

Game Audio



Adam Sporka

Warhorse Studios / Charles University



Kingdom Come: Deliverance

Warhorse Studios

Adaptive music designer
Collaboration with Jan Valta
Co-author of OST
Game audio implementation



Photo by Pavel Dobrovský

video(s) active
AudioTranslater with FMOD Studio - System: 1.09.10 Header: 1.09.10 (data/sounds/fmod/Build/PC/) (WH-specific)
ATL Memory: Bucket: 4230 / ? KIB NumAllocs: 60387 Primary: 0.10 / 8.00 MIB NumAllocs: 11
Impl Memory: Bucket: 28639 / ? KIB NumAllocs: 216502 Primary: 34.57 / 106.00 MIB NumAllocs: 7028 Secondary: 0.00 / 0.00 MIB NumAllocs: 0
Listener <0> PosXYZ: 1260.87 3129.03 2619 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 - 30.0ms

FMOD Event Cat (cat#)
-END LIST

CRE ePLY PLY ePS PS eUPS eST ST STER

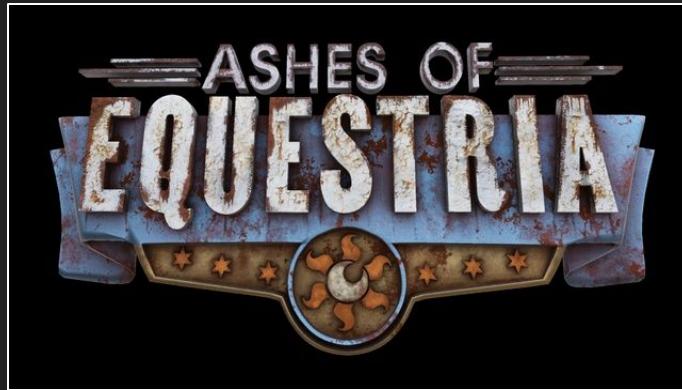
Adaptive Music Design

Adam Sporka

Music

Jan Valta

SQC Music Engine: 562.799988 seconds uptime
FMOD CPU usage: 3.376075 0.686511 0.000000 0.699479 1.480690



Ashes of Equestria
Overmare Studios

Adaptive music design
In-game songs



QFIELD
Frozen Phoenix

Adaptive music composition
Production



Chronostation

Manfromstars

Adaptive music design
In-game songs



Nuclear Football: The Button

Two Bulbs Studios

Adaptive music composition
Production



Chiptunes

Atari 800XL

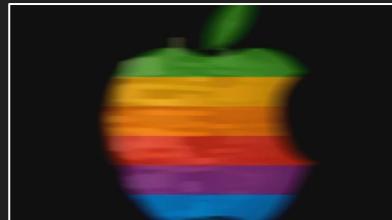


Electronic music for events

Video mappings

Openings

...

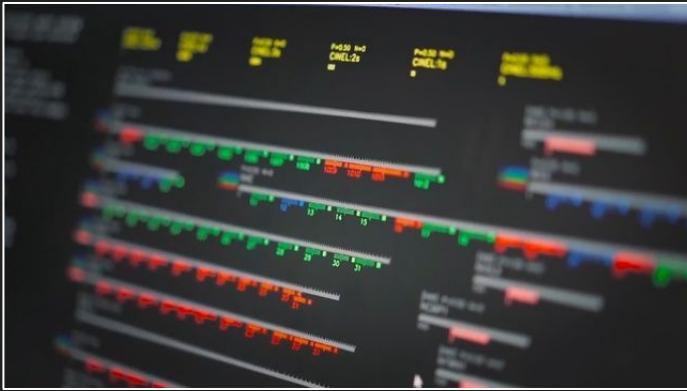


Composition, Production
Performance

The Wasteland Wailers
Original songs

Swing, Country, Pop
Composition, arrangement
Production





A screenshot of the welove.audio website. The top navigation bar includes links for HOME, DEMO, SIGN UP, and JOBS. The main header features a logo with a stylized 'A' and the text 'welove adaptive audio'. Below the header, there's a section titled 'The Adaptive MUSIC ENGINE for Game Developers' with a 'FREE sign up for BETA!' button. A large callout at the bottom left describes the 'Browser Based Workflow' as a way to 'Create, assemble and test adaptive music live in your favorite browser. Experiment with different functions and parameters. Seamlessly switch between exploration, combat and boss music. Make your choice and export your game music project to Unity with a single click. (other bindings follow)' followed by a 'Watch the Demo' link. To the right, there's a diagram showing a 'BROWSER' connected by a downward arrow to a 'GAME ENGINE'.

Sequence Music Engine

Adam Sporka, Jan Valta

Adaptive music engine



welove.audio Music Engine

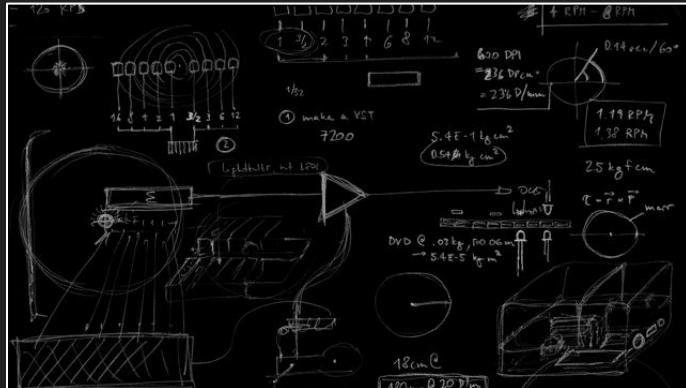
welove.audio GmbH

Adaptive music engine for indie devs
Music technology design

Plexigan

A virtual synthesizer (VST)

Sound design
Tech design + code



Gradrigo

Chiptune audio programming language
+ and middleware + VST

gradrigo

```
beep = dur(~0.1) {  
    @loop  
    sqr(#C4)  
}
```





Goddess Diana Statue
Lucie Svobodová

Sound design



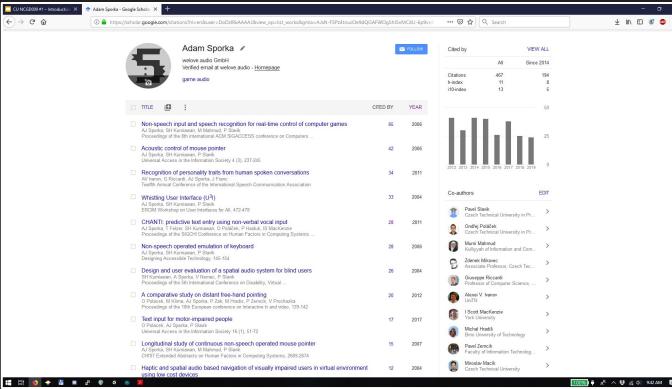
Circulation
Jan Trojan

A Prague Spring Festival concert
Tech design, performance

Research

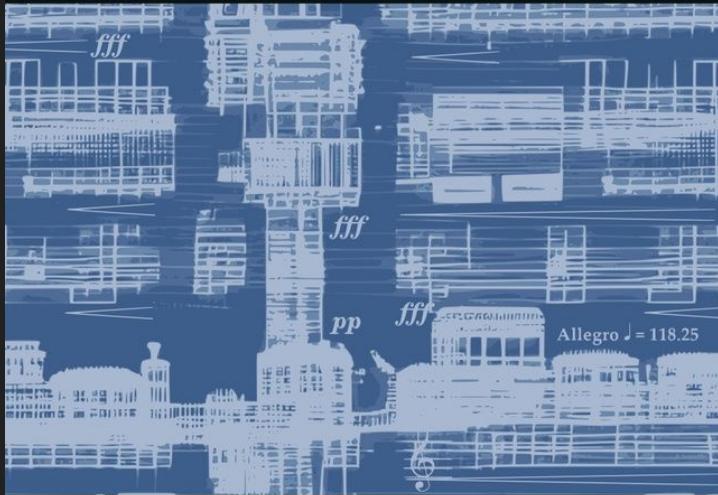
Quite a few papers in journals and proceedings of intl. conferences

Some are even interesting! :)



MUSIC DESIGN FOR GAME DEVELOPMENT STUDIOS

Strategies for meaningful adaptive music in video games



Acaremi

Adam J. Sporka

Get it on
<https://acaremi.com>

SFX

Purpose of Sound

- Interaction modality (input and output)
- Situation awareness
 - Events (alerts, one-shot sound effects)
 - States (atmospheres, music)
 - Widget sounds
- Additional information
- Setting the mood
- Sound branding

The Eternal Castle (2019)

- CGA-esque graphics
- Low-res, 4-color palette
- Details delivered via audio
- Realistic sounds

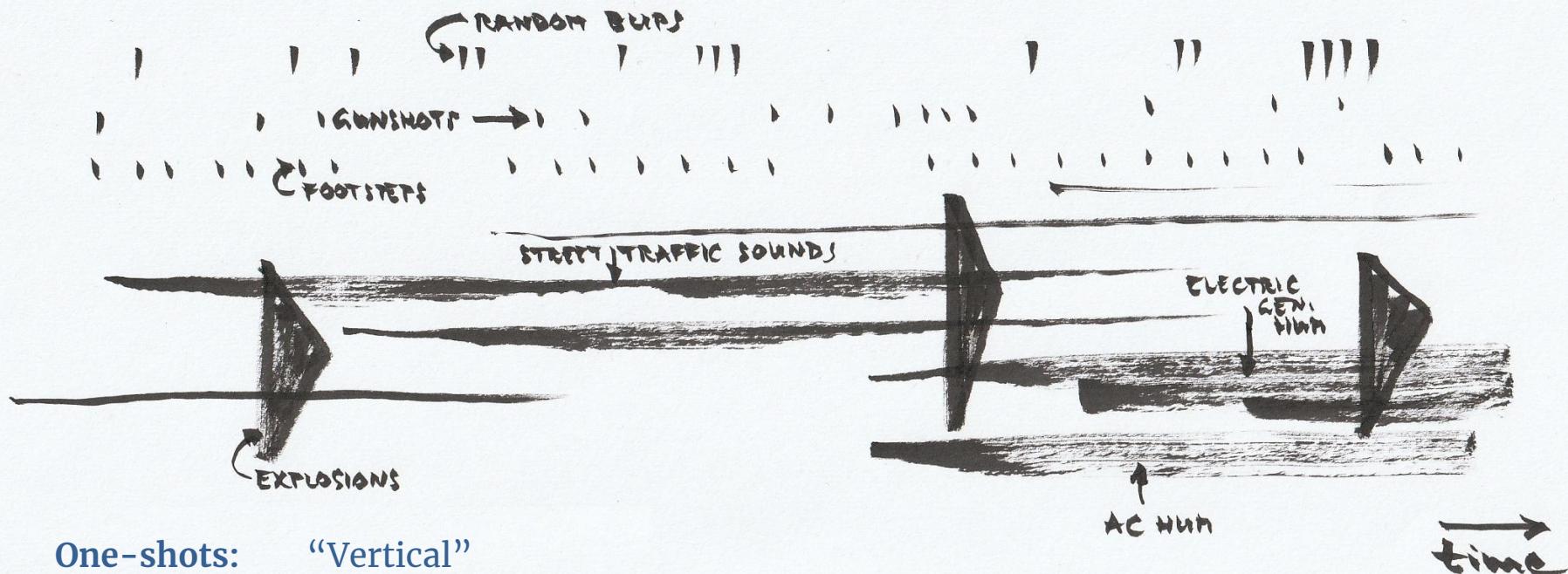


Sound Design Exercises

- Doors closing
- Bomb explosion
- Bomb explosion in outer space
- Two swords colliding
- Lightsaber combat
- Blade of sword, illuminated by sunrise
- Whisper in the crowd
- Cave
- Light

Plausible Semantics vs Correct Physics

Audio Mix



One-shots: “Vertical”
footsteps, shots, one-off activities

Sustains: “Horizontal”
situations, states, stable running machines

Purpose of Music

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

Music

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

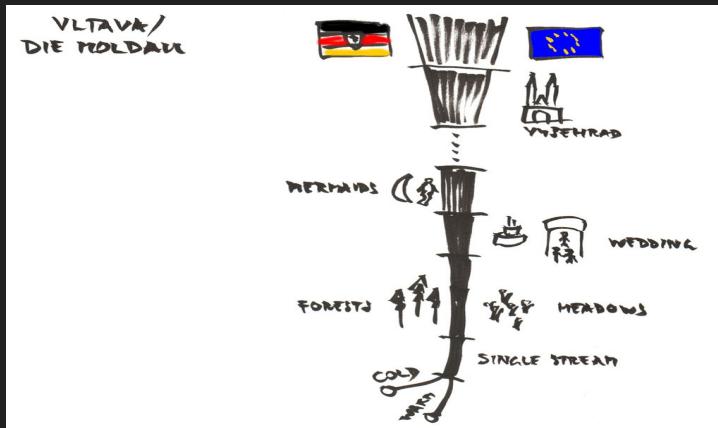
Music as Gameplay Drive

- *Dance Dance Revolution*
Konami (1998+)
- *Guitar Hero*
multiple publishers (2005+)
- *Beat Saber*
Hyperbolic Magnetism (2018)

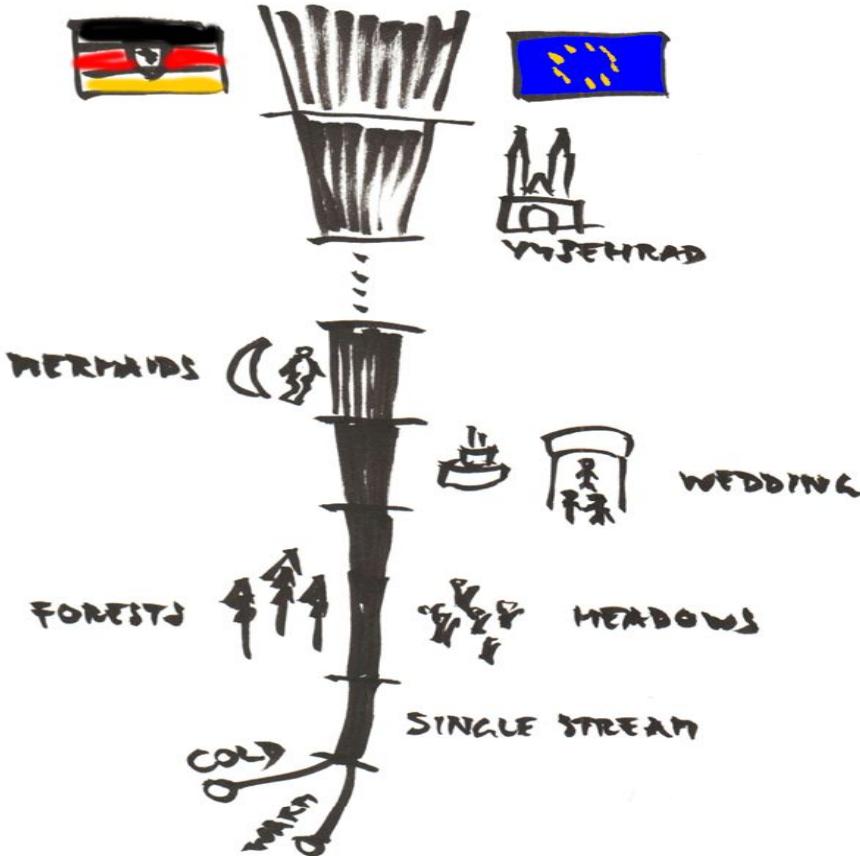


Program Music

- 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

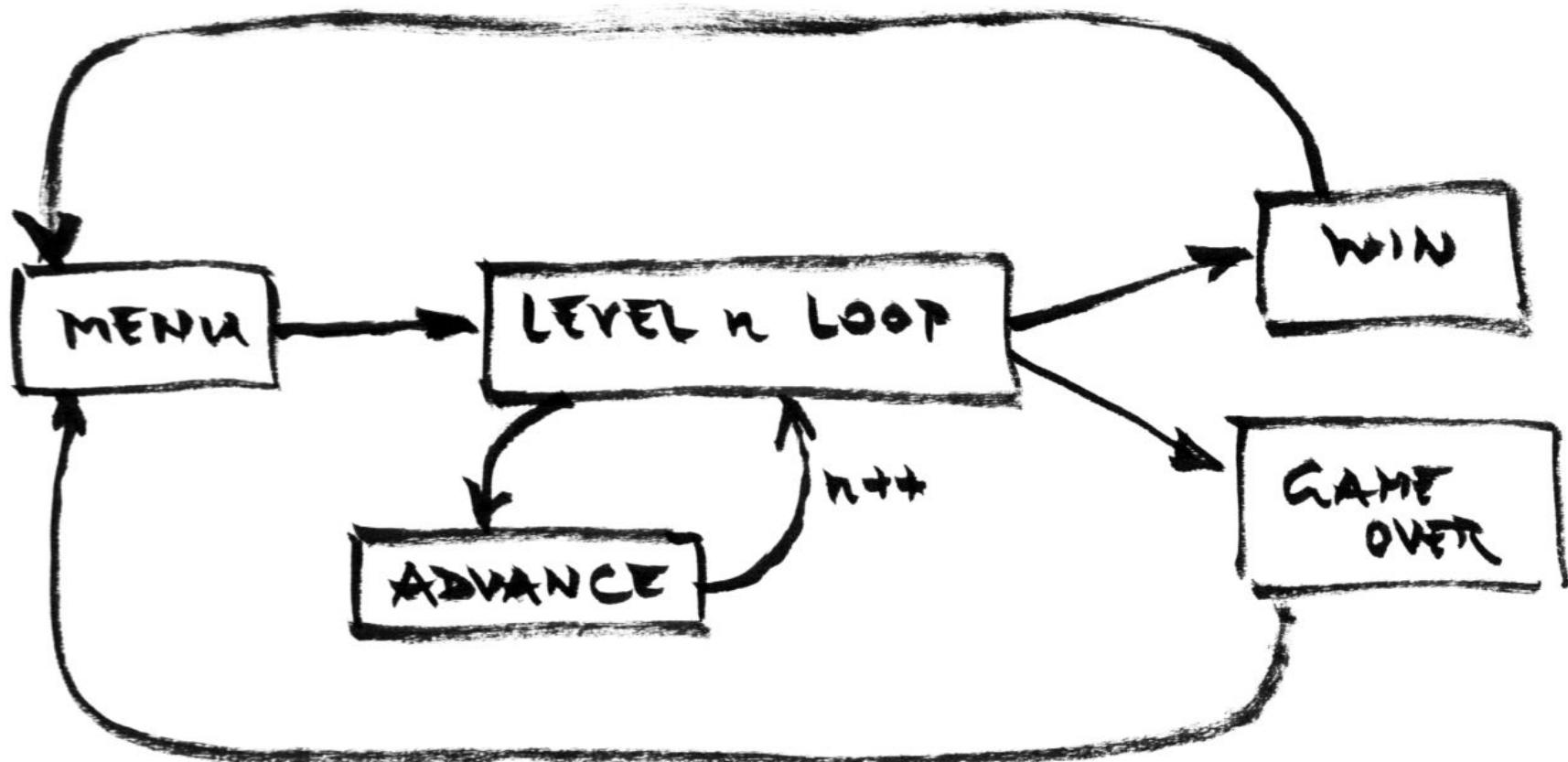
Static vs. Adaptive Music

- 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, ...

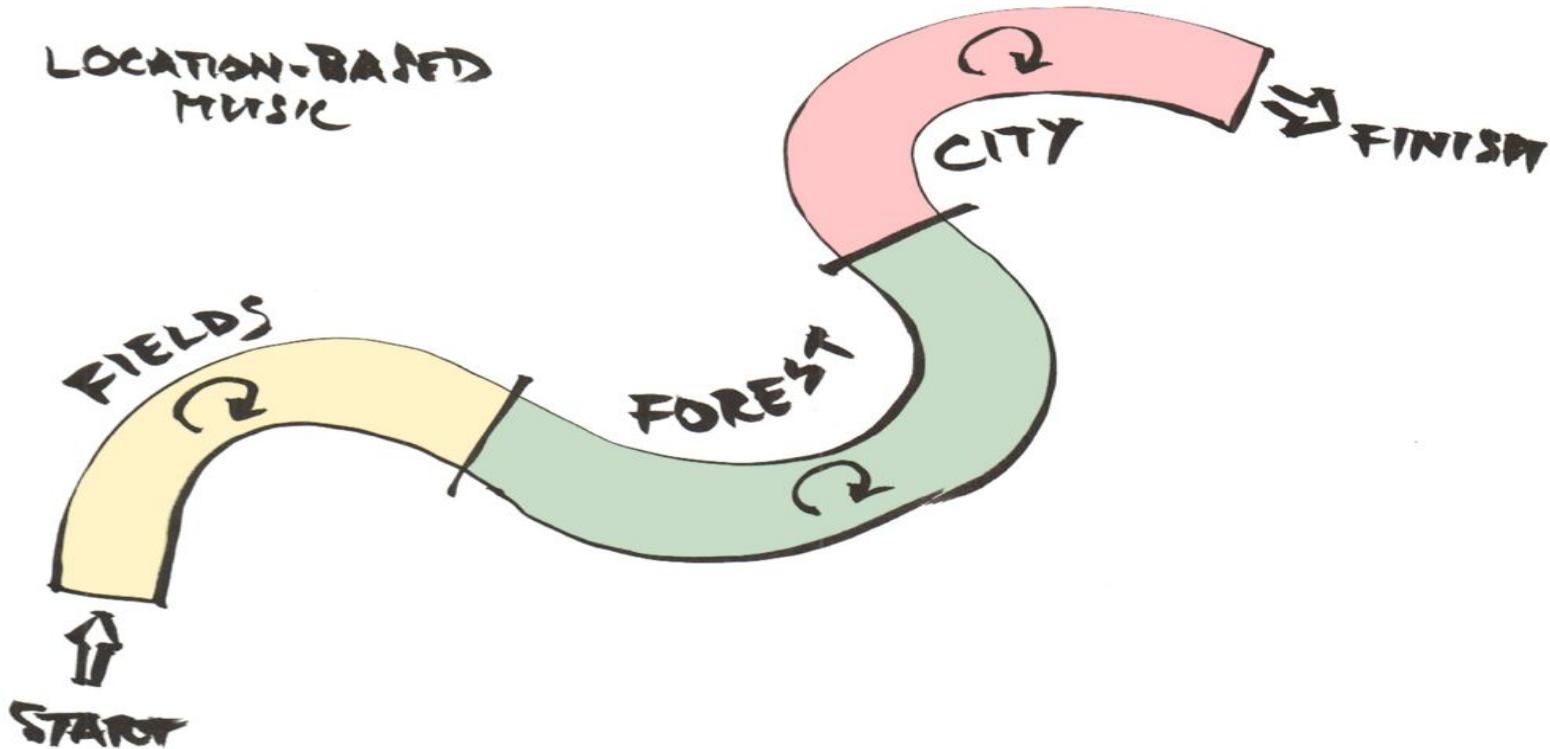
“Static” Soundtrack

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



LOCATION-BASED
MUSIC



Nimble Quest

- 2013; NimbleBit; iOS, Android
- Arcade / RPG
- Early 2000s pixel art graphics



Stingers

Short snippet of music

Often triggered asynchronously to any beat

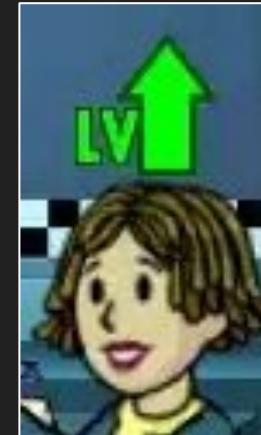
Examples:

- *Fallout New Vegas*
 - Magnum Stinger
- *Fallout Shelter*
 - Level up

Stinger Tips

Problem: Stingers often repeat.
This might be unwanted.

Tips: Think twice before using a stinger
Be aware of the triggering frequency
Multiple versions
(e.g. Fallout Shelter level-up)



Adaptive Music

Adaptive Music: Defining Characteristics

- Interactive contents
- *A priori* known range of music contexts
- Graceful responses to changing situation
- Deterministic & repeatable behavior
- Non-trivial transitions

High Level & Low Level

High-level decisions

- “Play what, when, any why?”
 - Dramaturgy



EXPLORATION



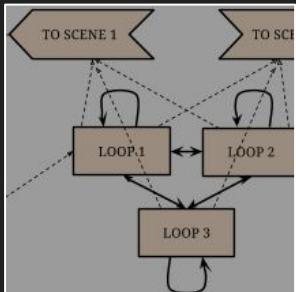
COMBAT



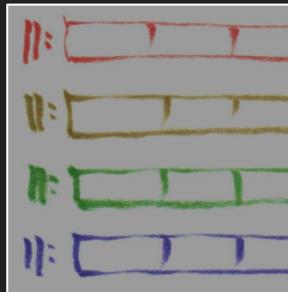
DICE

Low-level decisions

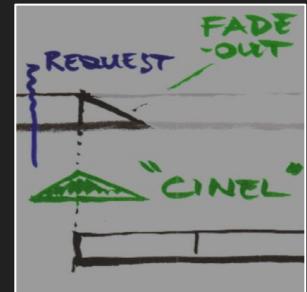
- “How to get there?”
 - Transitions



RESEQUENCING



LAYERING
(reorchestration)



TIMED TRANSITIONS

High-level Design

a.k.a. Dramaturgy

What to play, when, and why?

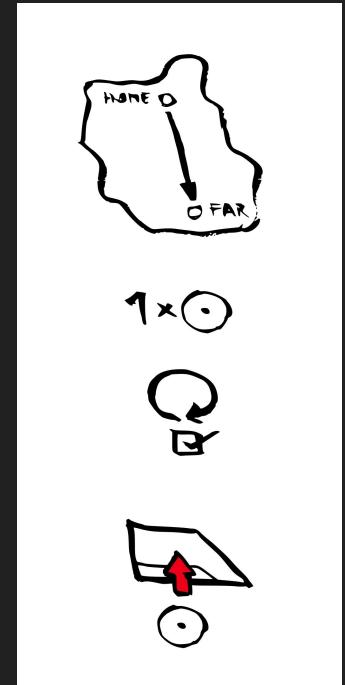
Low-level Design

Transitions

How to get there? Crossfades? Resequencing?

What We Need to Know

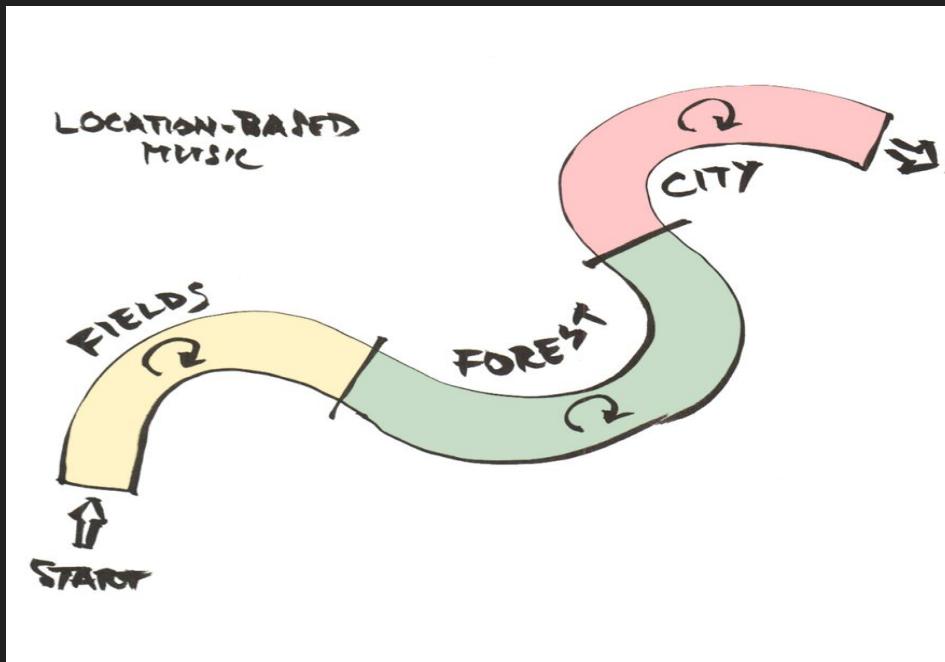
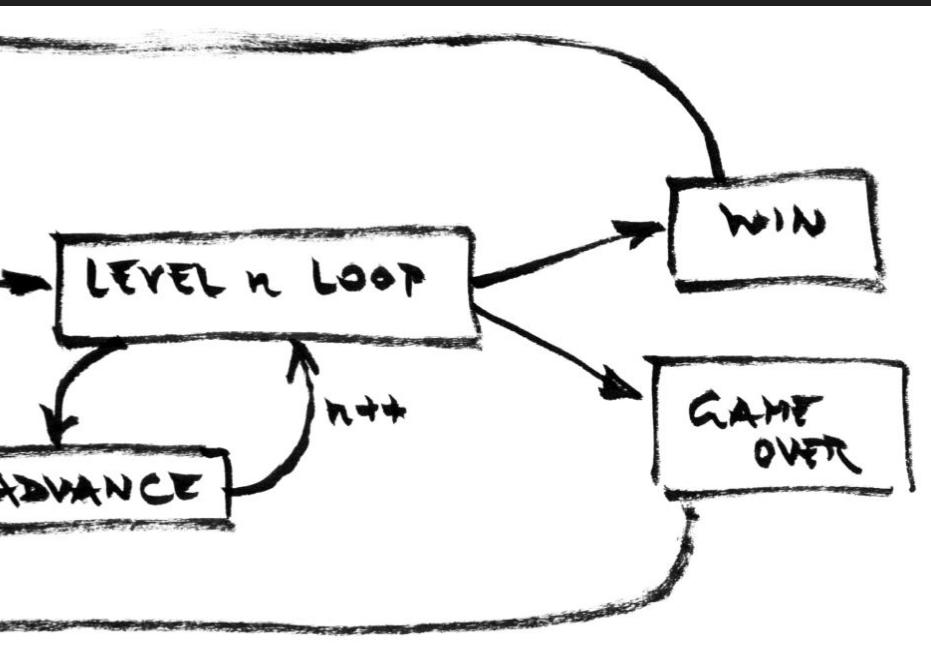
- Number of hours of gameplay
→ amount of music
How many times are you willing to listen to an album?
- Number and duration of cutscenes
→ amount of static music
- Activities in the game
→ genre & structure
- Important elements of the story (characters, locations, items)
→ genre & structure



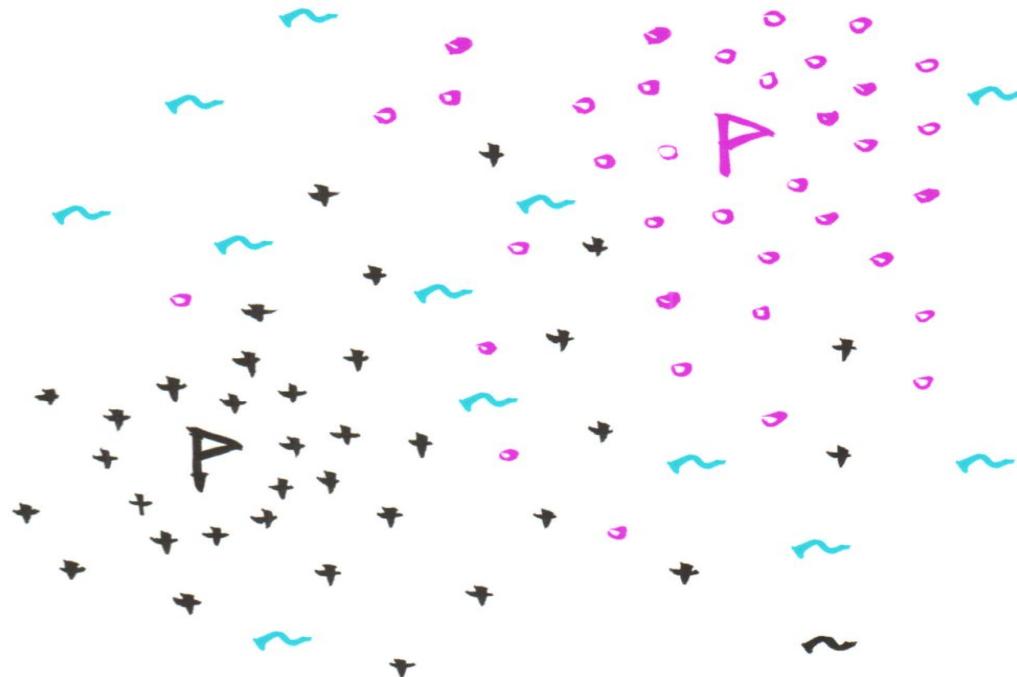
Parts of Music

- 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

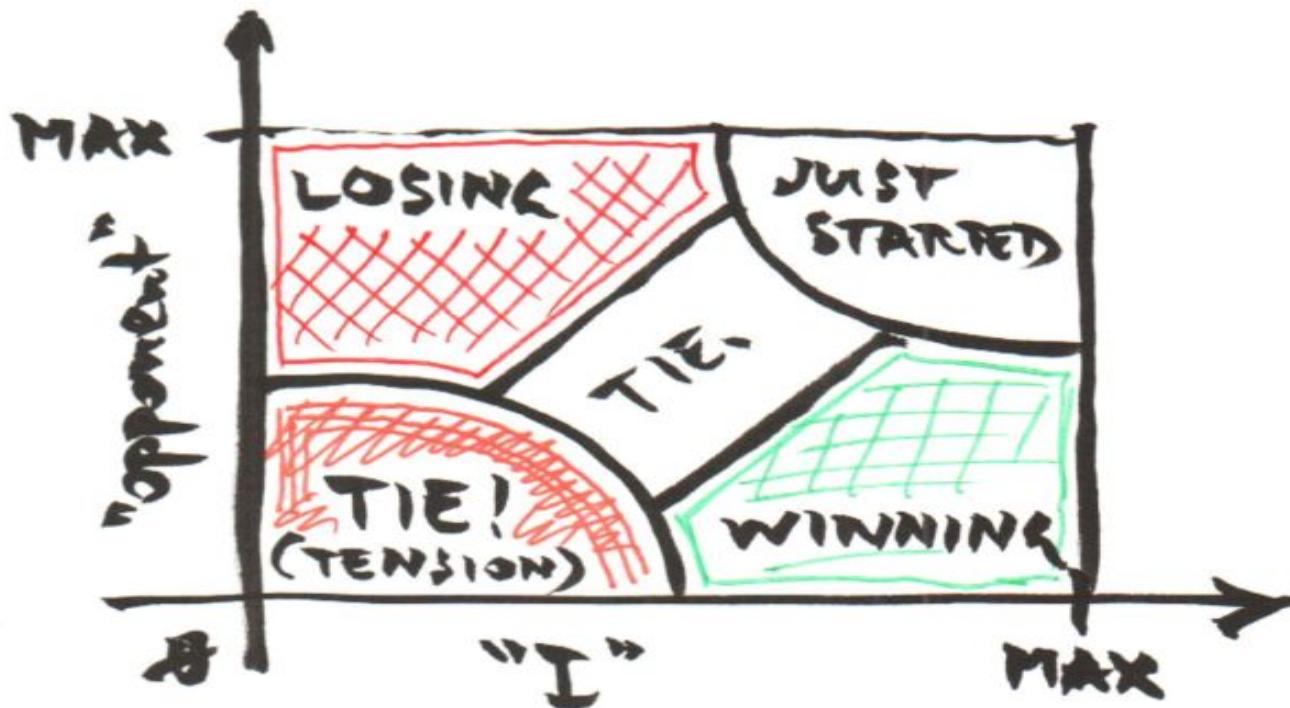
Soundtrack Structure



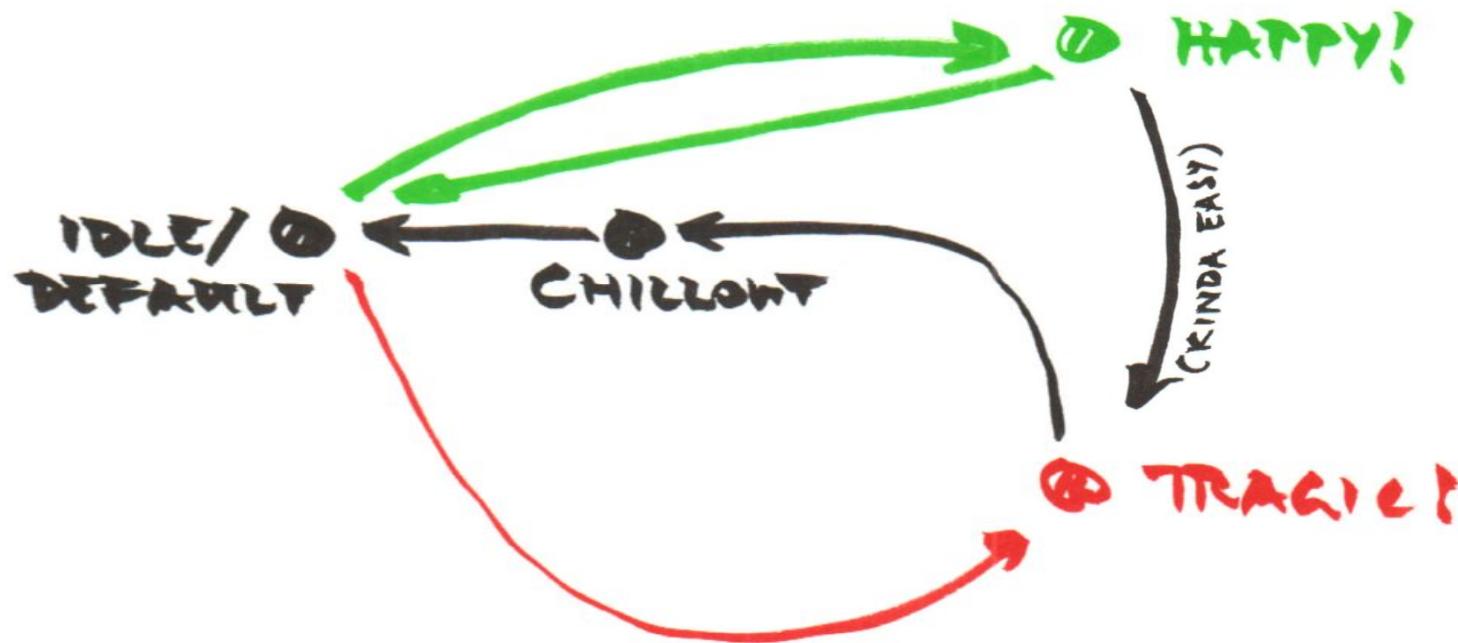
PROXIMITY



ONE-ON-ONE COMBAT



DIALOG



Dialog

- Do not play music while someone is talking!
 - Fine print: Except, of course, when you feel like it
 - Fine print below fine print: Know why you like it, though.

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

Kingdom Come: Deliverance

- 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



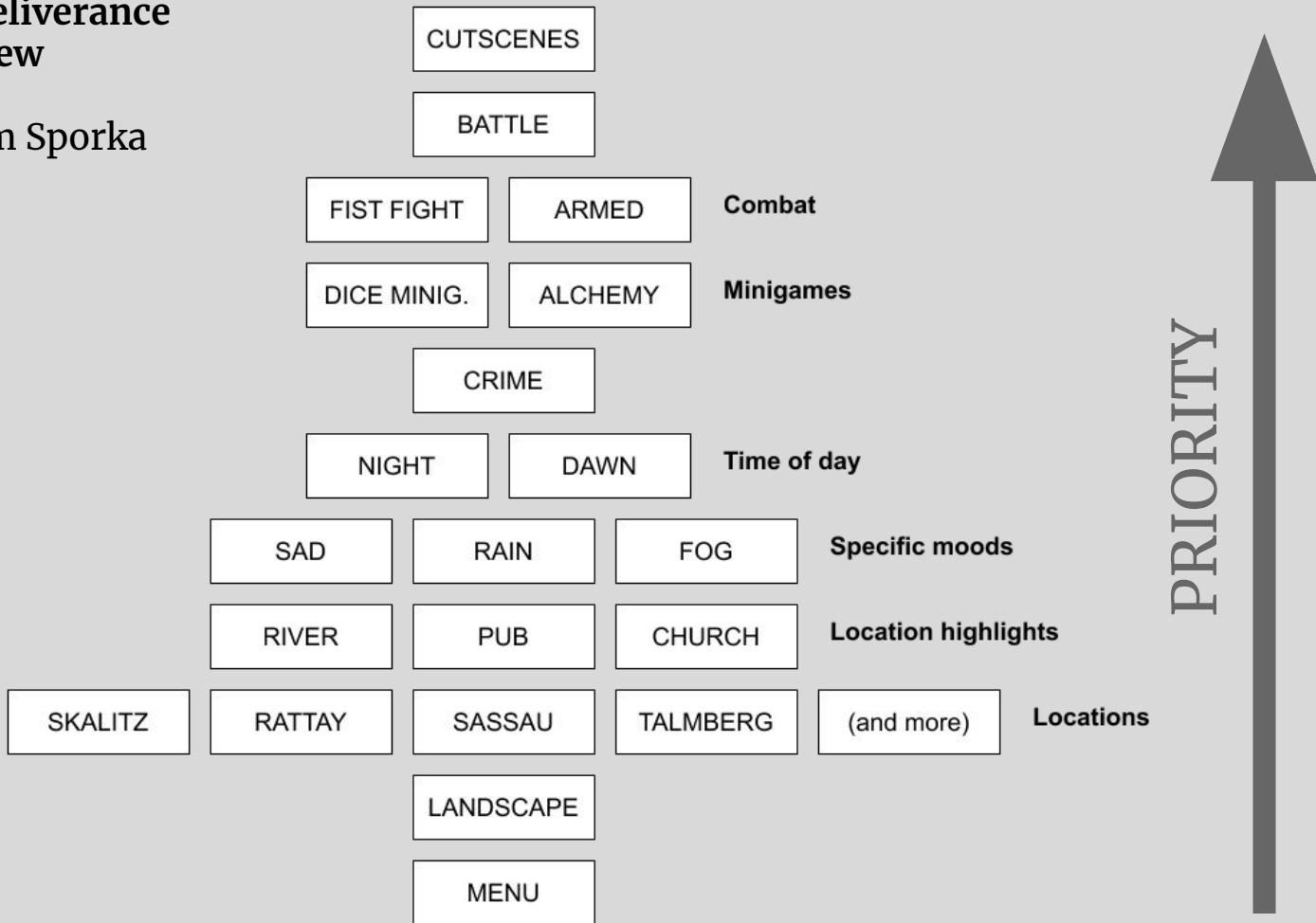




Photo by Daniel Vávra

Kingdom Come: Deliverance Soundtrack Overview

by Jan Valta & Adam Sporka



Repetition

Problem: Repetitions may be annoying
Unique material is expensive

Solution: Find the balance of repetition and unique material.
Iterate your compositions.
Seek feedback.

Repetition

Observation: Music does not have to play always

Solution: Have a dramaturgy of silence and music

Frequency of Changes

Observation: Deliberate change of music: Perceived as event.

Problem: Happens too often → sounds forced.

Approach: Have a detailed strategy how to deal with change.
Count and cap the number of changes.

High-level Design

a.k.a. Dramaturgy

What to play, when, and why?

Low-level Design

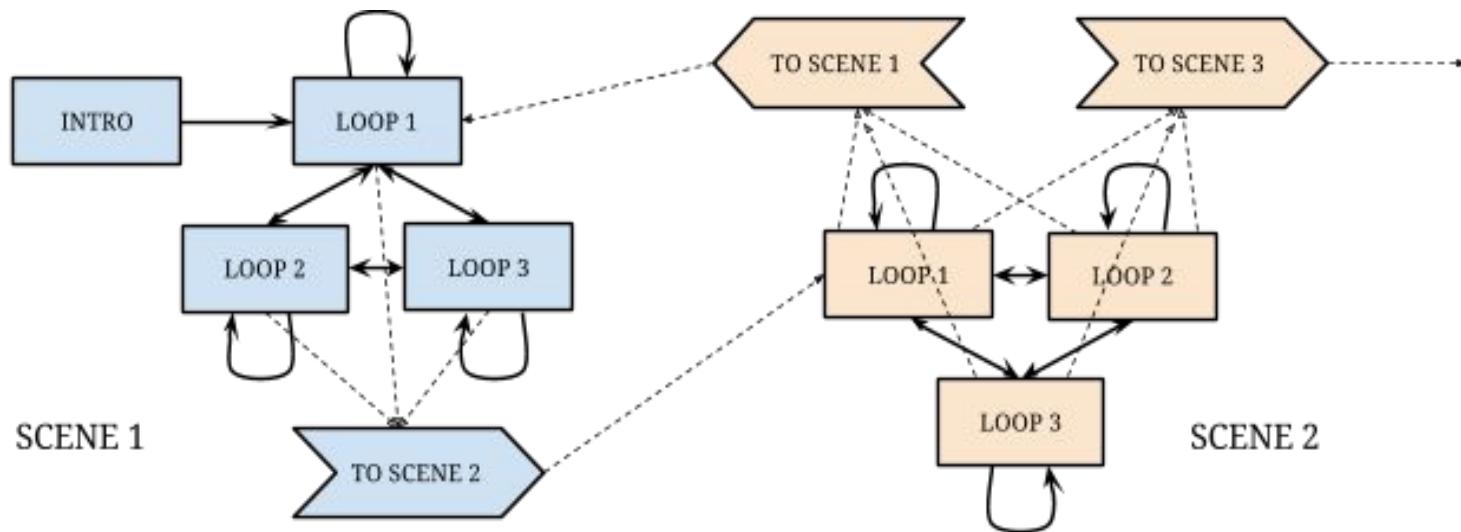
Transitions

How to get there? Crossfades? Resequencing?

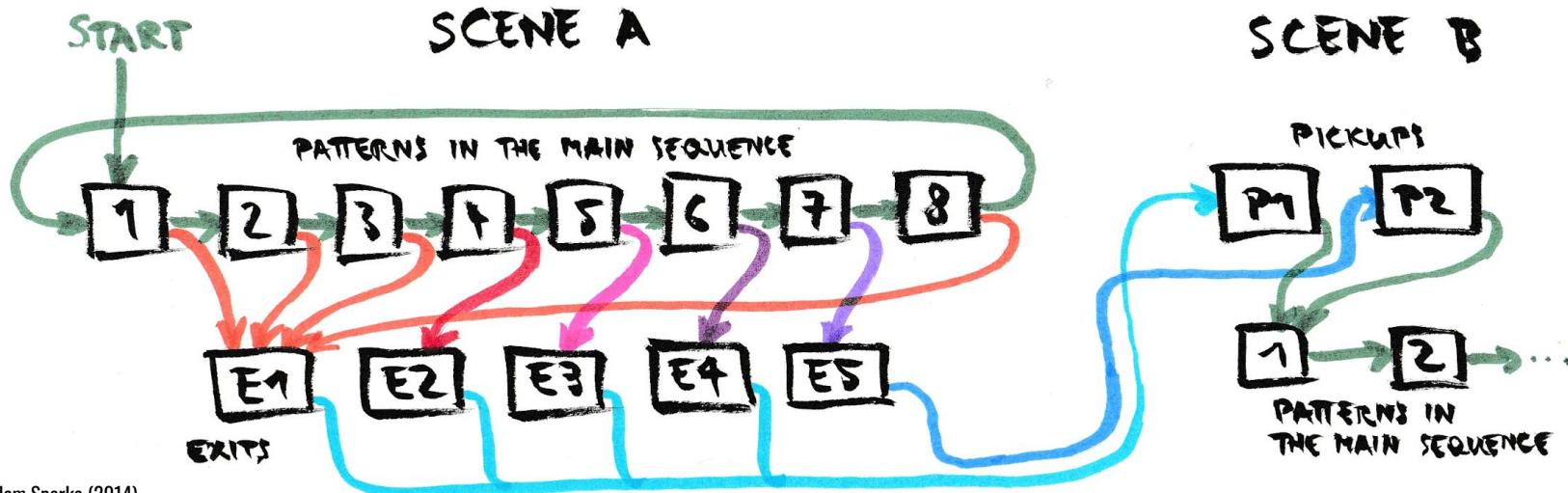
Not-so-good Transitions

- Fortnite: Lobby / Battle Pass screens
- The Sims 4
<https://youtu.be/ICmP6HDXLKc?t=183>

Resequencing



Example: Transition by Resequencing from “A” to “B”

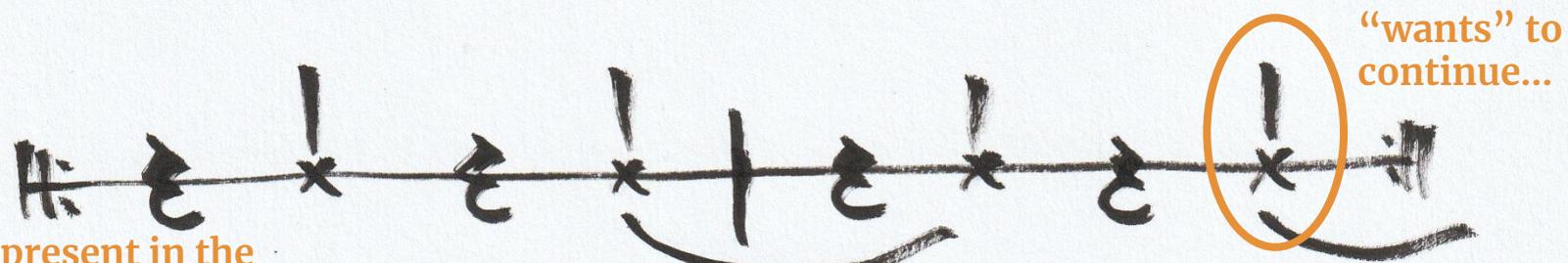


by Adam Sporka (2014)

- Scene “A” are patterns ||:12345678:||
- A route of patterns exists from “A” to “B”
- Dedicated exits E1..E5 of “A” follow different patterns
- Dedicated pickups in “B” for different exits

Connecting Loops

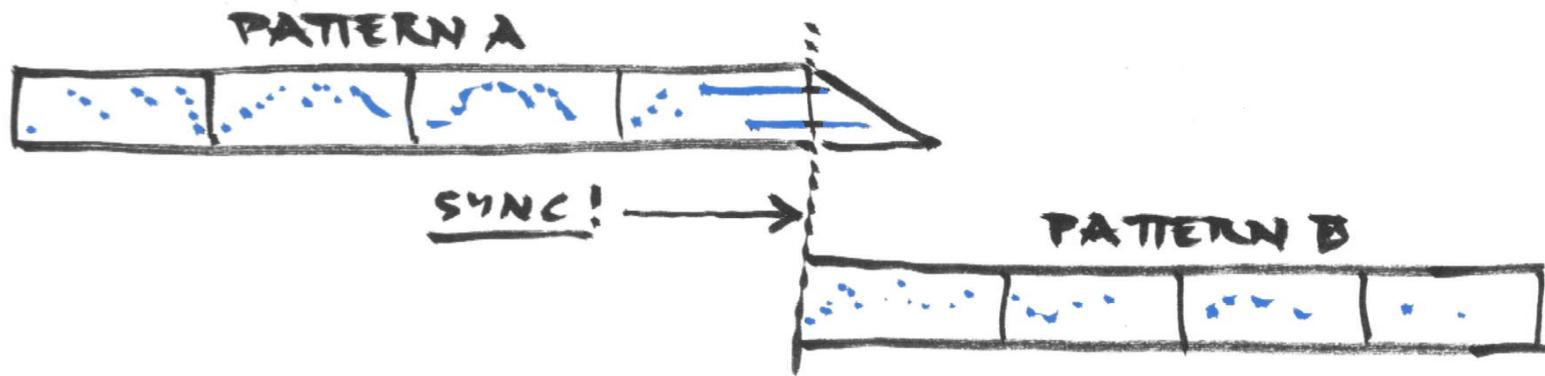
Problem: Overhanging tones



... but not present in the previous iteration

Connecting Loops

- Let tracks “bleed” one into another



Overlaps are Important

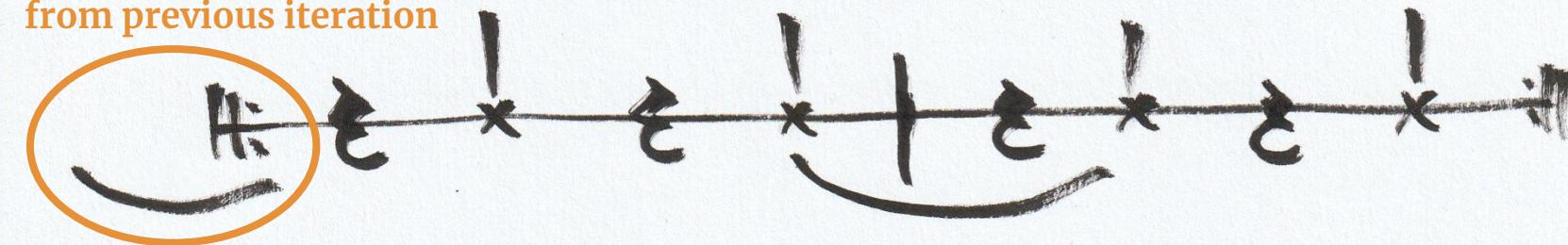
with overlaps

without overlaps

Connecting Loops

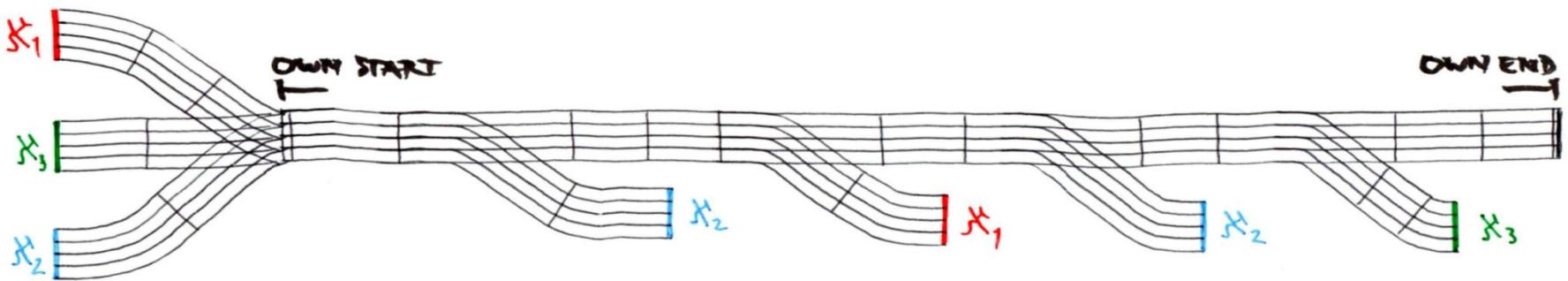
Problem: Overhanging tones

“wants” to continue
from previous iteration



Example: e:\Dropbox\talks\music_examples\2b-danger-overlaps
Solution: Don't let that happen :)

Low-level Structure of KC:D Music



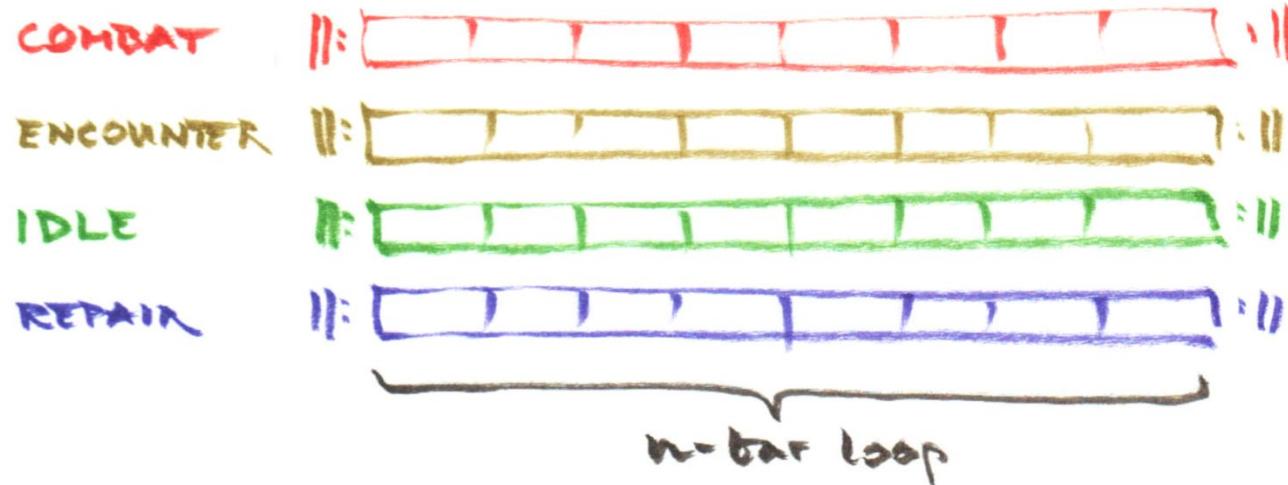
Design by Adam Sporka and Jan Valta

Layering (a.k.a. Reorchestration)

Technique: Add more music to the base layer to steer the mood



Reorchestration (Layering)



The Space Game (2009)
CasualCollective.com

0'00"
Menu

0'30"
Idle

1'57"
Encounter

2'12"
Combat

2'38"
Idle

2'54"
Repair

6'19"
Complete

THE SPACE GAME

25th Feb v1.07

Training

Missions

Mining Modes

Survival Modes

Bonus Modes

Credits

mine YOUR way INTO enemy space

Select an asteroid field to mine. The deeper you mine into enemy space the more pirates you attract!



Layering of Melodies

Problem: Cross-fade may result in dissonance <demo>

Musical notation illustrating two layers of melodies:

- Layer 2:** Notes A, B, C, D, E, F.
- Layer 1:** Notes A, B, C, D, E, F.

The notation shows overlapping segments between the two layers, indicated by red vertical bars. The segments are: (A,B), (B,C), (C,D), (D,E), (E,F).

Solutions:

- (1) Make sure all combinations of layers sounds nice
- (2) Keep any melodies in the base layer only

The Button

Two Bulbs Studio (2017)



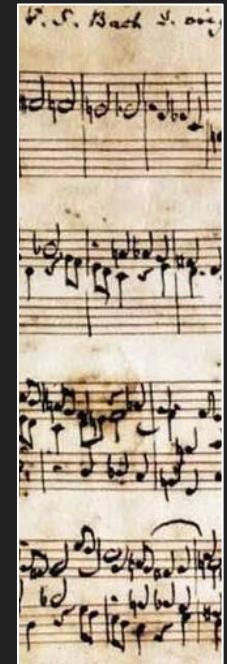
Layering of Melodies

Objective:

When adding a layer, the voices need to make space for each other

Tips:

Added melody: 2nd voice, counterpoint
Adding beat texture: safer
Adding sfx pad: safest



Layering of Melodies

Problem: Fading in the middle of the phrase disrupts the flow.



Solution: “Guard” the phrases when crossfading

N.B.T.: Keep any melodies in the base layer only

Layering: Timing Issues

Problem: Can't rely on synchronicity of the layers.

Layer 2

senza misura

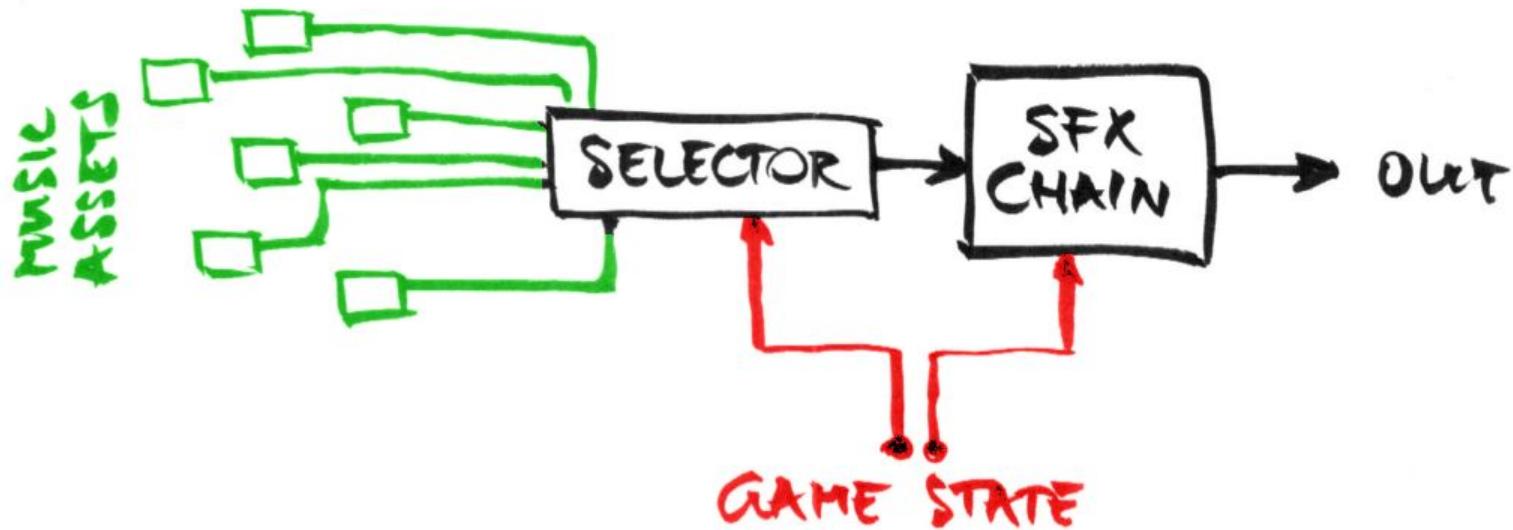
Layer 1

A musical score consisting of two layers. The top layer, labeled "Layer 2", features a treble clef and a "C" time signature. The bottom layer, labeled "Layer 1", also features a treble clef. Both layers consist of five empty measures, indicated by vertical bar lines.

Solution: Use sample-precise middleware

N.B.T.: Discernible beat only in one of the layers

Modulation



The Old Man Game (Working Title)

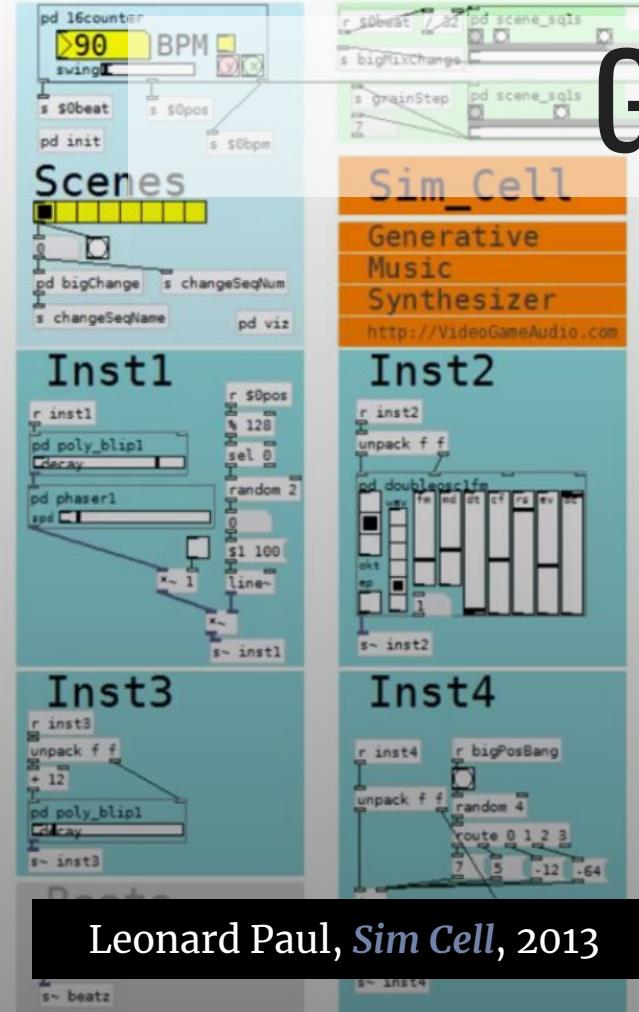


- Low-pass filter applied when the character is hiding
- by Retro Army Ltd, music by Lachlan Cohen
<https://twitter.com/ComposerCohen/status/1194401618332024833>

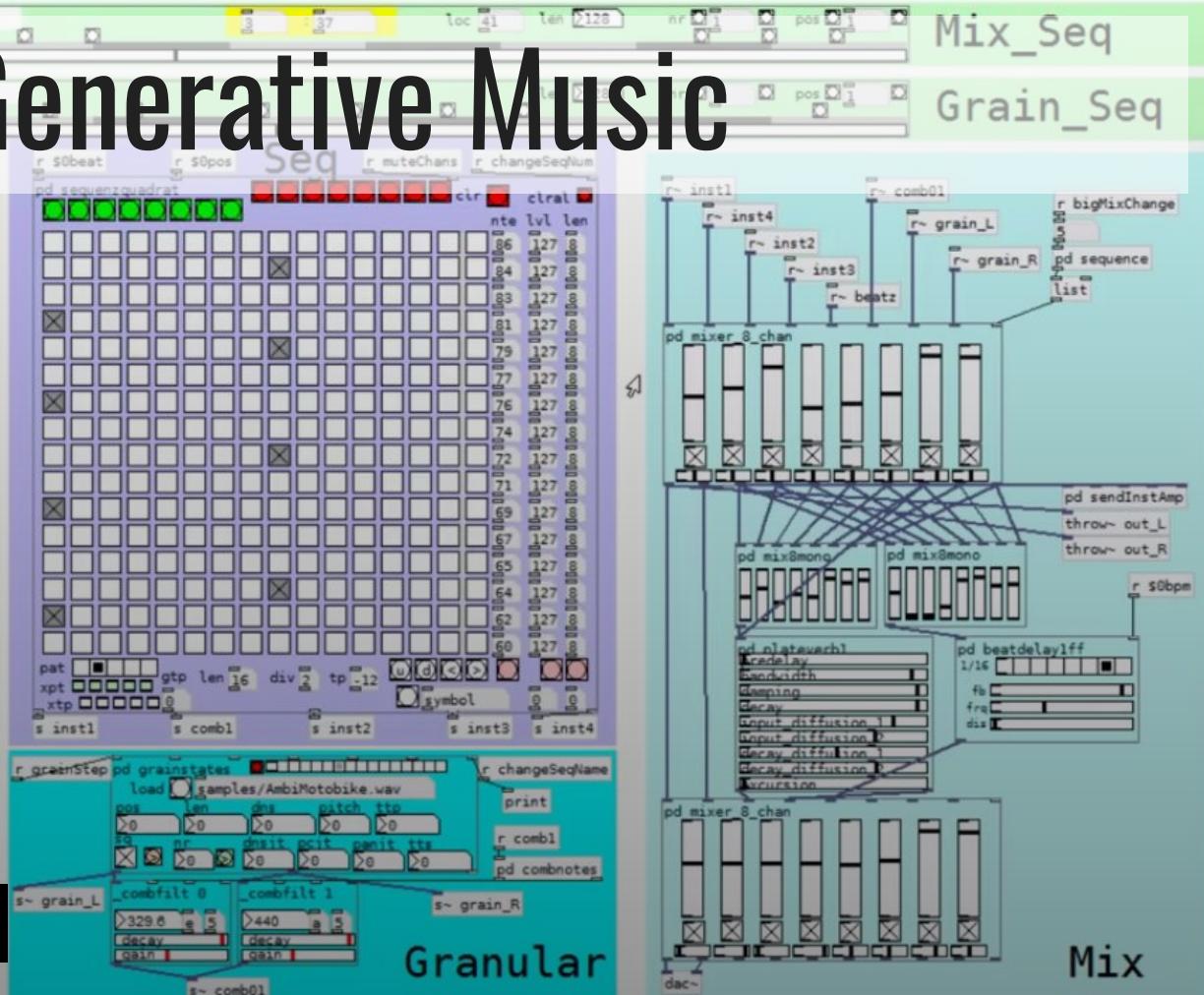


Modulation:
High-pass filter
during game over

Subway Surfers
Kiloo, SYBO Games
(2012+)



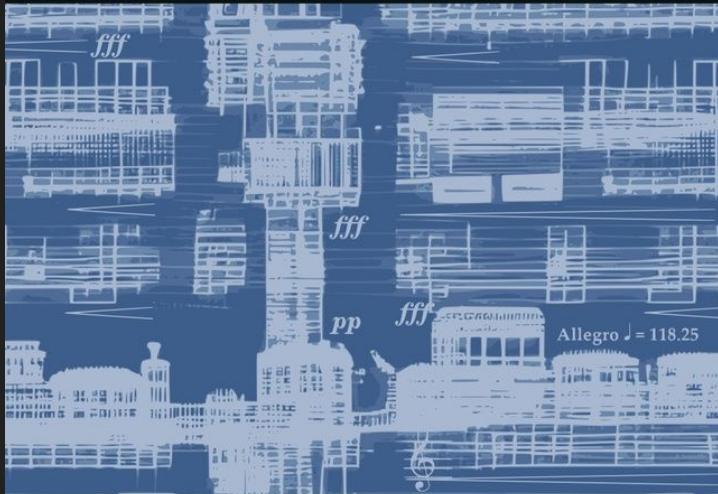
Generative Music



Leonard Paul, *Sim Cell*, 2013

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Strategies for meaningful adaptive music in video games



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