Lecture 8

Prototyping
What is a Prototype?

• An *incomplete* model of your product
  • Implements small subset of the final features
  • Features chosen are the most important now

• Prototype helps you visualize *gameplay*
  • Way for you to test a new game mechanic
  • Allows you to tune mechanic parameters
  • Can also test (some) user interfaces
What is a Prototype?

- A prototype helps you visualize **subsystems**
  - Custom lighting algorithms
  - Custom physics engine
  - Network communication layer

- Fits naturally with the SCRUM sprint
  - Identify the core mechanic/subsystem to test
  - Develop subsystem separately in sprint
  - If successful, integrate into main code
Types of Prototypes

- **Throwaway prototyping**
  - Prototype will be discarded after use
  - Often created with middleware/prototyping tool
  - Useful for *gameplay prototype*

- **Evolutionary Prototyping**
  - Robust prototype that is refined over time
  - Code eventually integrated into final product
  - Useful for your *technical prototype*
Case Study: Playing Fields

- Computer map aid for playing D&D
  - Provides a map grid for moving tokens about
  - Tools for creating tokens and images
  - Network support for a DM with many players
  - Intelligently obscures player visibility

- **Motivation**: lessen player “metagaming”
  - Physical map displays too much information
  - Playing over a network is a secondary concern
Case Study: Playing Fields

Prototyping
Gameplay Prototypes

- Focus on core mechanic (e.g. verb/interaction)
  - May want more than one for emergent behavior
  - But no more than 2 or 3 mechanics
  - Keep challenges very, very simple
- Prototype should allow *tuning on the fly*
  - Requiring a recompile to tune is inefficient
  - Use menus/input fields/keyboard commands
  - But do not make the UI too complicated either
Prototyping Playing Fields

• What are the core mechanics?
  • Moving a token about a grid
  • Using obstacles to block visibility

• Focuses on **visibility** and **user control**
  • Use a single token with fixed obstructions
  • Do not support network play
  • Do not worry about invalid moves

• Visibility distance is a *tunable* parameter
Playing Fields Prototype
Prototype: Lessons Learned

- Algorithm makes it difficult to see walls
  - May want unseen area a color other than black
  - May want to “fudge the edge of the boundary”

- Update algorithm does not support “strafing”
  - Vision is updated at start and beginning of move
  - Nothing “in between” is counted (e.g. alleys)

- Spacing of 50 pixels is optimal for viewing
Technical Prototyping

- Technical prototypes used for *subsystems*
  - Custom lighting algorithms
  - Custom physics engine
  - Network communication layer

- **Goal**: inspect inner workings of software
  - Features might be “invisible” in normal game
  - Specialized interface to visualize process

- **Not-a-Goal**: Make something fun
Case Study: Shadows and Lighting

- Recall gameplay prototype
  - Discrete shadows are easy
  - But had many problems

- Want something more robust
  - Continuously movement
  - Curved wall edges
  - Self-intersecting shadows

- Different features to test
  - Moving an avatar
  - Reconfiguring the wall
Case Study: Shadows and Lighting

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Case Study: Shadows and Lighting
Case Study: Agent Movement

- Artificial potential fields
  - Obstacles are repulsive charge
  - Goal is an attractive charge
  - Sum together to get velocity
- Fast real-time movement
  - No hard AI algorithms
  - But has other problems…
- Will cover later in class
  - See Pathfinding in schedule
Case Study: Agent Movement

Vehicle Location:
- x: [ ] y: [ ]

Vehicle Radius:
- 0.0 to 10.0

Vehicle Mass:
- 0.0 to 20.0

Vehicle Charge:
- 0.0 to 1.0

Vehicle Damping:
- 0.0 to 1.0

Vehicle Maximum Speed:
- 0.0 to 2.0

Instructions:
To create a new vehicle, Control-click on its desired position. Use a regular click to select an existing vehicle for editing. A selected vehicle is indicated by a heavier border.

Only one vehicle may be selected at a time. A selected vehicle is pinned and will not move, but will still exert a force for avoidance.
Case Study: Agent Movement

Support controls to change parameters on fly

Make subsystem robust (evolutionary prototype)

Make interface simple (throwaway prototype)
Case Study: *Forgotten Sky*
Nondigital Prototypes
## Digital or Nondigital?

<table>
<thead>
<tr>
<th>Digital Prototypes</th>
<th>Nondigital Prototypes</th>
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<tbody>
<tr>
<td><strong>Advantages</strong></td>
<td><strong>Advantages</strong></td>
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<tr>
<td>• Closer to final design</td>
<td>• Fast to create, iterate design</td>
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<td>• Input and control semantics</td>
<td>• Used by non-programmers</td>
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<td>• Great for complex systems (e.g. physics)</td>
<td>• Great for resources and game economy</td>
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<tr>
<td><strong>Disadvantages</strong></td>
<td><strong>Disadvantages</strong></td>
</tr>
<tr>
<td>• Shuts out non-programmers</td>
<td>• Input and player control</td>
</tr>
<tr>
<td>• Longer development time</td>
<td>• Complex systems</td>
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Lessons From Nondigital Prototypes

• **Evaluate emergent behavior**
  • Allow player to commit simultaneous actions
  • Model interactions as “board elements”

• **Model player cost-benefit analyses**
  • Model all resources with sources and sinks
  • Focus on economic dilemma challenges

• **Early user testing for player difficulty**
  • Ideal for puzzle games (or puzzle element)
  • Can also evaluate unusual interfaces
Prototypes in this Class

- Required to demo three prototypes in class
  - **Nondigital prototype** week from Wednesday
  - **Gameplay prototype** on March 3rd
  - **Technical prototype** on March 17th

- Nondigital prototype may be trickiest
  - Keep it simple; avoid a full game
  - Focus on dilemma challenges (e.g. choice)
  - More details in the next lecture
The Gameplay Prototype

- **Throw-away prototype**
  - Does not have to be in C#
  - Can use another language (e.g. Java)
  - Can use authoring tools (e.g. Flash, GameMaker)

- **Goal**: demonstrate gameplay
  - Challenges impossible in nondigital prototype
  - Basic player controls and interface
  - Primary game mechanic
The Technical Prototype

- **Evolutionary prototype**
  - Should be written in C# and XNA
  - Most of the code will be reused later
  - Some of code (e.g. interface) can be thrown away

- **Goal**: visualization and tuning
  - Simple interface displaying core functionality
  - Controls (e.g. sliders, console) to change parameters
  - Playtest to figure proper setting of parameters