

Digital Worlds: The History of Video Game Music
From a Production Perspective

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Introduction

In the modern era of technology and connectivity, one of the most interactive forms of personal entertainment is video games. While video games are arguably at the height of popularity amid the social restrictions of the current Covid-19 pandemic, this popularity did not pop up overnight. For the past four decades video games have been steadily rising in accessibility and usage, growing from a novelty arcade activity of the late 1970s and early 1980s to the globally shared entertainment experience of today. A remarkable study from 2014 by the Entertainment Software Association found that around 58% of Americans actively participate in some form of video game use, the average player is 30 years old and has been playing games for over 13 years. (Sweet, 2015) The reason for this popularity is no mystery, the gaming medium offers storytelling on an interactive level not possible in other forms of media, new friends to make with the addition of online social features, and new worlds to explore when one wishes to temporarily escape from the monotony of daily life.

One important aspect of video game appeal and development is music. A good soundtrack can often be the difference between a successful game and one that falls into obscurity. Some games, such as *Tetris* (developed by Alexey Pajitnov, 1984) or *Halo* (developed by Bungie, inc., 2001) are recognizable in gaming communities by their soundtrack alone. The importance of game music lies in the implementation of its soundtrack. The interactivity of game music sets it apart from any other form of media. While movies and television contain a linear soundtrack that will be experienced the same way on each viewing, a game soundtrack is non-linear, with changes based on the actions of the player. In the modern era this music is played through a game engine as the player progresses, such as the implementation system used in *Halo 3* which would loop sections of music based on the area of the game the player was currently in.

(Summers, 2016) Similar to live music, a game soundtrack is never experienced the same way twice. This variability aids in the most important aspect of a video game soundtrack: immersion.

The immersion of a player within the world of a video game is the main goal of developers and a major reason for the widespread popularity of games as a whole. Winifred Phillips, a video game composer from the US, explains that this immersion is achieved through multiple levels of engagement to develop an emotional investment: sonic and visual changes based on player actions, storytelling, perception of time, exciting gameplay, and music. (Phillips, 2014) With this knowledge, one realizes that an immersive soundtrack is a prerequisite to the immersion of a player. Without a proper soundtrack a game world feels dull and lifeless, lacking the elements to bring the world to life. This is why video game music is so important and why it is the subject of my capstone thesis project. Through the composition and production of my own soundtrack, I will explore how video game music development has changed through the past four decades. I have prepared four pieces of music, one for each decade, inspired by the soundtracks of games from their respective era with the intent to analyze the major differences of production, style and interactivity within.

Background

The intent of this section is to provide a brief introduction to the history of video game music development, as it has drastically changed and evolved over time with the advancement of technology. An understanding of the major changes to game music through these decades is necessary before analyzing my own work.

1980s

While audio in video games was first introduced during the mid-1970s with *Pong* (developed by Atari, 1972), the addition of musical audio and melody in games did not really appear until the 1980s. Michael Sweet, a prominent game developer and music composer, states that the invention of the Programmable Sound Generator (PSG) was the most important technological leap in video game music at this time. This device was essentially a microchip included in arcade games and rudimentary home consoles that allowed melodies made with basic sound waves to be played. These sound waves came in different shapes, such as the triangle wave or the sine wave, which would play different pitches based on the frequency at which the PSG synthesized them (See *Figure I* below). PSGs varied from machine to machine, but most arcade games and consoles allowed for up to four or five sounds to be played at once. (Sweet, 2015) For example, the Nintendo Entertainment System (1983) opted for two square wave channels, one triangle wave channel and a noise channel while the arcade machine for *Pac-Man* (developed by Namco, 1980), which was one of the first ever games to include a melody that would play during gameplay, included three square wave channels and a noise channel. (Mosley, 2020)



Figure I (screenshots taken from XFer Serum Synthesizer)

Due to the limitations of data storage at the time, the PSG was an effective way to include music without taking up too much space, but it was not the only way for games to include music. In 1984 with the release of the Commodore 64 computer came the Sound Interface Device (SID) chip, which included a more customizable alternative to the PSG. The SID contained three channels with selectable sound wave forms and analog filters, meaning a specific sound wave could be selected and programmed for a channel and analog filters could be applied to it with varying effects. However, the Commodore 64 did not begin gaining major popularity until the end of the decade, moving into the 1990s. (Sweet, 2015)

The style of 1980s game music was closely related to the technological limitations of the time. Because only a few different types of sounds could be created and only six maximum voices were ever used, composers had to use creative and interesting melodies to make their games more appealing. The music was often harsh and noisy because of the synthesized sound waves used, with abrasive and quick melodies complimented by counterpoint harmonies in the bass frequencies. *Super Mario Bros.* (developed by Nintendo, 1985), *Frogger* (developed by Konami, 1981) and *Tetris* are examples of games from the 1980s with iconic soundtracks that are still recognizable in popular culture to this day.

Interactivity is a very important aspect of game music for the modern era that did not play a major role in music production for the 80s. While there are many games that utilized sound effects for player actions like firing a gun or running and jumping, changes to music based on gameplay was not a prominent element of game design. This is largely due, again, to the technological limitations of the time period. Developers did not want to waste the small amount of data storage available to allocate the extra programming required to make changes to the music being played. However, there are a few examples of interactive soundtracks from this era,

such as *Dig Dug* (developed by Atari, 1982), a maze game similar to *Pac-Man* which featured a soundtrack that would increase in tempo based on how much time was remaining for the player to finish the level.

1990s

The 1990s were a pivotal point for video games as focus shifted from social arcade machines to home-owned consoles. As technology continued to advance, more channels were added to PSG oriented systems and composers began experimenting with new sound generation techniques. One of these techniques was utilizing Musical Instrument Digital Interface (MIDI) to produce sound through the internal sound card of a gaming machine rather than a PSG. MIDI is a form of data that can be read by sound cards in computers and consoles to produce sound. This MIDI data used the General MIDI instrument set made by the MIDI Manufacturers Association to produce sound rather than the basic sound waves of the PSG. (Sweet, 2015) General MIDI utilized more complex patterns of sound waves to imitate the sounds of actual instruments and would come preloaded on most standard sound cards on Personal Computers (PCs) and consoles of the 1990s. (Fritsch, 2013) This MIDI data could be created easily by composers utilizing a music sequencing program called a “Tracker,” which was a precursor to most modern Digital Audio Workstations. (Mosley, 2020) The gaming machines that utilized MIDI like PCs and the PlayStation 1 (developed by Sony Entertainment) switched from cartridges to CD-Rom discs that could hold much more data.

The 1990s also marked the beginning era of audio samples, as the progression of technology meant more data space could be allocated for actual compressed audio. For example, the opening sequence of *Sonic the Hedgehog* (developed by Sega, 1991) featured an audio

recording of a choir singing “Sega” while the Sega logo popped up on the screen. However, space was still limited and composers had to use samples sparingly. That “Sega” audio file alone reportedly took up 1/8th of the storage space of the *Sonic the Hedgehog* game cartridge. (Kemps, 2005) Thus, composers continued to prefer midi synthesized instruments which took much less data storage than sampled instruments or live recordings. These midi instruments had a unique, diminished sound quality that made them easily distinguishable from recordings of actual instruments. This, combined with the limited speakers of television and PC systems of the time, gave the music of 1990s era games a “thinner” sounding frequency range than contemporary music.

2000s

At the turn of the century technology was finally starting to catch up to the aspirations of game designers. Home consoles like the new Xbox (Microsoft) and PS2 (Sony) opted for DVD-Rom discs which could hold a whopping 5 GB of data, much larger than the 700 MB of CD-Rom discs of the 1990s. (Sweet, 2015) On the PC side of gaming, Microsoft was revolutionizing the industry with their Windows operating system and game development companies that focused on PC games began standardizing their software to fit the windows operating system as it became more popular. Just like before, as the size of data storage increased so did the complexity and quality of game audio. Video game sound designers could finally utilize most of the tools that other composers and producers had at their disposal to make game soundtracks. Instruments could now be fully sampled (see *Figure II* below) and advanced signal processing techniques like equalization and stereo imaging could be utilized without having to sacrifice

space. Video games that centered around almost entirely recorded audio and even popular music began releasing, like the *Guitar Hero* and *Rock Band* franchises.

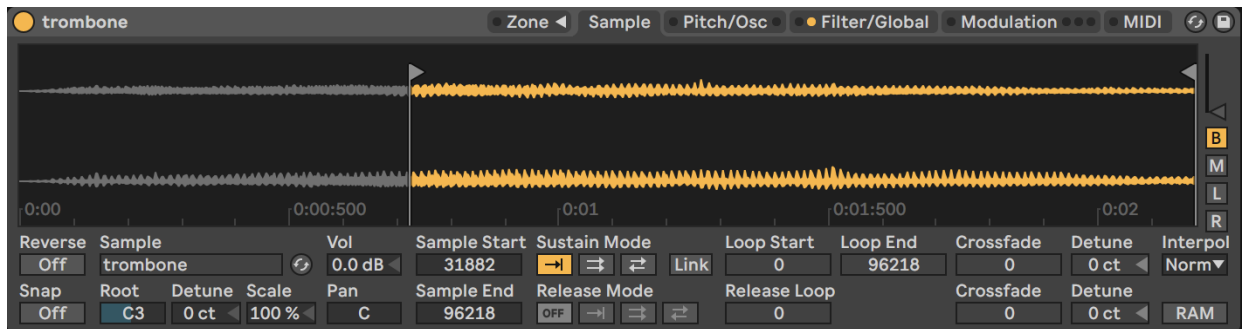


Figure II (A standard sampler with an audio recording of a Trombone. Screenshot taken from Ableton Live)

The music for games at this time varied wildly in quality through the decade. Rapidly changing technology in consoles, PCs and music production software meant that the data storage space allotted for music was changing along with the quality of instrument recordings and speakers. Music from the early 2000s still had a thin range of frequency and a bit of a distorted quality, while music from the late 2000s more closely resembled contemporary quality. Additionally, more advanced digital audio workstation technology opened up new production techniques for composers like automation and complex signal processing. This allowed sampled and synthesized instruments to begin sounding much more like recorded audio.

2010s

The 2010s can be considered the pinnacle of game development technology. Digital Audio Workstations like Ableton Live, Logic Pro X, and even Garageband were and still are utilized to this day to compose and produce full length game audio, while audio middleware like FMOD, Wwise, and Fabric are used to take those audio tracks and integrate them into game files.

The rise of online multiplayer games, digital online stores, and large data storage for consoles and PCs had massive ramifications for the industry of game music. Video game players could now download games directly from a digital store to their machine and be playing within minutes. This meant that the data storage of DVDs and CDs didn't matter anymore, game developers could make the game as large as they wanted to as long as it still was able to fit on the allotted storage space of home consoles and PCs. Composers were now completely free to use any contemporary production techniques. The quality of game music fully matched the quality of popular entertainment music for the first time; There were no longer any restraints to hold game music back. Huge game franchises like *Doom (2016)* (developed by id Software and composed by Mick Gordon), and *The Elder Scrolls: Skyrim (2011)* (developed by Bethesda and composed by Jeremy Soule) showed that a game soundtrack could become almost as popular as the game itself.

Reflection

This section of the paper will focus on a reflection of the production behind the four video game soundtracks I composed for this thesis project. Before I begin, I would like to clarify the goals I had in mind for writing these pieces. I challenged myself to create a musical piece that would fit in the soundtrack of a hypothetical game from each era. To do this I attempted to utilize the same instruments, melodic style, and production techniques that composers would have used during each particular decade. Obviously I could not perfectly mimic the tools of this era, as most of the software used during the earlier decades was outdated and unavailable to me. To overcome this drawback I emulated the software and techniques to the best of my ability with the tools I did have available.

I should note that for each soundtrack I included a simple and easily recognizable motif in the melody. I utilized this motif in an attempt to highlight the similarities and changes of the pieces through each decade. While I kept the general melody of the motif the same for each decade, I altered the tempo, key, and rhythm to better fit each piece on an individual basis. Please see *Figure III* below and the accompanying audio file titled “Thesis Motif Solo.mp3” for a brief example of the motif by itself so it will be easier to recognize in the following soundtracks.



Figure III (Score of the motif. Screenshot taken in Finale)

1980s: Level_1

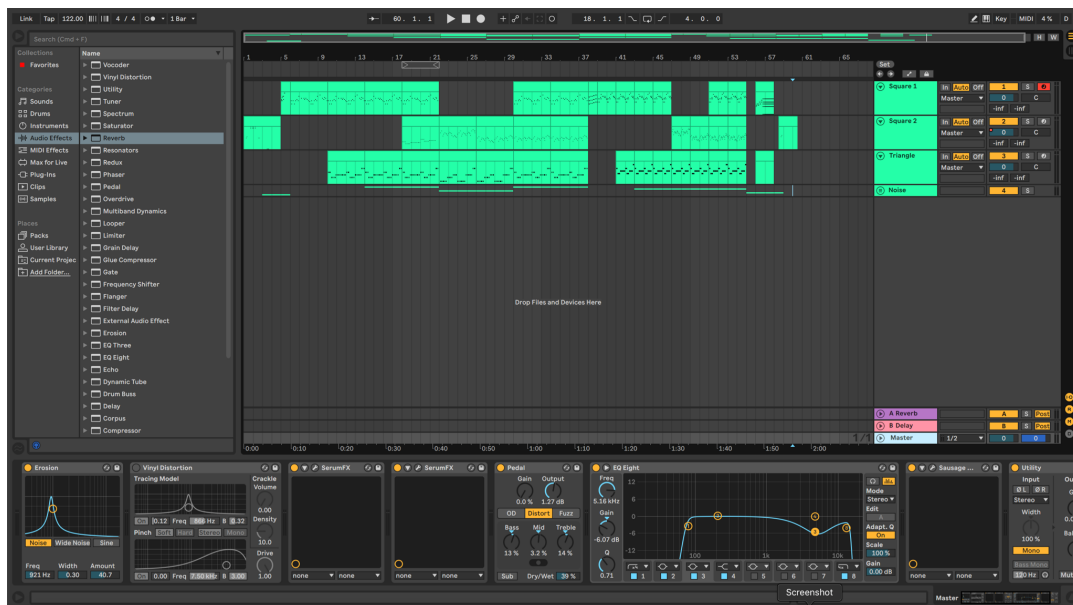


Figure IV (Project file for Level_1 in Ableton Live)

Above is a screenshot of the project for my 1980s video game soundtrack, “Level_1.” Please refer to the accompanying audio file titled “80s_Level_1.mp3” to listen to the completed track. My inspiration for this piece came from the soundtracks for *Super Mario Bros.* (Nintendo) and *Dig Dug* (Atari/Namco). The process for writing this piece started with creating the synthesized sounds I would be using as instruments; I mainly utilized the Xfer Serum synthesizer plugin to craft the melody and harmony synths. To stay true to the production method of the 1980s I only used four tracks playing at once to mimic the PSG of arcade machines. In addition to crafting my instruments, I needed to imagine what the hypothetical game for this soundtrack would look and play like. I decided on something similar to *Super Mario Bros.*, with the player character exploring a 2D side-scrolling world while avoiding monsters and facing off against a final “boss” enemy at the end of the level.

I wanted the intro of this piece to feel nostalgic and authentic, so I crafted some simple sound effects for what a main menu screen on an arcade game might sound like and played those as if a player was navigating through a real menu. One can hear the sound of the player actually starting the game, followed by the main melody. This melody is a very simple version of the motif I presented before and serves as the main theme for this soundtrack. The bassline comes in next with an upbeat harmony to compliment the theme. I imagined what I wanted the piece to sound like as the player wanders around in the game encountering enemies and fighting for survival. I also wanted the theme to be bright and energetic, like something that might attract attention from potential players at an arcade. The percussion sounds were a real challenge for me, I wanted to craft something with an exciting beat but I was limited by the decade for this piece. I could not use audio samples, so instead I created the drums by distorting white noise and experimenting with envelope shapes to form a kick/snare pattern out of a synthesizer.

The idea for the next section of the piece came directly from *Dig Dug*, which as I stated before had a soundtrack that increased in tempo as the time to complete a level slowly ran out. This segment was my take on that idea, but instead of a slowly increasing tempo I decided to modulate the key and utilize the same theme playing twice as fast. I wanted this segment to be what the player hears as they fight the final boss of the level for the hypothetical game, so I felt this double-time theme would effectively excite the player and fit the intense situation well. The last thing the player hears in this soundtrack is a little chiptune “congratulations” sound effect that would play after they beat the boss and finish Level_1.

1990s: The Promise



Figure V (Screenshot of 1990s project file in Logic Pro)

For my 1990s piece, titled “The Promise” I switched from the Ableton Live DAW to Logic Pro. This is a matter of personal preference, in my opinion Logic is better suited for more “organic” sounding music while Ableton works better for electronic compositions. Please refer to the audio file titled “90s_The Promise.mp3” for a recording of the completed track. Just like with the 80s piece, I imposed limitations on what I was allowed to use to compose this piece. To create the instruments in this track I started with the GM1 (General Midi Level 1) instruments

that would have been used during the 90s and altered their waveforms a bit to achieve an authentic “thin” frequency sound. I decided to change up the genre for this piece, imagining a hypothetical 3D horror game for the soundtrack, inspired by popular 90s horror games *Silent Hill* (Konami) and *Resident Evil* (Capcom).

To fit the horror atmosphere of my hypothetical game I used a creepy sounding minor piano progression to set the mood of the intro. Next I modulated the motif melody from the 80s soundtrack to fit the minor key and played it on the same piano instrument. I imagined this would be the main theme, sounding as if it’s being played on an antique record as the player explores the horror game, adding to the atmosphere of isolation and emptiness. Then, as the player continues to explore, I have the strings come in on a legato harmony and slowly increase in intensity to trick them into thinking a big scare is coming. But then the strings suddenly disappear, and the player is again left with just the piano theme and harmony. But this time there are short string plucks highlighting the beats of the piece and increasing the anxiety of the atmosphere. I imagined a big jumpscare happening at this segment, followed by a change of the theme to feature just plucked strings and a new melody to add some variation. Finally the original theme comes back in for a brief countermelody interaction with the new theme, ending yet again with just a piano and plucked strings to bring back that feeling of isolation and emptiness from the beginning of the piece.

2000s: Pirate Bay

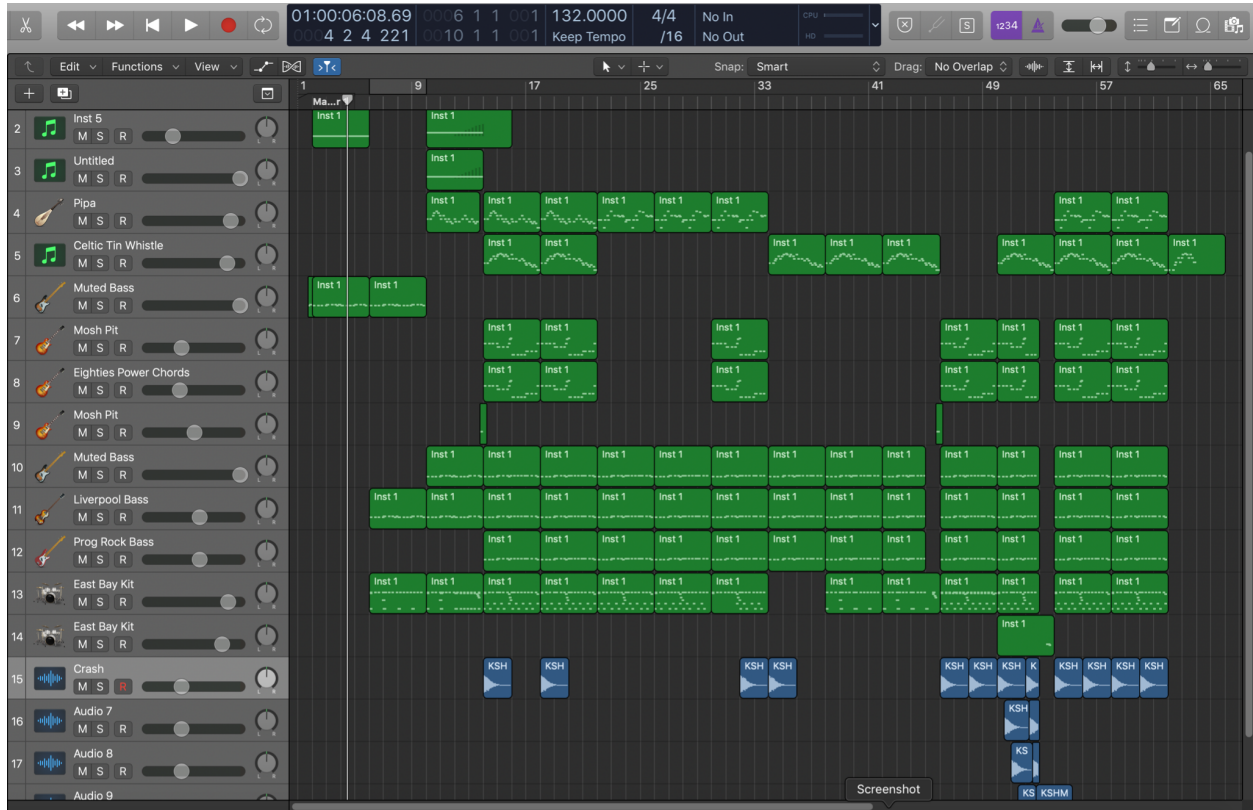


Figure VI (Screenshot of 2000s project in Logic Pro)

As one can see from *Figure VI* above, the complexity of the 2000s project, titled “Pirate Bay,” has increased significantly from the previous decades. Please refer to the audio file “2000s_Pirate Bay.mp3” for the completed piece. The project uses 11 instrument channels, 2 drum channels and 6 extra channels for miscellaneous audio samples, which is much larger than the 9 instrument samples used in the previous decade. Due to the rapidly changing technology of the 2000s, I had to find a middle ground for this piece in terms of sound quality and signal processing. If I used too much signal processing or opened up the frequencies of the instruments it began to sound more like a piece from the 2010s. But if I didn't use enough signal processing the instruments sounded flat and unrealistic. While a majority of the instruments I used were still MIDI based, I switched over to sample-based instruments and recorded audio for sounds that

were too complicated to replicate with MIDI, like guitars and drums. This choice did not violate my restriction on only using the instruments composers used during the particular decade. As I stated before, by this point video games had reached a data storage size capable of storing recorded audio.

When deciding on the genre of the hypothetical video game for this soundtrack I was inspired by the 2003 *Pirates of the Caribbean* action-adventure RPG developed by Bethesda. I imagined a similar 3D action game based around exploration and naval combat. What we as listeners would refer to as “pirate music” seemed to be inspired from multiple seafaring cultures throughout the world. Therefore, I structured my composition like a Rock and Roll piece to fit the exciting atmosphere of the imaginary game and included Asian and Celtic instruments for the added cultural flair.

I started the piece with a thumping bass line and dissonant strings to build into the main chorus. For the chorus I decided to go with a different style of melody, something that would fit the “pirate” feeling better, and settled on a Celtic/Irish Tin Whistle sound. Listening to a few traditional Tin Whistle tunes from Irish folk history provided inspiration for the structure of this melody. After the chorus I had the melody return to the original motif on a traditional Chinese instrument called a Pipa and changed up the rhythm to better fit the swinging tempo. The chorus melody and the motif melody fit really well together, so during the second chorus I had them both play at the same time. Finally, I had the piece conclude with just the chorus melody and the bassline so that it could loop back into the intro easily.

2010s: Champion

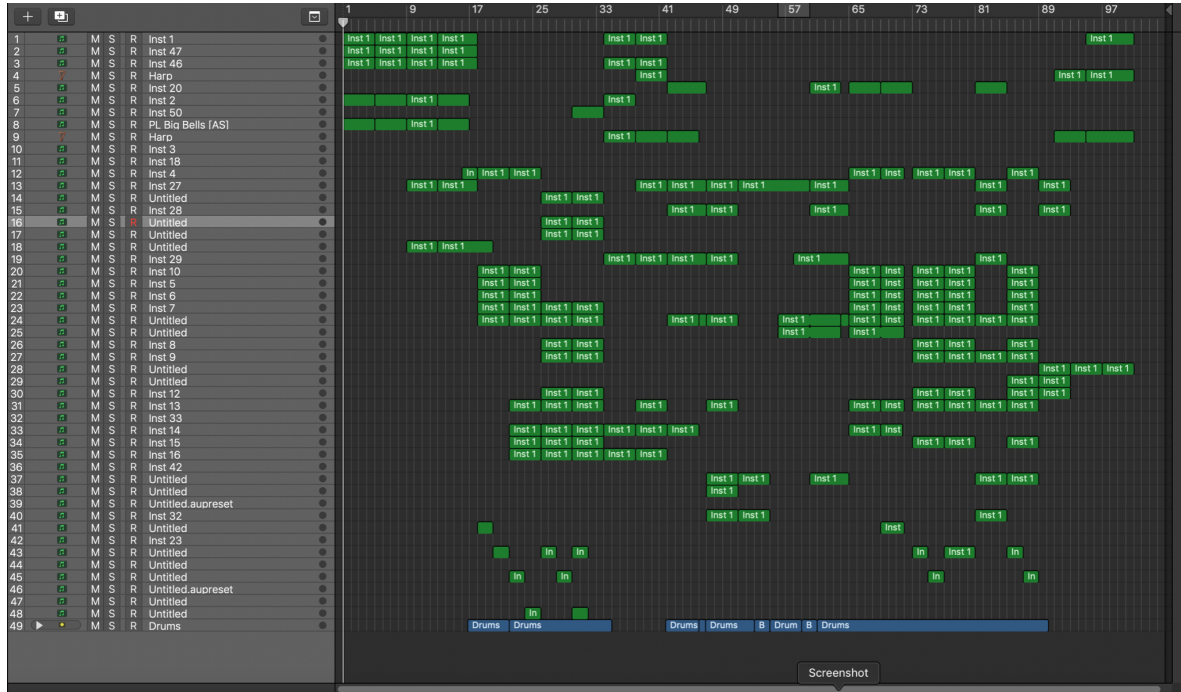


Figure VII (Screenshot of 2010s project in Logic Pro)

The final piece of my thesis, titled “Champion,” was easily the most complicated and advanced piece I composed. As before, please refer to the file titled “2010s_Champion.mp3” to listen to the finished product. Without the technological restraints of previous decades, I was free to compose this track using whatever instruments and sounds I felt best suited the piece. I settled on a fantasy-style RPG for the hypothetical game to accompany this soundtrack and was inspired by prominent 2010s era games like *Skyrim* (Bethesda) and *Legend of Zelda: Breath of the Wild* (Nintendo). These games feature prominently orchestral soundtracks with exciting themes and intense “epic” percussion, so I structured my soundtrack in the same way. Using sampled standard orchestral instruments, the final project for this piece had around 48 different midi instrument channels and an extra 18 different drum sample and recording channels.

The intro for “Champion” starts with a single piano playing a chord progression inspired by one of my favorite piano Etudes, “La Fille” by Claude Debussy, with an accompanying

melody line. I wanted to give listeners and players a chance to clearly hear the melody in this section, which features the motif from the previous decade soundtracks mixed with some improvisation. I had the cello in this section eventually split into a harmony, providing an interesting buildup to the next section. Eventually the entire orchestra comes in on the same chord progression and the melody is split between a french horn, oboe, clarinet and trumpet solo before building into a “faux” chorus section. I imagined this part would play during an exciting combat section of the game, where the player believes they have reached the climax.

I intended for the next part of the piece to serve as a transitional section by bringing the intensity and volume down a bit. I then changed up the chords into an ascending pattern to build into an explosion of horns. I imagined the player preparing for the final confrontation in the game, putting on their armor to face off against the evil villain. I wanted there to also be undertones of doubt in this section, getting the player to think “will I be able to prevail in this upcoming confrontation?” To achieve this, I had the horns eventually fade into a section with only a singular bass note and rumbling drums. Then I brought back in the ascending chord progression on strings and had a french horn play the melody from before as the player reaffirms their constitution.

The final chorus section serves as the main climax of the piece; While writing this segment my head was filled with scenes of a grand confrontation or battle that the player had to overcome. I had every instrument play either harmonies or melodies with the drums pounding away to create a huge and exciting sound capable of fitting this incredible scene. After the climax I wanted to have the piece transition into an epilogue, so I took out all of the instruments except for a harp and flute playing the melody and countermelody. For this last section I

imagined the player relaxing in a tavern surrounded by comrades after returning victorious from their final battle.

Conclusions

From the era of arcade music and catchy chip-tunes to the grand orchestral epic soundtracks of today, throughout the past four decades video game music has changed immensely. Ultimately, the driving force of this change stemmed from innovations in technology, with changes to production software and the sound devices of gaming machines being the most important factors. However, the instruments, sound quality, and production techniques used during these different decades were not the only elements of game music to change drastically. The styles of game music, such as genres and melodies, also went through extreme changes to fit evolving player interests. A composer from the 1980s was more interested in crafting a soundtrack that would stand out at an arcade with many other games all vying for player attention. Whereas a contemporary composer might be more interested in the experience of the singular player, someone who has already bought the game and is enjoying it in the comfort of their own home. Even though they were not the subject of interest in my capstone project, these intentions had just as much of an impact on the style of video game music as changing technology. I should note that in my research and compositional work I did not come close to examining the full extent of game music from these decades. Given the time constraint, I chose to focus instead on the more important “big ideas” in the history of game music. Consequently, there is still an abundance of research that could still be done going forward in this exciting field. As technology continues to advance, I intend to continue studying how these changes affect the unique qualities of video game music composition.

Colorado College Honor Code upheld

Signed: *Griffin Craig Tyler*, 5/1/2021

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Griffin Tyler. 2021. 2000s_Pirate Bay

Griffin Tyler. 2021. 2010s_Champion

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