

Introducing Simulation

Introduction

In many cases phenomena are simply too massive, complex, or dangerous to study in the real world. In such situations, simulation may be the only choice for their study. People who create models and simulations are responsible for producing tools to train astronauts, predict the impact of climate change, maintain a stable economy, prevent traffic jams, and predict the weather.



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Materials

- Paper and a writing utensil
- Computers with NetLogo installed

Procedure

Part I: Using a Model

1. Review the Simulation presentation along with the slide notes.

Refer to your downloadable resources for this material. Interactive content may not be available in the PDF edition of this course.

2. Form pairs as directed by your teacher. Meet or greet each other to practice professional skills.
3. Open NetLogo as directed by your instructor.
4. Choose **File > Models Library** and then **Sample Models > Biology > Wolf Sheep Predation**.
5. Click the **setup** button and describe what you see change in the viewport.
6. Click **setup** again multiple times and describe what changes you see if any.
7. Click the **go** button. Describe how the simulation behaves (click the go button at any time to pause the simulation).
8. Run the simulation ten more times, clicking the setup button to start fresh with each run. Describe the way in which the model behaves differently in these other runs. Make sure that you let the simulation run past a time of 250 ticks or until it is stable.
9. Within the GUI tab under "Grass settings," switch `grass?` from "off" to "on". Press the **setup** button and describe how this change modified the initial setup of the simulation.
10. Run the simulation as you have before, one time, and describe the results or any patterns that

you observe.

11. Describe a way to attempt to determine if the results or patterns you saw during your first run of the simulation will hold in following runs. Be sure to describe why you think your method is a good test of your observations.
12. Test your observations using your method and then describe why you think your observations were verified or not verified as well as what this means in terms of wolves, sheep, and grass.
13. Choose one of the following parameters to modify and experiment with. Describe the values that you chose for the parameter, how many runs you did with each value, as well as what your observations were about the impact your modifications had on the behavior of the simulations.
 - grass-regrowth-time
 - initial-number-sheep
 - initial-number-wolves
 - sheep-gain-from-food
 - wolf-gain-from-food
 - sheep-reproduce
 - wolf-reproduce
14. As directed by your instructor, present your results from Step 13, and discuss your experience with the simulation as a class.

Part II: Exploring a New Model

14. In Unit 2, you learned a little about how search engines decide which web pages are the most relevant pages for your search. To give you experience exploring a new model that you already know a little about we will now examine a model of the PageRank algorithm. Select **File > Models Library**, and then **Sample Models > Computer Science > PageRank**.
15. To learn more about the PageRank algorithm use the **Info** tab in NetLogo to help you summarize the two different methods that you can use to simulate the PageRank model in your own words.
 - Method 1 —
 - Method 2 —
16. Experiment with the Interface tab. What are the properties of this simulation that you can change?
17. This simulation has a **step** button, which is similar to the **go** button except it advances just one tick at a time. You can use this button to see the effects of the agents on the model as a whole at a much more precise level. Set the following interface values:
 - `Number-of-surfers` to 1
 - `Watch-surfers?` to On
 - `Calculation-method` to random-surfer

Click the **setup** button and then use the step button to examine the behavior of one surfer as it moves around the network. What do you notice about how the surfer moves?

18. Take time as directed by your instructor to experiment with this model with your partner. Try to draw some conclusion about the behavior of the model. You may change any of the simulation parameters that you like to try and support your conclusion.
 - What parameter values did you use?

- – network-choice
- – damping-factor
- – calculation-method
- – number-of-surfers
- – watch-surfers
- – show-page-ranks?
- What was your conclusion?
- How do you support your conclusion with evidence?

19. As directed by your instructor, discuss your experience with the PageRank model as a class.

Conclusion

1. Describe a simulation that you would like to see developed in NetLogo.
2. Choose a career of interest to you and describe a simulation that would benefit people doing work in that area.
3. Explain the benefits of using an environment like NetLogo.