ADAPTIVE MUSIC IN VIDEO GAMES

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My Affiliations

welove.audio (code)
CTO, co-founder
Middleware for adaptive music for game developers

**Warhorse Studios (code + music)**
Adaptive Music Designer
Author of part of the music in *Kingdom Come: Deliverance*

Freelance Musician (code + music)
Lightshows, video mappings, etc.

Czech Technical University (research)
Department of Computer Graphics and Interaction
Associate Professor
Research in audio-based human–computer interaction

**The Wasteland Wailers (music)**
Co-founder, producer
Euro-atlantic group of pop music producers
We make swing and country songs
Get your copy via http://kcdsoundtrack.com
Our Workflow

0. Our own middleware
   – Adam Sporka + Jan Valta

1. Genre decisions
   – Dan Vávra + Jan Valta

2. Music behavior design

3. Composition (+ arrangement)
   – Jan Valta + Adam Sporka

4. Production
   – Orchestral recordings sessions
   – Sample banks
   – Vocal recording sessions
   – Medieval recordings

5. Mastering
   – Ondřej Urban
   – Vojta Nedvěd
   – Andrew Jaworski

6. Playback metadata
   – Annotations

7. Implementation
   – “Probes” in game
   – Behavior script

8. In-game testing
Fuzzy Terminology of Adaptive Music

• What it does:
  – Adaptive music
  – Responsive music
  – Reactive music
  – Interactive music

• How it is done:
  – Procedural music
  – Algorithmic music
  – Composed music
Purpose of Sound in UI

- Interaction modality (input and output)
- Alerts
- Widget sounds
- Presentation of data
- Mood setters
- Sound branding
Purpose of Music

- Tradition

- Declaration / Affirmation of genre
  - “Yes, this is an 8-bit retro”
  - “Ah yeah, 1870s, North America”
  - “Medieval Europe”
Purpose of Music

• Presentation of emotion
  – Valence of emotion (happy, joyful, depressing...)
  – Actor-based vs. world-based

• Suppression of ratio
  – People are less analytic
Purpose of Music

• Setting the expectations
  – Difficulty *(Nimble Quest)* <demo>
  – Game pace

• “Sonification” of the game status
  – Changes of music over time indicate changes in game
Music as Gameplay Drive

- **Dance Dance Revolution**  
  Konami (1998+)

- **Guitar Hero**  
  *multiple publishers* (2005+)

- **Beat Saber**  
  Hyperbolic Magnetism (2018)
Purpose of Music

• Theme music
  – Feature
  – Recognizable theme
  – Elaborate
  – Genre announcer
  – Everyone will hear this

• Underscore
  – Background
  – Mood setter
  – Does not distract
  – Can be listened to throughout the gameplay
Adaptive Music
Program Music

• Music delivering a narrative
  – Hector Berlioz: *Symphonie fantastique* (1830)
  – Bedřich Smetana: *Vltava* (from *Má vlast*; 1875)
Program Music

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• Movie soundtracks
  – “Can see the future”
Program Music

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• Movie soundtracks
  – “Can see the future”

• Video games
  – Unknown order of events
  – Unknown duration of situations
  – Need to respond to those
Static vs. Adaptive Music

- Adaptive Music = Dynamic Music
  - More complex control of the music playback
  - Engine “aware” of the state of the game

- Music space
  - Contexts of game
    - Exploration, stealth, combat, minigames ...
  - Variables characterizing the state of game
    - Health status, imminent loss, expected victory, ...
Static Soundtrack

• **Pengon** (1984, released on Atari 800XL)
  – One music loop
  – Game over stinger

• **U.F.O. Enemy Unknown** (1994, MicroProse)
  – “Geoscape” loop
  – “Battlescape” loop

• **Nimble Quest** (2013, NimbleBit)
  – One song per level
Adaptive Music: Defining Characteristics

- Interactive media
- Known range of contexts
- Graceful responses to the situation
- Deterministic & repeatable behavior
- Non-trivial transitions
High Level and Low Level

High level
• What to play and when?
  – Dramaturgy

Low level
• How to get there?
  – Transitions
Dramaturgy as in “Music Contents Design”
What We Need to Know

- Number of hours of gameplay
  $\rightarrow$ amount of music
  *How many times are you willing to listen to an album?*
- Number and duration of cutscenes
  $\rightarrow$ amount of static music
- Activities in the game
  $\rightarrow$ genre & structure
- Important elements of the story (characters, locations, items)
  $\rightarrow$ genre & structure
ONE-ON-ONE COMBAT

- Losing
- TIE
- TIE!
- WINNING
- JUST STARTED
- OPPONENT
- MAX
- "I"
Transitions
Resequencing
Reorchestration (Layering)

The Space Game (2009)
CasualCollective.com
The Button
Two Bulbs Studio (2017)
Modulation

**Generative Music**
Fallout: New Vegas

- 2010; Obsidian Entertainment
- **In-game music**
  - Two layers, often playing simultaneously:
  - (1) Loops
    - Battle, Dungeon, Locations, ...
    - Layered compositions
      - Layers inside a layer
    - Different control variables: Location, Time of day, ...
  - (2) Incidental music
    - Creepy, Day, Night, Peaceful
- **Radio songs**
KC:D Music

- 1400s
- “dungeons, no dragons”
- open world, sandbox RPG

- Typical for open-world RPGs:
  - Multiple contexts
    - Landscape exploration
    - Combats, battles
    - Dialogs
  - Unknown order of those contexts
KC:D Music

- Film-like score
- Live orchestral recordings
- Music produced using sample banks
- Period music (instrumental & vocal)
Genre

• Influences
  – Zdeněk Liška (Markéta Lazarová)
  – William Stromberg
  – Luboš Fišer
  – John Williams
Genre

• Inhabited areas
  – Period music
Genre

- Inhabited areas
  - Period music
- Nature
  - “Timeless”
Genre

- Inhabited areas
  - Period music
- Nature
  - “Timeless”
- Underground
  - Sound design
- Forests
  - Silence (intended so)
- Consistent vocabulary of themes
- Consistent instrumentation
KC:D Music Design

**Exploration**
- Location-based
- Weather
- Recent crime
- Ambient, slow-paced
- Landscape
- Environment

**Action**
- Stealth
- Combat
- Chase
- Fast-paced
- Player vs enemy
- Player’s health
KC:D Music Design

- Alternating between silence and music
  - Combat always has music
  - Villages alternate between music and silence
  - Forests will be mostly without music

- Sparse usage of themes
- Usage counters
- Timeouts and Priorities
Is “combat” always more important than “exploration”?

Should music always follow the player’s activity?
  - Rigid responses – consistency
  - Loose responses – interestingness

When does a piece of music become unsuitable?
  - Weather
  - Story development
  - “Karma” of a place
Sequence Music Engine in Kingdom Come: Deliverance
Music Transitions in KC:D

- Genre: Symphonic music
  - Continuous harmonic progressions / voicing
  - Crossfade not an option
  - One track at the time
  - (Unlike techno / electronica)

➔ Resequencing
Music Transitions in KC:D

• “Seamless transitions”
  – Exploration music
  – No hurry
  – 15 seconds
Seamless Transitions

Design by Adam Sporka and Jan Valta
The Three Alephs

- $\aleph_1$ C, strings
- $\aleph_2$ E, brass instruments
- $\aleph_3$ G#, strings
Transition Handling

- “Transition via cinels”
  - Exploration → Action
  - ASAP!
  - 1 second
Transitions via “Cinels”
Components of Music

- Scene Patterns
  - Can start from silence
  - Can seamlessly change
  - End in silence

- “Branches”
- “Intros”
- “Alephs”
Components of Music

• Nibbles
  – Start from silence
  – End in silence
  – May have branches

• Action Patterns
  – “Cinels”
Implementation
KC:D Tracks

• Each track knows how to start
• Knows how to end prematurely
• Able of graceful transition to another track
  – Seamlessly
  – Abruptly
KC:D Tracks

Intros
Main pattern
Branches

Internal routing script
Time code

Click track
  • Different pitches = different pieces of information linked to time
  • <demo>
KC:D Tracks

- **Suitability function**
  - “Can it play now? Can it continue to play?”

- **Priority**
  - Battle > Combat > Weather > Locations > Country

- **Timeout**
  - “Isn't it too soon to play again?”

- **Counter**
  - “Isn't there some music which has played fewer times?”
Tricks

- We let tracks “bleed” one into another
Onset of a *tutti* orchestra hit:

“Oomph”
Links + “Oomph”

“Oomph”

Decay

Nominal Length of Music

Physical Length of the Audio Sample

200 ms
In C++ Code:
- Player health
- Weather
- Time of day
- Combat
  - on/off
  - armed or not

In Script:
- Combat
  - phase
  - severity
- Battle phase
- Story elements
  “This place is burnt down.”

Placed in the map:
- Locations
  “Samopesh”
- Sub-locations
  “pub”
Avalon Adaptive Audio

• Music Library
  – Each track is adaptive music-ready

• Lightweight adaptive music engine
  – GUI definition of the music projects
  – Simple API to control

• **High-level** (dramaturgy) + **Low-level** (transitions)

• Additional behavior via Lua scripts

• Tools for producing your own music contents
Avalon Adaptive Audio

• Currently seeking for indie projects

• Join our closed beta program!
  (It’s free and we have cookies.)
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