Paper Catchers from Project GUTS

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Modified for size & families/friends for "STEM Grab & Go" by: NM MESA
Required materials: 4-5 people, recycled or scratch paper, graph paper and a pencil

RUNNING THE ACTIVITY—PART 1

In the first stage of this Activity, ask your family members and/or friends to crumple up a piece of (scrap) paper. Pick one person to come up to the front of the room and be the initial member of the population. Members of this population should follow these rules:

- If you are standing at the front of the room, then throw your paper high in the air (at least several feet above your head) when the facilitator gives the "next generation" command.
- If you catch your paper, then you survive and may "reproduce" by calling up another member of the audience to join the population.
- If you don't catch your paper, then you "die" and must sit down. Lead participants through several "generations."
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If the population crashes or becomes extinct (because all of the population members drop their pieces of paper), begin again, noting that sometimes populations will crash by chance or become extinct when their numbers are small. Record the size of the population over time. **What is the maximum population?**

Once the members of your group are all standing at the front of the room, take a look at the graph of the population over time. Ask your family and/or friends to reflect on some of the following issues:

- What type of population growth is modeled, and why does it occur?
- The growth curve changes shape dramatically when all potential members of the group are already in the population. What does this limitation add to (or take away from) the model?
- How realistic is the implementation of "death" in this model?
- How does chance play a role in this model? How does the inclusion of randomness make this model different from the penny growth model?

RUNNING THE ACTIVITY—PART 2

Next, place a newspaper-sized piece of paper on the ground. Follow the same rules you did earlier, adding one new rule: Each member of the population must have part of one foot on the paper at all times. Removing your foot from the paper (even for an instant) results in "death" (sitting back down).

Proceed, as in the last experiment, by calling up one initial population member and asking that person to throw the paper in the air. Continue propagating new generations, noting the number of people in the population over time. What happens to this population? Is everyone able to stand on the paper? When the population size stabilizes, discuss the implications of this new feature.

- Hold up the paper and show participants what they did to the "environment."
- What kind of growth does this model demonstrate?
- What kinds of death processes are modeled by implementing "dying" when you take your foot off the paper? How does this relate to limited resources in nature?
- Calculate a carrying capacity (maximum number of individuals supported) for this environment.
- Is there a newspaper size that leads to oscillating populations (many people die when the paper is crowded, which frees up a lot of space for growth, which fills up the paper, and so on)?

Compare the birth and death processes in this model and the penny growth model. What are the advantages and disadvantages of the two models? When would it be more appropriate to use one or the other?

FACTS FOR FACILITATORS

It is likely that people were cooperating in order to avoid collisions when they were standing close together on the newspaper. **How do social factors like this one influence population dynamics?** Depending on the paper-catching skills of the people in the group, you might need to adjust how high the population members throw their papers. You might also use throwing height as a variable in the model. For a description of a similar activity and additional explorations, see Byington (1997). Modeling a growing population is one avenue for exploration. You and your students can consider the many different ways to model a single phenomenon and weigh the advantages and disadvantages of each approach.