Rock/Paper/Scissors

Overview
This activity builds off of the classic game of Rock/Paper/Scissors, known to most students and also related to a phenomenon seen in biology. In the off-line activity students play two rounds of the game with different rules in each round. After debriefing the game, the outcomes will be discussed in the context of computer modeling by viewing a model that uses the same rules. This is followed by a brief decoding of the computer program to learn computer science concepts.

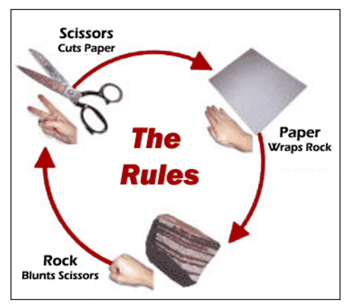
A teacher can lead this activity with up to about 40 students. A minimum of 10 students is recommended for the off-line activity.

Materials needed:

- Open space to play the off-line activity
- Paper hats, stickers or cards- 3 colors for all participants (to represent rocks, papers and scissors)
- Projector & computer with internet access
- Copies of the code blocks for small groups or individuals. (optional)

Part I - Off-line Activity- playing the game: (approx. 20 minutes)

Assign each student a "breed" of rock, paper, or scissors, making the groups as equal as possible. Have each student choose a classmate at random and play one round of the game (paper covers rock, rock crushes scissors, scissors cut paper). Have each student who loses the first round sit down, and the remaining students continue to play until a single student is left standing. Play again (with students reassigned in equal groups), and encourage students to choose partners at random. If there are enough students and the groups are roughly equal, the "winner" should not be predictable.



http://www.ankeshkothari.com/how-to-win-at-rock-paper-scissors/

Change of rules:
Have students play where *the loser of each round changes to the winner's breed for the next round.* For example, in a match between paper and scissors, the student who was paper 'loses' and becomes a scissor (and the student who was scissors stays a scissor). Both play round 2 as scissors. To identify the breeds, you can have participants wear colored hats, display a sticker or card.

Photo by Lisa Milenkovic

Continue to play until one breed wins (or is in a large majority) – again, with a large enough group, the winning breed should not be predictable.

Debriefing the Game:

- What did you observe while playing the game?
- Were you able to predict who would win the game? Why or why not?
- Who thinks someone in the group didn't follow the rules during the game?

Part 2 - Show a computer model (approx. 15 minutes)

Go to: http://www.slnova.org/GUTS/projects/9434/ for the computer model. Click 'View Code' button on right side. Scroll down to see the green Spaceland where the action will happen.

Show the model:

1. Click the Setup button
2. Click the Forever button to watch the action.
3. Take note of the data boxes counting the populations as well as the graph.
4. Run the model multiple times and have students take note of the outcomes.
5. Can students predict the winning group?

(If the Setup & Forever buttons are not showing, grab a lower corner of the browser window and resize it.)

Computer Science Connection- This is an opportunity to review or teach the uses of computer models.

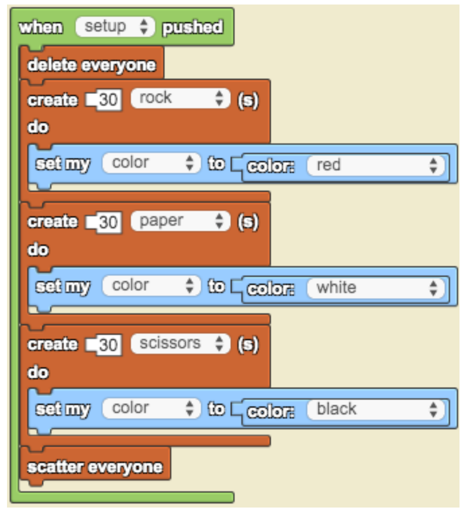
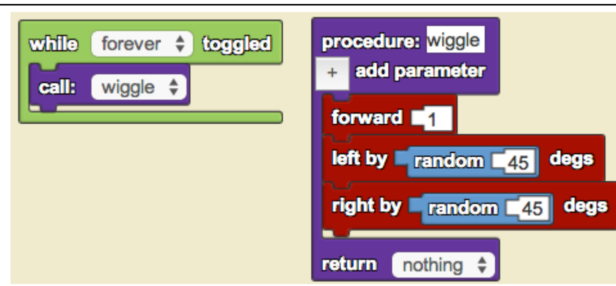
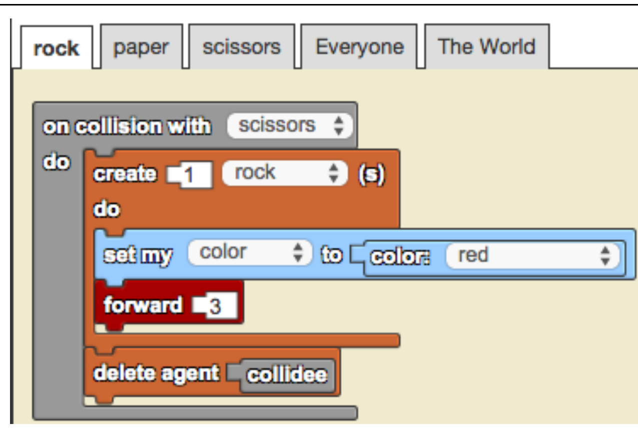
Discuss computer modeling with students-

- What are the benefits of creating a computer model of the game we just played? *(Answers could include: all agents will follow the rules (i.e. no cheating), can play over and over again quickly, agents don't only follow their friends the way students might.)*
- What can we do with a model that is impossible in the real world? *(Answers could include: larger number of agents, fast collection of data.)*
- What are the limits or assumptions behind such a model? *(Answers could include: agents all move the same way (step size, angle of turning), equal probability of interactions between agents (no clumping of breeds).)*

Part 3 - Decoding the computer model (approx. 15 minutes)

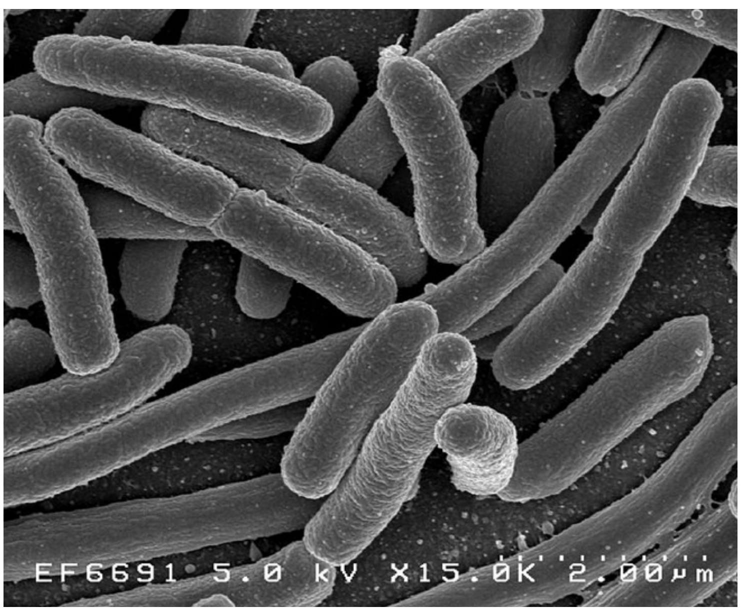
Have students work in small groups to look at the code and verbalize how the computer program works in StarLogo Nova. This can also be done as a large group with the code blocks projected on a screen.

Below are the code blocks for the computer model made in StarLogo Nova.

This set of blocks gets executed when the user presses the Setup button in the Spaceland area. It create 30 of each of the rock, paper and scissor agents and gives them specific colors and scatters them to random positions on the green Spaceland.	
These blocks define the movement procedure called ‘wiggle.’ The random blocks allows for the unpredictable movement of the agents (in this case, rock agents, paper agents and scissor agents)	
Collision blocks are used for agent-to-agent interactions. In this case, when the rock agent collides with a scissor agent, the rock ‘wins.’ In this case it means that the scissor agent is deleted and a rock agent is created to replace it. The new rock agent is separated from where the scissor agent was by the command ‘forward 3.’	

Science Connections:
Mixed populations of e.coli will exhibit similar strategies found in Rock-Paper-Scissors. So will side-blotched male lizards when establishing dominance.

Male side-blotched lizards can be divided into three different types. Each types varies in how it competes for mates. Variation within a breeding population is maintained by a rock-paper-scissors mechanism. A cycle is created where the least common type has the largest number of mature living offspring in the next year. This is because one type does particularly well against another, but poorly in comparison to the third type.



Computer simulations showing the preservation of biodiversity when the three strains of e. coli interact locally using the rock-paper-scissors dynamic are available at http://news-service.stanford.edu/news/july10/rps_video-710.html . The colicin-sensitive strain (blue) is quickly supplanted by the colicin-producing strain (red), which in turn is supplanted by the faster-growing colicin-resistant strain (yellow). The result is conservation of biodiversity.

Rock-paper-scissors may be common in many ecosystems, such as coral reefs, where scientists first observed the dynamic. The strategy of producing toxins to kill or slow the growth of a competitor is called allelopathy. It occurs in many plants, marine invertebrates, fungi and essentially every major bacterial group. The toxins that one population of bacteria uses to poison others are exploited in medicine as antibiotics. (http://news.stanford.edu/pr/02/bohannan724.html)