David Dunnings  
13015063  
Simon Scarle

Simulated Worlds 2



# In this assignment I will be:

Developing a simulation of predators and prey using a code base provided by Simon Scarle.

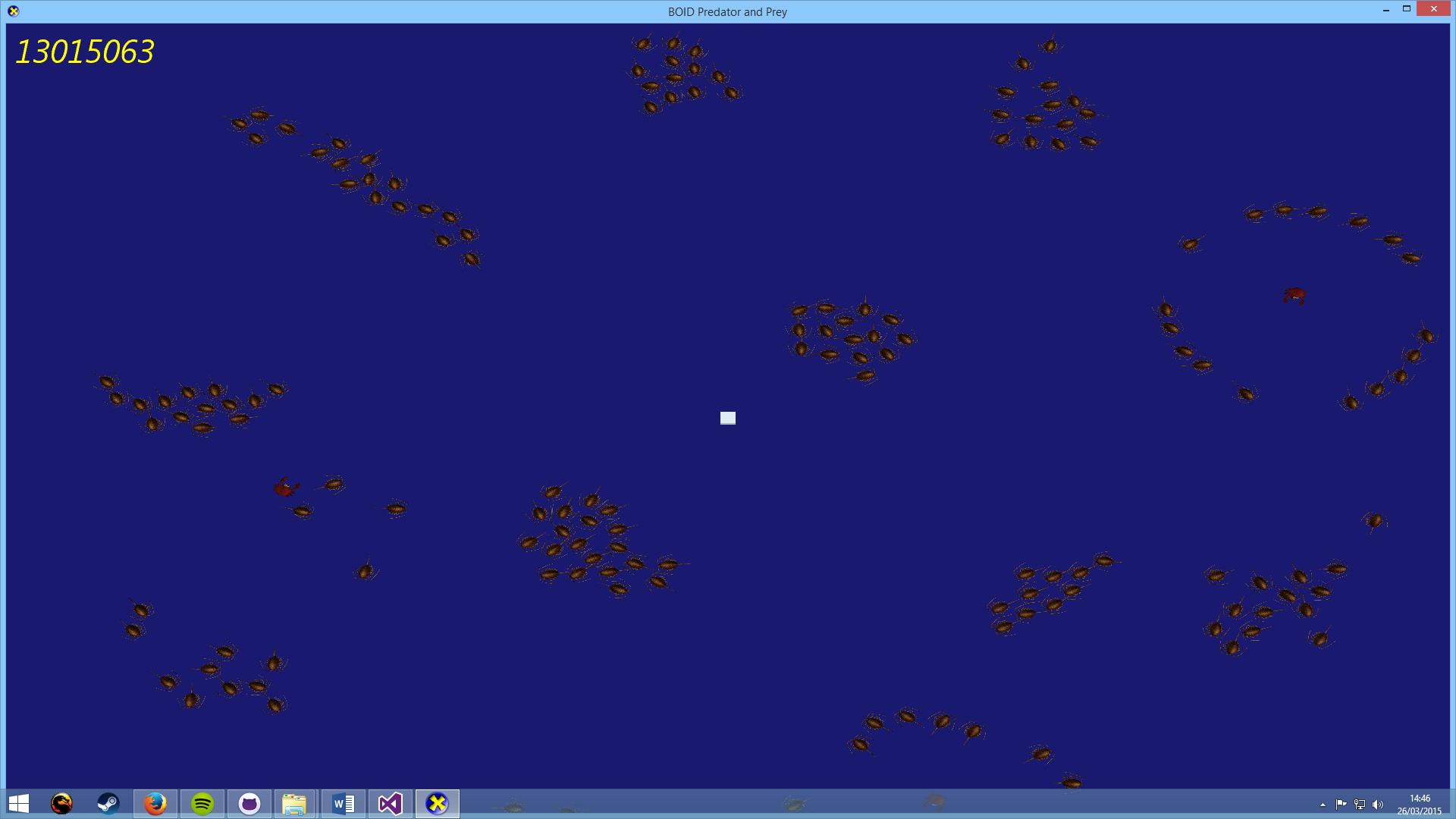
# Research

I have decided to split my research into two sub-sections. Firstly I will look at how animals react to their predators and how these predators hunt. I will then research previous BOID simulations that may be relevant to my work.

## Hunting

During my research I discovered that a predominant feature that defines the effectiveness of predators is their vision. Their eyes are generally located in forward position and allow them to see large distances whilst having a narrow field of vision. This means that the predators can keep track of a prey from far away and that they have little or no care for things in their peripheral vision, such as other predators. From this, I have deducted that the predators in my simulation will have a parameter to represent vision distance which a prey needs to be located within for the predator to begin hunting them.

## BOID simulations

In my research I discovered that the founder of BOID simulations was Craig W. Reynolds. Craig published a paper in 1987 titled “**Flocks, Herds, and Schools: A Distributed Behavioral Model**” (REF 1). This was the first paper to talk about using computer graphics to simulate real-world flocking behavior. One specific section of his paper, which I think will heavily influence my BOID system is the section labeled “**Simulated Flocks**”. In these few paragraphs Craig outlines the three behaviors which make up the flocking system:

Collision Avoidance: avoid collisions with nearby flockmates

Velocity Matching: attempt to match velocity with nearby flockmates

Flock Centering: attempt to stay close to nearby flockmates

From these three behaviors I concluded that to simulate collision avoidance, each BOID will have a force applied to it for each nearby BOID. The force will be created by calculating the vector from the nearby BOID to the original BOID. I can then apply a scaled down version of this vector to the original BOID to push it away from the nearby BOID.

As for the velocity matching I will most likely take an average velocity of every BOID in a localized area around each individual BOID. I will then apply a scaled-down version of this to each BOID.

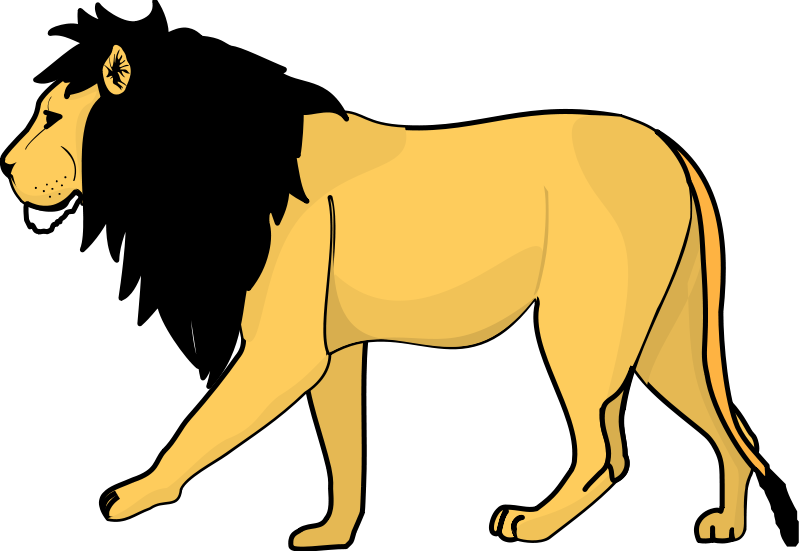
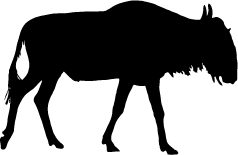
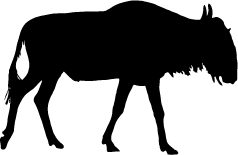
I will perform a similar calculation for the flock centering. I will take an average location of all nearby BOIDs and create a vector from the target BOID to the average group location. I can then apply a scaled-down version of this vector to the target BOID.

# Iterations

The first iteration of my BOID simulation had a ***predatorBoid*** class and a ***preyBoid*** class. I quickly realized that this was unnecessary as both classes were almost identical, except for the polarity of the forces applied being reversed. Therefore I merged both classes into a parent class ***Boid***. This class had a ***BoidType*** enumerator class which dictates the hierarchy of the food chain. For example, one simple setup of the ***BoidType*** enumerator could be the following:

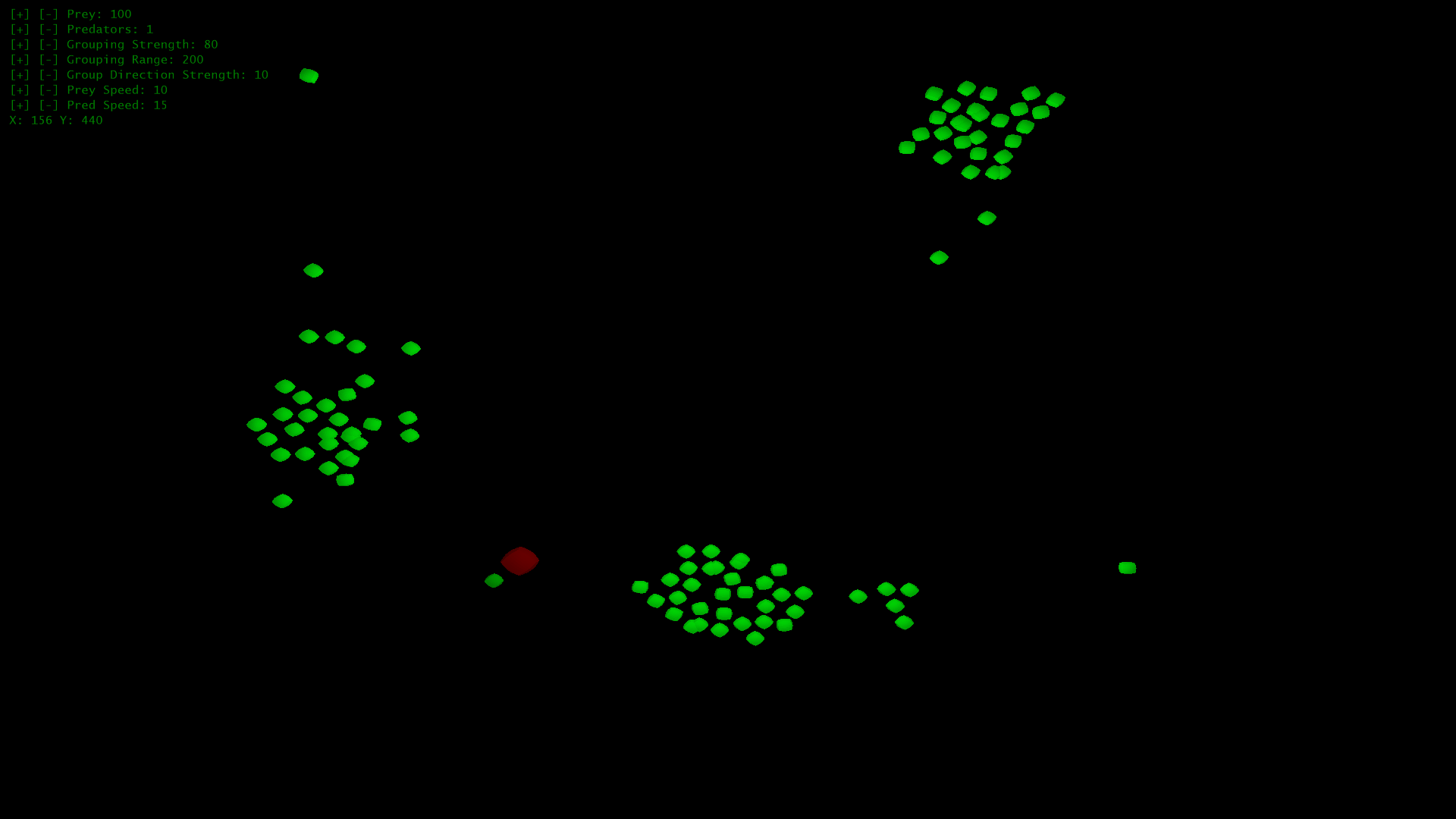
[0] BOID\_OBSTACLE, [1] BOID\_WILDEBEEST, [2] BOID\_LION

In this instance, any BOID with their BoidType set to [1] or [2] will avoid any BOID with their BoidType set to [0]. Furthermore, BOIDs with BoidType [2] will be attracted to BOIDs of BoidType [1]. This attraction is directly inversed for the relationship between BoidType [1] and BoidType [2]. This ultimately results in BoidType [2] being the sole predator type, which hunts BoidType [1].



Ver 1.2 of my simulation:

This version had a GUI with plus and minus buttons which incremented/decremented the associated value



# References

REF 1. http://www.cs.toronto.edu/~dt/siggraph97-course/cwr87/