

ADAPTIVE MUSIC IN VIDEO GAMES

Adam Sporka

DCGI, CTU Prague; Warhorse Studios; welove.audio

@adam_sporka

Seminář “Matematické problémy nematematiků”
MFF UK, 24.10.2018

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



Adam Sporka

Jan Valta

AudioPlayer with FMOD Studio - System: 1.0910 Header: 1.0910 (data/sounds/fmod/Build/PC/) (WH-specific)
ATL Memory: Bucket: 4230 / ? KIB NumAllocs: 69387 Primary: 010 / 800 MIB NumAllocs: 11
Impl Memory: Bucket: 28639 / ? KIB NumAllocs: 216502 Primary: 34.57 / 100.00 MIB NumAllocs: 0
Listener <0> PosXYZ: 1266.87 3129.03 26.19 FwdXYZ: -0.17 0.00 0.98
Objects: 400/2236 Events: 406 EventListeners 63 Listeners: 1 | SyncRays: 0.0 AsyncRays: 0.0

World ToD: 12:00
Free:4889/Flx:0/DLM:0
DL=1/1/209.4
FPS 32.7 - 30.6ms

FMOD Event Cat (cat.#) CRE #PLY PLY #PS PS #UPS #ST ST #TGR
-END LIST



Adaptive Music Design
Adam Sporka

Music
Jan Valta

SQC Music Engine: 562.799988 seconds uptime
FMOD CPU usage: 3.378075 0.688511 0.000000 0.699479 1.480690



Get your copy via <http://kcdsoundtrack.com>

Our Workflow

■ design ■ music ■ dev/code

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)



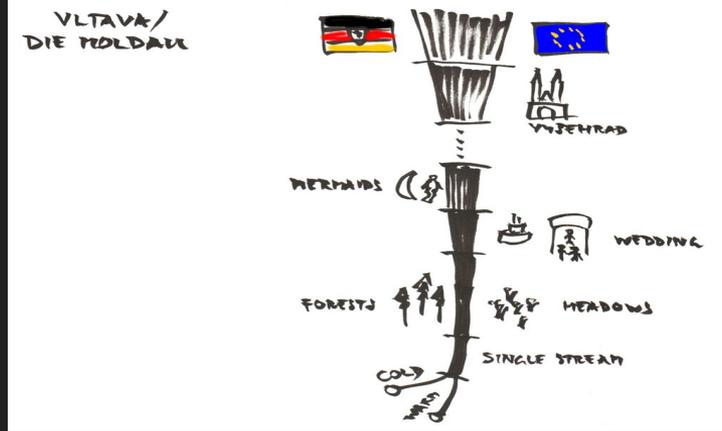
Purpose of Music

- 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

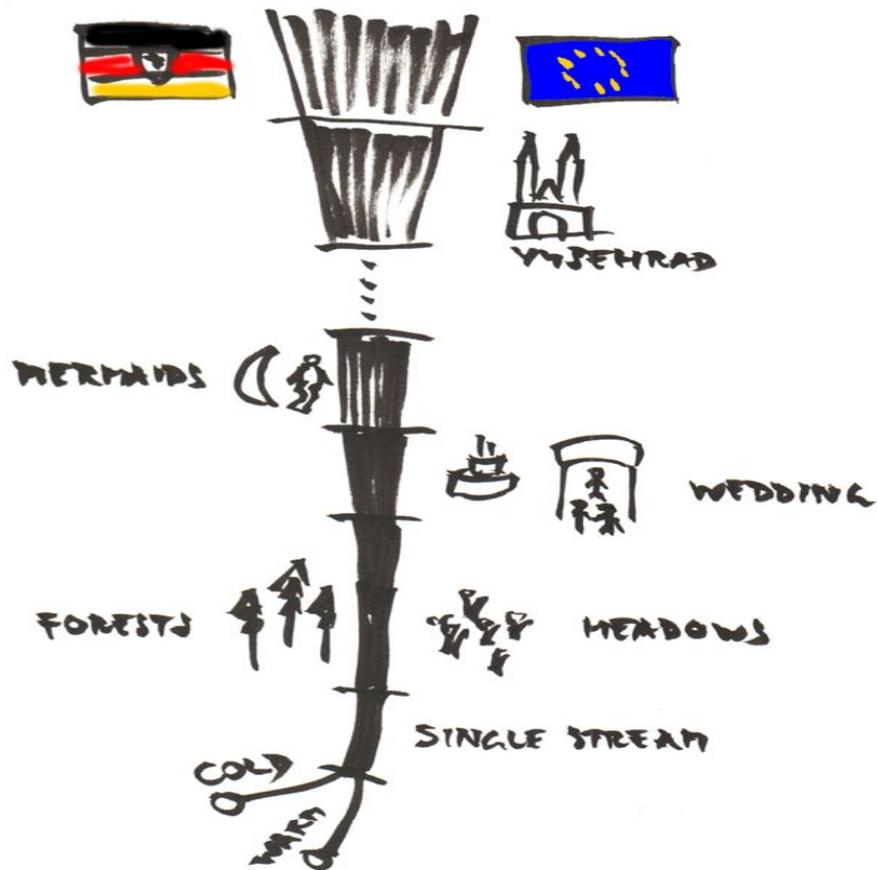
Adaptive Music

Program Music

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



VLTAVA/ DIE MOLDAU



Program Music

- Music delivering a narrative
 - *Hector Berlioz: Symphonie fantastique*
 - *Bedřich Smetana: Vltava (from Má vlast)*
- Movie soundtracks
 - “Can see the future”

Program Music

- Music delivering a narrative
 - *Hector Berlioz: Symphonie fantastique*
 - *Bedřich Smetana: Vltava (from Má vlast)*
- 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

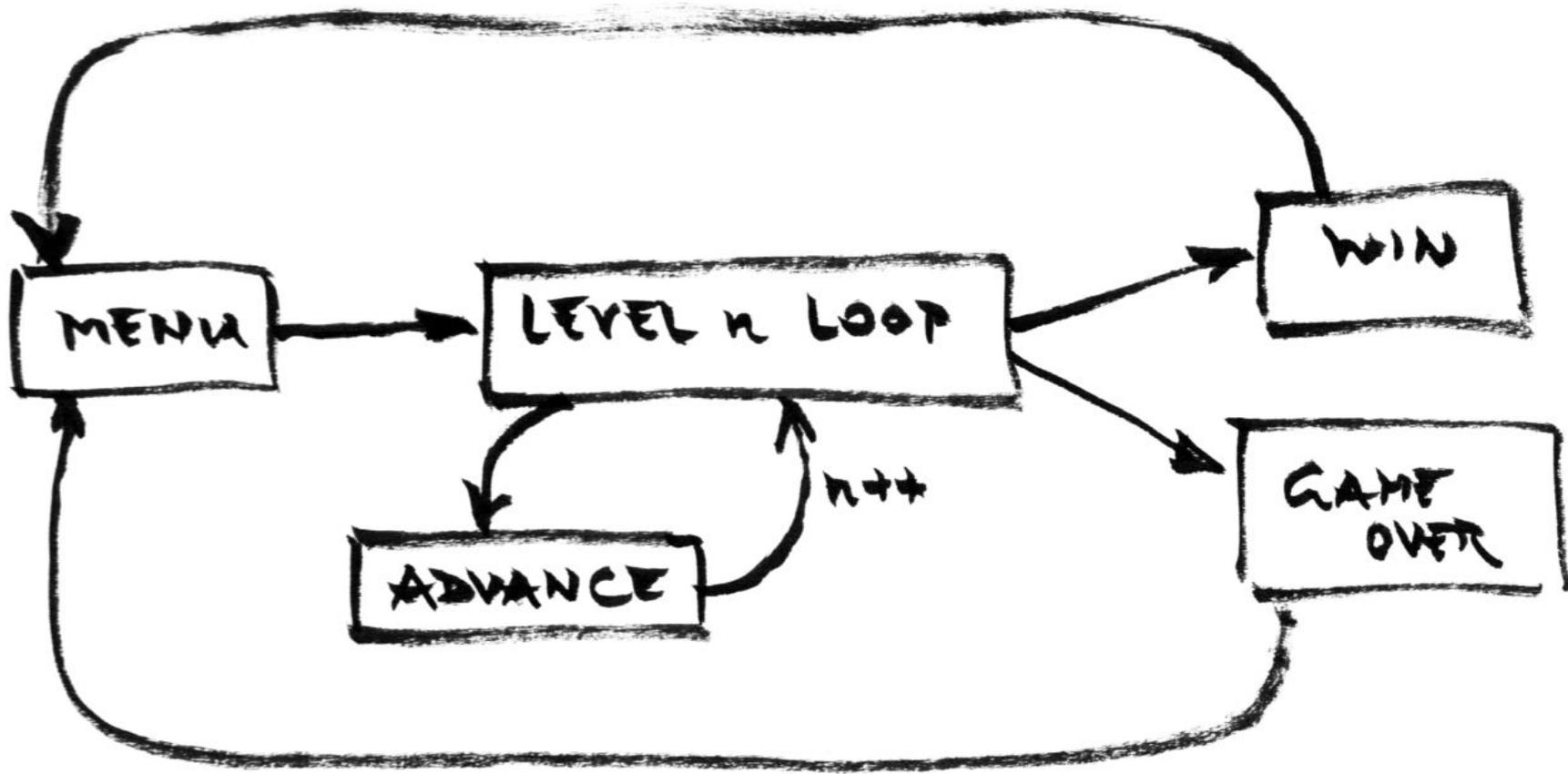
- How to get there?
 - Transitions

Dramaturgy

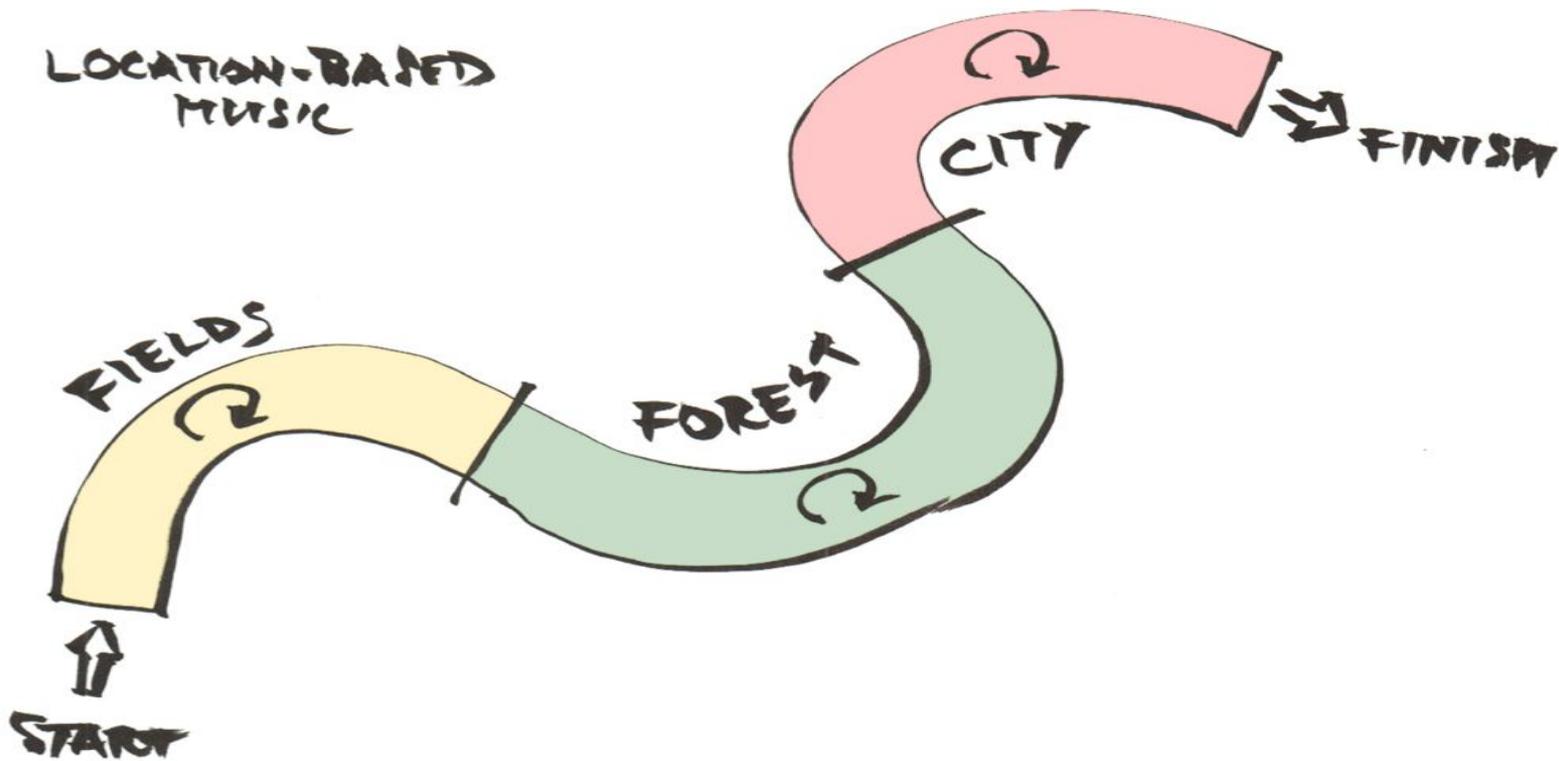
as in “Music Contents Design”

What We Need to Know

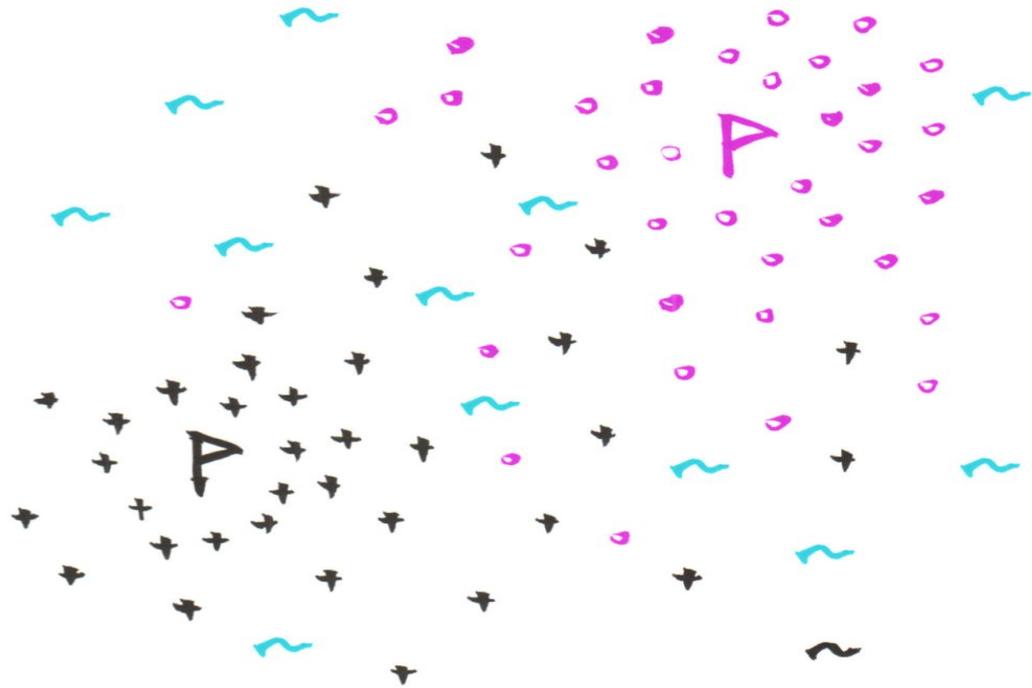
- Number of hours of gameplay
 - amount of music
 - How many times are you willing to listen to an album?*
- Number and duration of cutscenes
 - amount of static music
- Activities in the game
 - genre & structure
- Important elements of the story (characters, locations, items)
 - genre & structure



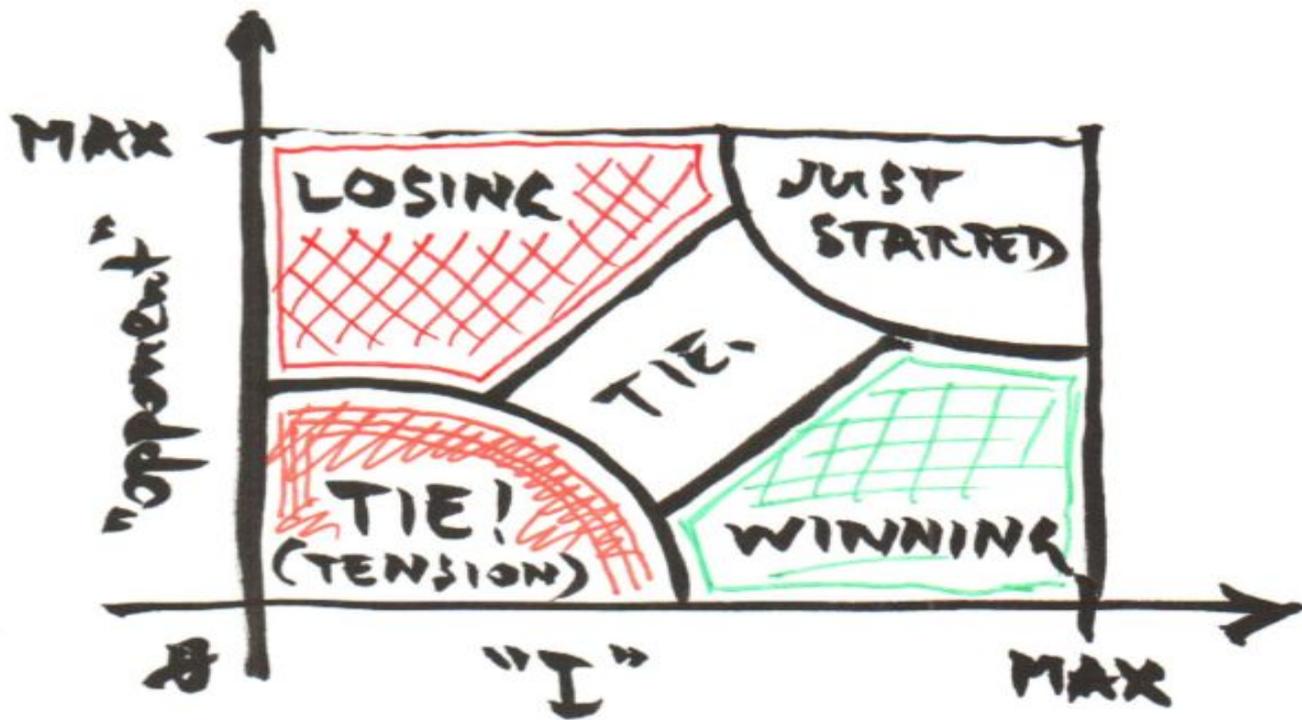
LOCATION-BASED
MUSIC



PROXIMITY

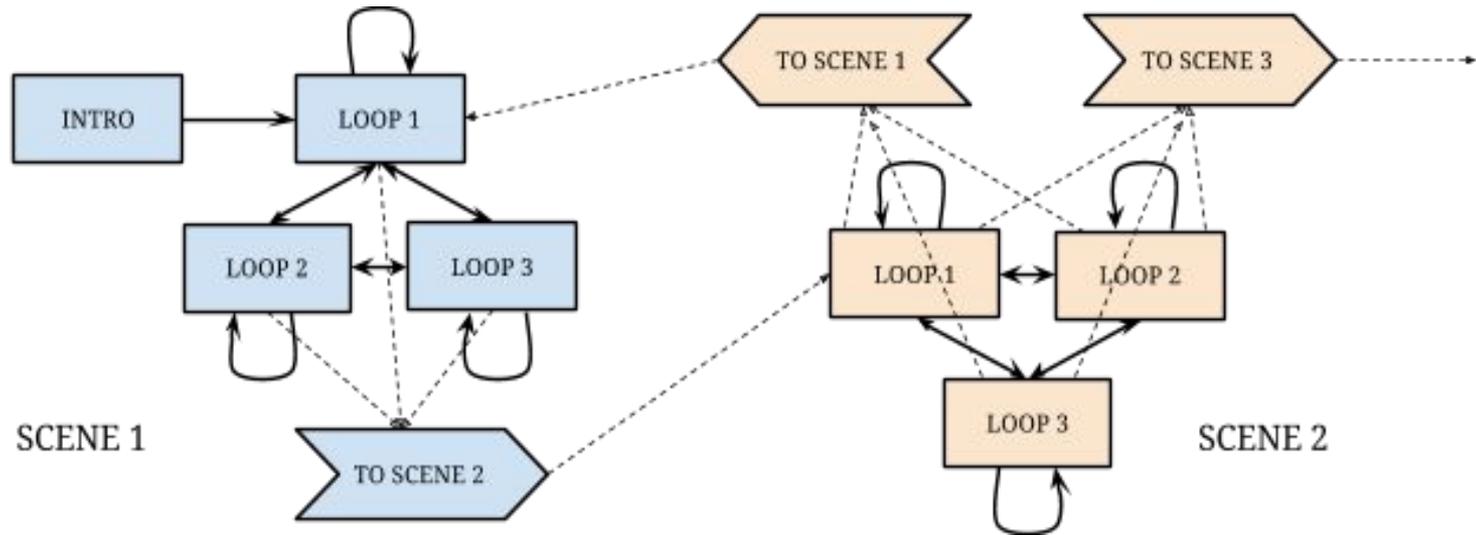


ONE-ON-ONE COMBAT

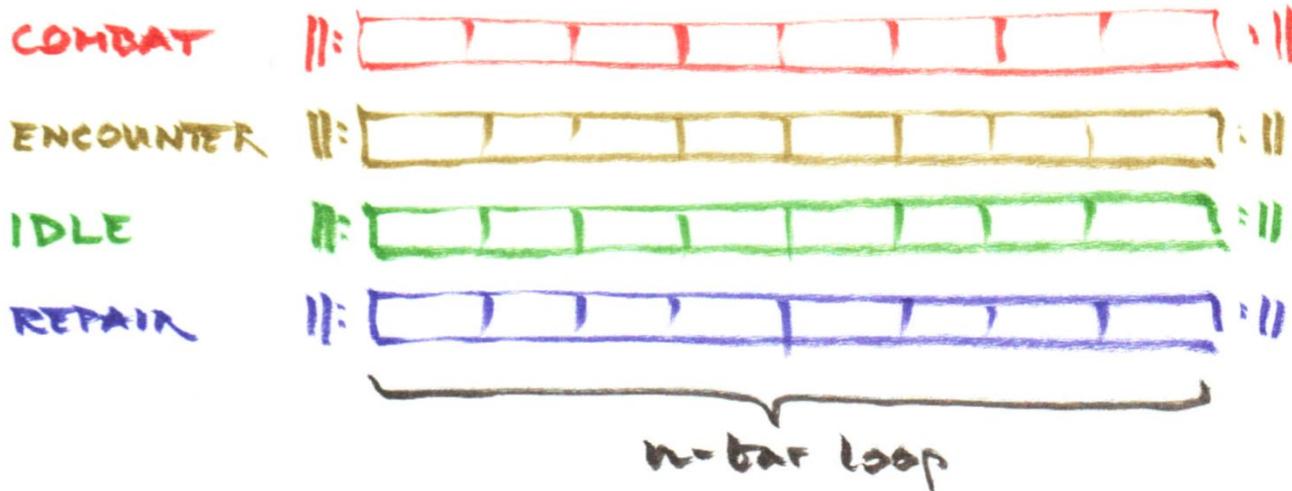


Transitions

Resequencing



Reorchestration (Layering)



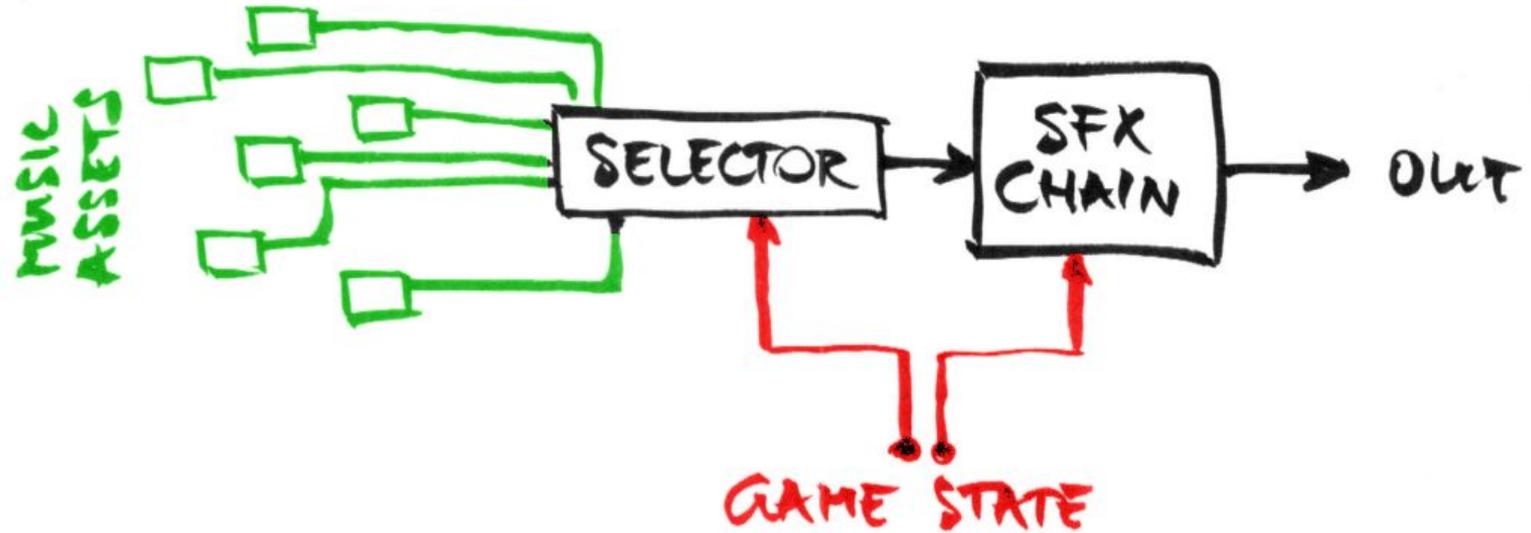
The Space Game (2009)
CasualCollective.com

The Button

Two Bulbs Studio (2017)



Modulation



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

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)





ČESKÁ
FILHARMONIE
1811. SEZÓNA
PRODEJ
VSTUPENEK



Warhorse St



Photo by Daniel Vávra



A recording studio session featuring four musicians. On the left, a man with a beard and glasses, wearing a red sweater and headphones, plays a flute. Next to him, a man in a brown suit and glasses plays a clarinet. In the center, a woman in a red top and headphones plays a violin. On the right, a man in a black t-shirt and glasses plays an acoustic guitar. The studio is equipped with microphones, music stands, and a djembe drum in the background.

Bakchus



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

KC:D Music Design

- 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

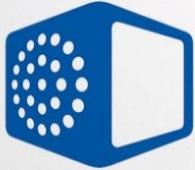


Sequence Music Engine

in Kingdom Come: Deliverance



CRYENGINE®



CRIWARE™

fmod®



SEQUENCE MUSIC ENGINE

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<demo>

Music Transitions in KC:D

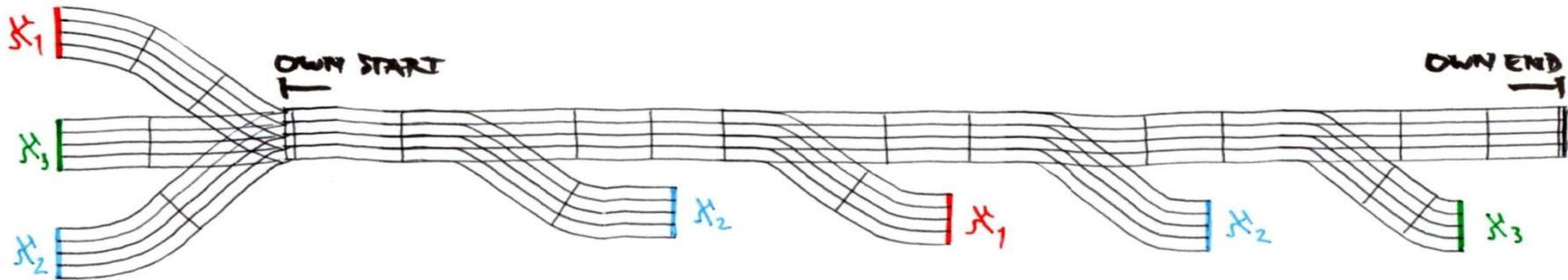
- Genre: Symphonic music
 - Continuous harmonic progressions / voicing
 - Crossfade not an option
 - One track at the time
 - (Unlike techno / electronica)

→ Resequencing

Music Transitions in KC:D

- “Seamless transitions”
 - Exploration music
 - No hurry
 - 15 seconds

Seamless Transitions



Design by Adam Sporka and Jan Valta

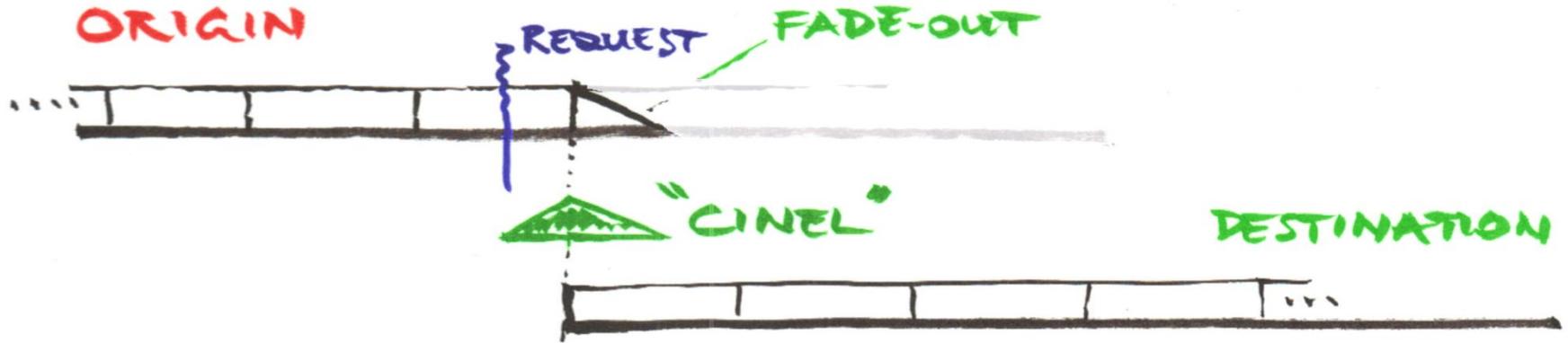
The Three Alephs

- \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”



Design by Adam Sporka and Jan Valta

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

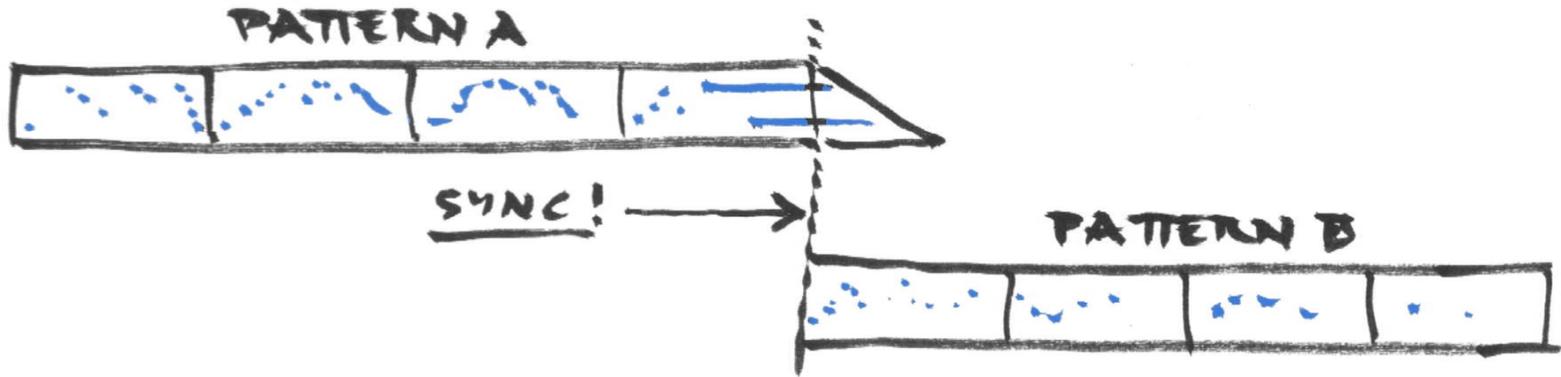
- Different pitches = different pieces of information linked to time
- <demo>

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



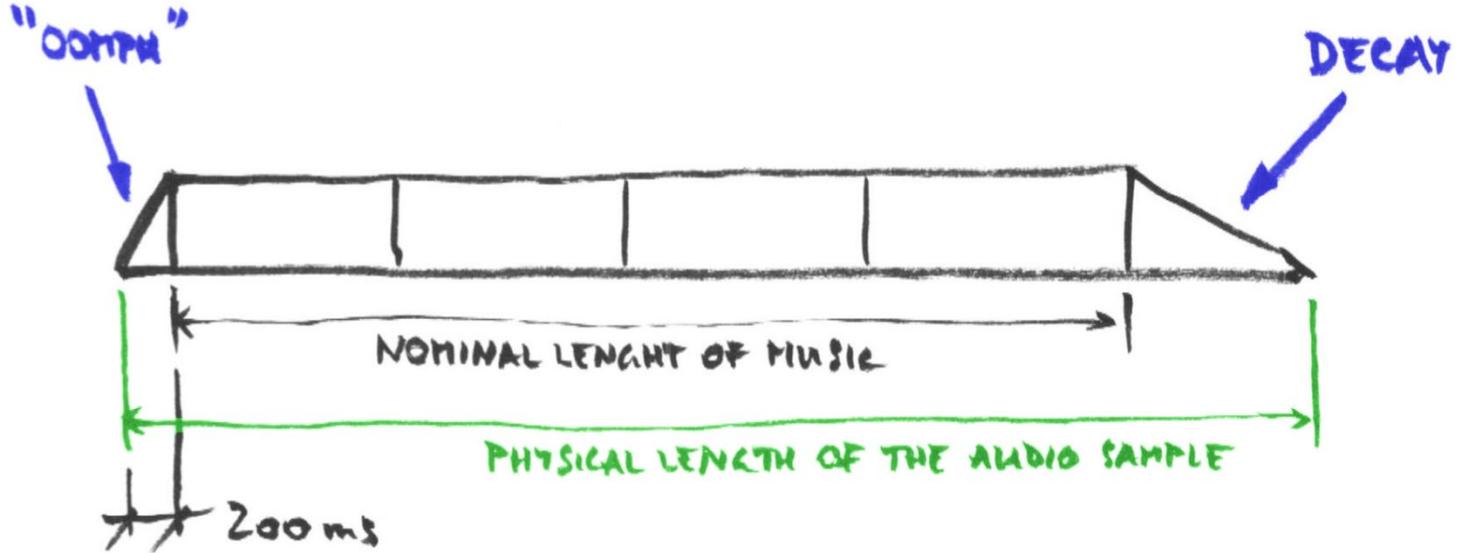
“Oomph”

A handwritten musical score for a tutti orchestra hit. The score consists of five staves, each representing a different instrument: VNI.1 (Violin I), VNI.2 (Violin II), VLA. (Viola), CELLI (Cello), and BASSI (Bass). Each staff begins with a treble clef (except for Basses which use a bass clef) and a common time signature (C). The notes are simple, indicating a tutti hit. Vertical ellipses (...) are placed above the first staff and below the last staff, suggesting that other instruments in the orchestra also play this hit. The notation is hand-drawn and appears to be a sketch or a quick notation.

Onset of a *tutti* orchestra hit:



Links + "Oomph"



“Sensors” in game

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.)

ADAPTIVE MUSIC IN VIDEO GAMES

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