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Project Link: https://github.com/deerbo/IMDM327-Boids.git

Sheep Dog - Interactive Boids System Design

Motivation:

When creating my Boids algorithm for this assignment, I became inspired by the natural flocking behaviour of sheep herds and how each animal interacts with each other. More specifically, I was drawn to sheepdogs and how a single dog can guide and influence the behavior of the entire group. I wanted to capture that dynamic by simulating a realistic flock of sheep that responds interactively to a player-controlled dog.

I found the herding behavior of sheep and the general boid algorithm to be satisfying to watch, so I had a motivation to make a natural looking sheep flock that felt playful and even meditative. A player could move around in and enjoy the simulation, imagining themselves a dog running in a field herding sheep. In the future, I could expand this concept into a small game or interactive art piece focused on guiding and observing the herd.

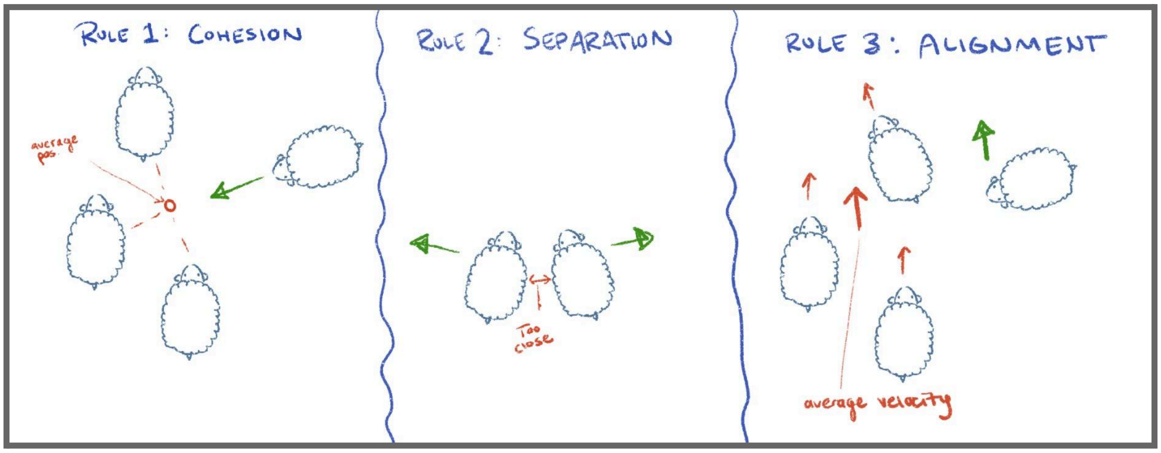
Sheepdog herding inspiration (2:50 - 3:30) : https://www.youtube.com/watch?v=Vl26RVA8Mng

Method:

To implement the system, I researched Boids algorithms beyond what we covered in class and found several helpful resources that explained the three fundamental flocking rules we learned in detail. Using this information, I implemented the following:

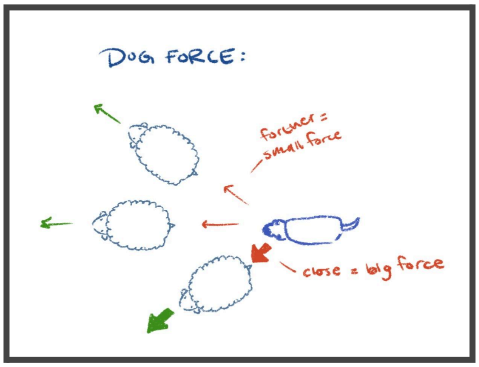
1. **Cohesion:** Each sheep moves slightly toward the average position of its neighbors, creating the natural tendency to stay together.
2. **Separation:** If two sheep get too close, they steer away from one another to avoid collision.

3. **Alignment:** Each sheep matches its velocity to the average velocity of the other sheep, creating smooth, synchronized movement.



After playing with these forces and capping each sheep's velocity, I achieved what felt like a believable and dynamic herd behavior. I also added a loose boundary to keep the sheep within a 50-unit radius so the flock wouldn't drift too far.

To make the scene interactive, I implemented a controllable sheepdog using basic movement controls. When the dog gets close to a sheep, it triggers a "fear response" by influencing that sheep's velocity vector. I made it so the closer and faster the dog moves, the stronger the sheep's reaction. This creates an intuitive and satisfying interaction where the dog can't catch the sheep, but it can guide and shape the motion of the flock through movement alone.



This directly ties back to my original motivation of simulating a sheep herd through a boid algorithm, and how interaction through the dog can transform the passive simulation into an engaging or almost meditative experience.

Resources:

- https://vergenet.net/~conrad/boids/pseudocode.html
    - This webpage by Conrad Parker contains psuedocode for the three fundamental rules of a boids system, and I relied heavily on his ideas to get me started and create my initial boid algorithm in C#
- https://www.youtube.com/watch?v=bqtqltqcQhw
    - This video by Sebastian Lague explains how he played around with the boids algorithm and modifications he made to make it work for his purposes. This video helped me better understand boids due to its clear diagrams.