Simulation

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GAM 224
Simulation

- Games simulate real-world activities
  - sports games
  - racing games
  - historical games

- Central idea
  - mapping between the game and the real-world activity
Simulation II

- Games also simulate fantasy and fictional activities
  - any RPG
  - most FPS

- Central idea
  - mapping between the game and...
Imaginary realism

- Games (like other fictional creations)
  - require "willing suspension of disbelief"
  - we agree to be lied to
  - (why is that?)

- We expect of a realistic game
  - that it be internally consistent
    - we expect "physical" laws to be the same everywhere
  - that its deviations from our consensus reality to be explained
    - we can learn what "physics" is in this world
Mapping

- Simulation is a mapping between
  - a representation in the game
  - an aspect of reality or some imagined reality
- The mapping will be incomplete
  - the game may leave out inconvenient or boring parts
  - the game may include improbable situations for gameplay reasons
- Example
  - realistic healing from wounds is slow
  - an announcement is heard on the radio just when you come in the room
  - you can't take over enemy buildings, you have to destroy them
The mapping will be inexact
- the game may exaggerate the physics for effect or gameplay
- the game may (will) abstract from physical reality for practical reasons

Example
- basketball players jump incredibly high
- crates can be destroyed but not doors or walls
Basic fact

- All physics is simplification
  - complex multi-body physical simulations are too slow
  - reality is chaotic
  - limits to what can be rendered graphically
Example: Halo

- What happens when a grenade explodes?
  - do we simulate the ignition and rapid oxidation of explosives, pressure waves, metal shear and shrapnel trajectories?
  - do we simulate concussion injuries, soft tissue damage, and bone trauma?
- No
  - we assign a certain amount of damage to characters based on their distance from the explosions center
Game physics

- Physics = the evolution of the game state
  - we want the player to feel as though there is a real world in the game
  - the game state must be complex
  - its evolution must seem natural
  - the player's control over it should seem natural
Natural?

- Games are profoundly unnatural
  - Aliens? Psychic powers? Controlling a civilization over centuries?
- Imaginary realism
  - whatever is natural in the game world context
- Game physics
  - may have nothing to do with Newton's physics
  - or they may be very selective in applying such physics
Simulation focus

- Games differ on where they focus their simulation effort
  - Some areas of the game will be simulated more closely than others

- Example
  - execution aspect of fighting games not much like real fighting
    - possible exceptions: "Fight Night“, “WiiSports”
  - Battlefield 1942 weapons modeled realistically
    - but ability and role of a given soldier not realistic
It is easy to criticize a game for not being realistic in some way

The question is

- where are the areas where the design sought realism?
- where is it omitted?
- what are the consequences for meaningful play?
Example

- Grand Theft Auto III
Scripting

- When there is a fixed stereotyped response to an action in the game, we say it is "scripted"
- As opposed to "simulated"
Example

- Designer decides what should happen when a grenade explodes
  - x amount of damage to all units within certain radius
  - x/2 damage within a larger radius
  - leaves a certain "stencil" on the floor or wall
- Simplifying the actual physics
Example

- Locked door in Zelda
  - If player tries to go through locked door with key in inventory, the door opens and key is used up

- Simplifications
  - Doors are logical, not physical barriers
    - Cannot be battered down, blown up, removed from hinges
    - Locks cannot be picked
  - In Elder Scrolls: Oblivion
    - Lock picking is a skill you can learn
    - (Some locks cannot be picked, though)
Advantages of scripting

- Much, much faster
  - to apply a simple rule than to run a physical simulation
- Easy to write, understand and modify
Disadvantages of scripting

- Limits player creativity
  - Players will try things that "should" work
    - based on extensive physical intuition
  - Will be disappointed if they don't
- Game will need many scripts
  - predicting their interactions can be difficult
  - complex debugging problem
Simulation

- Will still be a simplification
- Represent the quantities of interest
  - represent the forces that act on them
  - create physical laws for the game world
  - evolve the game state according to these laws
Example

- Half-Life 2
  - models weight of objects
  - models physical forces
  - can create puzzles involving moving objects of different weights
  - the "gravity gun" allows any movable object to become a weapon
Benefits of simulation

- More player options
  - Designer doesn't have to anticipate every way to do something

- Physical laws reusable
  - Do not have script every object
  - Can build (or buy) generic physics engine
    - Half-Life 2: Havok 2
Disadvantages of simulation

- **Speed**
  - extensive simulation may make the game too slow

- **Memory**
  - game state may become much larger

- **Testing**
  - difficult to test all possibilities
Design decision

- How much to simulate?
  - Where player creativity is important
  - Where realism is important
  - Where a simple enough model can be built

- What level of detail is required?
  - depends on the constraints of the game
  - always a computational cost
Example

- Fracture
Terrain effects on speed

- Some designers said yes
  - Others said no
  - Programmers wanted to avoid extra calculations
- Gameplay experiments
  - showed terrain weapons worse than useless without it
- Had to be exaggerated to achieve good gameplay
Example

- Action adventure scenario
- How do guards respond to player?
- Script
  - when player enters room, guards converge and attack
Simulation #1

- Proximity concept
- Model radius to guard
  - when player takes a step, sound is heard over certain radius
  - if guard is within radius and in room, guard will converge and attack
Simulation #2

- Stealth concept
- Model sound propagation to guard
  - when player takes a step, volume of sound is calculated based on level of stealth, floor material, etc.
  - sound is propagated through room and attenuated based on room contents
  - guards receive sound signal and if loud enough to reach attention, they will move in the apparent direction of sound
Simulation #3

- Unified level concept
- Model sound propagation through larger space
  - same as #2, but in 3 dimensions, through floors, etc.
Simulation #4

- Psychology of alertness
- Model guards' attention
  - same as #3, but guards have multiple alert states.
  - A single low-intensity noise will increase their alert state.
  - Over time, the alert state decays but not completely
Level of detail

- As we add more simulated detail
  - we add texture to the player's decisions
  - but we add complexity to the program
  - we may impact the play experience in unexpected ways

- We have to decide as designers
  - what is important for the game's impact
The role of simulation

"Immersive fallacy"
- the best game is one in which the player feels that they are totally immersed in a simulated world
- emphasizes only a certain aspect of the game experience

Realism is only one aspect of a game's experience
- it has to be weighed against other design criteria
Realism over all?

- Would "Wind Waker" be better if it had realistic (non-cell shaded) textures?
- Would Asteroids be better if the asteroids collided with each other?
- Would Gears of War be better if it took weeks to heal from injuries?
- Would Half-Life 2 be better if you couldn't carry an unrealistically large arsenal?
- Would GTA be better if there were child pedestrians and moms with strollers?
Wednesday

- Guest speaker
  - Patrick Curry, Midway Games
  - Stranglehold
Monday (10/15)

- Card game design draft due
- Next Wednesday (10/17)
  - Quiz #2: Play
- Monday week (10/22)
  - Card game presentations