IMGD 3000 - Technical Game Development I: Intro to AI in Games

by

Robert W. Lindeman

gogo@wpi.edu

Motivation

- Okay, so you are in control
  - What about NPCs?
- Use AI to make your experience:
  - More compelling
  - More challenging
- Much AI is AS
  - Movement too simplistic
  - Movement too predictable
  - Movement too repeatable

Sample Uses of AI in Games

- Bad guys guarding something
- Bad guys looking for you
- Bad guys trying to beat you to something
- Bad guys trying to beat you (literally)
- Good guys working with you
- Other people just minding their own business
- Summary: 4 Bad, 1 Good, 1 Neutral

More Detailed Examples

- Bad guys
  - Find a path through the environment from where they are to where you are
    - Pac man ghosts
  - Guard the base, but if I see you, then attack!
  - Opponents racing around a track
    - Be fast, but block you too
- Good guys
  - If we are attacked, then counter!
- Neutral
  - Act natural, please!

Let's Start Small

- Objects in an environment follow rules
  - Physical laws
  - Damage
  - Fatigue
- Particles
  - Water flows
  - Fire burns, rises, heat dissipates
  - These are just rules!
- Higher-order beings also follow rules
  - They are just more complex

Basic Model of Particle Systems

- A collection of many minute particles
- For each frame:
  - New particles are generated, and assigned a set of properties
  - Old particles die, and are removed
  - Remaining particles change their properties, *e.g.*, position, shape, color
  - Objects are rendered based on this new state
- Creation and attribute manipulation are procedural
  - Can be the result of computations

Changing Particle Properties

- How should the properties of the particles change over time?
  - Where does each particle move to?
  - How does its color change?
- Can be based on *anything*
  - Look at neighboring particles
  - Look at scene objects, like obstacles
  - Look at time
  - Look at distance traveled
  - Look at anything you want!

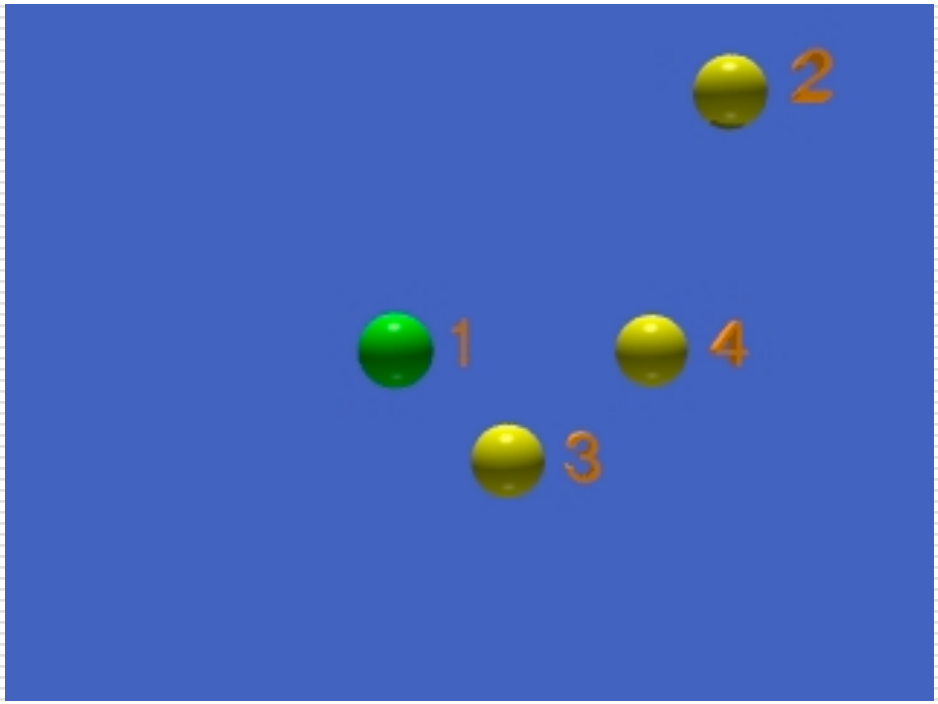
Basic Algorithm

```
Set up particle
While Animation In Progress
  If Particle Not Dead Then
    Add Particle Direction * Speed To Particle Position
    Add Particle Acceleration To Particle Speed
    Modify Particle Speed
    Modify Particle Energy
    If Particle's Energy < Threshold Then
      Mark Particle As Dead
    End If
    If Particle Hits Object Then
      Modify Particles' Positions, Directions, Speed and Energy
    End If
    Display Particle
  End If
End While
```

Example: Movement of Particles

- S_t is the state of all particles at time t
  - At $t=0$: S_0

Images: Greg M. Johnson
(http://www.geocities.com/pterandon/boids.html)



Example: Movement of Particles

- Compute the influence of all other particles within some range
  - Attraction, repulsion

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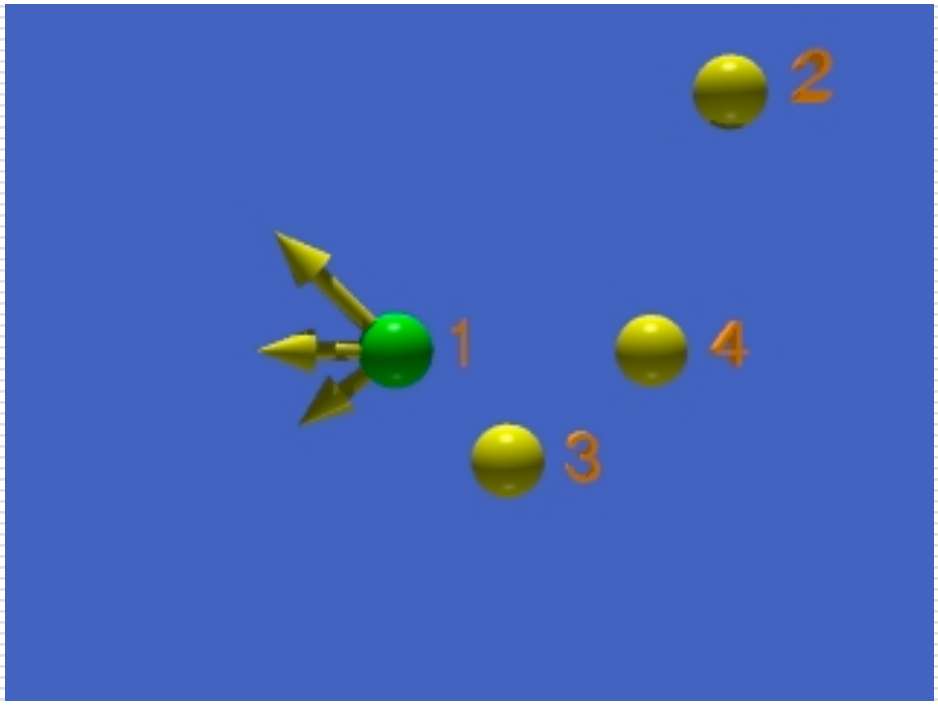

Example: Movement of Particles

- Add all forces together, and use that to update the current position

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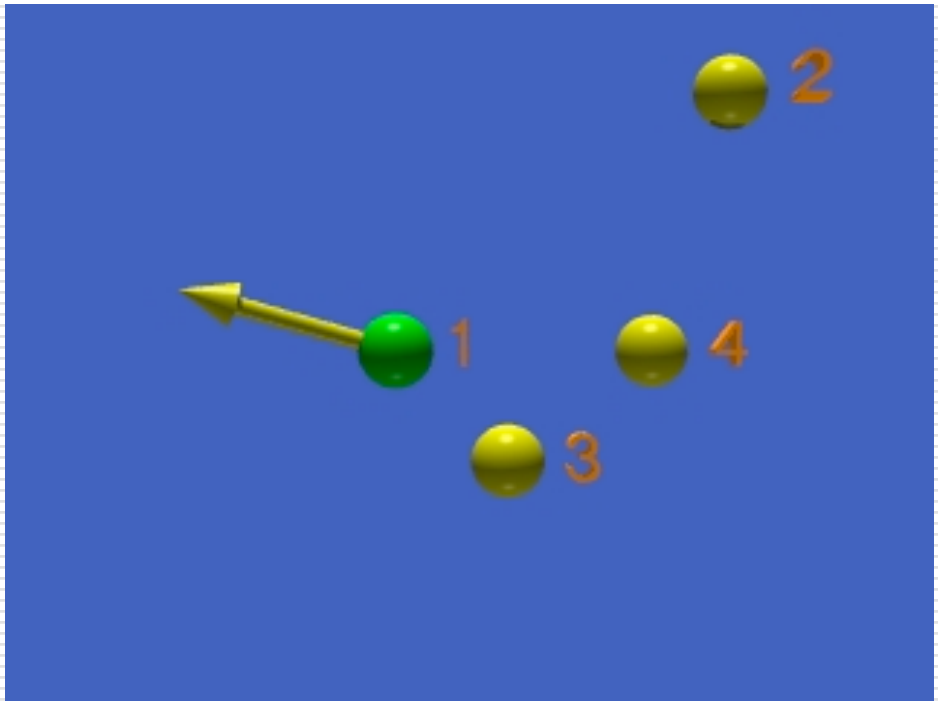

Example: Movement of Particles

- Wait, there might be other forces!
  - Whatever the goal is of the scene

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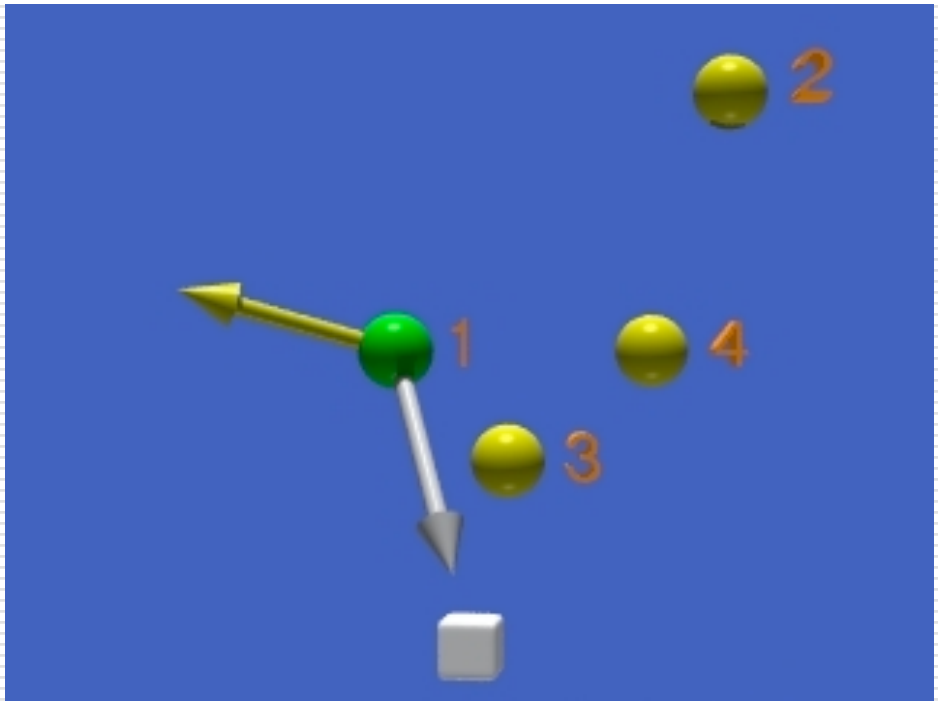

Example: Movement of Particles

- Again, sum these as the forces on the particle
- Repeat these steps for each particle

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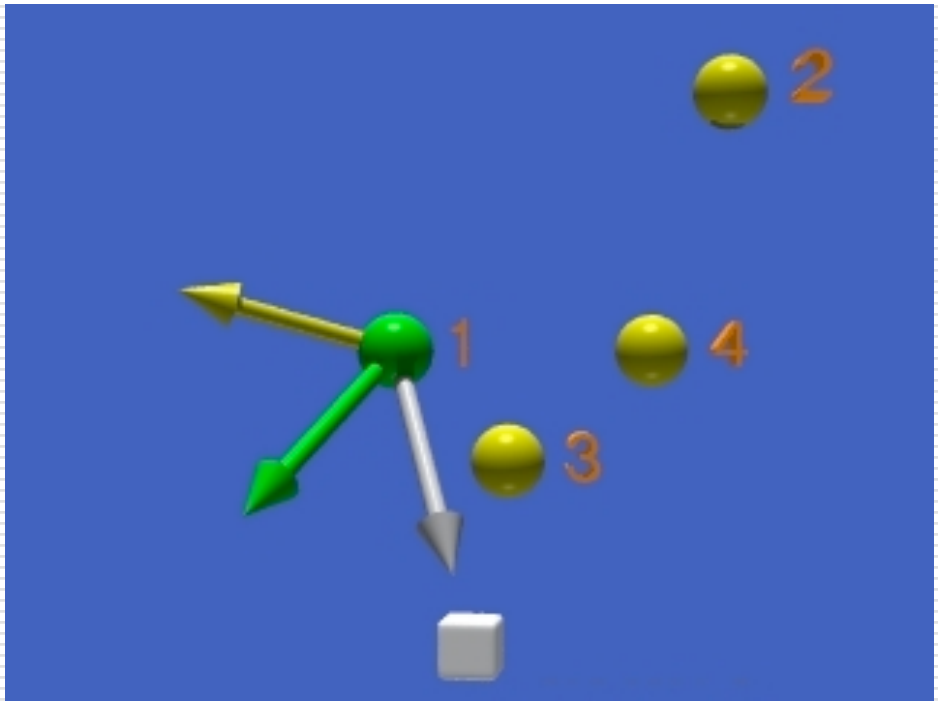

Particle Systems: More Examples

- Fire
- Explosions

Particle Systems: Final Thoughts

- In many cases, ignore self collisions
  - What does two fire particles colliding look like?
- Very general framework!
  - We can make special cases to get specific effects
  - Just change rules, objects, *etc.*
- How would you represent this system in code?