



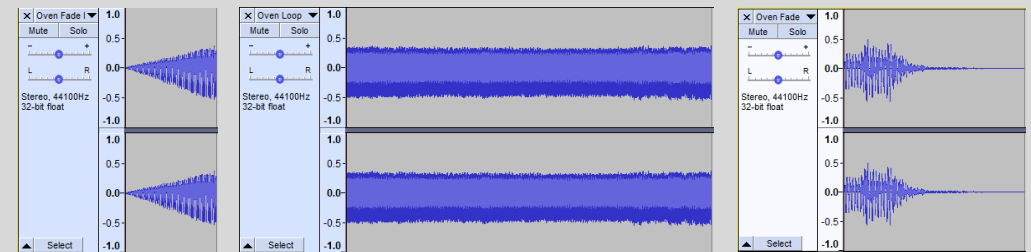
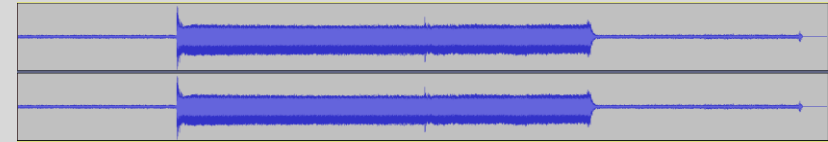
CMP 407 ASSESSMENT

Techniques Implemented

- Recorded audio
- Four basic audio effects
- Compressed file formats
- Integration with audio engine
- Dynamic digital music
- Synthesis of an sound effect
- Dynamic audio techniques

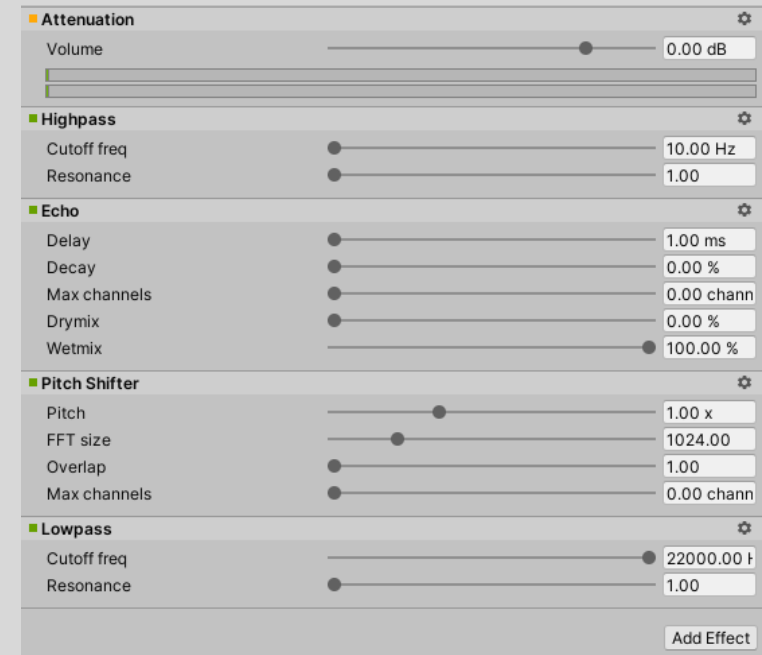
Recorded Audio

- Following effects have been recorded:
 - Oven Sound;
 - Cooker Knobs;
 - Oven knob.
- Recorded on iPad + GarageBand
 - Best microphone available (low noise level, good response)
 - *Microphone noise - The basics about self-noise in mics* (2018).
 - Good sample-rate (44100Hz).
- Processed in Audacity
 - Clipped
 - Normalized
 - Fade in + out for oven sound
 - Noise reduction from profile with Oven Sound



Audio Effects

- Indoor sound effect
 - High pass + low pass (band pass) to muffle out most outdoor sounds.
 - Only applied on 'outdoor sound' mixer.
- Drunk sound effect
 - High pass filter to remove sounds above 1000Hz
 - Based on Upile et al. (2007) describing alcohol lowering the ear's audio response above 1kHz.
 - Reverb/echo to mimic disorientation.
 - Pitch shift to mimic slowed responses.
 - (*Alcohol poisoning*, no date)
- Poisoned sound effect
 - Low pass effect to add a water-like, out of touch effect.
 - Pitch up to simulate inaccurate senses.
 - High pitched noise (covered later).
 - Based on ototoxicity (Wikipedia contributors, 2020a)



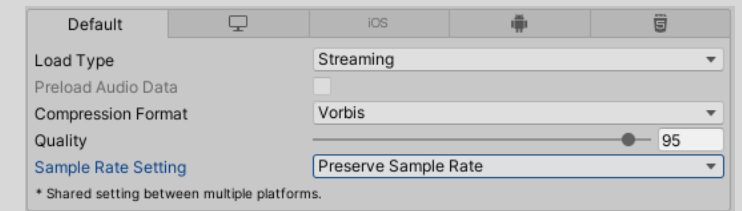
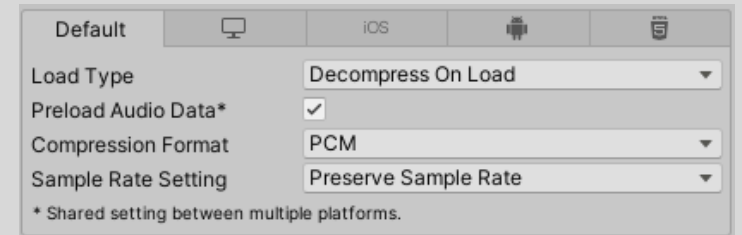
The screenshot shows a digital audio workstation (DAW) interface for applying audio effects. It features several sections, each with a title bar and a settings area. The sections are: Attenuation, Highpass, Echo, Pitch Shifter, and Lowpass. Each section contains sliders and input fields for various parameters. The Attenuation section has a Volume slider set to 0.00 dB. The Highpass section has Cutoff freq set to 10.00 Hz and Resonance set to 1.00. The Echo section has Delay set to 1.00 ms, Decay set to 0.00 %, Max channels set to 0.00 chann, Drymix set to 0.00 %, and Wetmix set to 100.00 %. The Pitch Shifter section has Pitch set to 1.00 x, FFT size set to 1024.00, Overlap set to 1.00, and Max channels set to 0.00 chann. The Lowpass section has Cutoff freq set to 22000.00 Hz and Resonance set to 1.00. There is an 'Add Effect' button at the bottom right.

Section	Parameter	Value
Attenuation	Volume	0.00 dB
Highpass	Cutoff freq	10.00 Hz
	Resonance	1.00
Echo	Delay	1.00 ms
	Decay	0.00 %
	Max channels	0.00 chann
	Drymix	0.00 %
	Wetmix	100.00 %
Pitch Shifter	Pitch	1.00 x
	FFT size	1024.00
	Overlap	1.00
	Max channels	0.00 chann
Lowpass	Cutoff freq	22000.00 Hz
	Resonance	1.00

- Low pass works by cutting high end.
- High pass cuts low end.
- Band pass decreases volume above and below
- Pitch shift works by using chunks of previous data and overlays them.

🎧 Compressed Audio Formats

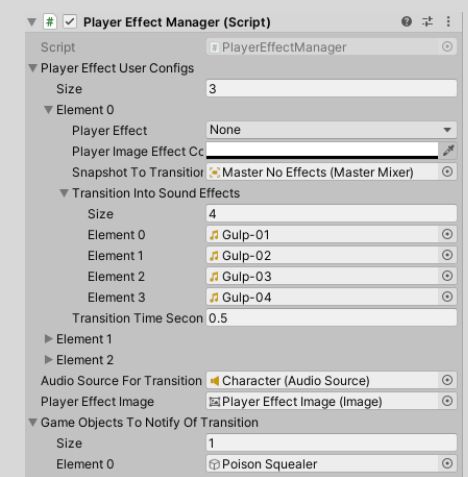
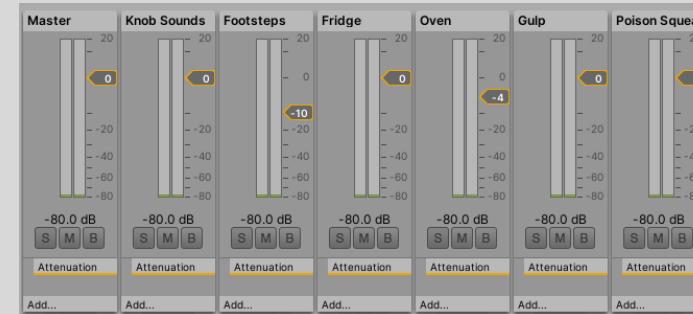
- Long sounds are stored in Vorbis for project files.
- Quick sound effects are stored in PCM (wav)
 - In memory
 - Quick copy
- Long effects are stored in Vorbis and streamed from disk.
 - Streamed to not to use up unnecessary memory.
 - 200 KB overhead
 - Vorbis is royalty free (no licensing cost).
 - Better performance than MP3.
 - 95% quality export to save on format further.
 - Native in Unity.
 - Wikipedia contributors (2020)
- Unity Technologies (n. d.)





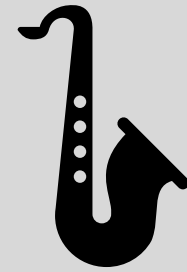
Integration with Unity

- Audio Mixers
 - Easy manipulation.
- Audio Snapshots for effects
 - Pre-integrated effects.
- Audio Source
 - For spatial audio.
 - Audio effect (OnAudioFilterRead).
- Audio Clip
 - Supported by Unity.
- Scripting + User configuration
 - Necessary variables are visible to the user.
 - Little modification should be required for adding features.
 - Splitting up of responsibilities.



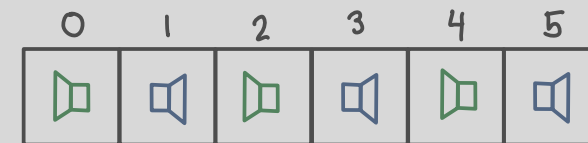
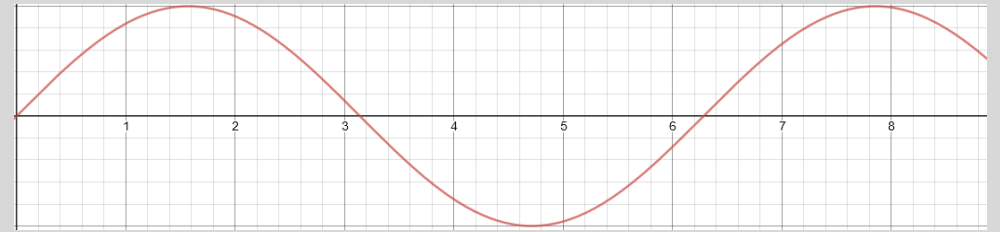
🎵 Reactive Music / Digital Music

- Two music tracks.
 - Both by Kevin Macleod
- Based on location.
 - Outside - Soothing new age.
 - Inside - Jazz.
- Crossfade between tracks.
- Implemented in a reusable way using colliders.



🔊 Synthesis of audio effect

- Creates a sine wave which mimics tinnitus when poisoned.
- Generated at runtime.
- Unity uses interleaving for multiple audio channels.
- Pitch is calculated in phase (Kablamo, 2017)
- Fade in/out effect
 - Slight change in pitch.
- Atomics for communication.
 - C# all 'simple' data types are atomic.
- No allocation in audio thread.



Dynamic Audio

One Shot Sound Effects

- Cooker + Oven Knobs
- Gulp sound effect.
 - On drinking.
 - From [FreeSound](#).
- Yawn sound effect.
 - On sleeping.
 - From [BBCSFX Archive](#)
- Footsteps
 - Path - [Premium Beat](#)
 - Indoor - [Sound Jay](#)
 - Grass - [Fesiyan Studios](#)
 - Implemented in a performant and reusable way.

Looped Sound Effects

- Outdoor Noises
 - Dependant on day or night.
 - From [Free To Use Sounds](#) (gotten when free)
- Oven sound when on.
- Intermittent fridge sounds.
 - From [BBCSFX Archive](#).

- Sound effects processed the same way as recorded audio.
 - Normalization etc.
- Tried finding good quality.

Credits & References

- First Person Character - [Vitefaïtt on Unity Asset Store](#)
- HDRP Template - Unity
- All sourced sound effects allow the use for educational purposes.

Reference List

- *Alcohol poisoning* (no date) *Nhs.uk*. Available at: <https://www.nhs.uk/conditions/alcohol-poisoning/> Kablamo, D. (2017) *Unity3D analog style Synthesizer Tutorial*. Youtube. Available at: https://www.youtube.com/watch?v=GqHFGMy_51c
- *Microphone noise - The basics about self-noise in mics* (2018) *Dpamicrophones.com*. DPA Microphones. Available at: <https://www.dpamicrophones.com/mic-university/the-basics-about-noise-in-mics>
- Unity Technologies (no date) *Audio Clip*, *Unity3d.com*. Available at: <https://docs.unity3d.com/Manual/class-AudioClip.html>
- Upile, T. et al. (2007) 'The acute effects of alcohol on auditory thresholds', *BMC ear, nose, and throat disorders*, 7(1), p. 4.
- Wikipedia contributors (2020a) *Ototoxicity*, *Wikipedia, The Free Encyclopedia*. Available at: <https://en.wikipedia.org/w/index.php?title=Ototoxicity&oldid=993610502>
- Wikipedia contributors (2020b) *Vorbis*, *Wikipedia, The Free Encyclopedia*. Available at: <https://en.wikipedia.org/w/index.php?title=Vorbis&oldid=992343769>