

3. DEFENSIVE BEHAVIOR: "PLAYING POSSUM"

Goal: To build a robot that only moves when the surroundings are silent. This models a possum's behavior of 'playing dead' in response to a predator.

Main Themes:

- Using the sound sensor, or microphone, and adjusting the volume threshold
- Programming with loops
- Animals' defensive behaviors

Biology Theory: Animals in nature are very patient and cautious; some animals even act like they are dead. They mimic the appearance and smell of a dead animal with the hope that predators lose interest in what they think is less-than-fresh food. Opossums (a.k.a. possums), North America's only marsupial, actually go into shock and become unconscious when threatened, similar to fainting. Some species of snakes are very good at pretending to be dead.

Robotics Theory: See activity 2 "Caribou Scattering"

Activity Instructions:

- At a minimum, use a simple wheeled robot with a sound sensor attached. (see activity 2)
- Place the robots around the room, far enough apart that they won't run into each other. An open area is preferable.
- The whole class needs to be quiet together to trigger the possum robots. Experiment with different volumes and thresholds.

Sample Code:

- Each group should build a robot that stays still when it hears sound and moves when the sound is under a certain volume threshold.
- Students may need to test out different sound thresholds, particularly depending on how much ambient noise there is outside of the classroom.



This program:

- Waits until the sound level is below the specified threshold
 - Note: if you make the threshold too low, the sound of the motors could cross the threshold and cause the robot to stop moving.
- Turns the motors on to drive forward for 0.1 seconds
 - This is the determining factor in how quickly the program makes it through the loop. Operating the motors for 0.1 seconds means the program will loop about 10 times per second, which will make the robot more responsive to changes in noise.
 - Use the "coast" setting instead of "brake" to achieve a more fluid movement.
- Loops back to the beginning to check the sound sensor again

Discussion Questions:

- What volume threshold made the behavior work correctly?
- How well could the class keep quiet at the same time?
- What happens when/if you change the duration of the motors driving?
 - The longer that the motors are on and driving forward, the longer it takes to finish that iteration of the loop and go back to sampling the sound from the microphone. This can make the robot less responsive.
- How well does the 'playing dead' behavior work for animals' defense? What are the advantages or disadvantages?
 - It can discourage predators, many of whom avoid decaying carcasses.
 - However, it may not work against scavenging predators, who will eat carcasses. Also it may not help against the threat of being run over by automobiles.
- What other animals have similar defensive behaviors?
 - Many animals hide and freeze in response to danger. For example, turtles recede into their protective shell and don't move or come out until the threat is gone.
- What animals prey on possums? What do possums eat? Describe a few levels above and below possums in the food chain.

Resources:

- Opossum fact page: <http://www.bbc.co.uk/nature/wildfacts/factfiles/658.shtml>
- More detailed info on opossums:
<http://www.wildliferescueleague.org/report/opossum.html>
- "Playing dead" info: <http://amos.indiana.edu/library/scripts/possum.html>