

ANALYZING COMPOSITIONAL STRATEGIES IN VIDEO GAME MUSIC

A Thesis

presented to

the Faculty of the Graduate School

at the University of Missouri-Columbia

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

by

KARA BALTHROP

Dr. Judith Mabary, Thesis Supervisor

MAY 2023

The undersigned, appointed by the dean of the Graduate School, have examined the thesis entitled:

ANALYZING COMPOSITIONAL STRATEGIES
IN VIDEO GAME MUSIC

presented by Kara Balthrop,

a candidate for the degree of Master of Arts,

and hereby certify that, in their opinion, it is worthy of acceptance.

Dr. Judith Mabary

Dr. Megan Murph

Dr. Peter Lea

Dr. Brian Silvey

ACKNOWLEDGEMENTS

First and foremost, I must express my utmost gratitude and admiration to Dr. Judith Mabary, who was there with me every step of the way and whose profound and gentle kindness brought both joy and inspiration to this project. She continues to serve as both my advisor and role model in many aspects of my life.

Additionally, I would like to offer my appreciation to Martin O'Donnell, Joshua Mancell, and Trevor Gureckis, whose interviews provided invaluable insight to this research and whose contributions to their field have stirred the affections of millions.

To my sweet husband, thank you for everything; from the late-night video game discussions to the spontaneous ice cream trips when I felt overwhelmed, you have been my anchor throughout this process. I am eternally grateful to you.

Lastly, I wish to acknowledge the indispensable assistance of my cat, Pepper, who provided emotional support from my lap for countless hours as I worked, and who made her appearance known in every interview I conducted.

TABLE OF CONTENTS

ACKNOWLEDGEMENTSii
LIST OF FIGURESv
ABSTRACT.....vi

Part One

1. INTRODUCTION.....1
2. A RETROSPECTIVE ANALYSIS OF AUDIOLOGICAL HARDWARE AND
MARKET TRENDS IN VIDEO GAMES.....14
 Silent Gaming: Cathode-Ray Tubes and Early Computers
 Arcade Culture and Game Sound
 Generation One: *Pong* and the Emergence of Atari
 Generation Two: The Crash of ‘83
 Generation Three: The 8-Bit Era and Multi-Channel Audio
 Generation Four: 16-Bits and Frequency Modulation Synthesis
 Generation Five: 3D Graphics and CD-ROMs
 Generation Six: Online Capabilities and the Console Wars
 Generation Seven: Controlling the Market
 Generation Eight: Digital Distribution and Streaming Audio
 Generation Nine: Today
 Conclusions

Part Two

PREFACE TO ANALYSIS: ESTABLISHING GENRE.....46

State of Current Scholarship Regarding Compositional Techniques

3. THEMATIC ATTACHMENT: EXAMINATION AND UTILIZATION.....51

 Studying Nostalgia

 Transgenerational Associations

 Thematic Attachment as a Narrative Tool

4. ADAPTIVE SEAMING: CHARACTERIZING THE SPECTRUM OF INTERACTIVITY.....79

 Exploring Modularity

 Gaming and the Musical Spectrum

 Outside the Spectrum: Fully Interactive VGM

5. DELIBERATE SILENCE: MANUFACTURING IMMERSION.....99

 Generating Ambience: Horror

 Silence in FPS

 Narrative Background Music (BGM): Adventure

6. CONCLUSIONS AND IMPLICATIONS.....119

Appendix A: Interview Transcripts.....130

BIBLIOGRAPHY.....146

GLOSSARY OF TERMS.....158

List of Figures

Figure 1: Original Transcription of the “Halo” theme57
Figure 2: Transcription of Link’s Leitmotif66
Figure 3: Transcription of Zelda’s Lullaby68
Figure 4: Diagram of a decision-based musical sequence in *L.A. Noir*82
Figure 5: Transcription of the “Haven City” base track88
Figure 6: Transcription of the JetBoard overlay90

Analyzing Compositional Strategies in Video Game Music

Composers of music for video games face a unique set of challenges, including issues of interactivity, non-linearity, diegesis, and versatility. This study explores several possible correlations among these challenges and the compositional strategies used to address them (i.e., thematic attachment, adaptive seaming, and deliberate silence). These approaches are analyzed across several popular gaming genres to determine how composers devise and implement a combination of compositional methods that most appropriately amplify the player's sense of immersion. With thematic attachment, for instance, the composer draws upon the player's feelings of nostalgia that are developed through their exposure to previous games within a franchise.

To develop a greater understanding of the representation of musical genre, one-on-one interviews and written correspondence with selected game composers (Joshua Mancell, Martin O'Donnell, and Trevor Gureckis) working in targeted types of games provided evidence to suggest and explore specific techniques they used to develop greater diegesis and immersion. Current scholarship focuses primarily on the cultural and psychological implications and influences associated with video game music. Developing a greater understanding of these three strategies and their various forms of implementation expands and helps to standardize the field of ludomusicology within the broader discipline of musicology.

Keywords: ludomusicology, video game genre, diegetic immersion, *Halo*, *The Legend of Zelda*

Chapter One

INTRODUCTION

Music in the visual entertainment industry has been the subject of scholarship and ardent debate since the early twentieth century when, in 1926, society witnessed the transition from silent films into “talkies” with the debut of *The Jazz Singer* by director and stage actor Alan Crosland.¹ Since then, composers have been writing and scoring a wide variety of music not only for the cinematic world but also for the many other genres that have since branched from the original craft, such as those for television and more modern forms of interactive amusement like video games and social media.

The modern entertainment experience can usually be delineated into two distinct categories. Film is a guided experience in which the consumer is a non-participatory viewer. As such, the music is often composed in a way that is linear and controlled, sometimes down to the individual frame. In this situation, the viewer has no bearing or influence on what they hear, which has been decided long before they took their seats in the theater. Games, on the other hand, rely entirely on direct input from the audience, or *player*, to further the narrative. With the rapid development of technology during the twentieth and twenty-first centuries, the craft of music-making has encountered significant change, most recently with a new emphasis on a more complete immersive experience. In the scope of modern digital entertainment, the emergence of video games has played a pivotal role in providing its audience with some of the most interactive experiences created to date, with music written to complement this new diegetic medium.

¹ Donald Crafton, *The Talkies: American Cinema's Transition to Sound, 1926-1931* (New York: Scribner, 1997), 19-21.

Therefore, the purpose of this study is to analyze the specific techniques used when composing music to interface with these modern interactive games and, through this analysis, to identify the composer's method of amplifying the game's actions and impacting the player. To establish a foundation for discussions of specific compositional techniques utilized for video games, it is first necessary to provide adequate historical context by examining scores from a variety of video games as well as the evolution of contemporary gaming sound. This overview is provided to enable a greater understanding of the processes, hardware, and cultural implications associated with game sound production. One-on-one interviews and other communications with selected game composers (Joshua Mancell, Martin O'Donnell, and Jason Graves) working in targeted genres provide evidence to suggest and explore specific techniques that are used as a means to develop greater diegetic immersion.

The study of video game music as a scholarly endeavor began in the early 2000s, most notably with Karen Collins's *Game Sound* (2008).² It was at this time that the term *ludomusicology* was coined, and scholars began to examine game audio from the perspective of both musical composition and game design.³ Collins poses several important queries about the development of game music as a parallel to film and notes the many unique difficulties that composers face when writing music for games, e.g., addressing non-linearity and diegesis as well as the musical relationships between sound effects and voice-over while also navigating unavoidable obstacles such as hardware limitations and licensing. Such distinctive features and challenges are among the reasons this topic warrants further research; not only is this field of study underrepresented in musical scholarship, but the current popularity of gaming and the

² Karen Collins, *Game Sound: An Introduction to the History, Theory, and Practice of Video Game Music and Sound Design* (Cambridge, MA: MIT Press, 2008).

³ Collins, *Game Sound*, 2.

distinguishing circumstances presented by the gaming environment warrant extensive analysis from the musicological community.

Sources consulted in the completion of this thesis encompass a variety of scholarly writings, literature from popular culture, interviews conducted by the author, and score samples from composers whose works are discussed. Many of these musical examples provide a foundation for the general understanding of the compositional techniques utilized in the creation of both video games and their soundtracks by supplying historical context as well as an explanation of commonly used mechanics and constructs. The popular sources—namely published interviews with relevant composers and critical reviews of the games they wrote for—have been a key component in developing a thorough understanding of the techniques and the thought process behind the music discussed.

As previously noted, the study of video game music is a comparatively new discipline, with the first instances of relevant literature dating back little more than a decade. One of the more foundational publications appeared in 2008, with Karen Collins's *Game Sound: An Introduction to the History, Theory, and Practice of Video Game Music* (see above). In this work, Collins provided readers with a thorough historical analysis of both consoles and game music of the last six decades. She is also one of the first published authors to study compositional approaches and the application of genre in video games as it relates to both popular culture and technological function. Collins released another salient text in 2013 titled *Playing with Sound: A Theory of Interacting with Sound and Music in Video Games*.⁴ In addition to presenting several of her previous theories, she focuses on the relationship between the players themselves and their

⁴ Karen Collins, *Playing with Sound: A Theory of Interacting with Sound and Music in Video Games* (Cambridge, MA: MIT Press, 2013).

perception of sound in games. This work, published five years after *Game Sound*, also provides a more modern perspective on several of the issues discussed in the earlier text. Collins's work not only examines compositional methods used in specific titles but also draws on interdisciplinary themes found throughout game music, for example, from film studies, computer science, and psychology. Her previous publications have proven relevant even to today's games, and her books are often considered to be the cornerstone of game sound scholarship.

With interest in this topic more prevalent among scholars than ever before, it is imperative for anyone conducting research in the field to maintain a miscellany of up-to-date literature to supplement the foundational writings from earlier decades. It is for this reason that *The Cambridge Companion to Video Game Music* (2021), edited by Melanie Fritsch and Tim Summers, is referenced here.⁵ This work is a compilation of chronological and pertinent essays written by scholars specializing in game sound studies. *The Cambridge Companion* features works by twenty-seven contributors including Michiel Kamp and Kevin Donnelly, both of whom are notable authors in the field who have produced full-length texts of their own.⁶ Among the topics discussed are early video game music technology, chiptunes, hermeneutics, psychophysiology, globalization, and semiotics.

A second collection of ludomusicological essays was consulted to acquire further context for music and play. *Music in Video Games: Studying Play* is part of a series edited by Kevin Donnelly, William Gibbons, and Neil Lerner, whose authors, much like those in *The Cambridge Companion*, state the need for a more focused and specialized dialogue surrounding games as

⁵ Melanie Fritsch and Tim Summers, eds., *The Cambridge Companion to Video Game Music* (Cambridge: Cambridge University Press, 2021).

⁶ Michiel Kamp, Tim Summers, and Mark Sweeney, *Ludomusicology: Approaches to Video Game Music* (Oxford: Equinox Publishing, 2016); Kevin Donnelly, William Gibbons, and Neil Lerner, eds., *Music in Video Games: Studying Play* (New York: Routledge, 2014).

they relate to their respective genres.⁷ The chapters in this publication target specific compositional strategies in games and the genres closely associated with each. For example, the scholarship of Rebecca Roberts in “Fear of the Unknown: Music and Sound Design in Psychological Horror Games” has been particularly relevant to my study of *Dead Space*, as detailed below.⁸

Generally published in a timelier manner, journal articles represent a practical resource for the study of game sound. For example, “Video Game Console Audio: Evolution and Future Trends” (2007) by Kyusik Chang, GyuBeom Kim, and TaeYong Kim centers on key technological aspects of video game consoles and the evolution of the hardware used to produce video games from as early as 1972.⁹ The authors’ close examination of the specifications of gaming hardware represents a reliable source for a historical account of game development.

Along with my review of scores and MIDI files sourced from specific games, I have also drawn comparisons between different genres and the compositional techniques used within them. One of these techniques, known as *seaming*, appears frequently across multiple categories of video games. To demonstrate its functionality, a second article, written by Elizabeth Medina-Gray (“Analyzing Modular Smoothness in Video Game Music”) was deemed relevant.¹⁰ The author of this article deliberates on the use of seaming and modularity to provide greater player immersion, which results in a more positive gaming experience. Medina-Gray references several

⁷ Donnelly, Gibbons, and Lerner, eds., *Music in Video Games*.

⁸ Rebecca Roberts, “Fear of the Unknown: Music and Sound Design in Psychological Horror Games,” in *Music in Video Games*, ed. Kevin Donnelly, William Gibbons, and Neil Lerner, 138-50.

⁹ Kyusik Chang, GyuBeom Kim, and TaeYong Kim, “Video Game Console Audio: Evolution and Future Trends,” in Proceedings from *Computer Graphics, Imaging, and Visualization* (Bangkok, Thailand, 2007), doi:10.1109/CGIV.2007.87.

¹⁰ Elizabeth Medina-Gray, “Analyzing Modular Smoothness in Video Game Music,” *The Journal of the Society for Music Theory* 3, no. 25 (October 2019): 1-60.

popular video game titles, notably *The Legend of Zelda: The Wind Waker* and *Portal*, which she dissects in terms of their scores and plots while also mapping several of the modules to provide concise examples of layering in modern gaming.

Today's video games have expanded from the primitive puzzle games of the mid-to-late decades of the twentieth century to include genres that are designed to appeal to varying player demographics. Examples include Combat, Platformer, Puzzle/Strategy, Role-playing games, Racing, Sandbox, and Simulator. While the music accompanying each of these genres exhibits its own compositional characteristics, those most closely examined in this thesis (Adventure, First-Person Shooter [FPS], and Horror)¹¹ have been associated with several compositional techniques such as adaptive suturing, fostering thematic attachment, and deliberate silence. These methods are not specific to a single genre but many overlap across two or more, a reality that will be explored further in this document. Mack Enns in his dissertation, "Understanding Game Scoring," comes relatively close to addressing the subjects covered in this thesis.¹² It references both genre and compositional technique, though only vaguely and as associated with *types* of music (area, hub, battle, etc.). Transitions between musical cues are explored, but no implications or reasonings are noted. Consequently, the ambiguity found in the present literature in terms of defining genres in video games will be addressed in part by demonstrating that similar or identical techniques appear across a wide variety of types of games to accomplish

¹¹ These genres will be capitalized throughout to indicate that the passage in which they appear refers to a specific type of game.

¹² Mack Enns, "Understanding Game Scoring: Software Programming, Aleatoric Composition, and Mimetic Music Technology" (PhD diss., The University of Western Ontario, 2019), <https://ir.lib.uwo.ca/cgi/viewcontent.cgi?article=8647&context=etd>. This should go in your justification / lit review.

dramatically different goals. I have chosen at least two representative games from each classification whose musical characteristics suggest imbrication between methods and genres.

The analysis of these techniques has been divided into several distinct sections, each pertaining to a specific compositional approach as it is utilized across representative genres. In addition, in-depth interviews, for which IRB approval was secured, were conducted with composers for several franchises to discuss their work. These interactions provided insight into the processes and intentions each considered although composing for games in vastly different genres.

The first compositional method discussed, thematic attachment, is defined as the emotional bond that is formed between the player and their experience within a narrative and is connected closely to narrative-centric games and franchises that span multiple games. Notable composer Martin O'Donnell provided an interview for this portion of the research, as his compositions for the *Halo* (2001) franchise are perhaps the most significant in the gaming industry in terms of player retention and established popular precedent. His most famous track, which is also the main theme for the series, has been used in many sequels and movie/television adaptations to evoke strong reminiscences in those who are familiar with the games, which I will refer to as *nostalgia*. This series' soundtracks are almost entirely orchestral, featuring choral chants and an expansive percussion section, performed by the combined forces of the Chicago Symphony Orchestra and the Chicago Lyric Opera Orchestra.

The purpose of interviewing O'Donnell was to discuss his intentions in cultivating thematic attachment with the recurrent use of the *Halo* theme throughout the franchise to harness

player-listener¹³ attachment and to ensure a consequent feeling of nostalgia. This theme has proven to be particularly applicable to my inquiry as one of my aims was to investigate the longer-range psychological impact of game music on players—this single track has brought fans back continuously to a series that now spans two decades and has garnered O’Donnell significant prominence among musicians and non-musicians alike.

Other games have also been examined for their use of theming. Santa Monica Studio’s *God of War* was chosen for its demonstration of thematic development and association with its characters. *The Legend of Zelda* was also selected for discussion, as the series’ significant history with Nintendo has resulted in over twenty-five titles to date, each utilizing thematic attachment to connect players to its characters and maps.

The second concept explored is adaptive/interactive suturing, which is found prominently in games with open worlds or unique musical gameplay mechanics.¹⁴ Suturing describes the interplay between layers of a game’s soundtrack, which can be manipulated based on player circumstances and/or gameplay triggers. To illustrate this technique, game composer Joshua Mancell was consulted to discuss his work on the *Jak and Daxter* (2001) franchise. These games were selected for this investigation because of Mancell’s nearly seamless use of suturing in various tracks throughout the series. Adventure games in particular are notoriously non-linear, requiring that composers provide a means to adapt to the player’s continuously changing circumstances during gameplay by creating layers and seams throughout their scores that can be triggered by certain input and/or events in the overworld (i.e., an area in a video game that

¹³ This terminology is used specifically by Collins, *Game Sound*, 9.

¹⁴ Juan Pablo Fernández-Cortés and Karen Cook, “Ludomusicology: Normalizing the Study of Video Game Music,” *The Journal of Sound and Music in Games* 2, no. 4 (2021): 13-35, <https://online.ucpress.edu/jsmg/article/2/4/13/118800/LudomusicologyNormalizing-the-Study-of-Video-Game>.

connects multiple levels and locations). An example in this franchise can be found in the track titled “Haven City.” This piece, like many others in the series, consists of one base track over which several layers have been designed to activate during certain gameplay scenarios, such as the use of the Morph Gun or JetBoard. In communicating with Mancell, my objective was to gain a greater understanding of the implementation of suturing and other techniques used primarily to compose music for Adventure games.

This research also explores a relatively novel topic in ludomusicology: the spectrum of interactive music. This subject, explored most prominently by Joshua Sites and Robert Potter,¹⁵ spotlights the contrasting levels of interactivity of certain forms of game music and how players can utilize them in varying degrees to achieve a state of flow in which they are fully immersed in the gameplay experience. The levels of interactivity range from *generative music*, which is randomized by an algorithm, to *linear music*, which is fixed and unchangeable regardless of the player’s circumstances.

Discussions of deliberate silence in this project tie in closely with games that use it either tactically or for the purposes of creating ambience. In the views of composers utilizing these methods, silence is meant to describe the withdrawal of intentional musical presence and a reliance instead on environmental sound and general ambience. As a result, the games and tracks analyzed in these discussions were selected with the intention to observe their sparse instrumentations and use of unconventional compositional methods. An interview between composer Jason Graves and scholar Karen Collins is featured in Collins’s film, *Beep: A Documentary History of Game Sound*. Although Graves has composed for multiple genres of

¹⁵ Joshua Sites and Robert Potter, “Everything Merges with the Game: A Generative Music System Embedded in a Videogame Increases Flow,” *Game Studies* 18, no. 2 (September 2018).

games and television, he is perhaps best known for his work on the *Dead Space* (2008) survival horror series, for which he was selected for inclusion here. A remake of the game was released in early 2023, with additional music scored by Trevor Gureckis, who provided a personal interview for this project. Instilling fear through music is an exclusive task uniquely assigned to those who compose for horror games. Composers must work strictly within the confines of the player's circumstances at any given moment and create music that encapsulates and amplifies the terror the character experiences within the game. As this goal is accomplished mainly through jump-scares and diegetic ambiance, the specific techniques Graves and Gureckis use to create these associations are integral to this analysis, especially in their use of creative silence. In the documentary, Graves also explains the specifics of sound design in video game horror and the development of ambiance through diegesis to create deeper immersion.

FPS and Adventure games also frequently and notably demonstrate implementations of deliberate silence for tactical purposes. As FPS games often strive to create the most realistic combat situation possible, silence is commonly utilized purposefully to facilitate aural engagement with players, allowing them to listen more closely to their surroundings. This method is especially prevalent in battle-royale titles such as *Apex: Legends* (2019) and *Fortnite* (2017), in which large swaths of players are pitted against one another, requiring active listening and awareness of surroundings in order to succeed. Narratively focused Adventure games can also employ silence to augment the atmosphere and make the player feel more connected to the game's story. One notable instance of this tactic occurs in *The Legend of Zelda: Breath of the Wild* (2017), which consists of a story largely reliant on elements of sparsity and desolation.

Although these three techniques—thematic attachment, adaptive suturing, and deliberate silence—often exist outside the genres with which they have been associated here, they do seem

to appear more frequently in titles within these categories. Consequently, an analysis of these techniques is provided for three representative franchises (correlating with the genres mentioned previously) to ascertain whether this relationship is coincidental or the result of the composers' direct intention. With all three composers, the inquiry pertained not only to the music itself but also to the relationship between composer and developer and the hardware limitations they encountered at the time of each title's release. The titles and franchises chosen for this analysis were selected based on their narratives and general gameplay mechanics. These games and their music are considered representative of the compositional styles and techniques that will be explored in this thesis.

In keeping with the commonly understood definitions of both *music* and *sound*, I will be using these terms in the literal sense to describe audial differences that might occur as a result of a game's environmental foley (sound effects) as compared to the musical tracks that are composed for the game. Furthermore, sound and music can be delineated as either diegetic or nondiegetic. The term *diegetic* is used to refer to music or sound that exist within the game's environment that can be heard by both the player (externally) and the characters (internally). Conversely, *non-diegetic* effects only exist in the background and cannot be heard by characters in the game itself and are meant to provide interpretive clues or ambience to the player.

A key component of this project was the examination of the scores written for each title to determine the prevalence of certain compositional strategies. To accomplish this, an online archive (<https://vgmusic.com>) containing transcriptions of tracks from many popular games was consulted. These transcriptions, paired with accompanying MIDI files, allowed a more thorough analysis of compositional techniques. Since this archive did not include every track from the

titles analyzed, however, the materials found there were supplemented with my own transcriptions, as well as figures from the blogs of various game composers.

As a significant portion of this research centers on the psychological impact of video game music and plot development on players, much of my investigation consisted of gameplay analysis by genre with particular emphasis on the player's experience. Not only were my observations of gameplay informative for this task, but reviews from other players were considered as well as the creative intentions of composers and developers as mentioned in published and personal interviews and other relevant publications. The narrative plots of each title are also discussed as a means of obtaining a greater understanding of the function of music for story enhancement.

Several popular sources key to this investigation include relevant articles from video game magazines as well as critical reviews of popular titles in several genres. Although they mainly exist to provide a summary of the games' plots and gameplay, reviews and articles written from the perspective of both players and non-musicians are vital to developing a well-rounded understanding not only of the music within the games but also of the games themselves and their impact through the lens of public opinion.

Because of the adaptive nature of creating interactive music operating in tandem with the game's events, subsequent chapters will alternate analyses of techniques with broader industrial/cultural associations, as appropriate. Since many facets of game production, notably marketing, design, development, and post-production, must also be considered, each chapter addresses these matters along with issues relevant to the music. Considering the provided historical context, interviews, and subsequent compositional analysis, this thesis is divided by subject matter into six chapters. The present chapter, as has already been stated, introduces the

research topic and provides basic historical context as well as a justification for the study. It also discusses several of the more relevant ludomusicological sources that will be referenced in the document.

The second chapter provides a retrospective analysis of both the hardware and software used to manufacture games over the last five decades in order to supply the aforementioned historical context. Discussions include industrial advancements and the emergence and development of video games in popular culture. The third, fourth, and fifth chapters focus on the characteristics of individual compositional strategies and their primary generic associations.¹⁶ A general overview is provided regarding popular genres outside those selected for this research along with a sample and limited analysis of at least one title from each. Additionally, these chapters include a thorough analysis of tracks in the games selected for this project as well materials drawn from several interviews with composers. Also addressed are the reasons these games are representative of the genres with which they are associated. Results of the analysis are then presented, compositional patterns are interpreted, and creative intention is considered as it might apply to other games in several additional genres. Lastly, the sixth chapter will contain a review of the findings presented and offer possible cultural and academic implications as they relate to both musicology and the video game industry. To explain the significance of this work, I will review the results of several musicological and psychological studies relevant to this research and posit current and future trends of both the market and the position of video game music as a subject of scholarly debate. To aid readers in developing an understanding of the various terms discussed in this thesis, a glossary has been provided.

¹⁶ The term *generic* is used here and throughout this document to mean “pertaining to genre.” See: <https://definition.org/define/generic/>.

Chapter Two

A RETROSPECTIVE ANALYSIS OF AUDIOLOGICAL HARDWARE AND MARKET TRENDS IN VIDEO GAMES

It is widely understood within this field of research that the term *video games* (alternatively *videogames*) is synonymous with “electronic games” or “computer games,” distinguishing this media from other forms of interactive entertainment such as tabletop games and sports. These labels often represent multiple forms of media outside this generic designation. For example, *electronic games* are also associated with some children’s toys, while *computer games* are often used to refer to games that exist only on personal computers. While *video game* might also be used to describe console games exclusively, I have employed this term in its broadest sense to represent any console, computer, mobile, and arcade games discussed from this point.

The purpose of the following analysis is to familiarize those outside the discipline with the terminology and fundamental ideals associated with video game construction. Consequently, this chapter summarizes the development of video game hardware with a focus on audiological limitations encountered from the earliest interactive electronic entertainment through the contemporary materials in use today. Context is also provided to address the cultural development and emergence of gaming as a substantial and profitable industry.

Silent Gaming: Cathode-Ray Tubes and Early Computers

Most of Generation X—those born between 1965 and 1980—likely witnessed the advent of early gaming, with many attributing their first personal experience to *Pong*, released to mainstream audiences in 1972. In reality, the first iteration of interactive entertainment emerged

from the work of A.S. Douglas who, twenty years earlier, utilized three cathode-ray tubes (CRTs) paired with a rotary dial to produce a display and input generator for an electronic tic-tac-toe game, which he called *OXO*.¹⁷ The game was programmed as part of Douglas's thesis on human-computer interaction presented to the University of Cambridge in 1952. Each match is played by a single user against an artificially intelligent (AI) opponent, which chooses a move after the player manually selects in which of the nine squares to place their "X." The program was written on an Electronic Delay Storage Automatic Calculator (EDSAC), one of the first operating stored-program computers with memory that could be written to and read from simultaneously. As well as having no sound capabilities, the hardware for this system was non-mobile and could only be played with special permission by those visiting the Mathematical Laboratory at the University of Cambridge.

The next major iteration in gaming came in 1958 when American physicist William Higinbotham designed *Tennis for Two*, the first computer program created purely for the sake of entertainment rather than the promotion of commercial technology or scholarly research.¹⁸ Higinbotham, head of the electronics division of the Manhattan Project from 1943 until 1945, shifted his focus to work at Brookhaven National Laboratory, which centered its research on exploring peaceful uses of atomic power. At the research facility's annual public exhibition, Higinbotham contributed his interactive showcase, which drew queues that were several hours long. The machine, like its predecessor, was completely silent. It displayed a side-view of a tennis court (a horizontal line) using an oscilloscope and was played with two aluminum

¹⁷ D.S. Cohen, "OXO aka Noughts and Crosses - The First Video Game," About.com: Classic Video Games, January 22, 2009, <https://web.archive.org/web/20151222084801/http://classicgames.about.com/od/computergames/p/OXOProfile.htm>.

¹⁸ Kristin Kalning, "The Anatomy of the First Video Game," msnbc.com, October 23, 2008, <https://web.archive.org/web/20151120131805/http://www.nbcnews.com/id/27328345/#.Vk8dtezP2Cc>.

controllers, each with a single knob and button. The game simulates a tennis match for which two players use the knob to adjust the trajectory of the ball (a single point of light) and press the button to send it back and forth over the net (a vertical line).

OXO and *Tennis for Two* were only available to those who visited the laboratories or exhibitions in which they were housed, as moving them would require significant effort and disassembly. One of the first publicly available computing instruments was released in 1959 by Digital Equipment Corporation (DEC), who called the 1,600-pound machine the PDP-1.¹⁹ DEC donated one of these early machines to the Massachusetts Institute of Technology, where it served as the platform for an extensive list of innovations in computing technology, notably the creation of *Spacewar!* by computer scientist Stephen Russell. His program was loaded into the processor by means of a punch tape bundle and displayed on a Type 30 CRT, which was capable of refreshing the displayed image at a rate of approximately 89Hz.

Spacewar! featured two spaceships controlled by human players. The objective was to maneuver around the gravity well of the star at the center of the screen and destroy the opponent's ship without colliding with any on-screen obstacles. The position of the player's spaceship was controlled by individual switches on the PDP-1; a specialized control panel would be implemented later on. The PDP-1 was equipped with an audio output mechanism—capable of producing four-voice harmony—but lacked the processing power to run more than one program at a time. Consequently, the game had no accompanying sound. Fifty-three machines were sold before production ceased in 1969, with each costing consumers \$120,000 (the equivalent of \$1.1

¹⁹ PDP-1 stands for *Programmed Data Processor*.; J.M. Graetz, "The Origin of Spacewar!" *Creative Computing Magazine* 7, no. 8 (August 1981): 6-8, <https://www.masswerk.at/spacewar/SpacewarOrigin.html>.

million in 2023).²⁰ As researchers stationed at MIT moved to other institutions, they brought with them copies of *Spacewar!* and, with no feasible way or reason to copyright a computer program at this time, began coding their own variations of the game over the next decade to include new features. The game was popular among programming communities in academia and would retain its appeal through the end of the CRT era, heavily influencing the expansion of electronic games.²¹

Arcade Culture and Game Sound

While the PDP-1 was mainly employed at well-funded research institutions and other academic establishments, the first widely available and commercialized electronic arcade game debuted in 1971 with Nutting Associates' *Computer Space* cabinet console.²² The machine was conceptualized by engineer Nolan Bushnell, who partnered with computer scientist Ted Dabney. Bushnell noted that the interactive entertainment industry had been dominated by coin-operated pinball machines and other gallery-type games and considered adding a coin slot to his own. He expressed concern that the cost of manufacturing the computing equipment required to run his program would present a significant risk if unsuccessful.²³ As a result, in 1965 he would discontinue the venture entirely until 1969, when the standardization of computer hardware made the cost feasible. Bushnell and Dabney would eventually collaborate with Nutting Associates to

²⁰ Digital Equipment Corporation, *Digital Equipment Corporation - Nineteen Fifty-Seven to the Present* (Maynard, MA: Digital Equipment Corporation, 1978), <http://gordonbell.azurewebsites.net/digital/dec%201957%20to%20present%201978.pdf>.

²¹ Devin Monnens and Martin Goldberg, "Space Odyssey: The Long Journey of *Spacewar!* from MIT to Computer Labs around the World," *Kinephanos, Cultural History of Video Games Special Issue*, <https://www.kinephanos.ca/2015/space-odyssey-the-long-journey-of-spacewar-from-mit-to-computer-labs-around-the-world/>.

²² Benji Edwards, "Computer Space and the Dawn of the Arcade Video Game," *Technologizer*, December 11, 2011, <https://www.technologizer.com/2011/12/11/computer-space-and-the-dawn-of-the-arcade-video-game/>.

²³ Edwards, "Computer Space."

obtain the funding and materials necessary to construct the game, which was then distributed to bars and arcades across the country.

Computer Space, drawing influence from its predecessor at MIT, pits a player-controlled rocket against AI-controlled flying saucers set against a starfield spanning a built-in television screen. The player controlled the rocket with four buttons set in a control panel centered at the front of the console, which was given a bright and futuristic appearance to attract passers-by. The mechanics within the cabinet were rudimentary even by the standards of the decade, consisting of a simple circuit board mounted with transistors and diodes. Without a CPU to process code, the finite-state machine was only capable of executing commands hardwired into the logic circuitry.²⁴

Computer Space was the first interactive electronic game capable of diegetic sound production.²⁵ This was accomplished by wiring an amplifier to a 6V Zener diode, which was a voltage-regulating device that gave off “pink noise” (a dense static sound similar to that of heavy rainfall) as it operated. An integrator was added to produce a “fade-in/fade-out” effect. This allowed Bushnell to assign specific tones to the varying elements of gameplay, such as hissing and popping sounds to indicate missile fire and explosions.

Generation One: *Pong* and the Emergence of Atari

After the modest success of *Computer Space* (1,500 units sold between 1971 and 1976) and the continuing rise of arcade culture, game manufacturers began streamlining technological innovations for both cabinet games and the newest variety of entertainment: the home console.

²⁴ A logic circuit is a chain of electronic logic gates that are used to conduct electricity based on conditions applied to its inputs and outputs.

²⁵ Paul Drury, “The Making of *Computer Space*,” *Retro Gamer* (August 2011): 29-33.

These early machines took hardware similar to that implemented in arcade cabinets and compacted it to use with home television sets. The earliest known console, the Magnavox Odyssey, sold for \$99.99 in 1972 (equivalent to \$720 in 2023) and displayed a monochrome set of three square dots and a vertical line that could be manipulated into various sizes based on the cartridge installed.²⁶ For each of the twenty-eight games made for the system, a plastic overlay would be placed over the screen and held in position by the CRT static. These overlays would provide the setting for the game selected by the player. For example, the game *Ski* had players maneuver the dot through the maze-like overlay that simulated a ski slope. Players were meant to avoid various obstacles and make it through the course in the fastest time. Since the console itself was not capable of keeping score, players would hand-write the results of each round. Similarly, many of the games required the use of other props or tools that were included with the Odyssey, such as cards or chips, which made it a videogame-boardgame hybrid. The system, much like the PDP-1's *Spacewar!*, was incapable of producing sound. Magnavox would sell over 350,000 units before the console was discontinued in 1975, making it the first console in the industry to become truly prevalent in American households.

One of the activities included with the Odyssey was *Table Tennis*, which pitted players against each other in a game of virtual ping pong. Each player manipulated their dot (representing the paddle) to volley a “ball” (the smaller dot) across the “net” (a thin vertical line in the center of the screen). Nolan Bushnell and Ted Dabney, designers of *Computer Space*, noted the success of this game and were inspired to establish their own video game company, Atari, in 1972. One of their newly hired engineers, Allan Alcorn, expressed interest in

²⁶ Benji Edwards, “Inside the Magnavox Odyssey: The First Video Game Console,” *PCWorld*, May 27, 2012, https://www.pcworld.com/article/464739/inside_the_magnavox_odyssey_the_first_video_game_console.html.

developing arcade video games using transistor-transistor logic circuits (TTL) paired with the mechanics of Bushnell's earlier games. As this was Alcorn's first attempt at game design, Bushnell first tasked him with what he called a "warm-up exercise": create a table-tennis game with one moving dot, two paddles, and a way to keep score.²⁷ This was similar to the game produced for the Odyssey, which Bushnell had played as part of a demonstration earlier that year while attending a Magnavox product showcase.

In August of 1972, Atari completed a prototype machine they named *Pong*. Unlike the Odyssey, this hardware was capable of audio production, accomplished by manipulating various tones created by the sync generator, which was initially intended to synchronize the display output. This allowed for a variety of sound effects, e.g., a beep when the ball struck the paddle and a longer drone when the ball traveled out of bounds. The game was originally designed as an arcade cabinet and was installed at a local tavern to be field tested.²⁸ Within four months, Atari had produced and distributed over ten thousand coin-operated machines along the West Coast that proved to be extremely popular with bar patrons and arcade enthusiasts. Their favorability drew the attention of Magnavox, who believed that Atari had plagiarized the concept they had developed for the Odyssey earlier in the year. Magnavox brought a lawsuit against Atari in 1974 for patent infringement and won. Atari settled the matter out of court in 1977 for \$1.5 million enabling them to license the technology and continue to market *Pong*. It was at this point that Atari brought the favorable game into the home with their first dedicated console, *Home Pong*,

²⁷ Allan Alcorn, interview by Cam Shea, IGN, Ziff Davis, Inc., March 10, 2008, <https://www.ign.com/articles/2008/03/11/al-alcorn-interview>.

²⁸ William K. Ford, "Copy Game for High Score: The First Video Game Lawsuit," *The Journal of Intellectual Property Law* 1, no. 20 (September 2012): 12. The establishment chosen was Andy Capp's Tavern in Sunnyvale, California, <https://digitalcommons.law.uga.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1035&context=jipl>.

which sold for \$55 in 1975 (\$308 in 2023). Engineers condensed the arcade version's printed circuit board (PCB) into a much smaller large-scale integrator (LSI) chip, which became significantly cheaper to produce in the mid-1970s and made for more powerful and cost-effective hardware.²⁹ *Home Pong* sold over 150,000 units during the 1975 Christmas season alone and would retain its prevalence until early 1977 when Atari released its next console, the Atari 2600.³⁰

This unit expanded on several concepts introduced by the *Home Pong* console, among them the conversion of mounted paddle controllers to the free-standing joysticks that had already been employed in arcade cabinets as well as for the Magnavox Odyssey. *Home Pong* featured microprocessor-based hardware and stored each game on a plastic ROM cartridge that could be swapped in and out of the machine. The 2600 utilized the Television Interface Adaptor (TIA) to generate sound effects, produce the screen display, and read controller inputs.³¹ The TIA chip used two channels of audio to create different types of pulse and noise through a frequency divider that was capable of 4-bit volume control and thirty-two pitch values. It also produced a variety of tones such as square waves and white noise along with pure pitches. Since the hardware was limited in its ability to run multiple lines of complex audio at once, programmers prioritized sound effects over music, meaning that the games were still silent aside from the various blips and beeps associated with the action on the screen. Nine titles were bundled with the console upon its release: *Basic Math*, *Combat*, *Blackjack*, *Indy 500*, *Street Racer*, *Star Ship*,

²⁹ Sonny Albarado, "Silicon Gulch Cowboys Aim to Be Top Gun of Games," *Play Meter*, October 1975, 31-37.

³⁰ David Ellis, *The Official Price Guide to Classic Video Games: Console, Arcade, and Handheld Games* (New York: House of Collectibles, 2004), 33-36.

³¹ Paul Slocum, "Atari 2600 Music and Sound Programming Guide," qotile.net, February 19, 2003, http://www.qotile.net/files/2600_music_guide.txt.

Surround, *Air-Sea Battle*, and *Video Olympics*.³² In 1980, Atari released a conversion of the popular arcade game, *Space Invaders*, for home consumption. This title was a striking success for the company, making their console the most popular on the market with over thirty million units sold before it was discontinued in 1992.³³

Generation Two: The Crash of '83

With the increasing popularity and normalization of home consoles paired with a general lack of solid copyright structure, the North American market became unstable and was oversaturated with copycat games and low-quality titles in the early 1980s. Over a dozen consoles were launched between 1977 and 1983 with many using hardware and technical specifications similar to those of the Atari 2600, though none of them would capture more than 17% of the market at any given time.³⁴ To combat this, Atari began investing in licensed games such as *E.T., the Extra Terrestrial* and *Pac-Man*. Both titles were highly anticipated by the public but suffered due to rushed production to meet the demand of the 1982 holiday shopping season. The substandard quality had a severe impact on consumer confidence in the company and would have disastrous implications for both Atari and the rest of the videogame industry.

Manufacturers, not realizing the extent of the damage done to the market, greatly increased hardware production, which created a significant surplus in the early months of 1983.³⁵ In addition to the financial strain caused by the overproduction of both games and hardware,

³² Marriot_Guy, Video Game Console Library (copyright: 2008-2022), <http://www.videogameconsolelibrary.com/index.html>.

³³ Scott Gallagher and Seung Ho Park, "Innovation and Competition in Standard-Based Industries: A Historical Analysis of the U.S. Home Video Game Market," *IEEE Transitions of Engineering and Management* 49, no. 1 (February 2002), <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=985749&tag=1>.

³⁴ Some consoles included the *Bally Astrocade* (1978), *VC4000* (1978), *Vtech CreatiVision* (1981), *Colecovision* (1982), and *Vectex* (1982).

³⁵ Steven Kent, *The Ultimate History of Video Games* (New York: Three Rivers Press, 2001), 234-40, <https://archive.org/details/ultimatehistoryofvideogamesrevisited/page/n3/mode/2up>.

customers began returning hundreds of thousands of cartridges purchased during the holiday season citing poor graphics and dull gameplay. This public rejection would flip the market on its head and cause many of the smaller companies to fold completely. Atari, which had previously held a sizeable lead in the industry, would be forced to lay off three thousand of its workers and discreetly bury over 700,000 unsold or returned game cartridges in landfills near their warehouses in New Mexico.

Generation Three: The 8-Bit Era and Multi-Channel Audio

Public interest in video games remained comparatively low until a market recovery began in 1985 with the successful exporting of the Nintendo Entertainment System (NES). Japan, whose market had avoided many of the negative economic effects of the crash, began to shift its focus from arcades to living rooms. Nintendo, which had previously been well known for its *Donkey Kong* arcade machine, began production of its first home console, which they called the Famicom. Although this console had already proven to be successful in Japan, Nintendo encountered considerable hesitancy from American retailers who were wary of investing any more into what they considered to be a failing industry. For this reason, Nintendo branded the unit as an “Entertainment System” instead of a console and designed it using a front-loading cartridge slot to mimic cassette players, which were selling very well in the United States.

Popular titles for the NES include *Super Mario Bros.* (1985) and *The Legend of Zelda* (1987), both of which were published by Nintendo and already very popular in Japan before they were ported over to the Western version of the console.³⁶ The company carefully vetted the number of third-party developers they allowed to license games for their console and used a

³⁶ “Porting a game” is the process of transferring its software from one operating system to another.

“Seal of Quality” to reassure consumers that these games met their rigorous quality standards. This led to an extraordinary surge in sales and effectively ended the crash. Nintendo dominated the market in 1988, pulling in over 70% of the industry’s \$2.3 billion profit.³⁷

The revival led to new innovations in game sound technology with the introduction of the Ricoh 2A03 8-bit microprocessor found in the NES. This dedicated sound chip meant that the CPU was no longer solely responsible for both visual display and audio production and allowed for the first implementation of video game music running parallel to the sound effects. The chip divided the sound output into five channels separated into two Audio Processing Units (APUs). Each of these channels had its own frequency profile that, when combined, could produce continuous musical themes. The first two pulse wave channels were reserved for the production of the melody, the third used a triangle wave to create a bass line, and the fourth was a noise track that produced percussive sound. The fifth track, a delta modulation channel, could reproduce prerecorded samples such as speech or a cheering crowd; however, this channel was rarely used as it consumed a large amount of memory. This type of sound sampling would become standardized in later generations as the capabilities of PSGs increased.³⁸

Composers for NES games were forced to operate within the capacity of the Ricoh microprocessor, which was limited to three pitches and a percussive line that could be produced simultaneously. Since complex harmonies and even simple triads were difficult to incorporate into this system, composers often used arpeggiated basslines while assigning one of the upper channels to a counter melody to thicken the harmonic structure.³⁹ A notable example of this

³⁷ Eve Belson, “The Most Popular Playthings of the Last 50 Years,” *Orange Coast Magazine* (December 1988): 88, <https://books.google.com/books?id=82AEAAAAMBAAJ&pg=PA88#v=onepage&q&f=false>.

³⁸ PSG is a blanket term for Programmable Sound Generator.

³⁹ Billy Donahoe, “History of Video Game Music,” Press for Sound, <https://pressforsound.com/history-of-video-game-music/>.

format can be found in Koji Kondo's theme from *Super Mario Bros.*, which was released for the NES in 1987. With the limited capabilities of these early dedicated sound chips, sound effects had to operate in tandem with the music. Subsequently, any action that produced a sound effect (Mario jumping or hitting blocks) would require that one of the pulse wave channels be temporarily muted to make room for the effect to sound.

Generation Four: 16-bits and Frequency Modulation Synthesis

Nintendo capitalized on the success of the NES and would continue to command the market well into the 1990s. Their closest competition came in 1989 when Japanese game/entertainment company Sega released their first 16-bit console, the Sega Genesis.⁴⁰ This console pioneered the 16-bit architecture and introduced Sega's flagship character, *Sonic the Hedgehog*, as a direct contender with Nintendo's *Mario*. This console sold over thirty million units internationally from 1989 until its discontinuation in 1999.⁴¹

As the internal processors for these consoles became more complex, so did players' experiences with each title that was released. Gaming controllers now consisted of between three and eight buttons, and many games now featured *parallax scrolling* instead of the previously used stationary or single-layer backgrounds for levels.⁴² Consoles were now capable of displaying up to 4,096 colors simultaneously from larger 16-bit palettes. Nintendo, realizing the capabilities of the new 16-bit systems, moved quickly to produce a new console in order to

⁴⁰ Duncan Dodsworth, "Fourth Generation Video Game Consoles: The 16-bit Generation," history-computer.com, December 15, 2022, <https://history-computer.com/fourth-generation-video-game-consoles-the-16-bit-generation/#:~:text=What%20consoles%20were%20in%20the.%2C%20and%20the%20CD%2Di>.

⁴¹ Kent, *The Ultimate History of Video Games*, 236.

⁴² Parallax scrolling is a method to change the background of a level in which objects in the foreground scroll horizontally at a faster rate than those in deeper layers, creating a simulation of depth within the display.

maintain its lead with Sega's growing influence on the market. This resulted in the Super Nintendo Entertainment System, or SNES, which debuted in North America in 1991.⁴³

The SNES was built with future innovations in mind; the hardware itself was designed in a way that left room in its game cartridges for the installment of "enhancement chips," which would continue to be developed even after the console's initial release. This gave the company a competitive edge in the market and allowed for further improvements to both graphics and audio that could be refined by licensed third-party developers as opposed to the constraints presented by the basic stock chipsets used previously.

Nintendo's new console employed a unique system to produce audio, which operated with a separate coprocessor installed on the motherboard. Two chips would operate in tandem: a 64-kilobyte APU and a *Digital Signal Processor* (DSP). The DSP created sound using eight channels of digitally sampled audio, which would then be converted and sent through the APU, which in turn communicated the signal to the console's main CPU. The DSP contained a preset stock of MIDI instruments that could be programmed by composers to suit their needs using software known as a *music tracker*. This program was significantly more user-friendly than software found in previous consoles and circumvented the tedium that was normally associated with programming music in games.

Conversely, the software behind sound production for the Genesis featured one of the first implementations of *frequency modulation synthesis* (FM synthesis) to create the pitch pallet from which game composers could construct their soundtracks. FM synthesis involves the digital manipulation of a primary waveform by modifying the frequency of its oscillation through the

⁴³ Brian Byrne, "History of the Super Nintendo (SNES): Ultimate Guide to the SNES Games & Hardware," *Console Gamer Magazine* (2017): 4.

introduction of a second waveform known as a *modulator*, which produces a set of harmonics different from those present in the original *carrier* wave. These new textures are measured and notated using ratios to represent the frequency of the modulating wave to the carrier wave. The more resonant frequencies use whole-number ratios, for example, 1:1, 2:1, and 4:1. These will produce complementary textures that supplement the bass and provide rich overtones, whereas uneven ratios result in greater dissonance and a grittier sound.

This highly efficient method of sound synthesis was licensed exclusively through Yamaha until 1995, allowing them to implement their patented sound chips into nearly all gaming consoles released in the fourth generation. Since FM synthesis only requires a minimum of two oscillating sound waves to produce a large pallet of sounds, the new 16-bit processors were left with significantly more space to run graphics and other performative assets. For example, the Genesis paired its FM chip with a more rudimentary four-channel PSG chip similar to those found in the NES, allowing for an even broader spectrum of sound production. The processing power saved by the use of FM chips also brought about the application of stereophonic sound, which created a three-dimensional space in which sound could be conveyed to the player. These chips, like the YM2612 in the Genesis, utilized six melodic channels and three percussive channels containing four oscillators each.⁴⁴ Different combinations of these oscillators allowed for the production of a wide variety of timbres including a pipe organ, bass guitar, flute, and even percussive sounds such as snare drum.⁴⁵

⁴⁴ Keith Stuart, "Super Sonic: Creating the New Sound of Sega's Hedgehog Hit," The Guardian, Guardian Media Group, February 13, 2020, <https://www.theguardian.com/games/2020/feb/13/super-sonic-creating-the-new-sound-of-sega-hedgehog-hit-sonic-the-hedgehog-masato-nakamura-tom-holkenborg>.

⁴⁵ Collins, *Game Sound*, 41.

Conserving processing power by using FM synthesis granted new freedoms to composers who wrote for these consoles. Instead of the previous restrictions of eight or twelve-bar phrases and only three melodic channels, loops could now be written out to create multi-minute-long tunes with clear-cut sections. For example, the “Green Hill Zone” theme from *Sonic the Hedgehog* features three separate eight-bar phrases: an intro, a verse, and a chorus. The intro is triggered immediately when the user begins the level and plays only once before transitioning to the verse. The verse loops twice, with the second iteration adding a countermelody. After the second verse, the chorus plays a single time before looping back to the verse, which repeats as it did before. This sequence continues until the player passes the final checkpoint, completing the level.⁴⁶

In order to produce the fuller synthetic orchestral sounds that were present throughout most of this generation, composers and sound designers found ways to work around the technical limitations that still obstructed their creativity. Segments of melodies were often copied, pasted, and transposed to facilitate the longer runtime of each section and sound effects were often recycled from the same tone pallets used for the background music. The most popular method utilized by 16-bit composers was *double-tracking*, in which a slight delay was added between two audio channels to create the illusion of thicker instrumentation and a fuller sound.⁴⁷

Generation Five: 3D Graphics and CD-ROMs

FM Synthesis would continue to be used in the majority of console sound chips through the end of the twentieth century. Larger companies would implement further improvements to

⁴⁶ Recording: <https://project2612.org/details.php?id=36>; Score: <https://musescore.com/user/3501681/scores/5969423>.

⁴⁷ Collins, *Game Sound*, 176.

their consoles' graphic and processing capabilities through the inclusion of add-ons, such as the Genesis's 32X and the NES's *Super FX* chip. Both of these would allow for the addition of rudimentary 3D effects and push the 16-bit consoles into the emerging 32-bit era, which was marked by the transition from 2D graphics to fully implemented 3D textures.

Similarly, the end of the 1990s was also characterized by a shift from the storage of games on plastic cartridges to *optical discs*. These discs, known as CD-ROMs,⁴⁸ provided a new and much less constraining medium by which both composers and game designers could work, as they were no longer reliant on the limited space of the DSP's used by the older systems. Instead, data could be stored as binary code in the microscopic grooves on the disc's surface, which could then be read by laser and translated back to the console's RAM, where it would be executed as sound/gameplay. These CDs could hold up to seven hundred megabytes of data and store live sampled sound, including voice recordings (dialogue), music, and other effects, as well as all of a game's visual data. This increase in storage capacity meant that gameplay was becoming significantly longer and utilizing new, revolutionary 3D graphics.

The leading console of this generation was Sony's PlayStation, which debuted in North America in the fall of 1995. An electronics company whose original intention was to partner with Nintendo to release a CD-ROM add-on for the SNES, Sony instead chose to introduce their own console in the hopes of appealing to a broader spectrum of third-party developers. This led to a significant increase in the volume of games released for the system, with over three thousand titles manufactured and one hundred million units sold by its discontinuation in 2006.⁴⁹ Sony fitted its console with several state-of-the-art coprocessors, including a *Geometry*

⁴⁸ Compact Disc- Read-Only Memory

⁴⁹ Nic Healy, "Evolution of the PlayStation Console," CNET.com, November 27, 2013, <https://www.cnet.com/tech/gaming/evolution-of-the-playstation-console/>.

Transformation Engine (GTE), which handled all the 3D graphics. This chip could render over 360,000 polygons per second and process the lighting, texture mapping, and shading used to create three-dimensional games.

The PlayStation's sound chip was capable of CD-quality audio from twenty-four channels, which was sampled at 44.1 kHz. This meant that composers for CD-ROM games no longer needed to worry about the specific capabilities of the consoles they were writing for. They were now bypassing the CPU entirely and sourcing the audio directly from the CD, through the sound chip, and into the I/O port. To further ease the strain on programmers, Sony also added MIDI support to their console, which allowed composers and developers to export files from their personal software into a format that was easily executable by the PlayStation.

Other companies quickly followed suit and released 3D-capable consoles of their own. Among them were the Atari Jaguar, the Sega Saturn, and the Nintendo 64 (N64). Nintendo's 64-bit console would be the one that followed most closely behind the PlayStation in sales due to its higher processing power and elimination of load times, but the company's decision to continue the use of cartridges instead of CD-ROMs led to higher manufacturing costs to reconcile the new technology with the old format, resulting in significantly fewer games created for the N64 when compared to those for the other consoles on the market. Regardless, Nintendo would combine the new graphic capabilities with their already popular exclusive titles such as *Mario* and *The Legend of Zelda*, which retained a large majority of Nintendo's consumer base and secured the N64's position as the second leading console through the turn of the century.

The fifth generation of video game consoles spanned from 1994 until approximately 2006 and was notable for the introduction of a more realistic three-dimensional gameplay experience. The establishment of 32- and 64-bit hardware meant that games were looking and sounding

better than ever, with the PlayStation and N64 machines now capable of supporting digital surround sound. Limitations were greatly reduced with regard to the compositional tools available to sound production teams from this point; the new CD-ROM-based system left ample space and processing power to allow composers to sample live orchestras and harness extensive MIDI pallets to produce their soundtracks. The gaming experience was now immersive; in many instances, players were also granted the ability to control the intensity of their inputs thanks to the wider range of motion possible with the new analog control sticks. This increase in interactivity between players and games led to a significant rise in demand for these systems; over 60% of U.S. households owned or had rented one or more of these consoles by 1997.⁵⁰

Generation Six: Online Capabilities and the Console Wars

The increasing technical specifications in the video game market meant that the sixth generation, which, in terms of technological expansion, would be considered the 128-bit era, saw bit ratings becoming less relevant when advertising gaming systems to the public. Instead, marketability relied on other performative factors, such as processing speeds, data storage capabilities, and improvements to latency (the amount of time needed to transfer data from one area of the motherboard to another). Two noteworthy innovations with this generation were the introduction of online capabilities and the solidifying of the “Big Three” (Sony, Microsoft, and Nintendo) as direct competitors in the market.

⁵⁰ Justine Cassell and Henry Jenkins, *From Barbie to Mortal Kombat: Gender and Computer Games* (Cambridge, MA: MIT Press, 1998), https://web.archive.org/web/20160307001348/http://webcache.googleusercontent.com/search?q=cache%3A2W7jV8xhO_QJ%3Awww.economics.rpi.edu%2Fpublic_html%2Fruiz%2FEGDFall2013%2Freadings%2FFrom%20Barbie%20to%20Mortal%20Combat.doc.

In March of 2000, Sony's new PlayStation 2 (PS2) hit the shelves in North America following a highly successful marketing campaign.⁵¹ This system, which was sleek and stylish compared to its predecessors, functioned both as a gaming console and a DVD player and touted its backwards compatibility.⁵² Sony's consumers could continue to use games on the new hardware that they had already purchased, making for a much easier transition between the two generations, with the PS2 going on to become the top-selling video game console of all time with over 160 million units sold worldwide by its discontinuation in 2013.

That same month (March 2000), Microsoft announced its decision to enter the console market with the release of its first home video game system, the Xbox.⁵³ As a company best known for its personal computers, Microsoft sought to implement several PC components into its new console, using a version of its own computer operating system in the Xbox to support both media playback and gaming as well as an Intel CPU similar to those used in gaming computers. Microsoft was also the first to include internet connectivity through an Ethernet port attached to the rear of the console. This would allow players to connect with each other and play together in real time via an online gaming service known as *Xbox Live*. The Xbox was also the first console to use an internal hard drive to store game data and other assets, making it the more powerful machine during this era.⁵⁴

⁵¹ Steven L. Kent, "PlayStation 2 Timeline," gamespy.com, February 18, 2004,

<https://web.archive.org/web/20080509145348/http://archive.gamespy.com/articles/february04/ps2timeline/>.

⁵² "Backwards compatibility" is a term meant to describe a newer gaming console that is able to read and utilize older hardware from earlier generations. For example, discs from the original PlayStation can be used with the PlayStation 2.

⁵³ Steven L. Kent, "Xbox Timeline," gamespy.com, February 16, 2004,

<https://web.archive.org/web/20080509095112/http://archive.gamespy.com/articles/january04/xboxtimeline/>.

⁵⁴ Patrick Garratt, "The Xbox Story, Part 1: The Birth of a Console," VG247.com, August 2, 2011,

<https://www.vg247.com/the-xbox-story-part-1-the-birth-of-a-console>.

While both the PS2 and the Xbox were marketed toward a more mature gaming audience, Nintendo, which was considered the more family-friendly gaming company, set to work on its own sixth-generation console, the GameCube, in late 2001.⁵⁵ This vibrant, blocky machine came in three colors (indigo, black, and silver) and focused on drawing the attention of younger consumers in the gaming market. The GameCube launched with several exclusive flagship titles, including *Luigi's Mansion*, *Super Smash Bros. Melee*, and *The Legend of Zelda: The Wind Waker*.⁵⁶ This was also the point when the company decided to follow market trends more closely and switch from plastic cartridges to optical discs.

Nintendo partnered with tech giant IBM to manufacture the GameCube's CPU, while its graphics card was handled by ATI Technologies. Unlike the other two competing consoles, the GameCube was designed not as a multimedia entertainment system but as a machine meant purely for gaming. The console was not capable of reading DVDs or audio CDs since the disc tray (and the entire machine) was significantly smaller to conserve space in an attempt to make the system more portable. As a result, the motherboard was also much less complicated, with the audio processor integrated directly into the Graphics Processing Unit (GPU,) where all graphics, sound, and I/O operations were handled. Aside from these two main chips, the only other large components contained on the mainboard were two smaller memory chips.⁵⁷

These three main competitors were each popular for their own marketed characteristics: the PlayStation 2 had the largest library of games and was backwards compatible with the

⁵⁵ Steven L. Kent, "GameCube Timeline," gamespy.com, February 17, 2004,

<https://web.archive.org/web/20080513133120/http://archive.gamespy.com/articles/february04/gcntimeline/>.

⁵⁶ "Exclusive" in the video game sphere means that the titles/franchises could only be released by one company and its consoles. For example, *Animal Crossing* is a Nintendo exclusive, *Halo* is an Xbox exclusive, and the earlier *Kingdom Hearts* was a PlayStation exclusive.

⁵⁷ Anand Lal Shimpi, "Hardware behind the Consoles- Part II: Nintendo's GameCube," AnandTech.com, December 7, 2001, <https://www.anandtech.com/show/858/13>.

original PlayStation, the Xbox was the most powerful console and allowed for online gaming, and the GameCube had many fan-favorite titles from Nintendo and was considerably more popular with younger audiences. All three companies would design controllers that featured “rumble feedback,” which stemmed from two weighted motors in the handles that vibrated based on in-game actions. This, paired with further integration of Dolby Digital Surround Sound in each console and further advancements in visuals and animation, greatly increased the immersive capabilities of games in the sixth generation.⁵⁸

Generation Seven: Controlling the Market

With the video game industry under the command of three companies by the early 2000s, each brand was participating in a frantic endeavor to maintain relevance within the increasingly competitive market. Profits were at an all-time high; home consoles were becoming progressively popular with over two hundred million total units sold among the three companies between 2005 and 2017. The gaming experience had become more realistic with the introduction of surround sound and stereoscopic graphics. The community was beginning to flourish; gamers were connecting over the internet to play MMOs⁵⁹ together and LAN parties were beginning to draw in sizeable crowds.⁶⁰ Following the success of their sixth-gen consoles, Sony, Microsoft, and Nintendo raced to be the first to release a new console to expectant audiences by 2005.

Microsoft would be the first to finish its seventh-generation console, dubbed the Xbox 360, in November of 2005. This version, like its predecessor, was an exceptionally capable machine that contained enough internal storage (thanks to two expanded hard disk drives) to

⁵⁸ Specifications for each console can be found at <https://www.angelfire.com/electronic2/mariotan/>.

⁵⁹ MMO is the abbreviation for “Massively Multiplayer Online” and refers to a game that is played over the internet by a large number of people simultaneously.

⁶⁰ A LAN (Local Area Network) party is a gathering of multiple individuals and gaming setups in which a local internet connection is established to facilitate multiplayer gaming.

download full-sized games directly from Microsoft's online catalogue to the console, eliminating the need for a disc to access them. To further increase the space available, consumers were also given the option of attaching an additional external hard drive to the console that came in sizes up to five hundred gigabytes. Other innovative specifications for the 360 included native HD rendering, wireless controllers, a motion-sensing camera (Xbox Kinect), an online achievement service,⁶¹ and the ability to stream music and films through the Xbox Music and Video portals.

Microsoft's attempt to surge ahead in the market with the release of its console nearly a year before those of its two closest competitors resulted in a significant number of technical issues that caused new or like-new consoles to fail entirely, including the infamous "Red Ring of Death." This malfunction was indicated to the player as a general error code represented by three or four illuminated red lights around the console's ring display. This hardware failure was caused in part by decreased quality control in the manufacturing phase, which allowed for a less heat-resistant solder to be used on the motherboard that could easily overheat and develop irreparable cracks that usually bricked the console.⁶² Microsoft responded to the problem first by extending the warranty on the Xbox 360 to allow for repairs before they issued a recall and replaced several million consoles at a cost of over one billion dollars.⁶³

Sony's seventh generation system hit U.S. shelves on November 17, 2006. Their new console, the PlayStation 3 (PS3), took home gaming to the next level with its inclusion of Blu-ray technology. The decision to utilize dual-layered Blu-ray discs instead of the DVD-R setup

⁶¹ Microsoft's Achievement service tracks players' progress through games by rewarding a certain number of "Gamerscore" points for each specific mission or task completed.

⁶² "Bricking" is a term used to describe a serious hardware malfunction that renders the console completely unusable. A bricked machine can rarely be repaired.

⁶³ Wesley Yin-Poole, "Peter Moore Recounts \$1.15bn Xbox 360 Red Ring of Death Saga," EUROGAMER.com, July 2, 2015, <https://www.eurogamer.net/peter-moore-recounts-xbox-360-red-ring-of-death-saga>.

seen in both the 360 and the entire previous generation added almost five times the amount of code space on each game disc, expanding the limit from about ten gigabytes to fifty gigabytes of possible storage.⁶⁴ Games released for the PS3 featured significantly longer and more cinematic storylines as a result, with several of its exclusive titles considered particularly memorable due to their high-quality graphics and dynamic soundtracks. Like Microsoft, Sony also implemented multiple hard disk drives into its console as well as support for wireless controllers and native HD rendering.

The PS3's launch price was notably higher than the 360's, which Sony attributed to its Blu-ray compatibility and expensive graphics processor. This led to a decrease in popularity among consumers who were willing to sacrifice the PS3's quality for the 360's online compatibility and lower cost. To regain their market lead, Sony announced a significant price drop for the base model PS3 the following year, which marginally boosted sales. Overall, they pulled slightly ahead of Microsoft by the end of each console's lifespan, selling a total of 87.4 million units to the 360's 84 million units.⁶⁵

The seventh generation would mark the first big win for Nintendo, which released the Wii in November of 2006. As in previous generations, Nintendo focused more on innovating and nurturing their brand than on revolutionary graphics or processing power. The Wii was designed and marketed to attract a much wider audience that included casual gamers and non-gamers alike. The idea was to facilitate a gaming experience that was entirely movement-based, which

⁶⁴ Ian Stokes, "DVD vs Blu-ray vs 4K Blu-ray: What's the Difference between [sic] Them?" TopTenReviews.com, August 28, 2020, <https://www.toptenreviews.com/the-difference-between-dvd-and-blu-ray>.

⁶⁵ Eddie Makuch, "E3 2014: \$399 Xbox One Out Now, Xbox 360 Sales Rise to 84 Million," GameSpot.com, June 09, 2014, <https://www.gamespot.com/articles/e3-2014-399-xbox-one-out-now-xbox-360-sales-rise-to-84-million/1100-6420231/>; <https://web.archive.org/web/20190427203732/https://www.sie.com/en/corporate/data.html>.

radicalized the concept of interactivity and immersion, making the Wii the most sought-after system of the holiday season and selling over 101 million units in the following decade.

The primary controller for the system, known as a Wii Remote, was a completely wireless handheld device that operated using traditional buttons combined with gesture recognition and motion sensing technology. Gamers were encouraged to incorporate physical activity and movement as they played, which had previously been done while seated. Several exclusive titles for the Wii were based on a variety of sports and other athletic activities, such as golf, baseball, and yoga. Other noteworthy characteristics included backwards compatibility with GameCube games and the introduction of Nintendo's first online game catalogue through the Wii Shop. The company continued to center its focus on providing a more laid-back experience that was considerably less "hardcore" than what was offered by the 360 or PS3. As with previous consoles, many fan-favorite titles were either reconfigured to incorporate the movement-based system or had new sequels released that were designed entirely around them, including *The Legend of Zelda* and *Super Mario*.

While each console of the seventh generation read games using optical discs and featured somewhat similar characteristics (1080p graphics, Dolby Digital surround sound, wireless controllers, etc.), all three found their own success with specific audiences in the gaming community: The 360 was the more powerful console that maintained a substantial online network, the PS3 facilitated Blu-ray technology and provided a more versatile "entertainment" experience, and the Wii changed the way people played games and stayed physically active. This generation would also prove to be the most sustainable, with all three consoles remaining in production through 2017, well after the release of the next series of systems.

Generation Eight: Digital Distribution and Streaming Audio

The console wars continued among the three major manufacturers with the start of generation eight in 2013. This line of hardware faced new competition in the form of mobile gaming with the growing popularity of smartphones and tablets as a gaming platform. This new market was particularly attractive due to the implementation of a free-to-play system in which users could download and play games at no cost, with developers securing financial support from advertisements and in-game purchases. Apple had sold over 58.2 million iPads in 2012, with many consumers supplementing its traditional professional capabilities with casual games such as *Minecraft* and *Candy Crush*.⁶⁶

Console gaming in the eighth generation saw the consolidation of many previously individual characteristics among the “Big Three.” The storage capabilities and visual advancements reached a threshold that modern games had no practical need to surpass; internal hard drives were capable of holding up to one terabyte of data and GPUs were capable of processing nearly twenty-six gigapixels per second while producing images in 4K resolution. At this point, PlayStation and Xbox were practically neck-and-neck in terms of efficiency; and with cross-platform gaming becoming increasingly popular, both companies were encouraged to collaborate in a greater capacity than they had before. Many previously exclusive titles were rereleased for multiple consoles which required gaming mechanics to function similarly in both operating systems in terms of control schemes and online features.

⁶⁶ Darrell Etherington, “Apple Hardware Sales in FY 2012: 125.04M iPhones, 58.23M iPads, 18.1M Macs, and 35.2M iPods,” TechCrunch.com, October 25, 2012, <https://techcrunch.com/2012/10/25/apple-hardware-sales-in-fy-2012-125-04m-iphones-58-23m-ipads-18-1m-macs-and-35-2m-ipods/>.

Sony and Microsoft both launched their eighth-generation consoles in 2013; the PlayStation 4 (PS4) and Xbox One, respectively. Many of their specifications were similar; both featured CPUs produced by Advanced Micro Devices, Inc., offered eight gigabytes of RAM, supported additional external storage of up to sixteen terabytes, and supported both Blu-ray and DVD. One new feature for this line-up was the switch from traditional PCM to bitstream audio. Bitstream converts recorded audio data directly into binary code, formats it to the selected output type, and sends it from the source (the disc or hard drive) to an AV processor and out of the speakers either through a cable or wireless connection. Home sound systems were then responsible for decoding the binary signal into the correct channels and outputting the sound through speakers or headsets.⁶⁷ The result was a significant increase in audio fidelity and quality as well as a substantial improvement in the efficiency of sound production.

Although there were many commonalities in the technical specifications between the PS4 and Xbox One, each brand retained several individualities that set them apart from the other. For example, the PS4 was the first major video game company to fully implement virtual reality into its console through the PlayStation VR apparatus. Sony also transformed its controllers to include a touchpad, gesture-sensitive motion tracker, and a small speaker that could play sounds from the game environment such as dialogue and other auditory effects. This revolutionarily immersive configuration was wildly popular with consumers, with the PS4 selling 106 million units by 2019.

Conversely, the Xbox One continued Microsoft's trend of fostering their online community by offering support for third-party applications such as Skype, Netflix, and Spotify.

⁶⁷ Robert Silva, "What Is Bitstream and How Does It Work?" Lifewire.com, July 22, 2021, <https://www.lifewire.com/what-is-bitstream-1846846#:~:text=A%20bitstream%20is%20a%20method,surround%20format%20sent%20to%20it>.

This was also the first in the market to feature an *all-digital* console, which did away with the disc drive and provided even more internal storage to allow players to purchase and store their entire library of games on the hardware without the need for physical discs. The Xbox One sold just over fifty million units before it was discontinued in 2020.

After the commercial failure of the rarely discussed Wii U in 2012,⁶⁸ Nintendo continued to focus on the more casual side of the video game market while working to add more idiosyncratic features to its next console. With increased pressure resulting from the emerging mobile game industry, the company combined the best of each concept with the release of the Nintendo Switch in 2017. This hybrid console was capable of both handheld and traditional play thanks to its innovative *docking* mechanism, which connected the hardware to a secondary display through HDMI, much like the larger gen-eight machines.

The Switch itself featured a seven-inch touchscreen display and removable Joy-Con controllers that allowed users to take the system wherever they liked. The controllers operated much like the Wii Remote, allowing for fully functional motion controls while also providing the option to snap them together to use as a traditional controller if desired. Nintendo continued to feature the proprietary titles they were known for, namely *The Legend of Zelda: Breath of the Wild*, *MarioKart 8*, and *Super Smash Bros. Ultimate*. Although the hardware itself was significantly less powerful than the Xbox One and PS4, the Switch's portability and family-friendly software led to over ninety-five million units shipped worldwide by 2022.

⁶⁸ The *Wii U* encountered a variety of issues that led to its early discontinuation, including a lack of third-party support and processing power. This led to very few titles being released for the console as well as a general lack of public support.

Generation Nine: Today

The ninth generation is witnessing the continuation of the console wars among the “Big Three” and features the current lineup of video game hardware available today. The intense competition between Microsoft and Sony led to launch dates that were notoriously close; Microsoft’s Xbox Series X hit shelves in the U.S. on November 10, 2020, with Sony following just two days later on November 12 with the PlayStation 5 (PS5). These releases were highly anticipated, as they had both been marketed as substantial upgrades from the machines of the eighth generation. The pair introduced and implemented the solid-state drive (SSD), which replaced traditional hard disk drives previously used for internal storage. SSDs operate at significantly faster speeds and nearly eliminate the need for load times while their smaller size also conserves space in the machine.⁶⁹ The Series X and PS5 also improved their graphics processors and could render a native 4K resolution at an optimized sixty frames per second with real-time ray tracing.⁷⁰ Another new standard of this generation was the option for a Digital Edition console, which, like the all-digital Xbox One, eliminated the optical disc drive and relied entirely on internal storage. This, however, only served to offer a lower-priced alternative to consumers and had no impact on the amount of storage provided.

Specific characteristics of these machines include the PS5’s new DualSense controller, which offers a built-in microphone and dynamic adaptive triggers, and the Series X’s Dynamic Latency Input support as well as a larger spread of third-party titles. The PS5 boasts a more

⁶⁹ Andrew Williams, “SSD vs HDD: What Does Switching to SDD Mean for Next-Gen Gaming?” GamesRadar.com, March 18, 2020, <https://www.gamesradar.com/ssd-vs-hdd/>.

⁷⁰ “Ray tracing” is a hyper-realistic 3D illumination system in which light sources produce linear rays that bounce off the surfaces they hit while accounting for the medium of the object. For example, a ray of light hitting the surface of water will reflect differently from one hitting dirt or concrete. This was only available from the ninth generation due to the graphics processing power required to produce the effect.

impressive collection of exclusive games, while the Series X retains its full backwards compatibility, which allows players to experience titles extending back to the original Xbox.

The two consoles were announced just before the outbreak of the COVID-19 pandemic, which would greatly impact production and distribution. The video game industry's annual trade event, known as *E3*, was intended to serve as a major marketing opportunity for both companies, but was cancelled at the onset of the outbreak. Companies instead opted for a fully digital marketing campaign aimed at introducing and demonstrating the capabilities of the new machines. This, coupled with severe supply issues stemming from manufacturing slowdowns, sharply damaged production capabilities and caused a shortage of consoles available by their respective release dates. The result was a highly volatile retail situation in which consumers, who were desperate for the new hardware, were camping at stores and trampling each other for the opportunity to get their hands on one of these scarce machines. Waitlists to purchase through online retailers were often several months long. Scalpers were using online bots to purchase multiple systems at a time, which they would resell to individual buyers at substantial markups. Although this generation brought with it the best technology to date, this shortage, which continues today, caused only forty-five million units to be sold across both companies to date.⁷¹

As of early 2023, Nintendo had yet to release its own ninth-generation system. Instead, the existing Switch was redesigned and further optimized with a new OLED display in 2021. In order to maintain relevance among its more powerful peers, the Switch offers many of the same cross-platform games as the PS5 and Series X but at a lower resolution to account for its less competitive processing abilities. Regardless, the new OLED Switch had sold nearly ten million

⁷¹ William D'Angelo, "PS5 vs Xbox Series X|S Sales Comparison- September 2022 Sales," VGChartz.com, October 27, 2022, <https://www.vgchartz.com/article/455260/ps5-vs-xbox-series-xs-sales-comparison-september-2022/>.

units by December 2022, with continuing sales of the traditional model and the purely portable Switch Lite further bolstering Nintendo's influence on the market.⁷²

Conclusions

Video games took their earliest forms in the 1950s as computer scientists were just beginning to understand the scope of electronic technology. Games evolved from primitive mainframe computer programs, to arcade cabinets, and finally to the first dedicated home game systems in the early 1970s with the invention of the Magnavox Odyssey, which spearheaded a frenzied effort to capitalize on the escalating home entertainment market. After many copycat consoles caused issues with oversaturation in the industry, the Crash of 1983 spurred the westernization of established Japanese video game company, Nintendo. The 8-bit NES would revitalize the industry and encourage several new companies to join in the trade, namely Sega, Sony, and later Microsoft.

From a visual standpoint, gamers witnessed the transition from rudimentary two-dimensional side-scrollers to fully rendered polygonal graphics with sophisticated control schemes. Players were learning to operate cameras, understand perspective, and truly command the narratives as they experienced them. The switch from plastic cartridges to optical media once again extended the boundaries of what graphic designers and sound engineers could do with their games. Characters became more relatable, environments became dynamic, and sound became captivating and adaptive. Composers encountered few limits on what they could create, with many scoring full-length orchestral soundtracks with live musicians to coexist with dramatic plots and photorealistic graphics. In later years, they found no need for discs at all; consoles now

⁷² Eduardo Ariedo, "Nintendo Switch Surpasses 114 Million Units Sold," ShowMeTech.com, November 8, 2022, <https://www.showmetech.com.br/en/nintendo-switch-114-million-sold/>.

contain more than enough internal storage and computing power to handle all operations singlehandedly.

In terms of the modern gaming experience, it has been made abundantly clear over the last several decades that the market is trending toward one overarching idea: immersion. Game developers are hyper-focused on fully absorbing players into the pre-rendered environments they have created. Innovations in both visual and sound design, as well as further advancements in computational technology, have provided today's gamers with a realistic and truly individual experience. From real-time haptic feedback through controllers to cinematic cutscenes rivaling those in the box office, video games have provided users with a place to relax, explore, and be enveloped by the capabilities of modern technology.

The twenty-first century saw the earliest "AAA" (Triple A) games, which are described as titles or franchises produced by major studios and distributed by high-end publishers with above-average development budgets and marketing campaigns. The initial AAA lineup included entries such as Square's *Final Fantasy VII* (1997) and Bungie's *Halo*, which had production budgets of \$40 million and \$100 million respectively. Today's AAA games are a much grander affair, with titles such as Rockstar's *Grand Theft Auto V* costing an estimated \$265 million to develop in 2013 and *Cyberpunk 2077* (2020) costing over \$316 million in both production and marketing, as well as an upcoming game known only as *Star Citizen*, which had already surpassed its \$501 million budget as of January 2023.

Today, the video game industry is a thriving, multi-billion-dollar business that has attracted the attention of countless developers and millions of consumers during its existence. While the original home systems were marketed toward children who crowded around the televisions in their living rooms, today's consoles cater to a more mature audience as a vital

element in their home theater configurations. According to J. Clement at [statista.com](https://www.statista.com), more than 76% of the U.S. adult population play video games in some capacity, while over 18% claim to spend six hours or more per week gaming.⁷³ As computational technology inevitably continues to advance, limitations in the interactive sphere will dissipate further and demonstrate that the video game industry's profitability will maintain its upward trend and prove itself more sustainable than early programmers could have imagined.

⁷³ J. Clement, "Video Game Industry: Statistics & Facts," [statista.com](https://www.statista.com/topics/868/video-games/#dossier-chapter1), November 17, 2022, <https://www.statista.com/topics/868/video-games/#dossier-chapter1>.

Part Two

Preface to Analysis

ESTABLISHING GENRE

A player's personal relationship with a video game will vary widely based on their affinity with the style of narrative and gameplay chosen by developers. Some players feel a much greater connection with fantastical Adventure games, while others might gravitate toward the more practical experience of a sports game. More serious professional Esports players even group themselves by the types of games, commonly referred to as genres, that they specialize in playing.⁷⁴ Karen Collins discusses the application of genre to such games by observing that specific categorizations “set the audience's expectations by providing a framework for understanding the fundamental rules of gameplay.”⁷⁵ Although the concept is commonly explored in the literature, it is rarely defined in a way that fully encompasses the scope of classifications present in modern gaming. The earliest games available for public consumption were often described colloquially as “racin’, fightin’, or shootin’,” and while those groupings still apply, the growing need for narrative variety and fresh avenues of exploration has led to an extensive catalog of genres and subgenres that are now referenced in the overarching discussion of video game design.

When analyzing topics in the context of video game music, it is important to develop an intricate understanding of genre as it applies to gaming. The broadest categorizations, or *supergenres*, refer primarily to the general mechanics in the games themselves (sandbox,

⁷⁴ Esports, short for electronic sports, is a form of professional competitive gaming.

⁷⁵ Karen Collins, *Game Sound: An Introduction to the History, Theory, and Practice of Video Game Music and Sound Design* (Cambridge, MA: MIT Press, 2008), 123.

platform, shooting, fighting, racing, etc.), while additional subsets have recently emerged to categorize games that do not easily fit into the general conventions or that overlap two or more genres.⁷⁶ For example, the “shooting” classification can apply to any game that utilizes a firearm mechanic regardless of plot or perspective, while the “FPS” delineation describes the use of a firearm mechanic with the added requirement for a first-person camera perspective. Within the “Sandbox” genre lie both “Sandbox RPGs” and “Sandbox Simulations,” both of which feature an open-world concept with the further inclusion of a different general mechanic.

Among prevalent game music theorists, the current consensus on categorizing video games by genre is that there is no consensus. Musicologist Tim Summers states, “Not all scholars use identical genre categories; even hybrid games that blend genres are considered distinct fusions of two (or more) elements.”⁷⁷ General mechanics are often easily defined, although determining the precise overlap or fusion of smaller subcategories can prove challenging to analysts, who often disagree on which precise details should be considered when determining genre. Many choose instead to draw comparisons to the film industry and its understanding of genre, though this has proven in recent years to be somewhat inflexible when considering growing degrees of interactivity in the evolving gaming industry.

One compelling perspective, again from Tim Summers, asserts that a distinction can be made between genres that are “narrative” and those that are “interactive.” His example regarding *Star Wars* draws on a franchise that spans both film and game. Summers notes that each film is firmly rooted in the category of science-fiction, though their depictions in games span many interactive genres including RPGs (*Knights of the Old Republic*, 2003), Adventure

⁷⁶ “Supergenres” as defined by the Entertainment Software Association.

⁷⁷ Tim Summers, “Playing the Tune: Video Game Music, Gamers, and Genre,” *ACT- Zeitschrift für Musik & Performance* 2, no. 4 (August 2011): 3, <https://d-nb.info/1014510945/34>.

(*Shadows of the Empire*, 1996), Simulation (*X-Wing*, 1993), and FPS (*Dark Forces*, 1995), among others. Summers adds that the science-fiction aspect of each title is paired with the interactive genre when determining the musical characteristics of each game.⁷⁸

When attempting to draw connections between genres and compositional techniques in games, a goal of this research, one must consider the variety of specific interpretations and applications of generic labels and proceed with the understanding that ludological scholarship will almost certainly evolve in the coming years. For the purpose of this thesis, emphasis will be placed on several representations of narrative genre in gaming, including Adventure, FPS, and Horror, among others. Arguments will be presented and defended according to my own interpretations of the categorizations of each title as well as the implications these classifications may have on the compositional techniques commonly used in each.

Often, musicologists and others in the entertainment industry draw comparisons between film and video games due to the fundamental similarities that exist between them. Both must keep their audiences sufficiently engaged for a period of multiple hours while conveying a narrative carefully designed to elicit an emotional connection. They can also be considered a social experience; many moviegoers visit theaters with friends or loved ones, while modern online capabilities have allowed for players to join small groups of fellow gamers or to gather in massive lobbies with hundreds of other players. Despite these similarities, video gaming has overtaken film in recent years as the most profitable entertainment industry by nearly five times.⁷⁹

⁷⁸ Summers, "Playing the Tune," 4.

⁷⁹ Ryan Parreno, "Gaming Is Five Times Bigger Than Movies Now," last modified December 13, 2022, <https://gameranx.com/updates/id/416500/article/gaming-is-five-times-bigger-than-movies-now/>.

What separates the gaming trade from film is one major characteristic: adaptability. Games are a participatory experience; players are meant to take an active role in the development of the plot, whereas movies have predetermined paths and scripts that are followed from end-to-end. Games are also notoriously lengthy when compared to films, with the average campaign spanning anywhere from twenty to fifty hours. Regardless of this contrast, the production and marketing processes in both businesses are largely the same. Video games draw significant inspiration from film design, leading music scholars to survey both industries when discussing issues such as narrative, foley, design, and genre.

State of Current Scholarship Regarding Compositional Techniques

As with many conventional works, music that is written for games serves a purpose; it is expressly designed to affect players without detracting from the game's objectives. While composers' creativity fosters individuality among the nearly forty-two thousand console titles published since the release of the NES in 1985, there has developed a well-established methodology that is often employed by audio teams as a means to create an immersive and supportive interaction between game and player.⁸⁰ The scope of the modern game composer's profession is complex; they are expected to maintain a firm understanding of standard digital audio software, to network with sound design teams and musicians/performers, to work closely with developers and storyboard artists to merge sound with visual elements, and to compose a dynamic and adaptable soundtrack that aligns with characteristics of the genre category and other narrative elements. Discussions of their works in the following sections will be guided by

⁸⁰ Sebastian Kowalczyk, "How Many Games? How Are The Number of Games on Consoles?" last modified April 24, 2021, <https://www.isgamers.com/news/how-many-games-how-are-the-number-of-games-on-consoles/>.

scholarly writings, professional opinions, and informal reviews and experiences from players of specific titles.

Current literature in the area of video game music makes little reference to particular techniques used by composers for creating sound material in games. Modern scholarship includes a smattering of relevant journal articles and theses, as well as a composer's guidebook written by Michael Sweet titled *Writing Interactive Music for Video Games*, which will be referenced throughout this chapter. An additional resource found especially applicable to the subject is Karen Collin's *Beep: Interviews from the Documentary*, which contains an invaluable collection of interview transcripts conducted with ninety-three video game composers spanning a wide range of genres and time periods.⁸¹ Composers referenced from this source include those working with franchises and titles related to the genres and techniques discussed in each section.

⁸¹ Karen Collins and Chris Greening, *The Beep Book: Documenting the History of Game Sound* (Waterloo, Canada: Ehtonal, Inc., 2016).

Chapter Three

THEMATIC ATTACHMENT: EXAMINATION AND UTILIZATION

Studying Nostalgia

“I thought I’d try shooting my way out - mix things up a little.” - Master Chief ⁸²

Much like film, one of the principal objectives of the video game industry is to harness an electronic medium in a way that creates the most engaging experience possible. Titles that can do this successfully often spawn sequels, which present an even greater challenge to developers: they must now maintain the momentum that resulted from the first game’s popularity without committing any major blunders that might turn players away or ruin the experience for them. When working on a sequel, a few major points must be addressed in terms of logistics and story. How much from the previous title should be kept? How much should be changed? How should the narrative evolve past what was presented before? What new mechanics should be implemented? Coupled with these considerations is also the understanding that the game, a continuation of a previous title, must be unique and enjoyable enough on its own to maintain interest.

While many of these issues apply primarily to narrative and gameplay, music also has a prominent role in this scenario. Even outside the scope of video games in fields such as film or opera, music is commonly used as a tool to control audiences’ emotions while conveying the general tone of the story being told. When used correctly, music adds a deeper layer to the listener’s environment that can captivate and engage them in a manner that is impossible with

⁸² 343 Industries, *Halo*, Microsoft, Xbox, 2001; Master Chief is the principal character in *Halo*.

purely visual media. In the video game industry, it is often said that no game franchise does this better than *Halo*.

Halo is a multi-billion-dollar franchise that is exceptionally popular in the video game domain. It is a science fiction first-person shooter series developed by Bungie that would eventually spur a massive multi-media merchandising campaign consisting of books, comics, live-action films, and an animated series. Its first entry (*Halo: Combat Evolved*) was developed as the launch title for the original Xbox in 2001. The game was heavily marketed alongside the console, identified by their matching green and black color schemes, and was considered to be one of the first mainstream AAA titles to exist alongside Square's *Final Fantasy VII*.

The premise of the game is that the player, controlling a largely ambiguous supersoldier simply called Master Chief, arrives in a ship known as "The Pillar of Autumn" at an unknown ring floating in space. The ship and its crew are attacked by a group of religious fanatics ("the Covenant") and are forced to escape onto the mysterious ring, where they continue to battle both the Covenant and a new parasitic enemy ("the Flood"). Through various combat scenarios and plot developments, it is discovered that the ring-like structure, now known to be a "Halo" installation, was one of a group of seven colossal weapons created by an ancient race ("the Forerunners"). The Halo rings were designed as a last resort to control the Flood, as activating all seven rings at once would wipe out all sentient life in the galaxy, effectively starving the parasite. Realizing the danger, Master Chief sets out with his AI companion, Cortana, to destroy the installation by destabilizing the fusion reactors in the Pillar of Autumn. The Covenant, who believe that firing the ring will allow them to transcend reality and become divine beings, seek to stop the humans from destroying it. They are unsuccessful, however, and Master Chief and

Cortana detonate the ship, narrowly escaping the exploding “Halo” installation by commandeering Covenant cruiser.

Its complex plot, impressive 3D graphics, and innovative gameplay made *Halo* an instant success following its release with the Xbox. While the game was designed to be level based, Bungie was lauded for its semi-open-world environment, which allowed players to explore each area freely and collect hidden Easter eggs known as *skulls*.⁸³ The game also features a third-person vehicular combat mechanic, in which Master Chief commandeers an armored vehicle known as a “Warthog,” that can be used to traverse levels and battle enemies. These mechanics, paired with the game’s stirring soundtrack and intricate storytelling, led to *Halo: Combat Evolved* selling over five million copies by 2005 and earning a prominent place on many lists for “Best Video Games of All Time.”⁸⁴ Its popularity instigated a number of spinoffs and sequels, with the franchise continuing to produce new games for modern audiences with the release of *Halo: Infinite* (2021).

The music for *Halo* was unquestionably monumental. Martin O’Donnell, lead composer and audio director for Bungie until 2014, wrote and designed both the music and sound for *Halo*, managed all voiceover work and collaborated closely with programmers to implement the sound into the game.⁸⁵ Having studied at the University of Southern California and Wheaton College Conservatory of Music, O’Donnell is a well-educated pianist with a considerable background in

⁸³ An “Easter egg” in this context is a secret or undocumented feature that developers hide in their games for players to find, somewhat like an Easter egg hunt.

⁸⁴ IGN Staff, “The Top 100 Video Games of All Time,” last modified March 4, 2023, <https://www.ign.com/articles/the-best-100-video-games-of-all-time>.

⁸⁵ Martin O’Donnell, interview with Kara Balthrop, December 18, 2022 (See Appendix A).

composition. As such, his creative decisions regarding the *Halo* series reflect both a historical and theoretical understanding of music performance and implementation.

The soundtracks across the series center around a thematic plainchant in the E Dorian mode that is arranged into multiple tracks that can be used in both gameplay and narrative cutscenes. When writing for the first game, O'Donnell was given three words by developers to inspire this theme: "Ancient, Epic, and Mysterious." With that, he sought to create what he called a "sticky melody" that people could sing after they heard it.⁸⁶ Historically, plainchant was used to decorate sacred texts and, over the course of history, has been heard in large spaces such as cathedrals and sanctuaries since the monophonic melodies pitched within a narrow range of notes caused little reverberation. The simplistic nature of the chant allowed for groups of individuals with little or no musical training to easily recite the melodies as they heard them, creating a sense of worship and community. O'Donnell, with a general appreciation for the historical context behind his own composition, believed that this method would not only create a theme that could be easily recognized and repeated but would also be unique and stirring enough to elicit an emotional response from players.

The theme was recorded with both live and synthetic voices and instruments that were systematically layered through Pro Tools⁸⁷ to create a hybrid synthetic-orchestral sound. The original recording uses only four violins, two cellos, and a small group of singers (including the composer himself) for the live sound. O'Donnell would have the musicians do what he calls a "read-down," in which they would all perform each part consecutively using the synthetic-orchestral sounds as a guide track. Each part would then be "overdubbed" in the final mix to

⁸⁶ O'Donnell, interview.

⁸⁷ Pro Tools is a Digital Audio Workstation (DAW) that has been used by sound designers since the early 1990s.

produce a fuller sound. This was not only a creative decision by the composer but also conserved the space needed for the Xbox's optical-disc system, which required that the music to take up as little room as possible.

When asked about his experience working within the limited capacity of the console, O'Donnell stated, "It didn't feel like limitations. It was more like trying to figure out what I could do that's really cool within these confines." He also asserted that the constraints forced him to be more conclusive, mentioning that "[having no limitations] could be a hindrance to creativity, because now you're just muddying it all up. You'd never make a final decision because there's nothing constraining you."⁸⁸

In the first *Halo* entry, Bungie sought to create an active listening experience that was as adaptable as its gameplay. The production team designed an innovative audio engine that could adapt the music to the player's progression through the level.⁸⁹ For example, the soundtracks' pacing and intensity would decrease as the player retreated and ramp up when they began to push forward through a group of enemies.⁹⁰ Bungie found the soundtrack so critical to the overarching experience that they chose to omit the option for players to turn down or mute the background music in the game's settings. This is largely unheard of as most developers find that players feel more in control when they are given the ability to mix a game's audio and music themselves.

O'Donnell's implementation of plainchant as the centerpiece for his theme struck a chord with *Halo*'s audiences (see Figure 1). The traditional instrumentation he selected is rarely used in

⁸⁸ O'Donnell, interview.

⁸⁹ "Just the Right Sense of 'Ancient,'" *Xbox Online*, March 1, 2007, <https://web.archive.org/web/20070301150741/http://www.xbox.com/en-US/games/h/halo/themakers3.htm>.

⁹⁰ Erik Sofge, "How *Halo: Reach* Perfected Video Game Audio," last modified September 9, 2010, <https://www.popularmechanics.com/culture/gaming/a6078/how-halo-reach-perfected-video-game-audio/>.

video games, especially in the modern era when many composers opt for electronic, orchestral, or song-like soundtracks. O'Donnell's decision to follow the monophonic introduction with an orchestral strain featuring a Qawwali-inspired vocal line accompanied by a tribal-sounding percussion section resulted in a theme that was truly unique to the science-fiction genre.⁹¹ Another tactic employed by O'Donnell was to insert pieces of the two-phrase motif (Figure 1) into as many places in the game as he possibly could to familiarize players with the tune. When approached by some on his team who thought the continued repetition would cause gamers to lose interest or become frustrated, O'Donnell cited his personal theory of "emotional equity," which he summarized as, "When a player hears the theme for the first time, they experience the real and raw emotion behind the music. Those emotions are now in the bank. So, if I recall that theme later on, it's going to bring back those feelings along with, perhaps, some new ones."⁹²

⁹¹ Martin O'Donnell, instrumentation shared through personal communication on January 15, 2023 with permission to include.

⁹² O'Donnell, interview.

"Halo" 1

Bungie Software 7/19/99
O'Donnell/Salvatori
Total Audio

Figure 1. The original transcription of the opening section of Martin O'Donnell's "Halo" theme⁹³

The *Halo* theme is heard in some form at least fifteen times during the first game's campaign.⁹⁴ In certain instances, the melody is presented in its entirety, while other iterations use only instrumental fragments of the original string motif. The opening chant may also appear in different instrumental variations, including strings and alternate vocals. O'Donnell's theory of "emotional equity" and the success of his theme would inspire composers in the franchise to utilize this form of theming in their own works after he left Bungie and *Halo* was acquired by Microsoft's own studio, 343 Industries.

⁹³ Martin O'Donnell, shared through personal communication on December 18, 2022 with permission to include.

⁹⁴ In the context of gaming, a "campaign" is a term used to describe the game's main storyline, barring any side-quests or additional multiplayer modes.

When the franchise was greenlit for a sequel in 2004, O'Donnell saw an opportunity to push the boundaries of his theory and capitalize on its malleability. The first game was considered a massive commercial success by this point, having cemented Microsoft's place in the console industry and selling over four million copies by the time the sequel was released. The music for *Halo 2* represented a different approach than its predecessor, as the composer had voiced concerns that the soundtrack needed to "go somewhere" just as the story did. Instead of plugging variations of the theme into every track, he instead chose a "*Peter-and-the-Wolf* approach," scoring several leitmotifs for the different characters and only using the theme sparingly for dramatic effect.⁹⁵ A full-length version of the main theme is presented at the beginning of the game and is fully orchestrated with the addition of an electric guitar overlay. For this title, which had significantly more financial backing from Microsoft, Bungie brought in a fifty-piece orchestra to record the soundtrack live at Studio X in Seattle, Washington. The resulting timbre was quite different from that which O'Donnell had worked with on the first game, which prompted some concern that there would be issues adapting the sound into the interactive levels. To solve this in the second game, the audio team divided the tracks into several more layers, which could be muted or unmuted based on the player's situation.

Halo 2 introduced the franchise to online multiplayer via *Xbox Live*, which drew in even larger crowds of players. The game's continuation of the earlier narrative provided deeper explanations of the lore behind the series, and many critics lauded the sequel as a "worthy successor to *Combat Evolved*."⁹⁶ Its music was so well liked that Bungie would release a two-

⁹⁵ "Interview with Halo 2 Volume Two Composer Martin O'Donnell," *Music4Games*, April 27, 2006, https://web.archive.org/web/20080509022635/http://www.music4games.net/Features_Display.aspx?id=45.

⁹⁶ Will Tuttle, "The Most Anticipated Game in the History of the Xbox Is Finally Here. Was It Worth the Wait?" last modified November 7, 2004, <http://uk.xbox.gamespy.com/xbox/halo-2/564301p1.html>.

volume collection of the game's soundtrack that would sell over one hundred thousand copies on its own.⁹⁷

Bungie would release three more *Halo* games before the franchise acquired new ownership. These three games (*Halo 3*- 2007, *Halo 3: ODST*- 2009, and *Halo: Reach*- 2010) were released for the Xbox 360 with its significantly improved graphics engine and even greater audiological capabilities. *Halo 3* was considered the last game in the original trilogy, and its soundtrack was designed as a reprise of the first. A full orchestra and 24-member choir were employed to record the entirety of the music, including a piano part that was featured throughout. No synthetic instruments were used in the game. The overall sound design was much more extensive than the previous two versions: over fifty-thousand total pieces of audio were recorded for the game, with over forty thousand as NPC dialogue.⁹⁸ The audio engine was capable of calculating distances at which gunfire could be heard and adjusting the volume levels accordingly using multiple tracks of recorded foley.

The presentation of the titular theme in *Halo 3* was perhaps the most emotionally potent of the three entries, as the sound quality granted by the live strings and percussion (as well as the Xbox 360's native Dolby Digital surround sound) made for a more cinematic listening experience. Its final track, "Finish the Fight," is a particularly evocative piece that draws heavily on the ideas of nostalgia and conclusion; the representation of the end of an era is portrayed through a dramatic piano line accompanied by orchestra that presents several of the series'

⁹⁷ Ryan Pearson, "Video-Game Melodies Are Going Mainstream," last modified August 8, 2005, <https://archive.seattletimes.com/archive/?date=20050808&slug=btvideogamemusic08>.

⁹⁸ An NPC, or *nonplayer character*, is an individual in a game who is not controlled by the player but can usually be interacted with through dialogue. Tuttle, "The Most Anticipated Game."

themes a final time. The game's soundtrack was praised by critics and audiences, who lauded O'Donnell's mixing of orchestra and piano.

Halo's combat theme is the perfect futuristic military anthem. How could you not bring your A game after hearing that evocative orchestral powerhouse? I can't stress enough how vital the sound is to this franchise. The score is powerful, cinematic, and at times moving. It's the music that humanizes a hero who wears a helmet 24/7. For my money, *Halo 3* has the best soundtrack of any videogame.⁹⁹

While *Halo 3* was in development, Bungie was also working on a fourth installment of the franchise (*Halo: ODST*), the story of which ran parallel to the plot of *Halo 2*. In this game, the player controls a number of fictional Marines from the United Nations Space Command, also known as "Orbital Drop Shock Troopers" (the acronym used in the title). These soldiers are tasked with exploring a ruined city to uncover the fate of their missing teammates. This entry was originally meant to serve as a minor expansion to *Halo 3* to extend the game's shelf life until the next major installment's release, but developers found the story to be interesting enough that they chose to award the game its own major title. As the game is focused on an entirely new set of protagonists, O'Donnell decided not to use the *Halo* theme at all, instead opting for a jazz-inspired *film-noir* approach with brief segments of the original theme's chord progression sprinkled throughout.¹⁰⁰

Bungie's final *Halo* endeavor came in 2010 with the publication of *Halo: Reach*. This title refocuses on the plot of the original trilogy, serving as a prequel but taking place in the same year as *Combat Evolved*. The game takes place on the planet "Reach," which is known to have

⁹⁹ Hilary Goldstein, "Halo 3 Review," last modified December 6, 2021, <https://www.ign.com/articles/2007/09/23/halo-3-review>.

¹⁰⁰ Chris Gossett and Martin O'Donnell, "Bungie Podcast: 09/20/07," September 20, 2007, produced by Bungie, podcast, MP3 audio, 1:47:39, <https://web.archive.org/web/20100217080842/http://www.bungie.net/Inside/content.aspx?link=bungiepodcasttime>.

fallen by the beginning of *Combat Evolved*. Understanding the somber tone this sets, O'Donnell chose a stern, dark timbre for its soundtrack. He described the music as “visceral” and “evoking a bigger sense of loss, a personal feeling of sacrifice.”¹⁰¹

The orchestral nature of this soundtrack (as well as the previous three) presented new problems in terms of adaptability. In *Reach*'s instance, each track would play for only a predetermined amount of time. If a player found themselves stalled in a certain part of the level or spent too long in an enemy encounter, the music would simply play through and then go silent. O'Donnell's justification in this mechanic was that his music was timed and composed with the “Heroic” difficulty setting in mind. Players who were using an easier setting might need less time to traverse a level, during which the music might never reach its climax. Alternatively, a player using the “Legendary” difficulty may need more time to finish, resulting in the aforementioned silence.¹⁰² As in *ODST*, the player does not control Master Chief in *Reach*. As such, O'Donnell's original chant does not appear in its entirety at all in the game. There are a few fragments of the melody in the track “Tip of the Spear,” as well as “Overture,” but the theme is never stated completely.

All the main entry *Halo* games enjoyed moderate to great success with Microsoft's audiences, selling over 81 million games worldwide as of 2021.¹⁰³ Many fans attribute their continued attraction to the music, writing, and multiplayer functions, with Martin O'Donnell's theme having become something of an anthem to gamers since the early 2000s. While over two decades have passed, the theme still appears even in the newest addition to the collection: *Halo*

¹⁰¹ Sofge, “How *Halo: Reach* Perfected Video Game Audio.”

¹⁰² Sofge, “How *Halo: Reach* Perfected Video Game Audio.”

¹⁰³ “Halo,” Video Game Sales, accessed March 13, 2023, <https://vg-sales.fandom.com/wiki/Halo>.

Infinite. Although O'Donnell did not produce the soundtrack (he had already parted ways with Bungie by the time *Halo* was acquired by 343 Industries), his original theme is once again remastered and expanded to draw on its established emotional precedent and bring players back to experience the new game.

As mentioned previously, the diverse and rapidly evolving taxonomy of video games makes it challenging to classify a title as belonging to any single genre. While specific elements such as perspective and overarching narrative characteristics can aid scholars in arranging games in such a way, the common presence of significant genre overlap is often the cause of some debate within the current literature. Martin O'Donnell even expressed his own doubt about the assignment of genre to the *Halo* franchise. In his interview, he states, "I don't think that [FPS] is necessarily a genre. It has certain habits that it's gotten into, but it mostly just means that the camera [is positioned] from the perspective of the character. [A shooter] can also be in a third-person perspective, but that doesn't change the genre, in my opinion. It's just changing the camera angle."¹⁰⁴

In the field of ludomusicology, it is often assumed that game genres exist as a summation of player interactions, audio and visual styles, rule sets, and mechanics, and must therefore be measured and classified with hybridity in mind. Scholarly understandings of the video game industry threaten to become convoluted if every new game is assigned a new or different genre based on its individual characteristics.¹⁰⁵ Instead, these games are often designated according to the classification that most closely aligns with their most dominant characteristics. As such,

¹⁰⁴ O'Donnell, interview.

¹⁰⁵ Aki Järvinen, "Halo and the Anatomy of the FPS," *Game Studies* 2, no. 1 (July 2002), <http://www.gamestudies.org/0102/jarvinen/>.

Halo, whose weapons mechanics and camera perspective generally classify it as a first-person shooter, features many of the same attributes as an RPG (combat style, science fiction setting, intricate narrative, and extensive open-world environments).

As also discussed earlier, subsets of smaller and more distinct genres often subsist within the greater overarching categories used to classify games. This is perhaps most applicable to FPS titles, as their generalized designation is less focused on the game's content and more on its most prevalent mechanic: shooting weapons from a first-person perspective.¹⁰⁶ I would argue that within the genre, two conventional hybridized subgenres are frequently seen: story-based FPS and action-based FPS. As their names suggest, the differences lie in the game's level of emphasis on narrative as a key feature of its general appeal. Both delineations employ the same player perspective and broad weapons-based combat system, though the narrative aspects of the former are often heavily marketed to increase interest and create additional opportunities for sequels by expanding on the game's established lore and storyline.

Conversely, action-based FPS games do not cater as heavily to a narrative, if any is present at all. Some games, such as *Call of Duty: Warzone* (2020) and *Apex Legends* (2019), have no story or single-player campaign whatsoever. They are solely multiplayer experiences in which the entire focus is on player-to-player combat. Others, like *Doom* (2016), contain some subjective plot development, but it is arguably overshadowed by an emphasis on action, intense combat, and health management. These games, like *Halo*, all fall under the same category of first-person shooter, though the overall experience in each game is entirely different. Such

¹⁰⁶ Mark Wolf, "Genre and Video Game," in *The Medium of the Video Game* (Austin: University of Texas Press, 2001), 113, <http://www.robinlionheart.com/gamedev/genres.xhtml>.

distinctions will arguably have an impact on the compositional approaches taken when writing music for these titles as well.

O'Donnell, having been exposed to many genres of video games and their music, discussed some of the differences between these types of FPS games. For action-based games, he argued that many developers seek a continuous stream of intense auidial stimulation in order to keep players engaged through seemingly endless combat. As a result, composers often create non-stop soundtracks that loop across entire campaigns with very few breaks for silence or atmospheric ambience. To add a bit of perspective, the OST for *Doom Eternal* (2020), written by Mick Gordon, is over three hours long, whereas the original *Halo* soundtrack lasted only one hour and six minutes. O'Donnell added that he purposefully incorporates silence into the games whose audio he directs, stating, "You want to use music when it's impactful. That means you should have a lot of silence. And silence is not silence; it just means no music. You still have so many other audio elements to play with."¹⁰⁷

In examining the distinctions between action- and story-based FPS games, it should be understood that titles centering on narrative progression will be more likely to utilize thematic attachment in both music and character development when compared to the wall-to-wall music often seen in their action-oriented counterparts. Those who prefer the intense overall experience, as found in *Doom* and *Warzone*, are drawn to the excitement and adrenaline rush created through the gameplay and are invested less, if at all, in the storyline. In a 2017 review of *Doom* by Mike Epstein, the game's plot is described as a façade. He states, "[The narrative] exists as a means of

¹⁰⁷ O'Donnell, interview.

disguising the game's simple structure as a grand adventure."¹⁰⁸ Since fans of this developmental style tend to care less about the characters and story, associating these aspects with recurring musical themes seems impractical. On the other hand, *Halo* finds that much of its recurring appeal is the byproduct of its impactful narrative.

Transgenerational Associations

Thematic attachment in video games also acts as the means to develop associations and expectations across subsequent iterations of games. Some franchises have used notable themes to span multiple generations of games. Nintendo, one of the longest-running video game companies on the market, was also among the first to capitalize on a character's theme to draw players back on the basis of nostalgia. Shigeru Miyamoto, game designer at Nintendo and creator of one such iconic series, conceptualized the first chronicle of Link and Zelda in 1986. His game, simply titled *The Legend of Zelda*, is a top-down Adventure title in which the player controls a young hero named Link, who sets out to gather the scattered pieces of the Triforce of Wisdom in order to rescue the titular Princess Zelda from the series' antagonist, Ganon. The plot, though seemingly simplistic, left ample room to expand the narrative, which explains why thirty-seven games now exist within the franchise bridging numerous genres including sandbox RPGs, action/combat, shooting, and puzzle games. These continuations, spanning nearly forty years, still draw in significant numbers of followers from both older and younger generations.

In many ways, Shigeru Miyamoto's *The Legend of Zelda* successfully combines O'Donnell's ideals of emotional equity with current theories regarding interactive music

¹⁰⁸ Mike Epstein, "Doom (2016) Review," last modified November 21, 2017, <https://www.digitaltrends.com/gaming/doom-2016-review/>.

(discussed in Chapter Four) in the ways it has connected with audiences across nearly four decades of entries. While each title’s plot is unique in its retelling of Link’s role as the hero of Hyrule (the fictional kingdom in which the series is based), two commonalities span across every game in the franchise: appearance of the three main characters (Link, Zelda, and/or Ganon) and the use of pervasive themes to foster feelings of nostalgia among its players. Perhaps the most influential of these is the “Overworld Theme” written by series composer Koji Kondo. This theme is particularly well known in the gaming community, as very few pieces of music are featured in such a large span of games; many of these are extremely popular on their own.



Figure 2. Transcription of Link’s Leitmotif from the *Legend of Zelda* series (transcription by author)

This melody is by far one of the most recognizable tunes from the series and has been used to accompany many different scenarios in each game—in the title screen, as a victory fanfare, in the after credits, and sometimes even interwoven into other themes. Also known as Link’s Leitmotif, this theme begins with a four-bar fanfare followed by the full presentation in B \flat major with the \flat VII and \flat VI borrowed from the parallel minor. The melody begins on the tonic pitch, then leaps down the interval of a fourth to the dominant to be followed by a scalar run up a fifth. After a few syncopated triplet runs focusing on scale degrees 5, \flat 6, \flat 7, and 1, a bridge featuring the \flat 3 transitions back to a now shorter expository fanfare before the theme returns. This formula is used in every theme’s appearance across these titles.

The “Overworld” theme is recalled in some fashion across each game in the franchise to date. It appears as the literal overworld theme in *The Legend of Zelda, A Link to the Past* (1991)

Link's Awakening (1993/2019), *Majora's Mask* (2000), *The Minish Cap* (2004), and *A Link between Worlds* (2013). It is adapted as a standalone theme for a character or place in *Ocarina of Time* (1998), *Phantom Hourglass* (2007), *Skyward Sword* (2011), and *Breath of the Wild*. In *Four Swords* (2002), *The Wind Waker* (2002), *Twilight Princess* (2007), and *Hyrule Warriors* (2014), it operates as the main title theme or accompanies a major cinematic cutscene. It is also found in a fragmented form when it is incorporated into another main theme in *The Adventure of Link* (1987), in which only the first two phrases are borrowed as the means to transition into a new overworld theme.

Other themes introduced early in the franchise have gone on to appear in numerous entries. Notably, “Zelda’s Lullaby” represents the titular character of the series: Princess Zelda. Its development across the series illustrates the dichotomous relationship between the princess and the hero. It offers a reprieve from the stress of continuous combat and adventure and is often heard in narrative moments of soft reflection. While Link’s Leitmotif portrays the courage and heroism associated with the protagonist, Zelda’s theme is delicate, echoing the graceful demeanor she encapsulates in each of her appearances.

“Zelda’s Lullaby” is a 24-bar melody featuring a complex harmonic structure that never cadences to the tonic as expected. Instead, there is a focus on tonal ambiguity and dominant motion that suggests an authentic cadence but never actually achieves this resolution. As is shown in Rone’s analysis (Figure 3), the piece consists of three 8-bar phrases that form a classical AAB structure. The melody suggests the key of G major, with each phrase opening with a pitch from the tonic triad. The accompaniment is normally arpeggiated and does not smoothly correspond to the implied harmonies found in the melody. There appears to be a modulation to C major in the third phrase, although no pivot chord can be easily identified as there is so little

tonic motion in the previous phrase. Finally, the passage transitions back to G major to prepare for the melodic repetition that follows the B phrase. Zelda’s graceful and elusive personality is encapsulated in this theme, which has appeared in eleven games to date, and further contributes to the character’s development throughout the series.

Figure 3. “Zelda’s Lullaby” transcribed with a closed-voiced harmony¹⁰⁹

What makes the franchise so memorable, however, is not only its main themes. The integration of unique interactive musical features in several titles in the series allows for further

¹⁰⁹ Vincent E. Rone, “Princess Zelda, Her Lullaby, and the Virtue of Elusiveness,” last modified April 21, 2015, permission to include granted by author, <https://www.ludomusicology.org/2015/04/21/princess-zelda-lullaby-virtue-elusiveness/>.

opportunities to create “sticky” leitmotifs capable of inspiring thematic attachment across multiple games. Players associated the first recurring melody in the original entry with Link’s ability to summon and play a small wooden recorder, which allowed him to warp through already-completed dungeons and reveal other secrets scattered throughout the game. This 8-bit motif was later adapted into the main theme for the first 3D title: *Ocarina of Time*, where it is accompanied by tranquil synth-strings and piano. A variation also appears in *The Wind Waker* in the bassoon melody for the track titled “Forbidden Woods.” The original tune is used again in *The Minish Cap* as a song Link can play on the Ocarina of Wind. The melody’s final appearance to date comes in *Breath of the Wild* where a variation is played on a bagpipe as Link traverses each of the 120 puzzle shrines in the game.

Thematic attachment does not always apply to a game’s characters; it can also draw on nostalgia as it relates to a place in a game. In the series’ lore, each “Link” exists in the same world spaced hundreds or even thousands of years apart. As a result, many of the areas available for exploration are often loosely based on locations from previous entries in the timeline. This opens up the possibility for musical theming that is not only associated with the people in the story but also the environment itself. An example of such a thematic location is the Temple of Time, which appears in several main entry titles including *Ocarina of Time*, *Twilight Princess*, *Skyward Sword*, and *Breath of the Wild*. The temple carries the same general atmosphere of majesty and grandeur in each game, though it is often seen by the player in various states of ruin through the course of the series. As the player explores each location, the theme, the “Song of Time,” plays in the background, but is orchestrated differently to reflect each unique storyline. The theme is also incorporated into a theme that Link can perform on the ocarina, which allows him to travel through time and open the Door of Time.

The Legend of Zelda combines several unconventional mechanics (discussed in Chapter Four) with its rich narrative and use of theming to create an abundance of memorable music and characters that draw players back to the series with each new release. Feelings of nostalgia can be invoked through acquired familiarity resulting from music, characters, environments, and/or mechanics present in earlier games that are carried through or reused in newer titles. We also see nostalgia applied in an adaptive context in *Halo*, as its main theme is taken and reorchestrated across decades worth of new titles that continue to remind players of the emotions they felt and the experiences they had when they played as Master Chief for the first time.

Nostalgia is often seen as a way to associate wholesome feelings such as comfort or emotional safety with a specific experience involving a particular person, place, or, in this case, musical theme. Scholarly discourse surrounding its application in video games draws much of its information from other studies in affective sciences and social psychology. Matthew Vess et al., define nostalgia as “personal moments that inspire positive feelings of joy, high self-regard, belonging, and meaningfulness.”¹¹⁰ Nicole Koenig argues that since these emotions are tied to a particular occasion in a person’s life, they are less dependent on the experience itself and more on the circumstances in which it transpired. The individual, seeking to experience these sentiments again, often turn to whatever media they associated them with initially. As a result, many adults note correlations between nostalgia and significant childhood memories they deem particularly meaningful, such as a game they played or a place they visited.¹¹¹

¹¹⁰ Matthew Vess, et al. “Nostalgia as a Resource for the Self,” *Self and Identity* 11, no. 3 (2012): 273, accessed March 13, 2023, <https://www.tandfonline.com/doi/full/10.1080/15298868.2010.521452>.

¹¹¹ Nicole Koenig, “Theater’s Nostalgic Connection: Nostalgia’s Impact on the Entertainment Industry and Strategies to Solve an Age-Old Problem” (Master’s thesis, California State University, 2018), 15.

Gaming presents users with a unique opportunity to establish connections through dozens of hours of gameplay within franchises that span multiple generations of games and of players. Developers who choose to take advantage of this nostalgic tactic market their games to both old and new audiences by implementing new plots and mechanics alongside their preestablished characters and worlds. Composers do the same by designing and repurposing themes that resonate well with fans to create emotional musical bonds between the people who play the games and the experiences they have within them. Jonathon Dornbush, a game critic for IGN, details the nostalgia he felt through his experience with the newest release in the *Zelda* franchise, *Breath of the Wild*. In his review, he recalls playing the original *Legend of Zelda* as a young boy with his mother, who tragically passed away in 2009. When playing through the new game in 2017, he noted that the music and characters, which correlate closely with those in the original 1986 entry, brought back fond memories of her, “With every stamp [on the map], I get to relive a little of my time with her.”¹¹²

Thematic attachment is not constrained to any single genre of video games. In fact, its presence is particularly notable in both Adventure games (*The Legend of Zelda*) and story-based FPS games (*Halo*), where it has been used to accomplish similar goals of fostering nostalgia and creating emotional attachments between players and multi-generational game franchises. Likewise, genre overlap and the general lack of consensus regarding definitions of genres in games has led many scholars to call for deeper analysis of current classifications in order to arrive at a uniform understanding of the topic. As the video game industry continues to evolve

¹¹² Jonathon Dornbush, “The Legend of Zelda: Breath of the Wild’s Powerful Nostalgia,” last modified March 29, 2017, <https://www.ign.com/articles/2017/03/29/the-legend-of-zelda-breath-of-the-wilds-powerful-nostalgia>.

along with new trends in technology, it can be expected that the means by which developers and scholars sort games for the purposes of understanding genre will also become more imbricated.

The decreasing limitations present in modern consoles are allowing for more creative freedom and narrative interplay in even the most straightforward genres. Examinations across longer-running story-driven franchises have revealed significant development in the intricacies of their storytelling capabilities. For example, the original *Legend of Zelda* only mentions four characters by name across the entire game, whereas the newest title (*Breath of the Wild*) features unique dialogue options with over 300 fully 3D-rendered NPCs with individual backstories thanks to the increased processing power of the Switch compared to the primitive NES. This further exacerbates the nostalgic potential of thematic attachment, however, as recurring characters are now interspersed among a much denser population of NPCs with increasingly elaborate histories of their own.

Thematic Attachment as a Narrative Tool

Even broader comparisons can be made to instances of thematic attachment relating to games in linear franchises that span different genres. An ideal explanation of this is found in the *God of War* series. The first game was released in 2005 and was considered to be controversial among consumers due to its graphic themes and violent content. Its narrative brings dark themes of revenge and rage into the direct spotlight as its protagonist, Kratos, sets out to avenge the death of his wife and child. Kratos represents the embodiment of anger and grief, having been tricked into murdering his own family at the behest of the Greek god, Ares, whom he thought he could trust. He is constantly tormented by his own guilt and becomes blinded by his desire to seek vengeance against those who perpetrated these actions. In doing so, he slays the Greek

gods, destroys the Titans, and plunges the world into chaos. The first three games in the series are mostly combat-centered and are focused on combo-building and slaying large hordes of enemies.¹¹³ For the original trilogy, more than ten composers were brought into Santa Monica Studio to work on the music. As such, no themes appeared across multiple games in the franchise. All three releases used different orchestral motives to represent the main character.

From the conclusion of the first trilogy in 2010, eight years passed before the studio revived the series with a new *God of War* (2018). For this title, writers decided to take the franchise in an entirely different direction, with much greater detail invested in the game's narrative and the relationships between Kratos and those around him. The gameplay became more exploratory as opposed to the fundamentally combative mechanics found in previous games, choosing to shift the focal genre from "hack and slash" to the broader category of "Action/Adventure."¹¹⁴ To further emphasize this change, the camera perspective, which used to function as a zoomed out third-person position, is now set directly behind Kratos's shoulder. This makes the combat situations feel arguably more intense and realistic even through these changes in narrative.

The newer entries also feature dramatic shifts in narrative approach when compared to the earlier games. Instead of blind destruction, the new entries steer more toward the growth and maturation of the main character. By the beginning of *God of War*, Kratos has left the world of Greek mythology and settled in Midgard, one of the Nine Realms of the Norse. Over a century has passed, and he is now remarried and has a young son named Atreus. His wife passes away

¹¹³ "Combo-building" refers to the execution of multiple subsequent melee attacks that are measured by a "combo counter."

¹¹⁴ Andrew Webster, "*God of War* Review: An Incredible Reimagining of a PlayStation Icon," last modified April 20, 2018, <https://www.theverge.com/2018/4/12/17223854/god-of-war-review-ps4>.

from unknown causes and the two set off to fulfill her final wishes: to scatter her ashes at the highest point in the Nine Realms.

The two main characters' experiences throughout the campaign lead to significant transformations in both their mentalities and personalities as they learn more about their pasts and start to cope with everything they have been through. Kratos begins to understand the importance of grace, while Atreus, at only eleven years old, learns the ins and outs of growing up and discovering his own path. Bear McCreary, the composer for the new title, found it necessary to write specific recurring themes for each of the main characters to represent the connections between them and to reflect the new narrative. Kratos's theme, which features the game's main motif, is introduced even before players launch the title. It is first heard in a solo horn line from the game's menu music on the PlayStation's home screen. The theme is presented from the onset of the narrative, is heard in the very first cutscene when Atreus is introduced, and then moments later returns as a confrontation erupts between Kratos and the game's antagonist, the Norse god Baldur.

McCreary states that the theme "is featured on nearly every track [in the game] in one form or another."¹¹⁵ Much like O'Donnell, he is attempting to create a sort of Pavlovian situation that puts players back into the emotional mindset they experienced in other instances when they heard the theme. The first phrase is scored several different ways throughout the soundtrack; McCreary explains, "It ranges from stern and ominous, to devastatingly longing, to sentimental and brittle, being presented by massive brass choirs, delicate solo harp, and everything in

¹¹⁵ Bear McCreary, "The Themes of *God of War*," PlayStation.Blog, May 8, 2018, <https://blog.playstation.com/2018/05/08/the-themes-of-god-of-war/>.

between.”¹¹⁶ The theme is further described as a type of motor for the game’s score, existing to keep things moving while creating poignant attachments to the character and story. Kratos’s theme is meant to convey both the strength and rage of his younger self (through the three-note ostinato normally found in low brass or baritone voice) and the vulnerable, older, and wiser version that we see in the new games (through the delicate, layered supporting harmonies).

Kratos’s theme, among others in *God of War*, was reused for the newest installation in the franchise, *God of War: Ragnarök* (2022). Again, as with the developers of the *Halo* series, Santa Monica Studio wished to extend and deepen the personalities of these characters to demonstrate an emotional shift to a more mature mindset. Kratos has now almost completely moved away from the bloodlust that drove him in the past and is now fighting for more noble causes. His theme has also evolved into a mellower motif, with the three-note ostinato now building less aggressively, reflecting his newfound wisdom. McCreary notes that he made a conscious decision to give Kratos’s piece a more “familial” undertone, featuring fragments of the themes associated with his wife and child to demonstrate the importance of these bonds to the main character.¹¹⁷

Atreus, now fourteen years old, has established himself as a capable warrior in his own right, consequently, McCreary granted him his own theme for *Ragnarök*, titled “A Son’s Path.” This piece is played with traditional Nordic folk instruments including the hammered dulcimer and nyckelharpa and begins with an energized eighth-note ostinato followed by an adventurous orchestral melody representing Atreus’s adolescent spirit. The three-note motif from Kratos’s theme also appears, but only in two retrograde statements. The B section reflects the intimate and

¹¹⁶ McCreary, “Themes of *God of War*.”

¹¹⁷ McCreary, “*God of War Ragnarök*.”

melancholic fragments of Atreus's mother's theme from the previous game, titled "Memories of Mother." Again, McCreary is alluding to the familial bonds that unite these characters by combining the themes of the two parents and presenting their altered form alongside the new motif that represents Kratos.

Over the past eighteen years, the *God of War* has been one of the very few franchises to successfully shift generic approaches while maintaining overwhelmingly positive ratings and audience engagement. Fans who grew up knowing Kratos only by his violent and callous nature are now seeing a much older, wiser man who only fights for what is right. One IGN reviewer, Jonathon Dornbush, describes the maturation of Kratos's character in these terms: "The new *God of War* transforms him from the previous game's flat embodiment of the bloodthirsty warrior cliché into someone who can stand shoulder to shoulder with some of my favorite protagonists."

When discussing the new camera angle, he notes:

At some of the most tense and heartbreaking moments, the camera never leaves Kratos's mindset. You're forced to sit with him—sometimes in silence, sometimes in anguish as a haunting choir echoes around him, and sometimes in relief—through every second of it. That intimacy makes those emotions all the more real and impactful. It's made Kratos relatable enough that I've been caught audibly referring to Atreus as "my son" several times since the opening hours.¹¹⁸

Bear McCreary expertly ties in these new narrative ideas with his music, creating themes that grow and evolve as the characters do. Dornbush briefly mentions the relationship between the game's music and the creation of flow within the gameplay. "Its musical score elevates story moments, which flow seamlessly into fantastic action gameplay, which facilitates exploration and puzzles that reward you with a deeper understanding of its characters."¹¹⁹ These positive

¹¹⁸ Jonathon Dornbush, "God of War Review," last modified April 13, 2018, <https://www.ign.com/articles/2018/04/12/god-of-war-review>.

¹¹⁹ Dornbush, "God of War Review."

emotional associations add significantly to the game's immersive qualities by fully engaging with players and creating an environment that is sufficiently rich and captivating to retain their focus for the several of dozens of hours needed to complete the game's full campaign.

The functions of thematic attachment in video game music have been observed across many genres including FPS, Action, Adventure, and Platformers. Originally drawing inspiration from theming in film, the video game industry has capitalized on the technical advancements of previous decades to harness a new and adaptive strategy with the aid of composers who create memorable themes closely associated with the game's characters. These themes may span multiple generations of gamers and can serve as a central marketing point for new releases. For example, Nintendo's *Mario* has been gracing screens in arcades and living rooms since the 1983 introduction of *Mario Bros*. The game's famous overworld theme has been an influential component of the franchise's subsequent releases and marketing strategies. Nintendo recently announced the production of a new film, *The Super Mario Bros. Movie* (2023), which will combine elements from many of the games within the franchise. The trailer for the film, released forty years after the first game, features an orchestral rendition of the famous theme, further demonstrating its timelessness and potential to evoke nostalgia. Games such as *Halo* and *The Legend of Zelda* have since spawned their own noteworthy motifs that encapsulate the nature of their narratives and characters.

Thematic attachment allows players to connect to the game, creating feelings of comfort and familiarity through repetition while also leaving room for these themes to develop over time to reflect the dramatic development of the game's plot. *God of War* and *God of War: Ragnarök* demonstrate this form of theming attached to a character's growth through the evolution of its main protagonist, Kratos. Composers such as Bear McCreary and Martin O'Donnell have

masterfully harnessed these ideals to create immersive and captivating soundtracks to accompany their respective franchises.

Chapter Four

ADAPTIVE SEAMING:

CHARACTERIZING THE SPECTRUM OF INTERACTIVITY

The conventional techniques commonly used to analyze music are often difficult to apply to video game soundtracks due to the modular methodology by which composers often write for them. Since a game's campaign is usually individualized based on each player's choices and skill set, its music is not fixed. As stated previously, many games do not have dedicated scores available for scholars to analyze; their music is instead created and stored through a computerized software known as a DAW (Digital Audio Workstation). Popular programs such as Pro Tools and Logic Pro can be used in tandem with various MIDI keyboards, microphones, and other analog instruments to bypass notation entirely and directly record inputs into up to 192 separate tracks. They are then edited and mixed within the program to produce finished tracks which are implemented into the final versions of films, games, or television media.

Since there currently exists no feasible way to compile game scores for analysis, many will instead transcribe the music themselves or seek out transcriptions from other individuals through websites such as ninsheetmusic.org or musicnotes.com. While these sources are normally sufficient for casual fans who explore the music recreationally, it can prove to be difficult to determine the accuracy of each transcription. For the sake of transparency in this research, each score that is directly referenced henceforth has been either fully transcribed by ear and/or cross-referenced with existing scores found online.

As mentioned previously, technological developments in the gaming industry have led to a sense of general ambiguity resulting in some speculation regarding the overall consensus of

genre parameters.¹²⁰ The complex narratives that are now present in modern gaming span many categorizations and are no longer limited to RPGs or even single-player titles.¹²¹ As explored in the last chapter, even FPS franchises such as *Halo* are capable of creating immersive storylines that rival genres such as interactive visual novels, whose focal gameplay mechanic centers around decision-based dialogue. As games become more cinematic, we are seeing an even greater hybridization of genre. For example, while every previous *Halo* game used a level-based system, *Halo Infinite*, thanks in part to the powerful Xbox Series X's hardware, is the first in the series to feature an open-world gameplay mechanic that allows players to freely explore the map and complete quests. Story progression in this instance is done through a “dungeon” system in which individual missions are completed and cannot be revisited.¹²² This game is still most closely identified by its first-person perspective, though its exploratory elements and open-world design also align with aspects of Adventure and RPG games.

Scholars often refer to the optimal immersive gaming experience in terms of *flow*.¹²³ Hungarian-American psychologist Mihaly Csikszentmihalyi describes flow as “an occasion where we feel a sense of exhilaration, a deep sense of enjoyment, which we cherish for a long time and that becomes a landmark in our lives.” He further explains that these moments happen when we’re in our deepest level of concentration and conscious enjoyment.¹²⁴ In gaming, flow is

¹²⁰ Mia Consalvo and Nathan Dutton, “Game Analysis: Developing a Methodological Toolkit for the Qualitative Study of Games,” *Game Studies* 6, no. 1 (December 2006), http://gamestudies.org/0601/articles/consalvo_dutton.

¹²¹ Co-op campaigns have seen a significant rise in popularity through the last decade. *It Takes Two* (2021) is a prime example of an award-winning story-based video game designed for split-screen multiplayer gameplay. Kelsey Raynor, “The 17 Best Co-op Games of All Time,” last modified March 1, 2023, <https://www.vg247.com/best-coop-games>.

¹²² A “dungeon” in this context refers to a closed-off area in which players encounter enemies and complete missions to progress the story.

¹²³ Zach Whalen, “Play Along: An Approach to Videogame Music,” *Game Studies* 4, no. 1 (November 2004), <https://www.gamestudies.org/0401/whalen/>.

¹²⁴ Mihaly Csikszentmihalyi, *Flow: The Psychology of Optimal Experience* (New York: Harper & Row, 1990), 3, https://www.researchgate.net/publication/224927532_Flow_The_Psychology_of_Optimal_Experience.

achieved when a player is able to completely focus on the game due to its challenge being closely matched with their skill level. They are continuously contested, yet able to succeed and continue making progress. There is a synthesis between awareness and action that can cause individuals to lose track of time as they get caught in a loop of challenge and reward. While discussing the elements of flow is a relatively simple task, measuring it quantifiably has proven the opposite. Surveyors who ask study participants about experiences with flow note significant difficulty, as they are often requesting that individuals recall how they felt during a moment that they were so engrossed in an activity that they lost their sense of identity.

Exploring Modularity

One method that is commonly used in video game scholarship is *modular analysis*. Modularity describes the separate musical components within video game soundtracks. To summarize, modularity is what allows for adaptive music in games. Distinct sections of music are written into a game's code along with a definitive ruleset that dictates where and how the music will be triggered based on the player's choices. The modules are interwoven and layered together by the console's CPU as the player traverses the game, creating a unique experience with each playthrough (see Figure 4). The means by which composers facilitate transitions between modules is through a process known as *seaming*. This method is integral to maintaining immersion, as the player's engagement must not be broken by the distractions produced by hard audio cuts or fragmented musical ideas in these instances.

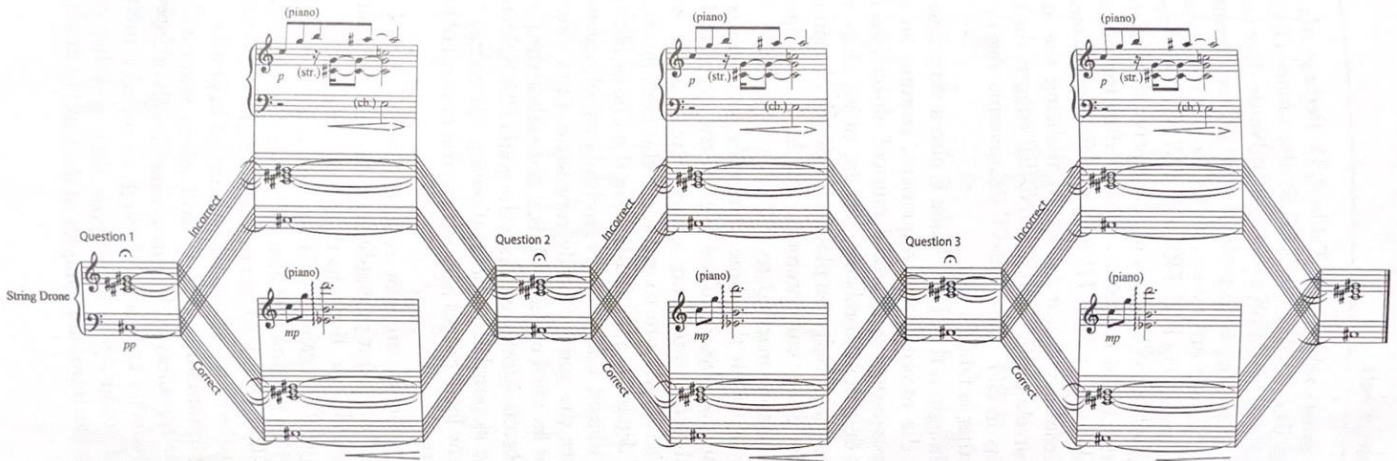


Figure 4. An example of decision-based musical sequencing as heard in *L.A. Noir* (2011)¹²⁵

This subject is explored thoroughly by prevalent video game researchers, including Collins and Summers, who have both published works on the topic. However, it is rarely discussed in relation to genre, and while it is not unusual to see diagrams and scores describing the modular structures in games, discussions regarding the compositional techniques behind the modules are mentioned infrequently. The volume of games currently in circulation that utilize musical modules is quite substantial since this developmental method became popular in the early 2000s. While this opened the door for analysts to look more closely at the musical “road-mapping” used in games, correlations between modular seaming and genre have produced very little substantial literature to date.

Modular smoothness is a topic more commonly associated with exploration-based genres such as RPG and Adventure since these are the most likely to feature open-world designs that require smooth passages between areas of the map. These games (and their respective consoles)

¹²⁵ Kevin Donnelly, *Music in Video Games: Studying Play*, ed. Neil Lerner and William Gibbons (New York: Routledge, 2014), 99, used with permission to include.

often boast their ability to render large areas of the map at a time with no loading screens to disrupt the flow, and their music must also reflect this trait. Genres that tend to be more level-based (e.g., racing, platformer, sports, puzzle) have no need for modularity in their music, as their soundtracks are usually punctuated by soft fades or outros to facilitate transitions between levels or areas.

Naughty Dog's *Jak and Daxter* franchise exhibited one of the first known masteries of modular smoothness. Its composer, Josh Mancell, had already established himself due to his work on the *Crash Bandicoot* (1996) series, which was one of the first 3D platformers on the market. This led Naughty Dog to recruit him to work on the new game in late 1999.¹²⁶ The first installment of the new franchise, *The Precursor Legacy*, was known as a defining title for the PlayStation 2, much like *Halo* was for the Xbox. It is a single-player Action/Adventure game that combines elements of platforming, racing, and puzzle-solving and holds the Guinness World Record for having the first seamless 3D world in a console game.¹²⁷ Developers of the game wanted to expand on the linear nature of *Crash Bandicoot* by facilitating greater exploration without the presence of loading screens to break the player's immersion. As a result, the console renders *The Precursor Legacy's* world in large sections as the player moves through each area, culling out older sections as the player advances.¹²⁸ As such, the game's entire map is experienced seamlessly, with no breaks between levels for loading screens or buffering.

¹²⁶ Joshua Mancell, interview with Kara Balthrop, November 18, 2022, (See Appendix A).

¹²⁷ Evan Wells, "*Jak and Daxter* Collection Delivers the Original Trilogy to PS3 in HD," PlayStation.Blog, November 21, 2011, <https://blog.playstation.com/archive/2011/11/21/jak-and-daxter-collection-delivers-the-original-trilogy-to-ps3-in-hd/>.

¹²⁸ Alex Avard, "The Secret Art of the Video Game Loading Screen, and Why They Won't Be Going Away Anytime Soon," last modified March 21, 2019, <https://www.gamesradar.com/the-secret-art-of-the-video-game-loading-screen-and-why-they-wont-be-going-away-anytime-soon/>.

The *Jak and Daxter* universe draws inspiration from many fantastical and exotic ideas. One of these is the existence of a substance known as “eco,” a mysterious energy source that is used to power much of the machinery in the game. It is soon discovered that the main protagonist is able to physically harness eco within his body in order to perform various feats such as increased speed and strength. While many types of eco are used for the benefit of humanity, one form, known as “dark eco” corrupts everything it touches. In the first game, its sole purpose is to damage the player, but it is repurposed in later games through means that will be discussed momentarily.

The franchise chronicles the many adventures of the two teenage boys after whom the series was named. In the first game’s introductory scene, they are exploring a mysterious island against the warnings of their guardian, Samos. The pair encounter a hostile creature known as a “lurker” and Daxter is pushed into a pit filled with a dark eco and reemerges having taken the form of a small anthropomorphic animal known as an ottsel (thought to be a combination of an otter and a weasel). The pair then set off on a journey to the northern lands in the hopes of finding Gol Acheron, who is believed to be the only person capable of turning Daxter back into his human form. They progress through the game’s levels by collecting two types of items: “precursor orbs” and “power cells,” which are used as either currency or power sources to unlock access to the next sections of the map. As the two near the end of their first adventure, they discover that Gol Acheron has been corrupted by dark eco and, along with his sister, plans to harness its power to reshape the universe. In the game’s final confrontation, Jak and Daxter must defeat Gol after he commandeers a giant ancient robot, effectively dashing any hopes of turning Daxter back into a human.

From the early stages of development, Naughty Dog knew that the soundtrack would need to reflect the seamless nature of the map. As this territory was relatively unexplored at this time, they paired Mancell with the lead sound designer to collaborate on the process of both creating the music and implementing it into the game's engine. For the purposes of this research, emphasis will be placed on one particular track in *The Precursor Legacy*. This track, known as "Sandover Village," presented one of the most notable instances of suturing in video games in this era. *Suturing* describes the deliberate and mechanical layering of different tracks or overlays that are triggered by positional or situational cues by the player-character, enemies, or other environmental conditions to create the illusion of seamlessness.

The theme itself features an array of synthetic instruments that Mancell describes as "world music from another world."¹²⁹ Technological limitations forced him to forego the expected orchestral soundtrack that normally accompanies fantasy games and opt for a more percussive pallet with very few sustained notes (see Chapter One). The base track consists of an upbeat, cartoonish melody using synthetic percussion instruments, including conga drums, temple blocks, shakers, and boobams.

Theming is used in *The Precursor Legacy* in a variety of ways. For instance, the player enters Sandover Village after a brief stint in the tutorial level. This village is the hometown of all main characters in the game, including Samos, Keira (Samos's daughter and the village engineer), Jak, Dexter, and their close friends and neighbors. Traversing the outdoor paths found throughout the village will cause the base track to loop continuously. As the player enters various homes or other areas, the music changes to reflect which building Jak is entering. Every

¹²⁹ Joshua Mancell, "*Jak and Dexter* Composer Says, 'Distinctness Is Born of Limitations,'" interview by James Troughton, December 3, 2021, <https://www.thegamer.com/jak-and-daxter-composer-interview-20th-anniversary/>.

secondary character residing in the village has their own theme that functions as an overlay to the base track. For example, when the player-character walks into the Bird Watcher's house, a synthetic whistle-like overlay is placed on top of the base track to create a countermelody within the existing piece. The same is true for every single supporting character that Jak and Daxter can interact with in the game, for example, the Farmer, Fisherman, Geologist, and Miners. For Sandover Village alone, seven separate overlays were composed to interact with the original theme, each representing a different villager.

According to Mancell, this endeavor was “the first real attempt at an interactive score that would respond dynamically to gameplay.”¹³⁰ The mechanic was designed to create an experience in which the player could achieve the maximum amount of immersion possible within the technological constraints present in the PS2's hardware. The player would begin the level hearing one track but noticing subtle differences as they explored each area. Giving each villager an individual subtheme adds a deeper level of musical interrelation that allows players to associate each character with a certain musical motif or instrumentation. For example, the synthetic sanxian used for Samos's overlay is present in every level in which he appears.¹³¹ While the tracks on which the overlays are placed are different in each iteration, the identical instrumentation associated with each character allows players to connect the music they are hearing with a place they have already explored or a person they have already met. As with one function of thematic attachment, such associations will theoretically cause players to develop a much deeper relationship with the story and make the experience more memorable to them if the conditions are met to create an optimal state of flow.

¹³⁰ Mancell, “Distinctness Is Born of Limitations.”

¹³¹ The tracks in question are titled “Sandover Village,” “Rock Village,” and “Volcanic Crater.”

When the second game of the trilogy, *Jak II*, released in 2003, players witnessed a dramatic shift in the tone of the story. The colorful and cartoonish appearance of *The Precursor Legacy* was replaced with an industrial, dystopian world in which the plot takes on a much darker tone and the characters undergo intense changes in demeanor. Jak, in particular, experiences the greatest development from the adventurous hero of the first game. In *Jak II*'s introductory cutscene, Jak is captured, imprisoned, and violently tortured for two years. Upon his escape from prison, he acquires a multipurpose weapon known as the *Morph Gun* and sets out to overthrow the tyrannical government that caused his trauma.

Mancell, who was again tasked with producing the game's music, initially expressed confusion with this dramatic narrative switch, mentioning the feelings of mental whiplash he experienced when approached by the development team.¹³² He theorized that Naughty Dog wanted to compete directly with other popular games featuring more mature themes, such as *Grand Theft Auto 3*, in order to maintain relevancy among its audience as they grew older. Consequently, he found that his music must also adjust to reflect this new aesthetic, choosing to shift from the "world music" tone of the first game to something more militaristic and mechanical.

Not only did Naughty Dog expect the music to fit the new themes of the game, they also greatly expanded the suturing mechanic created for the first release. Whereas the map for *The Precursor Legacy* was linear, *Jak II* utilized a completely open hub world, allowing players to tackle numerous missions in no specific order. This area, known as Haven City, is where players will spend the majority of their playthrough as they travel from quest to quest and complete various tasks. Much like with "Sandover Village," the "Haven City" theme consists of a single

¹³² Mancell, interview.

base track that loops as the player is executing neutral inputs such as walking or running through the area (see Figure 5). According to the composer, the synthetic instrumentation used for this game aligns much more closely with that of a Western orchestra. In particular, the “Haven City” tracks features timpani, snare drum, crash cymbals, harp, French horn, English horn, and strings, though an African udu drum is also included in the more percussive sections of the piece.¹³³



Figure 5. One phrase of the “Haven City” base track with no overlay (transcription by author)

Mancell admitted that developers at Naughty Dog were initially unhappy with this track when presented on its own, claiming that it felt too “same-y” and assuming that players would likely become bored or annoyed by it considering the amount of time they would be spending in this area.¹³⁴ They instead suggested that Mancell apply an expansion of the same suturing technique from *The Precursor Legacy* into some of the music for *Jak II*. Mancell worked closely with the lead sound designer to create several overlays for each area’s track to add variety to the

¹³³ Joshua Mancell, personal communication with Kara Balthrop, February 7, 2023.

¹³⁴ Mancell, interview.

background music. The soundtrack for *Jak II* takes the positional suturing of the previous game and broadens it to become entirely situational, taking care to conserve the already-limited space and processing power of the PlayStation 2. Unlike the previous iteration, this new system was designed to allow for shifts in the background music to occur no matter where the player was positioned in the level. These overlays are designed to “cue up” through input triggers by the player.

As mentioned previously, the base track for “Haven City” will loop continuously so long as the character maintains a neutral position. When the player presses a specific button on the controller’s *D-pad* to prompt Jak to execute a certain action, such as pulling the Morph Gun from its holster or mounting a Zoomer, the game’s code will trigger an overlay to begin playing over the base track.¹³⁵ When the player presses the button to put the weapon away or get off the Zoomer, the background music will immediately transition out of the overlay and allow the base track to continue on its own. These cues were designed to operate seamlessly to avoid abruptly turning the tracks on and off, which would likely startle players and negatively impact immersion.

To maintain the militaristic atmosphere of the game and simultaneously conserve space on the console, each overlay consists of only two or three percussion or pitched melodic instruments playing a short, repeated ostinato that can be easily cued in or out regardless of the melodic position of the base track. For example, the overlay assigned to the Zoomer consists of a synthetic hi-hat producing a continuous sixteenth-note pattern paired with quarter-note bass drum hits.

¹³⁵ A D-pad, or “directional pad” is a set of buttons on a video game controller that are associated with four different directions: up, down, left, and right.

Gaming and the Musical Spectrum

Joshua Sites and Robert Potter describe the relationship between video games and psychological flow by suggesting the existence of a kind of immersive spectrum.¹³⁸ They argue that two types of musical sources are used in video gaming: generative and linear. Generative music, making up the extreme left end of the spectrum, appears as part of a dynamic system designed by the composer. This system has no predetermined melodic, harmonic, or rhythmic properties. Instead, the composer organizes a system of metamusical possibilities that functions without any direct input from the game's code. An algorithm is used to interact directly with the inputs from the player, producing a pseudo-randomized score that is unique to every playthrough.

Sites and Potter provide a scenario in which a line of blocks is stacking higher and higher on the player's screen, indicating imminent failure of the level. As the risk increases, the harmonic structure of the background music gradually causes greater tension. The music is generative in that, based on the random pattern of block shapes and the unpredictability of the player's response, no two playthroughs will ever be the same.¹³⁹ Another prime example of generative music can be found in Thatgamecompany's *Flower* (2009). In this game, the player controls a concentrated gust of wind across an expansive outdoor environment. The player is tasked with picking up petals from various flowers scattered across the level. Finding all the flower petals in each area causes the environment to shift, usually through blooming foliage or changes in color and lighting. There is normally a subtle orchestral track playing in the

¹³⁸ Joshua Sites and Robert Potter, "Everything Merges with the Game: A Generative Music System Embedded in a Videogame Increases Flow," *Game Studies* 18, no. 2 (September 2018), http://gamestudies.org/1802/articles/sites_potter.

¹³⁹ Sites and Potter, "Everything Merges with the Game."

background, but the majority of the game's music is generated when the player picks up a petal. Each flower is associated with a randomized pitch on either a glockenspiel, pizzicato strings, or with a choir (depending on the type of flower), and sounds as the breeze passes by, resulting in a randomized string of music that is algorithmically determined based on inputs from the player.

On the other end of the musical spectrum lies linear music. This type of sound can be closely compared to music in cinema in that it is scored from start to finish with little to no room for interactivity. Games that use these types of soundtracks often rely less on immersive musical qualities, opting instead to use licensed tracks or those that more closely resemble modern pop songs. In many cases, linear music is used more for ambience than immersion, as is often the case in the popular MMORPG *World of Warcraft*. In this game, players are encouraged to form teams with other players in order to explore maps, complete quests, and fight monsters. Hosting a large number of players at any given time would make it more difficult to configure music that could adapt to each one's unique inputs or environmental circumstances. Developers therefore choose to use linear orchestral background music to allow greater opportunity for interactive experiences between individuals.¹⁴⁰

Many life simulation games also opt for linear soundtracks, such as in Eric Barone's *Stardew Valley* (2016). Social role-playing games often place a significant emphasis on creating a more casual experience when compared to their action-based counterparts. Instead of defeating enemies or journeying across large maps, players are tasked with slice-of-life missions such as caring for a farm or village, fostering relationships with NPCs, or collecting enough currency to build and customize a home. These games tend to feature laid-back soundtracks that encourages

¹⁴⁰ Philippe Pasquier and Cale Plut, "Deep Dive: A Framework for Generative Music in Video Games," last modified December 21, 2022, <https://www.gamedeveloper.com/audio/deep-dive-generative-music-in-video-games>.

players to relax in a stress-free environment. In *Stardew Valley*, a track is associated with each in-game location and designed to fade in and out as the player enters and exits an area through a loading screen. There is less focus on musical immersion and player engagement in these types of games, as their purpose is to serve only as pleasant background ambience.

Through my research in this topic, I have found that games featuring extensive elements of suturing or layering often fall into a healthy, yet largely undiscussed middle-ground within Potter's and Sites' spectrum, as this music often features aspects of both linearity and generativity. In the case of the *Jak and Daxter* franchise, the soundtracks lean more toward the linear end than the generative, as purely linear music is often much more algorithmic in its execution when compared to the aleatoric nature of randomly generated sound. The association of a specific track with a positional area also makes the game's music somewhat more predictable. In *Jak II* particularly, linear elements are derived from the continually looping and unchanging base tracks, which are played back exactly as the composer wrote them. Generative characteristics within the game stem from the input-based inclusion of overlays that can occur anywhere within the level regardless of the player's position. As Potter's and Sites' applications of the musical spectrum to ideals of flow do not include deep considerations of the types of music that exist further within the confines of linear and generative music, significant room is left for scholars to explore the inner areas of this spectrum and more decisively classify the ways in which composers address adaptability and player interaction within these games.

Outside the Spectrum: Fully Interactive VGM

The Legend of Zelda was included in an earlier section for its use of thematic attachment to bridge the many games in the series. The franchise is also included here in deliberations on interactivity due to its many notable gameplay mechanics that allow players to interact with, or

play, the instruments using their controllers. Michael Sweet, in *Writing Interactive Music for Games*, makes an interesting distinction in the types of music written for narrative-based stories. He considers differences between *adaptive* and *interactive* scores, terms that are often used interchangeably when discussing technical concepts in games. Sweet defines *adaptive* music as “used when the player has indirect control over the music. It may use other factors in the game world itself to change the music dynamically, including the time of day, weather, number of enemies, or player health.”¹⁴¹ Adaptive music is often considered *nondiegetic*, meaning that it is not heard by the character or others in the game’s environment; only by the player from the outside perspective.

On the other hand, *interactive* is outlined as being “used more frequently when the player has direct control over the music, as [in] musical games such as *Guitar Hero*.”¹⁴² This type of music is more prevalent in Adventure and Role-playing genres, with a mechanic normally implemented to allow players to control the character who performs the music directly. Since the sounds produced are heard by both the character (in-game) and the player (outside this environment), the music is considered *diegetic*.¹⁴³

Both delineations share a common ground in discussions of thematic attachment, as game users are likely to associate memorability with melodies heard both in the background and within the gaming environment so long as emotional equity is attained and preserved, as was discussed by Martin O’Donnell.¹⁴⁴ Developers and composers who succeed in finding the appropriate balance between diegesis and commentary are capable of producing themes (both in

¹⁴¹ Michael Sweet, *Writing Interactive Music for Video Games* (New York: Addison-Wesley, 2015), 76.

¹⁴² Sweet, *Writing Interactive Music*, 77.

¹⁴³ Both terms are fully defined in Collins, *Game Sound*, 184.

¹⁴⁴ Martin O’Donnell, interview with Kara Balthrop, December 18, 2022 (See Appendix A).

their narratives and in the music) that can retain their emotional equity through decades of new games and adaptations. While game developers have long been able to accomplish this goal in the adaptive sense, they have only been able to master direct interactivity relatively recently. A key example occurs frequently across the *Legend of Zelda* franchise.

Throughout the lore, Link (as both the character and player) has produced music using many different instruments including flutes, ocarinas, pipes, guitars, harps, bells, drums, and even an enchanted baton used to conduct an ethereal choir.¹⁴⁵ This logistic allows users to experience the music first-hand and even play a role in how it is executed via the songs and spells Link performs with each instrument. When the first truly interactive musical mechanic was introduced with *Ocarina of Time* in 1998, composer Koji Kondo was able to model Link's ocarina after the button layout of the Nintendo 64's controller to add an even greater sense of realism.¹⁴⁶ Link is able to use the ocarina, which is considered sacred in the series' lore, to cause magical events to occur within the game, such as opening mystical doors or teleporting the character to other areas of the game.

Majora's Mask, the direct sequel to *Ocarina of Time*, also features this interactive technique, though it is most commonly employed in this instance to control the flow of time in the game's overworld.¹⁴⁷ Additionally, many of the themes or songs played using the ocarina are those that were seen in previous games as overworld or character themes. For example, "Zelda's Lullaby" appears as a performable song in *Ocarina of Time* to connect Zelda with the protagonist

¹⁴⁵ Mack Enns, "Understanding Game Scoring: Software Programming, Aleatoric Composition, and Mimetic Music Technology" (PhD diss., The University of Western Ontario, 2019), 66,

<https://ir.lib.uwo.ca/cgi/viewcontent.cgi?article=8647&context=etd>.

¹⁴⁶ Peer Schneider, "*The Legend of Zelda: Ocarina of Time* Review," last modified August 21, 2021,

<https://www.ign.com/articles/1998/11/26/the-legend-of-zelda-ocarina-of-time-review>.

¹⁴⁷ A direct sequel is a subsequent title in which the story picks up where the earlier game left off. These often involve the same environments and characters seen previously.

as well as to solve puzzles and open doors. Other short themes playable by characters across both games include “Epona’s Song,” which summons Link’s horse, and the “Song of Storms,” which can create storms and remove curses.

As the *Zelda* franchise has adapted its titles to make effective use of the technical advancements in newer consoles, these interactive mechanics have also become more immersive. *Skyward Sword*, a relatively newer game in the series, was released initially for the Nintendo Wii and designed with the Wii Remote in mind. At a certain point in the story, Link acquires the “Goddess’s Harp,” which functions much like the Ocarina of Time in that the player is able to interact with the instrument in order to affect the environment and the progression of the plot. The harp is played by gently swinging the Wii Remote back and forth in a motion similar to the strumming of a handheld harp. If the player is able to keep a steady beat (noted by a pulsing ring of light or a swaying medallion), the arpeggiated chords begin to reflect the song Link is playing. Once the song is completed, it is repeated automatically and the intended effect, such as the opening of a door, is shown. This mechanic has been heavily explored by Karen Collins, who describes it as *kinetic gestural interaction*.¹⁴⁸

The level of interactivity involved with this type of gameplay creates a deeper sense of immersion by allowing players to connect with the character both physically (playing the instrument) and emotionally (through memorable character themes). Composers are responsible not only for creating music that is pleasing to the listener, but they must also ensure that the unique interactive element is unified with their overall musical vision of the game. The tunes of the ocarina must not clash with the background music or other sound effects that may be present

¹⁴⁸ Karen Collins, “An Introduction to the Participatory and Non-Linear Aspects of Video Game Audio,” in *Essays on Sound and Vision*, ed. John Richardson and Stan Hawkins (Helsinki: Helsinki University Press, 2007), 268.

when the character is playing the instrument. Players, on the other hand, are expected to learn or sufficiently master musical skills such as keeping a steady beat, melodic association, and recall.

The transition from background music to interactive music creates what musicologist Elizabeth Medina-Gray calls *modular smoothness*.¹⁴⁹ When switching from ambient background music to the active *participatory* state, developers are expected to design the two modules to fit together like a puzzle piece. This can be simulated in both the vertical and horizontal sense; some composers might choose to either utilize the interactive mechanic as an additional musical layer that is placed over preexisting music or to write an individual piece to accompany the interactive element, resulting in the fading out of the present background music (BGM) to allow the new piece to begin. Achieving modular smoothness creates a sense of cohesion, avoiding any jarring transitions that might disrupt the game's flow and detract from the overall experience. To accomplish this, composers must consider several aspects of both the foregoing track as well as the new mechanic, such as instrumentation, orchestration, melodic flow, and harmonic adaptability, to ensure that any transitions are as seamless as possible.

In well-established franchises such as *The Legend of Zelda*, interactive elements are often combined with pre-existing musical themes that exaggerate the player's associations with characters and places within its universe. This most certainly aids in improving the marketability of the series, as the interactive mechanics, especially those interfaced with the Wii Remote in *Skyward Sword*, bridge familiar concepts presented in earlier iterations with new and exciting possibilities for plot development without running the risks associated with repetitiveness. According to IGN's compilation of reviews across the *Zelda* franchise, titles that utilized these

¹⁴⁹ Donnelly, Gibbons, Lerner, *Music in Video Games*, 105.

participatory musical elements as a focal game mechanic scored consistently higher than others in the series, proving that fans enjoy being able to reproduce their favorite themes through virtual instruments.¹⁵⁰

The techniques used to write adaptive music is changing with every new game and console release. The methods that composers might employ to create greater immersion or player engagement can vary widely depending on both the genre and individual characteristics of each game, such as atmosphere, instrumentation, and character development. In some instances, composers opt to use vertical remixing, also known as suturing, to create smooth horizontal transitions between different tracks or musical cues within a game. Others might choose to focus instead on positional modular smoothness, as Josh Mancell does in the *Jak and Daxter* franchise. Lastly, some developers have taken these concepts beyond the scope of adaptability, gradually beginning to explore the possibilities of fully interactive music as a core gameplay mechanic. This type of musical writing could arguably be considered the most immersive form of game music in use today, as players can now take on the role of performer and fully close the gap between themselves and the character.

¹⁵⁰ Dan Stapleton, “Every IGN *Zelda* Review,” last modified January 13, 2020, <https://www.ign.com/articles/2019/02/15/every-ign-zelda-review>. Games with interactive elements scored an average of 9.8/10, while all others scored an average of 9/10.

Chapter Five

DELIBERATE SILENCE: MANUFACTURING IMMERSION

As the processing capabilities of modern consoles have become more powerful, the soundtracks and scores for video games have become an aspect of the development process commensurate with graphic design and scriptwriting. The thematic soundscapes and aural environments designed for games have become increasingly comprehensive as composers continue to find new ways to engage with players. While many popular games successfully tout grandiose and densely orchestrated full-length soundtracks, some franchises are also widely recognized for either their use of minimalized underscoring or purposeful absence of music to enhance gameplay.

Silence can be implemented into game sound in a multitude of ways, which are often closely associated with the narrative or with technical genres assigned to the franchise in question. For the purposes of this research, deliberate silence is examined according to the ways it is commonly implemented in three specific genres of game: Horror, FPS, and Adventure. In each case, an in-depth analysis of common sound and music design practices is offered as well as a possible rationale for these decisions and the emotional and psychological impact they can have on the player. This line of inquiry is to provide a greater understanding of the use of intentional silence as a creative musical tool, which furthers the emotional implications commonly associated with narrative games as well as the player's objective perspective within the games' virtual environments while also demonstrating the relationship between seemingly adverse emotions (fear and stress) with positive attachments to sentiments such as amusement and endearment.

Generating Ambience: Horror

The horror genre remains a popular subject of scholarly deliberations regarding the modern classifications of games within today's expanding taxonomy. While an outside perspective might speculate that the central purpose of video games, much like film, is to provide players with an entertaining and enjoyable experience, the horror category sets out to accomplish just the opposite. In most cases, these games feature disturbing and brutal themes that are meant to elicit feelings of terror and shock.

Horror titles were largely absent in the video game market until Capcom's *Resident Evil* (1996) for the original PlayStation. This apocalyptic zombie-survival game was instantly successful with audiences, selling more than eleven million copies by 1999 and soundly defining the "survival horror" genre.¹⁵¹ The game was one of the first to earn a Mature 17+ rating from the Entertainment Software Rating Board; its graphic content featuring mangled corpses, substantial amounts of gore, and several gruesome death scenes.¹⁵² The game's focus on puzzle-solving, inventory management, and providing limited opportunities to collect ammunition or healing items spawned a formula that many horror franchises have sought to emulate in the twenty-eight years since the game's release.

As *Resident Evil* was forced to work within the strict confines of the original PlayStation's computational limits, its soundtrack was relatively sparse, consisting of a few thinly voiced atonal MIDI melodies and chord progressions that played during combat or other instances of extreme stress. As was mentioned in Chapter Two, these limitations no longer exist

¹⁵¹ Rebecca Roberts, "Fear of the Unknown: Music and Sound Design in Psychological Horror Games," in *Music in Video Games: Studying Play*, ed. Kevin Donnelly, William Gibbons, and Neil Lerner (New York: Routledge, 2014), 138.

¹⁵² Rich Stanton, "Resident Evil: 20 Years On," last modified March 27, 2016, <https://www.eurogamer.net/resident-evil-20-years-on>.

by today's aural standards thanks to the abundance of memory and comprehensive software in modern systems. Video game composers are now rarely limited in the means by which they can write or produce their soundtracks. To this end, musical sparseness or silence in games is no longer a product of necessity but is instead implemented deliberately for the purposes of ambiance or narrative emphasis.

As the immersive capabilities of video games have greatly increased, developers of horror franchises have become more creative in the ways they implement both foley and music in their games to create realistic scenarios in which players are able to experience genuine fear from the perspective of the character. Game development has seen significant progress regarding the integration of foley in gameplay since the earliest simple and repetitive effects seen in original *Resident Evil*. Footsteps have become much more lifelike (often adapting to the characters' physical environment), gunfire has become more convincing, and rudimentary MIDI pallets have been replaced with full orchestras and live musicians. This continuing evolution has granted composers significantly more freedom and allowed them to expand the previously constrained limits of creativity and more closely integrate the game's sound into its narrative.

The *Dead Space* franchise, developed by Motive Studio and published by Electronic Arts (EA), has been considered one of the staples of the modern survival horror genre, with the first game classified by many fans as one of the greatest games of all time.¹⁵³ Much like in *God of War*, the story is experienced from an over-the-shoulder third-person perspective. The player takes on the role of Isaac Clark, a systems engineer working for the world's leading governmental body, known as EarthGov, sometime in the twenty-sixth century. He receives a

¹⁵³ Bo Moore, "The 100 Greatest Video Games of All Time," last modified June 16, 2014, <https://web.archive.org/web/20161202235359/http://www.popularmechanics.com/culture/gaming/g134/the-100-greatest-video-games-of-all-time/>.

distress signal from his significant other, Nicole, who had been working on an interstellar mining ship on a distant planet. Her message prompts Isaac to join the search and rescue mission that was sent out to the ship to investigate. As their vessel attempts to dock with the seemingly stranded ship, significant damage is inadvertently caused to both spacecrafts, causing Isaac to board the ship alone to search for his partner.

In his exploration, Isaac discovers that the ship has been infested with “Necromorphs”—horrific biological anomalies borne from the corpses of the ship’s crew. The infestation was caused by the presence of a “Red Marker” somewhere on the vessel, which causes humans to experience severe hallucinations and paranoia, eventually leading to their deaths. Isaac is forced to combat the Necromorphs using only the tools available on his “Resource Integration Gear” (RIG) suit, which grants him access to various mining tools such as portable saws and plasma cutters which can be upgraded at various workstations positioned throughout the game.¹⁵⁴ A particularly effective design element present in the game is the multi-functionality of the main character’s suit. Isaac’s RIG suit also serves as the game’s HUD, providing information about the player’s health and ammunition while also functioning as a navigation system, two-way communicator, oxygen supply indicator, and how various game menus are displayed.

The game’s combat system is distinctive in the way the player is expected to slay enemies. While many other weapons-based survival horror titles suggest taking aim at the heads or hearts of adversaries to increase effectiveness and conserve ammunition, *Dead Space* instead advises that players focus on the extremities (arms, legs, etc.), claiming that Necromorphs, who are technically already dead, can only be eliminated by removing their limbs and effectively

¹⁵⁴ G. Christopher Williams, “Isaac Clarke: Intergalactic Handyman,” last modified February 9, 2011, <https://www.popmatters.com/post/136940-isaac-clarke-intergalactic-handyman/>.

disabling their movement. This approach was coined “strategic dismemberment” and has been a central combat mechanic of all *Dead Space* games to date.¹⁵⁵

This game embodies several key characteristics of the horror genre while simultaneously introducing several sonic and spatial elements that further enhance these features and create a more immersive and fear-inducing environment. One such example is the developer’s decision to implement fully diegetic menus. In many games, pressing the “pause” button will stop gameplay to allow the player to navigate through various screens, such as maps or character upgrade menus, without needing to concern themselves with enemies or other gameplay elements that would otherwise continue in the background. In the horror genre, these menus are notorious for breaking the player’s immersion and permitting them a means to figuratively “escape” when they experience extreme amounts of fear or stress by the means of a jumpscare, chase scene, or intense combat scenario.

Dead Space developers instead capitalized on the RIG as an in-game HUD, choosing to integrate the game’s menus into the suit. In this instance, when a player pulls up the menu, a holographic display illuminates a menu above Isaac’s arm, allowing players to navigate the screen from there. This diegetic interface circumvents the breaking of immersion found in many horror games, encouraging the player to maintain complete immersion and taking away the opportunity to catch their breath if the situation becomes dire. If the menu is opened while the player is in active combat, the encounter will simply continue, allowing Isaac to take damage just as he would otherwise. Dino Ignacio, the lead UI designer for the *Dead Space* franchise, spoke freely on this topic in a 2013 interview with Polygon: “*Dead Space* was conceived to be an

¹⁵⁵ Joshua Rivera, “The *Dead Space* Remake Is Revamping Some of the Series’ Most Iconic Mechanics,” last modified August 31, 2021, <https://www.polygon.com/2021/8/31/22650616/the-dead-space-remake-cut-off-their-limbs>.

immersive, story-driven science fiction experience. It is not just diegetic by design, it's diegetic by implementation. Anything that didn't belong to [Isaac], we elegantly placed behind him. [This was created] out of the necessity to keep the player immersed."¹⁵⁶ Visually, he states that these game elements are not simply overlays; they are a part of the game world. As a result, they have particle effects and cast light. Ignacio directly contrasts this method with the UI used for *Mass Effect* (2007), whose screen is filled with information about the game's map and inventory. The creators of *Dead Space* instead chose to integrate this information directly into the space suit, further embedding the player within the game's environment.

Also included in the game's mechanics is the player's ability to physically check in with Isaac during hushed or silent moments of exploration. As the protagonist explores each area, his breathing and heartbeat can be heard as they occur diegetically in order to reflect his current mental or physical status. If he witnesses a particularly horrific event, his breathing will speed up. Likewise, if he takes a significant amount of damage in a fight, the player will be able to hear his heart pounding in his ears.¹⁵⁷ This mechanic is exacerbated when Isaac enters an area with zero gravity. After entering a vacuum, all sound within the game is either completely muted or drastically muffled save for his heart rate and breathing, which are heard from within the suit. All foley, including gunfire, footsteps, and enemy sound effects, are heard as their vibrations travel through Isaac's suit and to his ears. The mechanic is paired with the rumble motors in the game

¹⁵⁶ Dave Tech, "Deliberately Diegetic: *Dead Space*'s Lead Interface Designer Chronicles the UI's Evolution at GDC," last modified March 31, 2013, <https://www.polygon.com/2013/3/31/4166250/dead-space-user-interface-gdc-2013>.

¹⁵⁷ Jason Graves, "'Pure Terror in Musical Form': *Dead Space*'s Composer Shares Its Unsettling Secret," interview by Dom Peppiatt, January 20, 2023, <https://www.theguardian.com/games/2023/jan/20/dead-space-composer-shares-its-unsettling-secret-jason-graves>.

controller to create greater realism, causing them to vibrate as the character fires his weapon or physically collides with objects.

This diegetically centered approach was also applied to the game's soundtrack. Jason Graves, who composed for the original *Dead Space* trilogy, drew heavy influence from the avant-garde, indeterminate style as seen in Penderecki's *Threnody to the Victims of Hiroshima*.¹⁵⁸ Graves's soundtrack is scored for a full orchestra, with the composer opting to use very little thematically based sound throughout the gameplay, saving the very few "hummable" melodies for more dramatic cutscenes. Instead, the music heard by the player as they control the character is notably atonal, featuring clusters of dense string sonorities and heavy dissonance throughout the ensemble. His goal with this approach was to create a kind of sound that both terrified the player and allowed them the freedom to interpret it individualistically.

Graves further described the audio engine that was developed to integrate the music with the gameplay, "[There were] four pieces of music, essentially, that were all playing at the same time. They would just get turned up and down depending on how scary the game needed to be at that one point in time." When the player is involved in an encounter with numerous enemies, the game's "fear meter" increases, causing the ostinato in the high strings to become louder.¹⁵⁹ Likewise, the treading percussion line and biting string stingers become steadily more pronounced as the player traverses the final level of the game, reaching its climax once Isaac finally engages with its largest enemy.

¹⁵⁸ Karen Collins and Chris Greening, *The Beep Book: Documenting the History of Game Sound* (Waterloo, Canada: Ehtonal, Inc., 2016), 327.

¹⁵⁹ Izabela Besztocha, "Dead Space: A Musical Necromorph," last modified October 26, 2020, <https://gamemusic.net/dead-space-a-musical-necromorph/>.

While these games, like others discussed in this project, successfully integrate aspects of both interactivity and adaptability into the music, the horror genre differs in its creative application of musical silence as a compositional tool. *Dead Space*, in particular, is one of the few games within the modern catalogue in which players experience more silence than music during the gameplay.¹⁶⁰ Graves began his compositional process by assigning each of the tracks to one of two categories: exploring or fighting. Then, he further divided them into their intended moods: tense, creepy, or neutral.¹⁶¹ Graves himself confirms that this style was implemented to elicit more intense physical and emotional responses from the players. The exploratory background music for each area includes several prolonged periods of musical silence to allow the player to experience the tension and anxiety produced purely by the sounds that are present within the game's environment, such as nails scraping across walls, doors slamming, screams heard in the distance, and the lumbering feet of nearby enemies. As mentioned previously, these silent moments also enable the player to listen and connect directly to Isaac's breathing and heart rate.

Silence is also used in this context to allow the player to maintain an auditory connection to their physical environment while they are exploring. In an interview with the *Dead Space* (2023) remake's composer, Trevor Gureckis, he notes that audio designers would often call for very thinly-textured or nonexistent background music in areas where the players were meant to focus their attention on the sounds of the ship's ambience, such as creaking floors, noisy machinery, or unspecified slamming in a nearby corridor.¹⁶² He points out that the inclusion of

¹⁶⁰ A playthrough of the original *Dead Space* takes between six and eight hours, while the game's official soundtrack is a little over an hour in length.

¹⁶¹ Jason Graves, "Dead Space Composer Interview," interview by Spence D., May 12, 2012, <https://www.ign.com/articles/2008/10/18/dead-space-composer-interview>.

¹⁶² Trevor Gureckis, interview with Kara Balthrop, February 21, 2023 (See Appendix A).

silence as a tool for creating ambience helps to expand the overall range of dynamicism available to composers, making moments of high intensity feel even more impactful. In his work for the series, he describes the quieter atmospheric cues that were written for lower-intensity gameplay such as exploration or puzzle-solving. In these instances, he often calls for a single line of muted strings that play softly in the background as Isaac moves about, but if he suddenly encounters an enemy, these lowered dynamics leave more space for a shocking stinger that theoretically stimulates a visceral reaction from the player.

The psychological associations between silence and fear have been widely explored as they apply to the many ways in which we seek entertainment. The recent increase in humankind's exposure to sound via television, music, or social media has created an environment in which we rarely experience complete silence. Bruce Fell, a communications lecturer at Charles Sturt University, conducted a study over a period of six years in which he observed the effects of complete silence on a pool of over 580 undergraduate students.¹⁶³ Based on the results, he found that all but one student had been exposed to television and/or radio from birth. Many also reported that as they were growing up, television, music, or other streaming services were frequently left on even when no one was directly watching or listening. Fell argues that, as a result, younger generations have come to rely on a constant stream of background noise and can experience feelings of agitation and unease when they are left in complete silence for a prolonged period. When asked to spend a single hour in a completely silent environment, one student noted, "The lack of noise made me uncomfortable, it actually seemed foreboding."¹⁶⁴

¹⁶³ Bruce Fell, "Bring the Noise: Has Technology Made Us Scared of Silence?" last modified December 30, 2012, <https://theconversation.com/bring-the-noise-has-technology-made-us-scared-of-silence-10988>.

¹⁶⁴ Fell, "Bring the Noise."

Composers for both film and games have discovered and capitalized on this phenomenon to establish feelings of tension and nervousness. In *Dead Space* games, periods of heavy combat accompanied by a highly intense, blaring orchestral soundtrack are often followed by several moments of total musical silence to give the player an opportunity to recover from the earlier rush of adrenaline and collect their thoughts. Silence is also used to facilitate active listening, often to create an environment in which the player must be able to anticipate an upcoming encounter or predict the location of an enemy. In some cases, sound designers choose not to include any form of background music simply because it is not necessary. As mentioned in the previous chapter, composer Martin O'Donnell makes a strong case for the use of music only when it is needed.¹⁶⁵ He argues that “wall-to-wall music,” as he calls it, can break immersion just as much as it can create it. He adds that the existence of this “wallpaper” music makes it more difficult to elicit an emotional response from the player.

Dead Space uses strategically placed moments of silence to gradually incite tension as the player approaches a story beat.¹⁶⁶ Gureckis provides an example from the *Dead Space* remake in which Isaac is nearing an auditory cue that begins a narrative encounter. As he gets closer to the trigger, the music adapts, growing gradually more intense and building a sense of anticipation for the upcoming cutscene and/or combat scenario. Jason Graves created similar musical associations in the original game using varying instrumentation to illustrate the dichotomy between the “fear state” and the “neutral state.” He scored several minutes of chamber music for string quartet that is meant to represent Isaac as a lone individual roaming through a large, haunted spacecraft. He notes that the music is still “a little scary, but a little

¹⁶⁵ Martin O'Donnell, interview with Kara Balthrop, December 18, 2022 (See Appendix A).

¹⁶⁶ A “story beat” is a point of action in the gameplay that propels the narrative forward and marks a shift in tone.

more melodic, a little more normal, a little more of a connection to the listener. So they're leaning in and listening [before a chase ensues] and then the orchestra comes in and knocks you back on your seat."¹⁶⁷ He intended to emphasize the emotional discrepancy that the listener experiences between the intimate, vulnerable, lonely string quartet and the large, dissonant "Necromorph" orchestra.

Gureckis further draws upon the importance of this "up and down" cycle of tension and release as a means to create a more intense overall experience.¹⁶⁸ Including silence within the game's soundtrack is meant not only to allow players breathing room in between encounters, but it is also designed to create apprehension and make the game itself feel "alive."¹⁶⁹ Much like film, composers for horror games make frequent use of dissonant intervals and chord clusters that are considered off-putting or "scary" to audiences. Additionally, they have been able to utilize periods of deliberate silence to further the game's immersive capabilities and craft an environment in which the player truly feels the horror that the characters experience as the narrative unfolds.

In video games, the horror genre employs many of the same sonic elements that are commonly seen in film, such as stingers that are used for jumpscare and soft, keening string overlays that convey feelings of uneasiness. *Alien: Isolation* (2014) is a game developed by Creative Assembly that functions as a direct sequel to an already-popular film series. It uses many of the same scoring techniques seen in the film, with Jeff van Dyck (audio director for the game) explaining that 20th Century Fox gave his studio access to the original sound effects to be

¹⁶⁷ Collins and Greening, *The Beep Book*, 327.

¹⁶⁸ Gureckis, interview.

¹⁶⁹ Gureckis, interview.

used in the game.¹⁷⁰ Creative Assembly was presented with the unique challenge of designing and executing a fully-interactive product that directly integrates key cinematic elements of the films with the adaptive nature of gaming while considering both the creative challenges as well as the audience's potential reception to the shift in medium.

The premise of the games is somewhat similar to *Dead Space* in that the protagonist, Amanda Ripley, is tasked with navigating a large derelict spacecraft in which unknown circumstances have caused the death or incapacitation of a majority of the population on board. As the main character searches for her mother aboard the ship, she discovers the presence of the *xenomorph*, which then begins an unending pursuit of her throughout the remainder of the game. The xenomorph, reminiscent of the one seen in the film, is a large and deadly creature that stalks the player through hallways and ducts. While the protagonist is equipped with a variety of weapons that can be used to defeat smaller enemies, the xenomorph is immune to them as well as all other forms of direct combat; it can only be evaded through tactics of stealth and avoidance.

Alien: Isolation was highly praised for its innovative use of AI and sound design for the xenomorph.¹⁷¹ Functioning as the titular antagonist, the Alien is the game's most terrifying element by design. Throughout the entire playthrough, it actively hunts the player, who is completely powerless against it if they are captured. The creature's AI is complex and inventive, consisting of several "behavior modules" that determine the direction and intensity of its pursuit. It is an intelligent entity that responds to a player's physical position, including direction and

¹⁷⁰ Jody MacGregor, "Seeing with Your Ears: The Audio of *Alien: Isolation*," last modified May 10, 2022, <https://www.pcgamer.com/the-audio-of-alien-isolation/>.

¹⁷¹ Tommy Thompson, "The Perfect Organism: The AI of *Alien: Isolation*," last modified October 31, 2017, <https://www.gamedeveloper.com/design/the-perfect-organism-the-ai-of-alien-isolation>.

linearity of exploration, and is able to adapt accordingly in order to maintain a constant level of apprehension for the player without becoming overwhelming.¹⁷²

The game uses two generalized behavioral management systems to dictate the xenomorph's behavior: the *director* AI and the *alien* AI. The director keeps a constant record of the player's location and behavior, while the alien is responsible for executing the xenomorph's actions and physically hunting Amanda down. The xenomorph itself is guided by a series of "pointers" that are provided by the director to give a general sense of the player's whereabouts. Despite this assistance, the game's engine does not allow the alien access to this knowledge; though the director AI is always aware of the player's location, the alien must determine the best course of action on its own. This means that it is possible for the player to avoid it, surprise it, or even escape it if it spots them.¹⁷³

The xenomorph's AI operates in a matter that is entirely unscripted, meaning that it could change tactics at any given time and suddenly become significantly more or less aggressive in its pursuit. This not only makes each playthrough unique but also maximizes the player's trepidation as they attempt to solve puzzles and explore the ship. Lead Artist Jude Bond explains that "[The team] realized very early on that a horror game with checkpoints [that are] scripted just isn't going to be scary."¹⁷⁴ They instead relied on a continuous and randomized algorithm that adjusts its difficulty based on the player's behavior. If the alien's pursuit is deemed to be too intense or an encounter is too drawn-out, or the player is being caught too many times, the

¹⁷² Jaroslav Švelch, "Should the Monster Play Fair? Reception of Artificial Intelligence in *Alien: Isolation*," *Game Studies* 20, no. 2 (June 2020), https://gamestudies.org/2002/articles/jaroslav_svelch.

¹⁷³ MacGregor, "Seeing with Your Ears."

¹⁷⁴ David Rodriguez, "*Alien: Isolation* Developers Describe Gameplay as 'Unpredictable,'" last modified January 20, 2014, <https://www.dualshockers.com/alien-isolation-developers-describe-gameplay-as-unpredictable/>.

director will sometimes send the xenomorph to another area in order to decrease the difficulty and allow the player to progress.

This endless game of cat and mouse makes up an overarching plot in which the player is expected to use whatever means necessary to avoid direct contact with the Alien, many of which require them to make little to no sound as they covertly roam the ship. The alien AI was designed to be able to “hear” noises created by the character based on their proximity to the creature. Loud footsteps created by running, or any clattering made by knocking objects off surfaces will activate the xenomorph’s “stalking” phase, disabling the option for withdrawal within its behavior tree and encouraging it to actively seek out the player.¹⁷⁵ This greatly heightens the need for the player to hear even the smallest auditory occurrences in their surroundings so that they can respond or strategize appropriately. Composers and sound designers accomplished this by integrating periods of “exploratory silence” into the gameplay.

Silence is employed in *Alien: Isolation* as a survival mechanic both within the game as well as in the player’s physical space by combining an intricate AI navigation system with an entirely separate mechanic for detecting noise. The sound and music in the game are sparse, reserved mainly for cutscenes, moments of impact, or diegetic necessity to encourage the player to listen for the xenomorph. When it moves from a hallway into a nearby vent, the timbre of its footsteps will change and the position of the sound will shift to a space above the character’s head (assuming the player is using Surround Sound). If the player has chosen to employ a strategy of avoidance, it is necessary for them to be able to discern the proximity of the xenomorph’s movements to determine their next move. As such, the game’s soundtrack,

¹⁷⁵ Tommy Thompson, “Revisiting the AI of *Alien: Isolation*,” last modified May 20, 2020, <https://www.gamedeveloper.com/design/revisiting-the-ai-of-alien-isolation>.

composed by Joe Henson and Alexis Smith, was based on only three minutes of thematic cues that were sampled from the film's score.¹⁷⁶ The remaining two hours of music consists largely of soft dissonant string clusters and eerie synthetic drones. In a game with an average playthrough that lasts anywhere from twelve to eighteen hours, this results in several hours of complete musical silence. This was done to immerse the players in their immediate surroundings while simultaneously instilling feelings of fear and apprehension through the uncomfortable stillness. Smith adds, "There's quite a lot of silence with little bits of music. But people aren't playing the game for the music; they're playing it for the overall experience. The music is there to play a part in that."¹⁷⁷

The game also works to expand the scope of player immersion by utilizing the microphone systems in both its Xbox and PlayStation versions to bridge the separation between the *game space* and the *player space*. Those who play the game using either of these consoles are granted the ability to toggle a feature known as "noise detection," which allows the Alien to hear and respond to any sound that occurs in the immediate physical area of the player through either a headset or camera microphone. In short, the hostile AI can not only detect sounds made diegetically by the character (running, opening doors, or using the motion tracker), but also any noise produced by the players themselves, such as yelling, breathing, or sneezing. This creates an environment in which musical silence is not just employed to enhance the game's ambience; it is required as a means of survival and story progression.

¹⁷⁶ Joe Henson and Alexis Smith, "The Flight Interview: *Alien: Isolation*, Composing for Video Games," interview by Paul Weedon, October 4, 2015, <https://www.denofgeek.com/games/the-flight-interview-alien-isolation-composing-for-video-games/>.

¹⁷⁷ Henson and Smith, "The Flight Interview."

In the survival horror genre, the active demand for silence and the absence of dense musical sequences are designed to make the player feel uneasy and tense. The little music that is often written for these games exists mainly to augment these negative emotions, subconsciously associating the exclusion of music with the presence of danger. This is further exacerbated by the intrinsically interactive nature of video games that require players be actively engaged in order to progress. Players who become frightened or overwhelmed may not simply cover their eyes and look away as they might if they were watching a film or television show. Instead, they are forced to grapple with their emotions and fully commit to the experience if they wish to see it through to its conclusion.

Silence in FPS

Though the implementation of deliberate silence is particularly conducive to the survival horror genre as a means to instill fear in players, it is also employed in other genres to enhance realism and allow the player to be auditorily engaged with the gameplay environment and/or the actions of other players. This is largely present in battle royale games such as *Fortnite* and *Apex: Legends*. These online shooting games involve a large number of players (dozens to several hundred) who are pitted against each other in a last-person-standing style match in which the map gradually constricts as the round progresses, forcing individuals into combat situations. Players begin each match without any equipment or weapons and must scavenge the map for supplies while avoiding being killed. Once a player is eliminated, they are unable to respawn and are forced back into a lobby, where they can choose to begin another match with a new set of opponents.

While these games have soundtracks written and composed for them, many only employ substantial music within the menu and character selection screens, resulting in significantly

shorter OSTs. The soundtrack for *Apex: Legends*, for example, only consists of eighteen minutes of music in total, all of which is found outside of the gameplay.¹⁷⁸ The game's musical theme is present as the player chooses their desired game mode and character, but once the match begins, all music ceases in order to facilitate active listening. This permits undiluted communication between teammates (if they choose to play using the “doubles” or “triples” game mode) and lets players hear all sounds that occur within a certain proximity, such as gunfire, footsteps, or character dialogue triggers to indicate the condition of the map. In these gameplay scenarios, not only would music be unnecessary, but it would detract from the overall experience and become disruptive for the player.

Many FPS games employ the same tactics of deliberate silence to encourage the players to focus on the sounds of the gameplay environment. When a composer's work is implemented into the game by the sound design team, it is often expected that each gameplay track will be punctuated by periods of silence either between loops or before the beginning of the next track in order to avoid creating game with “wall-to-wall” music. *Halo*'s Martin O'Donnell argues that music should only exist when it can enhance the gameplay, “It's really hard to get any kind of emotional impact out of *more* music. You can still play with so many elements outside of that.”¹⁷⁹ As an FPS franchise that is heavily reliant on narrative storytelling and the use of musical themes, much of the gameplay consists of significant periods of silence in between story beats. Not only does this let the player focus more intently to their surroundings, but it makes the music even more impactful when it reappears.

¹⁷⁸ Marek Domagala, “*Apex Legends*: Pathos and Tension with Fun,” last modified April 4, 2019, <https://gamemusic.net/apex-legends-original-soundtrack/>.

¹⁷⁹ O'Donnell, interview.

Narrative Background Music: Adventure

As was previously discussed, titles or franchises with particularly dense plots often supplement the dialogue and other storytelling elements with a soundtrack that compliments the game's recurring themes, be it through instrumental motifs that represent specific characters or diverse orchestrations that convey different areas within the map. While the specific generic parameters have not yet been clearly defined within the current scholarship, many have closely associated these intricate narratives with Action, Adventure, and Role-playing games. These games focus on the relationships players form with the characters and locations they encounter during their playthrough. Game music is designed to blend seamlessly with its visual aspects to become an indivisible component of the immersion and allow audiences to become fully enveloped by the experience and is therefore used frequently in these scenarios to elicit emotional reactions or connections that remain with the players and lay the foundation for the intended affect. For example, one might encounter an ornamented modal melody performed on a Persian tar if a level takes place in a desert or a bright flute sound reminiscent of bird calls if a character was modeled after a flying creature.¹⁸⁰

Nintendo's *The Legend of Zelda: Breath of the Wild* demonstrates the use of musical silence to further narrative in Adventure games. This latest entry in the franchise places Link (the player-character) on a deserted plateau one hundred years after Hyrule has been decimated by Ganon. The setting of the game's overworld is sparse, consisting of various ruins and other scattered scenes depicting the aftermath of a war that raged while the protagonist slept. The landscape is punctuated by the occasional settlement or horse stable but is otherwise completely

¹⁸⁰ The Persian *tar* is a long necked, stringed instrument with a waisted lute body that is played using a plectrum.

untouched by civilization. The music that plays as Link is navigating this open world is perhaps even sparser, consisting of only a few fragmented ideas that occur at seemingly random intervals.

This naturalistic musical style was implemented intentionally in order to strengthen the world's atmosphere, since limiting the presence of superfluous background noise (similar to the deliberate silence found in horror games) enhances the virtual environment through the sounds of wildlife, the forest, and other diegetic sounds that serve to connect the player to their surroundings. The melodies written for the overworld embody minimalist ideals, with understated, short motifs emphasizing both vast emptiness and quiet tranquility that has enveloped Hyrule in the wake of the war. It must also be considered that developers expect players of *Breath of the Wild* to spend many hours roaming through the overworld on their quest to save the kingdom. One might argue that the thinly textured soundtrack may have been applied not only for the purpose of tethering the audience to the environment but also to prevent the occurrence of "music fatigue."¹⁸¹ If the overworld theme were too intense or thickly scored, players could become irritated or weary of the repetitiveness, as was sometimes the case in previous *Zelda* entries. *Breath of the Wild* composer Manaka Kataoka expertly avoids this by creating an overworld theme that is somewhat aleatoric in nature, with the lack of a clearly defined time signature or phrase structure giving the illusion of delicate simplicity.

As demonstrated through this discussion, musical analysis shows the use of deliberate silence to both manipulate the player's perception of their surroundings and to generate adverse reactions associated with emotions such as panic and anxiety. Intentional and extended periods of aural stillness have been shown to cause audiences to feel tense and ill at ease and is

¹⁸¹ Adam Grindley, "The Underappreciated Achievements in the Breath of the Wild Soundtrack," last modified December 28, 2022, <https://techraptor.net/gaming/features/underappreciated-achievements-in-breath-of-wild-soundtrack>.

commonly employed in games bearing the “Survival Horror” classification. These titles often pair apprehensive silence with other mechanics such as resource limitation, disturbing enemies, and psychological elements (hallucination/disorientation) to generate a frightening atmosphere that is reflective of their generic categorization. This method can also be employed to facilitate active listening in order to produce greater engagement with the game’s foley, as is the case in many FPS games that require players to develop an awareness of the conditions of their environment. Lastly, silence is sometimes used within a soundtrack to augment the vastness or sparseness of the game’s world. To this end, composers and sound designers must work closely to implement music into games in a way that is stimulating and appealing without becoming overbearing.

Chapter Six

CONCLUSIONS AND IMPLICATIONS

In the last several decades, video games have transitioned from simplistic tennis simulations on mainframe computers to exceptionally interactional endeavors that take dozens of hours to digest fully. Advancements in computer processing and modern graphical capabilities have produced a rapidly evolving and adaptable industry that has since grown to surpass both film and television in terms of consumer retention and profitability.¹⁸² As of 2021, the gaming industry was worth over \$180 billion dollars and is now widely accepted internationally as a standard form of modern entertainment. To maintain this business, a diverse number of roles are imperative, including hardware manufacturers, game developers, publishers, and software engineers.

Socially, gaming has spawned new opportunities for individuals to connect with a community of shared interests and ideals. Statistics show that video games are enjoyed by audiences of varying demographics including children, teens, and adults regardless of gender, race, or background.¹⁸³ The culture of gaming has also experienced an evolution alongside the burgeoning industry, beginning as weeknight gatherings in arcades, transitioning to the multiplayer sphere through LAN parties, and existing currently as MMO's and other large-scale servers that permit users to play and communicate from their own gaming spaces. Consequently, games are being designed with the community in mind, with some campaigns being molded specifically to a co-op mode designed for two players to experience together, while others

¹⁸² Stephen Kelly, et al., "Digital Supply Chain Management in the Videogames Industry: A Systematic Literature Review," *The Computer Games Journal* 10, no. 19 (2021), <https://link.springer.com/article/10.1007/s40869-020-00118-0>.

¹⁸³ Jonathan Burns, "Video Games in the US," last modified January 2023, <https://my.ibisworld.com/us/en/industry/nn003/about>.

address single-player storytelling elements that were popularized in the late 1980's with Square's *Final Fantasy* and Nintendo's *The Legend of Zelda*, both generating highly successful franchises that are still popular today.

The popularization of this form of entertainment has led to attempts to classify games in both narrative and technical genres based on their primary characteristics and gameplay mechanics (i.e., Action, Horror, Adventure, etc.). Consequently, a significant portion of this project has drawn comparisons between scholars' current understanding of genre and the ways in which it is applied to video games. The subject of genre is particularly prevalent in the field of film studies, and recent years have seen some assimilation of categories into video games as an interactive expansion of film.¹⁸⁴ However, applying taxonomies to video games has proven to be quite difficult for ludomusicologists due to the significant overlap between both narrative and interactive genres.¹⁸⁵ The narrative genre is often defined in ludology as a classification of a game based upon its plot or story elements, such as romance or sci-fi. The interactive genre, on the other hand, refers to specific control schemes or mechanics that are present in the gameplay, such as FPS or RPG.

Tim Summers explains that many consumers rely equally on both varieties of generic classification being applied when discussing video games, as each has a significant impact on the consumer's expectations when purchasing or playing a game.¹⁸⁶ Until a more thorough consensus can be reached among theorists, however, one can expect to encounter significant dissent among scholars regarding classifications of specific games as well as the parameters that

¹⁸⁴ Juan J. Vargas-Iglesias, "Making Sense of Genre: The Logic of Video Game Genre Organization," *Games and Culture* 15, no. 2 (February 2018), <https://journals.sagepub.com/doi/full/10.1177/1555412017751803>.

¹⁸⁵ Tim Summers and James Hannigan, *Understanding Video Game Music* (Cambridge: Cambridge University Press, 2016), 3.

¹⁸⁶ Summers and Hannigan, *Understanding Video Game Music*, 4.

are used to define each genre. For instance, the *Halo* series has been widely recognized as First-Person Shooter due to the franchise's central mechanic that involves the character's wielding of firearms from a specific camera perspective.¹⁸⁷ However, the *Halo*'s lead sound designer and composer, Martin O'Donnell, actively questions whether or not the game's perspective is the true determinant of its genre. In short, he states that he doesn't consider FPS to be a genre at all, but simply a means of communicating the game's perspective to the player so they know what they should expect when they begin their playthrough.¹⁸⁸ He instead relies on the game's narrative genre (sci-fi, epic, etc.) when making creative decisions regarding the music and sound.

Through this research, it is apparent that the current understanding of generic application in the video game industry relates differently to musical constructs based upon the *type* of genre examined. To illustrate the point, this study explored music that exists in two delineated subgenres of FPS: action-based and story-based. Though both employ the same camera perspective and weapon scheme, their accompanying music contrasts significantly in terms of style and compositional technique. To perceive these differences most effectively, one must look beyond the interactive category and observe such applications through the lens of the narrative genre. For example, *Halo*, a story-based FPS franchise, frequently utilizes thematic attachment in its music to connect players to its overarching story and foster emotional responses that capitalize on both drama and nostalgia. Conversely, *Doom*, an action-based FPS game that features very little narrative content, relies on an intense wall-to-wall heavy metal soundtrack to generate adrenaline and momentum, keeping players invested throughout the gameplay.

¹⁸⁷ Aki Järvinen, "Halo and the Anatomy of the FPS," *Game Studies* 2, no. 1 (July 2002), <https://www.gamestudies.org/0102/jarvinen/>.

¹⁸⁸ Martin O'Donnell, interview with Kara Balthrop, December 18, 2022 (See Appendix A).

In terms of writing music for games, composers of a franchise have been known to reuse the same melodic motifs across multiple games to foster emotional attachments and evoke nostalgia in their audiences. In an interview conducted with *Halo* composer Martin O'Donnell, he suggested a theory behind this practice, which he coined "emotional equity." He argues that inserting memorable musical themes into a game's soundtrack establishes a core memory associated with the experience that can be called upon at a later time as a way to invoke those feelings again and deepen the connection between player and game.¹⁸⁹ O'Donnell uses this method extensively by calling upon the main theme across the *Halo* franchise, which has appeared in six games to date. Recurring themes are also commonly employed in the Adventure genre, particularly when there is a reappearance of certain characters or locations. One franchise, *The Legend of Zelda*, has spanned nearly four decades while continuing to recycle several motifs, such as "Zelda's Lullaby" and "Link's Leitmotif."

There are also several compositional techniques across genres that cater primarily to the adaptive nature of gaming. One such technique, adaptive suturing, has appeared in many games produced after the turn of the twenty-first century. As the popularization of 3D and open-world games began to eliminate the need for loading screens, developers sought ways to implement sound and music in order to match the seamlessness of their maps. Composers, namely *Jak and Daxter's* Josh Mancell, have therefore been tasked with producing various ways to layer and stitch tracks together both vertically and horizontally to construct seamless musical lines that retain variety without breaking immersion.

Scholars have used the term "suturing" to describe a compositional method that is strategically employed across a "musical spectrum" to create a sense of seamless flow in

¹⁸⁹ O'Donnell, interview.

gameplay. On one end, *generative music* is determined primarily by the player's direct input and is based upon an algorithm designed by the game's composers and/or sound designers. This method results in unpredictable musical encounters that are wholly individual to each playthrough. *Linear music*, which lies at the opposite end of the spectrum, is considered by most as the distant cousin of film music. It is often scored from beginning to end, leaving little room for interactivity based on the actions or positions of the characters. This category often applies to games with soundtracks intended as ambient background music. My research has attempted to place games that utilize adaptive suturing extensively into this spectrum, arguing that elements of both generative and linear flow are often present in them.

The final compositional method explored in this project, deliberate silence, is also seen across many genres of games and accomplishes a diverse range of musical objectives. In titles classified as "survival horror," musical silence is very commonly employed as a means to induce fear or augment atmospheric tension. In many instances, it allows the player the aural space to experience more of the diegetic sounds present in their surroundings. In games that require participants to employ tactics of stealth or evasion, active silence is used to permit the player an awareness of the enemy's position or activity. To that end, composers for horror games often write music with extremely thin instrumentation to provide ambience, saving more extensive orchestration for key story beats or impact sequences to create greater contrast within the game and make players feel uneasy.

Silence is also present across other genres, including FPS and Adventure. As with the horror category, many multiplayer battle royale games utilize silence during gameplay to facilitate easier communication between players while also letting them listen for the diegetic sounds made by enemy teams. Music in these games is heard almost entirely in menu and

character selection screens. Even single-player FPS games such as *Halo* are known to include periods of silence between tracks to avoid creating “walls of sound” that could detract from the experience and decrease the overall impact of the music. In Adventure games, the absence of music can sometimes be used to enhance the storyline as well as the emotional connection that a player forms with both their characters and surroundings. In a narrative context, musical silence can aid in establishing the game’s setting, as in the case of *The Legend of Zelda: Breath of the Wild*, which features an overworld theme reminiscent of the realm’s sparse and naturalistic environment, which is demonstrated by several short piano interjections that occur between prolonged periods of silence when the player is in a neutral/exploratory state.

The function of music in video games is not simply to fill a space that would otherwise be silent or exist in the player’s peripheral; the soundtrack is meant to support both the visual and interactive material and adapt to the non-linear nature of gaming. Adaptability plays a critical role in the production of game music, dictating many of the barriers to a composer’s creative freedom and presenting a unique obstacle that, so far, applies only to this medium of entertainment. Generally, one overarching goal that determines successful game development is to cultivate immersion, which occurs when the player perceives themselves as being completely enveloped by, and included in, a continuous stream of stimuli.¹⁹⁰ While the concept of measuring immersion definitively has yet to be fully achieved, studies have been conducted that attempt to gauge players’ level of immersion in games both with and without background music. One study from the *Journal of Psychology and Psychotherapy* noted significant disparities in player’s performance and overall enjoyment of a game when they played it with no music, suggesting that

¹⁹⁰ Jiulin Zhang and Xiaoqing Fu, “The Influence of Background Music of Video Games on Immersion,” *Journal of Psychology and Psychotherapy* 5, no. 4 (2015), <https://www.longdom.org/open-access/the-influence-of-background-music-of-video-games-on-immersion-2161-0487-1000191.pdf>.

the game's soundtrack plays an integral role in creating the general realism that so many software developers seek to master. A separate study found significant correlations between players' physical behavior (the movement of their mouse) and their experiences with musical conditions within gameplay, implying that the presence of BGM stimulates greater engagement from audiences. When asked to complete the same type of task twice—once with musical accompaniment and once without, participants stated that the beat of the music made them want to work faster and time their movement with the sound.¹⁹¹ These findings further support the previous notion that music has a positive impact on a game's flow, as it adds to the player's overall involvement and creates a more immersive environment.

In recent years, scholars have begun to explore the role of video game music in popular culture, including the importance of diegesis, memorability, and the psychological impact that sound has on participants. Karen Collins, one of the leading voices in the field of ludomusicology, theorizes that the player's reception of diegetic and non-diegetic music varies based on the depth of the player's ability to interpret the meaning behind certain tracks.¹⁹² She describes two levels of generalized interpretation, which she calls "primary" and "secondary" connotations. Primary connotations refer to a player's immediate reaction to a sound effect or musical idea, whereas secondary connotations rely more on the personal experience or pre-existing knowledge of the player. For instance, when a player enters a large area with a sandy biome and begins to hear themes of Arabian oud music, the primary connotation is, "I am now in a desert," while the secondary connotation might be, "Deserts are hot and I don't like feeling sweaty. I don't like this level." This makes assigning an understood interpretation to a sound or

¹⁹¹ Laura Levy, "The Effects of Background Music on Video Game Play Performance, Behavior, and Experience in Extraverts [sic] and Introverts" (Master's thesis, Georgia Institute of Technology, 2015), 43-48.

¹⁹² Karen Collins, "An Introduction to the Participatory and Non-Linear Aspects of Video Game Audio," in *Essays on Sound and Vision*, ed. John Richardson and Stan Hawkins (Helsinki: Helsinki University Press, 2007), 269.

piece of music wildly unpredictable, as developers are not able to accurately predict their players' baseline of knowledge or experience.

Since game music is a subject still in its relative infancy,¹⁹³ developing a greater understanding of these concepts among other discussions of popular compositional techniques and interactivity would serve to further establish the discipline among other musicological areas. Though the video game industry has become a staple of modern entertainment, ludomusicology as a topic of scholarly discussion is still widely unexplored when compared to the literature available in other areas of traditional Western musicology. This limited consideration could be attributed to a general lack of knowledge of the field's existence and its comparative novelty or to a general attitude that considers the field too juvenile or irrelevant to be considered a subject of serious study. As much of the debate that is present in the current literature pertains to audiences' personal or individualized interpretations of music and narrative in games, the most prevalent topics regarding music and gaming still lack much evidentiary data apart from surveys or questionnaires.

What few statistics that do exist are rarely published outside the scope of theses or essay compilations.¹⁹⁴ The only known active periodical pertaining to sound in games, *The Journal of Sound and Music in Games*, has only published seventy-three articles to date, many of which are literature reviews or colloquies. Of the thirty-seven research articles in this periodical, very few address issues of genre application or specific compositional techniques in games, instead studying the cultural or emotional influences that music has on players. One notable article,

¹⁹³ The first ludomusicology publication appeared in 1999. Matthew Belinkie, "Video Game Music: Not Just Kid Stuff," last modified December 15, 1999, <https://www.vgmusic.com/information/vgpaper.html>.

¹⁹⁴ Mack Enns, "Understanding Game Scoring: Software Programming, Aleatoric Composition, and Mimetic Music Technology" (PhD diss., The University of Western Ontario, 2019), <https://ir.lib.uwo.ca/cgi/viewcontent.cgi?article=8647&context=etd>.

“Ludomusicology: Normalizing the Study of Video Game Music,” has contributed significantly to furthering the recognition of game study through the musical lens through its critical analysis of game soundtracks in popular culture. In this article, Juan Pablo Fernández-Cortés and Karen Cook describe ludomusicology as an interdisciplinary field that straddles both ludology (the study of games) and musicology.¹⁹⁵ It explores an evolving genus of sonic expression that is conceptualized, notated, and performed by means that do not necessarily apply to other musicological disciplines or to the process by which the music interacts with the observer/participant and is therefore deserving of both acknowledgment and integration by the pedagogical community.

Following the upward trend of the current digital revolution, gaming has emerged to represent a significant portion of consumption in the entertainment industry. Regardless, scholars, composers, and developers alike have still not produced any single foundational model for video game design or creation. And even though narrative games have been circulating for over five decades, there is still very little consistent agreement regarding the definitions or implementations of genre categories in the interactive sphere. One general consensus among scholars is that current research has still not clearly defined the best practices to create player immersion, whether musically or narratively.¹⁹⁶ While it is certainly possible to speculate when this methodology could begin to solidify, one could contend that the subject’s rapid progression

¹⁹⁵ Karen Cook and Joan Pablo Fernández-Cortés, “Ludomusicology: Normalizing the Study of Video Game Music,” *Journal of Sound and Music in Games* 2, no. 4 (Fall 2021), <https://online.ucpress.edu/jsmg/article/2/4/13/118800/LudomusicologyNormalizing-the-Study-of-Video-Game?searchresult=1>.

¹⁹⁶ Melodie Griffin, “Evaluating Player Immersion in Survival Horror Video Game Design” (Master’s thesis, Ball State University, 2019), 7, https://cardinalscholar.bsu.edu/bitstream/handle/123456789/201687/GriffinM_2019-2_BODY.pdf?sequence=1&isAllowed=y.

inhibits us from garnering a proficient comprehension that can be applied uniformly across the industry.

Video games show no signs of losing momentum in the foreseeable future. Those in the trade have certainly learned from the mistakes that led to the Crash of 1983 and have since built a lucrative empire from the ashes, with over 200 million Americans reporting gaming as a significant source of personal entertainment in 2023.¹⁹⁷ Projections are showing a continuation of this trend through the next four years, which suggests that publishers and game studios will continue to implement new technology and other innovative designs in the graphics, music, and narratives of their games. Nevertheless, one might argue that the current course could be leading to a comparative plateau since there has been a significant increase in exposure to popular culture and an overcompensation in the attempt to develop new mechanics. Virtual Reality, for instance, is commonly marketed as the ultimate gaming experience due in part to its fully immersive capabilities. In spite of this seemingly revolutionary technology being on the market for several years, it currently accounts only for about 4% of the industry's profits.¹⁹⁸ This is caused in some degree by consumers being reluctant to relinquish environmental awareness during gameplay as well as a lapse in technological implementation that would otherwise allow the medium to match the current graphic and narrative capabilities of standard console/PC games.¹⁹⁹ The hardware is significantly more expensive and less optimized for a comfortable gaming experience, leading to a notable shortfall in both sales and consumption.

¹⁹⁷ Burns, "Video Games in the US."

¹⁹⁸ J. Clement, "Global Virtual Reality Gaming Content Revenue 2019-2025," last modified January 16, 2023, <https://www.statista.com/statistics/499714/global-virtual-reality-gaming-sales-revenue/>.

¹⁹⁹ Andrea Roberto, "Why We're Not All Wearing AR/VR Headsets," last modified August 31, 2022, <https://arpost.co/2022/08/31/why-were-not-all-wearing-ar-vr-headsets/>.

I project that, as it currently stands, the video game market will move in one of two directions in the coming years: it will either become so much a part of mainstream culture that nearly everyone will be exposed to it, or the industry will experience severe burnout due to overexposure that may result in a second market crash. Regardless of which scenario becomes reality, it is my belief that we will not be able to view the full scope of gaming as a cultural or musical phenomenon until there is some stagnation that will allow us to see the greater breadth of its impact. This, paired with the fact that ludomusicology currently functions as a niche topic in the realm of academia, has significantly constrained the flow of research as well as the subject's potential in general. I predict that the coming years will see many more publications, conventions, and dissertations around these topics that will facilitate a deeper appreciation of both the music and the art form.

Appendix A: Transcripts

Excerpts from an Interview with Martin O'Donnell (*Halo*)

Conducted via Zoom, December 18, 2022

K.B.: *What are some of the first things that you consider when you're writing for a new game and how early in the process are you usually brought in?*

M.O.: Well, so far with every game that I've done—and this is somewhat unusual for composers—I've been brought in almost from the first day. I've been brought in when everybody's still in the concept stage going all the way back to *Myth: The Fallen Lords*, which was a real-time strategy game.

So, it's interesting that you're talking about the [different] genres. You know, I would probably question whether these are truly genres, because- I'll put this into your head, and you can take it as you will- I think that the most important thing about a video game is: Who is the player? If the player is a character in the game, I see that as a story-driven game. If there's a story. There are games that are not story driven. There are puzzle games, sports games, and all that. So, I put those in different categories. But when it comes to something where there's a story, of course, [this] means music has a giant role to play. I tend to look at: what is the player? Is the player a character in the game or is the player controlling characters in the game? And those are the big ways I look at the genres. As I'm looking at it from that standpoint, it's almost like with literature: first-person and third-person and omnipotent narrator. Things like that, where it's like, “Who is telling the story, and who is that person as a player?” I think that's more important, because when people say first-person shooter, I don't believe that's necessarily a genre. It has certain habits that it's gotten into and it's mostly... First-person means the camera [is positioned from the] perspective of the character. So, you're playing this character, and your perspective is out of your eyes, right? It can also be in a third-person perspective. But that doesn't change the genre, in my opinion. It's just changing the camera angle. And, as a matter of fact, in all the *Halo*'s we ever made, from the very beginning we were first-person and third-person, because as soon as you get into any vehicle, or you pick up any kind of heavier weapon, we switch to third person. So, to me, the most important thing is: Who is the story about? And how is that story being told? And who is the player? As the player, are you taking the role of an avatar, or is it just you controlling characters on the screen?

So, if I [were] to be hired to do an Action/Adventure, an FPS, or a Horror game, I would first ask that question, because that's the most important thing: Whose story is it? And who are you as a player in the story?

I usually come in right at the beginning as the concepts, plot, writing, characters, and all that stuff is happening. What's happening, especially in games and making games, is a lot of proof of concept and mechanics. “How are you going to try to present this? And what sort of engine do we have?” Everything I've done has been in some sort of 3D space, so there's world-building. “What's the world? How do you navigate through the world? What's the sandbox? What do you get to play with?” So, I'm there right at the beginning, and then, “Why does this world exist? What's the lore? What's the background? What's the story? What's the context?”

K.B.: *You worked not only as the composer for the Halo franchise, [but also as] the audio director for the entire studio during that time. So obviously you were involved in more than just the music itself. Would you describe the entire developmental process as collaborative between writing and audio teams? If so, do you feel like you had any influence on the story?*

M.O.: I was really lucky. I'm lucky because I got in early enough in the mid-nineties where there weren't a lot of set rules. There wasn't a lot of, "This is standard industry practice. This is how these things are made." It was a group of creative people who said, "Wouldn't it be cool if—" and that was the main thing. If you're in on that small team of 4 or 5 people who are saying, "Wouldn't it be cool if this happened?" you do have a lot of influence. So as the older guy in the group, which is why my nickname is "Marty the Elder," I was always the oldest one on a team, even 30 years ago. Because I'd had a career already doing professional film scores and commercials and TV, I could come in and let these young kids who were making games know that when it comes to the audio side of things, I'm the expert. I know how to create things. I know how to compose. Me and my partner, Mike, have been producing things for years. [We would say] "What you really need is for me to be your audio director" and I would sort of cross my fingers and hope nobody would question that. Because the role of audio director didn't exist. I kind of made it up on the fly, but the reason I wanted to be audio director was because I felt like we had the technology to handle anything that came out of the speakers; anything in the audio environment for the listener and the player. I just wanted all of that to feel like a whole [unit], so I didn't want there to be a composer that worked on this side of things, and the sound designer who did this, and someone who worked on UI sounds. I felt like, even if I had a team of people working on individual elements, I wanted to be directing everything, so that at the end of the day I could take the blame for anything that wasn't working well. But it was nice to be able to say, "Well, that person worked with me, and we know we have this team that did this great stuff. But if you don't like the way the mix is, if you don't like the sounds that are in here, if you don't like the music, blame me, I'm the one person who— this is my vision for audio." So that's the reason I say that was lucky, because I think that *isn't* the role of audio directors today, and on many big AAA titles, the audio director is almost like the music supervisor on films. They sort of supervise things, but they're not in the weeds. I worked [closely] with the writer. I could help influence the story. I could help influence character development. I was always the one casting for the voices. And then I directed the actors and edited the voice and implemented it. So, I got to be so much more hands-on than most people are today in the AAA space now. In the Indie studios, it's a little bit more like it used to be, if you remember—you don't remember, because you're too young. But if you've done any research, the team that did *Halo 1*, which at the time was a launch title for the Xbox— It came out in 2001, and if there was such an idea of AAA, it was considered a AAA game. And we did it with 40 people. So today AAA is almost always eight-hundred, nine-hundred, twelve-hundred people working on AAA games, so it's an entirely different feel in today's environment than it was back then. So, if anything, I think I feel better in those smaller teams where everybody is collaborative and everybody has an influence regardless of where, you know—we had testers, people who were on the test team that influenced how the game went.

K.B.: *Do you feel like being the audio director left much time for composition?*

M.O.: I was insanely busy at the time. It's funny, I was just talking to Mike yesterday on the phone. Somebody was talking about the *Halo* series, and we handed it off after ten years to 343 [Industries]. Of course that's an entirely different studio, and they had a different approach to many things. There's a few videos out there that talk about the Golden Age of Gaming, or the Golden Age of *Halo*. And I just said, it was basically Camelot, and you don't know when you're in Camelot. You only know it afterwards, and you can look back and say, "Oh, wow! That was really a magical golden time. I wish I'd known it while I was in it." But yeah, I don't know if that really answers your question. It's just that we had this sense of camaraderie. We were all moving in the same direction. It was a small enough team, and it really felt like a golden age, but mostly in hindsight. Because we still went through a lot of disappointments, a lot of crunch, a lot of late nights, so strains on marriages and relationships. I mean, all that stuff was happening. But in hindsight, I still feel really proud and I long for those days. Although, let me just say, I think the game industry is still mutating and going through some evolution. And there is something— it's more than nostalgia, although I agree there's a lot of nostalgia involved. Especially people your age who will say, "Oh, I grew up with your music. I used to sometimes sit on my dad's lap while he was playing *Halo*,"

which is really fun for me to hear, but then it also makes me realize how old I am. I realized that their approach, their memories of this music that they had as toddlers and as grade schoolers and junior high kids and growing up with this music, has a much more powerful attachment to their inner beings than I was ever anticipating. Because when you're making a game, you're like, "Who's our demographic? Who's gonna play this?" It's like, 18- to 29-year-old people who want to play this game. So, you're only thinking about people who are already essentially adults. We never considered that this game was gonna be around more than like six months. Because at the time, games come out, and then if they're popular for five or six months, you're really excited. That's a success. And then it goes away, and you make a new one. So, the idea that people are still out there playing some of these games that we made twenty-five years ago is mind blowing. It took on a whole different sort of form. So, my point is that there's the nostalgia factor. But then there's also the real, hardcore facts. You know, there were 35 people that I knew really well at Bungie, and we made the first *Halo* with this tight team. We were all going in the same direction. We all had input, we fought, we crafted, we were happy, we were sad. We were all working together, and that was a real way that games were made. It's not just a nostalgic [way to] look at it; it's a fact. And those AAA games are not being made that way anymore. *God of War*—as great a game as it is— is not made that way. Now it's smaller independent titles [that] are made that way, so I think that's kind of interesting to see.

K.B.: *Do you feel like the subsequent games, not only in the franchise, but like the Anniversary Edition, and everything that's come out over the last 10 years- Do you think that nostalgia has played more of a role in keeping the series alive?*

M.O.: Even the idea of having a very successful franchise that has five titles in it- and all five titles took over ten years to make. It's a long period of development for these five titles that Bungie made and I worked on. I was audio director on all five [of them]. My claim to fame is that there's nobody else within Bungie that actually was at the Director level on all five titles. So, I can think of that as a claim.

But then, when handing it off to a new studio, 343 [Industries]- What I'm saying is that hadn't really been done before. You have a team that made this really highly successful franchise now completely handing it over to a brand new company, a brand new team of creatives, and they were put into a position that no one had really been put in before. "What do we do with a franchise that has an established player-base? That has absolutely rabid fans that probably know more about the lore than anybody?" How do you make something new that has your creative imprint on it. And how do you sort of honor the past?

I think that was a really tough needle to thread. I don't envy them at all. I think that would have been very, very hard. Bungie moved on to *Destiny*. And even with *Destiny*, I think we had trouble getting away from things that the fans expected because of what we had done with *Halo*. It's difficult because the fans go, "Well, we expect this, this, this, and this." But then there's another set of fans who are just as rabid who are like, "Well, no, we don't want that and that. We want these other things because that's what we like."

So how much do you try to honor the past out of a sense of fan service? And how much do you try to innovate because you think that's the right way to go? That's not easy at all, and I don't envy what 343 [Industries] was tasked to do. It was very hard.

K.B.: *The first Halo released on the original Xbox, and [the franchise now] spans the [Xbox] 360, the Xbox One, and now the Series X. What sorts of technical limitations were present during the earlier period that you feel have been resolved with newer consoles?*

M.O.: When I got into producing for video games, it started in '96, '97 when I worked on the sequel to *Myst*, which was called *Riven*, which was not Bungie; it was Cyan. And the reason I was excited about working on it then is because I was always a video gamer. I love video games, but I was never attracted by the production quality, because [back then] the limitations were so [high], especially on the audio side. You had people talking about *bleeps* and *bloops*. But by the time Nintendo was doing *Zelda*, it was

actually pretty cool stuff, but it was very much 8-bit and 16-bit looping music that was extremely creative, and you had to be very creative to do anything memorable within those limitations. But by the time the nineties came around, suddenly you could actually record real things. You could record real voice and real music. You could use sound files. You could manipulate sound files digitally in real time.

To me, it was like the entire technological world opened up. I was able to jump in and do what I knew how to do. So, I didn't necessarily see this as limitations because it seemed like it was so much [more] advanced from where it had been in the early console days. But yeah, there were some limitations. You couldn't just record hours and hours of music and hours and hours of voiceover, and just have long playing things happening at the highest bit rates.

But with *Halo 1*, compression was—this is the technical thing—It was 80 PCM, so it was 16-bit. It basically sounded almost as good as CD quality audio. We were able to manipulate CD quality audio for sound design, music, and voice, and I was able to come up with a system that allowed me to make tweaks to the final mix while everything was still in the engine. And we were playing it. And we could move all those things around. What was fun for me was that there was no such thing as third-party software at the beginning. If you know anything about the industry, there's Wwise, and there's FMOD and there's some other off-the-shelf third party, *extremely* complex and highly technically advanced third-party software, just for audio for video games.

And I remember going back to probably after we released *Halo 1*, so sometime in probably 2002 or whatever, this young guy came and visited the Bungie offices and was showing me this concept that—it was a guy named Simon Ashby, who was the founder of Wwise—and he was asking me how we did the implementation, how we did the looping, how we made random choices and put all the stuff together. The audio implementation side. And I'm like, "Yeah, I'll share with you all of this stuff. Here's how I think about it. And here's what I think is important." But he's feverishly taking notes, and it was really cool, and I said, "What are you planning on doing with this?" And he was like, "Well, you know, I think that we'll have a company that just handles the audio engine for game developers." And I was like, "Oh, well, good luck with that! That's never going to take off." Because I really thought 'It's so specific. And how many of us are there? How can you make a living, you know, just depending on game development where there's like, 12 companies out here doing things? There's no business model that'll make that work.' Which shows that I had no vision for that, because it's now a thriving business, and his program superseded anything that we ever did.

So yeah, the technological limitations, to a certain extent, helped me stay within some confines. It didn't feel like limitations. It just felt like, "What can I do that's really cool within these confines?" And then later on it was like, "Well, now we could have, even instead of ten random audio files for this one thing, we could have one hundred." And eventually you get to the point where you don't seem to even run up against any limits of how many voices could simultaneously play.

It's not dissimilar to early multi-track recording. The Beatles did *Sgt. Pepper* on a 4-track machine. And just because you have an 8-track machine doesn't mean you're gonna make an album that's twice as good as *Sgt. Pepper*. Right? I mean that's not where the goodness comes from. It maybe takes some of the constraints off you in certain ways, but it doesn't necessarily make you more creative, or make the final product actually better or more memorable.

And I think even with recording, when you don't have to make decisions because you are not going to run out of space digitally, you can have thousands of tracks in your session. That actually could be a hindrance to creativity, because now you're just muddying it all up. You'd never make a final decision, because there's nothing constraining you. So, I believe that right now, it's pretty much: whatever you can imagine, you can do. So, you have to figure out how to put some constraints on your imagination. If that makes sense.

K.B.: *The games that you worked on used both synthetic sound and live samples layered on top of each other. For the first couple of games, using the original Xbox, that would have been compressed quite heavily. Do you feel like that took away from your actual compositions themselves?*

M.O.: No, not really, because [with] some of the pieces that I had written for *Halo 1* in 2001, [the issue] was more of a budgetary constraint and a time constraint, and so by the time we got to *Halo 3*, I went back to some of those pieces that were heavily sampled and synth-produced and I said, “I’m gonna blow this out and use all live players in an orchestra.” One of the ways I approach music is, if I’m trying to sound like real players, and I don’t have the budget or the time or the wherewithal to hire real players, I’m trying to make the synthetic stuff sound as musical as I possibly can. And then sometimes it’s like “No, I actually the sound of the mellotron strings. They’re spooky and creepy and weird.” I’ll still play them musically, but I don’t necessarily want to replace them with a live orchestra, because something about that color that was cool for that. Because I’m always thinking about live players. I’m going to do my best with a sampled oboe to make it sound real, but if I have the wherewithal, I’m going to say “No, I’m hiring an oboe player,” Because, whatever I’ve done, however hard and long it’s taken me to make that oboe line sound like a live oboe, I can be like “Wow! That’s really good. I think I did really well.” And then I get a real player to play it, and it just elevates it. Live players are gonna make a live-sounding thing so much better, so much more musical.

So yeah, most of it is not so much technical [restraints] as budget and time constraints. We could have done [live music] instead of trying to fake the live stuff in *Halo 1*, although we did have a lot of live players for *Halo 1*. But I stretched that as far as I could. I grabbed the cello stems from a live session and brought it into a new piece, and then put something else on top of it. But I knew that as long as there were still some live players in there, it would sound cooler overall. And frankly, when they went back and did *Halo Anniversary [Edition]* ten years after we had released it, they re-recorded all the music. You might be able to say, well technically or fidelity-wise, it’s better. And maybe it’s a better mix on some things, but you know, is every piece you’re hearing that’s been re-recorded better than the original? I think you can question that.

So, with *Halo 1*, we were primarily using Digital Performer and Pro Tools. Pro Tools was, at the time, less about instruments and sequencing music and more about audio production. But eventually, I felt like Pro Tools started getting better and better at the sequence inputting, with me actually sitting at the at the keyboard and doing MIDI straight into Pro Tools and hearing it and mixing it. So, by *Halo 2*, *Halo 3*, *ODST*, and *Reach*, it was almost entirely Pro Tools.

And that’s just on the production side. Of course, when you go to any of the big studios by that point in the early 2000’s, almost every major studio had a Pro Tools rig that recorded stuff which, in the nineties, was not the standard. In the nineties, it was a lot of two-inch analog tape machines. So, we used to go back and forth between digital audio workspaces and analog two-inch tape. But you know by *Halo 2*, it was almost entirely Pro Tools. But there’s so many great DAWs out there now, and the only reason I haven’t switched to other DAWs is because I’m old and stuck.

K.B.: *You mentioned in a 2004 interview with Nico from Red vs Blue that you used full synthetic and live music by setting a guide track for the string players to play over. Can you kind of describe some of the details of that process, and both yours and the musicians’ level of direct involvement with that?*

M.O.: This happens in the movie scores all the time, and a lot of game scores do it this way. Even if you know you’re gonna hire a live orchestra, a lot of times you will lay temp tracks down and stems that are like guide tracks. So, I’ll have the violins and cellos as separate stems. And then, depending on how big of an orchestra I’m hiring—For example, on the *Halo 1* soundtrack, I had six string players: four violins, two cellos. And I knew that, in order to get a big enough sound, not only would I have to overdub the violin several times, which means you can’t just have a brand-new conductor. Because you have to have a click track of some sort that the musicians are listening to. And once they lay their parts down, they could

listen to themselves. And in the final mix, however much sampled stuff I want to keep in the mix. Sometimes I'm like "Wow! This actually sounds better with no sampled stuff." But they all use it as a guide to play against. But it makes it easy, because the first track, [which is the] first pass for the strings, let's say [it] will be tutti, so four violins and two cellos. "Each one, play your part. Go." And that's a very thin-sounding tutti track, right? Then it's like, "Now let's go back and listen to what you just did, but all four violins play first violin. First chair, first stand." So top line, first violin. "Okay, now everybody switch. And now we're going to do second [violin]. Second stand. And now everybody's gonna pile on the second violins." So, you'd start thickening it up. But in order to do that, you have to have this guide track there to begin with. And then it depends on how big of a production budget you have, whether or not you keep any sampled stuff or synth stuff in. If you're going for pure orchestral sound, you might not want anything that's fake in there. If you're going for a hybrid sound where you've got crazy synth percussion or sampled weird synthesized sounds that are part of the piece, all that stuff is kept in. For example, when I did "Music of the Spheres" for *Destiny*, I got the opportunity to do an orchestral suite recorded with a hundred-piece orchestra and twenty-voice choir and the whole thing. And my vision for that was, "Okay. No stems, no click track. I'm gonna have the whole orchestra in the room and then conduct it on the stick." So, I had no constraints in terms of, "At two minutes, thirteen seconds, five frames, this has to happen." I had no constraints. So, whatever the tempo was, and whatever the rubato was, and whatever-you know, if you do a fermata and a rest, the room is still ringing. Then you don't bring the orchestra back in until it feels right. I know this probably sounds funny to you, but it's like "real music." But for so long, I had been in production music where you have all these other constraints you have to have, technically hitting timings and all the rest of it. So, you're sort of pretending like you're making real music. It was fun to get back to the "real music" production.

K.B.: Within the gameplay itself, would you consider your writing more adaptive? I know that you had to make a soundtrack that was evocative, because the game was so story-centered. But how did you work around making your own compositions adaptable to the gameplay?

M.O.: That is a spectacularly good question, in my opinion, because very few people talk about that. But the thing that attracted me to doing music for video games was this non-linear adaptive concept where rather than having, "Here's your constraints. You start here, and at twenty-two seconds, the guy kisses the girl, and at thirty-two seconds, the building blows up, and then the car drives away." And so that's the scene you're scoring, and you just score according to that story. But in games, the player's in control of all timing. The player's in charge of story beats. How do you still give that score and make it feel like you're scoring the emotional journey of the player without letting the player know that you are adapting to what they're doing? So, I thought, "Well, these are fantastically cool puzzles that no one has solved before." I felt really good about being one of the people at the leading edge of trying to solve that. But one thing I found was, and I still to this day, when I listen to game stuff- I think sometimes with game designers and the directions they give to the composers, they try to figure it out ahead of time, like you can only write certain kinds of music that can then be adapted. And what I found was that it was better for me to just write music that I thought was right and good and cool and enjoyable. And then I look at that music and I say, "Okay, here's where I'd like to use it." How do I take that music and adapt it to significant moments? And how do I branch into, "Well, here's this middle section. It could go here or here if I remix it, or if I take the stems and I do things..." So you've looked at like horizontal or linear approaches to adaptive music, both of those are very successful ways of making music adapt to players' choices. But what I found was, if you start thinking about writing based on the choices, you probably will write a boring piece. But if you write a cool piece that's exciting and really interesting to listen to, you probably can disassemble it and reassemble it in the engine to make it adapt to the players' choices. So, I have my composer hat on when I'm composing, and then I have my game design technician hat on when I'm implementing. And every once in a while, I go, "Okay, this piece won't work unless I not only disassemble it, but I write a new little section that I know I can use." So, I go back into the composition

part. But it's always been easier for me, and this is just my approach, to come up with a piece of music that I enjoy listening to. And then I think about how to make it adaptive.

It never really occurred to me that there would be someone else. I worked with the programmers to give me tools to make music more adaptive, and that grew as we went. It started off with- I had a very simple way of doing it. I know where I want it to start. I know how I want it to end. And there's a lot of different ways you can have a piece of music [do that]. It can fade out. You could have an ending that sounds like an ending. You can have one or two different endings. As long as you know when the ending is triggered, you could have that. And then, in the middle, how do I make it so that it's expandable and contractable so that when you listen to the final product based on the player's choices, it still sounds like one piece of music? And so, as [the player], you played through a section and it took you two minutes and ten seconds to get through. You had a beginning, middle, and an end, and it felt like it was [musically] scoring your activity. Now let's say I'm a speed runner, or I'm really good at something. Or I'm really bad, and it took me four minutes to get through it. If the [musical] piece is interesting enough, and I had to go that long, then my experience was a score that was four minutes long. I never wanted the player to be aware of how I was doing that. I never wanted them to know, "Oh, I just triggered the enemy thing," unless it was a really specific thing. Sometimes I would have stingers that I knew I could just pop in on top of something that was already playing, and it didn't matter where the stinger hit. It'd be like a cymbal crash. You can put a cymbal crash any place and make it sound like it was planned. But then, as we went, I would say, "Hey, you know what I'd like to be able to do? The same kind of controls I'm doing but have stems so that I can bring a different layer of music in or out. I want to have stems, and in the middle, I want to have a more intense piece of music that it could transition to, or a less intense piece of music it can transition to." So, I had transition things. I had different levels of emotional intensity. And it got more and more complex so that any one piece and encounter that, in real time, is being played back could be vastly different experiences. I worked with the programmers to let me have those triggers that I could play with. And then I would be with the level designer and I would say, "Okay, you need to start 'Music 1' here when this happens" or "When this happens, 'Transition 1, Transition 2, let it play. And then if the choice is this, trigger this. If they go past the bush and they trip, trigger this.'" So, if we had some very complex scripted triggers inside the game itself. And I worked with the designers, and they would say, "Hey, Marty, we need music for this encounter" and I'm like, "Okay, here's what I think would be good." You know, I would sit with the designers for the level. I'd be sitting with Jamie Grasmir for "Silent Cartographer," the fourth mission in *Halo 1*. And I would say, "Okay, here's how we [do this]. There's a cinematic at the beginning. Here's how we transition out of the cinematic musically. When this happens, trigger this line of dialogue, which also triggers this music cue." I would say, "Jamie, where's the player going to go?" And he's like, "Well, the player could jump out of the drop ship, and he could go straight into where the battle is, or he could turn around and go the other way." I'm like, "Wow, okay, that's really fascinating." Now, in order to finish the mission, there are certain specific things [the player has] to do. And so those moments are always going to be the most important moments for me [when] scoring. But I also have to make it so that [they] feel engaged, no matter what [their] choices are. I would sit with the designer and play through the missions over and over again, and then talk to them about what sort of emotions they feel like they want the player to have as they're playing. And then I would go back and do my best work, and then bring it to them, and they would implement it, and we'd play it again. I'm like, "Oh, boy, that didn't work. Let me try again." It was a really cool, interactive process.

I'm gonna say this again, and this is the same with sound design, you want to work so hard that the player is unaware of how hard you work. The player just feels at the end of the [game] that they had this great experience. You want the sound design to seem so real that they don't even consider the idea that somebody created that. You want the score to feel like it just played with what you were doing. You felt that your experience was enriched by the score, but you weren't aware of it at the time. So that is not an easy thing to do. I think some games do it really well, some games don't. Sometimes I'll hear games with just fantastically produced music that seems somehow like, "Why is this playing now? What's out of

place?” It's sticking out. Immersion is number one, in my opinion. And in the kinds of games I like to work on, you want people to stay in your world forever and never be aware.

K.B.: *What sorts of compositional techniques do you use to reconcile differences between story-based adventure games and other more action-based FPS games like Doom?*

M.O.: Well, I think this happened in *Doom 2016* and *Doom Eternal*. But here's the difference: Mick Gordon was not audio director. Mick was a hired gun composer. Mick is amazingly talented, and I know he was trying to get as much of his aesthetic in as possible, but he was also constrained a little bit by the producers, directors, internal people who said, “This is what we want. We need you to fulfill our wishes.” And that’s the very first thing that the *Doom* guys do, which I would not be able to do. I would fight against it until they fire me. They want non-stop music. They want music that is always playing. I do not like that approach. I don't like that approach when I'm playing a game. In a story-based, like *Journey* or *Flow*, or something like that- The first time I started playing *Flow*, I remember going into Bungie and saying, “Oh, there's this new game on the Sony, it's called *Flow*. It's unbelievable.” And one of the designers was like, “Well, that's not a game.” And I'm like, “You're too young to be that prejudiced! Are you kidding me? Of course, it's a game. It's an interactive, amazing game experience.” So, I could imagine where the music is so important and an integral to what's happening in the game, and it's not a specific story. It's this experience that I can imagine as sort of like a ballet. So I guess when it comes to telling a story, there's going to be characters and acting and voice acting, like a movie. I don't want to go to a movie that has non-stop wall-to-wall music that sort of gives an old-fashioned feel, where everything that was happening on the screen, the musicians cued. You know, “Oh, he's walking by a fence, so we'll do fence music.” I'm like, “Wait, what?” Or they go up the stairs and the music goes up, you know? There's so much scoring in some of the earliest films. I feel like you want to use music when it's impactful. And so that means you should have a lot of silence, and silence is not silence. It means just no music. You still have so many other audio elements to play with outside of that. If you don't have wall-to-wall music, then when the solo oboe comes in suddenly, it's like, “Oh, that's doing something.” But if you have this wallpaper of music, then it's really hard to get any emotional impact out of *more* music. But with *Doom*, I think they have this aesthetic where it's an adrenaline rush the whole time, and they just want this non-stop score to happen, even though it has different ups and downs and intensities. So, number one, I think that's probably the biggest difference in approach between *Halo* and *Doom*. I feel like *Doom* is adrenaline driven. And it's like, “Yeah, we're gonna have music all the time.”

K.B.: *As someone with a background in music theory and music history, in what ways do you incorporate your knowledge of music theory, symphonic instrumentation, and [the history] of Gregorian Chant and Qawwali into your own works?*

M.O.: There's nothing that's off the table. Once you've immersed yourself into all this education and music appreciation, it just opens that world up. If there's some area that I don't know how to [navigate], like back when I was doing commercial music, sometimes the assignment would be “Yeah, we need you to sound like a ragtime-type piano with this kind of style.” And I'd be like, “Wow, I don't know anything about that.” So, then I have to go study it and see if I could do it. I can listen to music and engage the left side of my brain. I can disassemble it. I take it apart and try to figure out what makes it tick and what makes that style or that genre of music. What are the elements of that stuff? Then I like to put the right side of my brain back in gear, and take those elements and see, “Can I do something that now comes through my creativity?” I've talked about the idea that you're immersed in culture, which means the musical culture I've been immersed in my whole life I can't get away from. But as soon as I try to copy something, then I've lost my compositional integrity. My artistic integrity. I remember doing a thing on a commercial, and I don't even remember where the idea came from. But it would need to be some Mozart thing, I thought, “Oh, Mozart, that's cool.” And so, instead of listening to Mozart— I've grown up playing Mozart. I've heard Mozart— I just thought, “Okay, what were the elements of Mozart that stands out in my memory as being ‘Mozart?’” And then I thought, “Okay, this is one of those like, ‘what would Mozart

do' moments, right?" So, I wrote this piece, and I'm not saying it's as good as Mozart, but it might be as good as Salieri. It definitely had that eighteenth-century classical form, and I really enjoyed it because I thought, "Well, that's not a piece that I'm copying. It's not a piece that's been done before, but the spirit of that genre is something I have absorbed and tried to do." So you don't want to copy culture. You want to create culture. That's something I say, and that might sound egotistical. But if you're a composer, you'd better have an ego of some sort. But what I'm saying is, as soon as I hear something that I can tell, "Oh, no. That person is just trying to sound like something that is already out there. They're copying something, because that's the assignment." And that just doesn't work. You gotta figure out a way to bring your own spark of creativity to something. But you're never going to get away from the culture you've been immersed in, which is one of the reasons why I think it's good to have as broad a taste as possible.

It's interesting, but I did a YouTube video where I talked about the *Halo* theme and emotional equity, which means that once you've heard something, you develop "emotional equity." I call it equity because it's like the emotions that somebody is feeling when they first hear this theme; those are emotions that are now in the bank. There's equity there. So, if I recall that theme later on, it's going to bring back those feelings along with, perhaps, some new ones. That's one of the reasons why themes can have such a strong impact is because they were heard already. So, in a through-composed approach where it's just "action, action, action," everything's new. But if you do brand new stuff, that's just gestural. I hear a lot of film and game scores that have spectacularly good gestures, but nothing sticks with me. I don't remember it. It's just a gesture. But if you watch a John Williams scored movie, you're gonna have emotional equity; those themes are going to come back and they're going to come back slightly differently. And yeah, he can use gestures. But he's going to have gestures with themes, and they mix together in such a spectacularly good way. And that's something I feel like you have to do. I did something similar in *Halo*. All the different elements of even just that opening three-minute theme that we did in 1999 are sprinkled all throughout just *Halo* 1. And it was funny because I had actually forgotten how many places I had developed snippets of those themes. It can seem like laziness, and maybe sometimes it is a little bit on the lazy side. But it has a lot of impact.

K.B.: When you look into the field of ludomusicology, it seems many assume that composers are really in touch with chord progressions and are using academic terms and approaches when they write. Is it really just about what sounds good to you, or are you truly thinking about the Neapolitan 6th when you're writing?

M.O.: When I was at USC in grad school, I was a TA. But for me with music theory—which is not going to surprise you—I'm somewhat anachronistic. Look at the way music theory is taught. I was a Leonard Bernstein fan as a kid. And now I'm not. It's like, "Leonard, you got it wrong. You took us down the wrong path. That is not the important thing." When I teach music theory, I have a really straight-ahead approach to it. All music theory is the study of different moments in time. And how composers did things. That's all it is. There's no right and wrong. But if you want [something] to sound like eighteenth-century classical music, these are the constraints you have to work with. This is the way they thought about music. If you want to do twentieth century, this is the way these guys thought about it. But I know I've had people ask me about things like, "Oh, man. augmented sixth chords. I dropped out of theory as soon as they got into that. It was so confusing." I'm like, "Are you kidding? I could teach you augmented sixth chords in like half a minute. It's the simplest thing ever." Don't be made afraid by any academic technical stuff. But when I got into composition, if you're thinking about theory when you're composing, you're gonna have a problem. Even when I decided I needed to do something that sounds like Beethoven, or I needed to do something that sounds like Barber, I don't want to copy. I just want to sort of put myself in that milieu. "This is the way they thought about things. Okay, so what can I do? That's new inside that little bubble?" And I don't think any game composers are thinking about theory. I don't think a good composer really thinks about theory while they're composing. It's not a helpful thing. Now, the one thing I do think is part of my style is that I was very taken with counterpoint. So, rather than always having a chord progression or a homophonic approach to composition, I really, really enjoyed the freedom that

sixteenth-century counterpoint [gave]. I know that species counterpoint seems super constrained, but it's actually not. Once you get through it, there's so much you can do when you're not constrained by four bar phrases and perfect authentic cadences, and all of this junk. They didn't care about any of that. They just cared about making good melodies that worked with each other. And I've always enjoyed having a more contrapuntal approach to music so that I don't get stuck. I mean, I still get stuck, but it's not so much about "Here's a harmonic progression that I want to do." It's like, "Here are melodies. What's another melody that it works with?" And then I look at it, and I go "Oh, that's interesting. That got me to a chord I never would have thought of." But the melodies took me there. So, the vertical alignment happens because of something that I did with melodies.

I can kind of feel when composers are stuck and every once in a while I just want to say "You know, what you could do is just break out of that by approaching it again and thinking of a different thing." The classic thing I talk about that people tend to misunderstand is that when I had to drive to the studio, we had a weekend to come up with a *Halo* theme and I had already been working on *Halo* and the sound design stuff. We were still in the proof-of-concept area, and I was adding sound design and a bunch of stuff. We had no clue what the story was going to be yet. We didn't even know about Master Chief yet. But we had this world, and then we were going to have to suddenly do this big show in 1999 at Mac World in New York with Steve Jobs showing it. And so, we were going to do the scripted demo that played off the computer, but there was no sound. Because it was on a Mac, and we hadn't worked on the Mac yet. So, I said, "Let me do a sound. Let me just do music for it. And we'll just have music play at the same time from a CD player. So, somebody hits play on the CD. Somebody hits play on the computer at the same time, and we'll see how it winds up." Before I knew I had to record this thing, I said, "Let me record it with violins and singers, and I'll figure out what it's going to be." They're like "fine." So, I asked the writer, "What's the emotions we're trying to do?" And he says, "Ancient, Epic, Mysterious." I had only these three words. And so, as I was driving over to Mike's basement studio at this point, I thought. "Okay, I need to do something that feels ancient." Gregorian Chant is ancient. I need a sticky melody, maybe in Dorian. If it's going to be a sticky melody, I want it to be a strong enough melody that people will sing it after they hear it. That'll be in their head. So, it's got to be a jingle. It's going to be a Gregorian Chant. And I thought, "What's a really good melody? Well, Paul McCartney's 'Yesterday.'" It's a good melody. There are four phrases, one high point, one low point. Now I'm going to do a Gregorian Chant melody that has four phrases, one high point, one low point, in Dorian. And maybe it'll be sticky. And that's where the melody came from. But people go "Oh, you copied Paul McCartney's 'Yesterday.'" I'm like "No, no, that's not a copy." I worked with Paul, so I talk to Paul. He doesn't analyze like I do. He's never had any formal education, so he doesn't even know how to analyze. So all he knows is like, "Where did that melody come from?" He basically dreamed the "Yesterday" melody, woke up, had it in his head, and didn't know where it came from. Then he went out and did some really dumb melodies. I wish I could explain to Paul. "Here's why that melody is so good." Because when I teach composition to some kids, I'll say, "Look, one thing you should do as a compositional technique is, take a melody that you love and look at it, analyze it, and then change one note to make it a bad melody. Once you do that, then you can start looking at your own stuff and say, 'This melody isn't working for me.' What is it about it that's not working, and it could just be that you keep hitting the same top note three times in a row? Try taking the second time and go up a step. Don't even think about progression. Don't think about anything else. Just think about the shape of your melody and try something technical to see if it changes it." It's funny how few people do that or think that way. But they're not taught. And I think that's the biggest problem with Western music. It starts all the way back, I think, even to Bach chorales. We talk about voice leading- and voice leading is important, but voice leading comes from counterpoint, and then it got stuck into progressions. Bach is never that bad. But what I mean is that all these kids who are like "Well, I'm in a rock band, and we play C, F, G. Or we play A, F, G." They play three-chord songs, and everything is locked into these chord progressions and they don't know how to break out of that. And there's nothing wrong with chord progressions. It's just it's not the only way to approach music.

Excerpts from an Interview with Joshua Mancell (*Jak and Daxter*)

Conducted via Zoom, November 18, 2022

K.B.: *Your first project as the lead composer was Crash Bandicoot. What did you find similar or different composing for the original PlayStation versus the PS2?*

J.M.: Well, technically speaking, it was pretty much the same method, and I don't know how much you want me to get into technically how I did it. I'll just backtrack to when I worked on the first *Crash* game on the PS1. What was appealing about it was that I didn't have to use a preset general MIDI palette. I could actually choose my own instruments, which is a huge leap from what I thought I was getting into. When they first asked me, "Do you wanna work on this game?" I thought, "Okay, it's gonna be like a chiptune kind of thing. It's gonna be like, kind of *Mario*." And I was just like, "Yeah." I was happy to work on anything really. I wasn't that excited because I didn't think I'd be able to use interesting sounds. But it turns out, the technology was such that I could use whatever sound I wanted as long as I could sort of reduce it to one note for every instrument, if that makes sense. I would do all my composing and mixing as a reference piece for them to listen to and comment on using multi samples and having it sound pretty good. But I also had to keep in mind that when it finally got into the game, it was gonna be quite different as far as the sound quality goes. But at that time, I was so happy that I could use my own sounds that I didn't even feel super bummed out that I was gonna be reducing it to this smaller version of what I created in the real world. With that being said, I feel like I had to be really careful about what kinds of sounds I used. There were certain sounds, like certain organ sounds or certain guitar sounds that I couldn't really do chords [with] very well because somehow, if you use one note, the harmonics don't work out quite so well. It was definitely a period of trial and error where I kinda had to figure out what sounded good on such a small scale. And I feel like that also informed the way the music sounded or the compositional style in a way. I was better off using really short kind of percussive sounds that, in a way, dictated the style of the music. So when I was done with a piece of music and it was approved, I would export my MIDI files as a general MIDI file. And then I would take, like I said, one note of every instrument, generally in the center part of the range, and that would be reduced to just one single sound file. And then from there, the programmers at Naughty Dog would take that sample and then down-sample it further to its lowest form before it basically turned into dust. In the first game, they had to do it sort of like, if full-res was like 44.1, like CD quality, they could only cut it in half. [With] certain sounds, we had to make a strategic decision, "Okay, well if we're gonna have this cymbal really have a good sound, then we're gonna have to take it away from another instrument." But on the second game, they developed this tool that could do a custom downsampling, and even though I wasn't the one who was crunching the numbers, I felt like there was a lot more flexibility, "Well we can have this sound." So we could have samples that were 4.5K and 8.7K. You know, we could get really specific about it. So going back to that method, that was the same for the first four *Crash* games and also the first two *Jak and Daxter* games. So, it was limiting because I felt like I really had to stick to a certain style of music. It was hard for me to do long sustained notes. If I was going to use a background ambience, which I did end up using on quite a lot of the underwater level of *Crash 3*, there's kind of like that underlying bubbly sound. That was a decision that we made. It's like, "Oh yeah, let's use some of our sound budget to have this nice ambience." And it wasn't until the very last *Jak and Daxter* game that I did, *Jak 3*, where we were able to stream full audio files. And then the shackles were off and I didn't have to worry about that so much. So, that was sort of like the big leap, but I didn't really get to that until the third game I did on PS2, even though other games were streaming audio. Like with Naughty Dog, you'd have to ask them why they waited so long to do that. My feeling is that they were spending so much time and game space improving their graphics and their gameplay, that the music and the sound effects always took a backseat to that, which is kind of common for any media really. We're always kind of last in line and have to take what we're given.

K.B.: *When you're brought onto the project of a new game, what are some of the first things that you consider? Is there a similar process for each project that you work on?*

J.M.: I feel like with every single project, whether it's a game or a film, the person who's making the initial creation has the creative vision. Like, the director usually [has] at least a vague idea of what kind of music they want. And they might even give you a handful of references before you even get started. Like, "We're thinking something like this." Like on the first *Crash* game, I thought it was gonna be much more of sort of like a melodic chiptune kind of thing. But that wasn't exactly what they were looking for. They wanted something that felt a lot more atmospheric and maybe a little bit more experimental. And so they gave me a cassette from this band called Dead Can Dance, which is like an eighties band that was not goth, but definitely very ambient and not necessarily like wall-to-wall melody. I was kind of taken aback because I was ready to do like all this cartoony music, which, it's still kind of cartoony. But there's those directors coming to you with preexisting ideas of what they want. And then there was a fair amount of concept art- they call it a Bible, but it's really just their internal creative brief or style guide. And it's like, "Here's what these characters are gonna look like. Here's what their personalities are like." And they gave me one of those at the beginning when the game was still called *Willie the Wombat*. They had already come up with this stuff over a year before I even entered the picture. It definitely informed a lot. You look at these pictures and it looked like, "Oh, I wanna watch this cartoon on TV." It was very well-developed. But in a lot of cases, music shows up a lot later in the process. They had a lot of levels that were sort of close to being finished, but just without music.

I actually went in there and picked up one of their test consoles and played through quite a few levels without music, just to get a vibe for what the intensity was or the rhythm of it. And that was part of the process throughout all the games. I would periodically go into Naughty Dog maybe once a month and just check out what they were working on and, "Oh, this is gonna be coming up in the next couple weeks. You might wanna check out this medieval level and just see what it looks like." Then you just filter it through that pre-creative part of your brain and then you access it when you're sitting down at the computer. And they even went so far as to make videotapes of the testers playing through levels. I wouldn't actually see the tester, but they would be playing through it and they were able to record the game being played. And then they would put it on a videotape, send it to me, and then I could put it into my video machine and sync it up to my music so I could score it like a TV show or a movie. And then on the *Jak and Daxter* games, they gave me a testing console that I could set up in another room at the studio, and they would send me discs of top-secret kind of stuff. They would send me these burned PlayStation discs and I could pop 'em in and actually play through it, which was kind of a test of my own self-control because these games were really addictive. I remember bringing in that first one and I found other people sort of like going into the room and firing up the machine while I wasn't there. I'm just like, "Guys, you know, I'm trying to work. Don't you have work to do? This is my project. Stop playing my project."

K.B.: *The Precursor Legacy and Crash Bandicoot were both more of a cartoony, cheerier mood. And then Jak II and III are obviously a lot darker with a [more] grown-up plot. For your own composing, what's going on in your mind? What was difficult about switching the tone?*

J.M.: I think I had trapped myself in a corner, creatively speaking. I was used to writing in a certain way. I think I only did one other game during that whole Naughty Dog period, so I really feel like I trapped myself into, "This is the way I should be writing game music." And I knew that something more epic and orchestral was being asked for, and I still didn't really have the technical bandwidth to do large, sweeping [orchestral work]. I didn't really have the skills either. I had done a little bit of orchestral stuff, but it really wasn't my strong suit. I felt a little bit like, "Well, I'm gonna use orchestral instruments and incorporate them into whatever else I'm doing. If I'm gonna have this sort of menacing beat or something like that, I'm gonna add some strings and maybe the French horn," [which] sort of became like the *Jak and Daxter* instrument because, for some reason, I felt like I could be more melodic with it. It wasn't necessarily in a register that was too shrill and it had this stately [timbre]. And so that's where I landed with it. But as far

as the tone goes, it was definitely a shift. Here you have like *Jak I*, [where] he doesn't talk, he doesn't have any weapons, I think he was barefoot. It's very, you know, "jungle boy." And now you have this guy who's cross and talks in a menacing voice and has a gun and a hoverboard. And it did feel like whiplash. I think *Grand Theft Auto 3* was sort of the game changer that really influenced everybody. Everybody felt like they needed to step up the violence. And I don't really think of *Jak and Daxter* games as being violent, but you know, he did have a gun and it was quite different stylistically.

K.B.: You mentioned in an interview with James Troughton that the Jak series was your first interactive score that responded dynamically to the gameplay. Can you describe as specifically as you can what the layering or suturing process was like for the first two games?

J.M.: Well, for the first game it was a lot easier. It was a positional thing. It was intended to help the player navigate throughout the game because of the open gaming world. The *Crash* games were like, "Here's your level." And then you sort of zoom up into the next. It was segregated. And then with the first *Jak* game, you're basically going from level to level, but it was seamless. It was mainly used in the village. You would go to certain parts of the village and then [the characters] would have their own instrument. So even if you didn't know quite where you were or where you were headed, you might hear this instrumental audio cue, like an accordion. And it would tell you that you were back somewhere that you had already been. And maybe it was for younger kids, but there wasn't really a lot of the stuff that we got into in *Jak II*, which was way more specific. You're sort of in 'explore mode' and then things start to heat up a little bit and you hear a sting that leads you into an extra layer of percussion that adds action to it. And that was the same thing for the hoverboard and the weapon. We had to come up with a very simple [layer], usually just a single instrument that could be added to whatever music was playing and turn on and off as you are using a gun or jumping on a hoverboard. And that was a lot of trial and error. I had to write a base [track] that had to be fairly static in terms of how involved it was musically so I could add in these [extra] elements and not have it sound totally out of place or awkward. [They had to be able to] come out basically at any beat [without it sounding] like someone was pausing and unpausing a CD in the background. And nowadays it's a lot more sophisticated; they can do cross fades and it's a whole different world, but back then it felt very much more particulate. We were still dealing with little bitsy things and that's why a lot of those extra layers are really just like, "Here's a little tuned percussion thing that adds a bit of interest," but it's not so specific that it's gonna be really that noticeable as far as a musical element.

K.B.: In today's video games, they have plenty of space to work with in terms of the memory, so [composers are] able to layer [multiple tracks] in a more intricate manner and just mute whatever track they [don't want to be heard]. But obviously that was an issue for the PlayStation2. Technically speaking, how did you navigate that?

J.M.: I did have the lead sound designer. We just kind of figured it out as we went along. I actually don't know exactly where other games were in terms of interactive elements, but it felt like we were just trying to figure it out as we went. It was just very much a trial-and-error thing. And even when we would come up with ideas, I had to just do it. Like my *Jak and Daxter* archives are filled with themes for the game, like a city theme [for example]. And there'd be like ten different variations that I would make, where they would go on for seven, eight, twelve minutes like, "this is what it sounds like when this element comes in." Just spitting out ideas of what could be used for this effect. And we just sort of got through it. But because that process was so tough to get through, by the end of the game, some of the lead Naughty Dogs felt that the music was sort of same-y in a way. They really just needed some straight-up action music that they could switch to rather than trying to have all these interactive elements.

Excerpts from an Interview with Trevor Gureckis (*Dead Space*)

Conducted via Zoom, February 21, 2023

K.B.: *You've done a lot of work for television and film, but Dead Space was your first venture into the world of video games. Shifting from the linearity of film to the interactivity and adaptability of video games, in terms of composition, what was that like for you?*

T.G.: So I didn't have to do any of the implementation of the music into the game itself, but I was very aware of how it was gonna play out. I was given some game captures and later on, I got storyboarded cut scenes with motion capture things put together. Again, it was all so sketchy, but it was at least a guide for how I was gonna score it. It's like "a cutscene leading into boss battles." That was a little bit more traditional, in a way, because I was scoring long sequences and hitting moments that were captured by whoever was playing it. I did have to plan on a couple of things like off-ramps and bumpers that were designed to be a little bit malleable, so that if you're [a really skilled] player, you could just jump to the next part of the boss [fight]. You could also loop it [if you needed to.] It was a little bit of a learning process. I also did a couple of cues that are not on the soundtrack, but they call them generic "move cues." These are multi-layered cues and each layer [builds up to a] full orchestra. And *Dead Space*, in general, [its music system] works with four layers. Say you've got a hallway, and you're going towards an event. Layer one is generally playing most of the time, and then layer two starts to creep up and the intensity increases. And layer three is like, "Something that's gonna happen." And then there's a stinger that's triggered that makes layer four happen, which is like an action cue that mutes the other cues. And then once you defeat all the Necromorphs, it pushes everything back up, and then it goes back down like, "all right." That's the system. Learning that process, and then learning looping and best strategies for looping was an interesting thing. Not anything I did in scoring for film or TV at all, because you're making adjustments for picture changes or whatever happens, [but film is a] much more linear concept. But I was trying to bring linear concepts to the *Dead Space* remake because we were trying to connect [with the audience]. They're searching for [Isaac's] girlfriend, and we're trying to find ways to make emotional connections across the game. So, in some ways, we were searching for more film-like experiences.

K.B.: *Jason Graves used the same system in the original Dead Space regarding the base layer and then the three layers on top that were based on the intensity of the scene. Did they tweak [this system] at all for the remake?*

T.G.: As far as I know, it is the same system. I don't know if it was tweaked or anything. I know they had a whole different game engine, so that might have had some other elements or complications. But there were the action sequences, like the boss music, that I scored five- or six-minute pieces for that I wasn't thinking of in four layers at that time. Those were specific for bosses or [scripted encounters] that sort of conveyed, "What is the religion, or what is Nicole's relationship? What is corruption?" And all these thematic moments in the game.

K.B.: *You mentioned the thematicism of Nicole's theme and the religious undertones of the Cult's themes. Do you find a lot of differences in your compositional approach to those sorts of sequences versus the ambient sequences or the gameplay sequences?*

T.G.: Well, with the gameplay stuff, you're definitely constrained in that, for example, you only have two minutes. You have to make that two minute [limit] work with Jason's material, too, so I had to [ask questions] like, "Could that material dovetail into moments when they were going to use his score?" I wasn't doing the implementation, but I knew that was going to happen. So it was like, "Can we take an example of his?" They had these titles that were called, like, "Creepy Layer Three." And my title was "New Creepy Layer." So we just sort of put them together to see like, "Okay, this would be a four-minute experience now, because I have his part and my part." And then it would be a whole new experience

between both of us. Obviously, the music editors were eventually hired to put the game all together. They were the ones who had to actually see [if it worked]. And I've been playing the game now, so I've been seeing what parts they're using, or what cues they're using. I'm only halfway through it. I'm very, very slow.

K.B.: *It's somewhat unique the way that [sound designers] had Jason Graves's music spliced together with yours throughout the soundtrack. How much creative control did you have in determining how that was executed?*

T.G.: I certainly wanted to make sure that I was familiar with his music for *Dead Space* so that there wouldn't be a feeling or sense that something was dramatically different. I did my best to incorporate similar sonic techniques and performance styles with the orchestra or with my own playing to play on the same stage that he was with the same style that he created for *Dead Space*. He created the DNA that [the music] is based around. And when I would write something and there'd be kind of a review, the audio team would ask, "Does it sound like it fits in the game? Does it sound like *Dead Space*?" And if something was too electronic or something felt a little bit off, then I would revise or change it to make it fit the aleatoric or dissonant tone better. But then I had my own little edge to what I was trying to do, which definitely wanted me to do, but they also needed to make sure that it felt comfortable and natural in the game.

K.B.: *As a musician yourself who also plays games, I know that you've played the original *Dead Space* and you're also a fan of the *Mass Effect* series. [Regarding] your 'composer' persona versus your 'player' persona; do you see yourself as a player or a composer when you're writing?*

T.G.: I definitely try to get in the mind of a player. But when I'm composing, sometimes I would put up *Dead Space* playthroughs on YouTube, totally muted, so I could see if it feels like it's [the] right energy or intensity. [It helps me] get a sense of that drive and the fear and all of the great stuff that was going on in the original. And then the things that I was interested in in terms of my role, which is mostly trying to connect all these narrative plot points. That's a little bit harder to do, because I wasn't able to actually play the game and see how that stuff was going to play out. But I certainly had conversations with the head writer, Jo Berry. But now that I'm actually back to the player position, I'm like, "Okay, this is more of Nicole's theme stuff coming back, which is me playing piano." But I'm hearing it like it's fully developed now.

K.B.: *You mentioned that you are currently working on a playthrough the game. Do you feel like having that curtain pulled back and seeing the inner workings of the developmental stages of the game has colored your playthrough experience?*

T.G.: It's given me some thoughts about things I've learned about sonic qualities and things. I was just talking with my assistant, who did a lot of work with me on it; we were watching the Leviathan sequence and observing how the soundtrack comes across versus how it plays in the game. It's totally different. It's something that I definitely wanna learn more about. It's such a well-developed game with sound design and creature design. There's just so much going on, and I write the music. It's very dense, and I have a lot of musical material. So, when you mute everything and you just play the music, it's overloaded with so much music that makes me realize that some more simplicity and focus could help sell some things that are getting buried [in the chaos]. But there's this whole world of mixing and understanding sound design. How do they know how to get the music to cut through, especially with the loud sound effects? I think there's a lot to be said for that in film, too.

K.B.: *In an interview that Jason Graves did a while back, he mentioned that in *Dead Space 2* there was a shift from the large, scary orchestral sound to a much smaller string quartet that represents Isaac and his feelings of loneliness and isolation. Were you able to follow a similar approach and implement chamber music more in that regard?*

T.G.: I was doing that kind of thing for this remake. I was trying to capture Isaac's journey to the center of hell, and as he's searching for his girlfriend, we're hearing what he is hearing, like voices and hallucinations which we had recorded. They're not Satanic, but they're kind of like Unitology verses. So we [had to] get a little bit closer, because that's the thing about having a big orchestra for these big attacks. It's great for impact and the fear of being surrounded and locked out for quarantine and all that stuff. But then again, for that inner voice in [his] mind, there's something special about having a smaller group of instruments. That was my pathway into that with the piano, as well.

K.B.: *As someone who has written music for a Survival Horror game, how do you implement silence into your music, if at all?*

T.G.: I think the score of *Dead Space* has some tracks that are definitely in the “ambience” world. “Tram Station” is a good example. And it might not be dead silence, but it will be something along the lines of that scope. Like in [the track] “Make Us Whole,” there's a full choir singing just normally-composed “Ahs,” with proper singing. But then I also have this singer who just did all this vocal fry and throat sounds, and other kinds of textures which I'm passing [stereoscopically] back and forth so that she's kind of floating around. And there is a lot of silence in the game. Now that I'm playing, I can tell that there's times where there's no music. And it's great, because I do believe in silence, because wall-to-wall music is oppressive. But for the music that I wrote, I think it's good to have dynamism that's extreme, you know. And I think that that track is pretty extreme. The choir is pretty quiet except for this one singer, and there's some clicks, and there's little percussion things here and there. But then there's also full or smacks and hits where I have all the strings doing multiple high-pressure tremolo stuff. I think that kind of extreme up and down [motion] is really interesting, and I think that it speaks to how the game works. You can play the game, and you can hear anything from his heartbeat just walking down the hallway to all the weird machinery of the ship. And I'm even trying to imitate some of that intimacy, like getting the sound of the ship musically. I have a lot of metallic little instruments that I incorporate on the low end, because I know that they're going to be making those big sounds in the sound design.

I think silence is super important, and it gives player a break between events to understand their space. But even if you're in the midst of a musical cue, having music that's really quiet, like pianissimo—you can still have textures that are really busy and dense, and I think that gives you a bustling energy. And the ship is alive, too. So, it's like I'm trying to describe a lot with those concepts. Even though I might get down to almost nothing. There's still quite a bit of energy to it. There's still something in the background.

Music is super powerful, and it can sometimes be really bad. [Overexposure] leads you the wrong way, and we can get distracted by the fact that there's too much music. It has to be scored very carefully, because that leaves time for people to experience the acting and the drama. [When you're playing a game,] you want to experience the world; you want to experience the universe that's been created. And there's so much sound design and so much creativity and detail. To have a score constantly playing is just too much. I totally think that less is more in that way. If it's not a crutch, it's got to be there for a reason. I think that the best use of music is when there's a reason for its existence. Either to capture the fear or heighten anxiety, or the sense that some impending doom is happening or even some kind of relief.

Bibliography

- “Halo.” Video Game Sales. Accessed March 13, 2023.
<https://vgsales.fandom.com/wiki/Halo>.
- “Interview with Halo 2 Volume Two Composer Martin O’Donnell.” *Music4Games*, April 27, 2006.
https://web.archive.org/web/20080509022635/http://www.music4games.net/Features_Display.aspx?id=45.
- “Just the Right Sense of ‘Ancient.’” *Xbox Online*. March 1, 2007.
<https://web.archive.org/web/20070301150741/http://www.xbox.com/en-US/games/h/halo/themakers3.htm>.
- Alcorn, Allan. *IGN*. By Cam Shea. Ziff Davis, Inc., March 10, 2008.
<https://www.ign.com/articles/2008/03/11/al-alcorn-interview>.
- Ariedo, Eduardo. “Nintendo Switch Surpasses 114 Million Units Sold.” ShowMeTech.com, November 08, 2022.
<https://www.showmetech.com.br/en/nintendo-switch-114-million-sold/>.
- Arnold, Matthew. “Inside the Loop: The Audio Functionality of Inside.” *The Computer Games Journal* 7 (October 2018): 203-11.
<https://doi.org/10.1007/s40869-018-0071-x>.
- Avard, Alex. “The Secret Art of the Video Game Loading Screen, and Why They Won’t Be Going Away Anytime Soon.” Last modified March 21, 2019.
<https://www.gamesradar.com/the-secret-art-of-the-video-game-loading-screen-and-why-they-wont-be-going-away-anytime-soon/>.
- Belinkie, Matthew. “Video Game Music: Not Just Kid Stuff.” Last modified December 15, 1999.
<https://www.vgmusic.com/information/vgpaper.html>.
- Belson, Eve. “The Most Popular Playthings of the Last 50 Years.” *Orange Coast Magazine* (December 1988): 75-91.
<https://books.google.com/books?id=82AEAAAAMBAJ&pg=PA88#v=onepage&q&f=false>.
- Besztocha, Izabela. “Dead Space: A Musical Necromorph.” Last modified October 26, 2020.
<https://gamemusic.net/dead-space-a-musical-necromorph/>.
- Bradford, Wesley. “Exploring the Narrative Implications of Emerging Topics in *The Legend of Zelda: Breath of the Wild*.” *The Journal of Music and Sound in Games* 1, no. 4 (Fall 2020): 1-21.
<https://doi.org/10.1525/jsmg.2020.1.4.1>.

- Burns, Jonathan. "Video Games in the US." Last modified January 2023.
<https://my.ibisworld.com/us/en/industry/nn003/about>.
- Byrne, Brian. "History of the Super Nintendo (SNES): Ultimate Guide to the SNES Games & Hardware." *Console Gamer Magazine* (2017): 46-62.
- Cassell, Justine, and Henry Jenkins. *From Barbie to Mortal Kombat: Gender and Computer Games*. Cambridge, MA: MIT Press, 1998.
https://web.archive.org/web/20160307001348/http://webcache.googleusercontent.com/search?q=cache%3A2W7jV8xhO_QJ%3Awww.economics.rpi.edu%2Fpublic_html%2Fruiz%2FEGDFall2013%2Freadings%2FFrom%20Barbie%20to%20Mortal%20Combat.doc.
- Chang, KyuSik, GyuBeom Kim, and Taeyong Kim. "Video Game Console Audio: Evolution and Future Trends." *Computer Graphics, Imaging, and Visualization* (August 2007).
<https://doi.org/10.1109/CGIV.2007.87>.
- Clement, J. "Global Virtual Reality Gaming Content Revenue 2019-2025." Last modified January 16, 2023.
<https://www.statista.com/statistics/499714/global-virtual-reality-gaming-sales-revenue/>.
- Clement, J. "Video Game Industry: Statistics & Facts." *statista.com*, November 17, 2022.
<https://www.statista.com/topics/868/video-games/#dossier-chapter1>.
- Cohen, D.S. "OXO aka Noughts and Crosses: The First Video Game." Last modified January 22, 2009.
https://web.archive.org/web/20151222084801/http://classicgames.about.com/od/computer_games/p/OXOProfile.htm.
- Collins, Karen, and Chris Greening, *The Beep Book: Documenting the History of Game Sound*. Waterloo, Canada: Ehtonal, Inc., 2016.
- Collins, Karen. "An Introduction to the Participatory and Non-Linear Aspects of Video Game Audio." In *Essays on Sound and Vision*, edited by John Richardson and Stan Hawkins, 263-98. Helsinki: Helsinki University Press, 2007.
- Collins, Karen. *Game Sound: An Introduction to the History, Theory, and Practice of Video Game Music and Sound Design*. Cambridge, MA: MIT Press, 2008.
- Collins, Karen. *Playing with Sound: A Theory of Interacting with Sound and Music in Video Games*. Cambridge, MA: MIT Press, 2013.
- Consalvo, Mia, and Nathan Dutton. "Game Analysis: Developing a Methodological Toolkit for the Qualitative Study of Games." *Game Studies* 6, no. 1 (December 2006).
http://gamestudies.org/0601/articles/consalvo_dutton.

Crafton, Donald. *The Talkies: American Cinema's Transition to Sound*. New York: Scribner, 1997.

Csikszentmihalyi, Mihaly. *Flow: The Psychology of Optimal Experience*. New York: Harper & Row, 1990.
https://www.researchgate.net/publication/224927532_Flow_The_Psychology_of_Optimal_Experience.

D'Angelo, William. "PS5 vs Xbox Series X|S Sales Comparison- September 2022: Sales." VGChartz.com, October 27, 2022.
<https://www.vgchartz.com/article/455260/ps5-vs-xbox-series-xs-sales-comparison-september-2022/>.

Dodsworth, Duncan. "Fourth Generation Video Game Consoles: The 16-bit Generation." history-computer.com, December 15, 2022.
<https://history-computer.com/fourth-generation-video-game-consoles-the-16-bit-generation/#:~:text=What%20consoles%20were%20in%20the,%2C%20and%20the%20CD%2Di>.

Domagala, Marek. "Apex Legends: Pathos and Tension with Fun." Last modified April 4, 2019.
<https://gamemusic.net/apex-legends-original-soundtrack/>.

Donahoe, Billy. "History of Video Game Music." Press for Sound. Accessed March 14, 2023.
<https://pressforsound.com/history-of-video-game-music/>.

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

Dornbush, Jonathon. "God of War Review." Last modified April 13, 2018.
<https://www.ign.com/articles/2018/04/12/god-of-war-review>.

Dornbush, Jonathon. "The Legend of Zelda: Breath of the Wild's Powerful Nostalgia." Last modified March 29, 2017.
<https://www.ign.com/articles/2017/03/29/the-legend-of-zelda-breath-of-the-wilds-powerful-nostalgia>.

Drury, Paul. "The Making of Computer Space." *Retro Gamer* (August 2011): 29-33.

Dudek, Bartosz. "A Sense of Fear and Anxiety in Digital Games: An Analysis of Cognitive Stimuli in *Slender—The Eight Pages*." *The International Journal of Computer Game Research* 21, no. 2 (Summer 2021).
<http://gamestudies.org/2102/articles/dudek>.

- Dutton, Fred. "Behind the Classics: *Jak and Daxter*." PlayStation.Blog, August 24, 2012.
<https://blog.playstation.com/2012/08/24/behind-the-classics-jak-daxter/>.
- Edwards, Benji. "Computer Space and the Dawn of the Arcade Video Game." Technogizer.
December 11, 2011.
<https://www.technogizer.com/2011/12/11/computer-space-and-the-dawn-of-the-arcade-video-game/>.
- Edwards, Benji. "Inside the Magnavox Odyssey: The First Video Game Console." *PCWorld*,
May 27, 2012.
https://www.pcworld.com/article/464739/inside_the_magnavox_odyssey_the_first_video_game_console.html.
- Enns, Mack. "Understanding Game Scoring: Software Programming, Aleatoric Composition,
and Mimetic Music Technology." PhD diss., The University of Western Ontario, 2019.
<https://ir.lib.uwo.ca/cgi/viewcontent.cgi?article=8647&context=etd>.
- Epstein, Mike. "*Doom* (2016) Review." Last modified November 21, 2017.
<https://www.digitaltrends.com/gaming/doom-2016-review/>.
- Etherington, Darrell. "Apple Hardware Sales in FY 2012: 125.04M iPhones, 58.23M iPads,
18.1M Macs, and 35.2M iPods." TechCrunch.com, October 25, 2012.
<https://techcrunch.com/2012/10/25/apple-hardware-sales-in-fy-2012-125-04m-iphones-58-23m-ipads-18-1m-macs-and-35-2m-ipods/>.
- Fell, Bruce. "Bring the Noise: Has Technology Made Us Scared of Silence?" Last modified
December 30, 2012.
<https://theconversation.com/bring-the-noise-has-technology-made-us-scared-of-silence-10988>.
- Fernández-Cortés, Juan Pablo, and Karen Cook. "Ludomusicology: Normalizing the Study of
Video Game Music." *The Journal of Music and Sound in Games* 2, no. 4 (Fall 2021).
<https://doi.org/10.1525/jsmg.2021.2.4.13>.
- Ford, William K. "Copy Game for High Score: The First Video Game Lawsuit." *The Journal of
Intellectual Property Law* 1, no. 20 (September 2012): 8-20.
<https://digitalcommons.law.uga.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1035&context=jipl>.
- Fritsch, Melanie, and Tim Summers. *The Cambridge Companion to Video Game Music*. New
York: Cambridge University Press, 2021.

- Gallagher, Scott, and Seung Ho Park. "Innovation and Competition in Standard-Based Industries: A Historical Analysis of the U.S. Home Video Game Market." *IEEE Transactions of Engineering and Management* 49, no. 1 (February 2002).
<https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=985749&tag=1>.
- Garratt, Patrick. "The Xbox Story, Part 1: The Birth of a Console." VG247.com, August 02, 2011.
<https://www.vg247.com/the-xbox-story-part-1-the-birth-of-a-console>.
- Gibbons, William. *Unlimited Replays: Video Games and Classical Music*. New York: Oxford University Press, 2018.
- Goldstein, Hilary. "Halo 3 Review." Last modified December 6, 2021.
<https://www.ign.com/articles/2007/09/23/halo-3-review>.
- Gossett, Chris, and Martin O'Donnell. "Bungie Podcast: 09/20/07." Produced by Bungie. September 20, 2007. Podcast, MP3 audio, 1:47:39.
<https://web.archive.org/web/20100217080842/http://www.bungie.net/Inside/content.aspx?link=bungiepodcasttime>.
- Graetz, J.M. "The Origin of Spacewar!" *Creative Computing Magazine* 7, no. 8 (August 1981): 6-8. <https://www.masswerk.at/spacewar/SpacewarOrigin.html>.
- Graves, Jason. "'Pure Terror in Musical Form': *Dead Space's* Composer Shares Its Unsettling Secret." By Dom Peppiatt. January 20, 2023.
<https://www.theguardian.com/games/2023/jan/20/dead-space-composer-shares-its-unsettling-secret-jason-graves>.
- Graves, Jason. "Dead Space Composer Interview." By Spence D. May 12, 2012.
<https://www.ign.com/articles/2008/10/18/dead-space-composer-interview>.
- Griffin, Melodie. "Evaluating Player Immersion in Survival Horror Video Game Design." Master's thesis, Ball State University, 2019.
https://cardinalscholar.bsu.edu/bitstream/handle/123456789/201687/GriffinM_2019-2_BODY.pdf?sequence=1&isAllowed=y.
- Grindley, Adam. "The Underappreciated Achievements in the *Breath of the Wild* Soundtrack." Last modified December 28, 2022.
<https://techraptor.net/gaming/features/underappreciated-achievements-in-breath-of-wild-soundtrack>.

- Grixti, Shannon. "Here's an Hour of *Dead Space* Remake Gameplay Footage." Last modified November 13, 2022.
<https://press.start.com.au/news/playstation/2022/10/18/heres-an-hour-of-dead-space-remake-gameplay-footage/>.
- Healy, Nic. "Evolution of the PlayStation Console." CNET.com, November 27, 2013.
<https://www.cnet.com/tech/gaming/evolution-of-the-playstation-console/>.
- Henson, Joe, and Alexis Smith. "The Flight Interview: *Alien Isolation*, Composing for Video Games." By Paul Weedon. October 4, 2015.
<https://www.denofgeek.com/games/the-flight-interview-alien-isolation-composing-for-video-games/>.
- IGN Staff. "The Top 100 Video Games of All Time." Last modified March 4, 2023.
<https://www.ign.com/articles/the-best-100-video-games-of-all-time>.
- Järvinen, Aki. "*Halo* and the Anatomy of the FPS." *The International Journal of Computer Game Research* 1, no. 2 (Summer 2002).
<http://www.gamestudies.org/0102/jarvinen/>.
- Kalning, Kristin. "The Anatomy of the First Video Game." msnbc.com, October 23, 2008.
<https://web.archive.org/web/20151120131805/http://www.nbcnews.com/id/27328345/#.Vk8dtezP2Cc>.
- Kamen, Matt. "PS5 vs Xbox Series X: Which Has the Best Features, Games, and Price?" Wired.com, September 22, 2020.
<https://www.wired.co.uk/article/ps5-v-xbox-features-games-specs-cost>.
- Kamp, Michiel, Tim Summers, and Mark Sweeney. *Ludomusicology: Approaches to Video Game Music*. Oxford: Equinox Publishing, 2016.
- Kelly, Stephen, et al. "Digital Supply Chain Management in the Videogames Industry: A Systematic Literature Review." *The Computer Games Journal* 10, no. 19 (2021).
<https://link.springer.com/article/10.1007/s40869-020-00118-0>.
- Kent, Steven L. "GameCube Timeline." gamespy.com, February 17, 2004.
<https://web.archive.org/web/20080513133120/http://archive.gamespy.com/articles/february04/gcntimeline/>.
- Kent, Steven L. "PlayStation 2 Timeline." gamespy.com, February 18, 2004.
<https://web.archive.org/web/20080509145348/http://archive.gamespy.com/articles/february04/ps2timeline/>.

- Kent, Steven L. "Xbox Timeline." gamespy.com, February 16, 2004.
<https://web.archive.org/web/20080509095112/http://archive.gamespy.com/articles/january04/xboxtimeline/>.
- Kent, Steven L. *The Ultimate History of Video Games*. New York: Three Rivers Press, 2001.
<https://archive.org/details/ultimatehistoryofvideogamesrevisited/page/n3/mode/2up>.
- Koenig, Nicole. "Theater's Nostalgic Connection: Nostalgia's Impact on the Entertainment Industry and Strategies to Solve an Age-Old Problem." Master's thesis, California State University, 2018.
- Kowalczyk, Sebastian. "How Many Games? How Are the Number of Games on Consoles?" Last modified April 24, 2021.
<https://www.isgamers.com/news/how-many-games-how-are-the-number-of-games-on-consoles/>.
- Levy, Laura. "The Effects of Background Music on Video Game Play Performance, Behavior, and Experience in Extraverts [sic] and Introverts." Master's thesis, Georgia Institute of Technology, 2015.
- Lewin, Ben. "The First Gaming Console." Computer Museum of America, October 2020.
<https://www.computermuseumofamerica.org/2020/06/22/the-first-gaming-console/>.
- Lim, William. "A Journey of Worlds and of Sounds: Taking a Look into Soundtracks in Video Games." *Medium*, February 3, 2019.
<https://williamlim3.medium.com/a-journey-of-worlds-and-of-sounds-taking-a-look-into-soundtracks-in-video-games-6151b1a7ab88>.
- MacGregor, Jody. "Seeing with Your Ears: The Audio of Alien: Isolation." Last modified May 10, 2022.
<https://www.pcgamer.com/the-audio-of-alien-isolation/>.
- Makuch, Eddie. "E3 2014: \$399 Xbox One Out Now, Xbox 360 Sales Rise to 84 Million." GameSpot.com, June 09, 2014.
<https://www.gamespot.com/articles/e3-2014-399-xbox-one-out-now-xbox-360-sales-rise-to-84-million/1100-6420231/>.
- Mancell, Joshua. "*Jak and Daxter* Composer Says, 'Distinctness is Born of Limitations.'" By James Troughton. *TheGamer*, December 3, 2021.
<https://www.thegamer.com/jak-and-daxter-composer-interview-20th-anniversary/>.

- McAlpine, Kenneth. *Bits and Pieces: A History of Chiptunes*. New York: Oxford University Press, 2019.
- McCreary, Bear. “*God of War Ragnarök*.” Personal blog, December 18, 2022.
<https://bearmccreary.com/god-of-war-ragnarok/>.
- McCreary, Bear. “The Themes of *God of War*.” PlayStation.Blog, May 8, 2018.
<https://blog.playstation.com/2018/05/08/the-themes-of-god-of-war/>.
- Medina-Gray, Elizabeth. “Analyzing Modular Smoothness in Video Game Music.” *The Journal of the Society for Music Theory* 3, no. 25 (October 2019).
<https://doi.org/10.30535/mto.25.3.2>.
- Monnens, Devin, and Martin Goldberg. “*Space Odyssey: The Long Journey of Spacewar!* from MIT to Computer Labs around the World.” *Kinephanos, Cultural History of Video Games Special Issue*.
<https://www.kinephanos.ca/2015/space-odyssey-the-long-journey-of-spacewar-from-mit-to-computer-labs-around-the-world/>.
- Moore, Bo. “The 100 Greatest Video Games of All Time.” Last modified June 16, 2014.
<https://web.archive.org/web/20161202235359/http://www.popularmechanics.com/culture/gaming/g134/the-100-greatest-video-games-of-all-time/>.
- Moorman, Peter. *Music and Game: Perspectives on a Popular Alliance*. Wiesbaden, Ger.: Springer Fachmedien, 2013.
- Parreno, Ryan. “Gaming Is Five Times Bigger Than Movies Now.” Last modified December 13, 2022.
<https://gameranx.com/updates/id/416500/article/gaming-is-five-times-bigger-than-movies-now/>.
- Pasquier, Philippe, and Cale Plut. “Deep Dive: A Framework for Generative Music in Video Games.” Last modified December 21, 2022.
<https://www.gamedeveloper.com/audio/deep-dive-generative-music-in-video-games>.
- Pearson, Ryan. “Video-Game Melodies Are Going Mainstream.” Last modified August 8, 2005.
<https://archive.seattletimes.com/archive/?date=20050808&slug=btvideogamemusic08>.
- Raynor, Kelsey. “The 17 Best Co-op Games of All Time.” Last modified March 1, 2023.
<https://www.vg247.com/best-coop-games>.

- Rivera, Joshua. "The *Dead Space* Remake Is Revamping Some of the Series' Most Iconic Mechanics." Last modified August 31, 2021.
<https://www.polygon.com/2021/8/31/22650616/the-dead-space-remake-cut-off-their-limbs>.
- Roberto, Andrea. "Why We're Not All Wearing AR/VR Headsets." Last modified August 31, 2022.
<https://arpost.co/2022/08/31/why-were-not-all-wearing-ar-vr-headsets/>.
- Roberts, Rebecca. "Fear of the Unknown: Music and Sound Design in Psychological Horror Games." In *Music in Video Games*. Edited by Kevin Donnelly, William Gibbons, and Neil Lerner, 138-50. New York: Routledge, 2014.
- Rodriguez, David. "*Alien: Isolation* Developers Describe Gameplay as 'Unpredictable.'" Last modified January 20, 2014.
<https://www.dualshockers.com/alien-isolation-developers-describe-gameplay-as-unpredictable/>.
- Rone, Vincent E. "Princess Zelda, Her Lullaby, and the Virtue of Elusiveness." Last modified April 21, 2015.
<https://www.ludomusicology.org/2015/04/21/princess-zelda-lullaby-virtue-elusiveness/>.
- Schneider, Peer. "*The Legend of Zelda: Ocarina of Time* Review." Last modified August 21, 2021.
<https://www.ign.com/articles/1998/11/26/the-legend-of-zelda-ocarina-of-time-review>.
- Shimpi, Anand Lal. "Hardware behind the Consoles- Part II: Nintendo's GameCube." AnandTech.com, December 07, 2001.
<https://www.anandtech.com/show/858/13>.
- Silva, Robert. "What Is Bitstream and How Does It Work?" Lifewire.com, July 22, 2021.
<https://www.lifewire.com/what-is-bitstream-1846846#:~:text=A%20bitstream%20is%20a%20method,surround%20format%20sent%20to%20it>.
- Sites, Joshua, and Robert Potter. "Everything Merges with the Game: A Generative Music System Embedded in a Videogame Increases Flow." *Game Studies* 18, no. 2 (September 2018). Accessed March 14, 2023.
http://gamestudies.org/1802/articles/sites_potter.
- Slocum, Paul. "Atari 2600 Music and Sound Programming Guide." qotile.net, February 19, 2003.
http://www.qotile.net/files/2600_music_guide.txt.

- Smith, Jacob. "I Can See Tomorrow in Your Ludomusicology." *Journal of the Royal Musical Association* 143, no. 2 (2018).
<https://doi.org/10.1080/02690403.2018.1507126>.
- Sofge, Erik. "How *Halo: Reach* Perfected Video Game Audio." Last modified September 9, 2010.
<https://www.popularmechanics.com/culture/gaming/a6078/how-halo-reach-perfected-video-game-audio/>.
- Stanton, Rich. "*Resident Evil: 20 Years On*." Last modified March 27, 2016.
<https://www.eurogamer.net/resident-evil-20-years-on>.
- Stapleton, Dan. "Every IGN *Zelda* Review." Last modified January 13, 2020.
<https://www.ign.com/articles/2019/02/15/every-ign-zelda-review>.
- Stevens, Tim. "Atari *Pong* Review." engadget.com. Yahoo, Inc. April 01, 2012.
<https://www.engadget.com/2012-04-01-atari-pong-review.html>.
- Stokes, Ian. "DVD vs Blu-ray vs 4K Blu-ray: What's the Difference between [sic] Them?" TopTenReviews.com, August 28, 2020.
<https://www.toptenreviews.com/the-difference-between-dvd-and-blu-ray>.
- Stuart, Keith. "Super Sonic: Creating the New Sound of Sega's Hedgehog Hit." Guardian Media Group, February 13, 2020.
<https://www.theguardian.com/games/2020/feb/13/super-sonic-creating-the-new-sound-of-sega-hedgehog-hit-sonic-the-hedgehog-masato-nakamura-tom-holkenborg>.
- Summers, Tim, and James Hannigan. *Understanding Video Game Music*. Cambridge: Cambridge University Press, 2016.
- Summers, Tim. "Playing the Tune: Video Game Music, Gamers, and Genre." *Act: Zeitschrift für Musik & Performance* 2 (2011): 2–27. <https://epub.uni-bayreuth.de/322/>.
- Summers, Tim. *Understanding Video Game Music*. New York: Cambridge University Press, 2016.
- Švelch, Jaroslav. "Should the Monster Play Fair? Reception of Artificial Intelligence in *Alien: Isolation*." *Game Studies* 20, no. 2 (June 2020). Accessed March 1, 2023.
https://gamestudies.org/2002/articles/jaroslav_svelch.

- Sweet, Michael. *Writing Interactive Music for Video Games*. New York: Addison-Wesley, 2015.
- Taylor, Laurie. "When Seams Fall Apart: Video Game Space and the Player." *The International Journal of Computer Game Research* 2, no. 3 (Winter 2003).
<http://www.gamestudies.org/0302/taylor/>.
- Tech, Dave. "Deliberately Diegetic: *Dead Space*'s Lead Interface Designer Chronicles the UI's Evolution at GDC." Last modified March 31, 2013.
<https://www.polygon.com/2013/3/31/4166250/dead-space-user-interface-gdc-2013>.
- Thompson, Tommy. "Revisiting the AI of *Alien: Isolation*." Last modified May 20, 2020.
<https://www.gamedeveloper.com/design/revisiting-the-ai-of-alien-isolation>.
- Thompson, Tommy. "The Perfect Organism: The AI of *Alien: Isolation*." Last modified October 31, 2017.
<https://www.gamedeveloper.com/design/the-perfect-organism-the-ai-of-alien-isolation>.
- Toh, Weimin. "The Economics of Decision-Making in Video Games." *The International Journal of Computer Game Research* 21, no. 3 (Fall 2021).
<http://gamestudies.org/2103/articles/toh>.
- Tuttle, Will. "The Most Anticipated Game in the History of the Xbox Is Finally Here. Was It Worth the Wait?" Last modified November 7, 2004.
<http://uk.xbox.gamespy.com/xbox/halo-2/564301p1.html>.
- Vargas-Iglesias, Juan J. "Making Sense of Genre: The Logic of Video Game Genre Organization." *Games and Culture* 15, no. 2 (February 2018).
<https://journals.sagepub.com/doi/full/10.1177/1555412017751803>.
- Vess, Matthew, et al. "Nostalgia as a Resource for the Self." *Self and Identity* 11, no. 3 (2012): 273-84.
<https://www.tandfonline.com/doi/full/10.1080/15298868.2010.521452>.
- Webster, Andrew. "*God of War* Review: An Incredible Reimagining of a PlayStation Icon." Last modified April 20, 2018.
<https://www.theverge.com/2018/4/12/17223854/god-of-war-review-ps4>.
- Wells, Evan. "*Jak and Daxter* Collection Delivers the Original Trilogy to PS3 in HD." PlayStation.Blog, November 21, 2011.
<https://blog.playstation.com/archive/2011/11/21/jak-and-daxter-collection-delivers-the-original-trilogy-to-ps3-in-hd/>.

- Whalen, Zach. "Play Along: An Approach to Video Game Music." *The International Journal of Computer Game Research* 4, no. 1 (Winter 2004).
<http://gamestudies.org/0401/whalen/>.
- Willaert, Kate. "Pixels in Print: Advertising *Computer Space*: The First Arcade Video Game." The Video Game History Foundation. April 10, 2018.
<https://gamehistory.org/first-arcade-game-advertisement-computer-space/>.
- Williams, Andrew. "SSD vs HDD: What Does Switching to SDD Mean for Next-Gen Gaming?" GamesRadar.com, March 18, 2020.
<https://www.gamesradar.com/ssd-vs-hdd/>.
- Williams, G. Christopher. "Isaac Clarke: Intergalactic Handyman." Last modified February 9, 2011.
<https://www.popmatters.com/post/136940-isaac-clarke-intergalactic-handyman/>.
- Wolf, Mark. "Genre and Video Game." In *The Medium of the Video Game*. Austin: University of Texas Press, 2001.
<http://www.robinlionheart.com/gamedev/genres.xhtml>.
- Yin-Poole, Wesley. "Peter Moore Recounts \$1.15bn Xbox 360 Red Ring of Death Saga." EUROGAMER.com, July 02, 2015.
<https://www.eurogamer.net/peter-moore-recounts-xbox-360-red-ring-of-death-saga>.
- Zhang, Jiulin, and Xiaoqing Fu. "The Influence of Background Music of Video Games on Immersion." *Journal of Psychology and Psychotherapy* 5, no. 4 (2015).
<https://www.longdom.org/open-access/the-influence-of-background-music-of-video-games-on-immersion-2161-0487-1000191.pdf>.

Glossary of Terms

APU (Audio Processing Unit) - The silicon chip that is found in most game consoles and computers that has been purposely designed to process sound and music.

Backwards Compatibility - Refers to a hardware or software system that can use interfaces and data from earlier systems.

BGM (Background Music) - Music that is intended as an unobtrusive accompaniment to an activity.

Bricking - Occurs when an electronic device is rendered unusable due to corrupted software or a hardware malfunction.

Campaign - A continuing and overarching storyline or set of adventures.

CD-ROM (Compact Disk- Read Only Memory) - A type of memory storage consisting of a pre-pressed optical compact disc that contains data.

Combo Building - Refers to a set of actions performed in a sequence that build up points or a score.

Cutscene - A scene shown to a player when they reach a particular point in a game, such as at the end of a level or when the player's character dies.

D-Pad - A set of flat, thumb operated directional buttons on a controller.

DAW - An electronic device or application software that is used to record, edit, or produce audio files.

Direct Sequel - A title that builds on the themes and narrative of a previously released game.

DSP (Digital Signal Processor) - The use of digital processing by computers or other specialized hardware to perform data processing using pulses or other waveforms.

Dungeon - A set location in a game consisting of combat and/or puzzle sequences that often grant the player rewards or story progression upon completion.

HUD (Heads-Up Display) - A method by which information is visually relayed to the player as part of the game's user interface.

LAN (Local Area Network) Party - A social gathering of players in a physical space in which their hardware is connected to the same network in order to play cooperative games.

MMO (Massively Multiplayer Online) - An online video game consisting of a large number of players on the same server.

NPC (Non-Player Character) - Any character in a video game that is not directly controlled by the player.

PSG (Programmable Sound Generator) - A sound chip that generates or synthesizes audio signals that are built from one or more basic waveforms.

Ray Tracing - A hyper-realistic lighting technique used to model light transport for use in rendering algorithms and generating images.

Story Beat - A structural element of a narrative that is used to mark an intentional shift in tone.