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Case Study

Sound of Music: The Form, Function, and History In Video Games

Do you remember the first video game you were really into? I mean *really* into. You couldn't put the controls down, your eyes were bloodshot from staring for hours at the screen, and all you could feel was the game. What was so hypnotic about it that kept you glued to the screen? What was it that made your heart race with anticipation and your body tingle with expectation?

The atmosphere of a video game is probably one of the most valued in importance when it comes to enjoying a game. A game with a good plot will be dull if the stimuli of the game does not actually get the player involved on a mental level. The most obvious of these stimuli is the visual aspect: the graphics of the video game. Yet another, equally important element in providing a complete atmosphere, a thoroughly enjoyable game-playing environment, is the sound and music that plays endlessly in the background.

Just think, for one moment, what it would be like to play a game such as *Super Mario Bros.* without the carefree rhythmic ditties encouraging you along or *Resident Evil* without the ominous ambience subtly putting your nerves on end. Without a full range of physical and mental stimuli, the video game itself often is less than complete. Yet the importance of music in such a media is often overlooked. Critics and players alike typically comment on what they consciously understand about a game: the story, the controls, the graphics. Nonetheless, at the very least, music subconsciously takes hold of the player and pulls him or her into the actual world of the game. Every so often, however, the music becomes such an outstanding feature of a game that it does become the topic of conversation, and people really do begin to appreciate just how important the auditory features of a game are.

Clearly, with the progression of technology has come a progression in the sound and music aspects of the video game industry. What began as a few hard-wired beeps has evolved into an impressive collection of digitally represented musical creations. Higher quality audio, as well as ever-increasing budget for such elements of game design, has allowed players to do more than just play a game, they can truly *experience* it.

The History

Tracing the progression of sound and music in video games over the past fifty years truly helps put into perspective just how far this type of media has come. The earliest sounds were little more than electronic beeps and buzzes, but over time patterns of these same mechanical tones were developed, creating primitive tunes. These tinny ditties soon developed into more intricate compositions, and presently, video game music has risen to a whole new level of complexity and professionalism.

The very first video game can be traced back to 1958, when William Higinbotham, an engineer at a U.S. nuclear research facility, fashioned a crude tennis-type game on an oscilloscope. Despite the progression marked by this accomplishment, music and sound in video games was yet to be born, as Higinbotham's creation was noiseless. Five years later MIT student Steve Russell's brainchild, *Spacewar*, was designed. The protogame featured two dueling spaceships controlled by toggle switches, and was produced on the mammoth PDP-1 computer [McDonald]. This mainframe was about the size of a Buick, yet regardless of the immense girth of the system, not a single sound emanated from it. Both of these milestones in video gaming were completely silent.

It took nearly a decade for any more significant developments to be made, but in 1972, the very first videogame home console was released by Magnavox. The aptly named Magnavox Odyssey came with plastic overlays, intended to create a "background," which were placed on the television screen. The system is rather impressive for the times, and is fully analog, but still is tragically fully silent.

Following the release of the Odyssey, Nolan Bushnell founds Atari. Later that year, Atari tests its new arcade game, *Pong*, at Andy Capp's Tavern in Sunnyvale, California. *Pong* marks the true beginning of the arcade revolution, as the game was comprised of two player-controlled paddles batting around a digital ball and featured the very first in-game sound. The hypnotic sonar-blip of the ball striking the paddles is simple, but captivating. Nonetheless, Atari's monumental game still functions exclusively on hardwired circuits.

Three years later, in 1975, the Japanese company Taito manufactures the game *Gunfight*. Imported into the U.S. by Midway Games, *Gunfight* is the first video game to use a microprocessor instead of previously used hardwired solid-state circuits. A one-channel amplifier provides mono gunshot sounds. This is Taito's first major contribution to the video game sound system evolution, but by no means the last.

1977 proved to be an enormously successful year for Atari as the company released its very first home videogame console. Simply named the Video Computer System (VCS) and later known as the 2600, the system sets the benchmark for future consoles. The 2600's sounds are scratchy and primitive, yet were nonetheless impressive at the time. The enormous success of the 2600 gives a generation a new experience of visual and auditory stimuli.

The following years saw some subtle growth in sound design, beginning with 1978's explosive *Space Invaders*, another Taito game. *Space Invaders* owes a large part of its appeal to its menacing, paranoia-inducing soundtrack. While not music as it is commonly understood, the thumping audio track actually accelerates in tempo as the enemy invaders draw nearer. Games will continue to use similar sound design for years to come, such as Atari's *Asteroids*, released the following year. The effect of such a design: sweat, panic, and increased blood pressure in a generation of gamers [McDonald]. Also 1979 saw the first talking video game in the home console arena, *Major League Baseball* for the Intellivision system. Though not by any means musical, the computer-generated voice marked new exploration in the use and progression of sound. At the turn of the decade, pop-culture got its first major video game makeover with the release of both *Pac-Man* and *Defender*. *Pac-Man*'s melodies mesmerized the public and permeated through the consciousness of the people. *Defender* boasted a busy,

chaotic sound design; the ship would thrust and shoot, while aliens exploded everywhere, creating a wall-of-noise effect that heavily contributes to the game's dynamic intensity.

Meanwhile, Atari had been developing a new microchip which would soon be put to use in the first color vector arcade game, *Tempest: Sound and Fury*, in 1981. The new Pokey chip is used primarily to generate sound, though it controlled other functions as well. The chip has four separate channels, and the pitch, volume, and distortion values of each can be controlled individually. *Tempest* uses two of the Pokey chips for a total of eight "voices" arranged in endless combinations. Atari then releases a separate soundtrack for the game, identified by the online video game museum I.C. When as the first stand-alone audio soundtrack in the videogame industry.

In 1982 Atari continued to establish itself as the forefront of the gaming business by releasing the Atari 5200. The system incorporates the four-track Pokey chip, but is otherwise a console version of the Atari 8-bit computers. Several arcade games make the move into the home arena thanks to the improved technology of the 5200.

The first arcade game to feature blossoming laserdisc technology, Cinematronics' *Dragon's Lair*, is released in 1983. The new technology allows for greater audio storage, making it one of the very first to incorporate stereo sound and actual voices. *Spy Hunter* follows in the tradition of stereo audio later that year, allowing one channel for the familiar Peter Gunn spy caper theme and the other to activated game sounds.

Two years later, Nintendo test-markets its new video console, the Nintendo Entertainment System (NES) in New York. The new 8-bit system boasts a powerful Motorola 6502 processor and performance that was unmatched. The NES was Nintendo's first major reach into home consoles in the U.S., but the company had already established itself in Japan. In 1984, a year before the U.S. had even heard of the console, the Japanese markets had been bombarded with the Famicom, which would become known in the U.S. as the NES. The Famicom would sell over 2.5 million of these systems in Japan before the end of 1984, and similar success would follow in the U.S. the following year. Games such as *Tetris* and *Super Mario Bros.* made the NES an instant success. The infectious rhythms of the Russian-programmed puzzle game would gain tremendous attention, but nothing would rival the game featuring an Italian plumber, countless oversized pipes, and walking mushrooms. *Super Mario Bros.* set a new high-water mark for music in video games; constantly shifting tone to match the action onscreen, the sound design achieved a new level of synthesis with the game play.

Meanwhile, the competition reacted to Nintendo's phenomenal success. Atari released the 8-bit 7600 system, while Sega countered with its own 8-bit home console. Sega's features four dedicated sound channels, three for music and one for noise. The following years would see a few 16-bit systems with higher audio capabilities, including the NEC TurboGrafx-16, Sega Genesis, and Super NES.

At about the same time, Ken Kutaragi would link himself with Sony, and start investigating a new format for video game audio. Around 1987 he would begin researching synthesizer sound and PCM, or pulse code modulation, a type of sound generation that samples and reproduces sounds by means of digital signal processing. Up to this point, the commonplace technique was frequency modulation, FM. Kutaragi found that the sound produced by the Sony PCM generator was several times better than FM, and thus began to pitch a sales proposal to Nintendo. At first, Nintendo was reluctant to switch to PCM because all existing Famicom software assets were FM-based.

Nonetheless, PCM proved to be superior to FM with respect to software flexibility as well; the PCM format held for greater potential for software innovation, a crucial factor in game-machine design [Asakura]. Nintendo ultimately adopted Kutaragi's proposal, which quickly led to a close relationship between the two companies.

After the U.S. release of Super NES in 1991, Sega began a series of add-ons, peripherals, and updates to its old 16-bit Genesis system. In 1992 it released Sega CD as the migration to CD-based storage continued, improving the audio storage capabilities in the process. A few short years later, in 1994, Sega 32X was released to the public as a 32-bit peripheral to the old Genesis. The 32X adds two more sound channels with its built-in PCM stereo sound chip. 1995 would give birth to the new 32-bit Sega Saturn system, as well as its rival, the 32-bit Sony PlayStation. Sega's new console employs two sound processors, a Yamaha FH1 24-bit digital signal processor and a 22.6 MHz Motorola 68EC000 sound processor. Comparatively, the PlayStation's 24 channel sound chip provides CD-quality stereo sound and has built-in support for digital effects such as reverb and looping.

The next few years would see a bit of a static in music development in the arena of home video game consoles. In 1996, Nintendo released Nintendo 64, which would pass most of its sound generation to its powerful CPU rather than a separate sound chip. But it wasn't until 1999 that truly significant changes were brought to the public, boxed neatly in the form of the Sega Dreamcast. It possesses a powerful 128-bit central processor and a super intelligent sound processor, which has a 32-bit RISC CPU, which equated to 64 channels of adaptive differential PCM or ADPCM. About a year later, in late 2000, Sony would release their much anticipated PlayStation 2. It would match the Dreamcast's 128-bit CPU, but downgraded to 48 channels of sound, adding instead 2 MB of dedicated sound memory.

The end of 2001 would spark a whole new rivalry, this time between Nintendo's Gamecube and newcomer to the home console, Microsoft's Xbox. Improved on-board sound processors and memory would just be a small part of what these consoles would add to video game music. The Gamecube's little compact discs can hold up to 1.5 gigabytes of memory, allowing for higher quality music, and more of it. Furthermore, Gamecube games such as LucasArts' *Star Wars Rouge Leader: Rogue Squadron II* will use Dolby Pro Logic II surround sound technology, becoming one of the first videogames to do so. Nonetheless, Microsoft seems to have gone bigger and better with its Xbox. Featuring a staggering 256 audio channels, 64 of them in 3D Dolby Digital 5.1, the Xbox features the new Dolby Interactive Content Encoder which immerses the player in surround sound when it matters most, while playing the game. Xbox is therefore the first game platform to be able to incorporate real-time Dolby Digital effects into game play. Furthermore, the Xbox allows the user to create his or her own personal gaming soundtrack right from a personal CD collection. This kind of customization is revolutionary in the home console industry, and with computer and sound technology rapidly improving, we can only guess as to what the future might bring.

A Move Towards Interactivity

Nearly all video game music over the past three decades has been linear in nature. That is, the songs have been pre-arranged with certain lengths. In the game, these tracks are switched at different points in time, but otherwise loop endlessly. While this has become a bit of a standard, pioneers have been experimenting with more interactive music in an attempt to draw the player more and more into the game. Interactive music is typically understood to be music that dynamically changes based on events and conditions in the game world. For example, the tone and tempo of the music may depend on a character's health as well as proximity to an enemy. Games such as *Need For Speed* and *Soldier of Fortune* employed relatively primitive methods for accomplishing interactive music.

The future of this type of sound is up for some debate. However, most experts agree that to accomplish quality interactive music it would take a combination of sample-based music and use of the MIDI/GM. Many producers tend to consider MIDI obsolete and dismiss the usage of it altogether. Composers have found ways to sidestep full MIDI usage, but the interactivity tends to remain fairly limited due to memory restrictions. Lee Jackson, Music and Sound Director for 3D Realms Entertainment pragmatically states: "I really don't believe that full-blown interactive music, where every little part of a track can be affected by the user, will ever really take hold. The payback just isn't there, and users won't ever really care whether or not the bass line changes because they just stepped in a pile of something smelly [Gamasutra]." All the same, full immersion in a game can be reached through more interactive music, even if it does take a few steps backward to progress forward again.

The Major Players

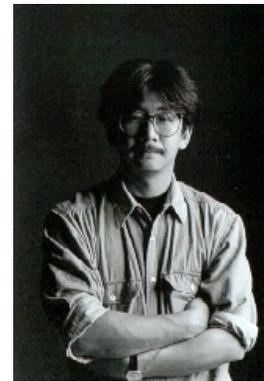
Hardware and software aside, video game music is reliant entirely on the musicians who create the melodies and rhythms that work their way into our consciousness. While some recent games have opted for pop-culture bands to be featured on their respective soundtracks, most games thus far have relied on original compositions. As in any industry, there are certain composers that stand out about the rest. Two such men that have risen in the ranks of the most respected video game music composers are Yuzo Koshiro and Nobuo Uematsu.

As a youth, Yuzo Koshiro was always interested in video games. From an early age he had decided he wanted to be involved with them, and as a high school student, decided he wanted to program for games. But with years of musical experience behind him and a want ad from a PC magazine in hand, he entered the offices of Nihon Falcom resolved to be involved with them as a composer. Koshiro brought Falcom a tape with several of his recorded compositions and he was soon an employee of the company's music staff.



His first professional project for Nihon Falcom would result in the highly renowned soundtrack for *Ys*. Koshiro would continue to gain wide recognition after he went freelance in the early 1990s with *Shinobi* and the *Streets of Rage* series. The first installment of the latter would actually be his ticket to stardom in the United States. Since he had his name on the title screen, he was one of the first Japanese game musicians to receive any kind of publicity in the U.S., getting one or two interviews in magazines. Koshiro continued to compose beautiful works, and ultimately cemented his place in the annals of video game music with his groundbreaking work on *Actraiser*. He has continued to create highly respected music with games such as *Adventure Island* and *Shenmue*.

While Koshiro may have been one of the first to gain some level of notoriety, the name of Nobuo Uematsu is currently more well known world-wide. Uematsu is responsible for the scores of dozens of video games, but is most well known for his alignment with Squaresoft and his compositions for the *Final Fantasy* series. After getting his foot in the door at Squaresoft via a friend who happened to work there, Uematsu established himself as one of the most talented composers in the industry. His transition into video game composition, however, came after years of writing radio jingles and the music for some low-budget movies.



Uematsu's career in video game industry has spanned over fifteen years, and he has been successful since the very beginning. Inspired by the likes of Elton John and the sounds of classic Irish folk music, Uematsu has diverse influences which have penetrated into the game music he creates. The unmistakable sounds of Irish fiddles are present in the *Final Fantasy* series, captivating audiences from both the video gamers' culture as well as from worldwide pop culture. The soundtrack of *Final Fantasy VII* actually reached number four on the Japanese pop charts, an admirable feat by any artist, and even more so by one who wrote the music specifically for a video game.

The Impact

It is undeniable that video games have become an integral piece of pop culture. More and more people are participating in such games and the soaring popularity has gained the attention of countless corporations, businesses, and, yes, musicians. Both game producers and musicians have begun to understand the mutually beneficial uses of the other. Video game companies can use a particular artist's music as a means of marketing their games with a big name already behind the product. This is not by any means a new idea; *Journey Escape*, featuring the band Journey, was put out in 1983 and *Michael Jackson's Moonwalker* was released to the public in 1989. Both featured the synthesized sounds of the respective artists. Technology has reached a new level, and current audio is indeed better, but the business minds remain the same. April of 2002 is scheduled to see the dawning of a new era: the princess of pop's entrance into the video

game industry. Capitalizing on Britney Spears' immense popularity and the overwhelming global reach of her music, software developer THQ is in the process of completing *Britney's Dance Beat*. The game is reminiscent of *Dance Dance Revolution* or *Bust A Groove*. The player's onscreen character dances away to hours of Britney's tragically catchy tunes. The game is sure to sell, at the very least due to the endorsement by Britney Spears.

To look at the game-music business dynamic from the other direction, we also must consider that music can benefit from the games themselves. Lately the gaming industry has seen quite a few examples of games that rely on a certain culture. Extreme sports games in general, and skating games in particular, seem to be the best examples of these. There is indeed a skate culture which includes particular genres of music, and thus, representative artists are featured on the games' soundtracks. It could be argued that among the skating subculture, independent music, particularly from hip-hop and punk rock musicians, reigns. *Thrasher: Skate and Destroy* featured the sounds of old hip-hop acts such as Sugarhill Gang, Public Enemy, and Run DMC. Meanwhile, *Tony Hawk's Pro Skater* includes songs by punk bands such as Goldfinger, Dead Kennedys, and Primus. The culture is thus reflected in the games. The benefit of this, of course, is the permeation of said culture. The music is heard by hundreds of thousands of players worldwide, and it just might spark a few extra sales for those musicians' own CDs. Thus, video games have become another invaluable tool to allow musicians to showcase their art, whether or not it is otherwise available to the public on such a large scale.

Meanwhile, video game music is starting to gain a foothold in American pop culture as a whole. Just recently the National Academy of Recording Arts and Sciences (NARAS) has added video game music to three Grammy categories: Best Soundtrack Album for Motion Picture, Television, or Other Visual Media; Best Song for Motion Picture, Television, or Other Visual Media; and Best Instrumental Composition for Motion Picture, Television, or Other Visual Media. While this does seem to be an impressive step for the video game music industry as a whole, it is yet to be seen if the American public is open enough to embrace a game-composer as a Grammy winner quite yet.

While the growth of the video game music community is rather astonishing, it still has quite a way to go. The game medium itself is still evolving, and the music will evolve with the games. Yet the ultimate goal is to create music that will heighten the overall gaming experience by heightening tension, manipulating the mood, and drawing you into the game world subtly but inexorably. Music has improved the gaming experience and will continue to do so as an invaluable medium of expression.

Some Music



Actraiser - Aitos.mid

From Yuzo Koshiro's composition for *Actraiser*.



Streets of Rage.mid

The Koshiro-composed title screen song for *Streets of Rage*.



FF7 - Gentle Heart.mid

From Nobuo Uematsu's composition for *Final Fantasy VII*.



FF8 - eyes on me.mid

One of the most well know Uematsu tracks from *Final Fantasy VIII*.

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