History of Video Game Music

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1 Introduction

Video game music has changed significantly during its history since the first bleeps and bloops came out of the first computer loudspeakers. Whereas in the early years the music was often created by the programmers themselves, today's video game scores are created by film music composers such as, for example, Danny Elfman (*Fable*, 2004) or Hans Zimmer (*Modern Warfare 2*, 2009) or by specialized game composers. They all have to face compositional challenges no other combination of moving pictures and music has presented before. A video game is non-linear and is only assembled from the different components provided in its storage medium when the player plays it. Therefore it needs a dynamic soundtrack which basically reacts to the player's inputs and the state of the game. This has to be addressed on the technical as well as the compositional level.

This article follows the technical development and is therefore subdivided into time-spans in which certain technical standards prevailed, the latter of which also created the prerequisites for certain aesthetics to develop. I will mention only the main characteristics and innovations as well as some of the, in terms of music, most interesting games and composers of each era. My approach here is to preferably give a broad overview and just highlight the particular developments which strongly influenced video game music or made remarkable progress possible. My focus is to acquaint the reader with the rich history of video game music as well as the literature[1] currently available for further research. At present, in particular, finding the appropriate vocabulary is a major issue in video game music research as can be seen in the existing literature[2] written by researchers and composers. Karen Collins also indicated this desideratum in her keynote speech at the 2010's "Music and the Moving Image" conference at New York University, posing the question: "Where do we go from here?"[3]

[1] Historical overviews can also be found in Collins 2005 and 2008a, Belinkie 1999, Douglas 2002, McDonald 2002, Pidkameny 2002, Dittbrenner 2005.

[2] Besides Collins, see, e.g., Ross 2001, Pidkameny 2002 and Dittbrenner 2005 (for an overview, 68, fig. 8).

[3] The slides are available on her website www.gamessound.com [05/05/2012]. See also Jørgensen 2010.

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But before reflecting about this question, one needs to know: "Where do we come from?"

2 …and a "bip" disrupted the silence

The earliest video games in the 1950s and 1960s, as for example, *Spacewar!* (Steve Russell et al., 1962), as well as the first-generation home consoles – such as the Magnavox Odyssey (Magnavox, 1972) – were silent. Collins identifies *Pong* (Atari, 1972) as the first game, with its short "bip" sounds, which turned the spotlight on sound as a feature in video games.[4] It was also *Pong* and its widespread popularity which brought gaming out of the arcades into players' homes by being released on the Sears Tele-Games system in 1975 (Atari), a console with sound capabilities, following a juridical struggle between Atari and Magnavox for the rights of the game principle.[5]

Between 1973 and 1977, the video game industry was born and had some initial commercial success. The arcade was the dominant platform, until consoles such as the Channel F (Fairchild, 1976) and the Studio II (RCA, 1977) made it possible to play games that were not hard-wired into their own hardware, but stored on and executed from external data carriers. The Studio II was capable of making simple "beep" sounds with slight variations in tone and length. The Channel F already had internal speakers to replay sound. The Atari 2600 (or Atari VCS[6], Atari, 1977) cut both out from the market, providing improved sound[7] and graphics.

Between 1977 and 1978, the industry suffered the first spectacular drop in sales, the console market being especially hit. The reasons were perfectly obvious: at this particular time, the market was flooded with hardware, but there was a significant lack of appropriate software. Atari was the only big western survivor of the crisis: in particular, due to the fact that they still released innovative games. Nonetheless, they lost the dominant position they had occupied before because, from then, Japanese companies also pressed ahead in the western market. It was the overwhelming success of *Space Invaders*[8] (Taito, 1978), which brought the industry

[4] Interestingly, the typical *Pong* sound was something like a makeshift solution: "It is interesting to note then, that the sounds were not an aesthetic decision, but were a direct result of the limited capabilities of the technology of the time." (Collins 2008a: 8) Originally, Nolan Bushnell (the founder of Atari), wanted the sound of a cheering crowd, but designer Al Alcorn wasn't able to get these sounds out of the insufficient hardware.

[5] For further information regarding the lawsuit, see Malliet/de Meyer 2005: 5.

[6] Video Computer System, which used cartridges and was sold from 1977 until 1992. For more information about the VCS's sound capabilities, see Collins 2008a: 21-23.

[7] The Stella/TIA-Chip of Ataris VCS held available two channels of one-bit sound.

[8] The game was released as an arcade version as well as in 1980 on the VCS.

back on track. Malliet and de Meyer cite its soundtrack as one of the reasons for the game's success:

> "[...] *Space Invaders* used sound in a functional way: the rhythmical bass-based soundtrack, which sped up with the rhythm of the game, was an integral part of the game experience. [...] Before *Space Invaders,* sounds in video games had generally been used as padding or a subordinate bonus, but afterwards game developers could not longer afford to ignore this aspect." (Malliet/de Meyer 2005: 29)

There is some dissent on the issue of when precisely the history of video game *music* starts, "depending on how one defines music" (Collins 2008a: 12). *Space Invaders*' monophonic continuous soundtrack set at least "an important precedent for continuous music" (Collins 2008a: 12) and recognized the need for the soundtrack to change during play. Collins also mentions the game *Asteroids* (Atari, 1979) with its two-note melody as another important reference game which aroused the desire and the need for more sound in games than just some "bip".

In 1980, the racing-maze game *Rally-X* (Namco, 1980) was the first video game to include continuous background music, a looped[9] "little chase ditty".[10] The same year, the most popular maze game *Pac-Man* (Namco, 1980) was the first game to also include cutscenes[11] accompanied by music. All this was made possible by the first dedicated soundchips, the PSGs[12], which were installed in arcade machines, making more background music and elaborated sound effects possible.

Some of those chips like the POKEY[13] already had the potential for polyphonic music, but this technical progress did not lead to a quantum jump in video game music:

> "The additional sound chips were typically used for more advanced sound effects, rather than increased polyphony for music. […] The advantage of separate chips for music, however, meant that any music included could play without being interrupted by the sound effects having to access the same chip." (Collins 2008a: 15)

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[9] A definition of looping is given in Stillar 2005 (cited from Collins 2008b: 212): "[…] In music production and sound design circles, a 'loop' is a bit of audio – usually, though not exclusively, of short length – that can be played back repeatedly and potentially endlessly without noticeable gaps or disruptions between one instance of the loop and the rest."

[10] http://www.gamesradar.com/f/gamings-most-important-evolutions/a-20101008102331322035/p-2 [05/05/2012]

[11] Cutscenes are intermissions of gameplay in which the player usually cannot or can only slightly influence the events on screen.

[12] Programmable Sound Generator; for a detailed explanation see Collins 2008a: 10, box 2.1; Dittbrenner also mentions earlier PSG-chips: the Stella/TIA-Chip of Ataris VCS, and the Atari POKEY, AY-3891x released in 1979, see Dittbrenner 2005: 8-9 and Collins 2008b: 213-214.

[13] POKEY stands for POtentiometer and KEYboard Integrated Circuit; for technical details, see Dittbrenner 2005: 11-12.

If one imagines an arcade hall[14], where several video game arcade cabinets are positioned in rows, the reason for this treatment of sound and music (besides the technical limitations) are obvious: in an arcade gaming-hall, the music and sound have to convince a possible player to put his coins into this gaming machine and not into the next one, both involving him and convincing him to spend some time and money. This happens, on the one hand, by running the attraction mode (when the machine is not occupied), which emits sound effects or scattered short musical pieces (Dittbrenner 2005: 57). On the other hand, during gameplay, the sounds also underline what kind of game is being played, so a passing player, who prefers, for example, a shooter, is attracted not only by the cabinet's style, but also by the interesting shooting sounds. Therefore, music was subordinate, usually monophonic and used sparingly, subjected to technical limitations as well as to the specific purposes it had to fulfill.

> "Typically, the early arcade games had only a short introductory and 'game over' music theme, and were limited to sound effects during gameplay. Typically the music only played when there was no game action, since any action required all of the system's available memory." (Collins 2008a: 9-12)

This music can be understood as an acoustic sign for players waiting for a certain game: hearing the "game over" theme implies that the machine will be available again, the introductory theme indicates that the current player has started another game.[15]

The game *Frogger* (Konami, 1981) was the first to introduce music without loops. It featured "eleven different gameplay songs, in addition to 'game over' and the levels' start themes. [...] Since the maximum time a gameplay could last before arriving at a safe-house or dying was about thirty seconds (much less as the levels increased), the songs did not need to loop." (Collins 2008a: 20) Interestingly, Collins states that the prevailing use of loops was not just due to the technical restrictions, but rather had become distinctive aesthetics, which were later developed in the mid-80s.[16]

Besides creating original short music pieces, using pre-composed music, e.g. classical music, was also a quite common practice. The decision to include any music in a video game meant that it would have to be transcribed into computer code by a programmer because "[c]omposing game music in the early days required

[14] Arcade machines were also widespread in shopping malls, traditional storefronts, restaurants and convenience stores.

[15] About the different types of music, see Dittbrenner 2005: 57-58.

[16] She demonstrates this by examining the development of the games for the ColecoVision (Coleco, 1982) as well as in Nintendo's early games: "There were a few early examples of games with loops [...], but it was not until 1984 that music looping in video games began to gain real prominence." (Collins 2008a: 19)

an enormous amount of technical knowledge. The music had to be developed in close coordination with programmers and special sound designers dedicated to making the composer's music work in the game." (Belinkie 1999)[17] Nonetheless, it was (and still is) an interesting field for composers:

> "Indeed, many composers say that video game music's most attractive feature is that players have few preconceived notions as to how it should sound. [...] 'Game music doesn't really have an identity,' agrees Mr. Pummell. 'It is hard to define because it has a unique style to it. It's not pop music. It's not serious classical music. It's not serious contemporary music.' At times, however, game music can be all of these, while keeping a unique identity." (Belinkie 1999)

Of course, conventions evolved over the years, but for the early periods this statement surely holds true. Those conventions were mainly established during the next phase of video game music history.

3 The second crash and the golden age of 8-bit

Between 1978 and 1982, the game industry recovered slightly from the first crash, the market was downsized, but, in 1983, less than five years later, the industry plunged into a second crisis which "was due to the overproduction of software, rather than to the overproduction of hardware (as in 1978). [...] The market was flooded with too many average games, and too many poor variations on the same concept, and the public massively lost interest in computer games." (Malliet/de Meyer 2005: 34) Nevertheless, regarding music, a golden age appeared on the horizon: the era of 8-bit music.

3.1 Personal computers

In 1977, the Apple II was the first computer designed for casual home users instead of being developed as a mere business device. It had a gameport, which permitted the use of paddles[18] or a joystick as gaming peripherals. But it was Apple's competitor Commodore, with its C64 (released 1982) and the MOS technology SID-chip[19] (introduced in 1983) which recognized the market potential of gaming

[17] See also Collins 2008b: 215.

[18] Paddles are game controllers which were used to play video arcade games like *Pong*, and were also delivered with the Magnavox Odyssey. They consist of a round wheel to move the player object on screen and one or more fire buttons.

[19] Sound Interface Device; for explanation, technical details and the typical problems with the filters see Collins 2008a: 30-31 and Dittbrenner 2005: 21-22.

and explicitly promoted the sound capabilities of the integrated synthesizer (Dittbrenner 2005: 31). The sound capabilities and the particular sound, as well as the prevalence of the C64, made it a great instrument and stimulated peoples' creativity (Dittbrenner 2005: 31). The game *Moondust* (Creative Software, 1983), for example, designed by Jaron Lanier, was "arguably the first full-blown 'art game' – for the Commodore 64. The bleepy ambient score that emerges during gameplay is as abstract and compelling as any modern blip-hop release." (Silfer 2007) The player guides a spaceman around the screen and, by doing so, leaves a coloured dust trace. Bullet-shaped spaceships have to pass this trace, creating the bleepy sound.

Outside gaming, the sound of the C64, as well as the other 8-bit machines, also became a rich fountain and inspiration for new music genres: based on the hacking[20] and cracking scene, the demoscene[21] came up and, in conjunction, the musical genre of chiptunes and the remixer scene evolved.[22] Interestingly, even though the C64 triggered this rich amount of musical activity, lots of video games for the platform contained no music, which was also due to technical implications:

> "Of the 'Top 100 C64 games', about ten percent had no background music at all, and the earliest examples of games – those dating from about 1983 to 1985 – had the least amount of music. [...] Two major factors played a part in the creation of audio for the C64: the music on the Commodore was coded in assembly language, which was harder to program than NES's BASIC-based language, and the availability of memory." (Collins 2008b: 216-217)

Following Collins, this also relates to the technique of looping mentioned above:

> "Whereas most C64 games averaged about 30 KB (on cassette), 10 KB (on cartridges), or 60 KB (to a maximum of 170 KB) on a floppy disk before having to go to a multi-disk game, Nintendo's cartridges held up to 512 KB; [...] The issue of memory was clearly linked to the amount of looping in the games." (Collins 2008b: 217)

[20] For the relationship between hacking and early game music programming, see Dittbrenner 2005: 74-75.

[21] For further information see e.g. http://www.demoscene.info/die-demoszene or http://www.8bittoday.com/about/

[22] In short, one can distinguish those scenes as follows: the demoscene works on the software basis with the aim of creating non-interactive audio-visual presentations that run in real time on a computer, the chiptune genre deals with the given hardware to create music with the characteristic 8-bit sound, and the remixer scene uses the given music of video games and remixes it in its own style. Regarding music, the chiptune scene is still of great interest and would be worth further consideration and research which cannot be carried out in this article. See also Driscoll and Diaz: 2009, and Dittbrenner 2005: 100-101. An interesting documentary also introducing the remixer scene is the film "The 8-Bit philosophy" made by Konstantin Stuerz and available on http://www.entsorger-film.de/start.php?site=news [05/05/2012].

Solutions for those memory problems were, e.g., random sequencing or looping with varying keys and registers. Loops ranged in length from some seconds to more than one minute depending on the game's genre and the area in which the musical piece was used. Especially for adventure games, in which a player spends more time in total as well as in a certain area than in other games, looping longer sequences was common: short loops could have quite quickly created boredom and annoyance.[23] But the lion's share of the storage capacity was reserved for graphics, as composer Rob Hubbard[24] complains:

> "Sound has always been the poor relation of graphics in the computer game world, proof that humans are more interested in what they can see than in what they can hear [...]. Playing second fiddle to the graphics means you get allocated only a tiny share of the computer's memory, typically between 4K and 6K. Not only do you have to fit your tune into that space, you also have to find room to define all your sounds - not just for the music, but also for the game-activated sound effects." (Vosburgh, undated)

Next to the problem of memory, the other main difficulties are summarized by Dittbrenner: the chips induced limitations regarding the number, tonal range and temper of the sound channels, the provided colours of sound and the possibilities of their soundwise designing. The hardware environment could influence the music and sound creation because of its limitations regarding the available memory space, the computational power, and the timing (important in particular for video games and demos).[25] Also the different soundcards in PCs could create problems because of their differing reproduction characteristics.

To deal with these difficulties composers needed to be creative and develop different technical programming as well as compositional solutions.[26] As composer Michael Pummell summarizes it: "It's [...] like writing for a string quartet. Imagine having only four instruments [...] and you're supposed to keep it interesting. That's the challenge".[27]

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[23] For further details, see Collins 2008b: 221-222.

[24] Hubbard became famous for the soundtracks of games like *Monty on the Run* (1985), *Thrust* (1986), *Spellbound* (1985), *Auf Wiedersehen Monty* (1987) and *International Karate* (1985). He is one of the most lauded composers for the C64.

[25] Dittbrenner 2005: 74. In the following pages, he explains in detail several compositional as well as technical approaches (in particular invented by Chris Hülsbeck) to overcome these difficulties and deal with the particularities of the sound colours one could get out of the different chips.

[26] See, e.g., Collins 2008b: 218; here she describes an approach made by composer Rob Hubbard.

[27] Quoted from Belinkie 1999.

3.2 Consoles

> "As with the arcade machines, the music of the domestic games consoles reflects their technological constrictions. The most obvious consequence of the tuning problems of the Atari VCS [...] was the avoidance of harmony. [...] Another effect was the inclusion of less common intervals, such as the prominence of minor seconds in the songs, which was due to the reduced number of notes available." (Collins 2008b: 216)

The other 2nd generation consoles like the Intellivision (Mattel, 1979) or the ColecoVision (Coleco, 1982) had similar problems, or, like the Magnavox Odyssey, no sound in general. Therefore, Matthew Belinkie states that "The history of game music begins in earnest with the Nintendo Entertainment System, the first widely popular home video game machine." (Belinkie 1999)

Composer Hirokazu "Hip" Tanaka issues a similar statement by saying that "The sound for games used to be regarded just as an effect, but I think it was around the time *Metroid* was in development, when the sound started gaining more respect and began to be properly called game music." (Brandon 2002) In *Metroid* (Nintendo, 1986), he made no distinction between music and sound effects, and the main theme could only be heard after "Mother Brain" (the main boss) is defeated. Tanaka "wanted only a winner to have a catharsis at the maximum level. For that reason, I decided that melodies would be eliminated during the gameplay. By melody here, I mean something that someone can sing or hum." (Brandon 2002)

The Nintendo Entertainment System NES[28] (Nintendo, 1985), for which the game *Metroid* was released, used a custom-made sound chip invented by composer Yukio Kaneoka which provided five channels.[29] Yet game music on the NES still had to share the available channels with other sound effects, similar to arcade music. But it was the virtuoso use of the NES's sound capabilities by Japanese composers, who effectively took advantage of the technical limitations, which allowed them to develop the typical and unique NES sound, making "Japanese composers [...] the first game music pioneers, […who] defined what sound players came to associate with games. [...] Fans seem to agree that Japanese scores are still the best." (Belinkie 1999) He justifies this statement by giving the following example:

> "For instance, look at the attached score to the Overworld theme of The Legend of Zelda (1986). [...] Despite the fact that millions of gamers heard this piece repeated literally hundreds of times as they played Zelda, the Overworld theme is beloved by players and lauded as one of the greatest pieces of game music ever. [...] The true test of game music is whether a player can still stand a simple theme after hearing it repeated for an hour or more." (Belinkie 1999)

[28] In Japan, it was previously introduced in 1983 under the name "Famicom".
[29] For a detailed explanation of the functional principle, see Collins 2008a: 25.

This piece was written by one of the most famous composers for the NES, the Japanese Koji Kondo. He was the first person hired by Nintendo for the single purpose of creating compositions. Besides his *Legend of Zelda* score, he became particularly famous for his *Super Mario Bros*. theme. The game, released in 1985 for the NES, "was the first video game to feature constant background music written by a professional composer. It established many conventions for game music which survive to the present day. Koji Kondo provided different background music for every area Mario visited. [...] The tracks were all done with three instruments and crude percussion sounds." (Belinkie 1999)[30]

Whereas Kondo was no professional musician when he started his Nintendo career, composer Koichi Sugiyama was a classically trained musician and conductor with experience in writing orchestral pieces. In 1986, he "recreated the sound of classical music" (Belinkie 1999) for the NES for the game *Dragon Quest* (Chunsoft et al., 1986). He was the first video game composer to record his music with a live orchestra, namely the Tokyo Strings Ensemble, and the CD *Dragon Quest I Symphonic Suite* was released the same year.[31] In 1987, on August 20, the "Dragon Quest in Concert Family Classics Concert" was the first ever video game music concert, once again performed by the Tokyo Strings Ensemble at Suntory Hall, Tokyo. In Japan, as with the *Dragon Quest* series, video game music gained high popularity and composers could become famous, whereas in the USA and Europe, the music was, of course, also well-known, but as Belinkie also stated in 1999:

> "Video game soundtracks in Japan are a major business. They can be found at almost every music store. Moreover, frequent concerts of game music by symphony orchestras attract large crowds. [...] In the United States, however, the public is not prepared to accept game music even as pop culture. Soundtracks are practically nonexistent."

It was in 1987 when the first Japanese video game composer appeared who also became quite popular among western audiences, even though not as famous as in Japan: the self-taught musician Nobuo Uematsu with his music for the *Final Fantasy* series. He composed the music for "what has been called one of the most memorable moments in gaming; millions of players wept to Uematsu's gentle melodies and

[30] By contrast Zach Whalen states: "I am not suggesting that *Super Mario Brothers* provides a template of game music archetypes." (Whalen 2004: 9) A concise analysis can be found in Pidkameny 2002, Whalen 2004, and Dittbrenner 2005.
Sounds and music from the game were also an integral part of *The Super Mario Bros. Super Show!* broadcast on American television from 1989.

[31] For detailed information on Sugiyama's as well as the other mentioned NES composers' work, discographies and biographies, see www.squareenixmusic.com [05/05/2012].

'Aerith's theme' was ingrained into the general gaming consciousness."[32] Uematsu's formula for success was combining eastern and western styles of instrumental music, and this formula truly worked:

> "Mario did have a strong melody, but it did not have harmony. Dragon Quest did have a strong sense of harmony, but it did not have standing melodies until recently. Final Fantasy had them all from the beginning."[33]

The same year, 1987, the game *Dance Aerobics* (Human Entertainment, 1987) was published for the NES. It came with a floor-mat game controller called the "Power Pad". It was a grey mat consisting of two layers of flexible plastic with twelve embedded pressure sensors and two sides on which the player could play by stepping on them. It represented an early predecessor of the rhythm-game genre that would explode into the mainstream gaming market in the late 1990s.

3.3 Handhelds

From 1980 on, Nintendo produced handheld games in its Game&Watch[34] series. Every handheld features a single game to be played on an LCD screen. But it was the launch of the company's 8-bit handheld GameBoy (Nintendo, 1989) which caused a revolution in gaming because "[t]echnically, the GameBoy was the first true 'handheld game computer' [...] Paradoxically it was a very simple game called *Tetris* (developed in 1985 by Russian mathematician Alexei Pajitnov) that brought about the breakthrough of the GameBoy." (Malliet/de Meyer 2005: 36)

The music for the puzzle game *Tetris*, which originally came packaged with the GameBoy, was created by Hirokazu "Hip" Tanaka. The game offered three types of background music or could be played with sound effects only. The most famous piece, "Type A", was based on the Russian folk song "Korobeiniki". The other hits from the NES were also ported to the GameBoy, such as the *Super Mario* series with *Super Mario Land* (Nintendo, 1989) and the *Legend of Zelda* series with *Link's Awakening* (Nintendo, 1993).

The original GameBoy was followed by several successors such as the GameBoy Pocket, the GameBoy Light, the GameBoy Colour, etc.[35] With the GameBoy,

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[32] Chris and Scherzo on www.squareenixmusic.com/composers/uematsu/biography/shtml [05/05/2012]; see also Pidkameny 2002 and Lue 2003.
[33] Takebe, quoted from Belinkie: 1999.
[34] For an impression, see http://www.nintendo.co.jp/ds/dsiware/game_and_watch/index.html [05/05/2012].
[35] For an overview of the GameBoy history, see http://uk.retro.ign.com/articles/100/1007864p1.html [05/05/2012].

gaming now also became visible in public, simply because people could play everywhere.

4 16-bit

From the mid-80s, computer and video game music was created by more people with professional experience, even by classically trained composers, who started to carve out distinct and creative approaches to meet the conditions of video game music. Therefore, the quality of compositions reached new levels, and video game music started to form its own identity. But still the challenge was to create the fullest sound possible with insufficient equipment.

> "The year 1984 seems to be a key point in the culmination of an 8-bit aesthetic that saw the establishment of loops, dynamic music, and various forms of polyphony. As Tetris and Clown Down Town, among others, demonstrated, since alternatives to this aesthetic were available, the games audio aesthetic was chosen as much as determined by the limitations of the available technology, yet each machine had a slightly different aesthetic that grew, in part, from the technology available." (Collins 2008b: 224)

4.1 Personal computers

In 1985, the Commodore Amiga, with its soundchip "Paula", was the first home computer using DSP[36] in the form of sampling. This technique allowed short samples of pre-recorded sound waves to be played back through the computer's soundchip from memory. A composer could now take a sample of a real instrument or sound at a significantly higher quality and fidelity than previously available. The new possibilities of the Amiga, and the release of a freely-distributed Amiga program named "SoundTracker" by Karsten Obarski in 1987, started the era of MOD-format.[37]

Another important technical progress was the introduction of Frequency Modulation (FM) synthesis. The FM chips offered a wider range of timbres and sounds, and made more realistic-sounding sound effects possible.[38] But "[t]he most significant advance of the 16-bit era sound, however, was the adoption of the Musical Instrument Digital Interface (MIDI) protocol." (Collins 2008a: 49-50)

This industry-standard protocol defined in 1982 allowed musical devices such as keyboard controllers, computers, and other electronic equipment to be compati-

[36] Digital Signal Processing; see Collins 2008a: box 3.1, 46.
[37] A MOD is a sound file, in which each individual note of each instrument is recorded in the studio, which can be altered on the fly, allowing for interactive music of high quality, but is very difficult to use. For further detail, see Collins 2008a: 57-58.
[38] Collins 2008a: 38; for detailed technical information, see box 2.1, 10.

ble and synchronize with each other. Instead of transmitting sound, it transmitted "event messages" such as the pitch and intensity of musical notes to play, as well as control signals for different parameters. The advantages on the one hand were great: composers were no longer forced to handle difficult programming languages. On the other hand, General MIDI was limited to 128 instruments[39], and hardware playback devices sounded quite different, which was no problem on consoles, but on PC's the results differed significantly depending on the built-in soundcard. Nevertheless, MIDI allowed for some flexibility on which some original ideas and developments were based. One very famous example is LucasArts' iMuse[40] technology which the composers Michael Z. Land and Peter McConnell created for their adventure games.

> "The iMuse system was really good at letting the composer constantly test out the various interactive responses of the music: how transitions worked between pieces, how different mixes sounded when they changed based on game parameters, etc. Without a system like that, it's much harder to conceive of the score as a coherent overall work."[41]

LucasArts had already developed their own scripting tool called SCUMM[42] to create games, and with iMuse they made a big step towards the implementation of dynamic music on the technological level. It allowed the music to "respond" to the actions happening on screen because "Lucas Arts' patented iMuse music engine handled sophisticated run-time interactions between dramatic onscreen action and a database of music loops, cues, and transitions."(Clark 2007: 1)

One noteworthy game, even though it did not yet use the iMuse technique, was *Loom* (LucasArts, 1990). Its gameplay was based on magical four-note tunes (called drafts) that the protagonist could play on his distaff.

"You learn new tunes from the environment. Looking at a hatching egg, you will hear the tune for the spell "Open". Some of the tunes are randomized at the beginning of the game so you are forced to find and remember the tunes even if you play for a second time. [...] The second additional idea is that some spells can be reversed by playing them backwards! So playing the "Open" spell backwards is the

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[39] For technical details see www.midi.org.

[40] Interactive Music Streaming Engine; for detailed explanation, see Collins 2008a: 51-52. The patent with the technological specifications can be found on http://www.google.com/patents/about?id=JJN7AAAAEBAJ [05/05/2012].

[41] Michael Land quoted from Méndez 2005. For more information about the composer, see also Pidkameny 2002.

[42] Script Creation Utility for Maniac Mansion; *Maniac Mansion* is the title of the game the SCUMM-tool was originally created for by Ron Gilbert and Aric Wilmunder in 1987. It was used together with iMuse for the point-and-click adventures LucasArts became famous for, starting with *Monkey Island 2: LeChuck's Revenge* (1991), and it has been used since then in LucasArts adventure games such as *Day of the Tentacle* (1993), or *Sam and Max: Hit the Road* (1993). Today, the published games are primarily based on the *Star Wars* and *Indiana Jones* franchises.

"Close" spell. Some spells, like "Night Vision" cannot be reversed, because it would make no sense. Here is the kicker: the spells, which aren't reversible are Palindromes – melodies, which sound the same if you play them backwards!" (Majewski 2008)

4.2 Consoles

In the area of consoles, Nintendo's dominant position on the market was attacked by Sega due to the release of the Sega Mega Drive[43] (Sega, 1988), which, by employing an FM chip, also had superior sound to the competing NES. Regarding the music, this allowed a richer sound, but caused no significant change in song structures, which still relied on the current conventions and suffered similar problems to those introduced by the 8-bit predecessors (longer loops for areas, shorter for boss fights, problems with transitions between the loops). The typical Genesis or Mega Drive sound instead used progressive-rock stylistic traits, due to the fact that the chips could now mimic the keyboard sounds typical of this musical genre (Collins 2008a: 40-41). Whereas the song structure remained, the melodic style did change, because "[...] it was a common element in some game music of the 16-bit era and beyond to avoid anything too 'catchy' that might become annoying after many repetitions, in favour of smaller melodic riffs which, collectively, could often be played like a longer epic soundtrack, with each tune thematically and instrumentally tied to each other. It was also quite common to use ground bass, a recurring bass line with variations overtop." (Collins 2008a: 44)

Sega also started using cross-marketing strategies by releasing games such as the beat'em'up/platformer *Michael Jackson's Moonwalker*[44] (Sega, 1990), which introduced the music and the dance moves of the pop star.

Nintendo's answer to this was the Super NES (Nintendo, 1990), which brought a wide selection of DSP effects, digitized sound and full stereo sound to console games. It could replay sampled sounds at up to 16-bit resolution. "For the first time, the sound of the music was approximating real instruments." (Belinkie 1999) But similar to the Genesis sound, the SNES also relied on the previously developed song structure of the 8-bit era, as well as maintaining the poppy, cheery feel Nintendo games were known for. Classical music was now more frequently used and, adopting the concept of movie tie-ins[45], by using more cover songs or

[43] In the USA it was released under the name Sega Genesis in 1989.

[44] The game is based on the same-named movie.

[45] The cross-marketing strategy always was a two-edged affair: on the one hand, it could be quite successful regarding franchises like *Star Wars* or, later on, *Lord of the Rings* or *Harry Potter*; on the other hand, the mediocre game *E.T. The Extra-Terrestrial* (Atari, 1982) produced for the Atari 2600 was a

licensed music, Nintendo also relied on the appeal of celebrities to promote their games.

5 Bit wars in the 1990s

> "During the 1990s, the bit capacities of PCs as well as consoles grew exponentially. New methods of visual processing were developed allowing computer generated images to achieve an unprecedented level of precision." (Malliet/de Meyer 2005: 38)

Even though the first 32-bit arcade game had been released in 1988, namely, the run-and-gun game *NARC* (Williams), the decline of the arcades was under way, and game companies were far more interested in creating games for home consoles and PCs than for the arcade halls. The gaming industry turnover increased to such an extent that at the beginning of the forthcoming millennium it exceeded that of the film industry (the latter's home sales excluded) (Malliet/de Meyer 2005: 38).

Concerning video game music, the introduction of the CD-ROM was the most important technical development in the 1990s. The advantages for game composers were enormous because it was the CD-ROM technology which freed them totally from an amount of restrictions: they were now able to use all live instruments, plus vocals and dialogue, and they could be sure how their music would sound on most consumers' hardware because the influence of a soundcard's synthesis on the emerging sound decreased significantly. Streaming audio was now the dominant approach for games based on CDs. Using music that was entirely pre-recorded improved sound quality notably. The main effort now had to be put into handling the track itself. The Redbook Audio standard for audio CDs was problematic because it allowed storing uncompressed audio data with a maximum playing time of only 79.8 minutes and therefore music still had to struggle for space on the CD, the lion's share continuing to be reserved for graphics. Audio compression formats such as MP3, initially released in 1993, diminished that problem. Looping was still problematic as, when the laser reached the end of a track, it had to move back to start reading again, which caused a sound gap.

Another major advance in game audio in general was the introduction of surround sound (also 3D or spatialized 3D etc.). Again, this sped up the development of new technological approaches which also affected music. In 1995, Microsoft released Windows 95 together with the collection of application programming interfaces (APIs) for handling tasks related to multimedia and gaming inputs called DirectX. It quickly became a standard for game programming on Microsoft platforms (PCs, as well as later on the Xbox) and also held an element named

gigantic flop (not to say the biggest commercial failure in video game history) and is frequently cited as a contributing factor to the video game industry crash of 1983.

DirectMusic, which "opened up MIDI to the possibility of higher-fidelity wavetable synthesis and sampling, while at the same time it allowed MIDI to have more extensible controls. Now, no matter, what soundcard a player had on his or her personal computer, the results could be much more predictable." (Collins 2008a: 65)

5.1 Personal computers

During the 1990s, the capacity of PCs increased significantly: architectural standards were developed, bit rates grew astonishingly, and PCs became immensely faster. From the mid-1990s, Microsoft increasingly dominated the software market. The growth and broader disposability of the internet brought along new possibilities for online gaming. The advent of online gaming and, in particular, the MMORPG-genre[46], with popular games like *Neverwinter Nights* (Stormfront Studios, 1991), *Ultima Online* (EA, 1997), *EverQuest* (Verant Interactive, 1999) and *Asheron's Call* (Turbine, 1999), as well as online playable shooters such as the FPS[47] *Quake* (id Software et al., 1996), augmented the challenge for composers to create music which could accompany games with far more hours of running time than a normal game, which, in the case of offline RPGs, could reach up to 70-100 hours of playtime.[48]

Because the field of PC-gaming in the 1990s was so multi-variant (Collins 2008a: 65), I will not go into further detail here, but just mention two noteworthy products. The software toy *SimTunes* (Maxis, 1996), created by designer Toshio Iwai, for example, was centred around music and was released for Microsoft Windows. The player painted a picture with large dots, where each colour represented a musical note, and then he placed up to four different-coloured "Bugz" on it. Those represented instruments or vocal syllables and the player could thereby paint musical pictures by changing their starting directions and relative speeds.

The "Tristram" theme in *Diablo* (Blizzard North et al., 1996) is also worth mentioning because it mesmerized players with its guitar intro, "[t]hat was string samples, more than actual synth. There is a lot of actual synth in the rest of the Diablo soundtrack, just not in Tristram."[49] Uelmen also explains why, in his opinion, this was so compelling:

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[46] Massively Multiplayer Online Role-Playing Game

[47] First-Person-Shooter; it was the introduction of 3D to graphics with the game *Castle Wolfenstein 3D* (id Software, 1992), which strongly brought forth the genre of the FPS, even though this "3D" effect was simulated by using the technique of ray-casting. An explanation can be found here: http://www.permadi.com/tutorial/raycast/rayc1.html#WHAT%20IS%20RAY-CASTING [05/05/2012].

[48] For compositional approaches to MMOs in general, see Collins 2008a: chapter 8; or Lagim 2002.

[49] Matt Uelmen quoted from Remo 2010.

> "And you always want a live element in every track, even if everything else is going to be from a sample library. It feels a lot more musical if the listener has the image in their head of somebody physically performing the music. That's definitely good practice no matter what your soundtrack approach is. I think a lot of times, people underestimate the ability of listeners to subconsciously notice when something is too sample-heavy, especially when it's the first texture you put in the foreground. That should be as live as possible." (ibid.)

5.2 Consoles

The 3DO Interactive Multiplayer (Panasonic, 1993) and the Atari Jaguar (Atari, 1993) were the first 32-bit home consoles. Even though the 3DO was highly promoted and also named by Time magazine as the "1993 Product of the Year"[50], its high price ($699.95 at launch[51]), limited third-party developer support and an over-saturated console market prevented the system from achieving success comparable to its competitors Sega and Nintendo. The Jaguar also proved to be a commercial failure and prompted Atari to leave the video game console market.

In 1994, Sega released their 32-bit Sega Saturn console equipped with a CD-ROM drive. It achieved success in Japan, but it flopped on the North American as well as on the European market. Its direct competitor was Sony's PlayStation, which was not only cheaper, but also easier to program software for and, therefore, more games were produced for it. The other competitor, Nintendo's N64, released in 1996, was a 64-bit console, but, despite the fact that on many points it surpassed the PlayStation on a technical level, it still relied on a cartridge system, which only allowed for the use of General MIDI.

> "The Playstation's competitor, the Nintendo 64, is also capable of producing 24 voices, but they are not 'dynamic.' This means that once a patch is allocated to a particular voice on the machine, it was very hard to change to a different patch. In addition, the Nintendo does not allow redbook audio, as it does not use CD-ROMs." (Belinkie 1999)

Nevertheless, experienced composers like Koji Kondo could handle these limitations, being still very inventive regarding the possibilities of video game music and, in particular, of dynamic music. Some games held a wealth of dynamic approaches as, for example, *The Legend of Zelda: Ocarina of Time*[52] (Nintendo, 1998), which "[b]esides boasting an amazing soundtrack, […features] music-making as part of its

[50] See http://www.time.com/time/magazine/article/0,9171,1125840,00.html [05/05/2012].
[51] For comparison: the Sega Genesis was released with the suggested retail price of $190, the successor, Sega Saturn, was far more expensive at $399, Sony's PlayStation was available for $299.99, and Nintendo's suggested retail price for the N64 was $199.
[52] A detailed explanation can be found in Collins 2008a: chapter 8.

gameplay. In the game, you use the ocarina, a kind of flute, to teleport, open portals, or summon allies. There's also a musical puzzle in which you must follow the bass line of a song to make it through the Lost Woods." (McDonald, undated)
The PlayStation instead provided a higher quality of sound fidelity, but it caused also a regress in terms of game music because "[a]s on personal computers, Redbook audio meant that there were compressed audio files with more channels and higher-quality sounding instruments used [...] but this was at the cost of dynamic adaptability and interactivity, and, as on PCs, many games went back to rapid fades and hard cuts between tracks, which typically looped continuously in game levels. [...] One notable exception was Nobuo Uematsu's soundtrack for Final Fantasy VII (Squaresoft, 1997) [...] which relied on MIDI from the on-board synth chip." (Collins 2008a: 69) It was probably around 1997 or 1998 when the first video game with a full live orchestral score appeared:

> "*The Lost World Original Soundtrack* 'from the Playstation and Saturn Games is Dreamworks' first game soundtrack release, purportedly the first original game soundtrack to consist entirely of a live orchestral score, and one of the few movie license games to use solely original compositions. [...] the score is composed and conducted specifically for the game by Michael Giacchino." (Corn)

The score for the game *Heart of Darkness* (Amazing Studio, 1998) was recorded earlier but, due to delays, the game itself was released after *Lost World* (DreamWorks, Interactive 1997). Nevertheless, it is often mentioned to be the first game ever to include a full orchestral score. A third contender for the title from the year 1996 (developed by Sega) is "[t]he eastern game 'Sakura Taisen' for the Sega Saturn [which] was actually the first game to feature live orchestra, just not throughout the whole game." (DeCastro 2007) Another noteworthy PlayStation game in terms of music (as well as regarding game aesthetics in general) was the first part of the *Silent Hill* series with the eerie music and soundscape created by composer Akira Yamaoka.

> "The ambience of Silent Hill is, with only a few exceptions, entirely electronic. Sometimes the music can sound like a small humming noise, like a faraway breeze. Other times it can sound like someone sharpening two butcher knives against each other, or an entire hive of bees buzzing, or someone breathing, etc. It is very hard to explain, especially to someone used to more 'common' game music, because to many people this doesn't even sound like 'music' at all." (DanielK 2002)

The practice of using licensed music was also continued, e.g., in the case of *Tony Hawk's Pro Skater* (Neversoft, 1999), including music by hip-hop and alternative punk artists such as Primus and Dead Kennedys.

Due to the CD technique, the PlayStation also allowed the user to put in his own music CDs to be played back while playing a game. This possibility to personalize the soundtrack became more and more important during the following years. The conceptual game *Vib-Ribbon*[53] (NanaOn-Sha, 1999) derived a very creative benefit from this feature: *Vib-Ribbon* is a sidescroller-rhythm video game and generates, in real time, the level (a course with loops, holes, pitfalls etc.) the player has to traverse with the bunny Vibri by visualizing the beat of any music the player puts into his PlayStation. Three years earlier, the same developer had also created a ground-breaking music game for the PlayStation: *PaRappa the Rapper* (NanaOn-Sha, 1996). The player had to repeat a sequence of sounds, not only by getting the correct sequence (by hitting the correct buttons), but also by the timing of the sequence. Points were given for correctness as well as for "style". For a higher rating, the player had to "freestyle", which meant varying from the given sequence but still keeping in time with the song's rhythm. Completing all levels with at least a "Cool" rating led to an alternative ending and unlocked a bonus song.

Those so called rhythm games[54], which had had an initial predecessor in the aforementioned NES game, now came into blossom: in 1997, Konami had released a DJ simulation game under the name *Beatmania*, and triggered a boom of such music games. The game was such a huge success that the Games & Music Division of the company changed its name to Bemani, which produced and still produces a long list of spin-offs and sequels.[55] Following this, home console versions of arcade hit games such as *Dance Dance Revolution* (Konami, 1998) were also released around which a vivid fan culture evolved.[56]

Linking the music directly to the players' inputs was not a new idea: in 1982, the game *DigDug* (Namco, 1982) had already made use of this principle. But, with the improved technical capabilities of the hardware provided, this idea aroused more and more attention.

6 Handhelds and mobile phones

The GameBoy was not the first handheld, but it was undoubtedly the most successful and beloved by players as well as by chiptune musicians due to its unique sound. Other handhelds like the Atari Lynx (Atari, 1989), the Sega Game Gear

[53] Information can be found on http://www.vib-ribbon.com/ [05/05/2012].

[54] It is not the place here to discuss genre designation; therefore I will use the most common genre labels. The question of genres regarding music is discussed, e.g., in Pidkameny 2002. The question of game genres in general is discussed, e.g., in Apperly 2006.

[55] Information on the plenitude of Bemani games can be found on http://wiki.bemanistyle.com/wiki/Main_Page [05/05/2012].

[56] See, e.g., www.ddrfreak.com [05/05/2012]. For an approach regarding the fan-culture around DDR, see, e.g., Chan 2004.

(Sega, 1990), the TurboExpress (NEC, 1990) and, later, the Sega Nomad (Sega, 1995) and the Neo Geo Pocket (SNK, 1998) were also fairly successful but could not compete with the GameBoy and its successors for a long time.

Mobile phones were also used as gaming devices from the late 1990s, porting successful games and their music from other platforms, but because there were no standards and memory space was limited, they still faced the same old music-related problems. Casual games, which existed as PC versions a long time before mobile phones arrived, were also successfully ported to the new platform, having the advantage of being short and not relying on the music and sound as integral features of gameplay.

7 The first decade of the new millennium

The years 2000 to 2010 also saw a wealth of technological improvements, in particular regarding online gaming, which also took place in the area of consoles, as well as the advent of the new motion controllers, currently peaking in the form of Microsoft's Kinect for the Xbox 360 (Microsoft, 2010), which, competing with Sony's PlayStation Move (Sony, 2010), opened new approaches towards gaming. Due to the fact that, in this period, most games were released for PCs as well as for consoles, and that PC-gaming was increasingly in decline, I will therefore discuss PC and console gaming together.

7.1 Consoles and PCs

Sony's PlayStation 2 (Sony, 2000) was the first console of the new millennium equipped with a DVD drive. It competed with Nintendo's Game Cube (Nintendo 2001), the first Nintendo machine which did not rely on cartridges as a storage medium, but on a custom-made optical disc, the "Nintendo GameCube Game Disc", which provided a storage capacity of 1.4 GB. The main advantage was that, next to the available storage, it was considerably more difficult than CDs or DVDs to copy illegally, and therefore piracy was mostly prevented.[57] On the other hand, for that same reason, the GameCube could not read music CDs. Nintendo's decision in favour of more security becomes more understandable if one takes the

[57] Building in so-called modchips in consoles allowed playing games which were illegally downloaded and/or copied. The prevalence of internet software piracy also became an increasing problem for the video game industry and, in particular, hit the PC game market and Sega hard. For a brief history of video game piracy see, e.g., http://www.gamesradar.com/f/a-brief-history-of-video-game-piracy/a-20100827151011160 96, a list of links related to the issue can be found here: http://vgsales. wikia.com/wiki/Game_piracy [05/05/2012].

fate of the Sega Dreamcast into consideration. This console was released in 1998, and introduced the so-called 6th generation, to which the other consoles also belonged. Hackers created a special BootCD, which was distributed via the internet and made it possible to play bootlegged games without modding[58] the console. Therefore, in 2001, the Dreamcast was discontinued and remained the last console Sega produced. But the gap was immediately filled. The same year a new competitor successfully entered the console market: Microsoft released the Xbox (Microsoft, 2001)[59] and "promised 'movielike' sound from its 64 voice I3DL2 audio processor. With 64MB of unified memory and a 200MHz bandwidth to the CPU, sound designers were given an enormous amount of power to work with."[60]

Due to the powerful hardware, composers now had almost total compositional freedom and decisions regarding music were linked rather to aesthetic and economic considerations as well as to questions of software (e.g. regarding sound engines) than to technical restrictions caused by insufficient hardware.[61] While classical game series with their typical music or musical style were continued, some game designers and composers started to explore the new potential in their own way. In 2001 the abstract rail-shooter game *Rez* (United game artists et al., 2001), designed by Tetsuya Mizuguchi, replaced the sound effects with electronic music and was augmented by an optional Trance-Vibrator peripheral (released only in Japan), the aim being to create some kind of a synaesthetic experience.[62] Two years earlier Mizuguchi had created the music video game *Space Channel 5* (United game artists et al., 1999) in which the player had to repeat dance sequences in time to the rhythm according to the commands spoken by the opponent (up, down, left, right and chu[63]).

> "And I've forgotten to mention the best part of the game, its sound. I've experienced the sounds of *Ys Book 1 and 2*, *Panzer Dragoon*, and *Lords of Thunder*, but dare I suggest that *Space Channel 5* features the finest soundtrack ever in a game? In addition to the music fitting the game's visual style flawlessly (or maybe it's the other way around), the sound manages to be a technical marvel, with dynamic effects like guitar and keyboard tracks brought on when characters join your procession." (Gantayat 2000)

[58] Here modding means building in the aforementioned modchips into the console.
[59] For an overview of the Xbox timeline, see http://archive.gamespy.com/articles/january04/xboxtimeline/ [05/05/2012].
[60] www.gamespot.com/features/6092391/p-7.html [05/05/2012]; by way of comparison: the GameCube included a 16-bit DSP sound processor, which "powers 64 channels with a 48KHz sampling frequency" equal to the PlayStation 2.
[61] For current compositional as well as technical approaches, see Collins 2008a: chapter 8, or Collins 2008c.
[62] An interview with the game designer Tetsuya Mizuguchi can be found on http://www.g-wie-gorilla.de/index.php?option=com_content&task=view&id=130&Itemid=5 [05/05/2012]. See also Pidkameny 2002.
[63] "chu" is, in Japanese, onomatopoetic for a kiss.

In 2001, another game for PlayStation 2 was released which had an interesting feature: the third part of the *Grand Theft Auto* series included a variety of radio stations which the player could listen to after he had acquired a car.[64]

For the rhythm game *Donkey Konga* (Namco, 2003), released originally for the GameCube, a special controller, namely the "DK bongos", was developed, and the game received the "Innovation" category award at the Game Developer's Conference in 2005.[65] One year later, another music game, which was also combined with a particular controller, won this same award: *Guitar Hero* (Harmonix Music Systems, 2005), released in November. The game was packaged with a guitar-shaped peripheral (a 3/4-scale reproduction of the Gibson SG guitar) on which the player had to push the correct buttons and hit the strum bar in time to complete a song.[66] It introduced an entire series and also gained the widespread attention of non-gamers, was also played in bars and pubs and was included in a lot of top-ten lists of the "most influential games".[67] In addition to the GDC award, *Guitar Hero* swept the board. The similar game *Rock Band* (Harmonix et al., 2007) mainly relied on the *Guitar Hero* gameplay elements, adding drums and the vocal part. The singer performs into an USB-microphone and has to hit the pitch of a note. MTV Games and Harmonix[68] strongly promoted *Rock Band* by promotional tours all over the USA, for example, and auditioning fan-created "bands". The two best bands appeared on MTV's "Total Request Live" show "Rock Band – battle of the bands" in September 2007.

Karaoke-styled singing games coming with USB microphones had already been introduced in 2004, including the game *SingStar* (London Studio, 2004) for PlayStation 2. It required players to sing along with the music, hitting the pitch of a note in order to score points. It introduced a series of *SingStar* games and also triggered a series of similar games. One of the latest games in the karaoke genre,

[64] A list and description of the radio stations is available on: http://www.thegtaplace.com/gta3/radiostations.php [05/05/2012].

[65] "The Innovation awards recognize games that demonstrate true innovation, advance the state of the art, and push the boundaries of games as an expressive medium. In essence, these are the games that are leading the way as the medium continues to evolve." http://www.gamechoiceawards.com/archive/innovation.html [05/05/2012].

[66] A concise description and analysis of the game can be found in Miller 2009.

[67] See e.g. http://www.wired.com/gamelife/2009/12/the-15-most-influential-games-of-the-decade/

[68] Another interesting game developed by Harmonix Music Systems was *Frequency* (2001). The game broke up any given song into tracks. The player travelled down an octagonal tube and on each side of that tube were a series of notes the player had to hit playing the score. "Unlocking multiple tracks in succession increased a score multiplier. Every eight measures, the song would progress to the next section, and the process would repeat. When the musical segment came around again, the previously unlocked tracks would still be on, and by completing all the tracks in a section, you could unlock a bonus 'freestyle track, which either added an arpeggiator or a scratch-pad to the music." http://www.giantbomb.com/frequency/61-5825/ [05/05/2012].

developed for the current generation of consoles, *Def Jam Rapstar* (4mm Games, 2010) has an interesting additional feature:

> "The music video plays on the screen, though that can be swapped out with footage of the players if you have a PSEye or Xbox camera. [...] Players using the aforementioned cameras have the option to edit their video at the end of each song. [...] You can essentially create your own music video, as low key or as crazy tacky as you want. [...] Uploading the video to the community opens up even more features. Sure, there's the in-game system where I can watch and rate videos, but the Rapstar website is where it gets really cool. Every video uploaded goes to the website, where players can rate each other, share their videos on Facebook and Twitter, make friends, earn fans, and develop rivals. They can even challenge each other to rap battles where each player has to submit a video and the users on the site vote on who is the best. It makes the experience universal." (DeVries 2010)

This current generation is formed by the 7th generation consoles, which are the actual state-of-the-art hardware: the Xbox 360 (Microsoft, 2005), PlayStation 3 (Sony, 2006) and the Wii (Nintendo, 2006). Since then lots of innovative games concerning music related issues have been released on these platforms. E.g., in 2007, the game *BioShock* included a soundtrack consisting of licensed music from the 30s, 40s, and 50s[69] as well as the original score composed by Garry Schyman. The score was an interesting mixture, including elements of musique concrète, twelve tone technique as well as aleatoric elements. The concert piece for piano "Cohen's masterpiece" is related to the compositional style of Sergei Rachmaninov and was often requested by people who wanted to play it themselves.[70]

Games like *Eternal Sonata* (Namco/Tri-Crescendo, 2007), which relates to the life of Frédéric Chopin, or *Brütal Legend* (Double Fine Productions, 2009), which is based on heavy metal culture, not only rely on a certain style of background music, they also include music-based gameplay elements, and refer to the culture around the music and give background information.

In 2008, the online multiplayer mode of the zombie game *Left 4 Dead* (Valve South et al.) included a very interesting feature regarding the personalization of music:

> "We keep the music appropriate to each player's situation, and highly personalized. The 'music engine' in *Left 4 Dead* has a complete client side multi-track system per player

[69] To put music from the decades to games with a dystopian setting seemingly has become a topos, as e.g. the *Fallout*-series shows. This would be an interesting question for further research. The *BioShock*-score is available for free on http://www.2kgames.com/cultofrapture/article/orchestralscore [05/05/2012].

[70] "Though it is not an easy piece to play, a lot of people have enjoyed the piece and requested a pdf. I got so many requests that I put the sheet music on my website to download. A number of people have posted recordings on YouTube of themselves playing the piece. It's struck a chord with some people – no pun intended – and it's really a trip." See Jeriaska 2010.

> that is completely unique to that player and can even be monitored by spectators. Since some of the fun of *Left 4 Dead* is watching your friends when you're dead, we thought it was important to hear their personal soundtrack as well. This feature is unique to *Left 4 Dead*."[71]

Every enemy zombie class as well as the 'horde' has its own musical cue, therefore, when a player hears, for example, the "Witch's" theme and her crying sounds, he/she knows that this very powerful enemy is around somewhere, creating high tension. The game's intro introduces the different types of zombies as well as their leitmotifs; in this way the player immediately gets a demonstration of which musical cues he has to listen out for.[72] Recently, *Rock Band 3* has attracted attention due to its peripherals, because the Fender Mustang Pro guitar controller is, like the keyboard, a fully functional MIDI controller, creating a "border-tweaking experience" as The New York Times enthuses:

> "But now Harmonix has brilliantly torn down the wall between music games and real music. If you're willing to put in a reasonable amount of practice – like the couple dozen hours I did – Rock Band 3 can actually begin to teach you to play guitar, bass and keyboards. [...] Rock Band 3 truly shines because of its new guitar. [...]This device has six physical strings down where you strum, but the neck is covered with 102 thin horizontal buttons corresponding to 17 frets (multiplied by six strings) on a real guitar. And so with this guitar you unlock Rock Band 3's Pro Guitar and Pro Bass modes." (Schiesel 2010)

But regardless of all the former success, in February 2011 a cry of astonishment was heard: Activision declared the end of the *Guitar Hero* series as well as the *DJHero* franchise due to "continued declines in the music genre" and "will release no new music or skateboarding games" (Grant 2011). *Rock Band*'s publisher MTV Games was also shut down, but in contrast to *Guitar Hero*, the *Rock Band* series will be continued (Chalk 2011). Even though the end of *Guitar Hero* startled the community, declaring the end of the music game genre was a bit overhasty:

> "The video game genre remains popular; it has just evolved. Many people these days play music-inspired games on the iPhone, such as 'Tap Tap Revenge', and dance games designed for Microsoft's Kinect motion-sensing controller, which hit stores just last fall."[73]

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[71] Tim Larkin in the developer commentary, see http://left4dead.wikia.com/wiki/Developer_Commentary_%28Left_4_Dead%29 [05/05/2012].

[72] The English intro can be watched here: http://store.steampowered.com/video/500/5141 [05/05/2012].

[73] Associated Press 2011, see http://pddnet.com/news-ap-party-over-for-guitar-hero-but-not-music-games-021011/ [05/05/2012].

New approaches, ideas and developments are already waiting to fill the gap, such as e.g. the augmented-reality application *AiR Guitar*[74] or the game *Rocksmith*[75] (Ubisoft Entertainment 2011), which allow the player to plug in any real e-guitar to play along.

Regarding the aforementioned motion-recognition technologies, three games are of special interest: *Wii Music* (Nintendo, 2008), *Dance Central* (Harmonix, 2010) as well as *Child of Eden* (Q development, 2011), a successor of *Rez* and also designed by Tetsuya Mizuguchi, but now for Microsoft's Kinect. *Wii Music* is a free-form music game which does not aim at scoring points, but just at being fun to play. The player holds the Wii Remote and/or the Nunchuck[76] and simulates playing an instrument or conducting an orchestra by imitating the typical gestures. *Dance Central* is "the first 'real' dance game [...], one that demands actual full-body dancing from the player [...] Dance Central uses the Kinect technology to read the player's body as he or she follows a series of on-screen prompts that depict a dance routine. These "flash cards" each represent one move, and that move can range from a simple shuffle step to an advanced series of upper body motions." (Clements 2010) The game *Child of Eden* is announced as an experiment in synaesthesia (similar to its predecessor *Rez*), integrating sound, vision and touch in one seamless experience and will feature music from Genki Rockets, a virtual J-Pop Band produced by Mizuguchi and made up of unnamed musical artists.

7.2 Handhelds and other platforms (smartphones)

Similar progress to that in the console area was also made in the current handheld market. Inventive music toys were made available such as *Electroplankton* (Indies Zero, 2005), created by designer Toshio Iwai for the Nintendo DS (released in 2004), rhythm games like the comic-styled *Patapon* (Pyramid et al., 2007), released for the PlayStation Portable (available since 2004), or the puzzle video game *Lumines* (Q Entertainment et al. 2004), by designer Tetsuya Mizuguchi for the PSP adapt genre, as well as gameplay elements for portable devices. In particular these introduced the stylus touch screen, and successors, e.g., of the Nintendo DS, are already available. An adaptation of *Guitar Hero* for the Nintendo DS also exists, which is

[74] It is a T-Shirt which "comes equipped with a barcode symbol that, when viewed through a Webcam, results in musical notes being emitted through a computer application each time the wearer strums across the barcode." See http://www.thetechherald.com/article.php/201111/6931/Strumming-soon-The-FauvelKhan-AiR-Guitar-T-Shirt [05/05/2012].

[75] See http://rocksmith.ubi.com/rocksmith/de-DE/ and http://ps3.gamespy.com/playstation-3/rocksmith/1155769p1.html [05/05/2012].

[76] Peripherals developed for the Wii.

playable with an adapter, the so-called Guitar Grip, in addition to other console games being released for PCs and/or handhelds.

A new dimension in mobile gaming was also opened with the rise of the so-called smartphones and tablet PCs, in which area designers are already eagerly experimenting, sometimes oscillating between game, music-making tool and musical toy. For the iPad several Musical Instrument Apps are currently available, turning the iPad into a virtual 'instrument'.[77]

8 Game music outside games (live concerts, radio stations, movies, TV series, education)

In 1999, Belinkie stated:

> "A major reason the music is viewed differently is that in Japan, video games are played by adults as well as children. In the U.S., adult gaming usually takes place on PCs, and so console systems are seen as children's toys."

Interpretive albums, remixes and live performances were also common variations to original soundtracks in Japan, as we have already seen. With the first generation of gamers coming to age, this also changed significantly in the West. Almost ten years later Karen Collins describes the following scene:

> "San Jose, California, March 2006: [...] It is the first time I have seen so many people turn up for an orchestra; every seat is filled as the show begins. This was, however, no ordinary performance: the orchestra would be playing classics, but these were classics of an entirely new variety – the songs from `classic´ video games [...]" (Collins 2008a: 1)

In 2003, the presumably first live performance of video game music took place outside Japan[78], at the Leipziger Gewandhaus on August 20, 2003, entitled "Symphonisches Spielemusikkonzert". It was the inaugural event of the Games Convention. Due to its popularity, it was extended into a concert series and continued till 2007.

In 2005, the specialized project "Video Games Live", initiated by the composers Tommy Tallarico and Jack Wall, premièred on July 6 in Los Angeles with the Los Angeles Philharmonic Orchestra. Since then it has toured the world and, in 2008, the already traditional "Symphonische Spielemusikkonzert" was supplanted by a "Video Games Live" show, which took place in the Leipziger Arena. Another

[77] See http://www.iphoneness.com/ipad-apps/best-instruments-applications-for-ipad/ [05/05/2012].
[78] Boecker 2003; a concert programme is also available.

tour project specializing in video game music trades under the name "Play! A video game symphony" and premièred on May 27, 2006, in Chicago.

In 2008, the WDR Rundfunkorchester Cologne also added video game music to their repertoire because its manager, Winfried Fechner – at the instance of a friendly conductor – had visited a concert within the framework of the Games Convention Leipzig and was amazed that the audience consisted of 2000 young people listening to classical music. Therefore, on August 23, 2008, the concert "Symphonic Shades – Hülsbeck in Concert" was performed, dedicated to the music of the German composer Chris Hülsbeck. It was also the first video game music concert which was transmitted live via radio.

In general, the impact of video game music on today's culture cannot be ignored as the following examples may demonstrate: Internet radio stations specializing in video game music[79] have existed since at least 2003, when Square Enix launched the "Final Fantasy Radio" on America Online.

In April 2009, while being on a flight with Delta airlines, if you had chosen to listen to channel 6A, you might also have had an encounter with video game music: you could have listened to the Soundtrack of *Fallout 3* (Bethesda Game Studios, 2008).

The movie *Scott Pilgrim vs. the World*, which generally works with video game aesthetics and conventions, also uses the sounds typical for 8-Bit-Games and features an 8-Bit "Universal" theme before the movie starts. In a dream sequence, music from *The Legend of Zelda* series appears: the "Fairy Fountain" theme, written by Koji Kondo. In a talk with actor Michael Cera, director Edgar Wright explains how he convinced the holder of the rights to permit him to use this music:

> "[...] Shigeru Miyamoto—the Mario creator from Nintendo—has seen part of the film. We had to get his permission to use this piece of music from 'The Legend of Zelda' for that dream sequence. So when I was writing to Nintendo to get permission, I was saying, 'This music is like nursery rhymes to a generation.' I remember seeing you get all misty-eyed any time Super Mario Bros. 3 was mentioned."[80]

Video games and their sound and music are cited in other musical genres[81] as well as in popular TV series such as *Scrubs* or *The Simpsons*, and are the topic of perform-

[79] A list of internet radio stations such as, e.g., the "RadioNintendo", "Gaming FM", "Radio GOSU" or the "Final Fantasy Radio" can be found on: http://www.homisite.com/radio.html [05/05/2012]. Some are, for sure, established for marketing purposes, some air a mix.

[80] Miller, 2010. See http://www.wired.com/magazine/2010/06/ff_cerawright/all/1 [05/05/2012].

[81] "The influence of early games audio has been underestimated. The continuing prominence of one particular sound, Pac-Man's 'waca waca' (the sound the character makes when eating), is clear evidence of the significance of this influence. In the 1980s, the sound was incorporated into popular songs such as 'Weird Al' Yankovic's 'Pac-Man' and Buckner and Garcia's 'Pac-Man Fever', but it has more recently been used by Aphex Twin, Bloodhound Gang, DMX, Lil' Flip, and many more." See Collins 2008b: 210.

ances such as the "Game Over Project", directed by the Swiss artist Guillaume Reymond, or inspire theatre performances such as "BestBefore" by the group Rimini Protokoll[82].

> "'You Can't Hum a Video Game,' wrote Mr. Davis. That statement seems to have been officially disproved, as the Recording Academy recently made changes to allow game soundtracks to win Grammy Awards beginning this year. A new category for competition has been created: 'Music for Television, Film, and Other Visual Media.' [...] It remains to be seen whether any game music will be nominated for these awards, much less win them." (Belinkie 1999)

And there we are: in 2011, on February 13th, a video game composition won a Grammy Award for the first time. Christopher Tin's "Baba Yetu", originally composed for Sid Meier's *Civilization IV*, received the award for "Best Instrumental Arrangement Accompanying Vocalists" (interestingly not in the category Belinkie mentioned in 1999).[83]

Game music has also entered the area of education: it has become part of the curriculum and the topic of summer schools, and the workshops of traditional schools and universities such as, for example, Berklee College of Music (Film Scoring Department)[84] and New York University (Game Center) feature game music. Game sound and music design has also been part of the curriculum at the Utrecht School of the Arts (Faculty of Art, Media and Technology) since 2003 and training seminars like the "GameSoundCon" also give classes in how to compose video game music.

All those facts may be interesting for further research, be it within the scope of musicological, sociological, educational, theatrical or marketing-related questions. As one can see by these examples, video games music today is not "just kid stuff" but has started to bring a new audience into the concert halls and also produced a new generation of composers who have created a distinct musical culture by exploring the various possibilities.

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[82] See http://www.rimini-protokoll.de/website/de/project_4397.html [05/05/2012].

[83] Caioli 2010: "Tin originally created 'Baba Yetu' for Firaxis' 2005 turn-based strategy title, but local and professional choirs have extended its popularity beyond *Civilization IV*, singing it at nearly 1000 live concert performances. It's also a staple of Video Games Live, the concert tour featuring game music played by orchestras and choirs." See http://www.gamasutra.com/view/news/ 31841/Grammys_ Nominates_First_Video_Game_Theme_Civ_IV_Music.php [05/05/2012]. The song was also used in Dubai for a performance by the Dubai fountain: http://www.youtube.com/ watch?v=M_GQYI9brGs [05/05/2012].

[84] See http://www.boston.com/news/education/higher/articles/2010/01/19/berklee_is_teaching_ students_to_compose_scores_for_video_games [05/05/2012].

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