The overall desired emergent behavior we hope to elicit in our experiments is that the wolves will work together to efficiently trap and capture deer.

We have three hypotheses surrounding this emergent behavior:

1. When wolf speed is less than or equal to deer speed, intelligent wolves will catch a deer in fewer ticks than dumb wolves.
2. A group of intelligent wolves (4 or more) will eventually catch a deer, even if the deer is twice as fast as the wolves.
3. Communication will reduce the number of ticks required to catch a deer.

In order to test these hypotheses, and hopefully elicit the desired emergent behavior, we designed three agents:

1. Deer
    + Naive agents
    + Can be configured to be either faster or the same speed as the wolves.
    + Travel randomly until a threat is detected
    + Runs away when a wolf is detected, using a perceived threat level function to determine where to move.
2. Naive Wolves
    + Naive agents
    + Do not communicate
    + Travel randomly until a deer is detected.
    + When a deer is detected, the wolf will simply chase it
3. Intelligent wolves
    + Intelligent agents
    + Can be configured to communicate with each other
    + Travel towards areas that the wolf has no information about until a deer is detected
    + When a deer is detected, the wolf will chase the deer. It will take the positions of other wolves into account when chasing the deer because it will move in whichever direction will maximize the deer's threat level.

Each of these agents is only able to detect other agents and the environment within a limited radius; however, intelligent wolves that have been configured to communicate can share information. In addition, each agent will have an energy level. When the energy level is depleted, the agent must rest and cannot move. There will be a maximum energy level.

The environment for our tests will include obstacles such as rocks, trees, etc., which the agents cannot travel through. The boundaries of the environment will be considered a fence or natural barrier as well. We will randomly generate the environment for each iteration; however, the same randomly-generated environment will be used by each testing configuration.

There will be three basic experiment types that we will perform, each of which have subcategories:

1. Naive deer, naive wolves with no communication
    1. 4 wolves, equivalent wolf and deer speeds
    2. Deer twice as fast as wolves
2. Naive deer, intelligent wolves with no communication
    1. 4 wolves, equivalent wolf and deer speeds
    2. 4 wolves, deer twice as fast as wolves
    3. 2 wolves, deer twice as fast as wolves
3. Naive deer, intelligent wolves with communication
    1. 4 wolves, equivalent wolf and deer speeds
    2. 4 wolves, deer twice as fast as wolves
    3. 2 wolves, deer twice as fast as wolves

In each type of experiment, whether or not the deer was caught and the number of ticks required to catch the deer will be recorded to evaluate our hypotheses. We will run each experiment subcategory a minimum of 10 times. The exact number of iterations will depend on how many are feasible.