

Agent-Based Model Implementation Lecture 2

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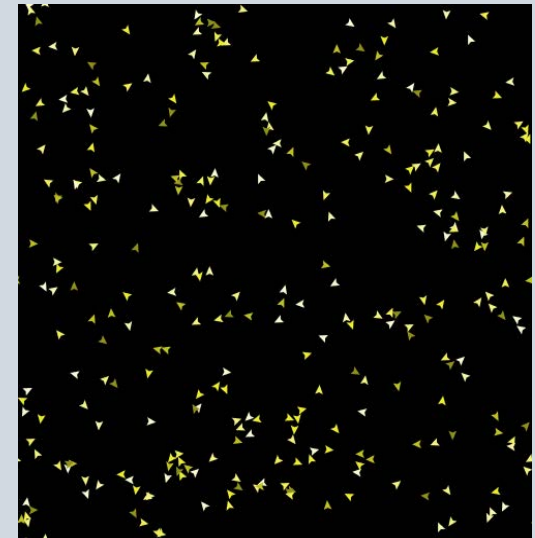
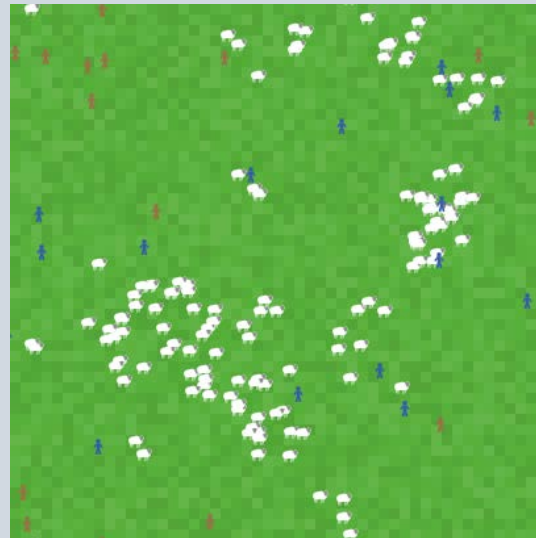
Implementation of ABM

- Using Netlogo source codes, design and simulate a simplified system.
- The user can give instructions to agents to control the behavior and interactions among the agents in the system and allow emergent behavior.
- Ask agents to do certain actions:

Move

Forage

To disperse

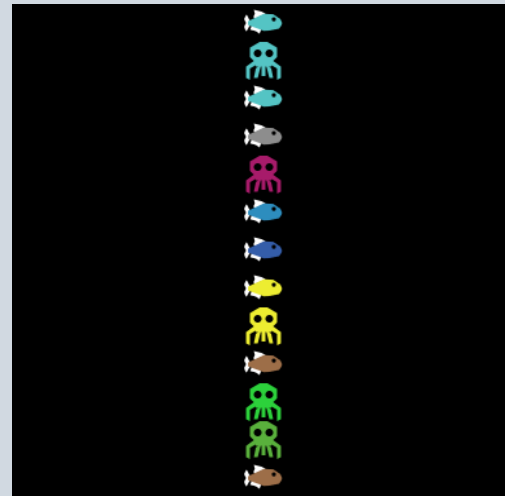
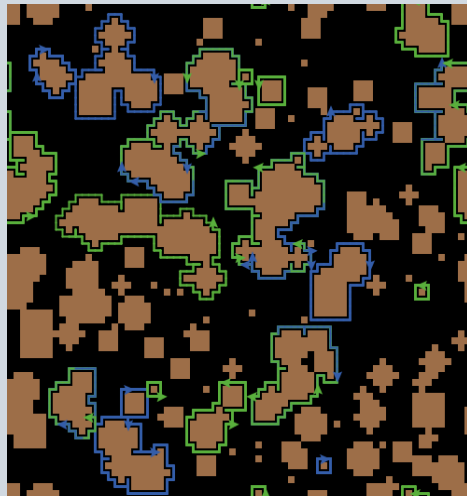


Elemental Units in NetLogo

Agents- Have their own defined actions and behavior

Types of Agents

- Turtles
- Patches
- Observer
- Links



Elemental Units in NetLogo

Turtles

- Can be non-stationary and movable.
- Generally have decimal coordinates (xcor, ycor) and direction (heading).

Patches

- Stationary but transitionary in a 2-D wrap around grid world.
- Have integer coordinates (pxcor, pycor).

Elemental Units in NetLogo

Observer

- Designer of the model.
- Being able to manipulate the elemental units.
- Can introduce new turtles and procedures and give turtles instructions.
- Have access to all the agents and variables.

Links

Links do not have coordinates.

Every link has two ends and each end is a turtle.

Elemental Units in NetLogo

Variables – are used to record values. These values can be decimals, integers or text.

- 1) global variables
- 2) turtle & patch variables
- 3) local variables

Elemental Units in Netlogo

Global variables

- One value for all agents.
- Every agent can access it (to use everywhere in the program).

Turtle & patch variables

- Each turtle and patch has its own global value.

Local variables

- Defined and accessible only within a procedure.
- Generally enclosed in square brackets.

Elemental Units in Netlogo

Key features to consider

- What types of agents (turtles)?
- Where agents (turtles) will live?
- Time frame
- Assign each agent (turtle) their rules
- Define parameters
- Run a baseline model and compare with other scenarios by changing parameters and other variables
- Explore the basic pattern to emerge from agents (turtles) rules

A NetLogo Model

Procedures

User defined sequence of commands to simulate changes.

Commands

Ask agents to carry out certain tasks

Initialization (initial setup)

To setup

To run the simulation

To go

Sub procedures

Embedded in procedure (e.g., to go)

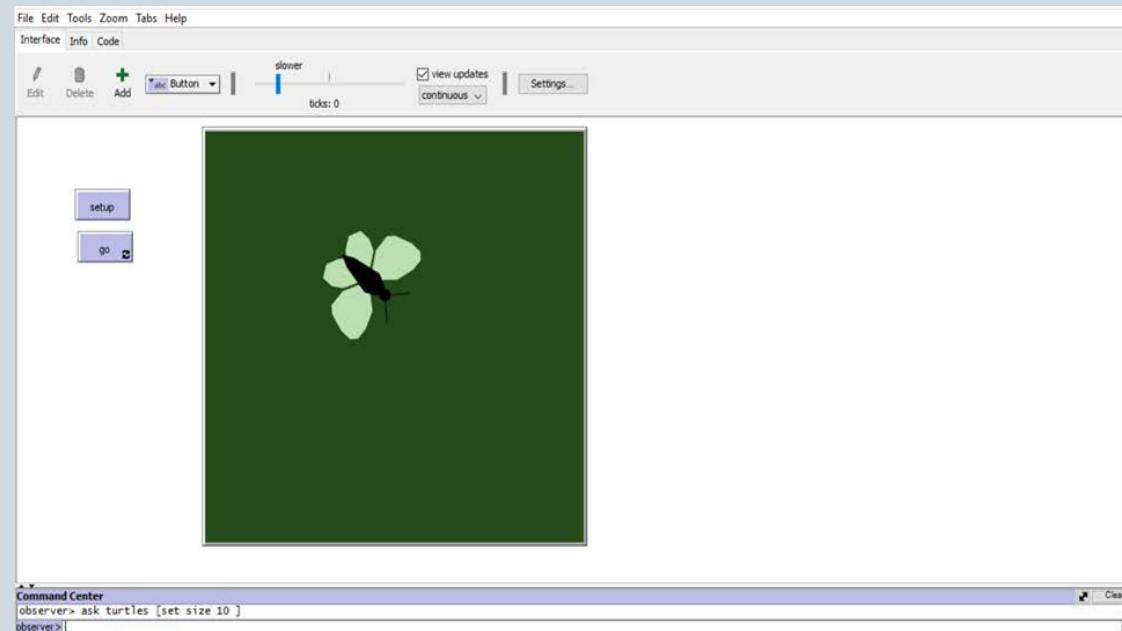
Example 1: Butterfly model

Model consists two procedures

Two buttons

Setup initial setup of the model

Go to run the simulation



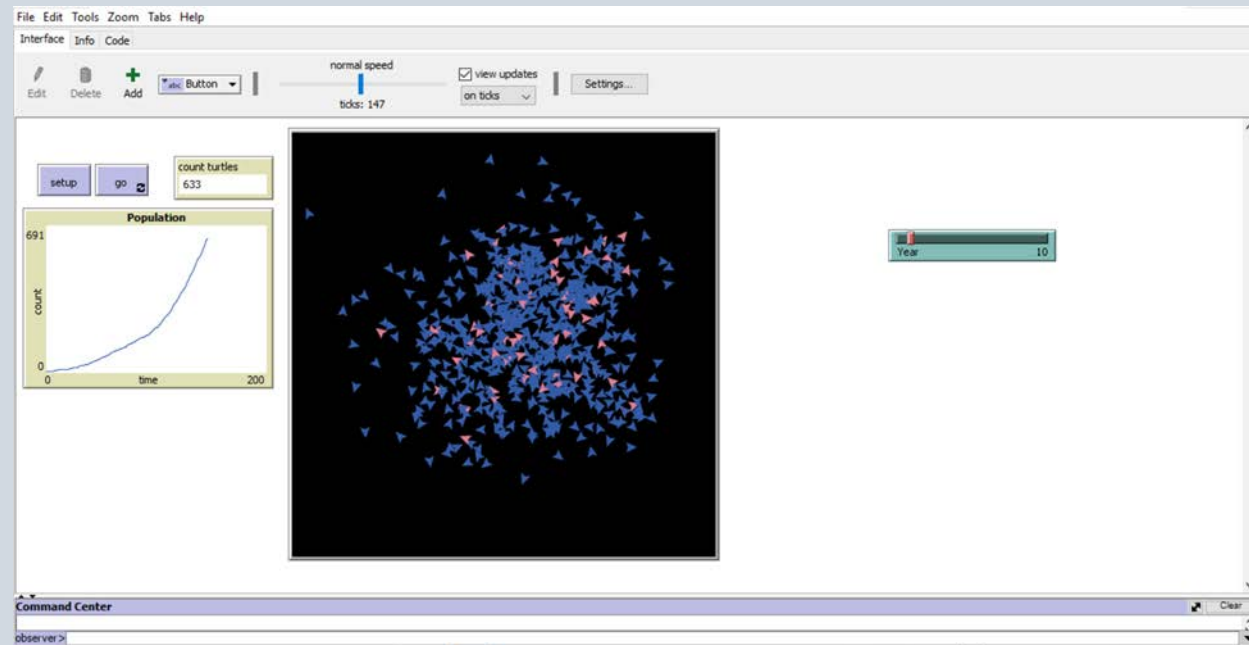
Parameterization

- Investigation of the behavior of the system by assigning different assumptions.
- These assumptions can be implemented through different parameter values or frequency.
- NetLogo have the flexibility to change the parameters during simulation.
- Parameters help in exploring the elements and the rules that generate certain emerging patterns.
- To see what data is important.

Example 2: Hatch Model

Build Hatch Model

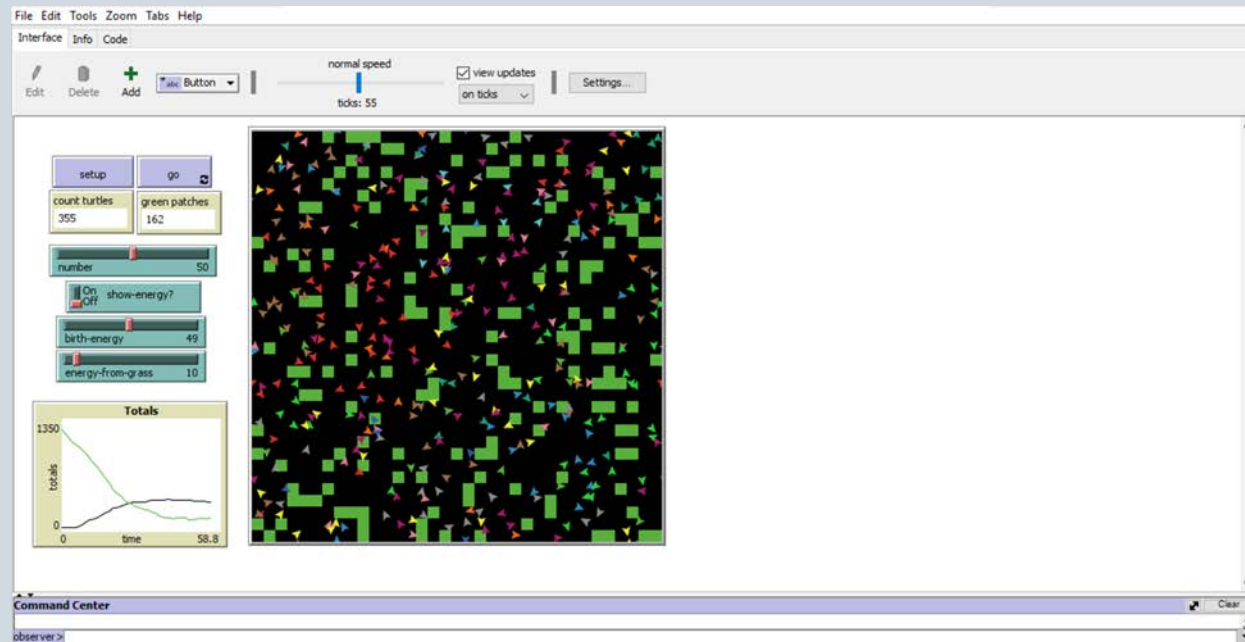
- Two buttons
- Setup initial setup of the model
- Go to run the simulation
- Slider
- Number of years (0-10)



Scenario Analysis

Once the model is implemented, run several times with removing, inserting and changing parameters, data and rules.

Note and collect the results and analyze.



Questions to ask

- What changes you see in turtles behavior in response to change?
- Does the same pattern emerge at all values?
- Are there any values that are too low or too high to create certain patterns?
- What real policies would be like?
- What would you suggest to policy maker to for solving the problem?

Class Exercise

Build three scenarios in excel sheet.

Scenario 1 (Baseline)

Scenario 2

Scenario 3

- Settings
- Model runs.

Settings	Maximum number					
Number	100					
Birth energy	30					
Energy from grass	60					
Run	1	2	3	4	5	Average
Max green						
Min Green						
Max Black						
Min Black						

Suggested Text

Uri Wilensky and William Rand, 2015. “An Introduction to Agent-Based Modeling: Modeling Natural, Social, and Engineered Complex Systems with NetLogo.” MIT Press

<http://www.intro-to-abm.com/>