Lecture 4

Game Components
So You Want to Make a Game?

- Will assume you have a *design document*
  - Focus of next week and a half…
  - Building off the ideas of previous lecture

- But now you want to start building it
  - Need to assign tasks to the team members
  - Helps to break game into *components*
  - Each component being a logical unit of work.
Traditional Way to Break Up a Game

- **Game Engine**
  - Software, created primarily by programmers

- **Rules and Mechanics**
  - Created by the designers, with programmer input

- **User Interface**
  - Coordinated with programmer/artist/HCI specialist

- **Content and Challenges**
  - Created primarily by designers
Features of Game Engines

- Power the **graphics** and **sound**
  - 3D rendering or 2D sprites

- Power the character and strategic **AI**
  - Typically custom designed for the game

- Power the **physics** interactions
  - Must support collisions at a bare minimum

- Describe the **systems**
  - Space of possibilities in game world
Commercial Game Engines

- Libraries that take care of technical tasks
  - But probably need some specialized code
  - Game studios buy *source code licenses*

- Is XNA a game engine?
  - No AI or physics support at all
  - But external libraries exist (e.g. Box2D)

- Bare bones engine: *graphics + physics*
Game Engines: Graphics

- Minimum requirements:
  - Low level instructions for drawing
  - API to import artistic assets
  - Routines for manipulating images

- Two standard 3D graphics APIs
  - **OpenGL**: Unix, Linux, Macintosh
  - **Direct3D**: Windows

- For this class, our graphics engine is XNA
  - Supports Direct 3D, but will only use 2D
Game Engines: Physics

- Defines physical attributes of the world
  - There is a gravitational force
  - Objects may have friction
  - Ways in which light can reflect

- Does **not** define precise values or effects
  - The direction or value of gravity
  - Friction constants for each object
  - Specific lighting for each material
Game Engines: Systems

- Physics is an example of a game **system**
  - Specifies the *space of possibilities* for a game
  - But not the *specific parameters* of elements

- Extra code that you add to the engine
  - Write functions for the possibilities
  - But do not code values or when called

- Separates programmer from **gameplay designer**
  - Programmer creates the system
  - Gameplay designer fills in parameters
Systems: Super Mario Bros.

• **Levels**
  - Fixed height scrolling maps
  - Populated by blocks and enemies

• **Enemies**
  - Affected by stomping or bumping
  - Different movement/AI schemes
  - Spawn projectiles or other enemies

• **Blocks**
  - Can be stepped on safely
  - Can be bumped from below

• Mario (and Luigi) can be small, big, or fiery
Traditional RPG Analogy: Engines

- Highest level decisions in the rulebooks
  - Dice mechanisms for entire system
  - Explanation of action types
  - Overview of spell, combat system
  - Statistical requirements for game entities

- SRD: System Reference Document
  - Feature of 3.x D&D (discontinued)
  - Allows creation of compatible games

Parts of a Game
Modern digital games borrow a lot from traditional RPGs.

- Highest level decisions in the rulebooks
- Dice mechanisms for entire system
- Explanation of action types
- Overview of spell, combat system
- Statistical requirements for game entities

SRD: System Reference Document
- Feature of 3.x D&D (discontinued)
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Characteristics of an Engine

• Broad, adaptable, and extensible
  • **Encodes** all *non-mutable* design decisions
  • **Parameters** for all *mutable* design decisions

• Outlines gameplay possibilities
  • Cannot be built independent of design
  • But only needs highest level information
  • **Gameplay specification** is sufficient
Data-Driven Design

• No code outside engine; all else is data
  • Purpose of separating system from parameters
  • Create game content with level editors

• Examples:
  • Art, music in industry-standard file formats
  • Object data in XML or other data file formats
  • Character behavior specified through scripts

• Major focus for alpha release
Rules & Mechanics

• Fills in the values for the system
  • Parameters (e.g. gravity, damage amounts, etc.)
  • Types of player abilities/verbs
  • Types of world interactions
  • Types of obstacles/challenges

• But does not include specific challenges
  • Just the list all challenges that could exist
  • Contents of the pallet for level editor
Rules: Super Mario Bros.

- **Enemies**
  - Goombas die when stomped
  - Turtles become shells when stomped/bumped
  - Spinys damage Mario when stomped
  - Piranha Plants aim fireballs at Mario

- **Environment**
  - Question block yields coins, a power-up, or star
  - Mushroom makes Mario small
  - Fire flower makes Mario big and fiery
Traditional RPG Analogy: Mechanics

- Engine + mechanics = core rulebooks
  - Material tailored to genre, setting
  - Less information than an adventure module
  - But enough to create your own adventures

- Vary the mechanics by genre
  - **D&D**: high fantasy
  - **Star Wars**: space opera
  - **Top Secret**: modern spy thriller
Game AI: Where Does it Go?

• Game AI is traditionally placed in **mechanics**
  • Characters need rules to make right choices
  • Tailor AI to give characters personalities

• But it is implemented by programmer
  • Complicated search algorithms
  • Algorithms should be in **game engine**

• Holy Grail: “AI Photoshop” for designers
  • Hides all of the hard algorithms
Interfaces

- Interface specifies
  - How player does things (player-to-computer)
  - How player gets feedback (computer-to-player)

- More than engine+mechanics
  - They just describe what the player can do
  - Do not specify how it is done

- Bad interfaces can kill a game
Interface: *Dead Space*
Traditional RPG Analogy: Interface

- Interface includes:
  - Character sheets
  - Pencils
  - Maps
  - Dice
  - Player voices

- Alternate interfaces for D&D
  - LARPing
  - Play-by-mail
Interface Tips

- Must consider input devices in design
  - For PC, typically mouse and keyboard
  - Game controllers have different “feel”

- Consider depth and width of interface
  - Details are best processed at the center of vision
  - Peripheral vision mostly detects motion

- Strive for “invisible” interface (metaphorically)
  - Familiarity is better than innovation
Content and Challenges

- **Content** is *everything else*

- **Gameplay** content define the actual game
  - Goals and victory conditions
  - Missions and quests
  - Interactive story choices

- **Non-gameplay** content affects player experience
  - Graphics and cut scenes
  - Sound effects and background music
  - Non-interactive story
Traditional RPG Analogy: Content

- **Content is what creates an adventure**
  - Could include adventure modules
  - But also includes the DM’s imagination
    - “Dealing with the exceptions” 90% of time
    - DM must quickly adapt to the players

- **Ability to improvise provides another lesson:**
  - Content should be easy to change as needed
  - Needs well-designed **engine+mechanics+interface**
Why the division?

- They are not developed sequentially
  - Content may require changes to game engine
  - Interface is changing until the very end

- Intended to organize your design
  - **Engine**: decisions to be made early, hard-code
  - **Mechanics**: mutable design decisions
  - **Interface**: how to shape the user experience
  - **Content**: specific gameplay and level-design
# Milestones Suggestions

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<th>Gameplay</th>
<th>Technical</th>
<th>Alpha</th>
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<td>Pre-Engine Tech</td>
<td>Completed Game Engine</td>
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<td>Interface (Functional Mock-up)</td>
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## Design Elements

- Pre-Engine Tech
- Completed Game Engine
- Mechanics (Design)
- Mechanics (Implementation)
- Interface (Functional Mock-up)
- Interface (Polishing)
- Content
Summary

- Game is divided into four components
  - Should keep each in mind during design
  - Key for distributing work in your group

- But they are all interconnected
  - System/engine limits your possible mechanics
  - Content is limited by the type of mechanics

- Once again: design is iterative