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MPA 475 Capstone

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Introduction

Since the 1970s, composition, and music for video games have been developing and evolving at a rapid pace, thanks in large part to the huge technological advancements made in the last 50 years. As our society and community continue along this path, we run into an obstacle that could potentially render current composers obsolete. Music has become an integral part of video games and sound production that helps to enhance the game mechanics and immerse the players as they take part on their journey. Composers have been tasked with this goal in mind and along the way there have been so many tracks that have stood the test of time. Game music has produced its fair share of pop culture classics and unforgettable earworms that are still talked about to this day.

Most of these songs stem from a more old-school or retro style of composition using a tool called a programmable sound generator, to create music within the style of Chiptune. These pieces of hardware produced very rigid and simple sound waves that were often arranged into all kinds of arrangements to create a sonic backing track to assist the gameplay. Driscoll and Diaz identify that this style of music was, “Born out of technical limitation...” and that, “...their soaring flutelike melodies, buzzing square wave bass, rapid arpeggios, and noisy gated percussion eventually came to define a style of its own...” (Driscoll and Diaz 2009). Within the domain and field of video game composition, there were many challenges that composers

encountered. Writing a track that could last for hours and seamlessly repeat itself during each level, as well as holding a strong amount of harmonic interest and complexity. One of the main solutions that was found to attempt to channel all of these aspects was loop-based music. Within this style of loop-based music, a select amount of loops were created by composers, and they were created to ensure that the entire game would have music and that these loops were proper fits within their respective levels. This is precisely how a small set of loops, timed at a 3-5 minute timespan, would be able to cover and last for an entire game which could be played for hours and hours on end. Over time, these scores started to develop into unique musical scores that are hours in length and have very complex and dense orchestration with helpful advancements in recording and technology.

Most recently, there have been huge strides in Artificial Intelligence and its ability to rapidly analyze music and be able to reproduce something similar with extremely minimal work done by a software engineer. Of course, this very notion appears problematic because this could imply that AI might begin to take over the bulk of the compositional work and there would be a very low demand for traditional composers. However, we must remember that this technology has been and can continue to be a tool for composers. In this paper, I will be discussing the background of video game music, techniques utilized by traditional composers, and how AI is used as a compositional device and as an aid to composers.

Why Do Games Need Music?

Looking at some background behind the scores and the composers themselves, it is important to highlight the individual philosophy and soul that goes into these songs. These songs

are crafted and tailored for their respective games all because of someone behind them who is attempting to supply a musical landscape to the overall vision. Rod Munday explores the idea that game music typically aids three main purposes. It will enhance either the environmental aspect, the immersion aspect, or the diegetic aspect. Some of the best game composers all have very individual and human takes on what makes for a good piece of music. When composing for a game many choices need to be made, usually concerning the mood, atmosphere, tone, and style of the piece. Munday lists three very important aspects that can be covered and explored for future compositions. The three aspects are Environmental (supports the perception of the game world), Immersion (how music supports the player's immersion), and Diegetic (how music supports the narrative) (Munday 2007). Game compositions tend to amplify the experience similar to that of a movie or television show. Many games have so much personality to offer that can just be found within the music. A lot of composers have a very strong ability to capture the essence of these characters or events just in a single theme. Even a single idea like flying can be expressed in numerous ways through music. Sean Atkinson discusses the use of upward melodic gestures, large interval leaps, or high-register melody lines to help create the feeling of flying (Atkinson 2019). The attention that goes into these themes is drastically important and it is what can help turn a good game into a great game.

There are always composers who can create these themes and ideas to perfectly supplement the game in front of them. Koji Kondo is perhaps one of the most well-known game composers, mainly due to his unique compositions, fun melodies, and unique innovations during the time of his compositions. Koji Kondo is responsible for the most famous piece of video game music, the "Overworld Theme" from *Super Mario Bros*. Without getting too technical this piece uses so many chromatic movements to give the music a very fun feeling. Chromatic notes tend to

give off this personality because of two main reasons. For starters, most chromatic music that people are familiar with usually comes from circus or carnival music. Vibrant waltz-like patterns with fast-moving chromatic melodies are played as the backdrop for many circuses and carnivals that are meant to promote fun and games. Additionally, from a theoretical perspective, chromatic notes are often unexpected in a diatonic key signature, so they often add an element of excitement and wonder once they get thrown into the mix. That's precisely how this fun feeling was captured within the *Super Mario Bros.* main theme. Game composer, Koji Kondo, approaches each project looking to give each moment a very memorable theme, to ensure that the game and music are inseparable from each other. It's an absolutely genius way to ensure that players remember the music by making it so catchy and fun that they sing it to themselves whether they play at full volume or on mute (Bozon 2007). This style of writing is not drastically different from more recent composers who attempt to capture the audience's attention through melody.

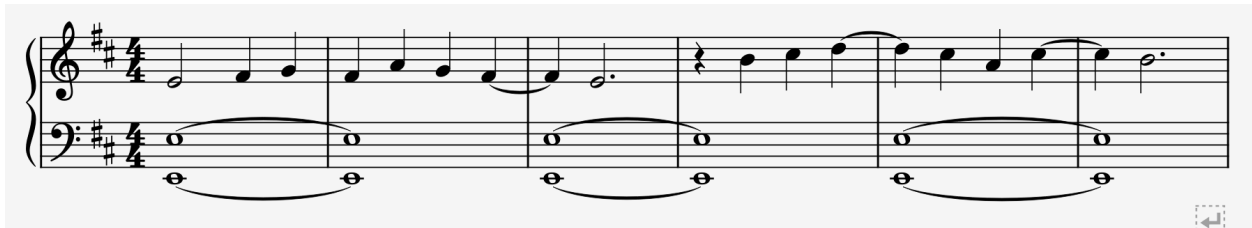
Austin Wintory is another well-known composer who is often called in to work and enhance the experience across some independently developed games and smaller companies. Austin Wintory states that his process is, "...to formulate a musical idea first, then try to develop sounds or templates to achieve that..." (Folmann 2013). Despite having access to so much technology and brilliant musicians able to play, perform, and compose, he still sticks to the foundations of a strong melody. Once he finally dives deep and retrieves a strong melody he is then able to evolve that into a longer musical piece and ensure that it is precisely decorated by an endless possibility of arrangements. The track "The Road of Trials" from *Journey* features a section of the game where the player is racing down these large desert landscapes embarking on their main quest. The "Road of Trials" is a term that is typically connected to a story where the

character must undergo many trials and tribulations to complete the rest of their journey and character development. In the game *Journey*, the track “The Road of Trials” plays during a climactic level, where the main character is at the height of their story unlocking new secrets and enduring difficult and dangerous tasks to achieve their goal. The blistering pace of this song as well as the ambiguous and free-flowing melody help establish that the future is uncertain but the stakes are extremely high. The logistical blend between Western harmony and Eastern instrumentation also creates a pleasant mixture sonically that is both nostalgic and unfamiliar to the player. When some of the elite and decorated composers for game music have a commonality between their techniques and development, it’s usually a good indication that it’s a very important pillar of game composition. Aside from just the ideas behind these melodies, we must understand why a video game would need music.

The Strength of a Single Theme

One of the best ways to incorporate an emotion or connection with the music is by composing a strong theme that will play before the game starts. The title theme and main theme of a game usually lend themselves to be a great representation of the character. The title theme is usually the track that plays over the menu or title screen, and the main theme often, but not always, reuses or revisits this theme usually under different contexts within the game. Above all the main themes are a helpful tool used by composers to highlight important character moments and events in the story. Martin O’Donnell, who’s had lots of previous composition experience with the *Destiny* and *Halo* franchises, as well as Greg Edmonson, previous works including the *Uncharted* series, were able to capture the personality and ideals of their game and setting just in these very opening themes. Martin O’Donnell favors the use of different church modes to add

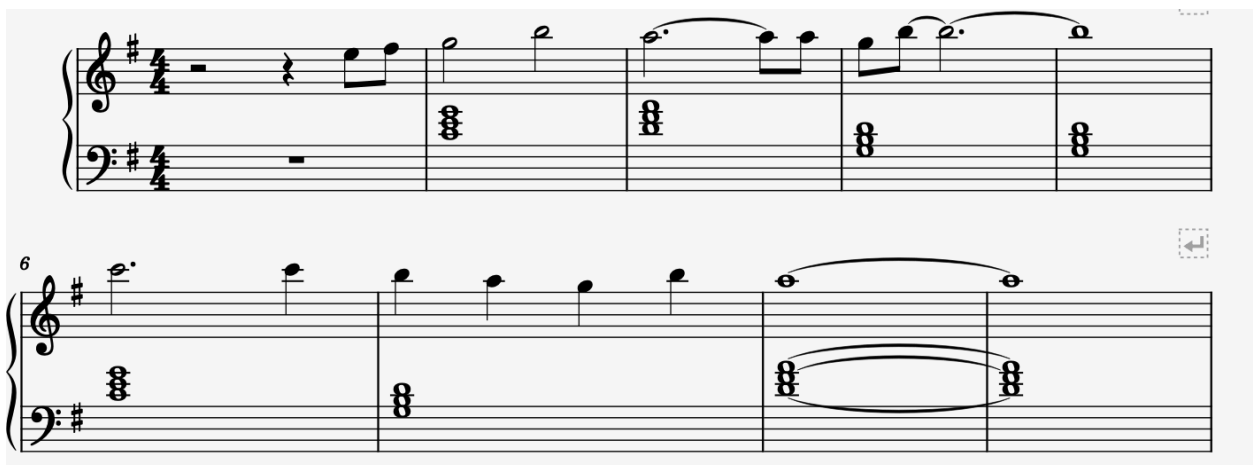
unique accents and characteristics to his music in the *Halo* series. O'Donnell has a big admiration for these modes because they, "...sound a bit more 'ancient' when heard by a modern audience" (Javier 2020). This makes total sense as to why this decision was made because of the very nature of the game. The story behind the game *Halo: Combat Evolved* (Bungie 2001) is about a futuristic war between these fictional ancient populations and it throws the players directly into the fight.



This ominous title theme helps instill a bit of fear and darkness to the player, while still managing to use the Dorian mode's raised 6th degree to inspire a bit of fire or hope inside of the melody. Dorian is exactly the right choice here, allowing for the theme to be composed around a minor modal center, but still allowing for the medieval sound to come through at certain points. Allowing the song to freely move from the long drawn-out chants into the fast-paced, high-energy ensemble allows for a dramatic change of scenery. This is extremely inspiring to the player as well, as the music begins to add to their narrative and control over the story. The player gets the impression that upon joining the fight, the small rays of hope have turned into waves of optimism and expression. O'Donnell's choice to highlight the Dorian mode was extremely clever and efficient, allowing all the emotions from a single mode to do a lot of the heavy lifting for this composition.

Similarly, Greg Edmonson, who's only scored three games in his entire compositional career, was able to strike quite a balance to achieve the themes for the *Uncharted* series. While we will just be focusing on the title screen track from the second game, also known as "Nate's

Theme”, I wanted to quickly highlight an interesting point made about his melodic choices as this series developed. In an interview back in 2011, Edmonson was asked about the time that he spent with Naughty Dog and the music he made for the franchise. In the beginning phases of the first game back in 2007, he was reluctant to overload the game with too many phrases and ideas. Progressively, he was able to find a nice pocket where the melodies and scores turned from simple ambient loops for platforming and combat, into full-blown scores that were completely interwoven with the entire story (Diener 2011). The rapid acceleration of these games and his progression of composition techniques helped directly influence the general atmosphere within these games. The orchestration and melody choices play a huge part in why this game feels so triumphant and grand.



Simply put, a large brass ensemble playing an emotional melody in the major key is our first impression of this hero, assuming the audience hasn't played these games before. The melody has such a strong sense of movement and motion and it has a beautiful shape while being such a concise idea. The large orchestral swells in the later sections of this song help symbolize the sense of adventure with grandeur just around the corner. But of course, it is nicely contrasted with dark, dense sections where danger looms just a step behind them. The melody moves very predictably around the major scale while holding out accented notes over long pauses on the I

and V chords. These pauses help reinforce the grandeur that is present within this theme. This is most likely the composer's initial idea and process when creating a theme for a game because chronologically it's not very efficient or smart to attempt the next steps without a strong melodic or harmonic passage.

How to Make A Track

In an ideal world, we would have infinite music behind our games with none of it ever needing to be repeated, but our lovely composers don't have the time to score all the hundreds of hours that we are playing on these games. Between financial restraints, deadlines, and creative limits, there is a very tough line that game compositions have to walk. There needs to be a substantial amount of music available that can be played and repeated throughout the game. But of course, composers can't craft endless amounts of music. Some players only play for an hour, some play for countless hours and days. The simplest way to cater the music to the player is by looping the tracks. It sounds straightforward and it is, but there are a lot of technical and musical components that go into writing a strong loop. Once again, another obstacle for composers since not only are these great themes not enough, but they need to be able to be repeated over and over and over without getting too repetitive. A game runs a huge risk of either being too repetitive and overplayed or if the music is not replayed enough it comes off as unmemorable and forgotten (Philips 2014). It's easy to see how game composition becomes quite a balancing act since the repetitive nature of the music is unique to the medium of video games. Regardless of how daunting the task may be, composers have never backed down from this challenge. There are two really good ways to ensure that these loops will function properly.

From both a compositional standpoint and an engineering perspective, loops are exactly what they sound like. A loop is a series of events, or a process even, that can begin from the same place it has ended. For a musician and composer, “Music loop creation for games is a multidisciplinary skill combining both musical artistry and technical expertise within an audio editor. To build a clean loop, you need both of these skills” (Munday 2007). There’s a big contrast between the two disciplines as well in terms of excitement about how the end of the loop will approach the beginning of another. There are a lot fewer limits compositionally since the main priority of the loop is to ensure that the ending point has a logical entry point into the beginning of the loop. A simple example of this would be this loop in C Major.

The image shows a musical score titled "SIMPLE LOOP" in 4/4 time, written in C Major. It consists of two systems of four measures each. The first system has chords I, V, IV, V. The second system has chords IV, I, IV, V. The melody is simple and diatonic, consisting of quarter notes and half notes. The bass line consists of chords. The score is written for piano.

5

figure 1 - written by Nathan Barrett

To illustrate how this simple loop works, I created a very loose and free-flowing melody that is mainly composed from chord tones and doesn’t really jump around anywhere. This simple loop also features very simply moving diatonic I, IV, and V chords to show how easy a beginning loop can be. The loop begins with a C major chord, which makes the G chord a very strong choice for the end of the loop. The composition should still make sense between loops, so using an F# major chord would just create a really harsh loop overall. Of course, a composer could have a lot of fun with this and attempt to create a composition that has different trailing-off

points for them all to arrive back at the beginning. . This, however, is contrasted by the engineering side of producing a loop. Despite what types of loops are being made, the timing, rhythm, key, sound, and dynamics need to all be compatible with one another. Essentially, there will most likely only ever be a handful of opportunities to cleanly loop from the technical side of this process due to all of the elements that need to be accounted for when looping (Munday 2007). These elements aren't just random either, they all serve a very real purpose as to why they should be considered for a proper loop. For example, a 12-second short song shouldn't be looped with a very lengthy track in a completely different time signature, and a piano loop in C major shouldn't transition straight into a guitar loop in D minor. Organization and careful planning are an engineer's best friends when it comes to processing loops and turning them into game-ready scores. If you've planned just enough, the job of the engineer gets much easier. Michael Sweet discusses a lot of introductory techniques for how to stitch together various loops from the more technical side of the compositional process. Most DAWs and editing software nowadays have extensive features that make editing, automation, and mixing much easier.

Compositional Techniques

Once these loops have been planned out and there is a logical flow as to how these loops are going to be interconnected with one another, there are some very helpful tactics about how a composition can be extended. This is to make sure that the material is being used to its fullest and also allow for some variation within the game and to try and dynamically match the events that are happening on screen.

Horizontal Composition, also referred to as horizontal resequencing, is a very effective tool to change the landscape of a piece as it moves horizontally. Many popular texts in this field

refer to the emphasis on resequencing more than composition. Michael Sweet's *Writing Interactive Music for Video Games*, Rod Munday's chapter on 'Music in Video Games' in *Music, Sound, and Multimedia: From the Live to the Virtual*, and Winifred Philips' *A Composer's Guide to Game Music*, all reference the importance of knowing these cool techniques that will elevate very mundane scores, into large ensemble scores with hours of music. They suggest that the way to get more out of the music is through these fundamental arrangement techniques. Composing horizontally often refers to the idea that the composer uses ambiguous chords and weak chord movements to allow for more possible landing points to use as a resolution. Those landing points might lend themselves very well to many different loops inside of a single game.

LOOP with NEW CHORD CHOICES

I V⁶ vi V⁶

ii⁴ I ii⁷ V⁴

figure 2 - Written by Nathan Barrett

In the looping example above where the G major chord resolves to the beginning of the C major loop, here is an example of different chords and weaker chord movement. Using more ambiguous chords like G/B or Dm7/C in certain areas could help the composer transition quite nicely into C chords but over different roots or just weaken the harmonic motion altogether. Sometimes a very helpful tool to use weaker harmonic motion because that way all the chords feel attainable and there's less tension and pull that would normally be present in a diatonic key

center. However, horizontal composing which refers to resequencing, usually refers to another tactic.

Horizontal Resequencing involves the use of many different loops that will be stitched together through transitions or sequences within the game (Philips 2014). The use of this is to create many loops and songs that can be played or substituted with another piece to ensure that each new area and moment is filled with music that rightfully accompanies the moment. The music within the *Pokemon* franchise does a wonderful job at this, specifically some of the battle and town themes in *Pokemon Black & Pokemon White*. It'd be difficult to find a moment in these games, where there isn't any music playing in the background. Many efforts of horizontal resequencing are made to always keep the player immersed and involved in the game through music. Sometimes it's as simple as a sound effect, maybe like a door opening to help transition from a house into a big city. Other times it's a sound bite that plays during a battle. In *Pokemon*, there is sometimes a quick short music phrase that is played to transition the song into a faster, more dramatic pace. To display the urgency and intensity, once a Pokemon reaches a low health, this quick sound bite is inserted to catch the listener's attention and increase the stakes of the fight musically. Fades and sound effects are great ways to help stitch together tracks that wouldn't necessarily be connected through a modulation or transposition.

Vertical Composition and Resequencing is the final main tool that gets used a lot by composers. Vertical composition involves the use of layers and adding or subtracting tracks to achieve a certain goal out of the layers of music. Being able to stitch together different songs works very well for constantly changing levels, but some games spend a lot of time doing the opposite. Many games have entire levels or campaigns centered around one or a few locations. It wouldn't make a ton of sense to write 4 different city themes or make a 2-minute loop that will

just constantly repeat itself if the player takes their time during a level. The best solution to this is to experiment and change the music alongside the gameplay of the level. For example, in *Pikmin 2*, the player controls a character where they will play multiple levels in the same environment. However these environments are always changing and the player is required to use allies and tools around them to help them break, build, or fight something in the vicinity. Because of these events that may or may not happen at any given moment within the game, there are multiple layered scores that all revolve around the same theme, they just use alternate orchestrations to illustrate what is happening in the game. The main theme is usually calm with a delicate orchestration, but the battle theme uses very large and dense percussion instruments. When using your allies to build a deep bass comes in to supply harmony and when the time is almost up for the duration of the level, there is a very sparse and childlike instrumentation that plays to inform the player it's time to wrap everything up.

Case Studies / Real Examples

This section will describe some of the tactics that are listed above, as well as show some of the tools that composers have used and how they can capture unique effects through musical choices alone. In order to do this, we will look at and break down some very popular songs and tracks from some well-known games. Some of the first examples show how a composer matches the song to fit the environment of the game. Veteran composers can dig within their toolkit and create songs that will help the player become more immersed in the game. Many of these songs create unique and individual musical connotations that the players can identify with. Sometimes immersing the player can come down to a simple choice like how they want the music to be arranged.

Instrumentation is a big part alone for a task like this, but the creative choices are tailored to the specific game. *Super Mario Galaxy*'s track "Space Junk Galaxy" uses a strong piano motif with arpeggiated chords while crafting a dreamy melody that floats right above the arrangement. A synth both accents the melody and creates some unique harmonies within the piece. The middle section of the piece uses synths still but in a staccato pattern. It's extremely reminiscent of a radio transmission or someone trying to broadcast their signal out in a deep space.

Sea of Thieves and its song "Maiden Voyage", uses a very fun moving bass part with snaps, claps, and a harpsichord in the beginning sections to open up the piece. There is a strong implication of 12/8 time which is in triple meter. The use of triple meter allows for the pulse of the song to sway back and forth, to help solidify melodic ideas and imply the strong themes of a pirate ship that sways side to side. In the middle of the piece, there are very fast chromatic moving themes as well as a brass swell that helps to transform the piece into a triumphant voyage out on the sea.

Finally, within this section, we will look at "Cloud Country" from the game *Stardew Valley*. This song uses a simple arrangement of a lead synthesizer part and a banjo/guitar part supplying the harmony. There is a piano that comes in later to supply some lovely texture above the ranges of both of these instruments. This simple arrangement doesn't use a lot of fancy chords or complex melodies, so that's why it gives off the unique atmosphere of a simple farmer doing simple things.

Music also has a tendency and ability to create emotional and physical responses to its listeners. Music can hold our minds hostage and instill a sense of fear and dread that may lurk around every corner, while also maintaining the ability to have us nodding our head and getting our body moving. *Wii Sports* and *Shadowman*, have great tracks that showcase this strength of

music and how quickly it can immerse the player. To show how effective these songs can be in their own sense, it would be best to discuss them at the same time. The *Wii Sports* title track features a fun band ensemble with an unforgettable melody and super upbeat energy. The drums present a very steady beat and the bass guitar plays very hypnotically on the pulse of the song while jumping around the fretboard quite a bit to showcase how well-crafted the harmony of this song is. The acoustic guitar is consistently strumming and acting almost as drone strings, while the piano and flute melody accompany the rest of the ensemble and give this sense of life and energy to the piece. Not to mention the uplifting and bright synth sounds that emerge to help bring the B section back to the beginning of the song. Alternately, from an older game called *Shadowman*, there is a song called “Playrooms” which uses some very disturbing techniques that create uneasiness and disturbance for the player. The track uses a simple classical childlike piano piece that feels like it could be played in a nursery, but deeper in the track there are saws, drills, screams, and cries all that can be heard by the listener. The game usually operates within a very dark atmosphere, so the change of scenery in combination with this track and to hear the disturbing sounds that follow just really add to the haunting experience.

Oftentimes in games, the players are tasked with battling various opponents, and it’s important to have a fighting theme that displays exactly what you are up against. Sometimes the music does a great job of defining and describing the personality of the foe to help establish a relationship within these boss fights. Oftentimes the music can act as a home-court advantage for these opponents as some of the cues and surprises might catch the players off guard, but seemingly never seem to create problems for the bosses. Some of the tracks I will be mentioning get very close to creating diegetic music which is music that is produced within the story and context of the game. These themes will show some interesting quasi-diegetic music as well as

themes that encapsulate the opponent. They are extremely energetic and they can offer so much intensity and excitement to the overall fight.

Take *Undertale* and *Cuphead*, which both have very straightforward game mechanics, where you control a player and have to complete challenges and fight loads of boss characters. That's grossly oversimplifying each of these wonderful games, but let's continue to look at the music of these games and their respective boss fights. *Cuphead*'s "Railroad Wrath" has the title character face off against The Phantom Express, which will ultimately grant them entry into the final phase of the game. *Undertale* puts the character in a fight against Mettaton EX, who also is a pivotal boss character to progress further through the game. Both bosses require extreme focus and attention to every minute detail on the screen and the expansive arrangements and blistering pace of the songs create so much urgency and almost an excitable amount of tension. These are not fearful encounters, but rather the player's sense of gaining confidence in their skills while facing a very strong opponent at the same time. Both of these songs also use unique features that dive into this quasi-diegetic music that I discussed a bit earlier. *Undertale*'s, Mettaton EX's, boss theme starts with a very low fast-moving bass groove that soon doubles on top of another. Synths begin to flood the mix and a very high octane lead part starts to steal the spotlight. It adds the context that we are possibly on stage against this foe and we have entered their home territory, which almost stuns the player the first time you listen. We get the impression that we are in this popstar setting which adds to the character, story, and climax. Additionally, the *Cuphead* track uses the snare drum and some brass growls to imitate a moving train. While the player is fighting this boss, the brass howls and whirls through the mix seemingly reminiscent of the train that is moving on screen, and the snare drum pattern and movement emphasize and bring to life the

moving platform that our characters will be jumping back and forth from. It's a very interesting and unique way to bring to life the settings around the players.

Now aware of the introductory techniques that are used to create and compose a video game score, let's begin to dive into some of the advanced techniques that can be taken advantage of. These techniques range from the unique and creative innovation made by composers of the past or just new technological advancements that are starting to become a staple in modern-day composition.

Composition Through Innovation

Looking back on some of the influences and innovations that took part in the development of video game music, a lot of them were due to the nature of the limited hardware at the time. External factors and technological limitations forced a lot of creative workarounds on how the soundtrack and music could function within the game itself. Youtuber 8-bit Music Theory has a lot of analysis and breakdowns about games that help showcase some of the unique approaches taken to create something fresh and new for a game that was posing early technical problems. For example, in the early *Pokemon* games, the sound files and structure of the sound chips were only able to produce 3 different noise channels at the same time. Due to this nature, it wasn't possible to create giant complex chords that could act as a soundscape in the background but rather needed to be more direct and simple with its harmonic approach. Compositional mastermind, Go Ichinose, crafted countless beautiful tracks for these games all revolving around simple melody and harmony to perfectly capture a nice upbeat adventure in this virtual world. The 3 lines are simply meant to create a constantly moving yet compact bass/tenor line while having a melody play on top with a contrasting counterpoint line right underneath in the alto position (8-bit Music Theory).

In addition to this, some challenges can be presented by the game directors themselves. Koji Kondo, a familiar name, also was in charge of the main game compositions for *The Legend of Zelda: Ocarina of Time*. Kondo was presented with the unique challenge of having to make 12 distinct melodies played by the players that would be called upon during the course of the game. That doesn't sound too bad, but that's just the goal that he was tasked with. He was faced with two main challenges: 1) Creating 12 melodies that would be very memorable for the player, since they would be recalling most of these multiple times through the game, and 2) There were only going to be 5 different notes available to arrange and write these melodies (8-bit Music Theory). Being put into a box like this surely would stunt and hinder many novice composers, but Kondo stood up to the challenge and not only created 12 distinct melodies but created 12 extremely memorable melodies that were strong enough to carry their own individual pieces during the game as well.

Technological Advancements

Of course, nowadays, it's become much easier to tackle these tasks and attempt to create a game soundtrack. The important part is to know exactly what is available to you and how you can use it as well. One of the biggest innovations and advancements that has been made is the use of MIDI, which stands for Musical Instrument Digital Interface. While it was developed in the 1980s, its recent advancements have shown how viable it can be to create an entire score, just from a laptop. "MIDI scores can easily shift in tempo or key during gameplay. MIDI scores also take up very little RAM—less than one percent of the space required by a pre-rendered audio file—allowing composers to create much longer sequences that can be loaded into memory more easily" (Sweet 2015). The writing, mixing, and mastering process are all able to be accomplished

through the free or cheaper software that is available to everyone. In addition to that, the sound libraries and virtual instrumentation in most DAWs are so advanced and rich sounding, that a new composer would be easily able to attempt to try their hand at it and explore new ideas. This would come with little to no pressure as well since there would be no ticking clock or worry of paying performers at this stage. As technology starts to consume the workplace, it's imperative to mention the importance of procedural music and the current state of it inside of the field of composition.

Procedural Music

Procedural music is kind of a gray area inside of the realm of composition, but essentially procedural music can be defined as when a game's soundtrack responds to in-game cues and events. That's a broad definition, but that's because procedural music is mostly just an umbrella term that is used to describe video game music. It's a tough introduction because all games have audio cues and events that trigger different music which technically makes all music procedural music, but for the sake of this conversation, we are going to refer to procedural music as music that reflects and dynamically matches the events to the player's immediate environment around them. Karen Collins compares procedural music to interactive audio which, "...refers to sound events directly triggered by the player, affected by the player's input device" (Collins 2005). That is how I'd like to continue looking at procedural music to avoid any conflict or internal debate within this perplexing and vague area of music. Creating this as the definition helps us to remove some music that was composed with a big emphasis on structure and chronology,

meaning that the music being played is mostly played upon level and menu cues rather than player inputs and gameplay mechanics.

Upon establishing this definition of procedural music, we now can split most of our musical selections into much cleaner categories, with a bit more structure and definition behind them. Two initial categories that would be helpful to define would be linear and adaptive music. Linear music writing uses singular songs for each level, event, or situation (Plut and Pasquier 2019). These songs loop after they are played and are composed with this in mind. Adaptive music refers to the use of actions or inputs that will decide what kind of music is playing during that time. This is where a big distinction can be made between games that we've previously mentioned. The *Cuphead* theme "Railroad Wrath" is a linear composition that plays in the background despite what is happening on the screen. With the action and music going so quickly, the players often connect the two frantic actions and merge them to create a singular hectic experience. However, the *Pikmin 2* track is adaptive, mainly because it relies extremely heavily on player actions and queues to provide reactions and responses with additional music. Inside of this large category of music, we can have music that is composed or is generative. These categories can be simply defined as music that is either precomposed by a traditional composer, or music that is created through AI programs or through some software inputs that will create an output source of randomly generated music (Plut and Pasquier 2019). To help clarify, generative music is created through software programs (or in certain cases just a list of preset rules) that will create an output of music that falls within certain parameters that are set by the engineer or developer. In theory, this is an avenue that could be very fruitful since one would be able to set their parameters and then have the computer create hours and hours of music.

It is possible to create an entire game score using various algorithmic techniques. Some tools available are programs and computers that deal with sequence recognition, algorithms for dynamics and melodic shapes, and quick-thinking programs that can improvise using random number generation (Lopez Duarte 2020). These tools are a huge asset since they can study and learn various types of music, as well as be able to replicate and return music that is similar to its previously composed input. However, it's just not very feasible to pursue this option, both financially and artistically. This method is being pursued, studied, and experimented with, but there are just too many current fallbacks that arise from this method. Collins refers to the main principles that first off the music needs to be meaningful and putting it on autopilot would most likely achieve the opposite results. Additionally, music production has not been seen as a bigger priority as compared to other departments at the game companies (Collins 2005). It is unfortunate, but it does make sense since the main draw for games are often the updated gaming engines, carefully crafted gameplay mechanics, and the high-level writing and storytelling that drives the games forward. The music will most likely only ever serve as an additional car on this lengthy locomotive of game composition since it's unlikely to find a game that utilizes music as the main engine and soul of the game. A lot of the main fallbacks of generative music revert to the idea that it is extremely diverse and also somewhat hard to control, which makes a lot of the music sound bland most of the time. Because there is no human composer actively changing things and writing with their strong educational ideals and creative ideas, there is nowhere to stop them from making bad music. Game companies are also not wanting to spend their money on technology that might end up producing worse music (Plut and Pasquier 2019). Understandably, the big companies want to ensure the quality that they are paying for, but it raises the question if this avenue is still a viable direction to pursue. *No Man's Sky* tinkered with

this idea fairly recently. While a traditional composer was creating some of the game's soundtrack, there were small applications to experiment and implement some of the uses of generative music. Some of the game's main tracks are well thought out and thoroughly composed and combed through, but since the gameplay revolves around an infinite number of planets to visit, there is a new need for potentially new infinite music. Generative loops and algorithmic designs were implemented to make sure that the composed music was somewhat recycled and recreated and then sprinkled across the game. All the tracks have similarities but, likely, the player won't hear any identical song while they are playing.

Ethics of Generative and Algorithmic Music

One of the main ethical concerns involving procedural and generative music is that one day, should it advance enough, it just might put game composers out of a job. It's very frightening to think about that concept and the notion that a select group of software programs might be able to run the game music industry (Plut and Pasquier 2019). As stated above, it doesn't seem viable financially or artistically, but there could be a middle ground located within these recent advancements. Instead of relying solely on these algorithmic programs to produce the soundtrack to any new games, we should attempt to harness their power and ability to create something bigger than any individual goal. There are intangibles to music that can be found inside of every single game. Each game has its own heart and soul, just as much as it has its brain and personality. The composer's job is to inject some of these missing pieces into the games to create something unique and special. Figuring out how to tame the beast and control the outputs to aid the creative process, could end up being a critical new tool that gets used by the composers of the next generation. Having an entire toolbox full of new ways to find harmony, explore

dynamics, replicate sequences, and produce new ideas could help with the struggles of writer's block as well as be a huge asset to any new composer. Think of agriculture, in the sense that while technology has been advancing and assisting with some of the trials and tribulations of farming, the basic concept remains the same. While these programs will surely help plant the seeds and ensure that there is an abundance of ideas to go around, it takes a skillful composer to be able to recover these ideas and turn them into something special.

Conclusion

Despite all the recent advancements and changes that have taken place over the years of composition, video game production, and music technology, there remains a home for future composers in the music industry. There's no doubt that the latest strides in generative music will create new obstacles, but it's also important to look at the opportunities that it might create. This has been an ongoing battle and journey within the game composing industry. As of late, a new toolkit is seemingly available for the modern composer, which in turn could leave more time open to strengthen other various aspects of their compositions. Additionally, new composing giants will rise above through their ingenuity and innovations that will be made through the current systems that are frowned upon right now.

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