

Introduction

Net Logo is a programming language for simulating interactions between “agents” in a suitable environment (such as the interactions between atoms in the formation of a crystal or between birds in the formation of a flock). This approach to modeling makes it possible to examine how the simple local behavior of individuals results in the complex global behavior of a group. This type of behavior is often called emergence.

NetLogo can be used in a number of ways. First, we can explore the large number of existing models of emergent phenomena that come with NetLogo, to see the types of phenomena that NetLogo is well suited to modeling. We can conduct virtual experiments to adjust the various model parameters and observe the response of the system. By so doing we can test whether the model fits with observations in the real world, and whether it predicts unexpected behavior. We can also modify existing models, for example, by adding a new types of interactions or particles. Our ultimate goal, however, is to learn the programming language in sufficient detail to create our own models. In this first lab we will focus on familiarizing ourselves with the the NetLogo interface and some of the basic commands for controlling the turtles and their environment. We will start programming in subsequent labs.

Preview

To get a preview of the types of models you will learn to create in NetLogo and to get an introduction to the graphical user interface, start this lab by completing Tutorial #1: Models, from the NetLogo User Manual (available under help). This tutorial explores one particular model form the models library. The tutorial poses questions and asks you to make predictions. Please ponder these questions seriously before moving on. While I don't think it is necessary to write responses to these questions, I do want you to jot down notes about new commands or useful information in your notebook.

Learning Commands

Open a new Netlogo file and save it in your student folder. You are faced with a black screen and no buttons. This is your nothing from which you will start creating a universe. For today you will enter all your divine instructions at the bottom of the screen. Later we will learn how to get around the Command Center by writing procedures and adding buttons and sliders like the examples model in Tutorial #1.

First we need some turtles for our universe. In the white box at the bottom of the Command Center (where is says `observer>`) type

```
create-turtles 20
```

 and then press enter

You have created 20 turtles in the center of the screen. They are all stacked on top of each other. To spread them out, enter

```
ask turtles [forward 20]
```

You should see a ring of multicolored dart shapes (we call them turtles). We can give instructions to the turtles to move around using the commands

```
forward, back, right and left.
```

Play around with these commands to make your turtles dance. You need to ask

`turtles` to do these commands, as with the previous examples, since they are turtle commands. Note: if you plan to enter a lot of turtle commands you can choose to enter turtle mode by using the popup menu located in the bottom left corner of the Command Center and select `turtles`. You can also use the tab key on your keyboard to cycle through the different modes.

You will have noticed a few things. First, all the turtles act in the same way, and second, it is hard to follow the path of individual turtles. To see the paths of the turtle we use the turtle command `pendown`.

Lets start again.

In observer mode type `clear-all` to clean the screen (`ca` also works) and then create 20 turtles (`crt 20` is short for `create-turtles 20`). At any time in this lab you might enter these two commands to clear the clutter that might ensue.)

In turtle mode type **`pendown`** and then **`forward 10`**. You should now see the paths of the turtles. Now play around with a variety of movement commands to see what they do. (note the movement commands have simple short forms: `fd`, `bk`, `rt` and `lt`).

- Get the turtles draw squares with side 5 pixels.

To make an individual turtles independently of the others we refer to a turtle's `who` number. Right click on a turtle and you should see what its `who` number is. In fact, if you select the turtle from the right-click popup menu you can inspect it – and learn all sorts of information about its coordinates and its color etc. These are attributes you can change directly.

To get a particular turtle to move independent of the others you could type

```
ask turtle 5 [fd 10]
```

which gets turtle with `who` number 5 to move forward 10 pixels.

To change a turtle's color you could type

```
ask turtle 0 [set color green]
```

which, in this case, changes the color of turtle 0 from grey to green. Not all colors you think of will be recognized by Netlogo. You can specify shades of color by typing a number. For example, light yellow is 48. Have a look at the Programming Guide in the user manual to see what other color numbers are.

If you want to change the thickness of the line that a turtle draws you can set the `pen-size`. Try the following set of commands

```
ask turtle 0 [set pen-size 4 fd 5]
```

In addition to moving turtles around you can also change the patches which the turtles move over. In the observer mode types

```
ask patches [ set pcolor blue ]
```

Notice, you use `color` for turtles but `pcolor` for patches.

Patches do not move, but it is possible to change the color of individual patches. One way to do this is to specify the coordinates of the patch. In the observer mode try typing:

```
ask patch 0 0 [ set pcolor red]
```

You can also get turtles to change the color of the patch they are on by typing.

```
ask turtles [ set pcolor red]
```

You can also inspect individual patches by choosing inspect patch from the right click popup menu and change some attributes.

This is enough for this lab. Next session we will learn how to create procedures to avoid all the typing.

The following homework questions are designed to get you explore different combinations of commands and to discover new ones. If you have trouble answering questions refer to the very helpful Programming Guide and Primitives Directory in the User Manual under the help menu. You will find these references invaluable. Answer the questions in a word document and drop your answers in the drop box using the naming convention

Intro_to_NetLogo_LastName_FirstName.doc

Homework Questions: Due in the Drop box by October 26th at 9:00 am.

1. Explain what the following commands do by either referring to the Programming Guide or trying them out. (If you try them out, make sure you leave space where space is required.)
 - (a) `cct 20 [set color red fd 10]`
 - (b) `ask turtles [pendown repeat 10 [fd 1 set color color + 10]]`
 - (c) `ask turtle 1 [hatch 1 [fd 1]]`
 - (d) `ask turtles [set heading random 360 fd 10]`
 - (e) `ask patch 0 0 [sprout 1 [set color green]]`
 - (f) `ask turtles with [color = red] [die]`
2. Write down commands that will do the following:
 - (a) cause all turtles to change the color of the patch that they are on to yellow.
 - (b) cause turtle with who number 5 to draw a regular pentagon with sides of length 5 pixels.
 - (c) cause a turtle to draw a square path with length equal to its who number.
 - (d) cause all the turtles on the left side of the screen to disappear.