

## **SATURDAY ENRICHMENT SPRING 2019**

### ***PROGRAMMING MULTI-AGENT MODELS IN NETLOGO***

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Robinson Center Classroom – Guggenheim Annex

### **Course Description**

Suppose we wanted to simulate anthills. How many ants can live there? How much food do they need? How large can the ant colony grow? What if there were enemy ants? What if it rains? What if an anteater comes by? Or a lawnmower? What if we wanted to simulate this a thousand times? While we could start a bunch of ant farms, we could also address a lot of these and many more questions with creativity in computer programming.

In this class we will simulate real-world phenomena in [NetLogo](#) by creating environments of pixel patches filled with agents called turtles, which can take on any size, shape, and color, and respond based on programmed behaviors. We can model different variables in the NetLogo interface and even shape the world itself using a few clicks, words, and numbers. We can use NetLogo to model and simulate vastly different phenomena, or set of events, ranging from collisions of molecules to traffic jams. The program also allows us to look at hypothetical situations such as asteroid impacts and zombie apocalypses. By combining different interactions, we can find new ways to accurately model and predict any phenomena of interest!

### **Essential Questions**

- How do we use the NetLogo language to get the model to do what we want?
- How can we model complex natural phenomena?
- How can we model complex social phenomena?
- How can we build off existing models?
- How and when can we use our models to perform experiments?

### **Learning Outcomes**

*Students will learn* features of the NetLogo language as a basis for future coding.

*Students will investigate and model* a phenomenon of their own interest.

*Students will be able to* use their models to design experiments to answer research questions.

### **Instructional Strategies**

Our most limited resource is time! However, our imagination and ingenuity are boundless! While the graphical capabilities of NetLogo are limited, the mix of bouncing dots and colors will come to represent some of the most complex phenomena we could observe in real life in a matter of seconds. While the program itself provides feedback as to whether the code works, the instructor and teaching assistant will work closely with students to get models working efficiently.

Students are encouraged to explore the models library (CTRL + M) to see what phenomena are already available. Most models use a combination of patches and turtles in different sizes and colors. While complex math, such as combinatorics and calculus, can be handled by the program itself, it is more important that students identify and articulate what they want their model to do.

### Student Assessment

Students will be given constant verbal and written feedback from the instructor. Students will self-reflect on their programming process and will constructively critique their peers' models and ideas. With improvement in mind, lessons learned will be shared. Finally, we will have periodic presentations to the class to brainstorm and iterate upon ideas.

### Resources and Materials

NetLogo, laptops, graph paper, class GitHub (account details will be shared in class).

All materials for this class will be provided by the Robinson Center.

### Tentative Class Schedule

Class Date	Topics	Activities
April 6	Ants, Wolf Sheep Predation	<ul style="list-style-type: none"> <li>- changing size and colors</li> <li>- adjusting global and breed variables</li> <li>- defining turtle-patch interactions</li> <li>- adding sliders and inputs</li> <li>- adding interactive buttons</li> </ul>
April 13	Flocking, Look Ahead, Vision Cone	- programming turtles to move to a location - tuning turtle movement
April 20	NO SATURDAY CLASSES	
April 27	Adding cool new stuff! Preventing Feature Creep	- manipulating world settings and user-variables
May 4	NO ROBOTICS CLASS (A.J. travelling) Students still have their other RC classes.	
May 11	Modes	- ifelse logic
May 18	Automating Models	- making sub-procedures and output files
May 25	NO SATURDAY CLASSES	
June 1	Personal Project	<ul style="list-style-type: none"> <li>- drafting an info tab</li> <li>- pulling code from existing models</li> <li>- commenting lines of code</li> </ul>
June 8	SHOWCASE! (morning before RC classes) Class will still meet at the normal time.	<ul style="list-style-type: none"> <li>-Presenting and celebrating work</li> <li>-IN-CLASS: model swapping mega-model</li> </ul>

## **Showcase**

On the morning of the last day of class, A.J.'s robotics and programming classes will meet to display their robots and NetLogo models. This time is reserved to make up the May 4 class. Parents will be sent e-mails with event details, and students will be reminded in classes in preparation for this event.