Module 5
Overview

- Variables and Scope
- Interface Input
- Interface Output
- Creating Turtles
- Creating Breeds
Variables and Scope

- Variable: container that holds a value

- Three steps:
  - Declare
    - Allocate space and set the name
  - Initialize
    - Set the initial value
  - Get and Set
    - Use in the program or change the value
Variables Example

- Declare, initialize, use and change a variable

```plaintext
to drawLines
  clear-all
  create-turtles 1
  ask turtles [ pen-down
    let stepsTaken 5
    forward stepsTaken
    set stepsTaken 10
    left 90
    forward stepsTaken
  ]
end
```
Variables and Scope

- Scope: where variables can be used
- Three types of variables
  - Local – used in the block where declared
  - Agent – used by specific type of agent
  - Global – used anywhere in the program
Four ways to input global variables from the interface:

- Sliders
- Switches
- Choosers
- Input boxes
Interface Input

- Sliders:
  - Set a global variable to a number
  - Moving the slider sets the value

- Switches:
  - Set a global variable to a boolean value
Interface Input

- Choosers:
  - Any data type in a list of choices with a drop down menu

![Example Chooser](image)
**Interface Input**

- Input boxes:
  - Globals with strings, numbers or colors
  - More variety than sliders
  - Variable type must be chosen
Interface Output

- Ways to gather data:
  - Monitors
  - Plots
  - Command Center
Interface Output

- Monitors:
  - Output the current value of the variable they are associated with
  - Updated each time their variable changes
Interface Output

- Plots:
  - More than one variable at a time
  - Updated every tick
Interface Output

- Command Center:
  - Useful for debugging

Command Center

turtles> set color red
patches> set pcolor white
observer> ask turtle 10 [ set color blue ]
observer> ask turtle 1 [ set color blue ]
observer> crt 10
Creating Turtles

- Three ways to create turtles:
  - By observer – `create-turtles` #
  - By patches – `sprout` #
  - By turtles – `hatch` #
Creating Breeds

- Subset of turtles

- Why should you use a breed?
  - Want agents with attributes
  - Want different behavior for different kinds of agents
  - Want to refer to each breed separately
  - Want different variables for each breed
Defining Breeds

- At the top, before any procedures

   **breed** [plural singular]

- Examples

  - **breed** [sharks shark]
  - **breed** [fish a-fish]
Using Breeds

- create-<breeds> number
  create-sharks 5
  create-fish 10

- Can set breed attributes
  ask <breed> [set attribute value]

  ask shark 0 [set size 3]
  ask sharks [set size 4]
Breed Specific Agent Variables

- Each agent within breed has own value
- Specified at the top of the program
  <breeds>-own [variables]

  sharks-own [energy]
Breed Specific Actions

- Only performed by members of breed
- Examples

```
ask sharks
[
  left random 90
  right random 90
  forward 1
]

ask shark 0
[
  set size 3
  set energy energy - 1
]`
Thank you for watching!
Video created by Bianca Bologa

https://moseslab.cs.unm.edu/lab-page/bianca-bologa.html