the gamedesigninitiative at cornell university

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

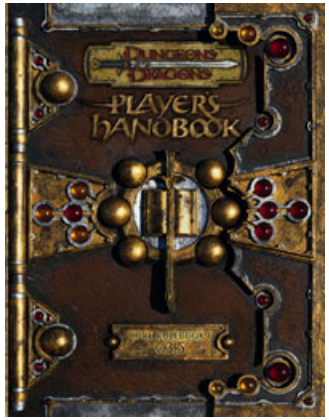
Systems: *Super Mario Bros.*

- **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

Traditional RPG Analogy: Engines

- Highest level decisions in the rulebooks
  - Dice mechanisms for entire system
  - Explanation of acti
  - C
- S Reference Document
  - Feature of 3.x D&D (discontinued)
  - Allows creation of compatible games

Modern digital games borrow **a lot** from traditional RPGs.

d20 system

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

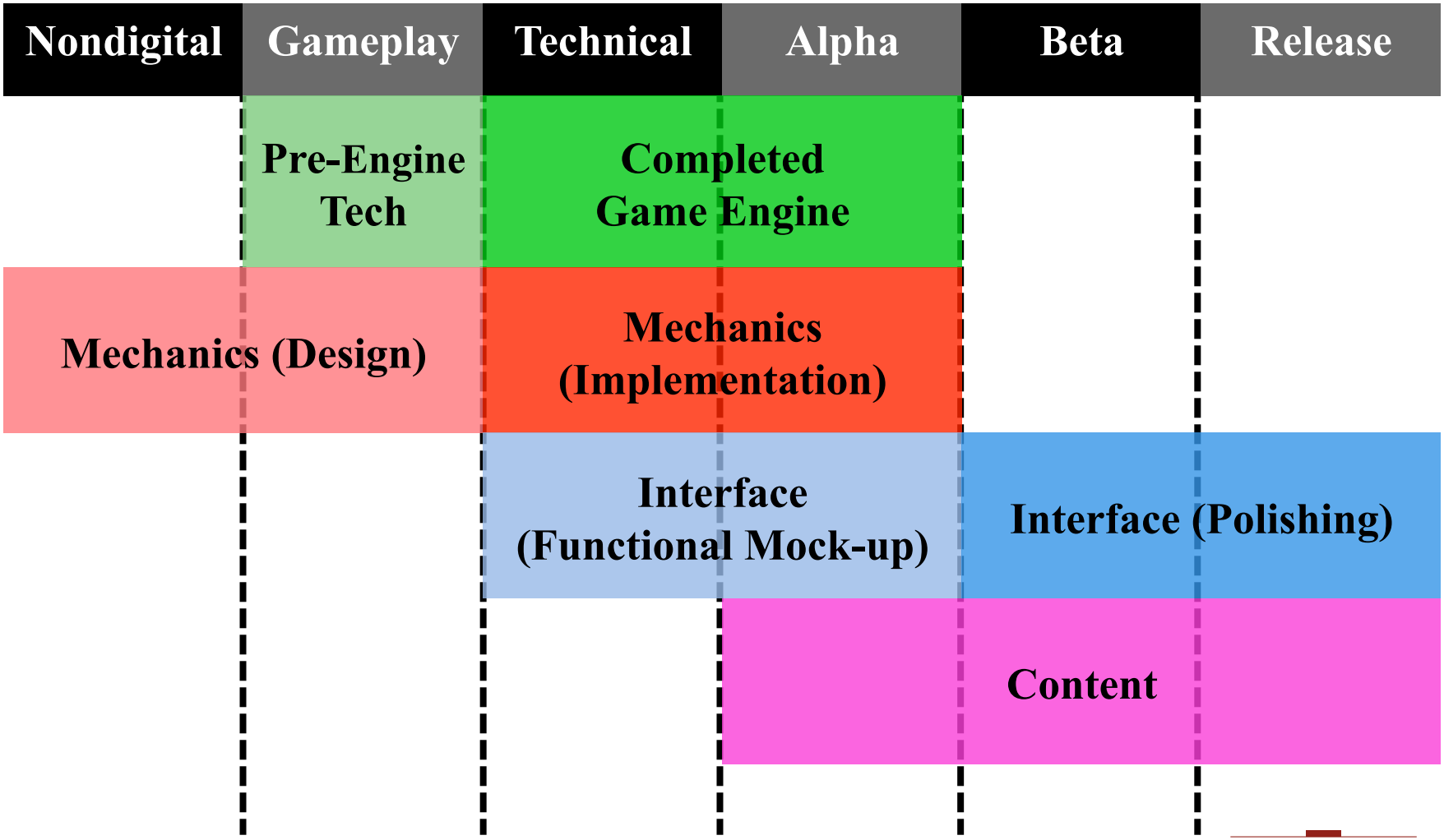
Traditional RPG Analogy: Content

- 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 requires 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



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**