Lecture 28

Audio Design
Engagement

- **Entertains** the player
  - Music/Soundtrack
- **Enhances** the **realism**
  - Sound effects
- **Establishes** **atmosphere**
  - Ambient sounds
- **Other reasons?**
The Role of Audio in Games

Feedback

- **Indicate** off-screen action
  - Indicate player should move

- **Highlight** on-screen action
  - Call attention to an NPC

- **Increase** reaction time
  - Players react to sound faster

- Other reasons?
History of Sound in Games

- Arcade games
- Early handhelds
- Early consoles
Early Sounds: *Wizard of Wor*
History of Sound in Games

- Arcade games
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Recorded Sound Samples
- Starts w/ MIDI
- 5th generation (Playstation)
- Early PCs
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- Sample selection
- Volume
- Pitch
- Stereo pan
History of Sound in Games

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- Multiple samples
- Reverb models
- Sound filters
- Surround sound
The Soundscape

- Mix of simultaneous sounds
  - Sounds can be layered
  - Sounds can be sent to multiple “channels”
  - Effectively no limit

- **Goal**: Make it **transparent**
  - Do not distract the player
  - Too much is cacophony

- **Goal**: Make it **effective**
  - What is its purpose?
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**Locations**

- Menu
  - Introductory music
- Cut-scenes
  - Dialog, soundtrack
- Ambient
  - Moving about
- Event driven
  - Interacting with objects
The Soundscape

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Dialogue
The Soundscape

<table>
<thead>
<tr>
<th>Components</th>
<th>Locations</th>
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<tbody>
<tr>
<td>• Music</td>
<td>• Menu</td>
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</tbody>
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Designing Music

- Basic element: **the loop**
  - Soundtrack has no set end
  - Record single music unit
  - Have it match on ends
  - Keep repeating as a loop

- Very similar to textures

- Also support **transitions**
  - Support multiple loops
  - Each can flow into another
  - Allows “theme” switching
Recall: Animation State Machines

Diagram of an animation state machine with states:
- Idle
- Attack
- Hit
- Any State

The diagram shows transitions between states.
Applies to Soundtracks

Level End

Boss Fight

Level Start
Applies to Soundtracks

Loop

Level End

Transition

Boss Fight

Level Start

Loop
Designing Sound Effects

- Directly tied to animations
  - Play when animation starts
  - Stop when animation ends
- Stock sound effects
  - Free sound libraries
  - Commercial licensing
  - **Example**: sounddogs.com
- Foley artists
  - Record to match animation
  - Standard in movies
Recording Dialogue

- Professional voice acting
- Tools from movies & TV
- Professional studios
- But can do remotely

- Games have challenges
  - Interactive dialogue
  - Variable PC choices (fem-Shep)
  - Variable NPC pairings (party banter)
Defying this order is violating the law -- you have to let her out.

This is bigger than Sederis, or you, or me. The Council's orders must be obeyed.
Sound Processing

- **Dynamic mixing**
  - Volume controller
  - Frequency equalizers

- **Special effects**
  - Reverb
  - Low/High pass

- **Channel editing**
  - Stereo sound (2 channels)
  - Surround sound (5.1, 7.1)
Reverb Example

Clean Loop
Static Sound Processing

Audio Editors

Multi-track Editors
The Need for Dynamic Processing

Player
The Need for Dynamic Processing

Player
The Need for Dynamic Processing
The 90s: Hardware Support

- PCs had dedicated hardware
- Support for MIDI and music
- Built in effects (e.g. reverb)
- Many DOS games used this

- Huge source of problems
  - Support was very uneven
  - Configurations often failed

- Still exist, but unused
  - No standard like OpenGL
  - OpenAL has not caught on
Software Solutions: DSP Programming
Software Solutions: DSP Programming

Diagram:
- Input
- Effect
- Effect
- Merge
- Output

Dialogue
Software Solutions: DSP Programming

Takes memory and CPU away from the game
Development Tools

Development Tools

Development Tools

Development Tools
Example: UDK Kismet

Warehouse Section

Turn on power?
- Trigger & Used

Already On?
- Compare Bool
  - In
  - False

WAREHOUSE AREA ON
- Play Sound
  - Play
  - Cut

WAREHOUSE AREA OFF
- Play Sound
  - Play
  - Cut

Toggle
- Turn On
- Turn Off
- Target

Delay (0.03)
- Start
- Finished

Toggle
- Turn On
- Turn Off
- Target

In
- Value
- Target

Out
- Value
- Target

False

True

Rattle 1
- Rattle 1

Rattle 2
- Rattle 2

Rattle 3
- Rattle 3

Rattle 4
- Rattle 4

Rattle 5
- Rattle 5

Music
- Ambience 1

Bass
- Ambience 2

Ambience 3

Ambience 4

Ambience 5
Future Research Directions

- **Sound rendering**
  - Eliminate the Foley

- **Reverb calculations**
  - Realistic acoustics

- **Binaural Synthesis**
  - Directional sound

- **Game Accessibility**
  - Games for the blind
Sound Rendering
Reverb Calculations

- Utilize raytracing
- Proper sound reflection
- More realistic acoustics
Reverb Calculations

- Utilize raytracing
- Proper sound reflection
- More realistic acoustics
Binarual Synthesis

- Current 3D sound is fakey
  - Essentially volume control
  - Cannot pinpoint source
- **Goal**: realistic perception
  - Track the sound parallax
  - Account for shape of head
- Limited to headphones
  - Cannot do speakers (yet)
- **Example**: Papa Sangre

![Diagram of binarual synthesis](image)
Example: Papa Sangre
Game Accessibility

• Supporting blind gamers?
  • Sonify game elements for full audible feedback
  • Make sure text is supported by screen readers

Examples

• Mortal Kombat
• Ninja Gaiden III
• Karateka
• Castlevania: Dracula X Chronicles
Summary

- Audio design is about creating soundscapes
  - Music, sound effects, and dialogue
  - Combining sounds is very similar to animation

- Sounds often require dynamic processing
  - Realistically implement obstacles blocking sound
  - Handle with digital signal processing (DSP)

- Audio processing is an area of active research
  - Sound rendering is the cutting edge of sound design