the local interaction of agents”* — Joshua Epstein, 1996
- Epstein ten years later: *“I have always been uncomfortable with the vagueness and occasional mysticism surrounding this word.”*
- Epstein now prefers to talk about *“**Generative** Social Science”*
- Other scientists (especially in natural sciences: biology, physics, etc.) are more comfortable talking about *emergence*.