

Composing Video Games

Introduction

Games and music have been around since before recorded human history, with archaeologists uncovering ancient Iranian dice [1] and paleolithic bone flutes [2]. The Ancient Greeks played musical games like *Cottabos* [3], and late Baroque middle-class Europeans enjoyed *Musikalische Würfelspielen*, or musical dice games [4]. Many games involve singing, clapping or other musical activities, while music performance and practice can often be of a competitive nature. Games have been used as educational tools to teach music and musical concepts since as early as 1793 [5], while music has accompanied sporting events since ancient times [6]. Suffice it to say, games and music have been commingling for a long time.

Both games and music exist through the activity of play. In the English language, unlike Spanish and Portuguese, the verb *to play* denotes both the activity of music making and the act of participating in a game. The polysemy play is found in the Germanic, Slavonic and Arabic languages with no sign of a shared etymological root. It is unlikely mere coincidence, rather, it may evidence a deeper human intuition on the similarity between play forms in human culture [7].

With the creation of the digital computer, games and music share the same means of production, and can occupy the same virtual play space. In the early days playing a videogame or composing a piece of music took all of a computer's resources, thus interactive music applications were difficult to create. Video games with a sound component were not well known until the ominous chromatic bass line of Space Invaders looped throughout video arcades. The technological limitations of early 8-bit games led to a now coveted aesthetic of animation and music, with the use of imitation of this technology spawning the genre of chiptunes [8]. Video game composers also created earworms that have become popular in their own right, eventually being performed by symphony orchestras and choirs [9].

Coming from experimental mainframe computer programs to a multi-billionaire dollar industry, video games have found a sturdy foothold in the consumer market. After a few crashes in the North American console and home computer markets, video games are now a worldwide phenomenon that out grosses the film and music industries in revenue. In recent years video games have been able to not only offer cinematic experiences but also immersive musical atmospheres. Beyond these passive elements video games offer an interactive experience not found in the movie theater. The ability to actively steer the narrative and control character actions is a fundamental advantage of video game systems.

Video games are an ideal form of synthesizing games and music due to their digital nature. Game controllers can manipulate the music of games, and musical instruments can control gameplay. The area between these two extremes is endless and has been explored by early audio/visual pioneers and newer generations of artists. Below I will describe a series of historic and contemporary games that deal specifically with digital play of music.

The 20th Century

Moon dust (1983) is an interactive audio visual computer program for the Commodore 64 and is widely referred to as the first art video game. Created by Jaron Lanier, it features an ambient electronic score with generative arpeggiated phrases corresponding to game events. [10] The game was a commercial success and is featured as an installation piece in art galleries. While this computer program may be enjoyable to play, the game-like scoring aspect is mostly superficial. Lanier himself says ‘there was a scoring system that nobody [sic] payed attention to... people just liked playing with the pretty music and pretty visuals.’ [11] It is not so much the game elements that makes it popular, but the general aspect of play that this program allows. Its lasting impression is not because of any challenge or skill the game required, but as an early, easy and fun way to interact with light and sound.

1987 saw the release of *Otocky*, a musical side-scrolling shooter for the Famicom Disk System. This game is noted for its interactive musical component, but it also has explicit goals like more traditional games. By destroying enemies and collecting items, the player is advanced to the next level, eventually fighting an end-game boss. Musical notes are produced as a side effect of firing the weapon, with each shot being quantized to the tempo of the underlying bass line. Through normal gameplay a melody emerges, but players can also freely improvise with the system. Ultimately the game offers a great balance between free play and completing objectives. Players can take as long as they want to finish a level, but each level has a new set of visuals and music. Designed by Toshio Iwai, this game went on to inspire later games like *Rez* and further works by Iwai such as *SimTunes* and *Elektroplankton*. The musical engine of this game is a clever design resulting in endless musical possibilities that avoid listener fatigue while using minimal computational resources.

Apart from games specifically designed to interact with music, separate systems for adaptive and procedural music have been created to accompany games. *iMuse* or *Interactive Music Streaming Engine*, by Michael Land and Peter McConnel, was used prominently in LucasArt's *Monkey Island 2* and subsequent LucasArts adventure games [12]. *iMuse* was unique for having the musical score fluidly transition from one scene to another, with timbres and melodies changing to reflect the different moods and visuals.

While *Otocky* and *Moondust* were holistically created by a single designer, *iMuse* is notable as a piece of software that worked for multiple games designed by teams of developers. *iMuse* is a good example of an adaptive music system that can be incorporated and reused for more traditional video games. *Moondust* is seen as a pioneering art video game, and is most similar to contemporary games that involve exploration of procedurally generated content, while *Otocky* can be thought of as a game that sonifies game events producing a score on the fly. In the following section I will survey 21st century video games that, while perhaps not directly inspired by these early games, definitely share many elements.

The 3rd Millennium

With a generation of composers who grew up playing video games, there is a much more concentrated effort to develop music video games for performance, exhibition, exploration and most importantly, play. In 2013 the *Foundation for Emerging Technologies and Art* (FETA) put out a call for works “that engage music and technologies in game-inspired multimedia interaction” dubbed the Cellotronic Games [13]. From the applicants seven composers were commissioned to write pieces for performance in the Spring of 2014. Before this, numerous independent game developers have created games with an emphasis on musical control and creation.

The *Center for Computer Research in Music and Acoustics* (CCMRA) at Stanford has been an incubator for artists and programmers who make musical games, holding a Music and Games concert and giving a workshop on designing musical games [14]. The majority of these pieces have featured the modification of existing video games or video game engines by incorporating *Open Sound Control* (OSC). This allows players/performers to broadcast gameplay data for use in sonification or procedural music generation.

maps and legends by Robert Hamilton is a performance piece adapted from the Quake 3 engine. The game communicates with Pure Data (PD) via OSC and ‘the global position of individual game players within the virtual game-space, and certain subsequent actions performed by each user, are mapped to a number of sound-generation and spatialization control parameters creating a rich interactive-system for musical control.’ [15] Similar techniques have been used on other games/engines including Starcraft 2 [16], the Unreal 3 Engine [17], and Minecraft [18]. Unlike most video game or art mods, which have been around for decades, the games by the CCMRA community emphasize musical performance and interactivity.

Other artists employ similar techniques for creating music from game events, but rather than modify existing games, they design their own. *OSCAvoid* by Niall Moody [19], is a multi-player

game that communicates via OSC. This is designed as a proof of concept for using a game to control existing multimedia art systems and led to an Exquisite Corpse OSC Game Jam [20]. OSC communicates over User Datagram Protocol, which was used by Alex Wroten for his three musical games: *Sphere*, *Pyramid* and *Cube* [21]. Wroten's games are designed to be used with a video game controller, essentially mapping the video game controller to music control.

John Dunlap takes a different approach to game control by using a vocalist's singing voice to combat virtual invasive bacteria in his game-piece *Organ Failure* [22]. In the work *Modal Kombat* [23] by David Hindman, players control the animation of *Mortal Kombat* characters by playing musical instruments in conjunction with *Sonictroller* [24].

David Plans and Davide Morelli use player experience, rather than game events, to drive music synthesis engines. Their system uses measurement of player excitement, frustration and fun to procedurally generate music to the video game *Infinite Mario Brothers* [25]. The music creation relies on player experience modeling rather than sonification based on game events.

While the previous artists modified existing games or programmed their own, Jordan Bartee builds his video games from scratch, hardware and all. *Ming Mecca* [26], designed by Bartee, is a voltage controlled video game console made of modular rack mounted units. With a patchable interface, it allows users to control and glitch 8-bit audio and visual data. It affords a player the ability to safely circuit bend their video game while playing it, creating and destroying virtual worlds. By manipulating gravity and collision detection controls the tile-based levels turn into an interactive 8-bit sequencer that leans towards an abstract generative audio/visual sequences. *Ming Mecca* not only allows one to play a hybrid musical video game, it lets the player play with the guts of the games hardware, redefining the very idea of the game being played.

The majority of the games described so far in this section were experimental games intended for performance and not market success. There are a growing number of indie games that have strong music control characteristics and commercial viability. *Wave Trip* by Lucky Frame [27] is

described as a musical arcade game that runs on iOS devices. Every game event is linked to a sonic event, and players can create their own levels/write their own pieces for this app. This is not unlike Lucky Frame's other games *Bad Hotel* and *Pugs love Beats*, both games which encourage simultaneous goal achievement and music creation.

David Kanaga, self-described music designer sees little reason to differentiate between games and music: 'As events and processes in time, musical structures and game structures can be described isomorphically. That is to say: games are musics, musics are games.' [28] The creator of multiple award winning independent video games, Kanaga creates procedurally generated worlds for players to explore.

While a wide range of games have been discussed in this section, many have been neglected. Further sources of information on music and audio in more popular video games include Karen Collins' books *Game Sound* [], *From Pac-man to Pop Music* [] and *Playing with Sound* [] and Kiri Miller's *Playing Along*

The Future

As video game systems incorporate more sensors and devices the field of digital play is ever expanding. Electronic musicians and artists are quick to take advantage of this technology, often using or contributing to open source projects and ever cheapening hardware resources. With the tools in everyone's hands, it would seem that games and digital play are limited only by our imagination.

When considering what video games may become, it is important to understand what they are. Defining video games outright is more trouble than its worth, and worrying about the specifics of the medium is restrictive to the exploration of digital play and art. This is not to say that we should dismiss video games altogether, but let go of any preconceived notions we may have

when considering the future. The games we have looked at are interesting for a variety of reasons, but most of all they cultivate a field of play inclusive of music.

Popular rhythm based games offer players the karaoke equivalent of a musical video game experience. This completely misses one of the major advantages of digital music systems, that being the ability for non-musicians to have meaningful musical interaction with other humans and computer agents. New possibilities with technology allow for new experiences, new modes of interaction further engender and inspires new ideas. Whats the use of having a worldwide communication network if there is no reason to communicate with anyone? Play is a form of interaction that does not require language, but can still allow for meaningful communication. I do not know what a video game will be in ten years, but I do think that we should use technology to promote creativity and interactivity, and that play is the ideal means of achieving this.

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