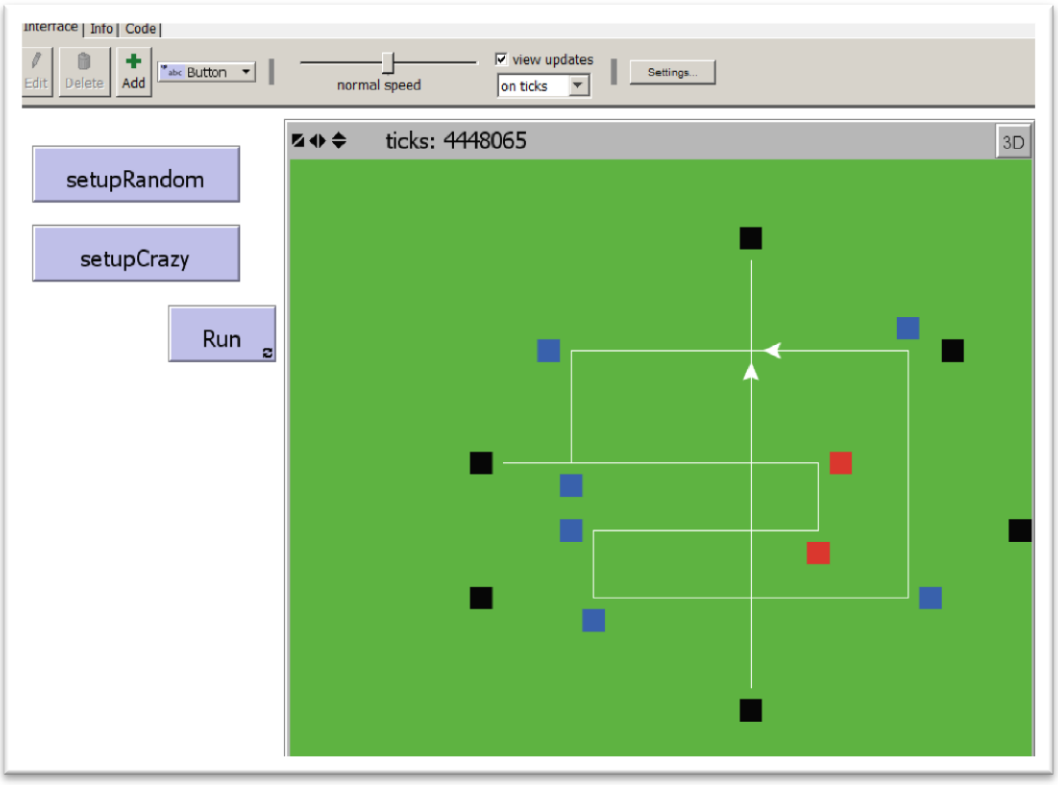
Lab 5: Bumper Turtles



min-pxcor = -16, max-pxcor = 16, min-pycor = -16, max-pycor = 16

The Bumper Turtles model created in this lab requires the use of ***Boolean logic*** and ***conditional control flow***. The basic rules are:

1) Each turtle starts in the middle of a patch. This could be any patch, but not part in one patch and part in another.
2) Each tick, each turtle "looks" ahead one patch in its current heading.
   a. If the patch ahead is black then the turtle makes a U-Turn.
   b. If the patch ahead is blue, then the turtle makes a 90° left turn.
   c. If the patch ahead is red, then the turtle makes a 90° right turn.
   d. If the patch ahead is beautiful green grass, then there are two cases to deal with: If there is another turtle in that patch, then the turtle makes a U-Turn, otherwise, the turtle runs one step forward in the turf.

Note: the turtle should ONLY move when the patch ahead is green. This is because after the turtle turns, there might be another block in its new forward direction.

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Setup Button:

Your program must have a setup button that when pressed must:

1) Clear the 2D world view.
2) Remove all the turtles (clear-all does both 1 and 2).
3) Set all patches to green. Then set specific, hardcoded patches to black, blue or red. You choose which specific patches to set black, blue or red such that the turtles you create in step (4) follow run around on a cool, creative, crisscrossing track. The screen capture on the first page shows an example of such a setup after the turtles have run around a bit. You may create more turtles and more interesting paths then that shown. Hint: Draw your pattern on graph paper before coding it.
4) Create at least 2 turtles each with a specific location and heading so that someplace along the path or that will enter the path created in step (3).

Hint: Setting a Particular Patch to a Particular Color

The Netlogo command:

```
ask patch 2 -4 [ set pcolor blue ]
```

will set the color of the patch with coordinates (2, -4)

Hint: Setting a Particular Turtle to a Location and Heading

Each turtle in Netlogo has a unique identification number. The identification numbers always start with 0 and count up to one less than the total number of turtles. The NetLogo **who** command reports a turtle's identification number.

These facts can be used to set properties of a particular turtle. For example:

```
 1)   create-turtles 2
 2)   [
 3)     if (who = 0)
 4)     [ setxy -3 0       ;; Lines 4 & 5 only execute for the
 5)       set heading 180  ;; turtle with ID number = 0.
 6)     ]
 7)     if (who = 1)
 8)     [ setxy 4 0        ;; Lines 8 & 9 only execute for the
 9)       set heading 0    ;; turtle with ID number = 1.
10)     ]
11)   ]
```

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Hint: Getting the Color of the Patch Ahead

See "Bumper Turtles" video for more details

We have seen before that within a turtle context, `pcolor` is the color of the patch the turtle is on. In this lab, we need to look at the color of the patch one ahead of the current turtle location. This can be done with the `patch-ahead` function as shown below:

```
ask turtles
[
  let colorOfPatchAhead green
  ask patch-ahead 1 ;;1 is the number of patches ahead to look
  [
    set colorOfPatchAhead pcolor
  ]

  if (colorOfPatchAhead == blue)
  [
    ;; In this code block, do what you want to happen when
    ;; the color or the patch ahead is blue.
  ]
  ;; also have an if statement for each of the other possible
  ;; colors
]
```

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Hint: Finding out Whether there is a Turtle Ahead

See "Bumper Turtles" video for more details

To detrmin whether there is another turtle on the patch ahead of the current turtle, we build a triple compound command :)

Within a turtle context, `patch-ahead 1`, reports the patch that is one patch ahead of the turtle's current location.

The Netlogo function, `turtles-on` ***patch***, reports the set of all turtles that are on ***patch***.

The Netlogo function, `any?` ***agentset***, reports true if ***agentset*** contains at least one agent. Otherwise, it reports false.

Putting this all together, the statement:

```
any? turtles-on patch-ahead 1
```

Reports true if and only if there is at least one turtle on the patch that is one ahead of the current turtle's current location.

Since this function reports a Boolean (true or false) it can be used in an `if` or in an `ifelse` statement.

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Grading Rubric [20 points total]:

[A: 1 points]: Submit one documents to your instructor: Netlogo source code named: `W5.`*firstname*`.`*lastname*`.nlogo`.

[B: 1 points]: The first few lines of your code tab are comments including your name, the date, your school, and the assignment name.

[C: 2 points]: The code in the code tab of your program is appropriately documented with "inline comments".

[D: 3 point]: Your "setup" button creates at least 2 turtles. Each turtle must be in a unique location. Also, every time the setup button is pressed, the turtles you create are always created in the same set of unique locations.

[E: 4 point]: When your "go" button is pressed after clicking "setup" every turtle moves along a path that sooner or later loops back to the same location and heading it has at earlier in its path.

[F: 3 points]: In your turtle run, there are a total of at least 10 black, red and/or blue patches that affect the path of the turtles.

[G: 2 points]: In your turtle run, whenever one of your turtles turns from its path to avoid another turtle, it later returns to its path. Hint: add a black patch to cause the turtle to turn back around.

[H: 2 point]: In your turtle run, there is at least one patch where two different turtle paths cross.

[I: 2 point]: Your turtle path is cool and original. NOTE: You cannot get any of these points unless you get ALL of the points from D, E, F and G.

Extra credit [5 points]: ALL of your turtle movement works as required AND you have at least 5 turtles AND your turtle paths cross each other in at least 5 places AND there are at least 25 black, red and/or blue patches that affect the path of the turtles.

Extra credit [10 points]: Do it in 3D! (see "Bumper Turtles" video for details).