Artificial Intelligence Part I

CMPUT 299

Winter 2006

February 28, 2006

Lecture Overview

- Lab Exam
  - Course Evals
- Design Issue Presentations
- Artificial Intelligence
  - Definition
    - Related concepts
      - Algorithm
      - Time/Memory Cost
  - Finite State Machines

Lab Exam Results

- 16 people got >97%
- TA's finished marking late last night
- Course marks will be posted in my office window later this week

Evaluations

- NWN at home
- Problems with ScriptEase
- What is important in lectures
- Lectures available earlier

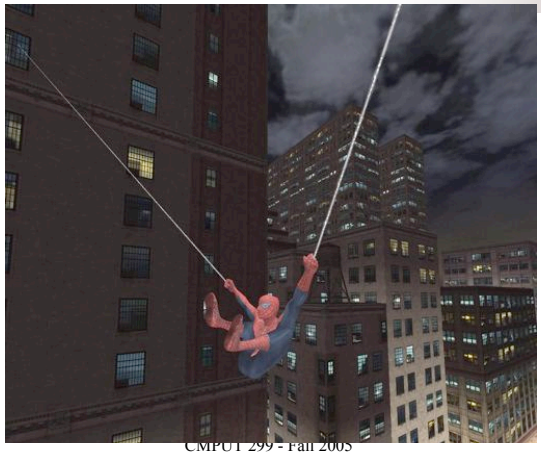
Project

- Game Prototype due this week
  - Demo Wednesday or Thursday in lab
- Supposed to meet with producer*!*
  - Meet with producer sometime this week
- Design issue presentations: next week

Order

- Tuesday:
  - Team Hanzo
  - Broken Glass Studios
  - OMGLAZERZPEWPEWPEW
- Thursday
  - Time Immortal
  - TiS3
  - Wasteland Entertainment

Spiderman 2



Spiderman 2: Swinging system

- What went right
  - Waiting for the right moment
  - Prototyping
  - Rotating talent onto the system
  - The advantages of consensus
  - Hallway gameplay testing

Spiderman 2: Swinging system

- What went wrong
  - Executives too lenient?
  - Not enough rigorous focus testing in early phases
  - It's not the tutorial, it's the system
  - The disadvantages of consensus

Design Issue Template

- Game Background
  - What do we need to know about the game to understand the issue?
- Issue Presentation
  - What is the difficulty? Why is it a design issue?
- Resolutions
  - What options have you considered for resolving the issue?

Design Issue Example

- Spiderman
  - Spidey runs around the city stopping bad guys
    - Use webs to quickly move through city
- Issue: Character Control
  - We'd like to have Spidey swing from dual webs
    - It looks really cool
  - It's too hard for some people
    - Some people just run along the ground
  - It's not necessary for game play

Design Issue Example

- Resolutions
  - Remove dual-web mode
  - Special menu to enable dual-web mode
  - Extra tutorials to help people learn
  - Leave things as-is
  - Re-design controls

Artificial Intelligence (AI)

- What is intelligence?
- What is artificial intelligence?

Intelligence (*wikipedia*)

- **Intelligence** is usually said to involve mental capabilities such as the ability to reason, plan, solve problems, think abstractly, comprehend ideas and language, and learn.

AI (*wikipedia*)

- Intelligence exhibited by an artificial entity.

Artificial Intelligence

- Any computer action that isn't understood by the user
- The "process" by which objects are controlled in a game environment
- The "process" by which agents make rational actions in an environment

Game AI

- Control for all but first-person entities
  - *Objects/areas*
    - Magical chests (ScriptEase)
  - *Enemies*
    - Computer-controlled teams (real-time strategy games)
    - Computer bots (first-person shooter)
    - Passive enemy units (arcade games)
  - *Allies*
    - NWN Henchman
  - *Your character*

Game AI drives Animation

- AI dictates the behavior of all non-passive objects in the world
  - Animation is determined by game AI
  - Sounds and music might be changed by the AI

Why is AI hard/important?

- Computers cannot easily deal with abstract ideas like we do
  - *Sting's blade glows blue when orcs are near.*
  - *Mars will not be this near to earth again until 2018.*
- We must define concrete rules (an *algorithm*) for the computer to follow

What is an algorithm?

- A detailed set of actions to perform or accomplish some task
- Examples:
  - Make a peanut butter and jelly sandwich
  - Draw a picture of a dragon

Describing Algorithms

- Actions
  - Move forward 1 step
  - Turn 90 degrees
- State
  - Location (coordinates)
  - Health
- Dynamics (State transitions)
  - How does state change when an action is applied

PB&J

- What are the actions?
- What are the states?
- What are the transitions?

Drawing

- What are the actions?
- What are the states?
- What are the transitions?

Evaluating Algorithms

- How can we evaluate an algorithm?
  1. Does it meet our time constraints?
  2. Does it meet our memory constraints?
  3. Does it solve the task at hand?
  4. Does it do so in an acceptable/realistic manner?

Evaluating Memory Usage

- How much is used during computations?
  - No less than the solution size
- How much is stored between computations?
- How much memory does our state take?
- How does this scale?
  - Bigger maps, more units

Evaluating Speed

- What is the cost of each operation we perform?
- How many of each operation will we perform?
- How does this scale?

AI Complexity in Games

- We must balance all four needs
- Most resources are dedicated to graphics

Complexity Numbers

- Suppose we have a 3Ghz machine
  - 3 billion cycles/second
- Suppose we run at 30 fps
  - 100 million cycles/frame
- Suppose we have 100 units
  - 1 million cycles/unit/frame
- Suppose world is as complex as all units
  - 500k cycles/unit/frame
- Suppose each unit has 1,000 polygons * 500 ops
  - Time's up!