Cartesian vs. Polar in a Predator-Prey System Computer Systems Lab 2009-2010

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January 27, 2010

1 Abstract

This project aims to use an agent-based system to model two different predator-prey systems. The first is in Cartesian x,y, the second is in Polar r,θ. From there, any differences between the predictions of the models will be ascertained.

2 Introduction/Goal

The purpose of this project is to ascertain any differences between choosing Polar coordinates or Cartesian coordinates for a predator-prey model.

3 Background

Understanding of different ways to model population and a cursory understanding of the Lotka-Volterra equations is essential to understand population modeling in general. The Lotka-Volterra equations are a set of differential equations governing how population behaves when the two interact with each other. It assumes simple exponential growth/decay for each group, the predator and the prey, and adds a factor to decrease, for the prey, or increase, for the predator, the populations based on interactions between the two populations. Polar and Cartesian are the two most common ways to

express coordinates in two dimensions. Cartesian expresses coordinates in terms of x, horizontal distance traveled, and y, vertical distance traveled. Polar expresses coordinates in terms of r, distance from the origin, and θ, counterclockwise angle from the Polar axis, the x-axis in Cartesian.

(3, 60°)

r

θ   θ

0   1

L

r

(4, 210°)

y

y   P

x

x

3
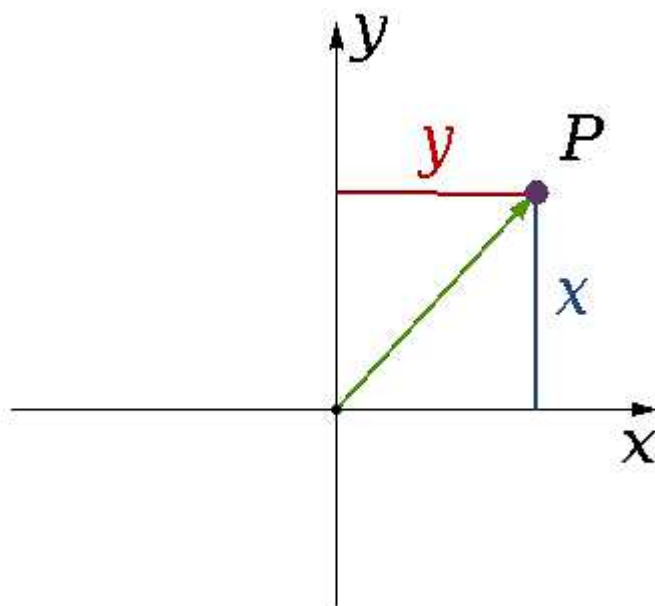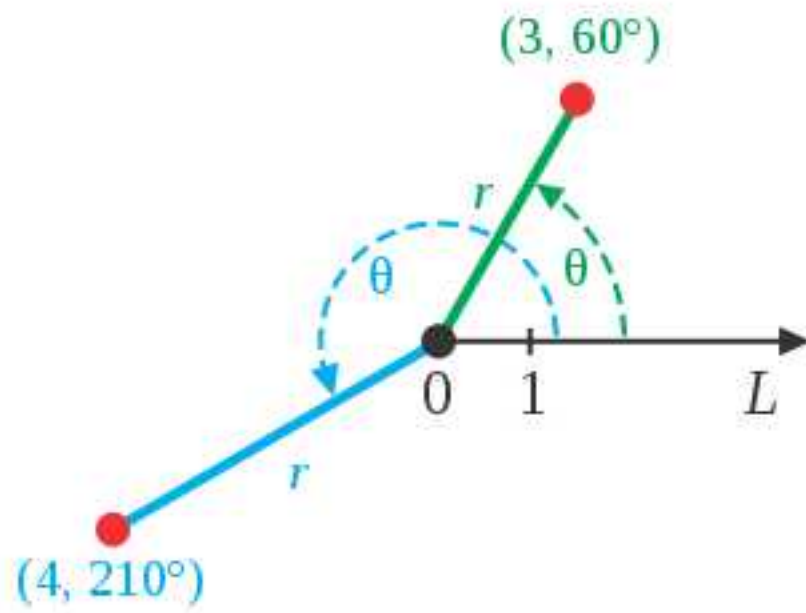
4 Procedure

Python will be used to implement the simulations and collect the data using TKinter for a graphical model. After this is complete, differences, if any, between the models will be found. Currently, neither program is finished, although the polar program is almost done.

5 Results

This project should find any differences between choosing Polar and Cartesian for representing the predator-prey system. This will hopefully help when trying to pick a coordinate system to run a Predator-Prey model in. Potentially, this could be expanded to any agent-based modeling simulation.