INSIDE

Sonic College 2026
Jakob Schmid

Overview

- Introduction
- Animation Events
- Cloth
- Voice Sequencer
- Voice Configuration
- Wrapping Up


INSIDE
PLAYDEAD
Xbox One, PS4, PC, iOS, Switch
Developed over 6 years
INSIDE
playdead.com/inside

Playdead

Released LIMBO in 2010

Copenhagen-based

Around 25 employees in 2016

Game Developers Choice Awards 2016

Best Audio, Best Visual Art

Game Critics Awards 2016

Best Independent Game

The Game Awards 2016

Best Art Direction, Best Independent Game

DICE Awards 2016

Spirit Award, Art Direction, Game Direction

13th British Academy Games Awards

Artistic Achievement, Game Design, Narrative, Original Property

The Edge Awards 2016

Best Audio Design

INSIDE Audio Team

Martin Stig Andersen	audio director, sound designer, composer
Andreas Frostholm	sound designer
Søs Gunver Ryberg	composer, sound designer
Jakob Schmid	audio programmer

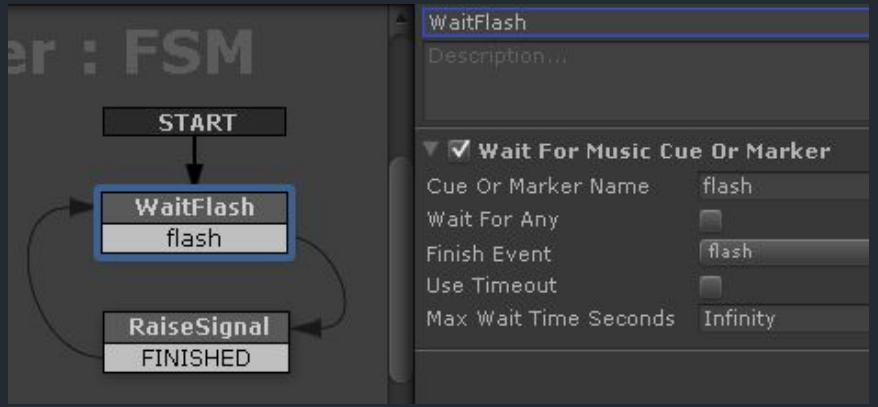
INSIDE Technology

Unity

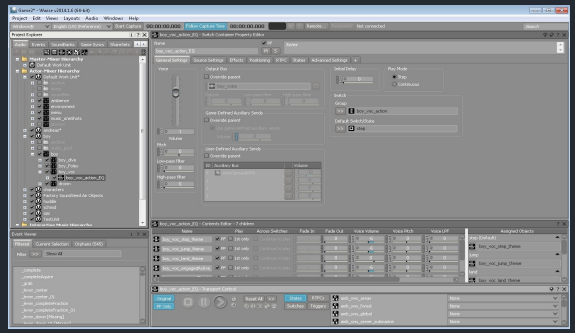
Audiokinetic Wwise

Modified Wwise-Unity plugin

PlayMaker



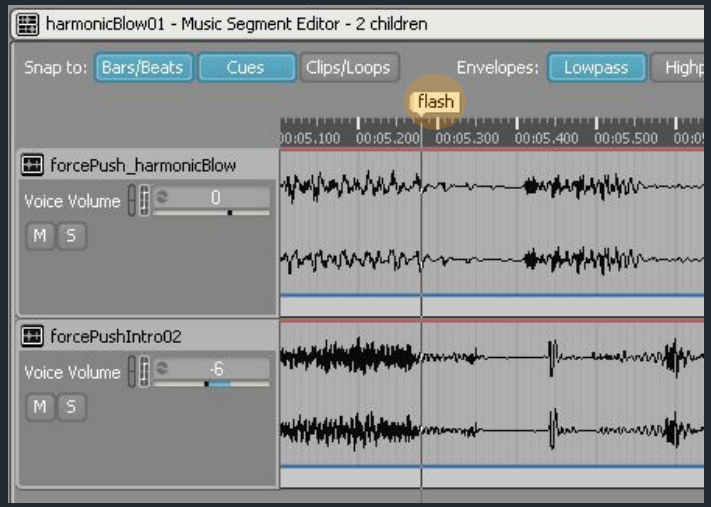
PlayMaker visual scripting

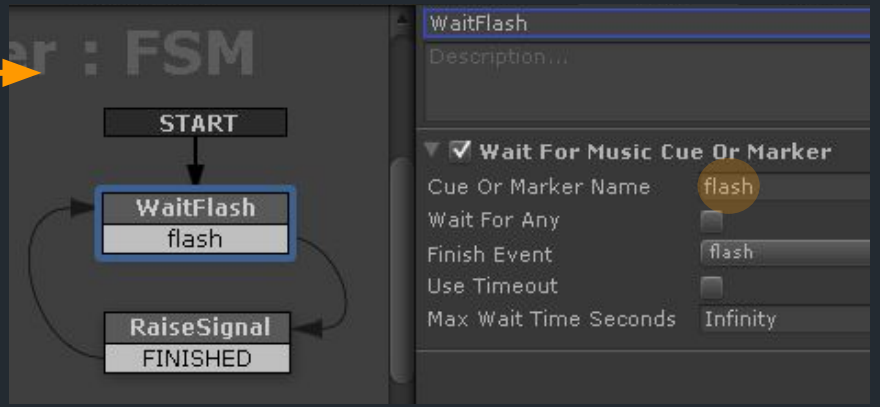


Wwise Authoring Tool
(2014.1.6)

Audio-driven Gameplay: User Cues

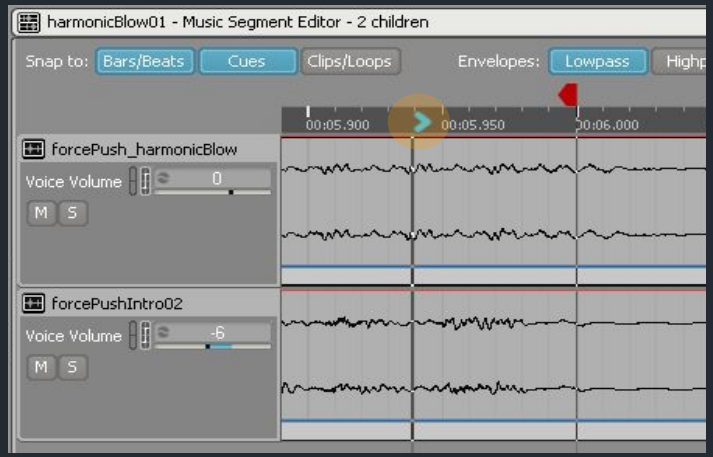
- Music segments can have User Cues
- Received in Unity the next frame

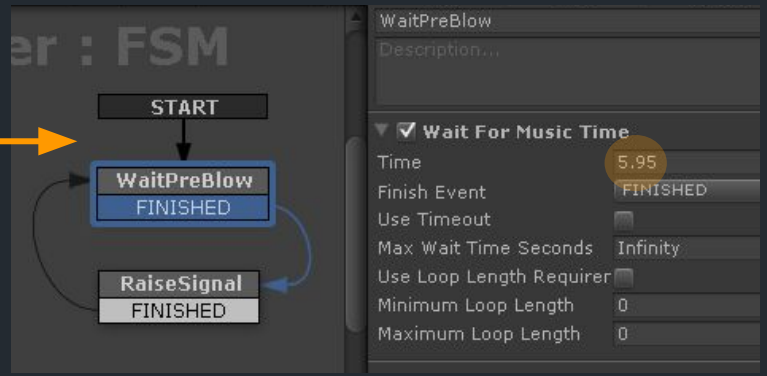




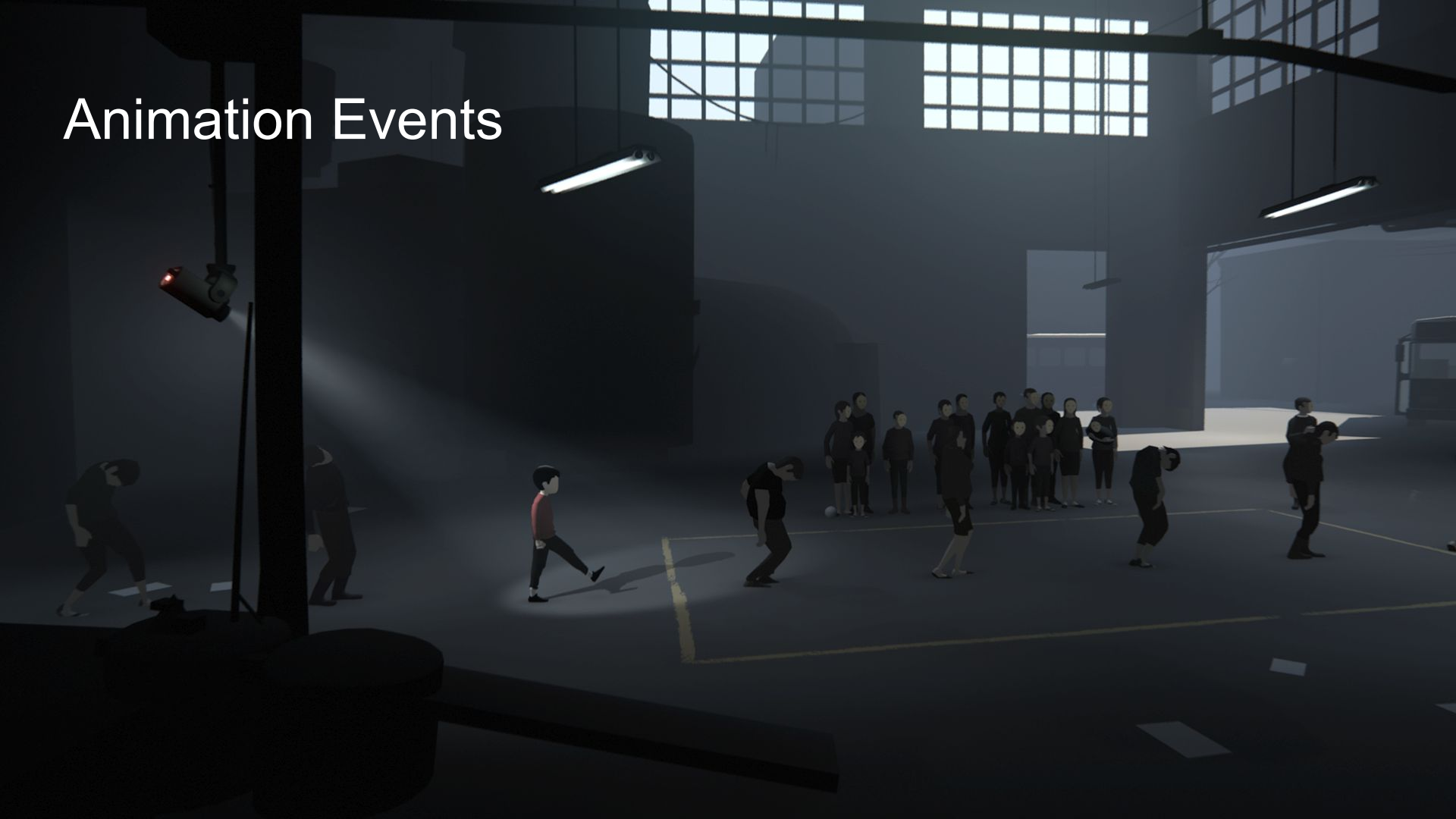
Getting Music Time

The game can also get music time information directly from Wwise



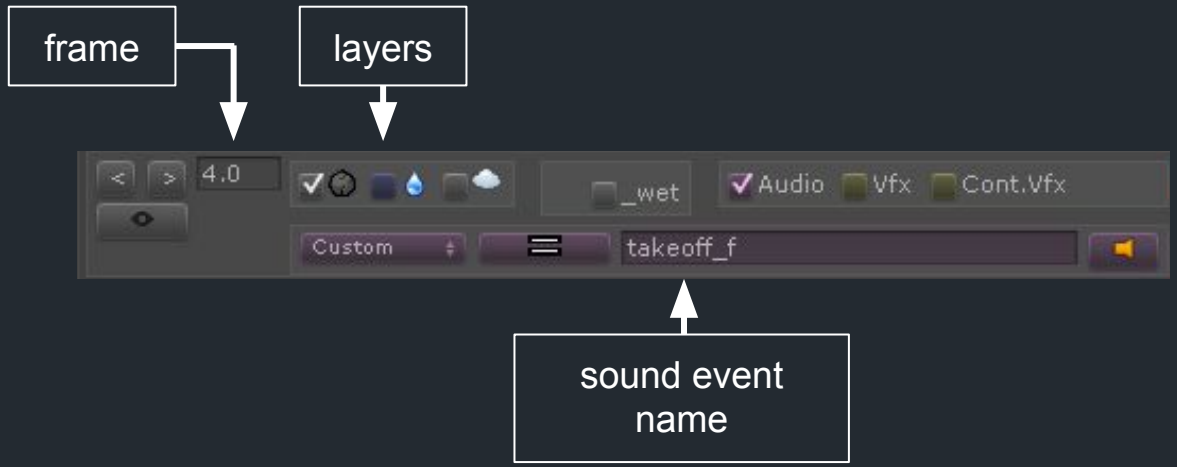


Animation Events



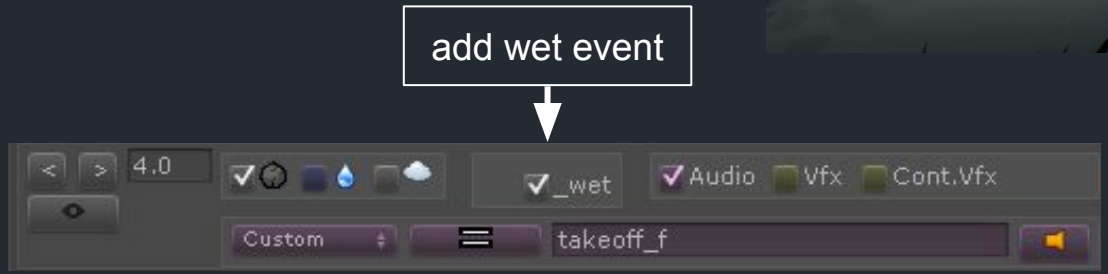
Custom Animation Events

- Name of sound event specified directly
- Fires when animation frame has been passed
- Checks layers: ground, water, air



Wet Animation Events

- Optionally plays additional wet sound event
- Current wetness is sent as a parameter
  - Is set high when in water or on a wet surface
  - When dry, approaches 0 over time



Matrix Animation Events

- **Matrix key** instead of sound event name
- Context-dependent sounds

  e.g. from 'run' to 'stop' yields 'brake'

Matrix Animation Events

previous key

current key

previous key \ current key	any	idle	sprint	run	jog	walk	sneak	JumpUp	JumpForward
any	none		sprint	run	jog	walk	sneak	jump_2feet_f	jump_1foot_mf
idle					takeoff_mf	takeoff_mp	takeoff_p		
sprint									jump_1foot_f
run									jump_1foot_mf
jog			run						jump_1foot_mp
walk			run	jog					jump_1foot_p
sneak			jog	jog	walk				jump_1foot_p
JumpUp									
JumpForward									
RunTurnRun									
RunStop									

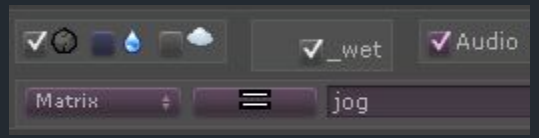
Current Matrix Key

- Current key is specified in current animation event

jog

current key: jog

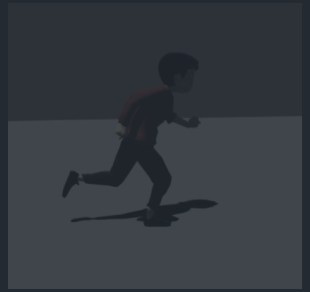
	any	idle	sprint	run	jog
any	none		sprint	run	jog
idle					takeoff_mf
sprint					
run					
jog			run		
walk			run	jog	
sneak			jog	jog	walk
JumpUp					
JumpForward					
RunTurnRun					
RunStop					



Previous Matrix Key

- Previous key was specified in previous animation event

idle



previous key: idle

	any	idle	sprint	run	jog
any	none		sprint	run	jog
idle					takeoff_mf
sprint					
run					
jog			run		
walk			run	jog	
sneak			jog	jog	walk
JumpUp					
JumpForward					
RunTurnRun					
RunStop					

Play Sound

idle

jog

previous key: idle

current key: jog

	any	idle	sprint	run	jog
any	none		sprint	run	jog
idle					takeoff_mf
sprint					
run					
jog			run		
walk			run	jog	
sneak			jog	jog	walk
JumpUp					
JumpForward					
RunTurnRun					
RunStop					

play sound 'takeoff_mf'

Context Sensitivity

- If previous matrix key was 'sneak', a different sound is played

sneak

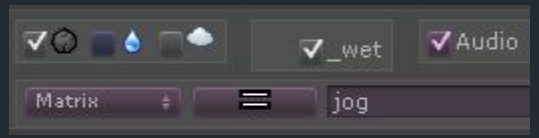
jog

previous key: sneak

current key: jog

	any	idle	sprint	run	jog
any	none		sprint	run	jog
idle					takeoff_mf
sprint					
run					
jog			run		
walk			run	jog	
sneak			jog	jog	walk
JumpUp					
JumpForward					
RunTurnRun					
RunStop					

play sound 'walk'



Column Default

- Empty entries are replaced with column default

idle

run

previous key: idle

current key: run

	any	idle	sprint	run	jog
any	none		sprint	run	jog
idle					takeoff_mf
sprint					
run					
jog			run		
walk			run	jog	
sneak			jog	jog	walk
JumpUp					
JumpForward					
RunTurnRun					
RunStop					

play sound 'run'

Cloth

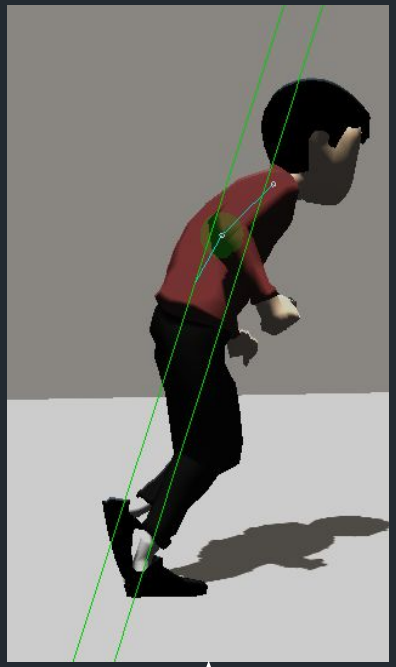
Cloth

- Sound of clothes rubbing against itself
- Generated at runtime from character geometry
- Sounds are selected based on movement speed

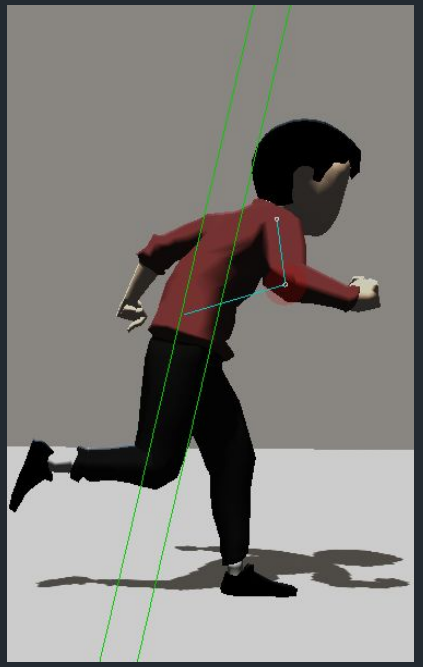
Elbow Torso Pass

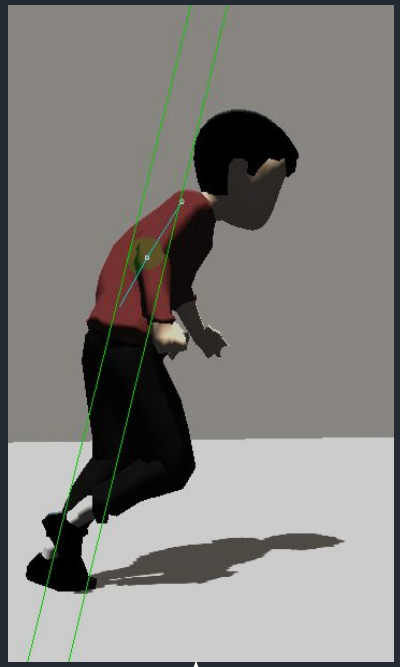
- Send elbow speed parameter
- Play sound when elbow enters 'brush zone'

Elbow Torso Pass



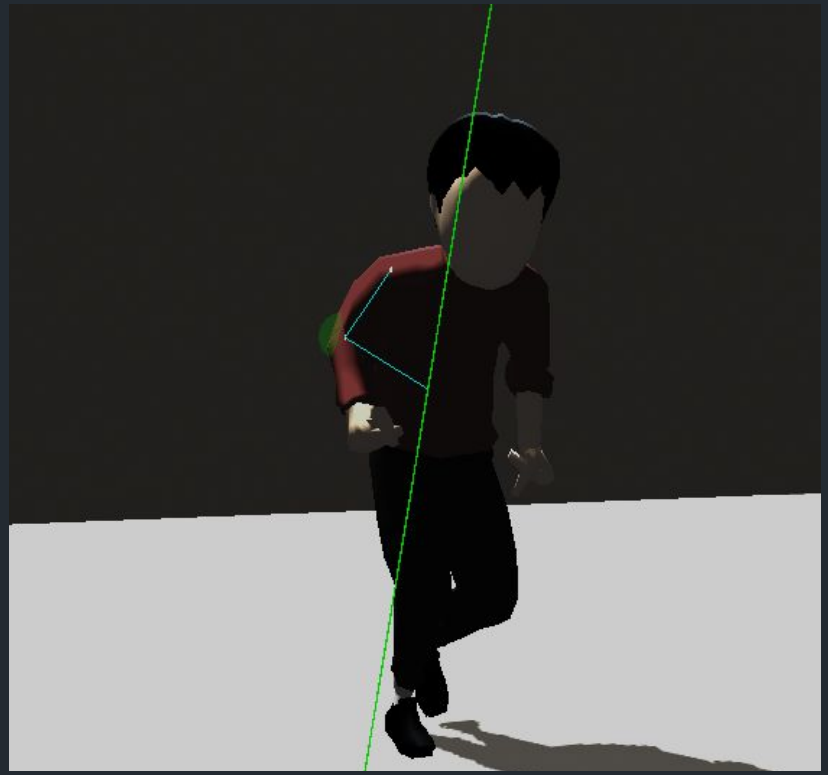
brush

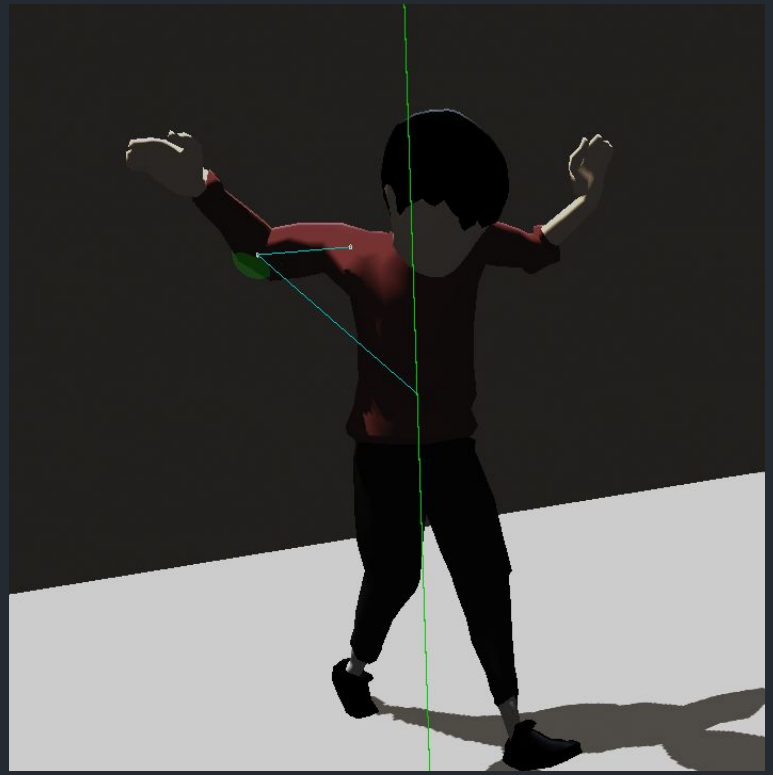




brush

Arm Angle





Voice Sequencer

Voice Concept

- Natural and adaptable audio playback
- Integration of physical and emotional states

Voice Demo

Voice Sequencer

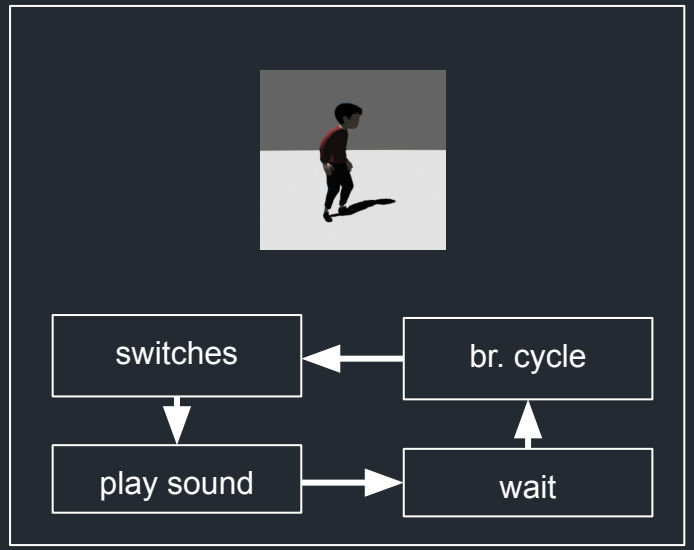
- Sequencer implemented in C# using Wwise callbacks
- Sequences voice sound events, alternating between inhale and exhale

Voice Sound Events

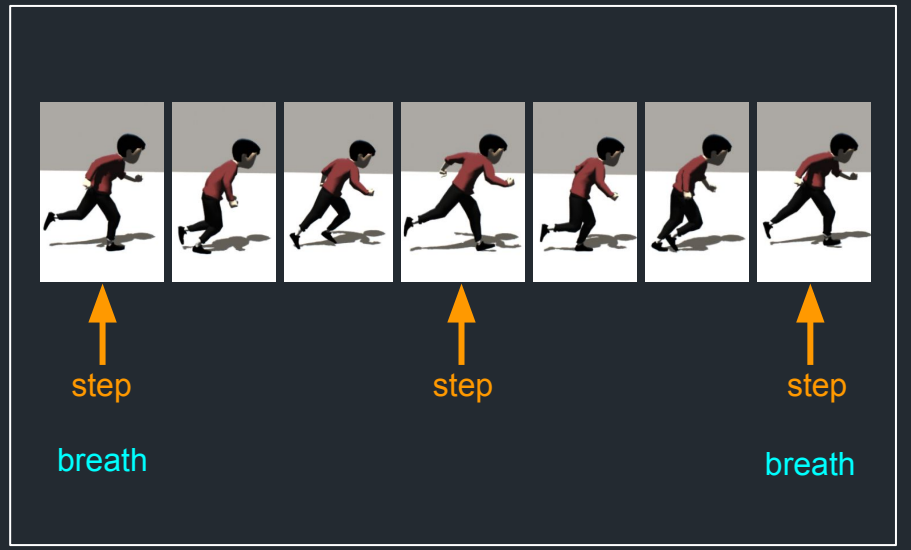
- Which sound to play is defined by switches:
  - Action
  - Emotion
  - Intensity
  - Etc.
- Intensity is a numeric value:
  - Increases with physical exertion
  - Decreases when idle

Voice Sequencer Modes

Continuous Mode

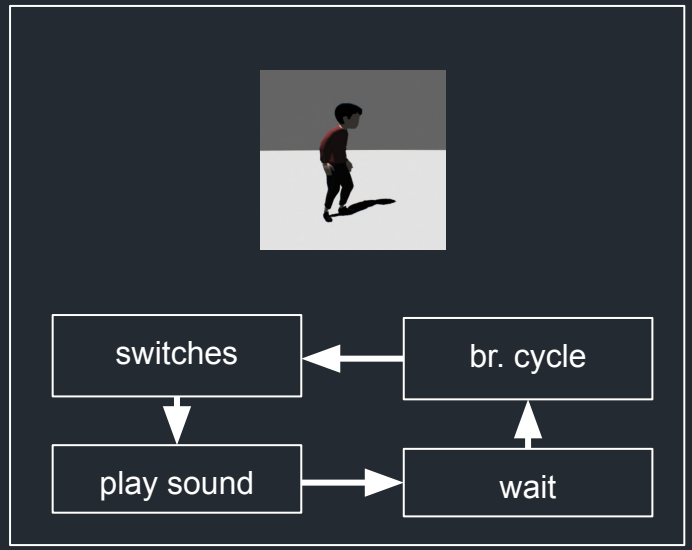


Rhythmic Breathing



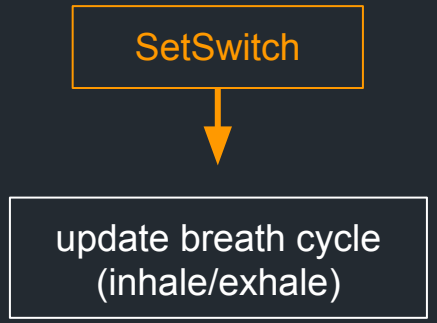
Voice Sequencer Modes

Continuous Mode

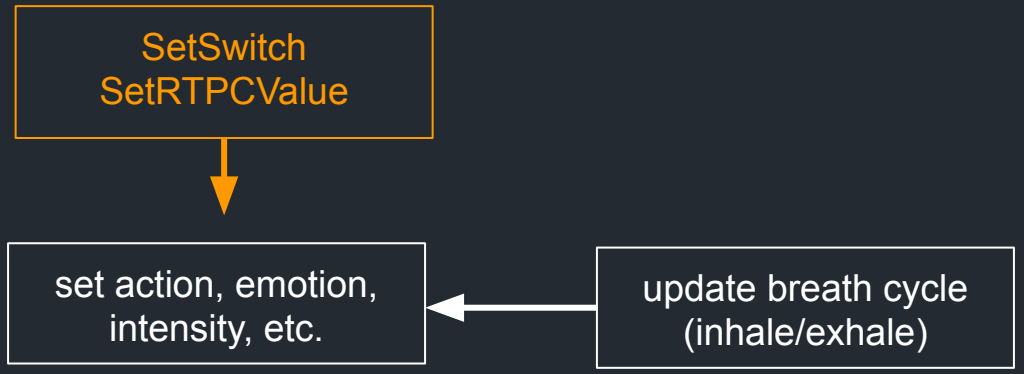


Rhythmic Breathing

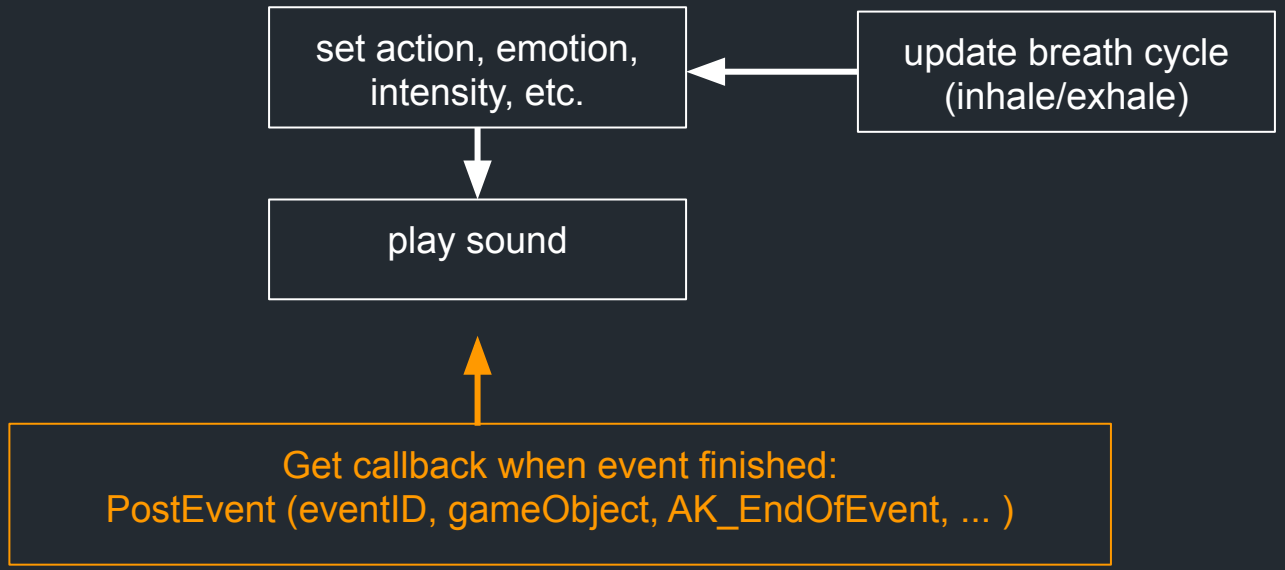
Voice Sequencer: Continuous Mode



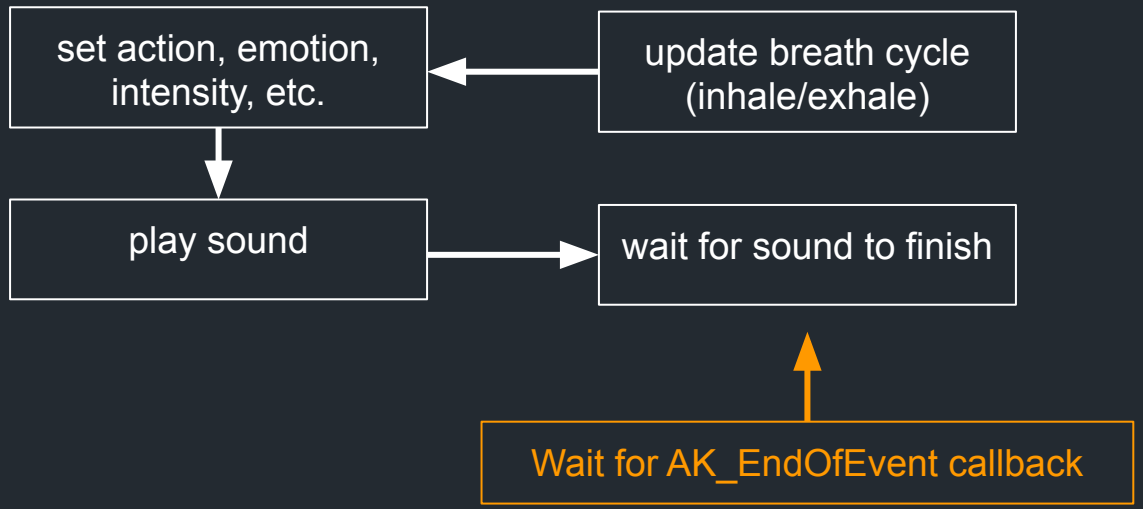
Voice Sequencer: Continuous Mode



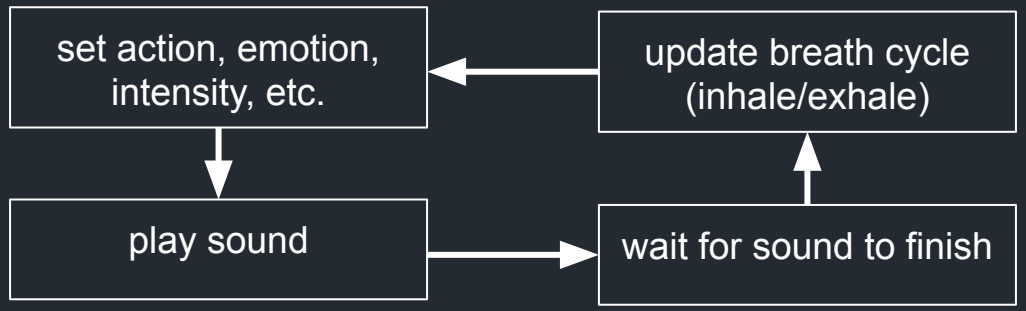
Voice Sequencer: Continuous Mode



Voice Sequencer: Continuous Mode

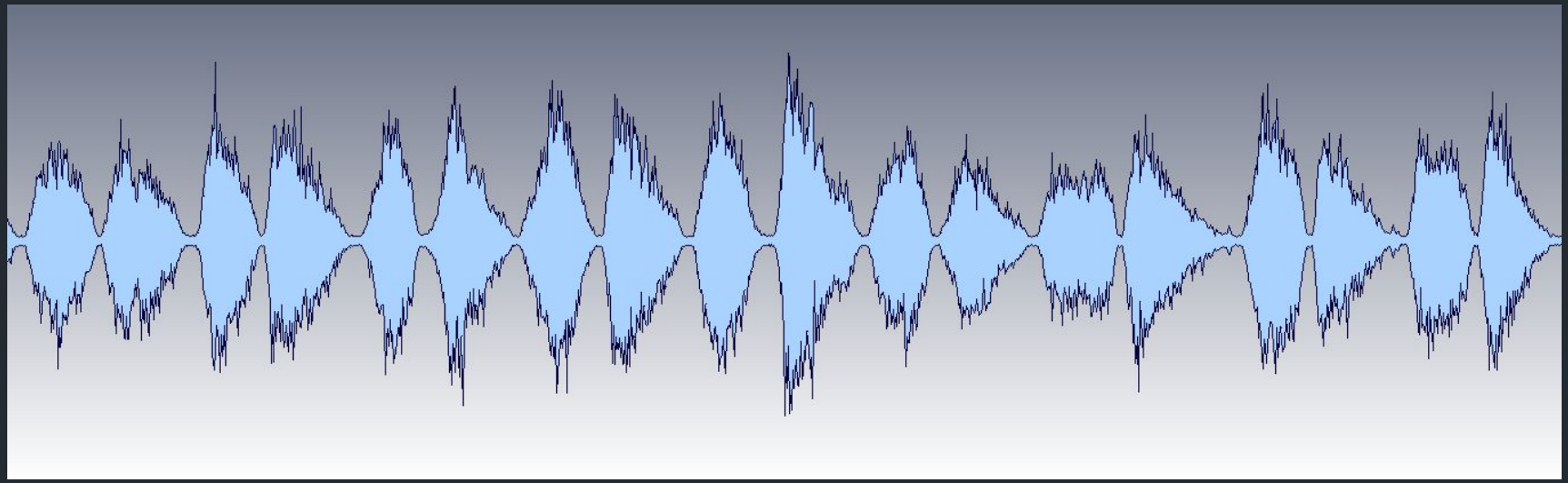


Voice Sequencer: Continuous Mode



Natural Breathing

- Recorded breath sounds have varying durations
- Continuous sequencing results in natural, uneven breathing pattern



Animation Feedback

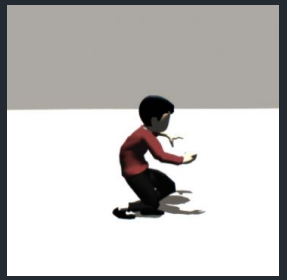
- Every breath results in a callback to the game
- Callback controls additive breathing animation, affecting boy pose

Holding Breath

On jump:

if currently inhaling, stop afterwards

if currently exhaling, do a quick inhale, then stop



On land:

restart breathing with exhale (action = land)

soft impact: normal exhale, hard impact: grunt

Engagement Actions

Special actions indicate performing work, uses different set of sounds

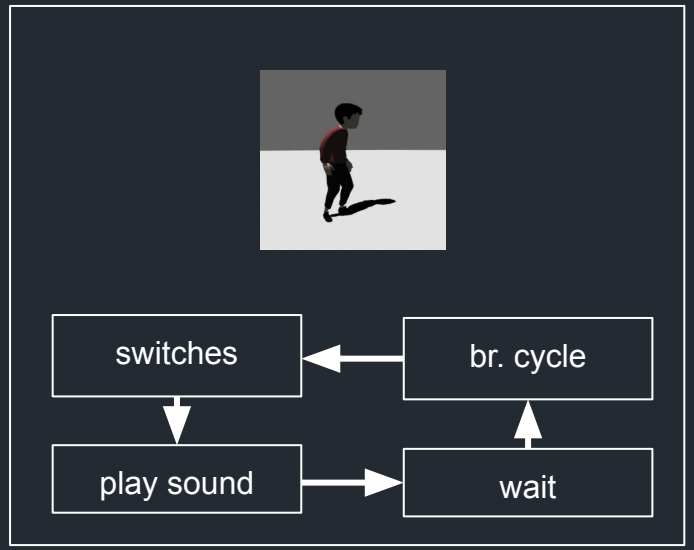
not engaged

engaged passive

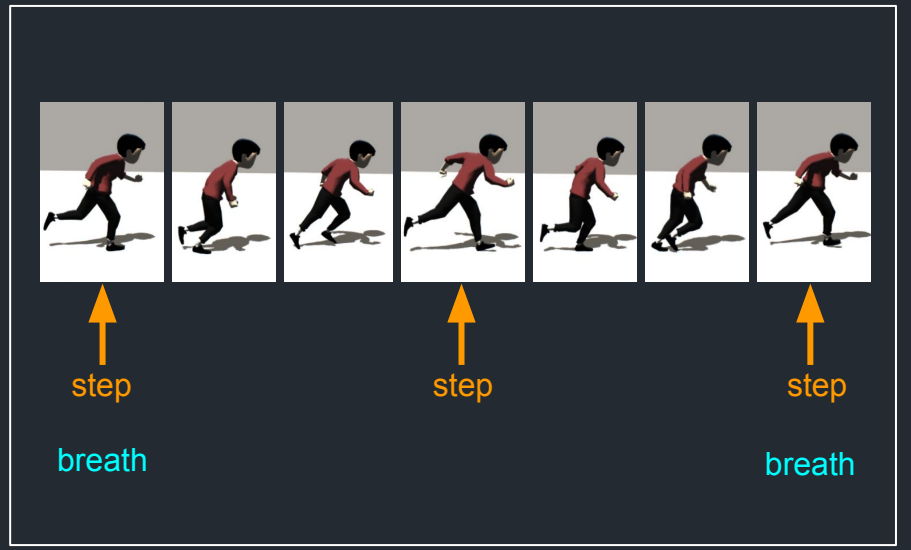
engaged active

Voice Sequencer Modes

Continuous Mode

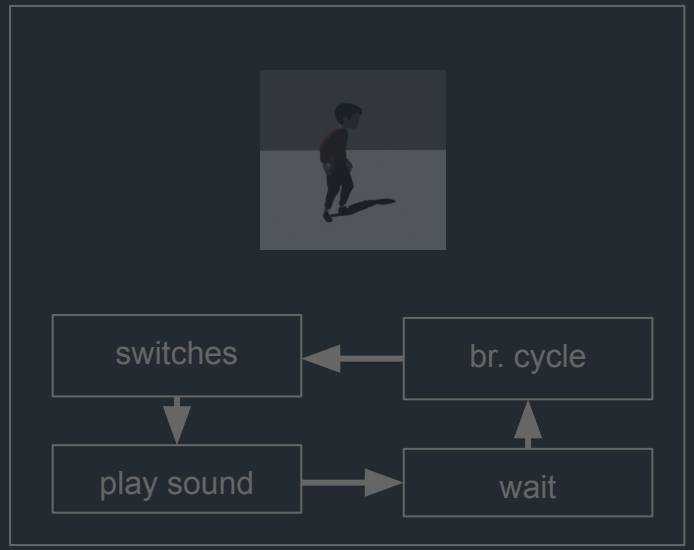


Rhythmic Breathing

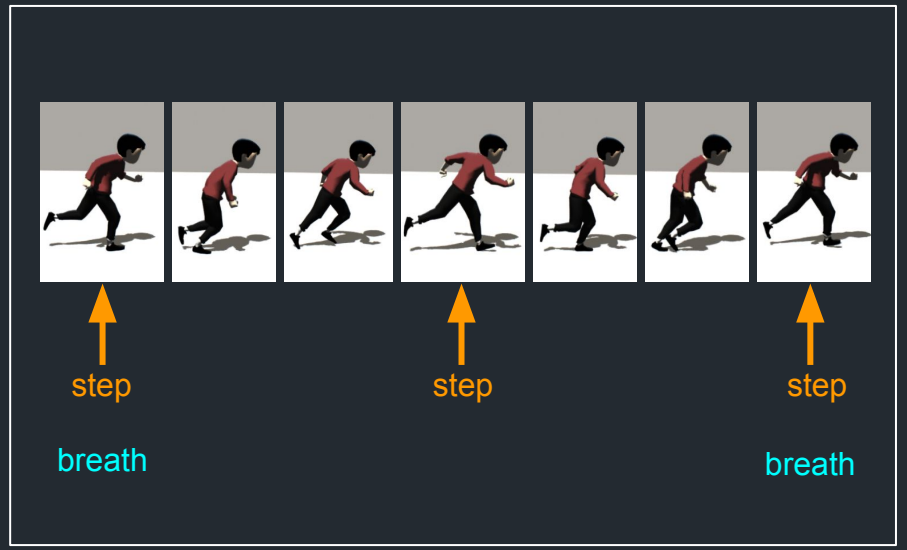


Voice Sequencer Modes

Continuous Mode



Rhythmic Breathing



Rhythmic Breathing

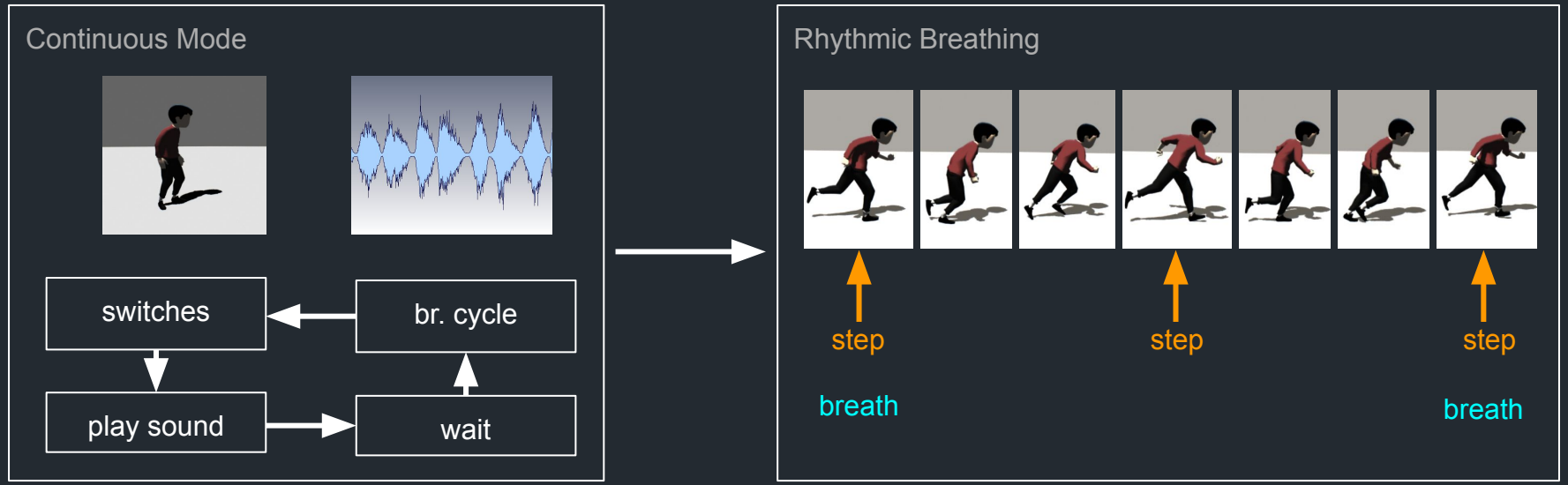
- Goal: breath should align with footsteps when running
- Non-continuous sequencing

Rhythmic Breathing

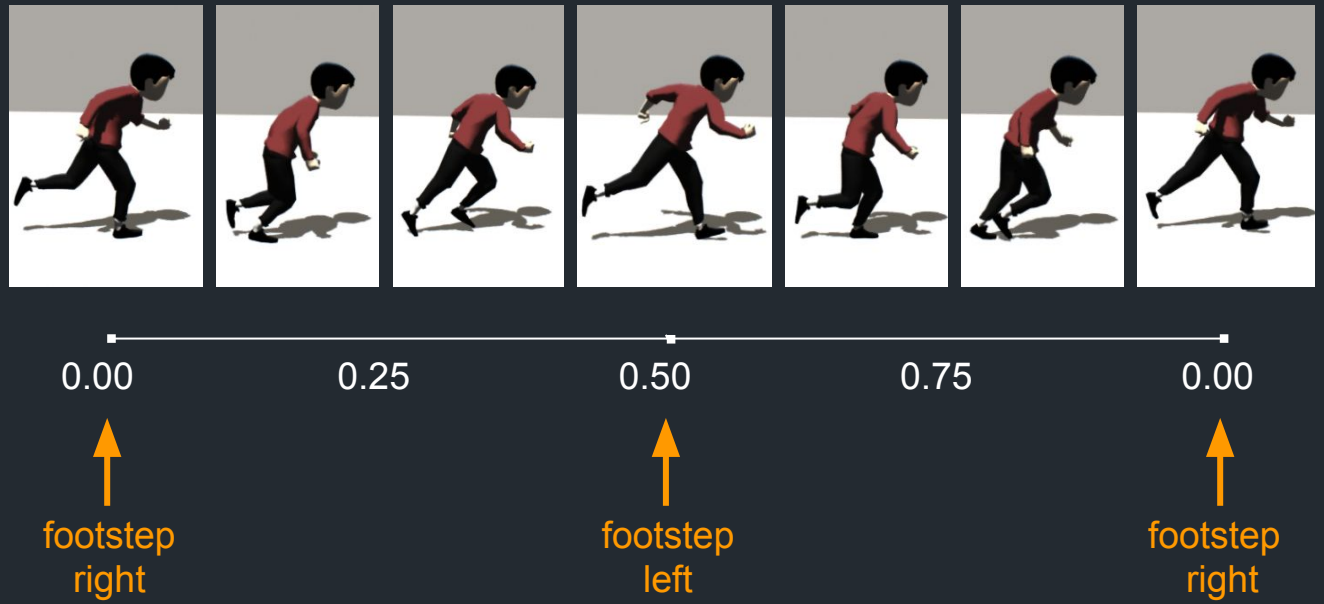
- Goal: breath should align with footsteps when running
- Non-continuous sequencing
- 1 breath for every 2 steps

Rhythmic Breathing Transition

- When not running, breath runs continuously
- When starting to run, gradually transition from continuous rhythm to footstep rhythm



Run Cycle Phase

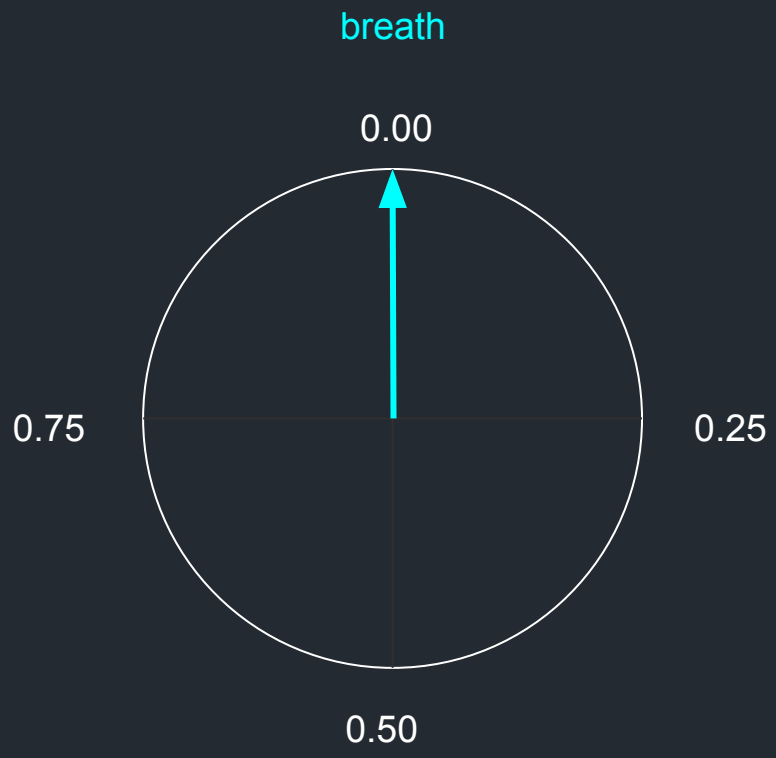


Run Cycle Phase

- Full cycle is 2 steps
- Right footstep on 0.0
- Left footstep on 0.5

Breath Phase

- Breathe when phase is 0
- Full cycle is 1 breath
- When switching from continuous to rhythmic breathing:
  - Compute frequency from last 2 breaths
  - Compute phase from frequency and last breath time



Gradual Alignment

- Gradually align breath rhythm to run cycle rhythm
- Align two **frequency, phase** pairs

Gradual Alignment Problem

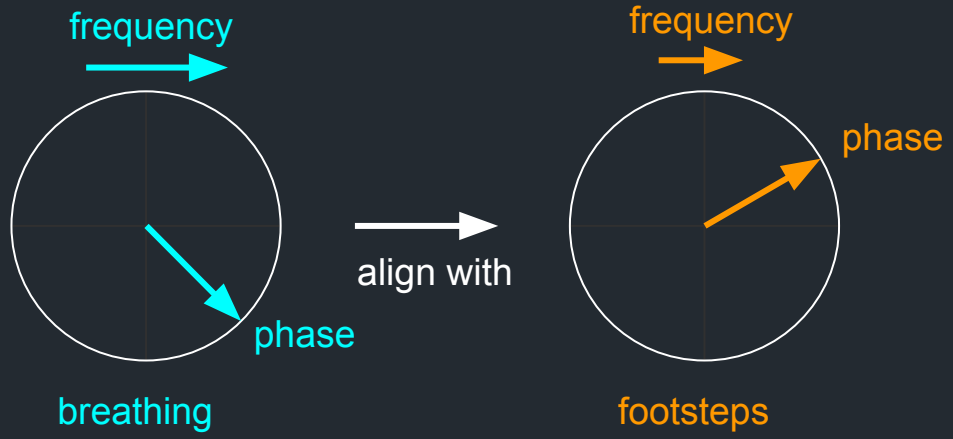
- General problem: aligning two **frequency, phase** pairs

Solution: Beat Matching

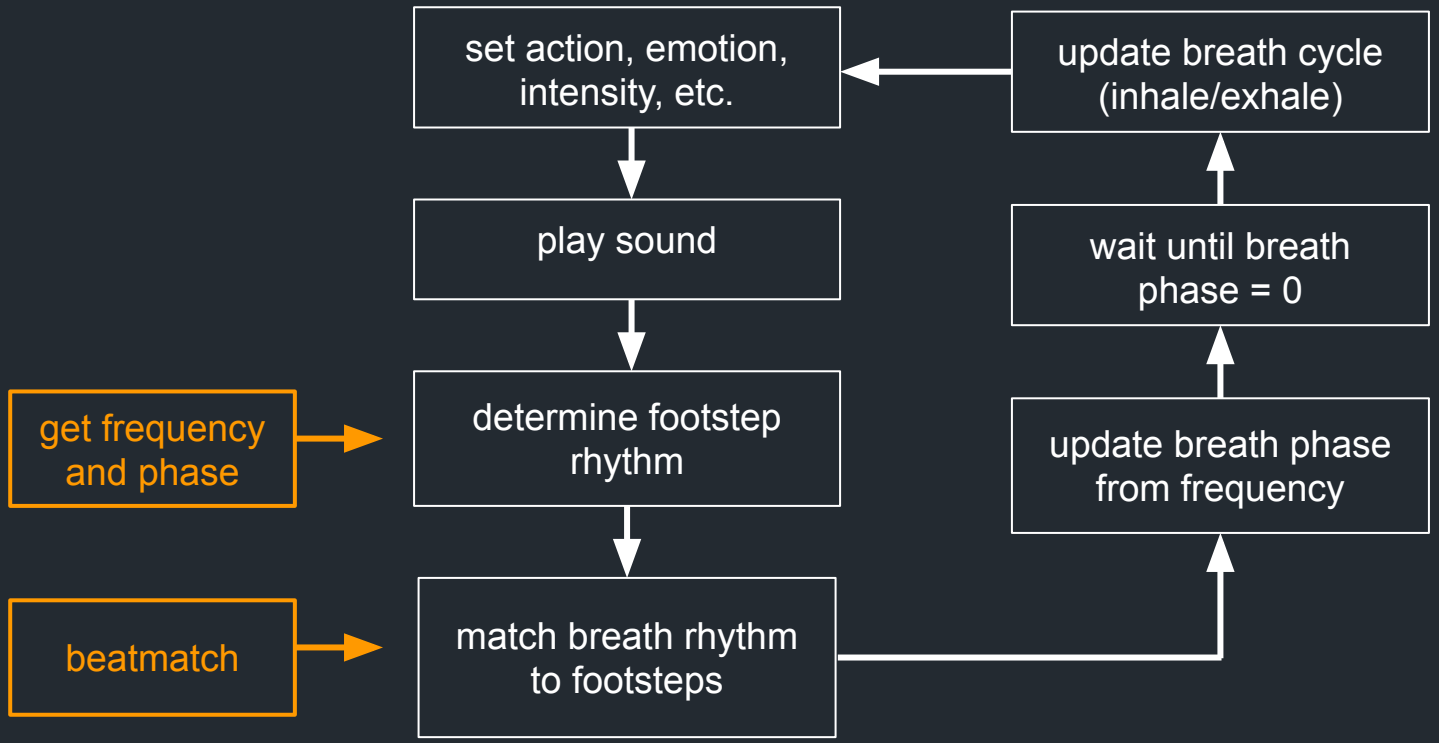
Solution: Beat Matching

- Gradually interpolate breath frequency towards run cycle frequency
- Compensate breath frequency for phase offset

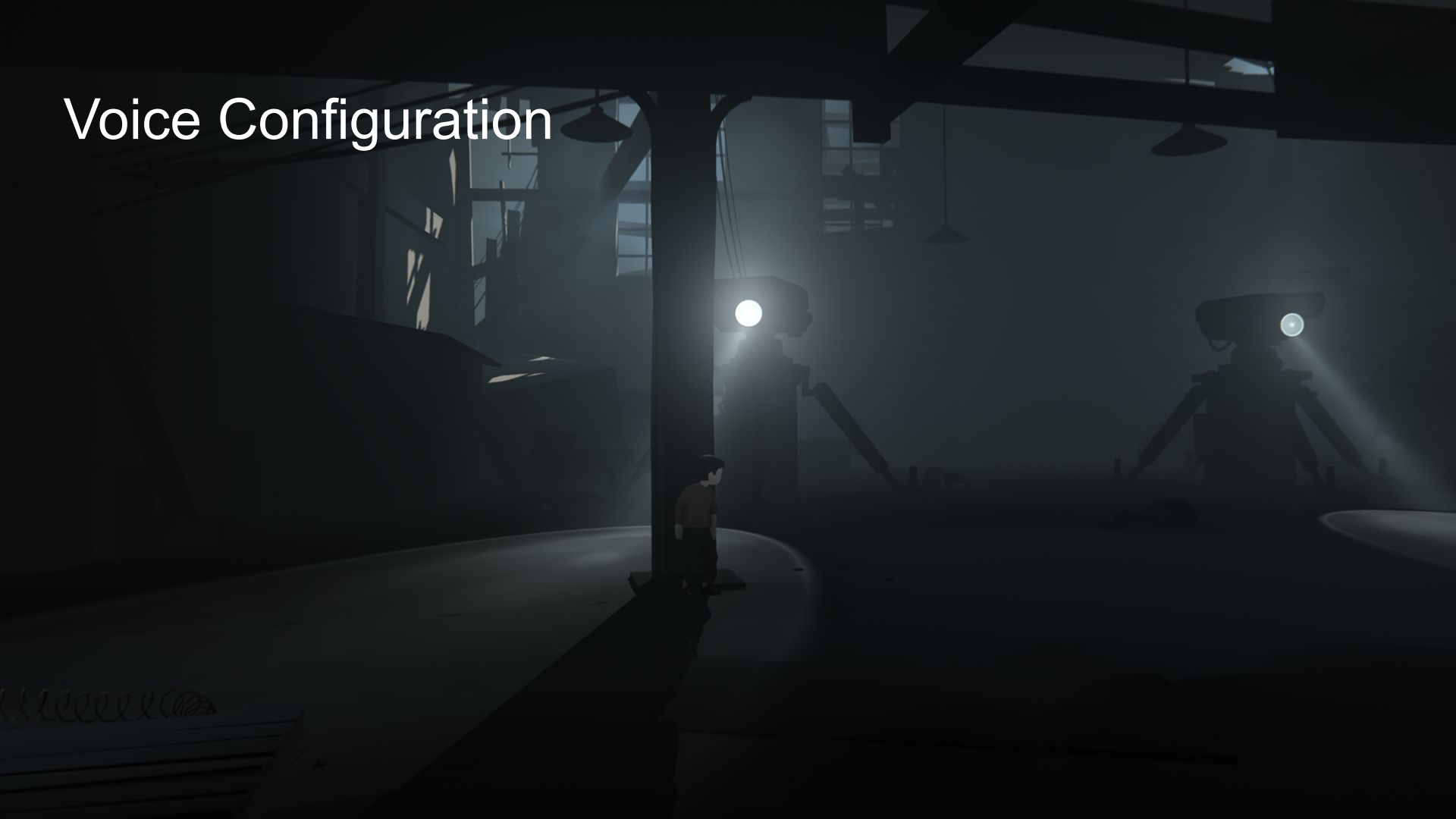
- Like a DJ that uses pitch adjust without nudging the record



Voice Sequencer: Rhythmic Breathing



Voice Configuration



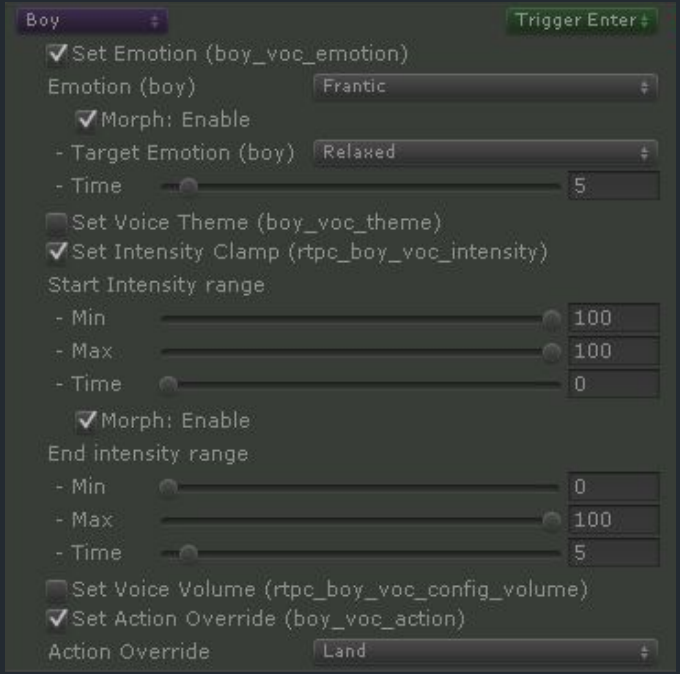
Voice Direction

- Voice direction is accomplished using our voice configuration system
- The director (Martin) instructs the actor (voice sequencer) how to emote:
  - based on location or
  - based on reacting to events

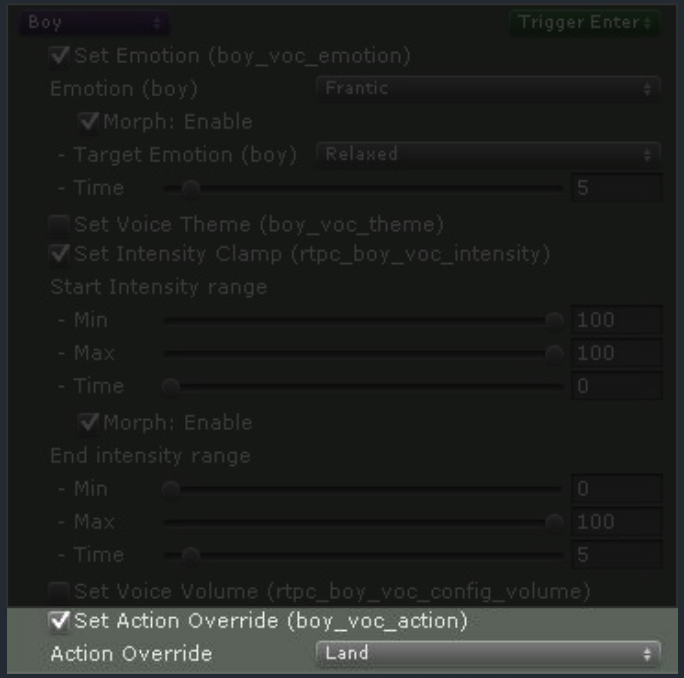
Voice Configuration

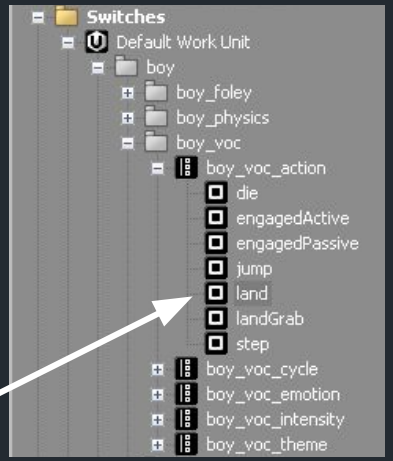
- Trigger boxes
- State machines
- Scripts
- Gives full control over voice parameters
  - action
  - emotion
  - intensity

Voice Configuration: Trigger box

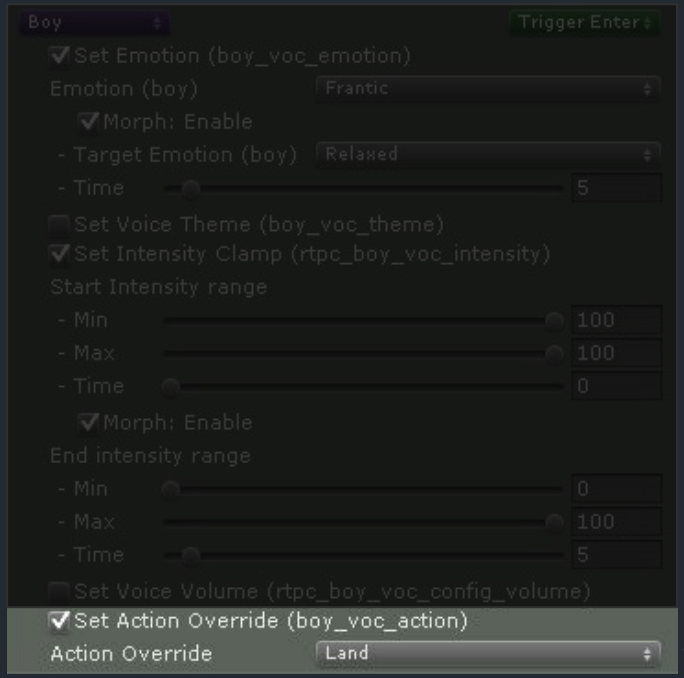


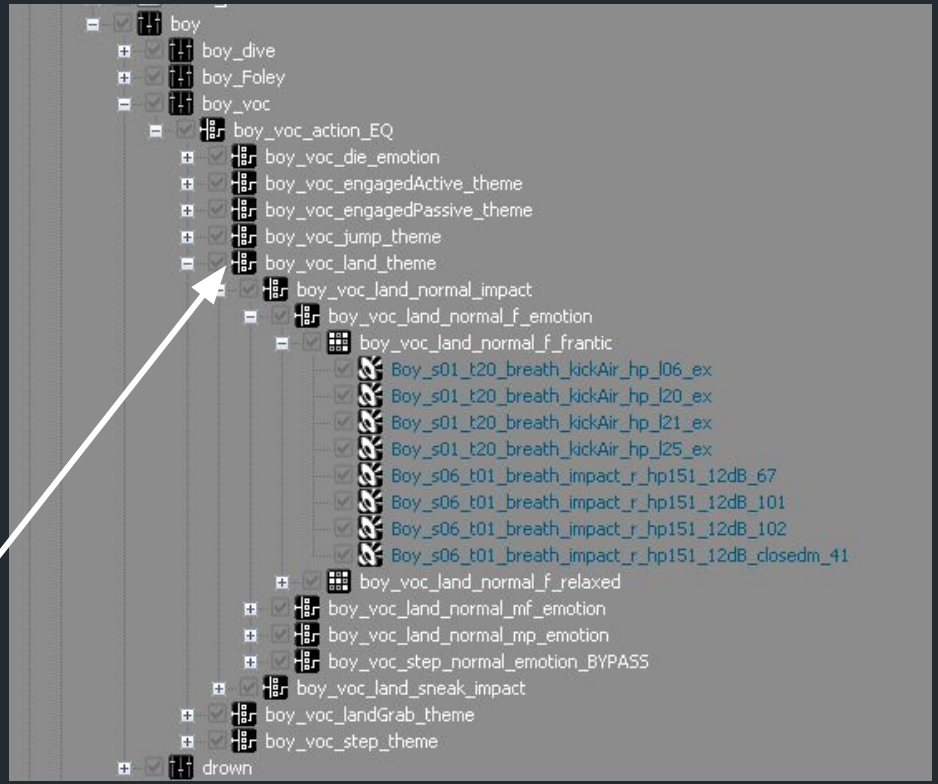
Switch


Boy
Trigger Enter
Set Emotion (boy_voc_emotion)
Emotion (boy)
Frantic
Morph: Enable
- Target Emotion (boy)
Relaxed
- Time
5
Set Voice Theme (boy_voc_theme)
Set Intensity Clamp (rtpc_boy_voc_intensity)
Start Intensity range
- Min
100
- Max
100
- Time
0
Morph: Enable
End intensity range
- Min
0
- Max
100
- Time
5
Set Voice Volume (rtpc_boy_voc_config_volume)
Set Action Override (boy_voc_action)
Action Override
Land

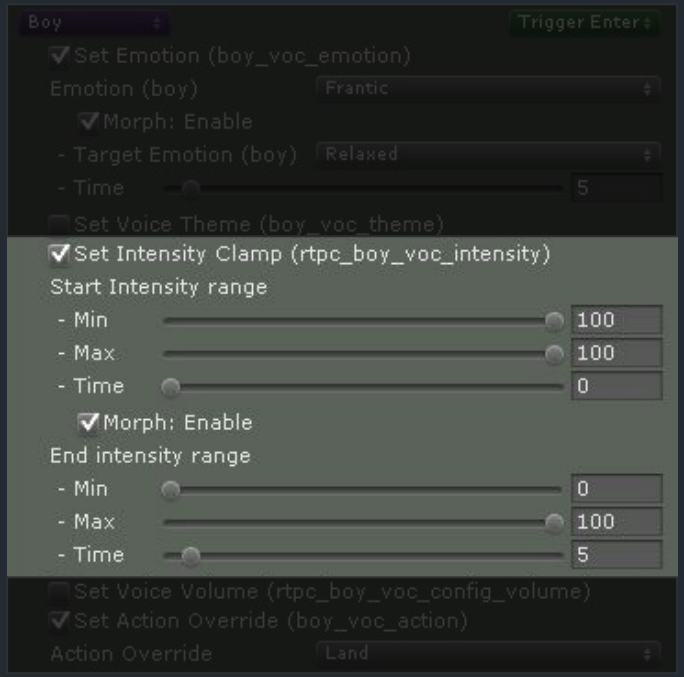

Switches
Default Work Unit
boy
boy_foley
boy_physics
boy_voc
boy_voc_action
die
engagedActive
engagedPassive
jump
land
landGrab
step
boy_voc_cycle
boy_voc_emotion
boy_voc_intensity
boy_voc_theme

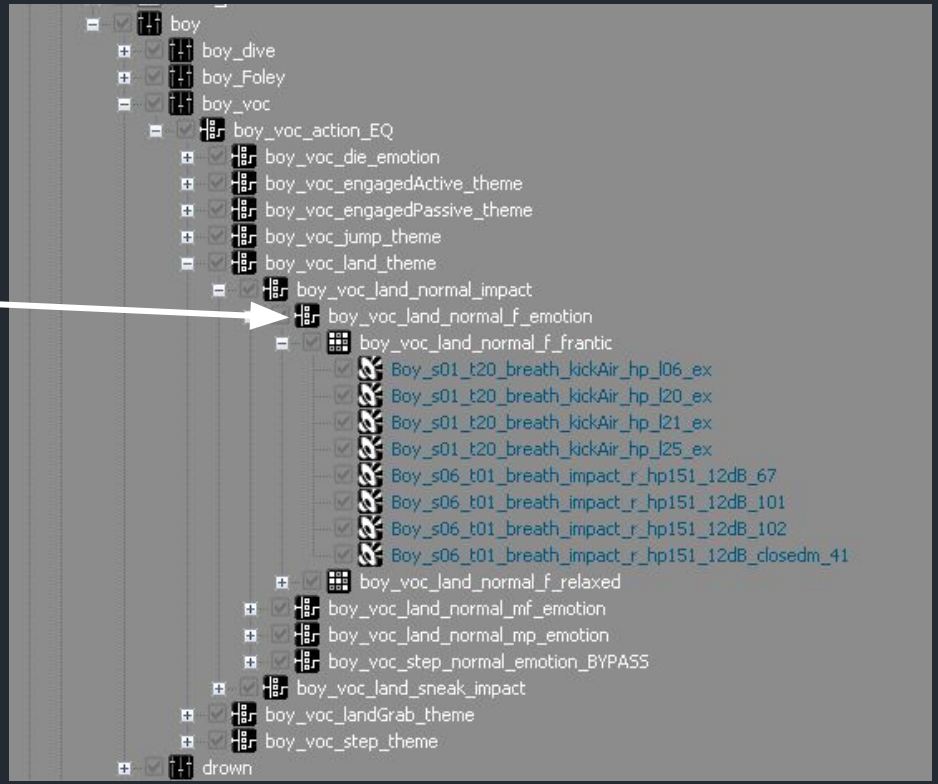
Switch Container: Action



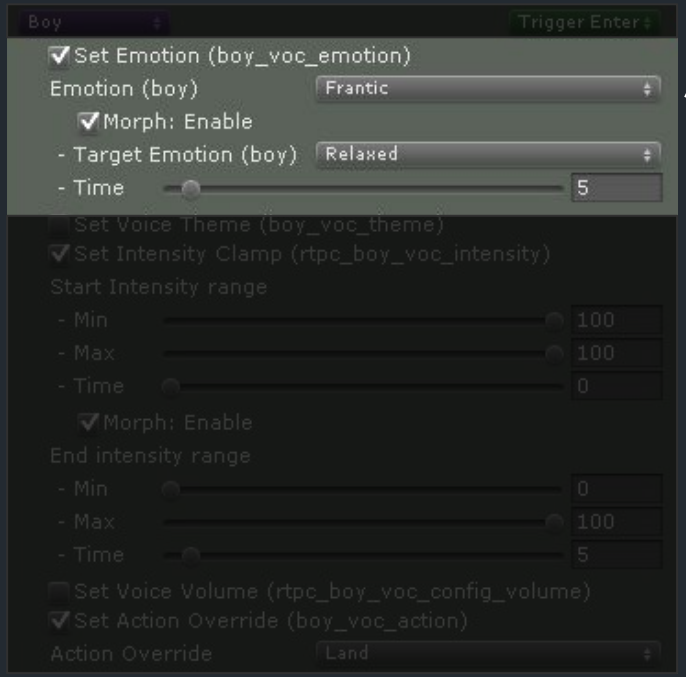


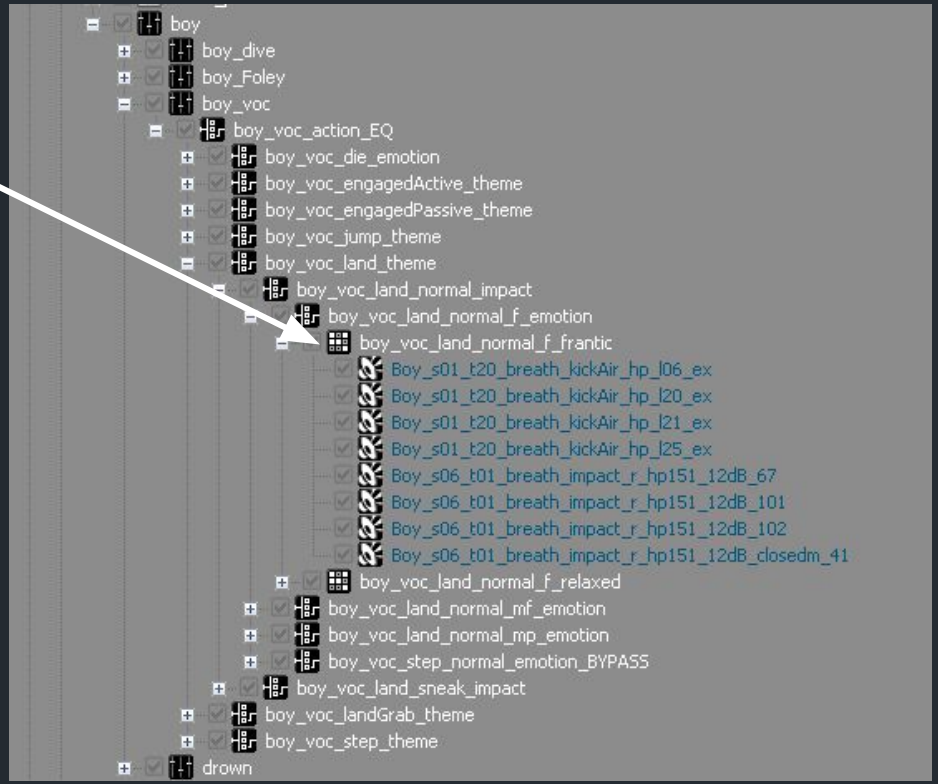
Switch Container: Intensity





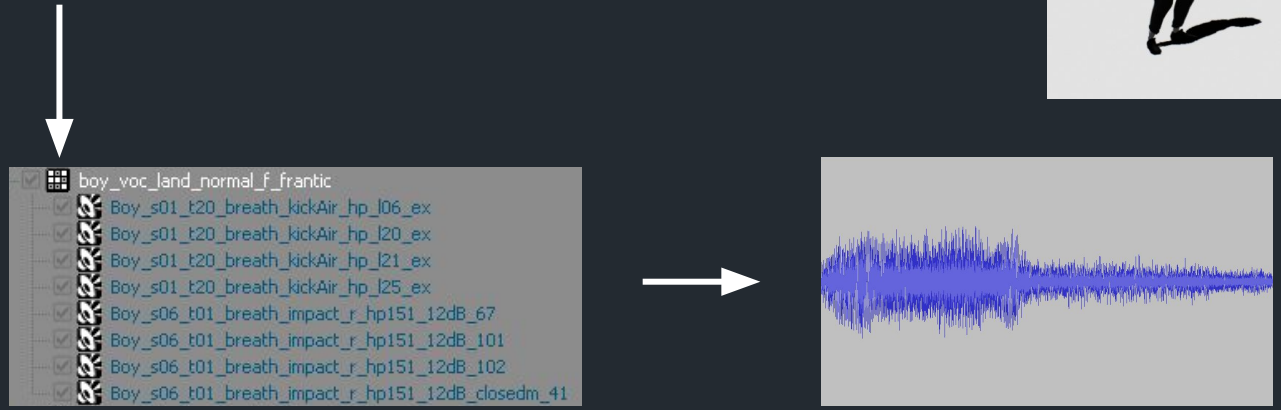
Switch Container: Emotion



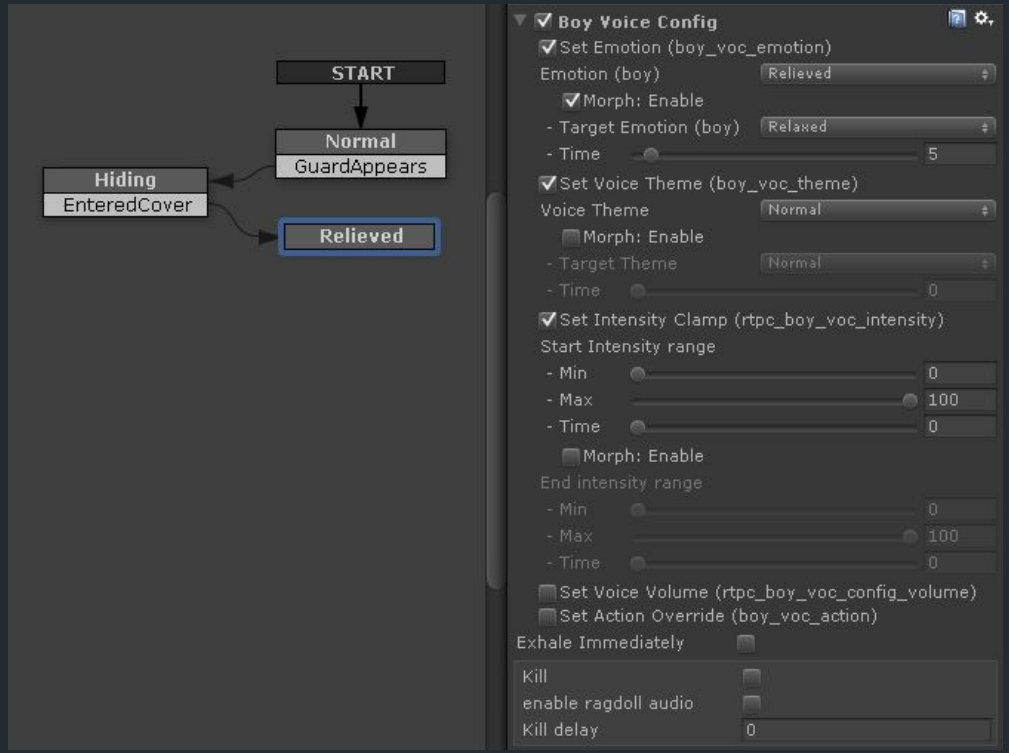


Random Container

Randomly selects and plays one of its children sounds

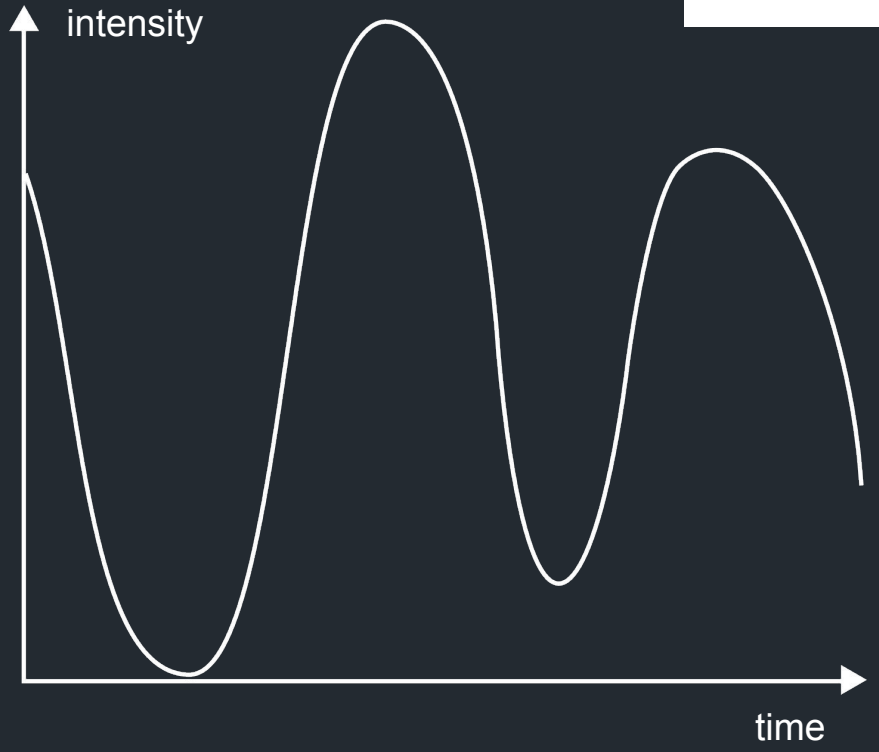


Voice Configuration: State Machine



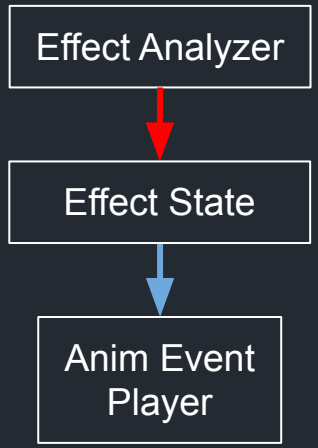
Voice Intensity

- Boy movement generates exhaustion
- Voice intensity = lowpass filtered exhaustion
- Voice Intensity selects depth and force of breathing
- Depending on the emotion, intensity defines:
  - Physical exertion level
  - Intensity of character emotion

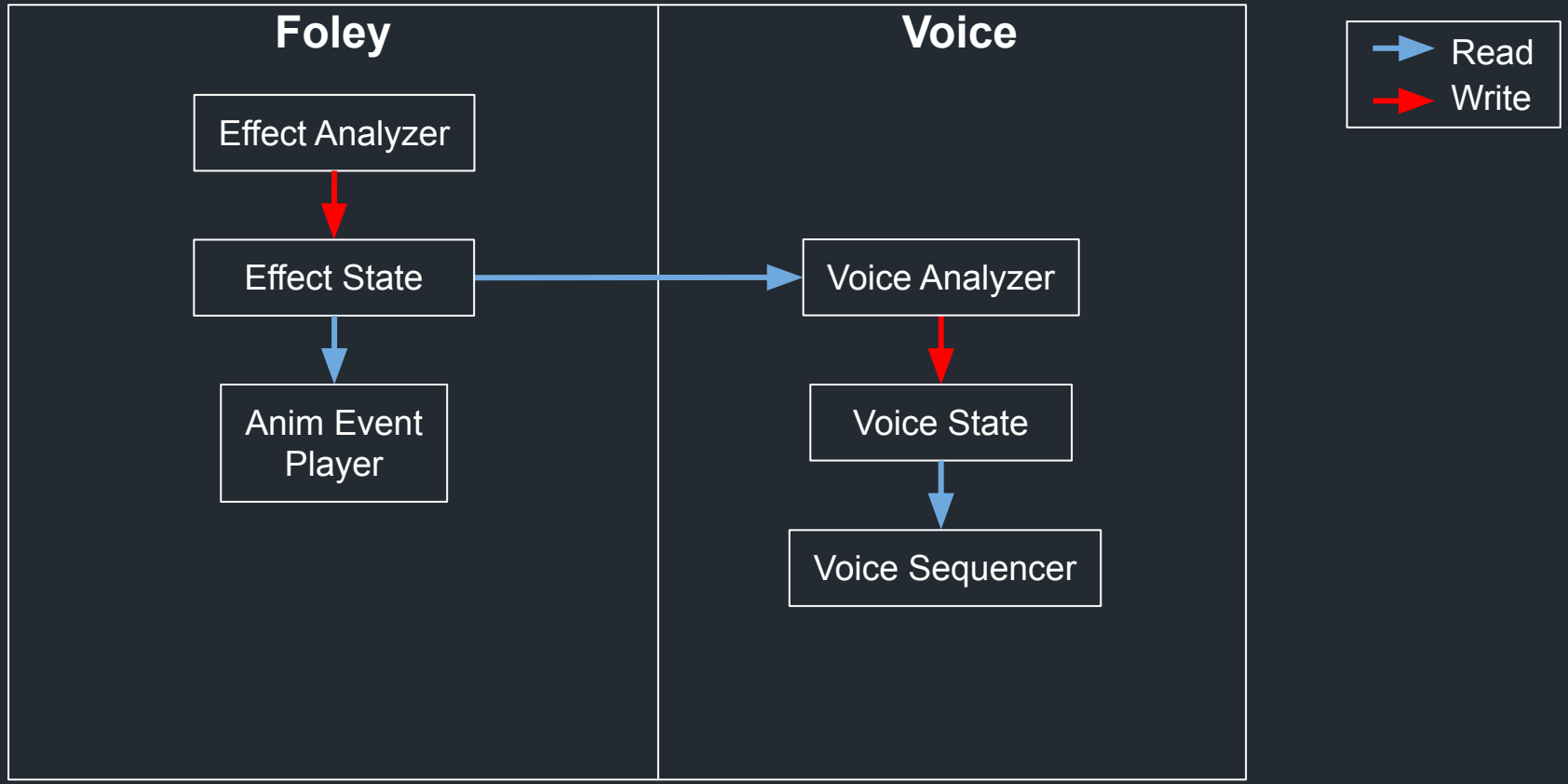


Wrapping Up

Animation Events



Voice Sequencer



Full Audio Architecture for the Boy