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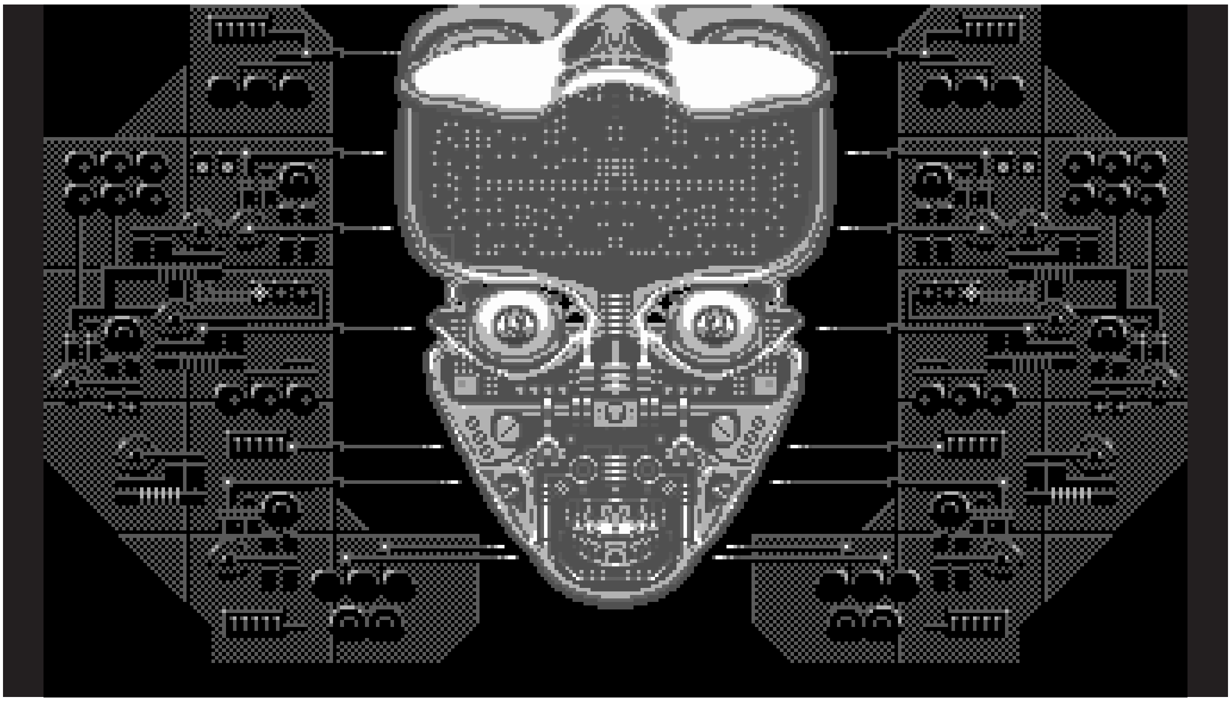
HEAR THE MUSIC, PLAY THE GAME

Music and Game Design: Interplays and Perspectives

Edited by H. C. Rietveld & M. B. Carbone



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CRITICAL NOTES

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Desert Island Diskettes

A Journey through Video Game Sound History

THE CHALLENGE OF MAKING A PLAYLIST FOR GAME SOUND

The sounds of video games have changed tremendously over their history, from about 1971 until now. Having been born approximately when commercial video games were first created and then growing up alongside the games as they evolved, the history of video games is very much a history of my own soundscape as it changed over the years. I had a *Pong* clone (a Telstar Alpha, made by Coleco) in the late 1970s, an IBM PC (the 5150, released in 1983), an Atari 2600, and then later Nintendo NES, Sega Genesis, PlayStation, and so on. What consoles I didn't own, my neighbors usually had (the Apple II, Colecovision, Intellivision, and so on), or my school (the Commodore 64), and I spent many hours of my childhood playing these games.

> the games listed below are the games that stuck in my head over the decades of playing games myself, and became important to me personally through the hours I spent with them. Some have admittedly "terrible" sound by today's standards, but to me, that's part of their charm, and growing up with these games means they hold a special nostalgia that I believe is best captured in their sound, even more than their graphics.

Being asked to make a playlist for game sound has always been a challenge for me. I have stayed away from lists as much as possible in the past, in the interests of not developing a canon for video game music. To me, there are far too many games deserving of our scholarly attention, and yet we in the field already seem to be focusing on just a few games, and a few genres of games, at the expense of others. Despite my long-time interest and expertise in the field, I also don't feel that I am qualified to decide which games are particularly important, or which are especially worth listening to or highlighting. My list below, then, isn't a "most important" or even "particularly notable" games when it comes to their sound and music. The list doesn't cover all of the consoles by any means, and anyone looking for a "best of" is sure to be disappointed by some of my inclusions and omissions. I take the title of my article from "Desert Island Discs", a radio show created in 1942 by Roy Plomley for BBC Radio 4, which would bring a celebrity guest onto the program and ask them to choose eight recordings to take with them if they were cast away on a desert island. They were not meant to be bests of anything, only personal picks that held some meaning, which the guest would explain.

Therefore, the games listed below are the games that stuck in my head over the decades of playing games myself, and became important to me personally through the hours I spent with them. Some have admittedly "terrible" sound by today's standards, but to me, that's part of their charm, and growing up with these games means they hold a special nostalgia that I believe is best captured in their sound, even more than their graphics. Some were games whose composers I have since met, befriended and/or interviewed and are now of interest to me for that reason. Some indeed are usually in top ten lists or were the "first to do something" games, but are chosen here simply for their place in my heart, not for their place in history.

The list is supplemented by interview material I gathered during a year of filming interviews for the *Beep* documentary film (Ehtonal 2016). This documentary is a history of game sound from the penny arcades to today, and involved over 80 interviews with composers, sound designers, voice actors, and others involved in game sound from around the world (shot in UK, Canada, US and Japan, but also including interviews with composers from Germany, Spain, France and the Netherlands). Each full interview is released as an independent webisode, as well as in my two-volume book series *Beep* (Ehtonal 2016). The clips described here have also been assembled into one video that can be streamed or downloaded from our Vimeo website.

1 – *THE TELSTAR PONG* CLONE: (COLECO 1976): ORIGINAL *PONG* SOUNDS BY AL ALCORN AT ATARI

Pong was originally developed in 1972, and was the first commercially successful video game. The home version was sold through Sears starting in mid-1975, but it was one of Coleco's Telstar models that my Uncle purchased one Christmas in the late 1970s that was my first foray into video gaming. The game had no music, and only made simple analogue beeping sounds of different frequencies for the four games (all simple variations on *Pong*) built into the system, but to us children at the time, being able to control something on the television set cannot be overestimated in importance. The game was captivating, and we spent many hours listening to the beeps. Compared to the Magnavox Odyssey, which was also available as a home console at the time, the *Pong* clones were a huge leap forward for the simple fact that they had sound at all. There isn't a whole lot of interest here sonically, but I can still remember hearing those sounds in my head a long time after the game was set aside.

2 – *FLOPPY FRENZY* FOR THE PC BEEPER (WINDMILL SOFTWARE1982): UNKNOWN COMPOSER

Floppy Frenzy was a little-known game that must have been one of the very first educational video games. My father brought the game home with the computer, to teach us children not to put the 5¼-inch floppy disks near magnets or dust. Movement triggers the soundtrack: stop the diskette from moving, and the sound stops. Move, and the sound continues its monotonous, never-ending beeping—a trait also found in *DigDug* (Namco) that came out the same year. It's unlikely that the games were created in the knowledge of what each other was doing, since Windmill was Canadian and Namco based in Japan, so the idea of tying game sound to the action of the main character (very much Mickey-Mousing the sound) may have been independently created, simultaneously. The game also had little bonus, high score and death jingles. It's the death song that sticks with me more than anything (heard at approximately 9:45 into this video): not only did players use to spend a lot of time "dying" in early video games but to me, today, the song epitomizes my experience of audio on the IBM PC: a single monophonic channel playing simple on/off square wave sounds in very short melodies. This was PC sound before soundcards: monophonic, without sound envelope generators, and dreadfully annoying, which is probably where the original option to turn the sound off in games (still present in most current games) came from.

3 – *TAPEWORM* FOR THE ATARI 2600 (SPECTRAVISION 1982): UNKNOWN COMPOSER

Tapeworm still fascinates me. Its atonal melody that introduced the characters of the game at the start was a wonderful representation of the limitations of the Atari 2600 TIA soundchip. Sounds on the Atari chip were created by dividing the system clock into 32 notes. These notes didn't align with just tuning, and the selection of each original note and waveform determined the division of frequencies of the other 32. This meant that each tuning was completely different depending on the first note selection, and for the most part completely atonal, resulting in some bizarre musical creations. I believe that the many hours of my childhood spent in front of the machine were a strong influence on my later musical tastes and even on the development of electronic music in the 1980s general (see Collins 2006).

Beep video clip: The first clip in the video features several of our interviewees talking about the infamous TIA soundchip and its difficulties. First is Brendan Becker, a chiptune composer known as "Inverse Phase", famous for his Nine Inch Nails 8-bit cover album, *Pretty Eight Machine*. This interview was recorded at the annual MAGFest (Music and Games Festival) in January 2015 in Maryland. The second clip is pinball/game composer David Thiel, recorded at his home studio in Seattle in May 2015. The third is founder of music software company Plogue Art et Technologie, David Viens. Plogue makes the popular soundchip emulator software called *chipsounds*, and the clip was recorded in Montreal in June 2015. It's easy to see that all of these folks have a love-hate relationship to the TIA chip: part of its appeal was its mix of very awkward tuning and rich waveforms.

4 – *MONTY ON THE RUN* FOR THE COMMODORE 64 (GREMLIN GRAPHICS 1985): ROB HUBBARD

The Commodore 64 had a much more advanced sound chip than its competitors. I didn't have a C64 at my house, but we had one at school and were allowed to play games at lunch time and during breaks. I remember playing *Where in the World is Carmen Sandiego?* (Brøderbund 1985) a lot, but not *Monty* in those days. However, when I began research for my book *Game Sound* (2008), I played just about every game ever released for the C64, and *Monty*'s theme was one of the songs that stood out for me amongst the lot. Created by Rob Hubbard, the theme uses Hubbard's module format, a way of maximizing the amount of music that could fit into a game by using loops, instrument changes (selections of sounds by picking waveforms and using envelope generators) and transpositions. Because the size of media and RAM was limited, there was a limited amount of space allocated to music. Through simple transposition statements, the same blocks of code could be re-used without the music sounding so repetitive.

Beep video clip: In this clip, German game composer Chris Huelsbeck talks about the Commodore 64 soundchip, followed by Charles Deenen, who explains some of the RAM issues. Both interviews were recorded in San Francisco in March 2015.

5 – *METROID* FOR THE NES (NINTENDO 1986): HIROKAZU "HIP" TANAKA

Metroid, along with *Super Metroid* on the SNES was, and still is one of my favourite games. The *Metroid* soundtrack was so different to nearly everything else that came out on the Nintendo. It used the NES soundchip to full advantage, but more than that, it didn't have the poppy "chippy" sound of so much of the music. The bass channel creates pedal tones that the melody rests on for the Brinstar level, but it's the Ridley and Kraid stages, with its sparse ambience, that captivated me as a young gamer. Not only did the music inspire in me a love of game audio, it's also one of those game soundtracks that inspired others to become game composers, such as Alexander Brandon (who composed for *Deus Ex*, *Unreal* and more).

Beep video clip: In this clip, recorded March 2015 in San Francisco, game composer Alexander Brandon talks about the importance of *Metroid* to his career.

6 – *SHADOW OF THE BEAST* FOR SEGA GENESIS (PSYGNOSIS 1989) DAVID WHITTAKER

The Shadow of the Beast game bears some resemblance to *Metroid*, which is probably why I really liked the game and its music when it first came out for the Sega Genesis. You'll notice we're still in the era of "wall-to-wall" music: non-stop looping background music. The repetition of the really happy chip music of the time tended to grate on me (and most other people in the vicinity at the time), but the more moody, slightly prog-rock styling of Psygnosis games in particular were a wonderful change from that style. Music on the Genesis (or MegaDrive as it was known in Europe and Japan) was created using a combination of FM synthesis as well as the more primitive waveforms of a programmable sound generator (the chip type used up to that time). It was the newer digital FM synthesis chip, which allowed for more realistic instrument sounds that could be programmed in by the composer individually, which defined the Genesis sound.

7 – *MONKEY ISLAND* 2: LECHUCK'S REVENGE FOR THE PC (LUCASARTS 1991): MICHAEL LAND, CLINT BAJAKIAN/PETER MCCONNELL

Monkey Island 2 was the first game to use LucasFilm Games' new (at the time) software engine, iMUSE, or Interactive Music Streaming Engine. iMUSE enabled the game's parameters to control what was happening in the music—if a player was winning a battle, the music could jump to a different cue, and if a player was moving around a space, the music could adjust to the location. The infamous Woodtick scene, for instance, changes music depending on which building the player enters. Although the techniques had been used previously in games, iMUSE made it easier for composers to have control over how music played back in the game.

Beep video clip: In this clip, the three creators of the iMUSE engine—Clint Bajakian, Michael Land and Peter McConnell—discuss iMUSE and the difficulties of the Woodtick scene and interactive music as a whole. All interviews were recorded in San Francisco in March 2015.

8 – *TOMB RAIDER* FOR PSX (EIDOS 1996): NATHAN MCCREE

Tomb Raider was the reason I bought a PlayStation. Not only did the game have a female protagonist, but the wall-to-wall music of the past was suddenly replaced by the game's more careful attention to ambience and using music more sparsely only to highlight key points in the narrative while showing a cinematic approach to the score. In an interview with Nathan McCree, he explained his choices about abandoning the wall-to-wall music in favor of ambience. In part, this shift was influenced by the switch to Redbook (CD-ROM)-based games, which allowed for higher production values, but reduced the amount of interactivity possible in the music. For a time, the concepts of interactive music dream of iMUSE was abandoned in favor of linear tracks, as composers adapted to the new format. McCree explained to me that he had no say in the implementation, which had been done on the last possible day before the game was shipped, and in some cases music was put into the wrong place or not as he had intended, but fans of the game never seemed to notice.

Beep video clip: Composer Nathan McCree talks about the change in the move to CD-ROM with the PlayStation and how that influenced the music and sound of *Tomb Raider.* The clip was recorded in London in February 2015.

9 – *WILD ARMS* FOR PSX (MEDIAVISION/SONY 1996): MICHIKO NARUKE

I'm a fan of Ennio Morricone's music for Sergio Leone's "Spaghetti Westerns", and so *Wild Arms* was a personal favorite not so much for the game, but for the heavily Morricone inspired music. The driving rhythms and some of the themes are close to being lifted directly from Morricone themes, but Naruke puts her own spin on them, and the nature of the role-playing game being set in a cross between the American West and medieval Europe meant a combination of Western themes and more traditional Japanese RPG musical elements.

Beep video clip: Michiko Naruke discusses Morricone's influence on her music for the Wild Arms series. The clip was recorded in Tokyo in May 2015. My interpreter was Alwyn Spies.

10 – *LEGEND OF ZELDA OCARINA OF TIME* FOR NINTENDO 64 (NINTENDO 1998): KOJI KONDO

No list of my favorite game music would be complete without some Koji Kondo somewhere. The composer for *Super Mario Bros* and the *Zelda* series is without doubt many people's favorite. Along with frequently being listed in the Top Ten Games of all time, *The Ocarina of Time*'s music is also among many top 10 lists. The music is carefully integrated into the game, drawing on past themes established in earlier *Zelda* games, but adding new music and allowing player interaction with the music in the form of an ocarina. I'm convinced that the game inspired sales of ocarinas the world over––indeed, there are many Zelda-themed ocarinas for sale. For me, the theme-driven nature of Kondo's music, combined with the careful integration of the music into the game itself, represents some of the best that game music has to offer.

11 – *GRIM FANDANGO* FOR PC (LUCASARTS 1998) PETER MCCONNELL

I first wrote about *Grim Fandango* in my 2008 book *Game Sound.* At the time I researched and wrote the book, the game had been out for a few years, and hadn't really had a huge following or notable public interest, but was near the top of my list straight away. The game has since become a cult favourite, particularly amongst music fans. Peter McConnell's delightful orchestral music fits the game so well—a mixture of the dark underworld Día de los Muertos (Day of the Dead) and mariachi. To me, Peter McConnell is the Danny Elfman of the game music world—he writes playful, humorous music with highly memorable themes, and the *Grim* music is no exception.

Beep video clip: The music was re-recorded and re-orchestrated for the remake of the game in 2015, and I spoke with both Peter McConnell and the recording engineer, Jory Prum, about the work that went into the remake.

They both talked about the difficulties with recovering the original files to remake the music. Jory's interview was recorded in his studio in Fairfax, California, and Peter's clip was recorded in San Francisco in March, 2015. Jory passed away suddenly in April of 2016, and thousands of people flooded the internet to express how much his work meant to them, despite his being very much a "behind the scenes" person in game audio.

12 – *CASTLEVANIA: HARMONY OF DISSONANCE* FOR GAME BOY ADVANCE (KONAMI 2002): SOSHIRO HOKKAI AND MICHIRU YAMANE

The soundtrack for *Harmony of Dissonance* was much maligned by the press, largely for its 8-bit aesthetic, but also for its dense layers and morose themes. I've always enjoyed the *Castlevania* games and their music, but to me, the nature of the music as more complex, fitting the game well, and its 8-bit sound are precisely why I like this soundtrack. The music always heads in unexpected directions, and although it has fewer immediately recognizable themes or melodies, it offers a lot of sonic interest despite having being created on the Game Boy Advance's crunchy speaker and four-tone (plus sample channel) synthesizer chip.

13 – *MARIO AND LUIGI: PARTNERS IN TIME* FOR NINTENDO DS (NINTENDO 2005): YOKO SHIMOMURA

Yoko Shimomura tops my list of favorite game composers, and although her more famous work lies in *Street Fighter 2* and the *Kingdom Hearts* series, it's the *Mario and Luigi* role-playing games that I find most endearing. Shimomura had to take the well-known and well-loved *Mario* musical style and make it her own for the games, a difficult task, but she manages to give each game its own characteristic style and memorable themes. It's worth noting that playing games on the Nintendo DS are always better heard with headphones rather than the limited speakers present in the DS.

Beep video clip: Yoko Shimomura talks about writing the music for the series and balancing adaptations of the original *Mario* tunes with her own style. The interview was recorded in Tokyo in May 2015, and my interpreter was Alwyn Spies.

14 – *BIOSHOCK* FOR XBOX 360 (2K GAMES, 2007): GARRY SCHYMAN

BioShock was the first game music that left me absolutely speechless. I first became aware of the music when I heard Schyman give a talk about it at the Game Developers' Conference in 2007. *BioShock*'s dramatic orchestration and sound design blew away everyone's expectations of what game music was, and what it could be, inspired by 20th Century modernism. I'm also a big fan of Schyman's other music, which ranges from Bernard Hermann-esque *Destroy All Humans* to the beautiful *Dante's Inferno*.

Beep video clip: Here, Garry Schyman talks about the direction he received from audio director Emily Ridgway for the *BioShock* game. The interview was recorded in Los Angeles in October, 2014.

15 – *PEGGLE 2* FOR XBOX ONE (XBLA: POPCAP 2014): GUY WHITMORE

Another soundtrack to blow away everyone's expectations of game music was *Peggle 2*. A casual game created by PopCap, the first game *Peggle* originally established the theme of playing Beethoven's *Ode to Joy* upon each level's success in a game that combines elements of pachinko and pinball. For *Peggle 2*, Whitmore plays on this idea, bringing classical themes with a modern twist to each character, or "master" that the player chooses. My favorite, though, abandons classical music and aims for a bizarre, chaotic dubstep track for character Jimmy Lightning. More remarkable than the music itself is the careful integration of the music into the game—with each peg being a note that harmonizes with the theme for the level.

Beep video clip: Guy Whitmore tells us all about the musical choices in selecting and creating the music for *Peggle 2*. The interview was recorded in Vancouver in August 2015.

REFERENCES

Behemog. (2016, February 25). *Wild Arms – Ps1 Soundtrack 2-20 – A Lonely Dream of Bygone Days*. [Video file]. Retrieved from https://www.youtube.com/watch?v=6dpm1s9_f3U

BioShock, 2K Games, 2007.

Castlevania: Harmony of Dissonance, Konami, 2002.

Collins, K. (2006). "Flat Twos and the Musical Aesthetic of the Atari VCS". *Popular Musicology Online*. Issue 1: Musicological Critiques. Retrieved From: http://www.popular-musicology-online.com

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

Collins, K. (2016). *The Beep Book: A Documentary History of Game Sound*. Waterloo, ON: Ehtonal, Inc.

Dante's Inferno, Electronic Arts, 2010.

DerSchmu (2010, December 16). *NES Longplay – Metroid (100% + best endsequence).* [Video file]. Retrieved from https://www.youtube.com/watch?v=Ly1PUEmxyyQ

DerSchmu (2010, November 11). *C64 Longplay – Monty On The Run*. [Video file]. Retrieved from https://www.youtube.com/watch?v=jAyDCti2XAc

Destroy All Humans! Pandemic Studios, 2005.

Deus Ex, Square Enix, 2000.

DigDug, Namco, 1982.

Doctormario4600 (2014, December 28). *Mario & Luigi: Partners in Time Longplay* [Video file]. Retrieved from https://www.youtube.com/watch?v=OI2T744kCHw

Ehtonal, Inc. (2016) *Beep: A Documentary History of Game Sound*. BluRay.

Floppy Frenzy, Windmill Software, 1982.

Grim Fandango, LucasArts, 1998.

Highretrogamelord (2010, July 29). *Tapeworm for the Atari 2600*. [Video file]. Retrieved from https://www.youtube.com/watch?v=rVFvlJ98Fu4

Inverse Phase (2012) *Pretty Eight Machine*. CD.

Kingdom Hearts, Square, 2002.

Legend of Zelda Ocarina of Time, Nintendo, 1998.

Mario and Luigi: Partners in Time, Nintendo, 2005.

Metroid, Nintendo, 1986.

Monkey Island 2: LeChuck's Revenge, LucasArts, 1991.

Monty on the Run, Gremlin Graphics, 1985.

MrBlockzGaming (2014, July 3). *BioShock Gameplay Walkthrough Part 1 – Welcome To Rapture (No Commentary)* [PC]. [Video file]. Retrieved from https://www.youtube.com/watch?v=5OC15R2XYBg

Nolddor, Jack. (2012, December 28). *[Full GamePlay] Shadow of the Beast [Sega Megadrive/Genesis]*. [Video file]. Retrieved from https://www.youtube.com/watch?v=vOw8TzvZa9g

Peggle 2, PopCap, 2014.

Peggle, PopCap, 2007.

Pong, Atari, 1971.

SevuhnEluvuhn. (2013, March 1). *Full Game Ocarina of Time N64*. [Video file]. Retrieved from https://www.youtube.com/watch?v=3QvlxoX1GjI

Shadow of the Beast, Psygnosis, 1989.

Sly DC (2015, March 4). *Coleco Telstar Alpha – Tennis (AY-3-8500-1).* [Video file]. Retrieved from https://www.youtube.com/watch?v=1We3V-vFWAU

Squakenet (2015, March 14). *Floppy Frenzy gameplay* (PC Game, 1982). [Video file]. Retrieved from https://www.youtube.com/watch?v=kx7aZ0YHFwA

Street Fighter 2: The World Warrior, Capcom, 1991.

Super Mario Bros, Nintendo 1985.

Tapeworm, Spectravision, 1982.

The Adventure Gamer (2014, August 19). *Grim Fandango – Full Longplay* [Video file]. Retrieved from https://www.youtube.com/watch?v=kcqj0APsDsM

TheWalkthroughGuru (2013, December 9). *Peggle 2* Xbox One Walkthrough Part 1 No Commentary *Bjorn The Unicorn*. [Video file]. Retrieved from https://www.youtube.com/watch?v=8NjQ6jMasoQ

Tomb Raider, Eidos, 1996.

Unreal, Epic Megagames, 1998.

Where in the World is Carmen Sandiego? Brøderbund, 1985.

Wild Arms, MediaVision/Sony, 1996.

World of Longplays (2010, November 5). *Game Boy Advance Longplay [020] Castlevania Harmony of Dissonance* [Video file]. Retrieved from https://www.youtube.com/watch?v=siIAivGSySs

World of Longplays. (2009, July 7). PSX Longplay [019] *Tomb Raider (Part 1 of 3)*. [Video file]. Retrieved from https://www.youtube.com/watch?v=LCO8R_qZ-cA

World of Longplays. (2009, March 20). PC Longplay [030] *Monkey Island 2: LeChuck's Revenge.* [Video file]. Retrieved from https://www.youtube.com/watch?v=tBNJgXcG1y4|

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Karen Collins is Associate Professor in the Digital Arts Communication program at the University of Waterloo, Canada. She has published five books on game sound, including *Game Sound* (MIT Press 2008), *From Pac-Man to Pop Music* (Ashgate 2008), *The Oxford Handbook of Interactive Audio* (Oxford 2013), *Playing With Sound* (MIT Press 2013) and the 2-volume *Beep Book* (Ehtonal 2016). She is also the director of the award-winning game audio documentary *Beep: A Documentary History of Game Sound* (Beepmovie.com).

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Killing-off the Crossfade

Achieving Seamless Transitions With Imbricate Audio

ABSTRACT

This paper examines common approaches to implementing adaptive musical scores in video games using pre-rendered music that make heavy use of the crossfade transition and are used in the production of both AAA and Indie titles (Phillips, 2014a; Sweet, 2014; Collins, 2008; Collins, Kapralos and Tessler, 2014). The aim of this paper is to critique shortcomings of the crossfade and to propose a way to address some of these shortcomings using existing technology. This is achieved through a new composing, recording, and implementation process, provisionally called "imbricate audio", the viability of which is tested through the creation of an original composition. Where crossfades create "conspicuous game soundtrack signifiers" (Houge, 2012 p. 1), imbricate audio aims to deliver modulations that sound close to those found in live performance or the linear scores of cinema, potentially increasing the ability of composers to immerse players in gameplay with adaptive music.

KEYWORDS: *Adaptive Audio, Composing, Game Music, Immersion, Recorded Music, Pre-rendered Audio, Music Systems*

INTRODUCTION

Like many of history's great inventions, adaptive audio was discovered by accident. When working on Taito's 1978 game *Space Invaders*, the game's designer, Tomohiro Nishikado, found a rather interesting bug: destroying on-screen "invaders" freed up processing power and caused the game to run faster (Paul, 2012, p. 71). According to Karen Collins (2005, p. 2), although the music in *Space Invaders* is only a simple four-note loop, this was the first instance of a game featuring continuous background music (previous titles containing either no music or only brief musical stingers heard at key moments). When Nishikado noticed the game increase in speed, he also heard the music increase in tempo. By intentionally exaggerating this effect, he was able to add tension as the game progressed (Paul, 2012, p. 71) – in fact, the music was responding emotionally to the gameplay.

Audio quality in game music has come a long way since the monophonic 8-bit synthesis chips used in *Space Invaders* cabinets. The technological evolution of arcades, consoles, and home computers has seen the introduction of sophisticated polyphonic synthesis, digital samplers, and fully recorded scores. Since the release of Sony's PlayStation 3 in 2006, home gaming consoles and PCs are capable of greater-than-CD-quality recorded music in 7.1 surround sound (Collins, 2008, p. 71). However, the ability to put a full orchestra into a game has come with a compromise in versatility: a simple musical function such as Nishikado's adaptive tempo increase in *Space Invaders* would be a challenge for a game with a fully-recorded score.

> Improvements in adaptive audio implementation such as imbricate audio may well have the potential to improve the gaming experience as a whole.

Cinema has long made use of changes in music to assist narrative, responding to every nuance of the on-screen action and story. According to Belinkie (1999, p. 1), now that games too can have cinematic-style scores––some of which are even written by renowned film composers (Copeland, 2012, p. 14). Players may in some cases expect the same fluid musical response as they would hear in a film. Liam Byrne explains: "We're used to constant soundtracks in [our] entertainment. The more exactly the video game soundtrack matches your experience, the more involving that experience is going to be" (cited in Belinkie, 1999, online). It is worth noting that the video game medium has its own precedents and narrative devices and that making games more film-like is not necessarily an improvement, but one cannot ignore that many of our expectations of scored music for visual media are derived from decades of cinema. However, a defining characteristic of game music is its nonlinearity, the "ability of the game's music to respond to things happening in the game [that] makes video game music unlike other genres of music" (Lerner, 2014, p. 1). The music matches action in films as both film and music are linear media, and as such the two can be meticulously interwoven. Without a linear form to which the music can be matched, a game score requires "complex relations of sounds and music that continue to respond to a player throughout a game" (Collins, 2008, p. 211). Game music that fails to meet these expectations of fluidity can adversely affect player immersion.

Immersion is a mental state, which Winifred Phillips describes as the "ultimate goal" of game development (2014a, p. 52). When experiencing immersion, players "forget that they are playing a game. For a short while, these gamers have surrendered themselves to the fictional world of the game developers, entering the flow state that allows them to relinquish awareness of themselves and suspend their disbelief in favor of the plausible truths that the game presents to them" (Phillips, 2014a, p. 54).

Laurie N. Taylor (2002) distinguishes immersion from the experience of being "engrossed in a video game just as a reader would become engrossed in a novel, or a viewer in a film," stating that video games can cause "intra-diegetic immersion, which allows the player to become deeply involved in the game as an experiential space" (p. 12). Research on this effect indicates that adaptive game music significantly increases a player's sense of immersion (Gasselseder, 2014, p. 3) and that a game's level of interactivity is related to the level of immersion that players can experience (Reiter, 2011, p. 161). The conclusion that one can draw from this research is that improvements in adaptive audio implementation may well have the potential to improve the gaming experience as a whole.

PROBLEM

The numerous inventive approaches to implementing adaptive game music fall largely into two camps: sequenced audio and pre-rendered audio. Sequenced audio includes the use of synthesizers, samplers, and sophisticated virtual instruments (which blend aspects of both). Sequenced music is produced in real-time during gameplay, and in the hands of a talented audio programmer can transform in almost any way desired. However, the characteristics of current tools constrain sequenced audio to "electronic-sounding" soundtracks. Highly developed modern virtual instruments may be capable of sounding sufficiently realistic to fool the listener into thinking that they are hearing a live recording (Tommasini & Siedlaczek, 2016), but such instruments have too high a memory and processing cost to run during gameplay, as current gaming consoles are already being pushed to their limits to deliver cutting-edge graphics (Sweet, 2014, p. 205).

The alternative, pre-rendered audio can consist of recorded musicians, sequenced music that has been "printed" into fixed audio files, or a mixture of the two. Adaptive implementation can be achieved in code, but various tools for implementing pre-rendered audio in games (known as middleware) have arisen to make the task of creating adaptive pre-rendered soundtracks much easier (Firelight Technologies, 2016). This technology allows for real-time mixing of parallel vertical stems, horizontal resequencing of independent musical sections, and many other complex interactions that are based largely on combining the former two techniques. While these processes are too complicated to cover in depth in this paper, for the interested reader, Winifred Phillips gives an excellent introduction to these concepts on her blog (2014b and 2014c).

One of the limiting factors that prevents pre-rendered video game music from achieving the seamless flow of film music is the use of fade transitions. When games have cinematic-sounding music, players expect game scores to behave like movie scores (Stevens & Raybould, 2014, p.149), but fade-ins, fade-outs, and crossfades are transitions that composer Ben Houge refers to as "conspicuous game soundtrack signifiers" (2012, p. 1), which rarely appear in film. A notable exception is the modular score, which opts for independent sections of music, the end of each section fitting neatly into the start of every other section. This has the benefit of seamless changes without using fades, though the system has to wait for the current section to end before a change can be made, which can result in short periods of inappropriate music (Stevens & Raybould, 2014 p. 150). A good example of an expertly crafted modular score is the soundtrack to *Monkey Island 2: LeChuck's Revenge* (LucasArts, 1991), which made use of the iMUSE system (Collins, 2008, p. 56). Watching a video capture of the game, one can see that the Guybrush (the player character) traverses different areas of the town of Woodtick, a distinct musical theme can be heard in each area (as discussed in Silk, 2010).

When the iMUSE system is triggered to change themes, by Guybrush crossing into a new area, a brief musical transition is selected depending on the playback position in the score. While these transitions create excellent seamless segues between the various themes of Woodtick, they can also take time to respond while iMUSE waits for an appropriate point in the music to transition from, then the whole transition must be played before the new theme can begin (Collins, 2008, p. 53). In the case of the video capture above, the longest response time was just over 7 seconds, counting from when Guybrush leaves the bar just after 1:40 in the video. 7 seconds may not be a significant amount of time in point-and-click adventure games like the *Monkey Island* series, but in faster-moving genres, it can feel like a long period for inappropriate music to be playing.

The Woodtick scene relies on sequenced virtual instruments to grant the moments of transition a seamless fluidity. The remastered *Monkey Island 2: Special Edition* (LucasArts, 2010) features a fully pre-rendered score with many recorded instruments, and unlike the original (which featured no crossfades) the fading used to facilitate these same transitions in the *Special Edition* can be clearly heard––though some pre-rendered modular scores can use clever edits to avoid using crossfades altogether.

The biggest issue with using fades in pre-rendered scores is the way in which the listener anticipates certain familiar instruments (especially acoustic instruments) to sound. Specifically, fades can critically change the start, end, or reverb tails of notes––something that would be odd and jarring to hear at a live performance. Reverb tails can be thought of as the expected natural ringing-out of an instrument. They are the result of a combination of an instrument's decay sound and the reverb of the space (or artificial reverb effect) in which the instrument is played. Human ears are "remarkably sensitive to fine details in audio content, and … sense the subtle artificiality that would occur when the reverb we've come to expect is momentarily absent" (Phillips, 2014a, p. 172). The start of a recording containing the reverb tails of previous notes also produces an unpleasant effect when played out of context (p. 173).

An important musical property that cannot be easily modulated during gameplay is music dynamic. Because manipulating the dynamic with crossfades interferes with reverb tails, and sounds unnatural, I chose this challenge as the first test of an imbricate audio system. The distinction between music dynamic levels and volume is an important one, so let us take a moment to examine their differences. Volume is a measurement of loudness, whereas dynamic is a measurement of performance intensity. Playing violin soft or hard has an enormous effect on the timbral qualities of the instrument––an effect that cannot be achieved by simply increasing the volume of a recording (Gauldin, 2004, pp. A2-A3). Below I use the terms *piano, mezzo piano, mezzo forte, forte, and fortissimo* to express dynamic levels in order of increasing intensity, as these are the terms traditionally used in music manuscripts.

> Imbricate audio consists of recording a score with regular pauses to capture the reverb tails of every branching point. Once all desired variations have been recorded, the tracks are divided into chunks, which are queued in the music system. No cut or fade would be audible.

PROPOSED SOLUTION

The solution I propose to this problem is ”imbricate audio”––a process that results in a densely modular matrix of musical "chunks" which can change states quickly while still preserving the integrity of the instrument sounds used (an example video of this is included below on page 9). The aim of creating such a process is to bring some of the flexibility of sequenced music to pre-rendered scores featuring recorded musicians, and/or virtual instruments that imitate recorded instrumentalists. Imbricate audio is an extension of the concept of a standard modular score, but with two important differences: firstly, instead of dividing the score into musical phrases, it is much more densely modular, with divisions every bar. Secondly, the reverb tails are preserved, eliminating the need for a crossfade to smooth out the transition. Together, these modifications grant many of the benefits of modular scores, but with a much quicker response time.

Imbricate audio consists of recording a score with regular pauses to capture the reverb tails of every branching point. Once all desired variations have been recorded, the tracks are divided into chunks, which are queued in the music system (the same can be achieved by creating sequenced music tracks and dividing them into chunks before they are rendered). The chunks are then played back in order, such that the lingering reverb-tail of each overlaps with the beginning of the following chunk. Without any input from the gameplay, the music will play in a linear or looping fashion without any audible signs that it is actually a collection of chunks and not a single, long recording. When the music system receives a cue or trigger from the game, the queuing is reordered.

In the case of Figure 1 (below), after receiving a trigger from the gameplay, the queued mezzo piano version of the following bar (Bar 4) is swapped out for a mezzo forte version of the same bar. Shortly after this starts playing, another instruction is received, and the mezzo forte version of Bar 5 is replaced with a forte recording.

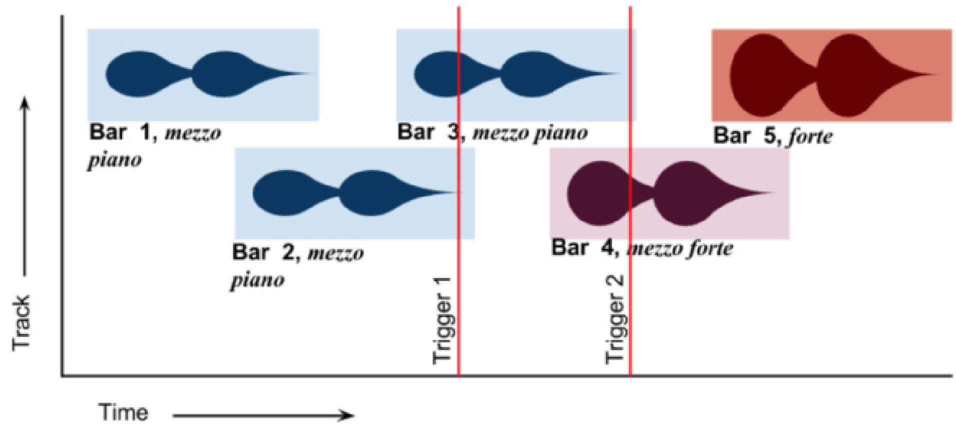

Figure 1 – Imbricate audio in action. Image courtesy of the Author.

From the listener's perspective, the musicians in the recording would be perceived as starting to perform with more intensity in response to an event in the game. No cut or fade would be audible, bringing the adaptive music experience closer to the linear experience of cinema without the distraction of the hallmark fades of game music (Houge, 2012, p. 1).

This is the simplest transition in an imbricate audio system: a trigger is received and the new music state is queued-up for the next branching point. In many contexts this may feel abrupt and sudden, so an intermediate transition chunk can be used. Consider if, in the above example, we ignored *Trigger 2* for the time being. *Instead of Bar 4* being from the mezzo forte music state, we would have a transitional music state, which is positioned between mezzo piano and mezzo forte. Every chunk in this transitional music state would consist of a crescendo from mezzo piano to mezzo forte, and the playback order would now be: *Bar 3, mezzo piano; Bar 4, mp-mf crescendo; Bar 5, mezzo forte.* Although including transitional music states would require considerably greater effort, it could be used for quite complex modulations between different dynamics, keys, tempi, timbres, meters, etc.

EXPERIMENTAL RESULTS

As a test case, I set out to create an adaptive score with the simple one-step process, which would be able to change the musical dynamic less than one second after receiving instruction from the game. For this reason, I composed a score in a 2/4 time signature at a tempo of 130bpm, resulting in each bar being less than one second in duration. I wrote the score to be recorded in its totality at five levels of dynamic intensity, ranging from piano through to fortissimo. Figure 2, below, shows a brief excerpt of the score I gave to the performers, and Figure 3 outlines the performance instructions I gave for each pass of the recordings.

Figure 2 – Excerpt from adaptive score for Eine Kleine Bärmusik (Hulme, 2015). Image courtesy of the Author.

	Track 1	**Track 2**	**Track 3**	**Track 4**	**Track 5**
Dynamic level	*piano*	*mezzo piano*	*mezzo forte*	*forte*	*fortissimo*
Brass and piano articulation	*legato*	*portato*	*tenuto*	*staccato*	*staccatissimo*
Bass bowing	*pizzicato*	*pizzicato*	*pizzicato*	*arco*	*arco*
Piano tremolo	*no tremolo*	*no tremolo*	*no tremolo*	*tremolo at (***z***) markings*	*tremolo on all right-hand simultaneous intervals*
Brass tacet	*tacet where marked*	*tacet where marked*	*mezzo piano where marked*	*mezzo forte where marked*	*fortissimo with growl where marked*

Figure 3 – Performance instructions for recording Eine Kleine Bärmusik.

In the context of "designing a game for music", Richard Stevens and Dave Raybould (2014) discuss the limitations of modular scores (such as the *Monkey Island* example above). They mention the possibility of a process similar to imbricate audio, but quickly dismiss it as "time consuming and unnatural" (p. 152). Having now performed this process, I can attest that it can be "natural-sounding" and the recording process is not much more time-consuming than that of recording a regular modular score. I concede that splitting, rendering, and naming each of the chunks manually was tedious, but the process is simple enough that it would be possible to automate. Additional rehearsals were also required for the musicians to become accustomed to the unusual performance technique.

In contrast to vertical remixing and horizontal resequencing approaches, the composing process for imbricate audio does require a consideration of the outcome of a transition from the end of each and every bar. It also imposes some limitations on the arrangement. For example, particularly long notes that span many bars may cause unintended dissonance. However, imbricate audio's quick responsiveness and lack of audible crossfades make it highly appropriate for some use cases.

An example of imbricate audio can be found in my brief demonstration of *Eine Kleine Bärmusik* attached to a set of buttons and run by a simple C# script in the Unity game engine (Hulme, 2016):

The dynamic intensity of the music is being modulated entirely by software, and although there are some distinct, sudden changes in timbre, these can be attributed to recording or performance mistakes. None of the many cuts in this example are themselves audible, as the natural decay of each chunk overlaps with the next. After 1:45 in the video, the system is instructed to start and stop so that individual chunks can be heard, reverb tails included. This piece is far from perfect, but it serves to demonstrate that imbricate audio is indeed feasible.

To efficiently record these chunks in a way that felt most familiar to the performers, I asked them to play only the odd-numbered bars of the score, treating the even-numbered bars as rests. When this was completed, they were able to listen to their performance of the odd-numbered bars and fill in the gaps by playing only the even-numbered bars. This method also had the unexpected benefit of cutting down on the number of full takes required, as when mistakes were made, a new take could begin only seconds before the error. This process was then repeated for each of the five music dynamic levels. I managed to record the entirety of the piece (5 instrumentalists playing 10 minutes of music each), during one day in the recording studio.

Like Stevens and Raybould (2014), I too had fears that the finished product would sound "unnatural" (p. 152), but I was relieved to discover that it performed seamlessly and adapted to instructions in less than one second as planned. An additional boon was the low processing overhead required to run this system: the simple C# script driving the queue runs in the Unity game engine so efficiently that it is even able to run in the background of mobile games. I have already shipped three games for iOS and Android that run this system, which both play smoothly even on low-end devices.

Fadeless modulations in music dynamics and smooth, fadeless modular score transitions are largely the domain of sequenced music systems, but imbricate audio can bring some of these features to fully-recorded, pre-rendered scores, bringing us one step closer to creating game scores that are indistinguishable from a live ensemble.

CONCLUSION

Imbricate audio can be used to imitate vertical remixing, horizontal resequencing, and other systems by creating a densely modular score made of short chunks. It would be presumptuous to assert that it can serve as a replacement for these approaches in every case, but when it can, it eliminates the need for "conspicuous" crossfades. Imbricate audio may not solve all the challenges that face adaptive game music today, but I hope that the introduction of this system will be of use to composers who want to make innovative adaptive scores. I am still developing imbricate audio, and currently it is the core of a procedural music system that I am designing for an upcoming console title. I hope that other composers will make use of this tool, and combined with the immaculate sound quality now available on consoles and PCs, the power to transition between different music states quickly and smoothly should improve composers' ability to engross the player in the game world. Fadeless modulations in music dynamics (as in the example of *Eine Kleine Bärmusik*) and smooth, fadeless modular score transitions (as in the *Monkey Island 2* scene) are largely the domain of sequenced music systems, but imbricate audio can bring some of these features to fully-recorded, pre-rendered scores. By maintaining reverb tails (and thus the musical integrity of the instruments used), it may even become easier to achieve the elusive goal of player immersion––bringing us one step closer to creating game scores that are indistinguishable from a live ensemble, playing just for you.

REFERENCES

Belinkie, M. (1999, December, 15). *Video Game Music: Not Just Kid Stuff.* Retrieved from http://www.vgmusic.com/information/vgpaper.html

Collins, K. (2005). *From Bits to Hits: Video Games Music Changes its Tune.* Film International, (12), 4–19.

Collins, K. (2008). *Game Sound: An Introduction to the History, Theory, and Practice of Video Game Music and Sound Design* (1st ed.). Cambridge, MA: MIT Press.

Copeland, M. D. (2012). *The Design and Implementation of Sound, Voice and Music in Video Games* (Masters thesis) California State University, Chico.

Gasselseder, H. (2014). *Those Who Played Were Listening to the Music? Immersion and Dynamic Music in the Ludonarrative. In 4th International Workshop on Cognitive Information Processing* (pp. 1–8). Copenhagen: Aalborg University.

Gauldin, R. (2004). *Harmonic Practice In Tonal Music* (2nd ed.). New York City, NY: W. W. Norton & Company.

Houge, B. (2012). *Cell-based Music Organization in Tom Clancy's EndWar. In First International Workshop on Musical Metacreation.* Stanford, CA. Pp. 1–4.

Lerner, N. (2014). *Mario's Dynamic Leaps.* In K. J. Donnelly, W. Gibbons, & N. Lerner (Eds.), *Music In Video Games: Studying*

Play (1st ed., pp. 1–29). New York City, NY: Routledge.

Medina-Gray, E. (2014). Meaningful Modular Combinations: Simultaneous Harp and Environmental Music in Two Legend of Zelda Games. In K. J. Donnelly, W. Gibbons, & N. Lerner (Eds.), *Music In Video Games: Studying Play* (1st ed., pp. 104–121). New York City, NY: Routledge.

Paul, L. J. (2012). Droppin' Science: Video Game Audio Breakdown. In P. Moormann (Ed.), *Music and Game: Perspectives on a Popular Alliance* (pp. 63–80). Berlin: Springerhttp://doi.org/10.1007/978-3-531-18913-0

Phillips, W. (2014a). *A Composer's Guide to Game Music (*1st ed.). Cambridge, MA: MIT Press.

Reiter, U. (2011). Perceived Quality in Game Audio. In M. N. Grimshaw (Ed.), *Game Sound Technology and Player Interaction: Concepts and Developments* (pp. 153–174). Aalborg: IGI Global. http://doi.org/10.4018/978-1-61692-828-5.ch008

Stevens, R., & Raybould, D. (2014). *Designing A Game For Music.* In K. Collins, B. Kapralos, & H. Tessler (Eds.), *The Oxford Handbook Of Interactive Audio* (1st ed., pp. 147–166). New York City, NY: Oxford University Press.

Sweet, M. (2014). *Writing Interactive Music For Video Games: A Composer's Guide* (1st ed.). Upper Saddle River, NJ: Pearson Education.

Taylor, L. N. (2002). *Video games: Perspective, point-of-view, and immersion* (Master's thesis). University of Florida, Gainesville, US.

MUSICAL WORKS

Hulme, Z. (2015). *Eine Kleine Bärmusik* Unpublished manuscript.

Hulme, Z. (2016). *Eine Kleine Bärmusik* (Video of interactive sound recording) (unpublished).

LUDOGRAPHY

Monkey Island 2: LeChuck's Revenge, LucasArts (1991). USA, 1991.

Monkey Island 2: Special Edition LucasArts, USA, 2010)

Space Invaders Nishikado, Taito, Japan, 1978..

Websites:

Firelight Technologies. (2016). FMOD Studio – Why Would You Use It?. Retrieved from http://www.fmod.org/products

Phillips, W. (2014b). *A Composer's Guide to Game Music – Horizontal Resequencing*, Part 1. Retrieved from https://winifredphillips.wordpress.com/2014/04/30/a-composers-guide-to-game-music-horizontal-resequencing-part-1/

Phillips, W. (2014c). *A Composer's Guide to Game Music – Vertical Layering,* Part 2. Retrieved from https://winifredphillips.wordpress.com/2014/03/12/a-composers-guide-to-game-music-vertical-layering-part-2/

Tommasini, G., & Siedlaczek, P. (2016). *Acoustical Sample Modeling Applied to Virtual Instruments.* Retrieved from http://www.samplemodeling.com/en/technology.php

AUDIOVISUAL

Silk, P. (2010). *iMUSE Demonstration 2 – Seamless Transitions*. Retrieved from https://youtu.be/7N41TEcjcvM

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The Sound of a Serve Toss

An Informational View on the Gameworld Interface as Sonic Interface Design

ABSTRACT

In this article, Jørgensen's three-layer model of the gameworld interface is used to analyze the practice of game sound design and to describe the informational role of game audio design, from the perspective of *Sonic Interface Design* (SID). First the relationship between visual and audio realism is discussed. Then three layers in Jørgensen's model (controllers, WIMPs elements, and gameworlds) are explored in relation to the semiotic analytical model of C. S. Peirce. By addressing the sound of the serve toss in games such as *Pong* (1972) and *Wii Sports Tennis* (2006), the article investigates how sound design can support realism, hypermediacy, and immediacy in varying contexts. Approaching game sound design from an information-based concept (the SID) as well as a holistic model (as gameworld interface), the aim here is to improve an understanding of the creative potential and extent of game audio design.

KEYWORDS: *Game Sound Design, Sonic Interface Design, Informational Spaces, Music Cognition, Semiotics, Persuasive Design*

INTRODUCTION

Kristine Jørgensen (2013a, 2013b) provides a fresh view on gameworlds by conceptualizing games as informational spaces working through three layers of an interface: the game controller, the WIMP elements (windows, icons, menus, and pointers) and the gameworld. Here this model is used to consider game sound design defined as *Sonic Interface Design* (SID) which "explores ways in which sound can be used to convey information, meaning, aesthetic and emotional qualities in interactive contexts." (Serafin et al. 2011, p.87). *As Collins notes* (2008), in the game *Pac-Man* (1980, Namco, Japan), "(t)ypically the music only played when there was no game action, since any action required all of the system's available memory" (p. 9). Considering aspects of immersion, it may seem like a disadvantage when, in early video games, it was not possible to combine sound effects and music because of limitations in available memory space; however, the omission helped players to understand the mechanics of the game better. The examples of *Pac-Man*'s "bite" and *Pong*'s serve toss sound can be considered to understand how different audiences may have different expectations of what a "realistic", "believable", or "appropriate" sound effect may be in a game.

When we look at one of the core mechanics of *Pac-Man* ("eat blocks"), neither the sound of taking bites nor the animation can be regarded as realistic. The concept of the mechanic is suggested by the up and down movement of *Pac-Man*'s mouth and a sound effect that vaguely resembles the sound of a bite. The perception of the sound effect as "bite" is, like all game audio (Jørgensen 2008), highly contextual. Furthermore, following the semiotic approach of C.S. Peirce (see, for example, Zalta, 2010)[1], a sound effect may be regarded as an iconic sign, a representation that resembles qualitative features of the object. Peirce introduced ten types of signs of which three types of object-sign relations, commonly called "modes", are applied to this discussion: iconic, indexical and symbolic. When the sign has an analog physical connection between the signifier and its object, then the sign is an indexical sign. And if the sign utilizes arbitrary convention, habit, or social rule or law according to which the signifier indicates the object, it is a symbolic sign Even though there is some allusion to a ping pong ball, the sound effects of *Pong* (1972) is even less realistic than *Pac-Man*'s. Even more, the visual design of *Pong*'s ball, a square set of low-resolution pixels, undermines the concept "ball" in the iconic mode (one expects a real ball to be round), but as a symbolic sign, it works: players do not seem to mind a lack of realism, as long as it functions as a type of ball in the game. As the gameplay of the ball-game is preserved, the minimalism of both sonic and visual representations balance each other without disturbing the understanding of the game mechanics.

Awareness of aspects of sonic design in relation to the gameworld and players' expectations can help make the production process of game sound design methodical and effective, but it also implies a more holistic approach to game sound design than what the one that dominates current game studies and game development.

Modes of representation differ according to the demands of context and game. If we were to use Pong's sound effects in the sound design of the much more realistic *Wii Sports Tennis* (2006), the balance would be disturbed. Each year when I introduce my students to game sound design and show them a gameplay movie of *Wii Sports* with the sound effects of *Pong* they are amused by the disturbance of their expectations of a more realistic sound (Huron 2006). Indeed, the relatively more sophisticated realism of *Wii Sports* shapes different expectations in the player than *Pong*'s sound effects.

There is, however, one exceptional sound in *Wii Sports Tennis* that outbalances its visual and sound realism: the serve toss.

This sound seems to have escaped from a cartoon soundtrack and sneaked its way into the *Wii Sports Tennis* game. The question is: why? The movement

1. Within Peirce's analytical approach, a sign consists of three inter-related elements: a sign (signifier), an object (signified), and an interpretant who makes sense of a sign. In the context of sound design, we can say that the sound itself is the sign element (signifier), whereas the object is what the sound stands for; so, in the Pac-Man example, the object can be described as "bite". The interpretant is best thought of as the understanding that the listener has of the sign-object relation. The process of game sound design can be related to these three elements when we consider its resulting product, the sound, as the sign which is based on the designer's applied theoretical and practical knowledge of sound design in terms of the sign's object and user test-based validation of the sound as the interpretant. Therefore, developing game sound design knowledge implies a focus on describing design patterns that can be deducted from knowledge of the relationship between the signifier and its object.

of a ball in the air (serve toss) can theoretically be considered but not practically be perceived as a sound for psychoacoustical reasons. Therefore, the serve toss sound can be regarded as a symbolic sign based solely on conventions. The upwards glissando (raise in pitch over time) represents the upward movement of the ball. Here, the sound of the serve toss is a good example of sonification, "the technique of rendering sound in response to data and interactions.' (Hermann et al. 2011, p.1). Sonification of movement in a game mechanic is not limited to this example alone.

The jump of Mario in *Super Mario Bros.* (1985) is another illustration of the same kind of sonification.

Such aspects impact on the gameworld as an informational space. Again, the player's interaction with a game can be described as a three-layer interface consisting of the game controller, WIMP (Windows-Icons-Menus-Pointers) and gameworld (Jørgensen 2013a, 2013b). According to Jørgensen, a gameworld as interface can be designed between the two opposing approaches of superimposing and integrating media, representing either a hypermediacy style of visual representation, the goal of which is "to remind the viewer of the medium", or an immediacy style of visual representation, which aims to "make the viewer forget the presence of the medium" (Bolter & Grusin 1998: pp. 272-273). Implementing the serve toss as a more or less "realistic" sound, while considering the affordances of context, is part of this strategy. Jørgensen explicitly includes audio as an important element of the gameworld as interface. The following part of this paper discusses how sound design can support these layers and design approaches in varying semiotic modes.

THE WIMP LAYER

The WIMP layer can be situated in the game's (graphical) user interface, or (2D) Head-Up Display, typically using windows, menus and the gameworld when (3D) pointers and icons are added inside the world. The main purpose of the WIMP layer is to provide the player with game system information (Jørgensen 2013b). In the WIMP layer, sound effects are most commonly used in the iconic mode when they support click actions related to the WIMP elements. In this case, the sound effect resembles the real-world sounds of our interaction with, for example, switches, buttons, and paper turns.

The click action in the WIMP layer can also be supported by sound effects that "look ahead" or "summarize" the (next) game state by representing the meaning of the state as a symbolic sign. In the app version of the game Risk, the WIMP layer sound effects contain elements of "arming riffles", "steps of army boots", and the "soundscape of a battlefield" to represent (part of) the meaning of the game states.

When the WIMP layer is used to indicate the outcome of our gameplay, for example when we score in Pong, the sound effects can be used to evaluate the gameplay. In that case, the design principle or design pattern of the evaluated sound effect is important to establish its semiotic mode. Comparing the evaluative audio signs (success and failure) of *Pong* and *Wii Sports Tennis* we can say that *Pong*'s sound effects are symbolic, based on conventions, while the sound effects of *Wii Sports Tennis* are iconic since they resemble the sound of a crowd[2]. Nevertheless, such effects can also be considered as indexical signs, signs (in this case the sound recordings) that result from, are analogous to, something that happens in the real world This explains why such sound effects are so successful in communicating the meaning of success and failure (Langhorst 2014).

THE GAMEWORLD LAYER

In the gameworld layer of Jørgensen's model, a sound effect may exist in all three semiotic modes, iconic, symbolic and indexical, and can shift from one mode to another, and appear in combination. The *Wii Sports Tennis* serve toss sound is symbolic as a sign representing the event of a ball thrown in the air[3]. It is, however an index sign in relation to the data it represents (the change in the height of the ball). This is crucial for the concept of sonification where the sound must represent data in a one to one relationship to provide the player with accurate information.

Jørgensen (2013b) notices a semiotic mode shift in the gameworld that is caused by learning: "(w)hen we have played the game enough to learn how it works, however, signs that were formerly mysterious change character and become familiar and recognizable. Now the signs become representative of specific events in the gameworld" (p. 79). When it comes to sounds that hold a strong first/third person relationship between game and player, such as footsteps, the idea of internalized signs shifting from the iconic mode into the indexical mode is substantiated by arguments from recent neuropsychological research that "consistently suggested that the brain processes the sounds of actions made by an agent differently from other sounds" (Serafin et al. 2011, p. 89).

The indexical mode-shift of audio-signs can be compared with the acceptance of the (unedited) photographic image as an indexical sign (Barthes 1977) and explained as the perception of realism. An improved understanding of perception, combined with improved technology to create virtual worlds, makes it possible to convert the unreal, or the virtual, into perceived reality, *or modality*. The latter concept "refers to the degree of truth assigned to a given sound event" (van Leeuwen, 1999, p. 180). In short, the codes and conventions of game audio, sound effects, and game music, interact with other dimensions of the game to produce a believable, immersive experience for the player.

2. The evaluating sound effects of *Wii Sports Tennis* have become part of the gameworld layer but nevertheless provide the player with game system information. Game sound design can help to integrate game system information into the gameworld layer.

AUDIO EVENT DISTRIBUTION

The function of sound events in games is to provide the player with important information to understand the game and its game mechanics through detailed sound design; sounds can do so in either an integrated or superimposed manner. Sonic interface design provides the possibility to create highly informative gameworlds, revealing game system information in an integrated manner, whereas dominance of visual information tends to lead to additional superimposed media.

Gameworlds with integrated audio events are alike our real-life environment and listening to this informational space can, therefore, be described as "(e)very-day listening [, which] is the experience of hearing events in the world rather than sounds per se" (Gaver 1993, p. 285). Gaver's framework explains how we perceive nonmusical sounds as a distribution of events and describe them not by their physical characteristics but by their source; for example, we describe a sound as "the siren of a passing police car" rather than that we summarize the physical specifications of the Doppler effect. Furthermore, Gaver shows how tolerant we are regarding the physical accuracy of a sound we hear: we have no problem recognizing footsteps regardless whether they sound on the street or in a large church despite that this significantly changes the physical characteristics of the sound. Game sound design can benefit from this tolerance to shift sound from accuracy to immersive experience. Summers' (2016) analysis of five different game types within the race game genre shows they each have their own specific relationship with how immersion serves realism, not only by facing the challenge of combining music and the dynamical sound of a racecar but also by the need to balance sound design in regard of realism, genre, and immersion.

Not only everyday sounds but also music can be perceived as "events" (Buxton et al. 1994). While listening to music involves a significant amount of cognitive processing within a complex auditory system, prediction seems to be an important aspect of this process (Huron 2006, Zatorre and Salimpoora 2013). Game music has been a topic of research quite some time, which seems to imply that interacting with game music is different than listening to music in general (Collins 2013). For example, *dynamic audio* "reacts both to changes in the game-play environment, and/or to actions taken by the player" (Collins 2008, p. 4), which is essential for game audio and for the immersive function of game music (Phillips, 2014), In relation to game music, this is often referred to as *adaptive music*. In a game with adaptive music, the game system's logic needs to evaluate the gameplay and accordingly change the game state resulting in a change in the music. This process implies two different levels of cognitive processing for the player, initiated by unpredictable event-based decisions of the game system's logic. This causes an additional demand on the cognitive process during listening to music. Firstly, in terms of perception––at the first level the musical composition will change according to the characteristics of the new game state. Typically, this involves changes in the perceivable emotions and/or referential changes in the music such as the use of themes, *leitmotiv*, and the *idée fixe*, to support the game's narrative (Phillips, 2014). Secondly, concerning decoding––at the second level the player needs to decode the "argument" that initiated the game state change to perform in line with the adjusted level challenges and goals. In an ideal informational space, the design characteristics and design patterns of the music matches the argument of the game system's logic state change. Thus, for

3. The relationship between the upward moving sound and ball is much more complex than one might think at first. Since pitch is perceived logarithmically and is therefore described as pitchΔtime = log2 freqΔtime , the linear frequency rise from 200Hz to 600Hz of the SFX will be perceived as a logarithmic pitch change from approx. G to d''. The position of the ball is a parabolic function that can be describes as positionΔtime = (V0$\star\Delta$T) + (1/2A$\star$ ΔT2) , where ΔT is delta time, A is the world's gravity (- 9.8m/s2) assuming that the Wii sports world behaves like ours, and V0 is the initial speed of the ball. As the ball in Wii Sports tennis rises until its velocity becomes 0 and the ball reaches its highest position (the optimum to hit it!), the curve of the logarithmic pitch function and the parabolic ball position function are very much alike. This is due to the characteristic of the two functions but also due to the variable values (glissando start and ending pitches, and SFX length) make the two curves more alike under the condition that the player needs to hit the ball while it is rising. Thus, however not mathematically identical, in effect the two curves may be perceived as equal, and therefore the server toss SFX is perceived as the sonification of the position of the ball.

example, a sudden attack to the playable character by in-game enemies results in a matching rise in arousal characteristics of the music, and the identification of a specific enemy involves the introduction of a theme or leitmotiv.

> To understand the full potential of sound-driven game control we need to look closer at the ways in which music can evoke motion through rhythm and expression.

THE SERVE TOSS RELOADED: THE CONTROLLER LAYER

The use of the serve toss sound in *Wii Sports Tennis* may be related to the absence of an actual ball (which one can physically strike), as an alternative cue is needed to initiate the player's action. Therefore, the purpose of the sound of the serve toss is to trigger the player's movement. According to Fogg's (2016) behavioral model, in addition to motivation and ability, triggers are the key element in persuasive design; "without a trigger, the target behavior will not happen" (online). Furthermore, triggers are especially interesting for game (sound) designers since they are the only element in Fogg's model that can be designed. The example of *Wii Sports Tennis* demonstrates that, at the game controller layer of Jørgensen's model, sound can be used successfully for changes in the player's behavior, resulting in a movement. This kind of kinetic interaction related to sound is well known from the music game or rhythm-action game genre that includes games such as *Guitar Hero* (2005) or *Rock Band* (2007).

"Rhythm-action games are video games in which the player must respond in some way to the rhythm or melody being presented, either through repeating the same melody or rhythm by pressing buttons (with hands or feet), or kinetically responding in some way to the rhythm, often using specially designed controllers" (Collins 2008, p.).

In general kinetic and sensory interaction, the haptic modality is regarded as an important aspect of interaction with virtual worlds (Mihelj, Novak & Begus, 2013). However, "the haptic modality is currently underutilized and poorly understood as a design material in game design" (Nordvall 2014, p.1). Nevertheless, sound as a trigger for behavior, as well as the rhythm-action game genre, shows the potential of game sound design at the controller layer. Therefore, to utilize sound as a trigger for motoric actions or expression seems like a valuable opportunity for new sound-driven game mechanics and controllers that go beyond the tradition of the music game genre.

To understand the full potential of sound-driven game control we need to look closer at the ways in which music can evoke motion through rhythm and expression. Firstly, concerning rhythm, movement and musical rhythm are closely connected, share neurological pathways and "indeed the close connection between music and dance suggest that musical rhythm might have evolved from rhythmic movement" (Trainor & Zatorre 2009, p.178). Some game mechanics are based on the rhythmical input of the player, as it happens in *Patapon* (2007) and in *Beat Sneak Bandit* (2012).

Secondly, in regard to expression, this also contains motion as one of its sub-components; according to Juslin & Timmers, 2010), also musical performance expression can be "conceived of as a multi-dimensional phenomenon that can be decomposed into subcomponents that make distinct contributions to the aesthetic impact of a performance "(p.454),. Unfortunately the use of expressive musical motion hardly has been explored outside the music game genre but still shows great potential if we look at the *Smart String* instrument of *Apple's Garageband app.*

Even though the physical interaction is with a limited haptic glass screen, players nevertheless intuitively adjusts their movements; they touch and impact with the screen in order to generate the expressive motion matching *pizzicato*, *marcato* and (speed dependent) dynamic sustained string sounds.

CONCLUSIONS

Game sound designers strive to design sounds that can inform the player, trigger behavior or evoke emotions. Therefore, the success of game sound design benefits from the use of design patterns. Studies in semiotics, cognitive neuroscience, psychoacoustics, affective prosody, and music psychology offer precious perspectives to understand these processes. Not only does the layered interface model of Kristine Jørgensen help game sound designers in choosing the location of their intervention with precision, it also helps them to optimize the balance between expectations of realism, hypermediacy, and immediacy of the style needed for any given game. Sonic design proves to be effective in integrated design, providing the player with information integrated into the gameworld. In the process of sound design, knowledge of design patterns is an important element for the development and production of sound. Awareness of aspects of sonic design in relation to the gameworld and players' expectations can help make the production process of game sound design methodical and effective, but it also implies a more holistic approach to game sound design than what the one that dominates current game studies and game development. Not only does a broader, and integrated, sonic approach to game design help to better understand the full potential and extent of game audio, but it also offers further creative opportunity in game design for the future.

REFERENCES

Barthes, R. (1977). *Image-Music-Text.* London: Fontana.

Boltor, J. and Grusin, R. (1998). *Remediation, Understanding New Media.* Cambridge (MA), London: The MIT Press.

Buxton, W. Gaver, W. and Bly, S. (1994). *Everyday listening. In: Buxton*, W. Gaver, W. and Bly, S. The use of Non-Speech Audio at the Interface [online] Available at http://www.billbuxton.com/Audio.TOC.html Chapter 5

Collins, K. (2008). *Game Sound – An introduction to the History, Theory and Practice of Video Game Music and Sound Design.* Cambridge MA & London: The MIT Press.

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

Fogg, BJ. (2016). *The behavior model. [online]* Available at: http://www.behaviormodel.org/index.html

Gaver, W. (1993). *How do we hear in the World. Exploration in Ecological Acoustics. In: Ecological Psychology. 5(4), 285-313.* Lawrence Erlbaum Associates, Inc.

Hermann, T. Hunt, A. Neuhoff, J. (2011). *Introduction. In: Hermann, T. Hunt, A. Neuhoff,* J. ed. *The Sonification Handbook. Berlin: Logos Verlag Berlin GmbH. pp.1-7.*

Huron, D. (2006). *Sweet Expectations: Music and the Physiology of Expectation.* Cambridge (MA), London: The MIT Press.

Jørgensen, K. (2008). *Audio and Gameplay: An Analysis of PvP Battlegrounds in World of Warcraft.* [online] Available at:http://gamestudies.org/0802/articles/jorgensen Game Studies Journal. Vol. 8 issue 2 December 2008.

Jørgensen, K. (2013a). *Lecture at the Philosophy of Computer Games Conference*, Bergen 2013. [online] Available at: https://www.youtube.com/watch?v=_i_-kliuRPg

Jørgensen, K. (2013b). *Gameworld Interfaces.* Cambridge MA & London: The MIT Press.

Juslin, P.N. & Timmers, R. (2010) . *Expression and Communication of Emotion in Music Performance.* In: Juslin, P.N. Sloboda, J.A. eds. *The Oxford Handbook of Music and Emotion.* London, New-York: Oxford University Press. pp. 453–489.

Langhorst, T. (2014). *The Unanswered Question of Musical Meaning – a cross-domain approach*. In: . Collins, K. Kapralos, B. & Tessler, H. eds. *The Oxford Handbook of Interactive Audio.* London, New-York: Oxford University Press.. pp. 95-116.

Mihelj, M., Novak, D. & Begus, S. (2013). Haptic Modality in Virtual Reality. In: Mihelj, M. Novak, D. Begus, S. eds. *Virtual Reality Technology and Applications.* (pp 161-194). Dordrecht, the Netherlands: Springer Science+Business Media.

Nordvall, M. (2014). *The Sightlence Game: Designing a Haptic Computer Game Interface.* In: Proceedings of the 2013 DiGRA International Conference: DeFragging Game Studies. [online] Available at http://www.digra.org/wp-content/uploads/digital-library/paper_473.pdf.

Phillips, W. (2014). *A Composer's Guide to Game Music.* Cambridge MA & London: The MIT Press.

Serafin, S. Franinovic, K. Hermann, T. Lemaitre, G. Rinott, M. Rocchesso, D. (2011). *Sonic Interaction Design.* In: Hermann, T. Hunt, A. Neuhoff, J. eds. The Sonification Handbook. Berlin: Logos Verlag Berlin GmbH. Chapter 5.

Summers, T. (2016). Understanding Video Game Music. Cambridge: Cambridge University Press.

Trainor, L. and Zatorre, R. (2009). The Neurobiological Basis of Musical Expectations. In: Hallam, S. Cross, I. and Thaut, M. eds. Handbook of Music Psychology. (pp 171-183). London, New-York: Oxford University Press.

Van Leeuwen, T. (1999). Speech, Music, Sound. Basingstoke: Palgrave Macmillan.

Zalta, E. (2010). Peirce's Theory of Signs. Stanford CA: Stanford University. [online] Available at https://plato.stanford.edu/entries/peirce-semiotics/

Zatorre, R. Salimpoora, V. (2013). From perception to pleasure: Music and its neural substrates. PNAS Direct Submission. [Online] Available at http://www.pnas.org/content/110/Supplement_2/10430.abstract.

LUDOGRAPHY

Beat Sneak Bandit. (2012). Simogo

Garage band. Apple Corp.

Guitar Hero.(2005) RedOctane, Activision

Pac-Man. (1980). Namca.

Patapon. (2007). Pyramid SCE Japan Studio.

Pong. (1972). Atari.

Rock Band. (2007) MTV Games, Electric Arts (AE)

Risk. Electronic Arts (EA)

Super Mario Bros. (1985). Nintendo.

Wii Sports. (2006). Nintendo.

Wii Sports Tennis. (2006). Nintendo.

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Tim Summers, *Understanding Video Game Music*

Scholarship about video game music is finally coming of age. Ludomusicology, or the study of video game music, is a burgeoning academic field of research that seeks to move video game music from the margins of game studies and its perception as a peripheral accompaniment to gameplay to its place as a central element of the game-playing experience. With very few exceptions, almost all academic journal articles or scholarly books on the topic have been published after 2000, and the majority of this research has been published within the last ten years. Early work in this area has dutifully served its purpose to establish video game music as a field that is worthy of critical attention, and helped to validate the work of *ludomusicologists* within musicology.

Interest in video game music is also evidenced by the growing number of academic conferences on video game music in Europe and North America, special interest groups in established academic societies, and the ever-growing body of published scholarship in this area.

Tim Summers takes this work a considerable step further. A Teaching Fellow at Royal Holloway, University of London, he is a co-founder of the UK Ludomusicology Research Group, which convenes an annual academic conference on video game music. Blending his expertise as a lecturer and scholar of music and games, Summers is usefully didactic (without being at all patronizing or condescending) and teaches readers about video game music and the ways it can be analyzed.

> *Understanding Video Game Music* is among an only handful of monographs specifically dedicated to music in video games, and it is one of the very few to be written by a musicologist for a primarily academic audience.

After a short introduction, Summers devotes Chapter 1 to the discussion of the video game as a musical source. Although musicologists and music theorists often rely heavily on a physical musical score for their analytical work, ludomusicologists rarely see the music they study engraved on musical staves. And as Summers explains, the music of a particular video game can vary widely depending upon the action of the player, the console the game is played on, and the version of the video game being played. Here, Summers also describes the types of music one is likely to find within video games, making sure to draw attention to the music of menus, loading screens, and session pauses, which is often overshadowed by the game's overworld music.

Chapter 2 outlines methods of analysis for video game music. Summers points out that actually playing the game is an important part of analyzing game music; watching online play-through videos only does not afford scholars the opportunity to hear the music that results from their interaction with the game. Summers then points to various analytical techniques already familiar to music scholars, such as the mapping of themes and motives, harmonic analysis, topics theory, music psychology, hermeneutics, formal analysis, ethnomusicological approaches, and performance studies, providing explanations and examples for each. He also points to sources outside of the game, such as production documents, trade magazines, interviews with creators and composers, patents, and player reviews as important satellite sources for analytical information. While Chapters 1 and 2 constitute the book's first part, dedicated to the techniques and materials of video game music analysis, the second part of the book offers critical perspectives and case studies.

In Chapter 3, Summers first introduces his concept of musical texturing, or the ways in which game designers rely on the pre-conceived references, cultural significance, and other "baggage" that comes with the music they use in a game to fill in some of the gaps left by deficiencies in the visual material, which "has the result of creating depth, implied detail and rounded context to the surface level of gameplay activity, elaborating beyond the basic frames of the gameplay mechanism" (60). He also goes on to introduce *epic texturing* in *first-person shooters,* or the ways in which music can change the perspective of the player from being solely focused on gameplay and instead connect "the player both to the subjectivity of the avatar and to the higher-level background narrative in which the avatar is placed" (83). For example, Summers refers to the music in *GoldenEye 007* (Rare Ltd., 1997) as an example of how the James Bond Theme (or an approximation of it) that plays throughout the game connects the player to the narrative of James Bond films they may have seen and to the franchise as a whole.

Addressing the notion of virtuality in game music, Chapter 4 outlines musical styles and compositional conventions used in various genres of racing games and how the music is employed to create an illusion of realism for the game's player. Summers also points out that music can create historical context for a game, either by using music from the concrete, "real" world, as with *Civilization IV* (2K Games, 2005), or by using music written by a contemporary composer using cinematic tropes and other musical signifiers that anachronistically allude to music of a different time period, as with *Age of Empires III* (Microsoft, 2005). In the chapter that follows, Summers uses speech act theory to discuss the power of music to communicate information within games, whether it alerts the player of the presences of a nearby enemy, conveys emotional material to the player, or directs them in the correct path to complete an in-game task.

Summers begins Chapter 6 by highlighting the strong connection between game music and its cinematic antecedents. As he recounts, not only are themes and other musical material in video games often directly borrowed from film and TV, the style and tropes from film music are used to give video game scores a cinematic quality. A thorough analysis of *Final Fantasy VII* (Square, 1997) demonstrates the value of a cinematic soundtrack and repetitive *leitmotifs* in depicting characters and their location, and in communicating emotional information to the game's player. Summers argues that music "routinely has a greater aesthetic priority, descriptive power and significant informational content in games than in film, primarily because of the graphical and sonic limitations of the rest of the media components, resulting in a proportionally larger role for the music" (p. 175).

Finally, Summers underlines in Chapter 7 the importance of interaction in the analysis and overall understanding of video game music. Examples of ways in which players interact with the game musically include *Legend of Zelda: Ocarina of Time* (Nintendo, 1998), wherein players use the buttons on their Nintendo 64 controllers to "play" an ocarina within the game. Likewise, karaoke games, dance games, and other music games, such as those in the *Guitar Hero* series (Harmonix 2005-2015), demand a type of interaction that is both performative and intrinsically musical (or at least rhythmic). He also describes in detail games, such as *Super Mario Galaxy* (Nintendo, 2007), that are played almost as instruments, mixing the pre-recorded music of the game with quasi-musical sound effects added by player action and interaction with the game. Summers also recounts instances wherein interaction with video game music is less "musical", but still interacts and is synchronized with the ludic action, as with the snowboarding games in the *SXX* series (EA Sports, 2000-2012). Summers ends with an epilogue that further explores the connection between playing games and playing music, and discusses the value of fun in both music-making and game-playing contexts.

Chapters 3-7 end with a valuable "Conceptual Toolkit" that highlights key points from the case studies presented in each chapter. In addition to its eight constituent chapters, *Understanding Video Games* includes an insightful Foreword by video game music composer James Hannigan on the value of both theory and praxis for video game music and its recognition as a legitimate form of aesthetic expression. This publication offers an additional game index, while its most useful extra feature is a seven-page appendix titled "How to Hear a Video Game: An Outline", which serves as a step-by-step guide to both listening to and analyzing the origins, genre, form, function, and extra-musical connotations of video game music.

Summers is able to present numerous musical examples and offers several options for analysis in each chapter. He asks important ontological questions about the source of video game music "texts" and their various versions and iterations––for example, which is the one "true" version of a video game's music?.

Although there are several video game audio and music books that are written primarily for practitioners hoping to break into the video game industry currently on the market, *Understanding Video Game Music* is among an only handful of monographs specifically dedicated to music in video games, and it is one of the very few to be written by a musicologist for a primarily academic audience. In my estimation, this book serves two vital functions for the field of ludomusicology. First, it offers a great introduction to the field of ludomusicology. But, despite the fact that this book was written primarily for budding ludomusicologists, Summers does a great job of defining gaming and musical jargon and explaining disciplinary assumptions in easy-to-understand terms for non-practitioners. Moreover, this book may be especially valuable to historical musicologists, as well as to media studies and game studies scholars, because of the way Summers builds his arguments from the ground up, describing the experience of gameplay (and in situ analysis) in great detail, and clearly laying out the foundation each analytical technique he introduces. Composers and industry professionals would also find this volume useful for broadening and deepening their understanding of the form and function of video game music across a wide range of styles and genres. In addition, each chapter of the book's second section presents aspiring ludomusicologists with many exemplary models of game music analyses to emulate. The book includes a range of useful tables and figures that present theoretical and analytical information in a wide variety of formats, and it features excellent musical examples and transcriptions of game music.

Secondly, this book serves as a much-needed overview of the various ways in which video game music can be approached and analyzed by ludomusicologists. When writing single book chapters or journal articles, ludomusicologists have little print space to expand their analysis of a musical example from a video game beyond one or two analytical techniques. Through this single-authored monograph, Summers is able to present numerous musical examples and offers several options for analysis in each chapter. He asks important ontological questions about the source of video game music "texts" and their various versions and iterations (for example, which is the one "true" version of a video game's music?). Of the recently published monographs on video game music, Summers' is perhaps the least esoteric. But despite its utilitarian design, it raises important questions and introduces valuable new theories and analytical techniques, while simultaneously clarifying, refashioning and championing tools already used by ludomusicologists. Most importantly, it helps to further ground the study of video game music in preceding musicological, philosophical, and media studies traditions.

REVIEWER'S INFO

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Michael Kamp, Tim Summers & Mark Sweeney (Eds),

Ludomusicology: Approaches to Video Game Music.

Michael Austin (Ed),

Music Video Games Performance, Politics and Play

As an expanding interdisciplinary field at the intersection of game studies and musicology, as well as sound studies, the interactive symbiosis between audio and visual elements of video games is essential in understanding game experience. The editors of *Ludomusicology*, state that the discipline, "at its broadest, attempts to see our engagement with music, any kind of music, in terms of play" and emphasize that "there is a special relationship between playing video games and engaging in their music" (Kamp, Summers & Sweeney, 2016, p.1). In the afterword to Austin's edited collection on music video games, William Cheng similarly observes that "much of ludomusicology's literature to date upholds music and play as a match made in heaven" (2016, p. 297). Earlier collections have appeared on video game music, such as a set of case study essays edited by Donnelly, Gibbons and Lerner (2014), as well as a comprehensive seminal collection edited by Collins (2008) that provides both industry and musicological perspectives, and that gives recognition to the chiptunes scene and to the growing importance of mobile phones in game sound.

> Both collections address the complexities, and pleasure, in the interactions between digital games and music. They provide an imaginative snapshot, and barometer, of the state of play in the study of game music, which has seen a steady growth in academic publications over the past decade.

While *Music Video Games* appears as part of a series in "Approaches to Digital Game Studies", offering a broad approach to the study of musical gaming, the

Ludomusicology collection is published as part of a series on "Genre, Music and Sound", which shifts the analytical focus to a musical understanding of video games. Born from an annual conference of the same title, organized by three musicologists who are also the editors of the collection, *Ludomusicology* takes on the task to systematize boundaries to the field of game music, albeit with an open attitude to the relationship between music and video games in general. This provides space for a range of methodological approaches from a musicological perspective. For example, music enhances both immersion into, and interactivity with, the game. In her paper, Isabella van Elferen develops a theoretical model in which musical affect, literacy, and interaction are identified as key elements in player immersion through the employment of game music.

An additional important characteristic of game music is that it is non-linear. Therefore, as Tim Summers points out in his study, the game must be played repeatedly to hear and analyze the variable, shifting, soundtrack. Only then can game music be fully understood in connection with its technical context, para-musical sources, and intertextual processes. In his paper, Mark Sweeney delves deeper into *intertextuality* through discussion of *Dead Space*, showing how cinematic conventions in the use of classical music can be heard in the use of neo-romantic (melodic) music as a narrative device, and the application modernist musical forms (which deconstruct traditional tonality) as underscore to signify and generate fear during game play. Michiel Kamp, meanwhile, investigates *paramusical* aspects of games, adapting Gérard Genette's notion of *paratexts*, shifting the focus of analysis to game music also exists in the *peritext*: "all those materials that surround and are attached to the text itself" – p. 75), outside the diegesis of game play, including menus and start screens. Summers suggests reaching further, beyond the game environment, including interviews, for example, to better understand the context of composition.

Focusing, by contrast, on the object of music-led digital games, music video games offer an opportunity to delve into a specific relationship between music and games. Such games can range from tools that enable the creation of music through game play (a type of gamification of music making) to games that involve the contexts in which music is developed, played and interpreted. Within a ludomusicological assessment of smartphone music games, Anahid Kassabian and Freya Jarman narrow down what they would include into the category of music games by deconstructing the main concepts involved in what such a game may entail, such as the activity of play, the structure of a game, and the very notion of "a music game". On the one hand, they include games, such as *Guitar Hero*, that allow control of "the production of sounds [during] the entirety of game play" and in which sounds are "a major part of the play" (p.122). On the other hand, they exclude games about music and musicians, and also games, in which sounds are only "a consequence of game play", including (perhaps surprisingly) games such as Rez, characterized by an explicit attempt to make sound an integral part of the gameplay mechanics.

The *Music Video Games* collection offers a broader view of what to include as a music game. In the editorial introduction, Michael Austin provides a range of definitions of music game play, suggesting that engagement with music can be compared to both the pleasure of game play as well as the structuring aspects of a game. Here he briefly considers music games as musical instruments. This is further explored in a separate chapter, where he theorizes music-controlling games as types of sequencers. In this way, games are understood in terms of mechanics, dynamics, and aesthetics, whereby gamification of music sequencing opens up new approaches to making music. Back in the editorial introduction, though, Austin also calls for an object-oriented approach that approaches music games in terms of genre rules and interface interactivity, such as rhythm-matching, pitch-matching, music-mixing and musical-making games. In this way, the focus turns to performance, on the personas that players may adopt during gameplay, and on the resulting music.

To illustrate the difference in approaches between the two collections, research by Melanie Fritsch appears in both collections. In *Ludomusicology,* she addresses the reinterpretation of the musical scores of *Super Mario* for orchestral performance. By contrast, in *Music Video Games* she investigates the use of Michael Jackson as a musical persona. Rather than enabling music making and performance, metonymic music games, then, allude to (known) musicians, to music making, or to the music industry. This type of music game veers away from how Kassabian and Jarman define music games in their contribution to Ludomusicology. The scope of *Music Video Games* collection is broad; it considers a wide range of music-focused digital games from historical, cultural and pedagogical perspectives, inspiring Cheng to call for "a ludomusicology that bounces along feelings of musicality, pleasure, and imagination, rather missions that get mired in agonism, definitional boundaries, and high scores" (p. 303).

> There is space for the further development of a ludomusicology as a rich subject area that is more than a sub-discipline of musicology, to further engage with the technological, social, cultural and economic dimensions of game music. There is also space for an inquiry into the symbiotic relationships between popular music and game music, both within games as well as within the sounds, attitudes, and interfaces of popular music forms.

Both collections address the complexities, and pleasure, in the interactions between digital games and music. They provide an imaginative snapshot, and barometer, of the state of play in the study of game music, which has seen a steady growth in academic publications over the past decade. Where they do differ, though, is that *Ludomusicology* aims to establish a sub-discipline in musicology of varying conceptual perspectives, including Medina-gray's discussion of modular video music composition and Gibbon's assessment of the role of classical music in games. *Music Video Games*, however, offers approaches to games that, rather than residing in musicology, are anchored in the interdisciplinary fields of media and cultural studies, with an interest in the politics and performance of play; for example, Plank's detailed study of online communal participation in *Mario Paint Composer*, and O'Meara's contextual study of *Rocksmith* as a music game and as pedagogical device.

Such diversity shows there is space for the expansion of ludomusicology as a rich subject area that is more than a sub-discipline of musicology, to further engage with the technological, social, cultural and economic dimensions of game music. As a field of study, there is scope for the further development of debate in order to refine critical approaches to the analysis and understanding of game music within variable contexts of creativity, production, distribution, performance, subjectivity, and play. There is also space for an inquiry into the symbiotic relationships between popular music and game music, both within games as well as within the sounds, attitudes, and interfaces of popular music forms. We've only begun to scrape the surface of a vibrant area of study that is still to be systematically explored.

ADDITIONAL REFERENCES

Collins, K. (Ed). 2008. *From Pac-Man to Pop Music*. London and New York: Routledge.

Donnelly, K.J., Gibbons, W. & Lerner, N. (Eds). 2014. *Music in Video Games: Studying Play.* London and New York: Routledge.

REVIEWER'S INFO

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INTERVIEW

The Ludomusicology Research Group

In this interview with Mark Sweeney, GAME discusses the activities of an important research group for the study of music and games.

GAME: You started the Ludomusicology research project in 2011 to offer a musicological and academic approach to the study of games, as a group of three young academics. What was the motivation for this?

Mark Sweeney (Ludomusicology Research Group): I was just getting started with my doctoral research on aesthetic theory and video games music when my doctoral supervisor, Peter Franklin, put me in touch with Tim Summers. Tim was in the final stages of completing his doctoral work on video game genres and music at Bristol. We met in the King's Arms in Oxford to discuss our research and hit it off, and in our discussions about the landscape of video game music research, between us we only knew of one other doctoral student at that time, Michiel Kamp, who was at a similar stage to me at Cambridge. Michiel's thesis was (eventually) titled *Four Ways of Hearing Video Game Music*.

Although we were all working on different things, we all had a similar background having taken undergraduate and masters courses in musicology, and the three of us decided that it would be great to organize a conference to see what sorts of research other people were doing on this material – video game music. We also decided that as part of the conference organization, it would be helpful to have a website, so we founded the Ludomusicology Research Group in August 2011, and I built the initial site and started posting news items that we hoped would be of interest to the broader community.

The main motivation for the group was, from the outset, ultimately about discovering what other research was taking place around the world, and who was out there paying serious attention to video game music. It was a very important "discovery" phase, and we wanted to provide some form of a hub (the website, and the conference) to connect researchers together and share ideas. Of course, although we now have a more clearly defined community, the discovery phase is open-ended and is central to our group philosophy.

GAME: When did the first LUDO conference take place? How many people did it attract? What academic/professional background do they have? Over the years, has there been a shift in the type of people who attend?

M.S.: The RMA Study Day at St. Catherine's College in Oxford was the real starting point for the Research Group. Around the time we set up the website, we also linked up with Huw Catchpole-Davis who was doing a doctorate in composition at Oxford, with a focus on interactive and generative musical systems. In fact, it was Huw who designed the logo that we've used for all our branding ever since!

With support from our supervisors – Nicholas Cook (Cambridge University), Peter Franklin (University of Oxford), Guido Heldt (Bristol University), Robert Saxton (University of Oxford), and Duncan Williams (University of Oxford) – the four of us secured funding from the RMA and were very fortunate that both Anahid Kassabian and Isabella van Elferen agreed to provide keynote addresses at the inaugural Ludo conference. Tim had heard Anahid speak at Bristol, where she had expressed her interest in the video game as a musically significant medium. Michiel had studied with Isabella in Utrecht, and we were all familiar with her work on the topic.

Through Jonathan Williams (Oxford), we were also lucky to make contact with industry professionals like Rich Aitken at Nimrod Productions, who also gave up his time to participate and present. The incredible input of all these people ensured the event was a success and laid the foundation for future events.

We were fortunate that several other major practitioners and academics found our "Call For Papers" and attended the event, including Melanie Fritsch, Stephen Baysted, and Roger Moseley. Given that we hadn't done anywhere near as much promotion for the conference as we do now, it was quite surprising we had so many excellent contributors and delegates!

The number of delegates has increased, steadily, year-on-year. It's great to see many Ludo regulars returning every year, and there are always news faces too, and occasionally people representing previously underrepresented disciplines.

GAME: In the context of the Ludomusicology project, how does the group apply a musicological approach to game music, and distinguish between the study of game sound design and of game music?

M. S.: Although the very term "Ludomusicology" betrays our disciplinary background, as a group, we have from the outset conceived of the emerging field as being particularly interdisciplinary. At our conferences, we have always made efforts to include a wide range of papers from researchers and practitioners that represent a considerable diversity of disciplinary perspectives. Musicology is one discipline amongst many that is involved in this. We know that the term has been understood as divisive in some quarters, but we don't mean it to be exclusionary at all. It's a fun, lighthearted term; it's become a useful shorthand to refer to the area of study, a way to network scholars, be honest about our backgrounds, and a way to say that we are taking to this material with a scholarly attitude.

GAME: How does Ludomusicology intersect with other centres and scenes regarding the study of sound and music in games?

M. S.: While we have been primarily in contact with other academic organizations and initiatives studying video game sound and music (see below), some of our colleagues are regular posters on the Overclocked Remix forums, which originate in the gaming community. There are more and more web-based communities and blogs focusing on music in games, in addition to real-world events like Video Games Live, and our connections with these are necessarily loose and informal.

The North American Conference on Video Game Music was established in 2014 by Steven Beverburg Reale, William Gibbons, and Neil Lerner, after Steven got in touch with us following our 2013 conference in Liverpool. In 2016, their committee also included James Buhler, Karen Cook, and Elizabeth Medina-Gray. NACVGM is very close in spirit to our Ludo conferences, and there has been plenty of crossover in delegates and presenters. Our close relationship with our colleagues in North America is particularly important, and from the outset we worked together to provide greater access to conference opportunities on both sides of the Atlantic.

Game Music Connect was established in 2013 by James Hannigan and John Broomhall (composers for multiple media forms, including games) and was targeted at primarily amateur, pro or semi-pro composers, but also to audio directors. We were very fortunate to have James Hannigan present at Ludo2014 in Chichester, alongside Richard Jacques and Winifred Phillips (both composers for successful games).

GameSoundCon was established in 2009 by Brian Schmidt and is targeted broadly at people working in the industry, or those involved in music and sound for more traditional media (film, T.V., music, etc.) who want to learn how games are different from linear media.

However, even older than all of these is Audio Mostly (http://audiomostly.com), which held their 10-year anniversary conference in October 2016 in Sweden (in 2017, the event was held in London). The first Audio Mostly conference (also in Sweden) in 2006 was described as a "conference on sound in games", and in the following year, this was expanded to "Audio in all its forms".

In December 2016, we teamed up with colleagues from NACVGM and Audio Mostly to launch the Society for the Study of Sound & Music in Games (SSSMG). SSSMG is an umbrella network with an extensive advisory board of leading academics and practitioners. The aim is to provide a hub to connect together these various groups of people working on game audio and to support advances in the understanding of sound and music in games. The SSSMG helps anyone who investigates game sound and music, whether in an academic or professional setting, to discuss the topic together, exchange ideas and information, and keep up- to-date with new research. Anyone can join, and the members are always looking for new approaches to the subject.

SSSMG have since announced our plans to launch a new journal entitled the Journal of Sound & Music in Games (JSMG). JSMG will be an academic peer-reviewed journal presenting high-quality research on video game music and sound. The journal will not seal game audio into a scholarly suburb, but will instead be an outward-looking publication that seeks to engage game audio practitioners and researchers from a range of disciplines, including anthropology, computer science, media studies, psychology and sociology, as well as musicology. Keep an eye on the website in the coming months for updates on this exciting project.

GAME: What are your selection criteria for venues of the Ludomusicology conferences? How did Southampton contribute to the presentation and experience of the 2016 event?

M. S.: Our original aim was to encourage inter-university collaboration and dialogue, and to establish game music as a research strength for UK academic musicology. I think this was because, at the start, we did not foresee the international scale of the emerging field or our full potential role as a hub to facilitate and encourage research on video game music across the globe and cross-disciplinary borders.

We're particularly grateful to Anahid Kassabian who was the first person to suggest another conference after the Oxford study day and kindly offered Liverpool as a host. By doing the second conference the next year, it implied it was going to become an annual event. Even by this second year, authors were contacting us to say, "I can't make it this year, but I'll make the next one", under the assumption it was going to be an ongoing project. This set the precedent we've been lucky to be able to follow.

Subsequently, our selection criteria for the Ludomusicology conference venues have evolved on a pragmatic basis. In 2015 we held our first overseas conference at Utrecht University, and we hope to alternate between the UK and the [European] continent in future, if possible. We also try to take into account the accessibility of the host institution for international travelers and do our best to keep costs as low as possible for what is still predominantly an early career academic demographic.

We have been fortunate to have a great diversity of approaches at the Ludo conferences. In particular, we've had solid papers from computer scientists, ethnomusicologists, psychologists, theatre studies, and so on. In terms of disciplines, we see ourselves as a broad conference. All disciplinary approaches are welcome to come and play together in this domain. We have tended to focus on game music through the lens of musicology, because we have that disciplinary background and that this was an area that musicology hadn't really approached very much before. There is sonic substance in games that is understood by creators, players, and critics as specifically musical, and the disciplinary approaches that musicology has built up has interesting things to tell us about this material. One of the most exciting things about this topic is that it is so well suited to interdisciplinary collaboration. Just as we bring (primarily) our musicological training to bear, so we want to learn from those with disciplinary resources we don't have, and to try and discuss these together. Every year, we've had involvement from industry professionals [mainly game composers], and we see it as a significant priority to cultivate those links alongside developing cross-disciplinary connections.

GAME: How do you reflect back on the experience of the Ludomusicology Research Group concerning the growing attention for music-related aspects of gaming?

M. S.: It's been inspiring to be working in this field at a time of such growth and interest. If we hadn't started something like this, it would have evolved elsewhere anyway. The connections make it useful to be aware of other research in progress, and an opportunity to talk with other scholars working on similar ideas. I think it also helps to cultivate a collaborative, rather than purely competitive approach. One of our long-term delegates said to me during our 2016 conference: "It's great that we can be critical of each other so much more now." I'm delighted that this person felt this way – that we can now hold each other to a higher academic standard and that it provides a comfortable, supportive environment for discussion and productive criticism.

GAME: Has anything changed regarding game music in the industry and/or in the academic world? Has the academic world been chasing up developments only, or is it also fostering new ways of looking at games? And, how do you think the area of game music and sound studies is developing now?

M. S.: It has been fascinating to see game audio studies slowly becoming part of an accepted landscape of study. It took film music scholarship quite some time to establish its own legitimacy, so I think we're making good progress. We've also been lucky to witness exciting times in the industrial development of game audio and sound.

We are on a continued mission for further interdisciplinarity, and that's going to be especially important in discussing new developments of VR [Virtual Reality]. This is an interesting phase of audio development when some of the fundamental questions about game audio that we've been talking about are now being discussed by industry practitioners, some of which are also consulting with academics [on] how to approach these issues. We have been working in partnership with ThinkSpace Education (https://thinkspaceeducation.com/?v=79cba1185463), a provider of professional degrees in game audio. This is one way that the research at our conferences helps to inform the practice of those who are entering the industry as audio professionals.

Again, coming from musicology, we've tended to emphasize historical and critical approaches related to user experience, musical cultures, and compositional creation. In that sense, yes, it is retrospective, but it's also an attempt to understand the experience of players who are at the heart of this cultural locus. And that's a concurrent phenomenon. We would, though, be very interested in engaging in closer dialogue with the industry. There's certainly the potential for this kind of study to develop into industry-facing research, as a domain that has the time and resources to engage with questions about music and audio in games that commercial companies do not have the expertise, time and resources to answer.

GAME: Please tell us more about the edited collection Ludomusicology: Approaches to Video Game Music (2016). How was this shaped within the context of the research group and its conferences? When did you start work on this?

M. S.: We are delighted that our edited volume, Ludomusicology: Approaches to Video Game Music, was published by Equinox. The majority of the chapters were born out of papers given at our inaugural conference in 2012, although we did not begin work on the project until much later. Authors have taken time to expand those ideas and develop them. Rather than focusing on history or particular types of game, we've been trying to put together a collection that will be useful to provide different ways of understanding this game music, which is one of the main projects of our scholarship.

AUTHOR'S INFO:

C Mark Sweeney (independent researcher) is a founding member of the Ludomusicology Research Group, and the Society for the Study of Sound and Music in Games. He has co-edited an anthology of essays and a journal special issue, and co-edits the book series "Studies in Game Sound and Music". Mark's research interests stem from a DPhil thesis on aesthetic theory and video game music, completed at the University of Oxford where he was also a Stipendiary Lecturer in Music at St Catherine's College.

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