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This paper documents my composition techniques, and the modern digital media I employ to produce works inspired by video game music. I write about my thought process and the general considerations I have for each piece, before going into details about specific procedures. The general considerations include: choice of Digital audio workspace (DAW), instruments I use, ways in which I use automation on instrument parameters, and I write about how sometimes I choose to work within limitations of DAW's for authenticity. This paper covers nine pieces of work presented at my master's degree recital on the 17th of April, 2024 and draws examples from each about my process.

COMPOSING FOR VIDEO GAMES

by

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APPROVAL PAGE

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CHAPTER I: INTRODUCTION

Products of the video games industry have been one of the greatest influences in my work. My general compositions either emulate the sounds of video games or are created to function as a soundtrack for an imaginary game. The recital for my Master's in Music composition degree was on the 17th of April, 2024, at the University of North Carolina Greensboro for which I created nine compositions. These pieces were inspired by a variety of conceptually different video games and drew influences from many different titles. I use these works as examples in this paper to describe the techniques and approaches used when I compose music.

The pieces I composed are shown in Table 1. The table identifies the compositions, the video games which were used as reference materials, and the styles/genres of those influences. There is a link to a YouTube playlist under Table 1 to my compositions.

Table 1. List of compositions, the genre, and the existing titles which inspired the work.

	Names of compositions	References	Video Game Genre
1	*Starfighter - Onward to Victory!*	Thunderforce III[1], Starfox[2], Starfox64 (Lylat Wars)[3], Hellfire[4], Empire of Steel[5]	Shoot em up
2 3 4	*Nitroburner - Are you ready?* *- Neon City* *- Death Hazard*	Extreme G III[6], F-Zero GX[7], Wipeout[8], Fast RMX[9]	Racing (sci-fi)
5	*Sims-ulated - Let's build a house*	The Sims 2[10],	Simulation
6 7	*JRPG - Onward to Adventure* *- Coastal Highlands*	Ys VIII[11], Xenoblade Chronicles 2[12], The Legend of Zelda The Wind Waker[13]	Japanese Role-Playing Game (JRPG)
8 9	*Doom-ish - Welcome to the Red Planet* *- Science Cat*	Doom 2016[14], Doom Eternal[15], Wolfenstein: The New Order[16], Wolfenstein II: The New Colossus[17]	First Person Shooter (FPS)

My compositions listed above in Table 1 can be found using the following YouTube link. Each song has accompanying video game footage from some of the listed references.

https://www.youtube.com/playlist?list=PLCm3A_SK6JnixrlEiy_yW1SvPJ3Wro1nx

[1] Thunder Force III 3 - Opening Theme & Stage Select Sega Mega Drive Genesis Soundtrack, 2019, https://www.youtube.com/watch?v=DZo9Y-aVjss

[2] StarFox (Full OST) - SNES, 2016, https://www.youtube.com/watch?v=byIjMomjWkA

[3] StarFox 64 (Full OST) - N64, 2016, https://www.youtube.com/watch?v=Wzwgztv3oCQ

[4] Hellfire OST: Sega Genesis - 01 - Ready to Go ~ Captain Lancer, 2021, https://www.youtube.com/watch?v=Ko2qiEWKhJg

[5] Steel Empire -01- Title Theme (SEGA GEN/MD) - OST, 2022, https://www.youtube.com/watch?v=gNGv3SBBjZs

[6] XG3: Extreme-G Racing [Music] - Menu, 2009, https://www.youtube.com/watch?v=rGUYXf64I1U

[7] Wings for My Way (GX Advertise)[F-ZERO GX], 2013, https://www.youtube.com/watch?v=CdggsUSLUqA

[8] WipEout® OST [PSX]: CoLD SToRAGE - Cairodrome, 2013, https://www.youtube.com/watch?v=dUQxO8ZFU9g

[9] Main Menu - FAST RMX, 2021, https://www.youtube.com/watch?v=lTGqwlsl-xc

[10] The SimsTM 2 Soundtrack: Main Theme, 2010, https://www.youtube.com/watch?v=lF90l7zWHMg

[11] Ys VIII -Lacrimosa of DANA- OST - Lacrimosa of DANA -Opening Ver.-, 2016, https://www.youtube.com/watch?v=NU4am8acLR0

[12] Xenoblade II - Where It All Began (Beta) - Xenoblade Chronicles 2 OST [001], 2018, https://www.youtube.com/watch?v=PFto0LPNkBI

[13] Demo [Nintendo Spaceworld 2001] - The Legend of Zelda: The Wind Waker, 2019, https://www.youtube.com/watch?v=0VSFJefHYaE

[14] Doom OST - I. Dogma, 2018, https://www.youtube.com/watch?v=7o9W-7JHs_w

[15] Mick Gordon - Hell On Earth, 2020, https://www.youtube.com/watch?v=ClUDlCgxetA

[16] 01. Deathshead - Wolfenstein The New Order Soundtrack, 2014, https://www.youtube.com/watch?v=xpzaHVg__KQ

[17] 1. Blitzmensch! | Wolfenstein II: The New Colossus OST, 2018, https://www.youtube.com/watch?v=JtQ8Kpkvzk4

The following chapters will highlight different approaches and techniques that were used to create nine compositions, and how each was applied to create the desired outcomes. Chapter 1I: Tracking Software and Retro Game Soundtracks will cover tracking software (creating authentic retro game sounds), followed by three chapters which cover digital audio workspace techniques: Chapter III: Electronic Composition (MIDI and digital assets), Chapter IV: Blending Digital "Acoustic Sounds" With Electronic Sounds, and finally Chapter V: Incorporating Electro-Acoustic Composition and Live Performance Controls. Before that however is some useful information about tools and thought processes I have before creating a composition (general considerations, and procedures).

General considerations

DAW (Digital audio workstation)

My compositions are created using either MIDI data, or Tracker software. Both methods utilise coded values which represent sound and pitch. When MIDI data values are inputted into a DAW on a computer it utilises virtual instruments or sound banks to produce sound from a pre-recorded library, or emulation of an electronic synthesiser[18]. Tracker software emulates how early video game composition was created, in which the values representing the sound and pitch data are used to communicate directly to a sound chip (which can be emulated) which then produces synthesised sounds. The tracker software I utilise is on physical devices using sound chips with limited outputs. When using a PC I use Pro Tools (version 2023.9) and Studio One 5. Both methods (MIDI or tracker) utilise coded values which represent sound and pitch. When MIDI data values are input into a DAW on a computer it utilises virtual instruments or sound banks to produce sound from a pre-recorded library, or emulation of an electronic synthesiser.

[18] Spelt synthesizer in America.

Virtual Instruments and Sound Banks

Virtual instruments emulate physical synthesiers to produce sounds. Sound banks function differently in that the sounds are all pre-recorded and kept in an audio library, then MIDI data pulls the appropriate sounds from an archive.

Virtual instruments I use include Hybrid3, Massive, Serum, and Xpand!2.

Sound banks I use are mounted onto Kontakt player and include Shreddage3, Shreddage Drums, The 88e, and Super Audio Cart.

Automation Parameters

Part of working with MIDI is crafting automation by adjusting parameters to change things about the audio playback. These parameters can include velocity of each note, dials on effects attached to the instruments being used, panning and volume etc.

Tracking DAW Limitations

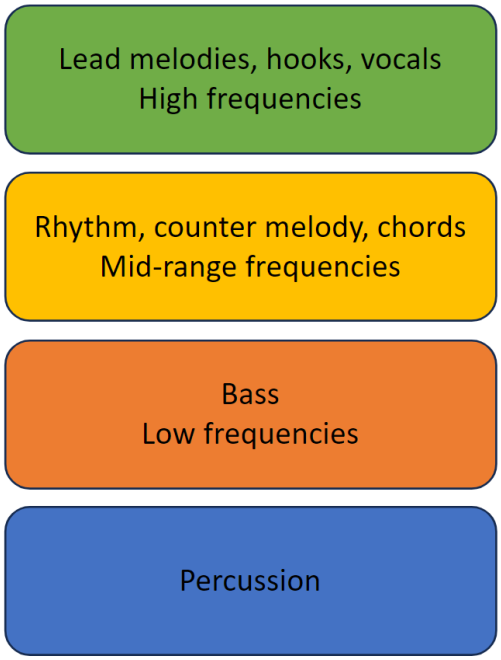
A different set of tools is needed when working with tracking software as limitations are present due to the maximum output of the sound chip being utilised. These limitations include the available sounds, the number of simultaneous voices, the total number of phrases of melodic material, length of the composition, etc. When using a MIDI based DAW on a personal computer (PC) those limitations are not present.

Procedures

When building a new composition, I will begin by thinking about instrumentation in verticality. Lead voices or vocals which exist in the higher frequencies or sit on top of everything as the most dominant sound, support and rhythmic instruments which fill space in the mid frequencies, then bass which fills out the low frequencies. Percussion is important to me as my primary instrument; I treat it as providing a supporting role depending on the style or genre of

the piece being composed. I think vertically this way due to the time I have spent engaging with Tracking software.

Figure 1. How I think vertically



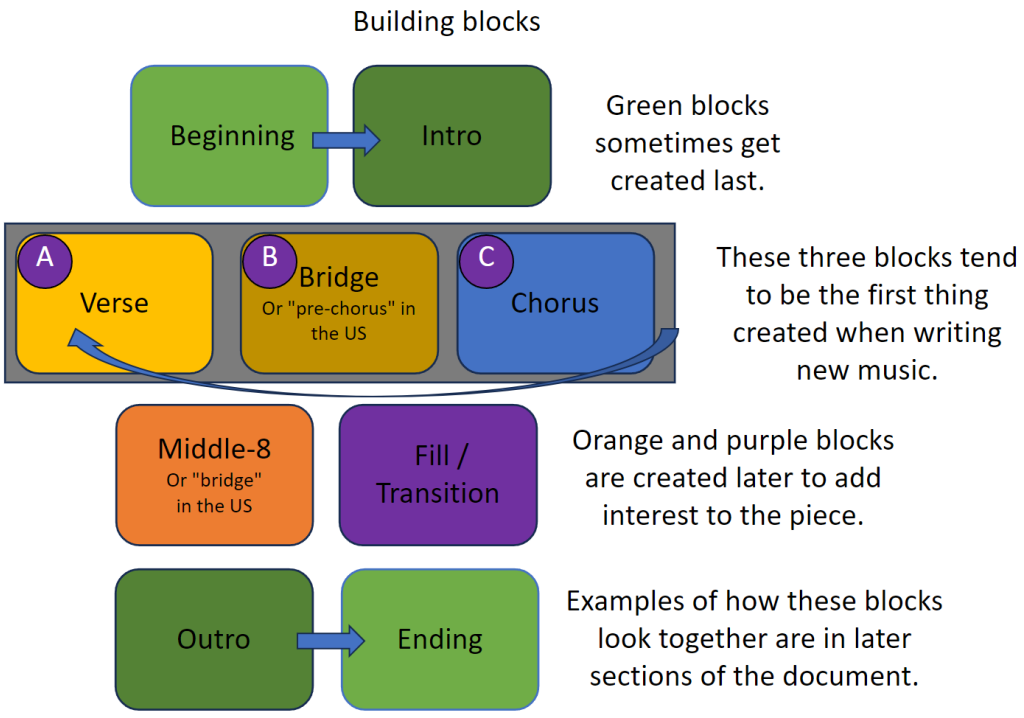
This way of thinking helps me create compositions that do not run into problems such as sounding hollow, or missing key components due to the limitations which are imposed when working in that environment (number of voices, etc.)

When beginning a new piece, I focus first on the main hook or feature of the piece, typically a melody or a riff which will serve as the chorus. Then I work backward filling out the space around that. When building the piece and forming the structure of a composition I try to create building blocks with identities such as beginning, intro, verse, bridge, chorus, middle-8[19], fill/transition, outro, and ending used frequently in some popular music. Usually some of these

[19] "Is a Middle 8 the Same as a Bridge? Explained," August 23, 2023, https://www.ac3filter.net/is-a-middle-8-the-same-as-a-bridge/ - Americans use different terminology, this article discusses the usage of bridge and middle-8 as I know them.

blocks are formed from already existing materials, for example the intro might be a variation of the verse or the chorus. The outro may also be a variation of already existing materials. What is most important to me is the identity of three key sections of each piece: the verse (A section), the bridge (B section - also known as a "pre-chorus" in America), and the chorus (C section). The verse usually contains a flexible melody and a steady chord progression. The bridge will connect the A section to the C section by moving in an upward motion either in the chords or in the intensity of the instruments. Then, in my compositions, the chorus is the main "hook" of the piece, the melody that the rest of the piece has built anticipation up to. I try to create these A, B, and C blocks first and ensure that they connect in a way so that they flow well and create a loopable piece of music. I consider this to be the bare minimum requirements of a piece to meet the core identity of my writing style.

Figure 2. Building blocks of a composition



CHAPTER II: TRACKING SOFTWARE AND RETRO GAME SOUNDTRACKS

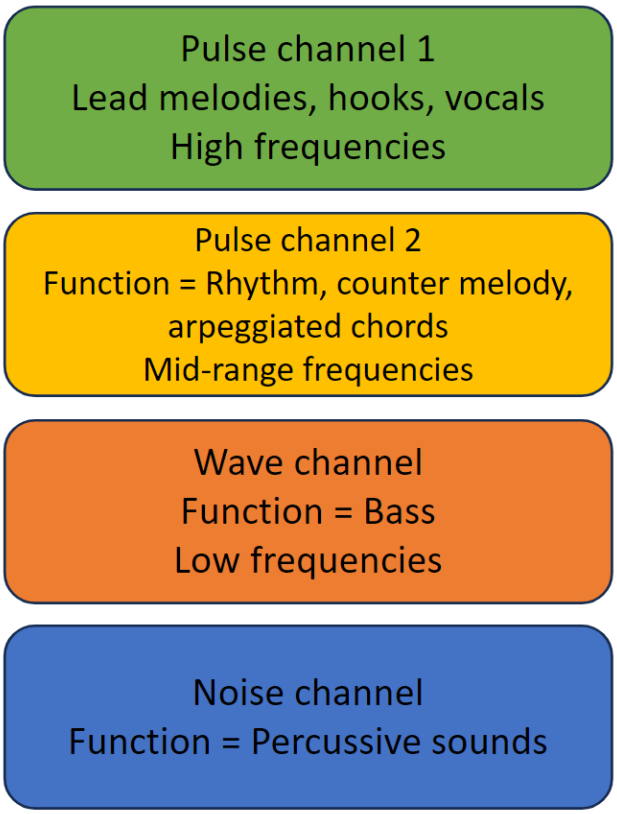
Early video games were played on devices which had limited possibilities due to the technology available at the time. Many of the consoles from the 70's through the 80's had onboard Pulse-code modulation (PCM) sound chips which had a small number of monophonic channels, and could only produce particular sounds or noise. Tracking software allowed composers to program the sound chips directly to inform them what sounds to produce. Because these programs function similarly to each other the concepts of one can be applied to others. For this reason, I shall only discuss the tracking software used for this project which was Little sound DJ (LSDJ). LSDJ is a tracking program for the Nintendo Gameboy.

According to the software user guide for LSDJ "The Gameboy sound chip has four channels, each with 4-bit resolution. Pulse Channel 1 Square wave with envelope and sweep functions. Pulse Channel 2 Square wave with envelope function. Wave Channel Soft synthesiser, sample playback and speech synthesis. Noise Channel Noise with envelope and shape functions."[20]

These limited voices provide some compositional challenges which is why I find it helpful to think vertically. I usually assign each channel a role: Channel 1 will provide lead hooks and melodies, channel 2 rhythm and countermelody, channel 3 (wave channel) is bass, and channel 4 is percussion. You can see this visualised below in figure 3.

[20]Johan Kotlinski, "Little Sound Dj v9.2.6 Operating Manual," n.d. May 09, 2021, https://www.littlesounddj.com/lsd/latest/documentation/ - User guide for LSDJ

Figure 3. Gameboy channels.



Other limitations are the sounds each channel can produce. The pulse channels can only produce pulse wave sounds (with different duty cycles of 10% 25% 50% and 75% which change the sound slightly[21].) The wave channel has additional features that the pulse channels do not, such as wave shape drawing, and sample playback. Finally, the noise channel produces white noise. These concepts are only a basic overview, but it is all that is needed to understand that you have limited vertical space working in this sort of DAW (four specific voices.)

[21] Classical Gaming, "Research in Game Music: The Difference between Pulse Waves and Square Waves," Classical Gaming (blog), May 15, 2012, https://classicalgaming.wordpress.com/2012/05/15/research-in-game-music-the-difference-between-pulse-waves-and-square-waves/ - Steve Lakawicz aka Classical gaming explains how the Pulse channels work using Pulse width modulation, and how duty cycle changes the sound of the pulse wave.

Shoot Em Up Genre – Starfighter – Onward to Victory!

A piece of music I composed was titled *Starfighter - Onward to Victory!* which drew influences from the shoot em up genre of video games. This genre of video game has many sub-genres, but generally the game play style for them revolves around the player controlling a unit which must dodge waves of enemy fire to survive and returning shots to defeat the hostile enemies to score points or to advance in the game. The shoot em up sub-genre of space has players controlling space vessels and this was my focus.

To compose music for the shoot em up genre whilst drawing from nostalgic roots I created three versions of a piece. These demonstrate different approaches which could be taken. The piece could be scored; powered by the earliest technologies (The PCM sound chips), or by the sounds of a Yamaha chip which were used during the height of the shoot em up revolution in the 90's[22] (Yamaha sound chips which had more capabilities than PCM chips); or scored for use in a modern video game (without any limitations but drawing on the nostalgia of those older machines.)

I created three versions of this piece. I wrote the 16-bit track first (version two), then worked backwards to create 8-bit composition (version one). This was achieved through a process that Ben Kidd refers to as "de-making"[23] which he defines as taking a musical piece with multiple layers and then compacting it into a smaller scale. Many of the sounds used in version two were also used in the modern track (version three). I used an audio sound bank virtual library called Super Audio Cart loaded into the Pro Tools DAW. Super Audio Cart contains audio

[22] Liberty Games, "A Detailed History of Shoot Em Up Arcade Games," Liberty Games, accessed April 2, 2024, https://www.libertygames.co.uk/blog/a-detailed-history-of-shoot-em-up-arcade-games/ - Chris Jordan Barrish documents the history of the shoot em up genre, and the "revolution" which began with space invaders.

[23] SNES vs Gameboy Music: Mega Man Xtreme, 2022, https://www.youtube.com/watch?v=G4nZ3Y8xLwA - Ben Kidd, aka 8-bit of 8-bit Music Theory, highlights how "de-making" music can create new interest in compositions.

library recordings of instruments from many early video game systems. This saves time from having to program and use software on those console systems myself, at the cost of some authenticity.

Table 2 shows the instrumentation of the 16-bit version of the piece *Onward to Victory!* The colour coding of the table highlights which instruments were "de-made" into the 8-bit version. (Yellow, green, orange, and light purple.) wrote the 16-bit track first (version two), then worked backwards to "de-make" the composition.

Figure 4. Versions of *Onward to Victory!*

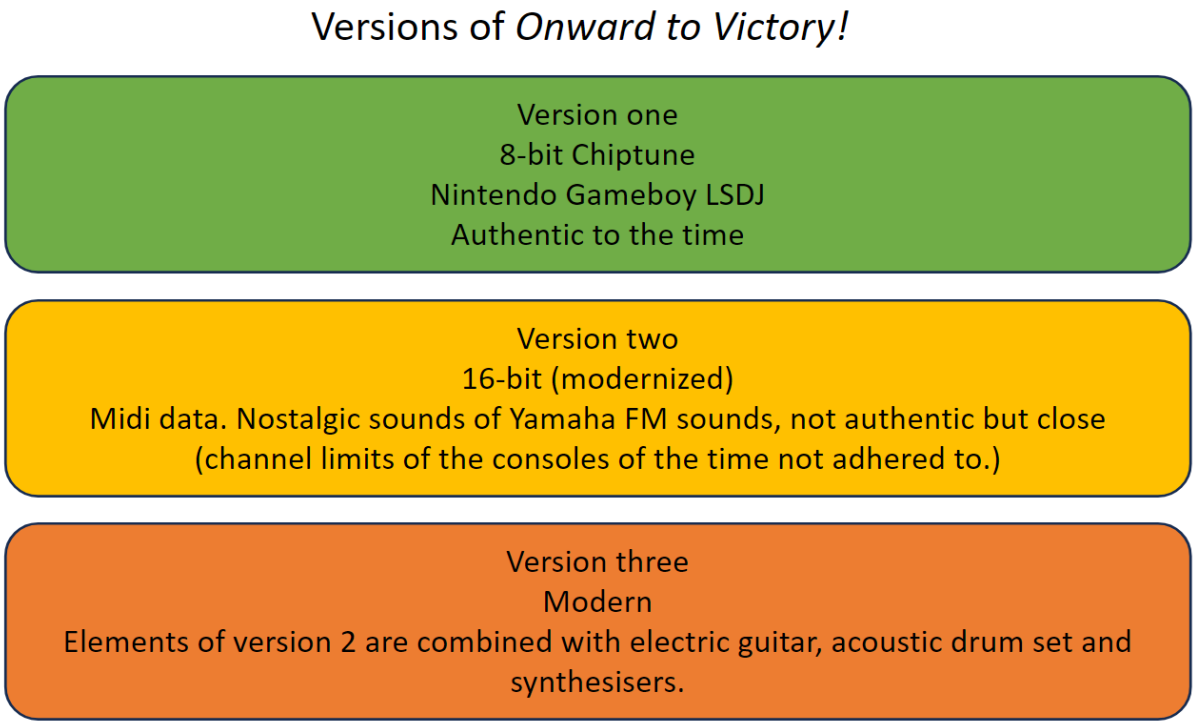


Table 2. Instrumentation of *Onward to Victory!* (16-bit and 8-bit versions.)

Starfighter - Onward to Victory! (16-bit)		
Function	**Instrument**	**Notes (base preset name/label)**
Rhythm Guitar		
Rhythm	Super Audio Cart	SNES STRINGS Section 1A SNES STRINGS Section 1B SNES STRINGS Section 2B
Lead Instrument	Super Audio Cart	SNES BRASS Bari Sax A
Lead Instrument	Super Audio Cart	GEN GUITAR Michael Dist
Harp	Super Audio Cart	SNES ORCH Harp A
Plucks	Super Audio Cart	SNES KEYS Rhodes A
Lead Instrument	Super Audio Cart	GB Pulse 50% GB Pulse 25%
Orch Hit	Super Audio Cart	SNES ORCH hit 1
Brass	Super Audio Cart	SNES BRASS Trombones SNES BRASS Trombone B
French horn	Super Audio Cart	SNES BRASS French Horns 1A
Bass	Super Audio Cart	GEN BASS Speedy1 Funk
Cymbals/Toms/Snare/Kick	Super Audio Cart	GEN DRUMKIT Metal
Starfighter - Onward to Victory! (8-bit De-made version)		
Lead	Pulse channel 1	De-made from above Lead instruments
Rhythm	Pulse channel 2	Dem-made from above Rhythm/guitar
Bass	Wave channel	De-made from above Bass and Kick
Percussion	Noise channel	De-made from Cym/Tom/Snare/Kick

Version three is a modern digital composition which builds on the instrumentations of versions one and two, and utilises the concepts covered in the following chapters (electronic composition part 1, 2, and 3.)

CHAPTER III: ELECTRONIC COMPOSITION WITH MIDI DATA

I often compose using digital audio workspaces which utilise MIDI data and virtual instruments. This section will highlight the ways in which I use these instruments to create desired results and will demonstrate using compositions made for the racing genre.

Racing Genre – *Nitroburner - Are you ready? / Neon City / Death Hazard*

The racing genre of video games has many subgenres, including Formula 1, street racing, dirt track and off-road. Each of these genres takes a different approach to the sort of composition it presents to meet the aesthetics of the game, such as using popular music as the game's soundtrack. For composing music for the genre of racing games I drew influences from titles which were set in a science fiction future, with themes such as hovering vehicles, floating or suspended racetracks, high speeds achieved by technology beyond petroleum-based engines, and dystopian societies. Compositions used across these games drew elements from electronic dance music (EDM) as sounds created by electronic synthesisers are used to create the aesthetics of the future.

Table 3 lists all the instruments used, the preset (if applicable) which was used as a foundation for crafting the sounds I wanted, followed by the label I gave it to indicate its intended function. I have highlighted lead/vocals, rhythm, bass, and percussion as mentioned previously in the procedures I follow. I composed three songs in this style; this table shows every instrument used in the first track. Many of these were used in the other two tracks also. The tracks used for vocals (in red) are treated like a lead line that has highest priority, which means it needs to be clearly heard whenever sound on that channel is produced. “Texture” and “interest” labelled instruments add depth to the piece or add interest in open spaces. Lead instruments

provide melodies and main hooks that grab the listener's attention. Rhythm fills the support role by providing chords and filling the Mids. Bass fills the lows, and percussion provides the drums.

Table 3. Instrumentation of *Are you ready?*

Nitroburner - Are you ready?		
Function	**Instrument**	**Notes (base preset name/label)**
Vocals	Hatsune Miku Vocaloid	Synthesised Vocals (Miku)
Texture (Mid-HF)	Hybrid 3	05 Soft Pads – 01 Simple Giant (Windy pad)
Texture (Mid-HF)	Hybrid 3	23 FX – 07 Noise Atmos (Noisy pad)
Interest (HF)	Hybrid 3	17 Bells – 10 Discrete (Bell)
Texture (Mid-HF)	Xpand!2	010 Acoustic Piano x4 (Piano) – Natural Grand Piano – Piano Hard Layer – Piano Med Hard Layer – Piano Soft Layer
Texture (Mid-HF)	Hybrid 3	19 Soft Leads – 05 Rich Saw Lead (Trance lead)
Lead Instrument	Hybrid 3	14 Poly Synths – 53 PWM Pluck Poly (Soft plink)
Lead Instrument	Hybrid 3	19 Soft Leads – 05 Rich Saw Lead (Synth rave)
Lead Instrument	Hybrid 3	18 Hard Leads – 046 Unison Smack Lead (Synth Hard)
Interest (Mid-HF)	Xpand!2	021 Hits x1 (Orc hits) – Orchestra hit 1
Interest (Mid-HF)	Loom II	Gentle Twister (Loom Trance)
Rhythm Instrument	Hybrid 3	01 Trance Chords – 56 Think Liz (Echo Synth)
Rhythm Instrument	Hybrid 3	14 Poly Synths – 09 Soft Maus (Rave Chords)

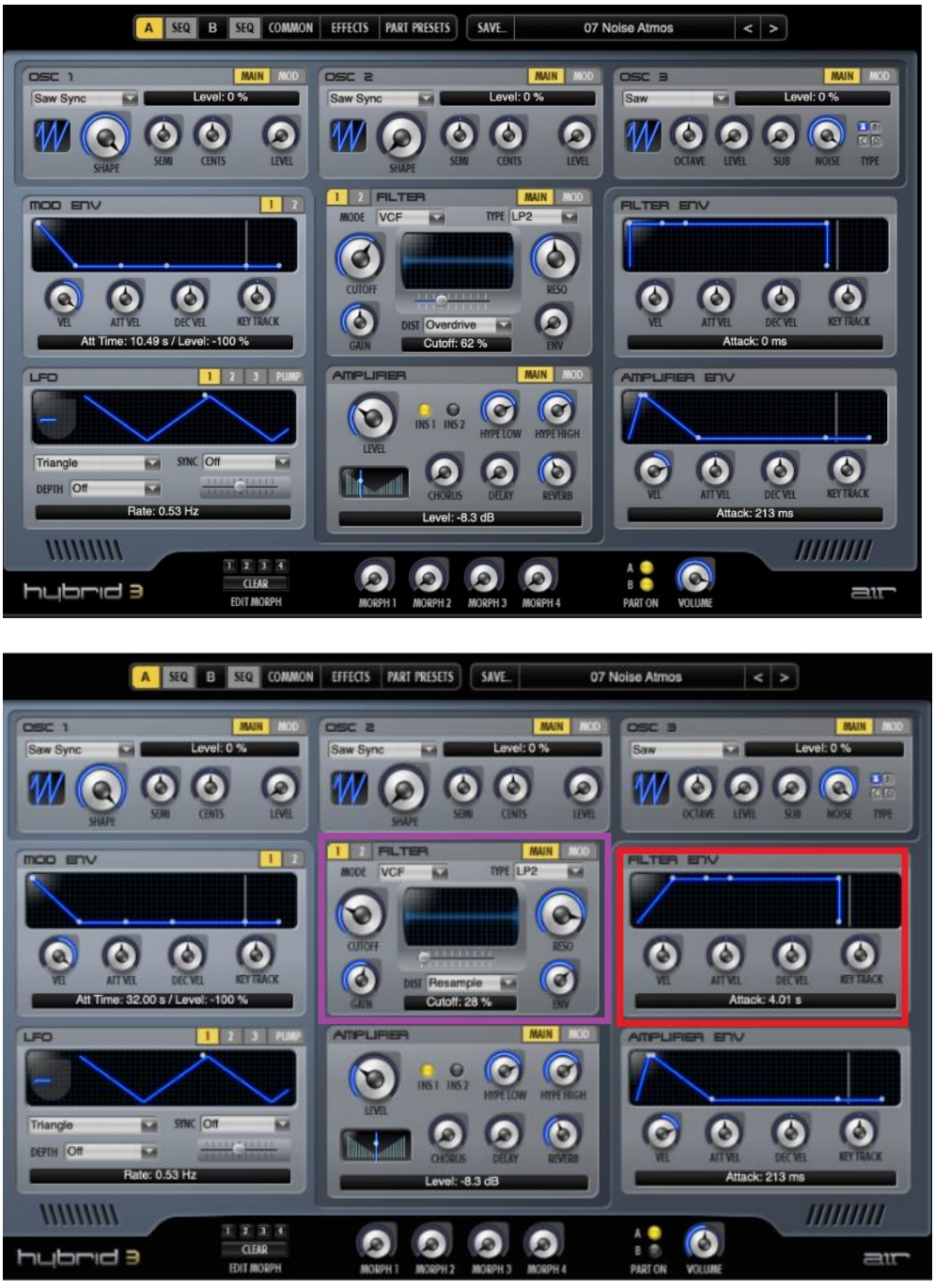
Rhythm Instrument	Hybrid 3	14 Poly Synths – 31 Trance Stabs (Chords)
Interest (Mid)	Hybrid 3	19 Soft Leads – 05 Rich Saw Lead (Poly Rave)
Bass	Loom II	Some Weight (Loom bass)
Bass	VacuumPro	06 Basses – Destructor (A) – Destructor (B)
Bass	VacuumPro	06 Basses – Meat (A)
Percussion	Hybrid 3	16 Percussive – 27 Hard Kick
Percussion	BD-909	Soft (Gabba)
Percussion	Xpand!2	024 Drums x1 (Rock Kick) – Kicks Menu X2+
Percussion	Xpand!2	024 Drums x1 (Rock Snare) – Snares Menu X2+
Percussion	Xpand!2	024 Drums x1 (Rock Click) – Snares Menu X2+
Percussion	Xpand!2	024 Drums x1 (Rock hats) – Hats+Toms+Cyms Selector X2+
Percussion	Xpand!2	024 Drums x1 (Ride) – Rides Menu X2+
Percussion	Xpand!2	024 Drums x1 (Claps) – Claps Menu X2+
Additional notes		
Samples	Audio channels x1	Used for Recorded Vocal Samples (Whispers and Screams)

When I load an instrument into the DAW I first explore the presets to find a pre-existing sound which has some of the elements I want. Once I have something loaded up I then personalise and mould the sound into what I am looking for. Here are a few examples from the *Are you ready?* track.

This first example (figure 5.) shows how I applied only minor changes to get a significantly different result. I wanted a gritty atmospheric pad to add background foundation

and interest in the upper registers of the track with a slow attack (fade in). Some changes were made to a preset which was close to the desired sound. To get a slow attack I edited the filter ENV (Figure 5. top right in the red). The filter (Figure 5. Purple box) was adjusted to achieve a more dirty/gritty/grainy sound. This was achieved from selecting another type of filter distortion, Resample instead of overdrive. I also significantly boosted the resonance of the cutoff point to create a self-oscillating effect in the filter.

Figure 5. Two images which show a before and after state of the Hybrid 3[24] Preset #23 FX - 07 Noise Atmos (Noisy pad.)



[24] "Hybrid 3 | AIR | High-Definition Virtual Synthesizer," accessed April 14, 2024, https://www.airmusictech.com/virtual-instruments/hybrid3.html

The next example (Figure 6.) shows some other considerations when making changes to a preset. I wanted to thicken the sound, however when I turned the level of OSC 3 up from 0 I was aware that the frequency register was impeding on instruments in the registers below it. To get the desired wider sound without creating unpleasant mud in the lower frequencies OSC 1, 2, and 3 settings (Figure 6. Across the top in red boxes) were altered. The OSC 3 was pushed to an octave above/higher away from the lower frequencies. The other OSC were adjusted by changing the waveform of the sound and the shape of that waveform to add to the thickness of the sound. The amplifier ENV was adjusted (Figure 6. At the bottom in purple), this was to change the decay and sustain of the delay and chorus effects.

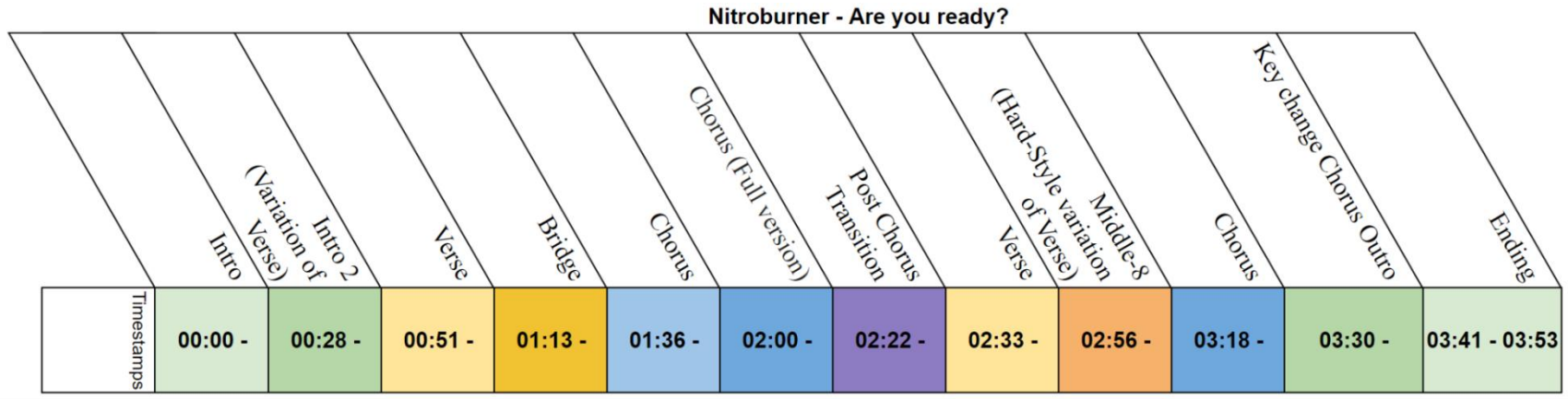
Figure 6. Two images which show a before and after state of the Hybrid 3 Preset #19 Soft Leads - 05 Rich Saw Lead (Synth rave.)

These examples demonstrate that my process is to select a preset close to what I want, and then edit the sounds in a direction that I desire.

Song Structures

The structure of the track *Are you ready?* was formed by using the building block idea presented earlier in Figure 2, and then by creating variations of the verse and chorus sections that had been written; those were then strung together into the song structure seen in Figure 7. This demonstrates that an idea can be used many times to create new material with minimal changes. This piece follows the verse – bridge – chorus loop from figure 2.

Figure 7. Image showing the song structure with timestamps for *Are you ready?*



Here is an example of my thoughts regarding the purpose of the Intro sections to *Are you ready?* Similar ideas and methods continue to be applied to every instance of my music writing.

Intro - This long section establishes the atmosphere of the piece and excites the audience by laying a solid foundation of four-on-the-floor kicks and offbeat hi hats. The snare was excluded to allow for anticipation for more. A lead synth plays in choppy and fast rhythms that grow more complex as the intro continues, other instruments begin to play and fill in spaces around it. The lower frequencies are present but restrained to allow for anticipation of something more satisfying.

Intro 2 - This is a variation on the middle 8 section (later in the piece) which is itself a variation of the verse material and introduces a filled-out bass end to drive up the energy levels. It hints at both a more filled-out percussion section by adding rim hits, and at the forthcoming chorus by introducing minimal snippets of the main hook phrase, preparing the listener for what is coming up shortly. This shows that material can be modified multiple times into new ideas.

The following two tracks, which were called *Neon City* and *Death Hazard*, were also produced using the same methodology, however the formula has been rearranged. Neon city is verse – chorus – bridge, and Death hazard is chorus – verse – bridge. This shows that there can be freedom in how a piece is constructed and will create what I think is a satisfactory piece so long as the three elements exist.

Figure 8. Image showing the song structure with timestamps for *Neon City*

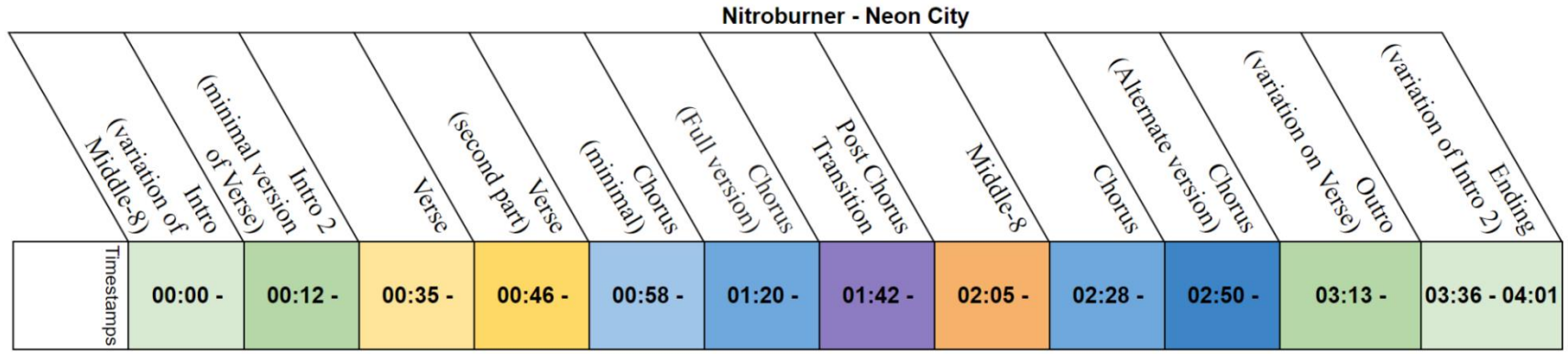
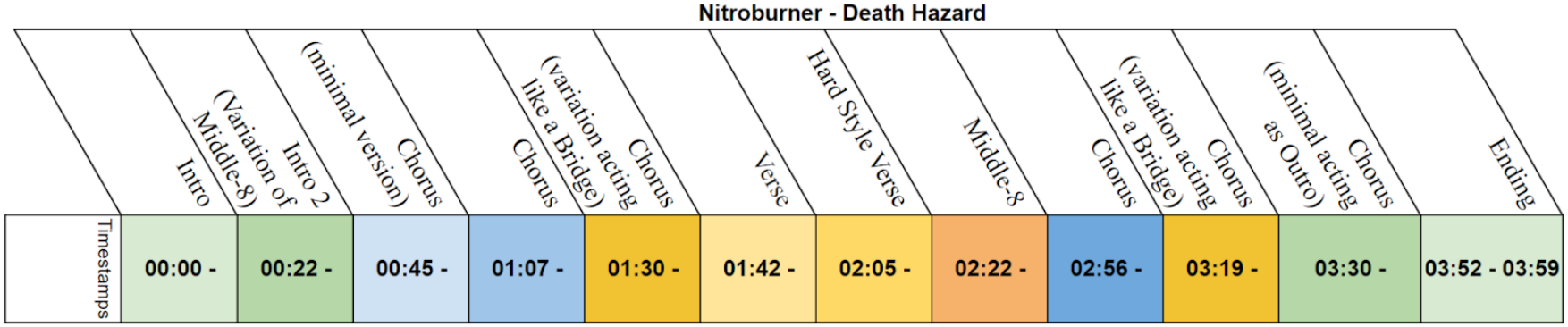


Figure 9. Image showing the song structure with timestamps for *Death Hazard*



CHAPTER IV: BLENDING DIGITAL “ACOUSTIC SOUNDS” WITH ELECTRONIC SOUNDS

Virtual Instruments that try to emulate Acoustic instruments can sound displeasing due to their inauthentic qualities to an avid listener. To hide the imperfections of the digital instruments I create complex layers of multiple virtual instruments and blend them together to mask the synthetic qualities, creating an illusion and difficulty in determining the nature of the sounds.

Simulation Genre – Sims-ulated - Let’s build a house. And Japanese Role-Playing Game Genre – JRPG - Onward to Adventure / Coastal Highlands

The simulation genre of video games contains a wide variety of digital experiences which reflect hobbies, activities, and professions from real life. This can include: car washing, skydiving, theme park management, city planning and construction, etc. To write a piece for this genre I drew references from games in which players will create families and homes and watch and control the lives of these digital puppets by putting them into drama-filled lives and humorous situations. The music compositions for these games are generally a mix of electric and acoustic instruments and are generally major in its tonality and quirky in its instrument combinations, though usually contains some amount of brass, woodwind, or string instruments. I had an opportunity to compose a piece for the Winnfield Quartet which contained a double bass, tuba, piano, and a marimba. This particular combination of instruments felt very unusual to me, however the tuba and the marimba instruments when played with a bouncy feel can be quite entertaining and joyful sounding. This inspired me to write *Let's build a house*. After having heard the quartet perform my piece live, I wondered how it could better reflect what I wanted from my composition. I took wav file audio files of each of those four instruments from the

MuseScore notation software and began adding electronic instruments to get a consistency that matched the aesthetic I wanted. This meant layering the piano with organs, adding a string section pad to the double bass, adding multiple different percussive instruments to the marimba, and adding some synth basses. Then I added an electric bass and electronic drum set. This blending of acoustic and electric instruments satisfied how I wanted the composition to sound. Table 4 shows how the four instruments were combined with other electronic sounds.

Table 4. Instrumentation of *Let's build a house*.

Foundational Instrument	Sound sources	Presets (if applicable)
Marimba - “Acoustic” • Electric	MuseScore Muse Sounds Serum Serum Massive	Marimba (imported as Wav) Plucked - Modern Drop [DRK] Plucked - So Dreamy [FP] Bell or Pad
Piano - “Acoustic” • Electric	MuseScore Muse Sounds Xpand!2 Hybrid 3	Violas (imported as Wav) 010 Acoustic Piano • Natural Grand Piano • Formant Control Piano+ • Piano Hard Layer • Piano Med Soft Layer Bell or Pad
Double Bass - “Acoustic” • Electric	MuseScore Muse Sounds Serum Xpand!2	Violoncello (imported as Wav) Lead - D_Lead 2 [DU] 014 Strings • Solo Violin+ • Big Hard Strings+
Tuba - “Acoustic” • Electric	Muse Score Muse Sounds Serum Shreddag3 Precision Free Serum (for the solo only)	Tuba (imported as Wav) Bass - D_Bass 1 [DU] Mellow Groove Bass Lead - A Bit of Luck [SD]
Drums - Electric	Shreddage Drums	Drum Machine

These same ideas of combining emulated acoustic instruments with other Virtual Instruments were applied when I composed pieces for the Japanese Role-Playing Game (JRPG) genre. Two songs were written in this genre, called *Onward to Adventure* and *Coastal Highlands*, which use strings, flute, woodwinds, and piano.

CHAPTER V: INCORPORATING ELECTRO-ACOUSTIC COMPOSITION AND LIVE PERFORMANCE CONTROLS

First Person Shooter Genre – Doom-ish - Welcome to the Red Planet / Science Cat

There have been games that use the first-person perspective since 1973 (Maze War) but the genre did not gain traction until the 90's when popular hits such as Castle Wolfenstein and Doom (table 1.) were released. Since then, there have been many different games within the genre, focusing on many ways to utilise the first-person perspective such as historical events (Battlefront), and parkour (Mirror's Edge). My focus is on the high action, intense shooter games, in which the player uses an arsenal of weaponry at their disposal to combat waves of deadly enemies set to a background of intense metal-influenced music composed intentionally to excite and energise the player. I was specifically influenced by the composer Mick Gordon who composes music for first person shooter games. To create my music, I acquired several virtual instrument sound banks to represent electric distorted guitars and an acoustic drum set. I combined these with electric bass and some virtual synthesisers.

Another part of creating this sound was creating electro-acoustic composition, which is the process of taking acoustic recordings and altering them to create new interesting sounds. Some examples of what was recorded include: windchimes, my pet cat, a train departing a station, high winds, and handheld acoustic percussion instruments. When these recordings are inserted into the digital audio workstation and then manipulated or changed using multiple and combined audio editing techniques, they can produce vastly different results from how they first sounded. These techniques may include: pitch changing, reversing, time stretching, reverb,

delay, distortion, phaser, flanger, EQ adjustments, etc. In the following two example tracks, the ambient sections utilised electro-acoustic composition.

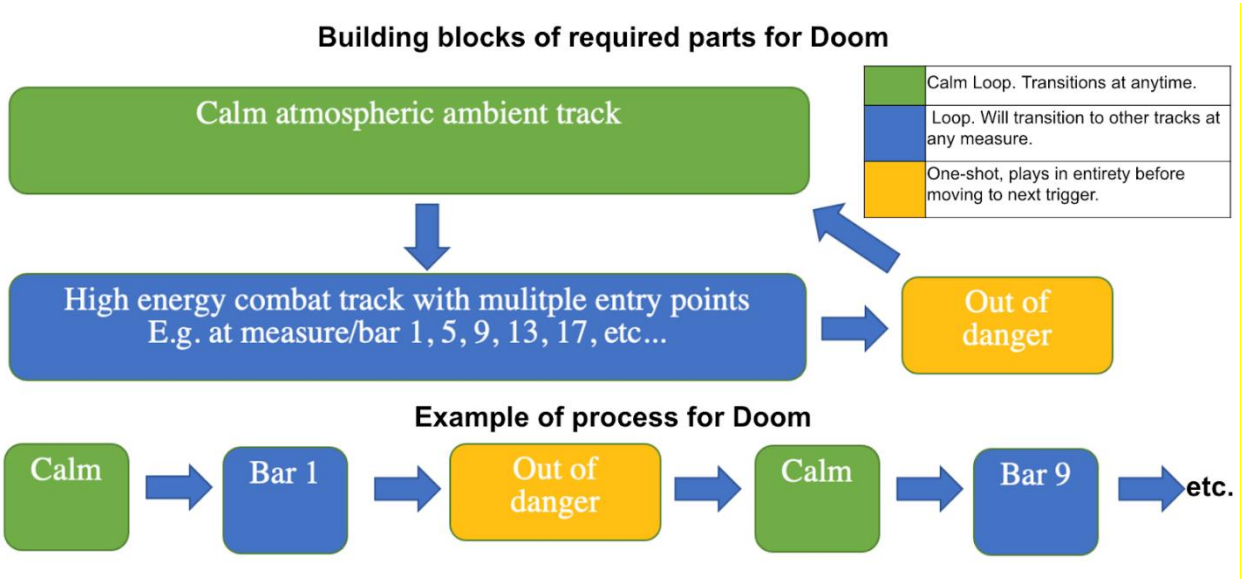
Two songs were composed using many of the same instruments (but different presets), the first of these tracks is shown in Table 5.

Table 5. Instrumentation of *Welcome to the Red Planet.*

Doom-ish - Welcome to the Red Planet		
Function	**Instrument**	**Notes (base preset name/label)**
Lead instrument	Serum	FX Robo Chatter [SN]
HF-MID Texture Rhythm	Serum	LD D_Lead 1 [DU]
FX Texture (HF)	Mai Tai	Lead - Dust Jance*
FX Texture (HF)	Serum	LD Dubrill [JD]
Ambience Pad	Eighty Eight E	The 88E
Ambience pad	FM8	Detune Drone
Ambience FX	Massive	Space Flourish
Lead Guitar	Shreddag3 Legacy 3.5	Modern Metal 3
Lead Guitar	Shreddag3 Legacy 3.5	Modern Metal 1
Rhythm Guitar	Shreddag3 Legacy 3.5	5150 Heavy Rhythm
Bass Guitar	Shreddag3 Precision free	Aggressive Swirl
Drums	Shreddage Drums	Default
Additional notes		
Samples	Audio channels x5	Used for Recorded Sample playback
Glitching effects	Glitch2 (V2.1.4)	Triggered by MIDI keyboard
Feedback	Analogue delay state space	Controlled by volume fader

These pieces were written in sections. Firstly, atmosphere to represent the game in a resting state which means: no dangerous enemies to fight, empty rooms, but suspense that at any moment there could be threats leaping out at you. Secondly, the intense heart pumping metal which plays when large conflict is occurring. This is typical of how Gordon has constructed soundtracks for the Doom games. My interpretation of this compositional function is represented in Figure 10.

Figure 10. Transitional flowchart for Doom which visualises my perception of how the score changes depending on the player's in-game combat state.



Gordon excels at using a large array of physical music devices connected in a particular array to achieve interesting results[25]. Without this equipment at my disposal, I used several techniques to create the same energy in my own way. Automating the main volume fader allowed for intensely dramatic crescendos by cutting all the reverb and decays of instruments

[25] DOOM: Behind the Music, 2017, https://www.youtube.com/watch?v=U4FNBMZsqrY - Mick Gordon presents about how he composed music for Doom.

instantly. I also programmed a MIDI keyboard to function as an effects board using the Glitch2 VST (Virtual Studio Technology) software. Glitch2 is a virtual effects unit which can trigger gating effects (chopping of sound), retriggering of notes/sections that just occurred (skipping effect), Lofi down sampling (degrades the sound so that it is less clear or defined), and distortions and delays etc. I set each note of a C major scale to trigger different scenes preset in the effect, and each black piano key to trigger a blank scene so that no effect is occurring shown in Figure 11.

Figure 11. Glitch2 empty scene triggered by any black key on the MIDI keyboard.

Another effect which was used was fake feedback. The guitar instruments did not have natural feedback which would occur when playing a physical instrument. To create feedback, I loaded up a digital effect called “analogue delay” by state pace. Figure 12 shows changes which were made to the default preset. I maxed out some of the dials (feedback, amount, and wet

amount highlighted in red) until the unit self-oscillated to produce a screaming sound. I automated the volume fader for this from a setting of -infinite so that the feedback would only be heard when I wanted it.

Figure 12. analog delay by state space set to self oscillate.

Song Structures

Figure 13. Image showing the song structure with timestamps for *Welcome to the Red Planet*.

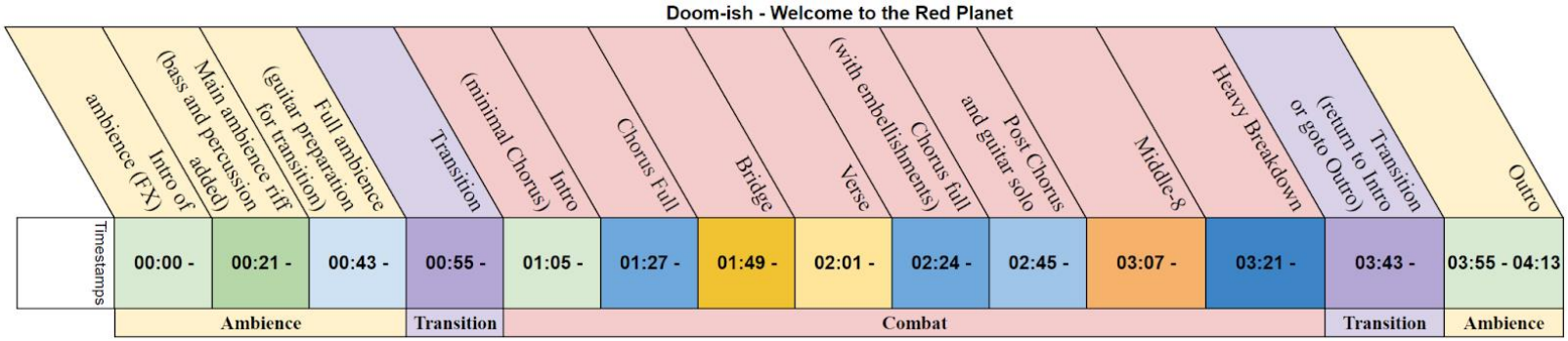
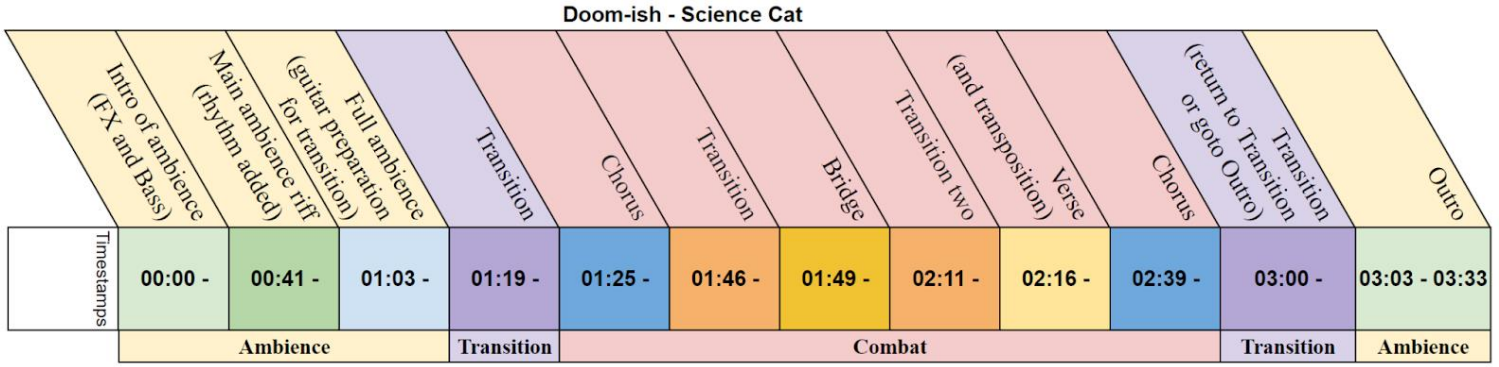


Figure 14. Image showing the song structure with timestamps for *Science Cat.*



CHAPTER VI: CONCLUSION

This paper introduced the core concepts of how I approach composition, the considerations and procedures for what tools and techniques I will use when writing a piece, and nine pieces of music which demonstrate the execution of the techniques in my digital compositions. Then I went on to describe the four general approaches involving digital audio workspaces. The first of these was how tracking software can be employed to create authentic retro video-game soundtracks. Next, I described how my workflow involves the process of envisioning the specific sound first and then manipulating presets to shape the concept into reality. Then, I described how I work with synthesised or emulated acoustic-sounding instruments. Finally, I note how I use electro-acoustic composition to create additional sounds that add depth and interest to my compositions. Combining these four approaches for digital audio workspaces, along with thoughtful consideration of verticality for instrumentation and the building blocks which create the core sections of the music, are what help me create my unique compositions.

My goal is to be able to continue to explore and create interesting, thematic, and story enriching compositions which would be considered for use in the video games industry. I think that each of the nine pieces presented through this document help to accurately demonstrate my capabilities as a digital composer.

REFERENCES

7GamerMinutes+: Video Game Music, dir. 2013. *Wings for My Way (GX Advertise)[F-ZERO GX]*. Accessed 2 April 2024. https://www.youtube.com/watch?v=CdggsUSLUqA.

Bethesda Softworks Music, dir. 2018. *1. Blitzmensch! | Wolfenstein II: The New Colossus OST*. Accessed 2 April 2024.https://www.youtube.com/watch?v=JtQ8Kpkvzk4.

Electric Dreams Chiptune & Game Music, dir. 2019. *Thunder Force III 3 - Opening Theme & Stage Select Sega Mega Drive Genesis Soundtrack*. Accessed 2 April 2024. https://www.youtube.com/watch?v=DZo9Y-aVjss.

Falcom Music Channel, dir. 2016. *Ys VIII -Lacrimosa of DANA- OST - Lacrimosa of DANA -Opening Ver.-*. Accessed 2 April 2024. https://www.youtube.com/watch?v=NU4am8acLR0.

Freakfinity Radio, dir. 2021. *Hellfire OST: Sega Genesis - 01 - Ready to Go ~ Captain Lancer*. Accessed 2 April 2024. https://www.youtube.com/watch?v=Ko2qiEWKhJg.

Games, Liberty. n.d. 'A Detailed History of Shoot Em Up Arcade Games'. Liberty Games. Accessed 2 April 2024. https://www.libertygames.co.uk/blog/a-detailed-history-of-shoot-em-up-arcade-games/.

Gaming, Classical. 2012. 'Research in Game Music: The Difference between Pulse Waves and Square Waves'. *Classical Gaming* (blog). 15 May 2012. Accessed 2 April 2024. https://classicalgaming.wordpress.com/2012/05/15/research-in-game-music-the-difference-between-pulse-waves-and-square-waves/.

GDC, dir. 2017. *DOOM: Behind the Music*. Accessed 2 April 2024. https://www.youtube.com/watch?v=U4FNBMZsqrY.

‘Hybrid 3 | AIR | High-Definition Virtual Synthesizer’. n.d. Accessed 14 April 2024. https://www.airmusictech.com/virtual-instruments/hybrid3.html.

ImGrahamB, dir. 2013. *WipEout® OST [PSX]: CoLD SToRAGE - Cairodrome*. Accessed 2 April 2024. https://www.youtube.com/watch?v=dUQxO8ZFU9g.

‘Is a Middle 8 the Same as a Bridge? Explained’. 2023. 23 August 2023. Accessed 2 April 2024. https://www.ac3filter.net/is-a-middle-8-the-same-as-a-bridge/.

J.O.E. VGM, dir. 2018. *Xenoblade II - Where It All Began (Beta) - Xenoblade Chronicles 2 OST [001]*. Accessed 2 April 2024. https://www.youtube.com/watch?v=PFto0LPNkBI.

Kotlinski, Johan. n.d. ‘Little Sound Dj v9.2.6 Operating Manual’. May 09, 2024. https://www.littlesounddj.com/lsd/latest/documentation/

lewdmeat, dir. 2020. *Mick Gordon - Hell On Earth*. Accessed 2 April 2024. https://www.youtube.com/watch?v=ClUDlCgxetA.

Nox, dir. 2018. *Doom OST - I. Dogma*. Accessed 2 April 2024. https://www.youtube.com/watch?v=7o9W-7JHs_w.

PlasmoidThunder, dir. 2021. *Main Menu - FAST RMX*. Accessed 2 April 2024. https://www.youtube.com/watch?v=lTGqwlsl-xc.

SEGA 16-bit OST, dir. 2022. *Steel Empire -01- Title Theme (SEGA GEN/MD) - OST*. Accessed 2 April 2024. https://www.youtube.com/watch?v=gNGv3SBBjZs.

SNES vs Gameboy Music: Mega Man Xtreme, 2022. Accessed November 12, 2022. https://www.youtube.com/watch?v=G4nZ3Y8xLwA.

Tansum, dir. 2014. *01. Deathshead - Wolfenstein The New Order Soundtrack*. Accessed 2 April 2024. https://www.youtube.com/watch?v=xpzaHVg__KQ.

TheGenOST, dir. 2010. *The Sims™ 2 Soundtrack: Main Theme*. Accessed 2 April 2024. https://www.youtube.com/watch?v=lF90l7zWHMg.

VGM Archive, dir. 2016a. *StarFox (Full OST) - SNES*. Accessed 2 April 2024. https://www.youtube.com/watch?v=byIjMomjWkA.

———, dir. 2016b. *StarFox 64 (Full OST) - N64*. Accessed 2 April 2024. https://www.youtube.com/watch?v=Wzwgztv3oCQ.

Video Games Music, dir. 2019. *Demo [Nintendo Spaceworld 2001] - The Legend of Zelda: The Wind Waker*. Accessed 2 April 2024. https://www.youtube.com/watch?v=0VSFJefHYaE.

xRussianYulia17x, dir. 2009. *XG3: Extreme-G Racing [Music] - Menu*. Accessed 2 April 2024. https://www.youtube.com/watch?v=rGUYXf64I1U.

APPENDIX A: COMPOSITION EXAMPLES

The following link can be used to find videos containing the composition examples used throughout this paper, and referred to in Table 1. https://www.youtube.com/playlist?list=PLCm3A_SK6JnixrlEiy_yW1SvPJ3Wro1nx. The compositions are also included as associated files with this document.

1. *Starfighter - Onward to Victory*
2. *Nitroburner - Are you ready*
3. *Nitroburner - Neon City*
4. *Nitroburner - Death Hazard*
5. *Sims-ulated - Lets build a house*
6. *JRPG - Onward to Adventure*
7. *JRPG - Coastal Highlands*
8. *Doom-ish - Welcome to the Red Planet*
9. *Doom-ish - Science Cat*

APPENDIX B: ADDITIONAL READING

Amos, Evan. *The Game Console: A Photographic History from Atari to Xbox*. San Francisco, CA, UNITED STATES: No Starch Press, Incorporated, 2018. Accessed November 1, 2022. http://ebookcentral.proquest.com/lib/uncg/detail.action?docID=5647552.

Bridgett, Rob. *Leading with Sound: Proactive Sound Practices in Video Game Development*. London: Focal Press, 2021.

Chan, Jayden, Justin John Daza, William Kwan, and Anup Basu. "Facilitating Player Progression by Implementing Procedural Music in Videogames." In *2017 IEEE International Conference on Systems, Man, and Cybernetics (SMC)*, 2328–2333. Banff, AB: IEEE, 2017. Accessed August 27, 2022. http://ieeexplore.ieee.org/document/8122969/.

Collins, Karen. "An Introduction to Procedural Music in Video Games." *Contemporary Music Review* 28, no. 1 (February 2009): 5–15.

———. *Game Sound: An Introduction to the History, Theory, and Practice of Video Game Music and Sound Design*. Cambridge, UNITED STATES: MIT Press, 2008. Accessed September 11, 2022. http://ebookcentral.proquest.com/lib/uncg/detail.action?docID=3338949.

Donnelly, K. J., William Gibbons, and Neil Lerner, eds. *Music in Video Games: Studying Play*. New York: Routledge, 2014.

Ewell, Philip A. "Music Theory and the White Racial Frame." *Music Theory Online* 26, no. 2 (September 1, 2020). Accessed November 11, 2022. https://mtosmt.org/issues/mto.20.26.2/mto.20.26.2.ewell.html.

Moormann, Peter, ed. *Music and Game*. Wiesbaden: Springer Fachmedien, 2013. Accessed September 11, 2022. http://link.springer.com/10.1007/978-3-531-18913-0.

Phillips, Winifred. *A Composer's Guide to Game Music*. Cambridge, UNITED STATES: MIT Press, 2014. Accessed September 11, 2022. http://ebookcentral.proquest.com/lib/uncg/detail.action?docID=3339744.

How Boss Music Works in Pikmin 3 Deluxe, 2020. Accessed November 12, 2022. https://www.youtube.com/watch?v=GaBJ2C7Am6E.

Thomas, Chance. *Composing Music for Games: The Art, Technology and Business of Video Game Scoring*. New York: Routledge, 2016.

Williams, Duncan, and Newton Lee. *Emotion in Video Game Soundtracking*. Cham, SWITZERLAND: Springer International Publishing AG, 2018. Accessed September 11, 2022. http://ebookcentral.proquest.com/lib/uncg/detail.action?docID=5287486.

Wolf, Mark J. P. *The Video Game Explosion: A History from PONG to Playstation and Beyond*. ABC-CLIO, 2008.

05 We Are All Going to Die! (Stage 2 Boss), 2021. Accessed November 13, 2022. https://www.youtube.com/watch?v=z1KdNAV_oh0.

CHAPTER 4: BASIC MUSIC SCORING TECHNIQUES FOR GAMES, n.d. Accessed November 12, 2022. https://learning.oreilly.com/library/view/composing-music-for/9781315318622/xhtml/15_Chapter05.xhtml.

CHAPTER 5: ADVANCED MUSIC SCORING TECHNIQUES FOR GAMES, n.d. Accessed November 12, 2022. https://learning.oreilly.com/library/view/composing-music-for/9781315318622/xhtml/16_Chapter06.xhtml.

Chapter 8. Horizontal Resequencing, n.d. Accessed November 10, 2022. https://learning.oreilly.com/library/view/writing-interactive-music/9780133563528/ch08.html.

"Game Composer Guy Whitmore Interviewed." *Game Music Town*, June 21, 2017. Accessed August 27, 2022. https://www.gamemusictown.com/interview-game-composer-guy-whitmore/.

"Gaming Is Booming and Is Expected to Keep Growing. This Chart Tells You All You Need to Know." *World Economic Forum*. Accessed August 27, 2022. https://www.weforum.org/agenda/2022/07/gaming-pandemic-lockdowns-pwc-growth/.

"IASIG - Interview with Guy Whitmore." Accessed August 27, 2022. https://www.iasig.org/pubs/interviews/guy_whitmore.shtml.

"Number of Gamers Worldwide by Region 2021." *Statista*. Accessed August 27, 2022. https://www.statista.com/statistics/293304/number-video-gamers/.

"The Game Music Handbook : A Practical Guide to Crafting an Unforgettable Musical Soundscape." Accessed October 30, 2022. https://web-p-ebscohost-com.libproxy.uncg.edu/ehost/ebookviewer/ebook/bmxlYmtfXzI2MjkwOThfX0FO0?sid=83558e1d-5977-4a8a-a46b-d02dcbc48ffd@redis&vid=0&format=EB&rid=1.

"U.S. Video Game Player Share 2021." *Statista*. Accessed August 27, 2022. https://www.statista.com/statistics/499703/share-consumers-ever-play-video-games-by-age-usa/.

"Video Game History." *Smithsonian Institution*. Accessed October 2, 2022. https://www.si.edu/spotlight/the-father-of-the-video-game-the-ralph-baer-prototypes-and-electronic-games/video-game-history.

Writing Interactive Music for Video Games: A Composer's Guide, n.d. Accessed November 12, 2022. https://learning.oreilly.com/library/view/writing-interactive-music/9780133563528/.

Writing Interactive Music for Video Games: A Composer's Guide, n.d. Accessed November 12, 2022. https://learning.oreilly.com/library/view/writing-interactive-music/9780133563528/.