Simple Simulation

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Basics – Euler Integration

- Update Positions based on Velocities

$$p = p_0 + v\Delta t$$

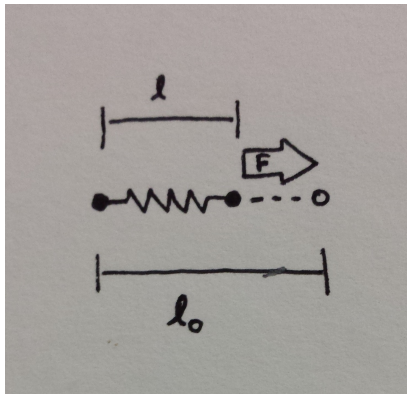
- Update Velocities based on Accelerations

$$v = v_0 + a\Delta t$$

- Update Accelerations based on Forces

$$a = \frac{F}{m}$$

Hooke's Law



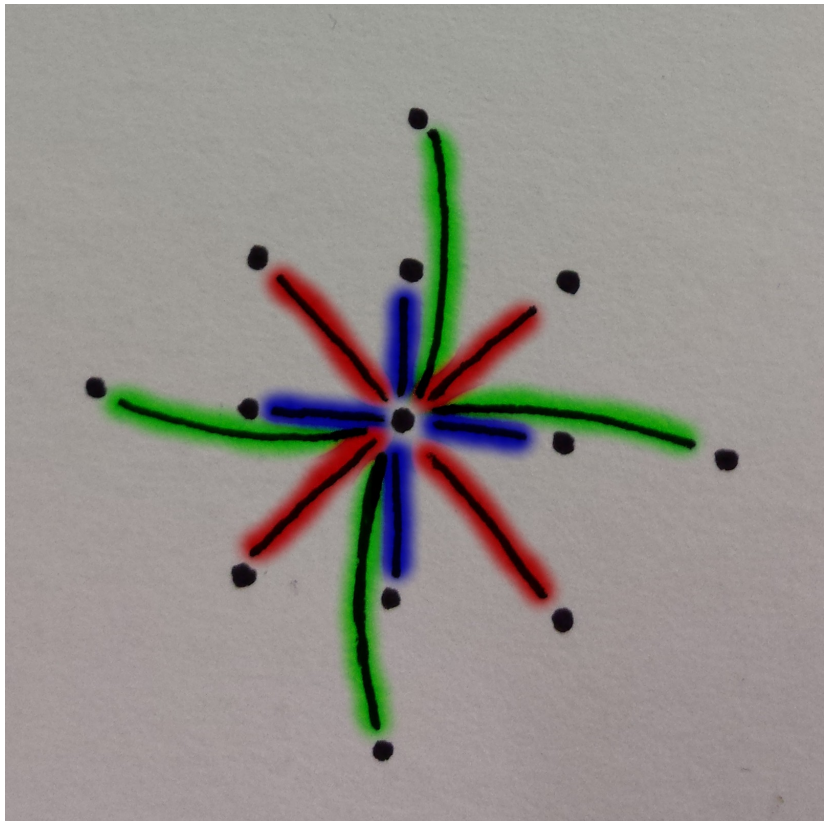
- k – The stiffness constant
  - Larger values give stiffer springs
  - Require finer time steps
- Easily adaptable to 3D.
  - Force exerted along the vector between two end points

$$F = -k(l - l_0)$$

Cloth

- Model cloth as a grid point masses connected by springs
- Compute the forces acting on each point and integrate to achieve motion

Cloth



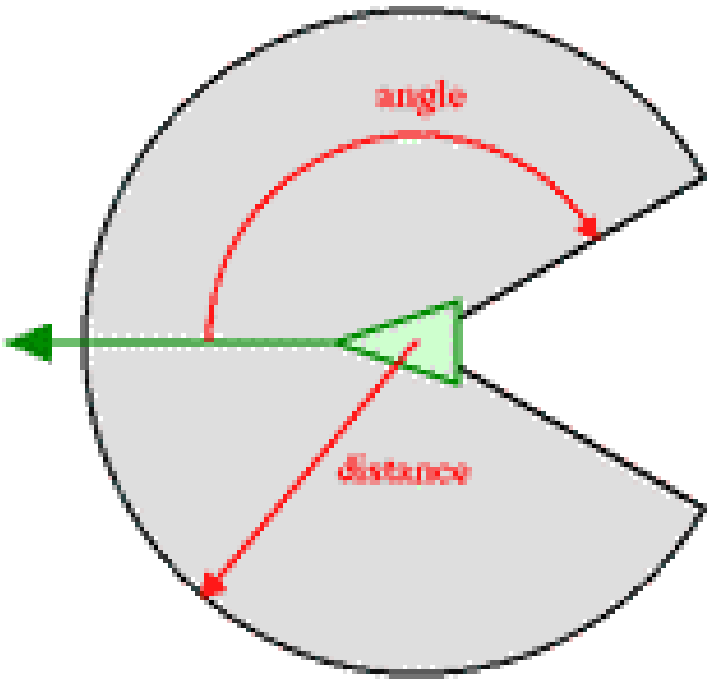
- Three types of springs
  - Structure
  - Shear
  - Bend
- Each have their own k values

Flocking

- Each particle represents a “boid”
- Motion controlled by three steering forces:
  - Alignment
  - Separation
  - Cohesion

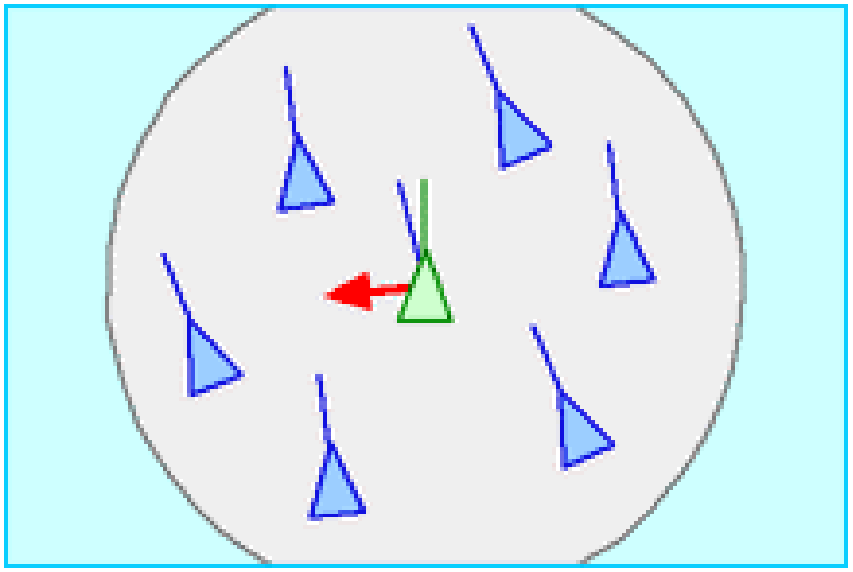
Most of the images in the following slides are taken from Chris Reynolds excellent website:http://www.red3d.com/cwr/boids/

Neighborhood



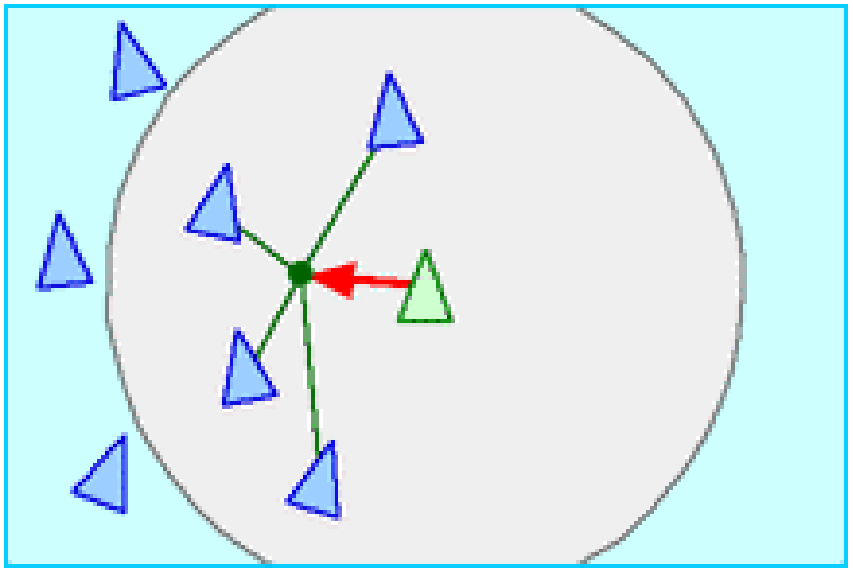
- Any given boid can only “see” other boids in a small area around it
- Area determined by two parameters
  - Distance
  - Field of view

Alignment



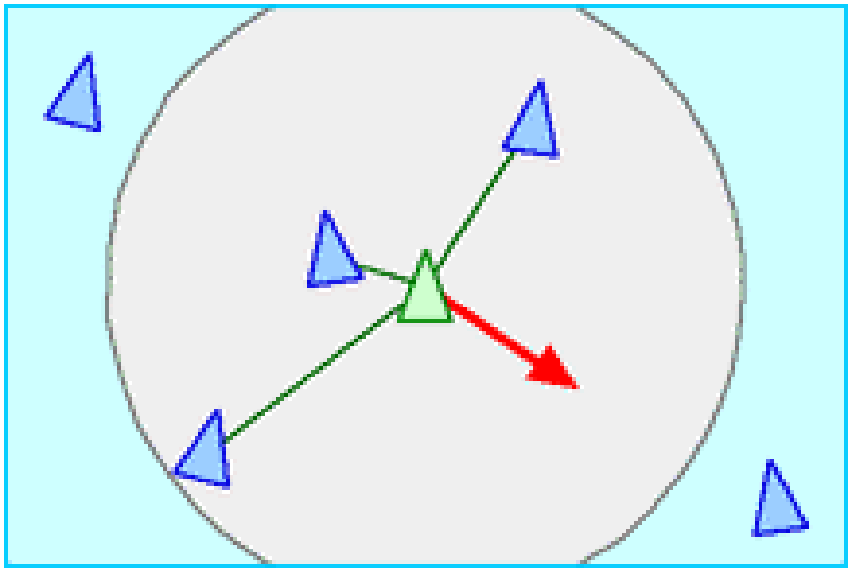
- Force applied to steer towards the mean direction of the group
- This force keeps everyone going in roughly the same direction

Cohesion



- Force applied to steer towards the mean location of the group
- This force keeps flocks from spreading out too much

Separation



- Force applied to steer away from collisions
- Without this force every boid would end up in the same place

Motion

- Represent velocity as heading and speed
  - Polar coordinates
  - Speed can remain constant
- Compute each force for each boid
- Sum the forces and integrate