the gamedesigninitiative at cornell university

Lecture 5

Rules and Mechanics

Today's Lecture

- Reading is from Unit 2 of *Rules of Play*
  - Available from library as **e-book**
  - Linked to from the lecture page
- Not required, but excellent resource
  - Important for the serious designer
  - And ignore the Amazon reviews…
- The "Bible of Game Mechanics"

What are Rules?

- Definition from *Rules of Play*:
  - Rules are *formal schemas*
- But what does this really mean?
- Is it different for digital games?

Challenge of Defining Rules

- They do not need to be *fixed*
  - **Example**: *Nomic* (simulates democratic voting)
  - But are changed in structured ways
- They can *ignored*
  - House-rules that add or remove rules
  - Rule relaxation (e.g. playing with a young child)
- They are not always *explicit*
  - **Example**: does *Battlefield* have rules on camping?

Implicit Rules

- We often consider these **social conventions**
  - If violate them, no one wants to play with you
  - Encapsulate being a "good sport"
- Implicit rules for Tic-Tac-Toe
  - Must move in a "reasonable" amount of time
  - If loss is inevitable, must move or forfeit
- These rules are generally made **ad-hoc**
  - Make them explicit only if there is a problem

Implicit Rules in Digital Games

- Often implemented as **terms of service**
  - Rules against using mods, bots
  - Rules against play-style (e.g. camping)
- Depend upon context, and can change
  - Ranked vs. unranked in network play
  - Official vs. private game server
- Exist because cannot specify everything
  - Goal is to prevent customer "churn"

How to Design Good Rules

- Player must have *meaningful choices*
  - Player must be able to make decisions
  - System must respond in significant way
- **Bad Rules**: Guess heads or tails to pick a winner
  - All you can do is guess the answer
  - Has no significant effect on the outcome
- **Bad Rules**: Move pieces on board with no interaction
  - Actions have no meaning since pieces don't interact
  - There are no victory conditions or even challenges

Informal versus Formal Rules

Informal

- Part of initial design process
  - Focuses on how it looks
  - Less concerned with code
- Many span multiple frames

Formal

- Part of implementation
  - Corresponds to code
  - Defined at the frame level
  - Interactions link multiple animation frames together
- Goal: match informal design
  - Is behavior correct?
  - Is behavior expected?

Understanding Game State

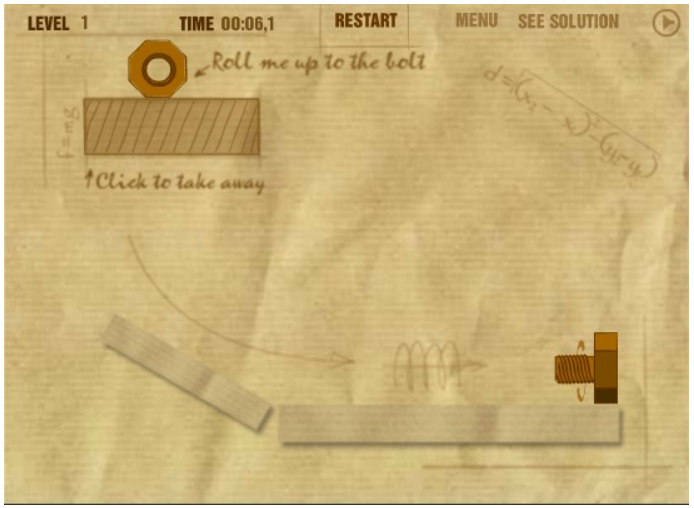
- Many game state values are **spatial**
  - Represent location of a game *entity*
  - Also physical values like velocity, acceleration
- Entities act as containers for non-spatial values
  - Values that never change: **attributes**
  - Values that can change: **resources**
- Attributes, resources can be global as well
  - Though most mechanics are at entity level…

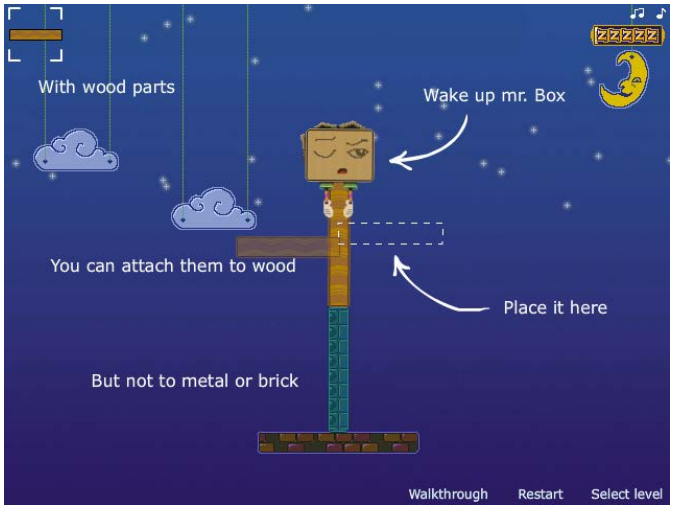
Actions Affecting Spatial State

- Typically we what we would call *movement*
  - Present in all but the most abstract games
- But there are many ways to implement
  - **Direct** movement of avatar (e.g. WASD)
  - **Indirect** movement of avatar (e.g. pathfinding)
  - Alter the **environment** (e.g. removing platforms)
- Area of much potential *innovation*

Altering the Environment

- Found in "physics" games
  - No direct control of avatar
  - Can only remove/add/move obstacles in environment
  - Movement is "natural"
- **Example**: *Screw the Nut*
- Physics is a rule system
  - Interaction, not action
  - Takes one state to another
  - Also one that is complex to understand/model





Innovating Avatar Movement

- 2D games move on 2-axes
  - Classic: left-right/up-down
  - Unless top-down game, one of these axes is restricted
- Is jump the only option?
  - Launcher/trajectory verbs
  - (Limited) teleportation
- **Example**: *Knightmare Tower*
  - Launcher-style game
  - Vertical movement is boosts gained from killing enemies

Environment **AND** Avatar

- Possible to split the verbs
  - Some for avatar movement
  - Others for environment
- Found in "drawing" games
  - Draw missing platforms
  - Avatar walks on platforms
  - **Ex**: Max & Magic Marker
- Innovate by limiting avatar
  - Move on single axis
  - Combine with environment
  - **Example**: Swindler

"Deep Gameplay"

- Want many ways to overcome challenges
  - **Example**: kill enemy or sneak past
  - If just one way, gameplay is "shallow"
- Shallow challenges hurt replayability
  - "Twitch" challenges become boring fast
  - Cerebral challenges solved by the walkthrough
- All games should have a strategic element

Strategy

- **Definition**: an elaborate sequence of steps
  - Action is the culmination of all the steps
  - Changing steps or order changes action
- Still allows for puzzle gameplay
  - Allow some *flexibility* in these solution steps
  - **Example**: Multiple solutions to Rubik's Cube
  - **Example**: Time-rewind in *Braid*
- *Resources* are a common way to implement

Resources and Gameplay

- Resources are crucial to "combat" mechanics
  - Entities have resource values (e.g. health, ammo)
  - Expend resources to affect others (e.g. attack)
  - May change resources of that entity (e.g. damage)
- Three basic categories of resource combat
  - **Tug-Of-War**: entities take from each other
  - **Dot Eating**: entities race to gather *limited* resource
  - **Flower Picking**: race to gather *unlimited* resource

Resources and the Game Economy

- Sources: How a resource can increase
  - **Examples**: ammunition clips, health packs
- Drains: How a resource can decrease
  - **Examples**: firing weapon, player damage
- Converters: Changes one resource to another
  - **Example**: vendors, *Starcraft* barracks
- Traders: Exchange resources between entities
  - Mainly (but not always) in multiplayer games

Economic Challenges

- You can use resources to
  - Control player progression (hinder or advance)
  - Modify player abilities (limit or enhance)
  - Create a large possibility space (for replay value)
  - Create strategic gameplay
- Do not need a lot of resources
  - Not every game is a strategy game
  - But **almost all** games have some economy

Resources as Dilemma

- Players perform cost-benefit analyses
  - Cost: resource change not beneficial to player
  - Benefit: resource change beneficial to player
- **Example**: Survival Horror
  - Use ammo to shoot zombie (Cost: ammo)
  - Use knife to stab zombie (Cost: health)
  - Benefit the same in each case
- Players act with least cost for benefit

Resources and Monetization

- Most resources are gathered in-game
- But some games allow **external sources**
  - Get resources from a friend on Facebook
  - Pay for resources with a credit card
  - Known as resource *monetization*
- Free-to-play, pay-for-stuff
  - Modern business model for online games
  - But BIG pushback right now (loot crates)

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Talk about this (and NFTs) in the advanced course.

Emergent Behavior

- **Coupled Interactions**
  - Two mechanics that can happen at once
  - **Verbs**: jump AND run in a platformer
  - **Resources**: warrior AND archer in an RTS
- **Context-dependent Interactions**
  - Mechanics combine to give new behavior
  - **Verbs**: jump and run is new form of movement
  - **Resources**: warriors form wall to cover archers

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Key Word

Emergent Behavior

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- **[illegible]**
  - [illegible]chanics combine to give new behavior
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Key Word

Advantage: game complexity grows **nonlinearly**

Examples of Emergent Actions

Running Jump

- Can move while in midair
  - Just horizontal movement
  - Not realistic; it is a game
  - Many platformer challenges assume this type of control
- Different than a *long jump*
  - Less height than reg. jump
  - No control once in the air
  - Would be a **distinct action**

Strafing Fire

- Based on "real life" property
  - Bullets travel in straight line
  - Movement changes origin
  - Walking side-side makes a spray (used in covering fire)
- But some features are gamy
  - Bullets slower than life
  - Character faster than life
  - Creates interesting effects

Examples of Emergent Actions

Interaction(?)

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Emergent Actions

Common Spatial Interactions

Collisions

- Can effect *resources*
  - Player takes damage
  - Player gains power-up
  - Player-NPC transfer gold
- Can effect *spatial values*
  - Bounce off collision point
  - Swing from attached rope
  - Attraction to magnet/charge

Detection

- Examples:
  - Line-of-sight (w/ obstacles)
  - Spatial proximity
- Can have *direct* effects
  - Alarms in a stealth game
- Can have *indirect* effects
  - Tower defense targeting
  - Adjust NPC reactions

Resource-Spatial Interactions

Resource Affects Spatial

- Resources can unlock areas
  - Keys are a trivial resource
  - Also use resource thresholds
  - **Ex**: Collect all tokens to pass
- Resources affect difficulty
  - Adjust input device sensitivity
  - **Ex**: Deadeye meter in *RDR*
  - **Ex**: Jet packs to increase jump

Spatial Affects Resources

- Resources made by entities
  - Have a spatial location
  - **Ex**: Time to transfer resources
  - **Ex**: Sources be captured
- Resource values are entities
  - Take up physical volume
  - Need space to acquire
  - **Ex**: Inventory in *Prey*

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Coupling is not Enough

- Example of *trivial* coupling:
  - RTS with single unit type – warrior
  - Coupling can arise from multiple warriors
  - When attack, count number on each side

- Group of warriors **is** sum of its parts
  - Just make a single warrior stronger
  - Discover from *resource analysis*
- Emergent behavior must couple *nonlinearly*
  - If n base mechanics, more than O(n) behaviors

Example: *Starcraft*

- Basic units can
  - Attack in sky and/or land
  - Defend in sky and/or land
  - How can these combine?
- Further complexity:
  - "Buff" friendly units
  - "Control" enemy units
  - How does this affect game?
- **Challenge**: What is minimal complexity for a good RTS?

Summary

- Rules are **formal systems** defining your game
  - Specify to change the game state over a single frame
  - Challenge is matching them to your informal design
- **Resources** create *strategic* gameplay
  - Resources define the game economy
  - Strategy is just players making economic choices
- **Interactions** facilitate *emergent behavior*
  - Coupled actions/interactions creating new features
  - Can provide deep, nonlinear complexity