**Altruism simulations:**

Learning objectives:

1. Understand how altruism would evolve under natural conditions
2. Relate altruism evolution to group-living dynamics

Running the model- Navigate to: <http://netlogoweb.org/launch#http://netlogoweb.org/assets/modelslib/Sample%20Models/Biology/Evolution/Altruism.nlogo>



**Be sure to reset to these population parameters before using sliders for each situation!**

1. Click the “Set up” button.
   1. Which population (altruist or selfish individuals) do you expect to dominate? Why?
   2. Now run the model by pressing “go”. Which population dominates? Which population was driven to extinction?
   3. What do you notice about the distribution of the altruist and selfish populations when both are present? If needed, slow the model down to view.
2. The “ALTRUISTIC-PROBABILITY slider “--- lets you determine the initial proportion of altruists while the SELFISH-PROBABILITY slider --- determines the initial proportion of selfish agents.
   1. What happens if you increased the altruistic probability but kept the selfish probability the same? Move the slider, then click “set up”, then click “go” to run the model.
   2. What happens if you increased the selfish probability but kept the altruistic probability? Move the slider, then click “set up”, then click “go” to run the model.
   3. How do the respective population sizes affect the outcome?
3. Use the slider to adjust the cost and benefits of altruism. At what values does the altruistic population begin to have greater success? Are these situations realistic? Why or why not?
4. Increase the Harshness and Disease values, independently, and with respect to one another. What are the effects of the Harshness Model? of Disease?
   1. When harshness high, then-
   2. When harshness low, then-
   3. When disease high, then-
   4. When disease low, then-
5. By manipulating the harshness and disease values:
   1. At what values does the altruistic population begin to have greater success?
   2. What do you notice about the distribution of the altruist and selfish populations at these parameters?
   3. The harshness variable gives each empty unit of the screen a chance of staying empty. Therefore, the harshness variable limits population growth by making some of the spaces uninhabitable. What do you suspect is leading to this result of altruists having greater success than selfish populations?

This material has been modified from:

Centola, D., U.Wilensky, E. Mckenzie. 2000. A Hands-on Modeling Approach to Evolution: Learning about the Evolution of Cooperation and Altruism Through Multi-Agent Modeling - The EACH Project. Proceedings of The Fourth Annual International Conference of the Learning Sciences

https://ccl.northwestern.edu/papers/Each/Each.html

Wilensky, U. (1998). NetLogo Altruism model. http://ccl.northwestern.edu/netlogo/models/Altruism. Center for Connected Learning and Computer-Based Modeling, Northwestern University, Evanston, IL.

Wilensky, U. (1999). NetLogo. http://ccl.northwestern.edu/netlogo/. Center for Connected Learning and Computer-Based Modeling, Northwestern University, Evanston, IL.

**Answer key**:

1. –
   1. Selfish has higher fitness- expected to survive better.
   2. Selfish dominates; altruist go extinct
   3. Randomly distributed. No real pattern.
2. –
   1. Initially increased altruist, then driven to extinction later
   2. Altruist driven to extinction quicker.
   3. Just effects rate of extinction.
3. Only if cost is really low or benefit really high. It is not realistic for really low cost, but could be realistic for high benefit. Let students come up with some ideas (when protected in some way… sibling care, disease, etc.)
4. -
   1. Harshness high- selfish wins
   2. Harshness low- selfish wins
   3. Disease high- selfish wins
   4. Disease low- selfish wins
5. –
   1. harshness value is set around 0.96, and the disease value is set around 0.2
   2. The altruistic individuals start to group.
   3. When natural conditions are harsh enough, single agents cannot survive against nature.
      1. Selfish agents are better in competition against the altruistic agents, but the altruistic agents are better against nature than the selfish agents.
      2. Altruistic agents survive in groups of altruists. The community can survive because each altruist adds to the fitness of the other altruists. The selfish agents are dying because they have less resistance to the disease (harshness).
      3. The void spots are preventing the altruists and selfish individuals from interacting. Therefore, the altruists can benefit from one another without the selfish individuals stealing any benefits. The altruists also increase their resistance because they can form groups.