

# Do Androids Dream of Computer Music?

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# RIP & TEAR: DECONSTRUCTING THE TECHNOLOGICAL AND MUSICAL COMPOSITION OF MICK GORDON'S SCORE FOR *DOOM* (2016)

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## ABSTRACT

The earliest mainstream examples of the first-person shooter game can be traced to the early to mid 1990s, during which one company above most others cultivated a genre that continues to dominate the global video games market. id Software was founded by John Carmack and John Romero, and of all their video games it is perhaps the 1993 *DOOM* that has been most influential and celebrated. Advancements in technological game development and creativity afforded *DOOM* exhilarating gameplay, killing monstrous enemies, spurred on by a synthesized, metal-infused soundtrack by Bobby Prince. The 2016 reboot of the serious, similarly titled *DOOM*, had one of the strongest legacies to live up to in the gaming world. To both respect the series' lineage and give this new game a distinguishing identity, composer Mick Gordon developed unique technical and musical processes based on a philosophy of energy passing through objects, and so doing, corrupt them.

## 1. INTRODUCTION

This Alongside titles *Wolfenstein 3D* (id Software, 1992) and *Quake* (id Software, 1996), *DOOM* (id Software, 1993) is arguably one of history's most influential computer games. The 3D graphics, game engine and in-game assets were all causal factors in the popularity of this science fiction/horror game. Core gameplay, an exhilarating combination of linear level exploration and the dispatching of numerous enemies using a minacious array of weaponry, largely defined the first-person shooter genre. An ambient metal soundtrack composed by Robert C. Prince III (Bobby Prince) accompanied gameplay in original versions of the game, taking inspiration from bands including Metallica and Slayer. Subsequent to related sequel and expansion games, the series' original developer company recently released *DOOM* (id Software, 2016), with Australian composer Mick Gordon composing the score. Gordon's music dances nimbly upon a line dividing originality befitting this reboot of the franchise, and homage paid to the original game's midi soundtrack.

This was achieved through a number of experimental, procedural, musical and technical processes. Motivic content such as distinctive electric guitar riffs from the

1993 game soundtrack were reconstructed and transposed down onto a Schecter nine-string guitar. The ominously guttural melody produced was altered with effects, a process that was ultimately a cornerstone of the score's aesthetic. Gordon stripped his music to its fundamental sine wave and noise forms, and pulsed rhythmic excerpts of this sound through vast arrays of analogue equipment. Eschewing the traditional effect processing capabilities of vintage guitar effects pedals and reel-to-reel tape machines, Gordon unconventionally used the circuits within this equipment to corrupt the pure sine waves and noise. Ricocheting electrons transfigured the sonic matter, and Gordon harnessed the capturing of this energy to imbue his musical phrases with literal charge. A similarly explorative process was undertaken in using a Soviet-era Polivoks synthesizer, labeled in Russian, made all the more experimentally nuanced, as Gordon does not speak this language. These sounds were combined with dark synth-rock rhythm section parts and numerous metallic, electronic and 'other worldly' sound effects to suit *DOOM*'s in-game environment.

The narrative does not explicitly expound a post-human paradigm, however the two settings of gameplay are a research centre on the planet Mars and a seemingly secularist depiction of hell. These are both distinctly chaotic locales, devoid of genuine humanity but replete with monsters, and as a non-diegetic musical accompaniment to play the score reflects the abstract-cum-dystopian visual elements and themes. Gameplay can swiftly evolve such that the player may need to engage in close-quarter combat against limited opponent numbers, thence rapidly adapt to face oncoming waves of enemies in vast areas. The score reacts dynamically to such changes, altering components such as instrumentation and theme in real-time, based on player actions. In so doing, a musical intelligence is presented that at any one time may provide the player with both a substantiated diegesis, and individualised soundtrack experience. It is the singular technical construction and musical composition, broader narratological links and gameplay experiences of Gordon's score for *DOOM* that this paper seeks to elucidate.

## 2. THE FIRST-PERSON SHOOTER

By the early to mid 1990's almost a quarter of US households possessed a personal computers (PC),

drawing millions of consumers to a platform experiencing a metamorphosis from the esoteric to the commercial (Kline, Dyer-Witthford and De Peuter 2003). Unsurprisingly, a wave of action games (and other genres) similarly saw commercial success during the same period. Garrelts (2005, p. 3) summarises that “as digital games have become more technologically advanced, the possibilities for interaction within the world of the game have also exponentially increased.” As crucial as technological innovation was and remains to the gaming industry,<sup>1</sup> it is the exhilarating gameplay experiences afforded by this innovation that propelled PC gaming.

Texas company id Software was an active digital games producer of this era, defining the first-person shooter (FPS) game, with *Wolfenstein 3D* (id Software 1992) the first of many (Egenfeldt-Nielsen, Smith and Tosca 2008). *Wolfenstein* portrayed a gameworld of a freely navigable castle environment, with structured pathways in which to exterminate numerous enemies. Key to the groundbreaking realism of gameplay was the first-person perspective, exploiting parallax-motion and graphics to place the player in the virtual shoes of the protagonist (Kline, Dyer-Witthford and De Peuter 2003). This design trope is fundamental to FPS games, in which the player will typically see no more than their character’s hands or weapons (Grimshaw 2007). Other FPS games such as *Quake* (id Software 1996) and *Duke Nukem 3D* (GT Interactive 1996) further developed and popularised the genre, however it is the original 1993 *DOOM* (id Software 1993) that this paper takes as its focus.

### 3. *DOOM*, SOUND AND MUSIC IN FPS GAMES

Kline, Dyer-Witthford and De Peuter (2003, pp. 143-144) claim, “*Doom* was the game that blasted hard-core computer gaming to commercial success” and that it “it lived up to its title’s apocalyptic overtones.” The player controlled an unnamed space marine protagonist traversing several interstellar installations owned and operated by the fictional Union Aerospace Corporation (UAC). Through a deterioration of defense systems and protective forces, the player was compelled to battle and overcome an onslaught of demonic enemies through a number of game levels. John Romero’s graphic design, and John Carmack’s ‘Doom engine’ (game engine), the creators of id Software, produced a compelling experience of interactive entertainment, simultaneously peaking in both technological sophistication and violence.

A first-person perspective was fundamental to the design and popularity of the game, and to that end Romero has stated that the protagonist was given no name with the intent that the player felt that they were the space marine (Internet Archive 2002). The minacious array of

weaponry at the player’s disposal and up-front gore of dispatching monstrous enemies made the action and horror all the more immediate. Herzfeld (2013, p. 150) offers that the “joy of gaming is bound to the degree of plausibility in the dissolution of objective space and subjective perception,” determining of *DOOM* that “the player sees and hears only what the avatar sees and hears.” Key to this is concept is the perception of sound, on which Grimshaw (2007, p. 121) notes that, in such instances “the character and player are ... one and the same.” In union with bombastic firearm discharge sounds and animal groans providing the beast noises in the game, was a techno soundtrack infused with metal influences (Kushner 2003).

Robert C. Prince III (Bobby Prince) had previously worked with id Software and Apogee Software Ltd. (Kushner 2003), the publisher responsible for another landmark FPS game series, Duke Nukem. Inspired by bands such as Metallica, Slayer and Pantera (Polanco 2016), Prince’s soundtrack for *DOOM* was part of a mid-1990’s convergence of rock musicians and game studios. Similarly influential was the aggressive, industrial sound in the soundtrack for *Quake* was written by Nine Inch Nails frontman Trent Reznor (Mernagh 2000). These soundtracks were a harbinger for successful collaborations soon thereafter, such as *Wipeout XL* (Psygnosis 1996) featuring Daft Punk, Prodigy and the Chemical Brothers (Collins 2008), *Big Air* (Accolade 1999) featuring Blink 182, Diesel Boy and Limp (Mernagh 2002), and tie-in fighting game *Wu-Tang: Shaolin Style* (Activision 1999). A series of sequels, updated versions and expansions and have been released in the *DOOM* series, but it wasn’t until a long running series of creative and corporate hurdles had been navigated that a genuine reboot of the series could be created (Hurley 2015).

### 4. *DOOM* REBOOT

Munday (2007, p. 51) describes that “[s]ince the mid-1990s, the improved memory capacity and increased processor speeds of game consoles have freed video-game composers from the technological constraints which gave the work of their predecessors such an identifiable aesthetic.” This is true, however while technological constraints are comparatively alleviated, the expectations of legacy, popularity and icon-status pervade reincarnations of old universes. Award winning Australian composer Mick Gordon was chosen to compose the main score and musical elements for the franchise reboot game, having previously worked on titles such as *Need for Speed: Shift* (Electronic Arts 2009) and *Killer Instinct* (Microsoft Studios 2013). In Gordon’s (2017, n.p.) own words, “modern *DOOM* is nothing but a tribute to 90s game design. Indeed, the 2016 game ultimately retained fast-paced gameplay, an expansive but linear level system and multiplayer modes in echo of its predecessor. As described by executive prouder Marty Stratton and quoted by Brinbaum (2015, n.p.), the fundamental narrative elements of *DOOM*,

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<sup>1</sup> A contemporary example would be the introduction of Intel’s Pentium computer chips.

“badass demons, big effing guns and moving really, really fast,” remain consistent. It is a recapitulation of the most celebrated elements of the original game, with a story drawing on previous titles, but nonetheless original. Gordon embarked on composing the score wishing to respect the strong legacy of the series, while imbuing the project with its own unique musical character (GDC 2017).

## 5. DOOM – CORRUPTIVE ENERGY

From very preliminary stages Gordon’s creative approach to composing the *DOOM* soundtrack was influenced by other elements of the (developing) gameworld, as well as more formalised guidelines. The initial music design document stipulated that guitars should not be used in the score, opting instead for synthesizers as a musical basis (GDC 2017). Gordon’s initial act was to create a rhythmically recursive sub sine wave part. As a foundation upon which other elements could be based this action made sense, however the low pulsing required accompanying higher frequencies to delineate rhythm.

To this sine wave Gordon added white noise. A prima facie appraisal this choice of sound component could result in an estimation of banality; an axiomatic nod to common storytelling conceit of using abstruse sonic entities within the horror genre, as discussed below. While this was likely a factor in Gordon’s creative thought process it was the implementation method of white noise that gives the *DOOM* score its character, not simply the inclusion of it. The white noise sound was turned on and off at a rate that mirrored the frequency of the sub sine wave underneath it. The sub was ‘ringing’ (bounces per second) at approximately 36.7-Hz in this case, and in alternating the white noise at the same rate Gordon essentially executed ring modulation at the audio frequency. The two parts were audible when combined, and by feeding this signal through a distortion process, extemporal harmonics were created. The result was sonically and aesthetically intriguing, however directives from id Software personnel compelled further investigation.

In studying design paraphernalia such as concept art, Gordon further established a broader electronic music palette that would suit the macabre visuals of *DOOM*’s settings. A specific visual component within the game’s concept art of a recurring motif of stalactite rock formations resonated with Gordon. These massive geographical structures comprised two or three solid pieces of rock floating in mid-air, with crimson electrostatic discharges flickering between the compartmentalised pieces. The effect was an augmented stalactite, broken, with each piece held together by a lightening-like energy of unknown but presumably perverted nature. This visual depiction of energy pulsing through objects and becoming corrupted manifested in Gordon’s conceptualisation of the composition process,

seeking to answer what this energy might sound like (Gordon 2016b). The result was the pulsing of sine waves, described by Gordon (2017, n.p.) as the “most pure representation of what sound can be”, through analogue equipment, not to utilise their intended effects processor elements, but rather “using the circuits of the equipment to corrupt the pure sine waves and noise” (Gordon 2016b). This became foundational to the construct of the score, and eventually epitomised the entire game’s narrative. It highlights Munday’s (2007, p. 62) articulation of using “music to provide stylistic cues to aid the comprehension of [games’] particular setting and narrative genre.” Gordon’s concept however seemingly transcends a symbiotic relationship of sound duplicating and enriching visual information, as conceived by Chion (1994) and as compared with video games by Munday (2007). It is perhaps more accurately surmised by Summers’ (2016, p. 59) aphorised calculation that “music in games often obviously deploys strategically chosen musical signifiers in order to finish the games’ fictional construct.” Summers’ also draws on Juul’s ‘cueing’ nomenclature (Juul 2005) in stating that music ‘cues’ the player to understand the universe of the game (Summers 2016), thereby equating the game music to the game narrative as a whole.

In the plot of *DOOM* the (reprised) UAC seeks to hoard and monopolise an immensely powerful form of energy, ostensibly to remedy a power shortage but clearly to exploit power; that is, good versus evil. This archetypal narrative dichotomy pervades diegeses, liturgical teachings and ethical discussions, with video games just another, comparatively recent, format for story telling, as expressed by Murray (1997) in Kerr (2006, p. 24). Naturally, there is also a ‘hero’ component to the plot of *DOOM*. The player-controlled protagonist is forced by to, as Zehnder and Lipscomb (2006, p. 250) articulate, “undergo a series of trials or difficulties, often involving a descent into hell (at least metaphorically).”<sup>2</sup> Absent however is the consequential resolution of returning to the ordinary world (Zehnder and Calvert 2004). Mover the game only partially adopts the classic Aristotelian model of narrative, dispensing with the more romantically satisfying notion of unwinding (denouement), but, as in a song comprised of so any dominant seventh chords,<sup>3</sup> a constant succession of rising action (desis) and climax (peripeteia) (Zehnder and Calvert 2006). What is distinctive and consistent in *DOOM* is the notion of flowing or being pushed through something, like a corporation imbuing machinery with corruptive energy, or floating rocks connected by lightening bolts pulsing through them. The game’s quintessential FPS design allows the player various ways to navigate required objectives and their environment, but within a strictly linear overall narrative progression and level system (Calleja 2011). Even at this macro level, the concept of passing through could be applied to

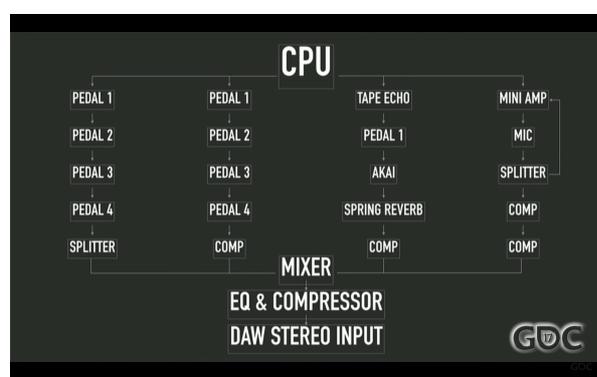
<sup>2</sup> In the case of *DOOM*, this is a literal descent.

<sup>3</sup> A relevant example would be the jazz standard ‘All of Me’ by Gerald Marks and Seymour Simons.

the player's progression through what is essentially a number of walled tunnels (levels), facing corruptive elements therein.

## 6. THE *DOOM* INSTRUMENT

To bring this concept to bear musically, Gordon constructed a complex and sophisticated array of audio signal pathways and distortion controllers, through all of which a sine wave was fed. Figure 1 is a screenshot from Gordon's 2017 Game Developers Conference presentation (GDC 2017), and shows the signal branches and sonic pathways that the eventual array consisted of. As it demonstrates, a signal generated by a computer was split into four pathways, each of which thence went into a chain consisting varyingly of effects pedals, speakers and other equipment.



**Figure 1.** Gordon's '*DOOM* instrument' array.

The predominance of 'pedals' listed belies the true variation of the equipment. For example, within the first two pathway chains (left to right) resides a Retro Mechanical Labs 432k Distortion Box (focused on signal routing), a Metasonix KV-100 (tube distortion), two Geiger Counters (bit crusher), Dwarcraft Fuzz pedal, Metasonix TX-3, Mu-Tron Bi-Phase (ca. early 1970's phaser pedal) and a DOD phaser pedal (ca. 1970's), as well as the listed splitter and compressor. The vast opportunities presented for sound distortion and attenuation are compounded in the other two paths. The third pathway chain begins with a Watkins Copicat Tape Echo machine (ca. mid-1960's tape-reel compact repeat-echo machine and a Trogotronic valve distortion box (used more for compression features). An Akai reel-to-reel tape machine (ca. 1070's, fed approximately 40-dB over capacity and recorded back off the machine simultaneously), a Spring Reverb Tank (with a wet/dry control) and another compressor follows. The fourth pathway chain begins with a mini-amp (small speaker, again fed approximately 40-dB over capacity). This amplifier had a microphone recording its emitted sound, and a small portion of its own signal was sent back via a splitter. An intentional feedback loop was created, so small that when a sound emanated from the speaker, the feedback sound would be 'choked out'. The effect was a constant and smooth fluctuation between a distorted

signal and feedback sound, which was thence fed into another two compressors. The split signals of all four pathways ran into a mixer for control purposes, then through equalization and compression, the latter of which was overlocked to approximately 20-dB. This was so that when the loud noises faded away, the compressor would open up and bring to the fore all of the various noise elements created by the pedals and equipment. This compressor had an attack set for approximately 30 milliseconds to produce a solid, punchy sound, with the release alternated depending on the tempo of the sound pulsing through it. Finally, this signal was fed into a digital audio workstation with stereo input for editing (GDC 2017).

There are obviously copious sound-control possibilities within such a vast network of effect pedals and machines, however other extemporaneous sounds were produced through experimentation. For instance, Gordon found that by playing consecutive intermittent F notes, an E, or a microtonal approximation thereof, would be created. This was not from conscious input by composer or computer, but generated by sources of ground hum within the setup, eerily reminiscent of John Williams' iconic shark motif (Burlingame 2012) in the score for *Jaws* (Spielberg 1975). Tonal harmonics were also created, as well as multiple layers of compressed distortion. These and any intended effects generated by the machinery remained true to Gordon's inspiration of a pure sine wave travelling through equipment, and in so doing becoming corrupted. So compelling was the tangible superlative modification of sound within this array that Gordon was led to "think about this as [his] *DOOM* instrument" (2017, n.p.). It became a predominant component of the *DOOM* score, producing multitudinous effects, distortions and contortions to sine waves whose only manipulation was initial amplitude and pitch.

The result was an audibly corrupted series of musical cues. By using the analogue equipment circuits to affect the sine sound instead of using digitally synthesized effects, there was a tangible grit and depth evident in the music. The ricocheting electrons transfigured the sonic matter, and Gordon harnessed the capturing of this energy to imbue the score with charge, both quixotically and practically. The extemporal electronic hums and metallic noises natively created by the *DOOM* instrument array compliment the abstract-cum-dystopian visual environments. Later stage equalization, mastering and transient processing remained a part of the process, creating balanced mixes with controlled dynamic ranges. It is because the sound was fed through amplifiers at decibel levels greater than the equipment was designed to handle however, that the music genuinely creates a sonic image of literally ripping and tearing sound apart.

## 7. MUSIC, ENVIRONMENT AND HOMAGE

The *DOOM* (Bartkowiak 2005) film based on the extant game series' universe was similarly based mostly on a future-set Mars, and depicted human citizens of a colony. The 2016 (video game) reboot of the series however showed little in the way of human inhabitants. Main non-player characters (NPC) such the facility director Samuel Hayden and scientist Olivia Pierce are cybernetic organisms, the UAC artificial intelligence named VEGA has no humanistic corporeality, and other identifiable humans are deceased and typically clad in full-body armour. The most prevalent depiction of human forms is perhaps the crimson floor piles of blood and loosely draped strings of internal organs, the sole remnants of eviscerated facility staff. The player is informed that humans have existed in the Mars facility until recently, meaning that the introduced paradigm is neither post-human nor post-apocalyptic, but rather one of dystopian massacre and peril. The two literal 'other worldly' environments of hell and the UAC Mars facility are overrun with monstrous creatures possessing the single ambition of extreme malevolence.

To sonically match the visual elements, Gordon maintained focus on the claustrophobic, aggressive, brutal, tactile and piercing experiences of gameplay, with the score aiming to "capture that complete lack of restraint" (Gordon 2016b). Again employing procedural and technical experimental methods, the composer turned to a 1980's Polivoks synthesizer to sonically match the visual elements. The analogue, duophonic instrument was manufactured in the Soviet Union, and as Gordon's was an original model it was labeled entirely in Russian, a language not spoken by the composer. Rather than a deterrent, this allowed for creative freedom when composing, with less focus on effect ratio measurement, and more on pure characteristic of sound. The onboard oscillators and filters of the Polivoks could provide desired sound of ambiguous origin and nature, and when combined with the '*DOOM* instrument' array exponentially increased Gordon's tools of creativity (ibid. n.p.). As briefly discussed above, the fiction of the gameworld is supported and enhanced by the game's soundtrack. Producing musical accompaniment to play that is convincingly copacetic as to give meaning to such an abstract gameworld presents challenges. Schell highlights the importance of using sound to convince the player of 'space' in a gameworld (2015), while Sweet determines the importance of musical themes establishing locations within a game (2014). Munday (2007, p. 53) similarly offers that in the case of video games "it is worth remembering that computer-generated environments make no natural sounds: hence the importance of music and sound effects to give them meaning." The initial directive from id Software was that guitar was not to be used in an attempt to distance the soundtrack from the generic. With a history as a guitarist however, and a strong sense of the affinity between guitars and the original *DOOM* soundtrack, Gordon

developed the view that it was this very instrument that was missing from the soundtrack (GDC 2017).

Gordon once again changed typical composition processes to enable the production of interesting musical outcomes. In so doing, the composer paid homage to the most definitive and celebrated elements of the original *DOOM* soundtrack. Having convinced a case for increased guitar use, Gordon singled out the iconic 'E1M1 riff' found in the track 'At Doom's Gate', heard during the 'E1M1: Hanger' level from the first *DOOM* game. Gordon has opined, "that original E1M1 riff is iconic, it is *DOOM*" (Gordon 2016a) but was not prepared to recapitulate it verbatim for the 2016 game. Instead, through a number of iterative stages, Gordon reorganised the original four notes of the E1M1 riff, creating a new riff reminiscent of E1M1 but possessing its own original construct.

Part of this construct included the transposition of this motivic content down onto a Schecter nine-string guitar, conjuring a depth and grit otherwise not possible. This process was itself inspired by audio engineer Sean Beavan's work with Marilyn Manson and Nine Inch Nails. Beavan would have guitar parts played up an octave at double the tempo, recorded to tape at 30 inches per second. The tape would then be slowed to 15 inches per second to produce unnatural qualities. This was replicated by Gordon, with the guitar signal pulsed through an additional preamp. Further distinguishing the distorted sound, the Morph audio editing plugin by zynaptiq was used to interpolate characteristics of one sound into another sound. Shrewdly, Gordon interpolated elements of the original *DOOM* game chainsaw sample into the guitar tone, thus imbuing the new riffs with a tone perpetually linked to the sonic identity of its predecessor. The resulting melody, ominous and guttural, was used in the track 'At Doom's Gate', sharing eponymous and musical links with the 1993 original track (GDC 2017). Phillips (2014, p. 149) has identified a main theme as serving "as a game's musical signature," and notes their ideal positioning to "help game players mentally organise the game world and emotionally interact with it" (ibid. p. 72). This importance was a substantive element in Gordon's creative process. As with much of the score, the new version of E1M1 also featured additional instrumentation in the form of dark synth-rock rhythm section parts (Machkovech 2016). This too was a carried-over influence of Prince's original midi soundtrack, and the metal-styled drums and bass parts encouraged the player to navigate the gameworld arena with increased vigor and excitement (GDC 2017). This one riff essentially exists as a microcosmic representation of Gordon's score nimbly dancing upon a line dividing originality befitting this reboot of the franchise, and deference to the original *DOOM* soundtrack.

## 8. DYNAMIC MUSIC AND SOUND EFFECTS ACCOMPANYING PLAY

As Collins (2008, p. 4) states, “nonlinearity is one of the primary distinctions between video games and the more linear world of film and television, in which the playback is typically fixed.” Munday (2007, p. 62) similarly notes that “a significant amount of video-game narrative is not causally predetermined, because it is generated ‘on the fly’ by the actions of the player.” Wall-to-wall music no longer features as prominently in modern FPSs (ibid. p. 53), unlike earlier examples in the genre such as *Goldeneye 007* (RARE, 1997), in which missions are accompanied by Graeme Norgate and Grant Korkhope’s score referencing, but not re-creating (Summers 2016), that of the film on which its based.<sup>4</sup> The technical implementation of music in *DOOM* was largely executed by the audio development team of id Software, with Gordon supplying separate sections of music as Wwise<sup>5</sup> files. This separation process was in support of increased variation, with bars of music able to be rearranged and avoid looping track situations.

The music in *DOOM* is most susceptible to extemporaneous change during core gameplay level exploration. At times it is indexical, subdued and awaiting the player’s activation of a cutscene, which in-turn cues an immediate and brief invasion of the game space by multiple enemies. The score reflects this increase in danger and required agility by switching to explicitly invasive and loud cues. Machkovech notes that these more ‘brutal’ arrangements of guitar and synthesizer riffs are noticeably triggered as gameplay changes from the player engaging close-quarter combat against limited opponent numbers, to rapidly facing oncoming waves of enemies (2016). This is a dynamic action as it is pursuant to the player’s timing, but is a consistent part of the level design, and in this one instance the score performs a number of functions. It acts as a referential means of musical communication (Zehnder and Lipscomb 2006) by alerting the player to the changing state of play and their increased danger. It also fulfills the role of an emotional signifier (ibid.) by eliciting the excitement, anticipation and focus required of the player to successfully defeat the oncoming monstrous masses. Gordon cites this and one other example as the most complicated features for which the dynamic music system of *DOOM* was built (GDC 2017). The other example is the musical accompaniment to ‘glory kills’, a melee execution system whereby the player rushes to an injured enemy and triggers a short cut scene, just a few seconds in length, featuring the enemy’s gruesome death. Depending on achievement settings glory kills in singular or successive forms may take differing amounts of time to complete, and such

<sup>4</sup> It should be noted that while music plays throughout each game level, once objectives had been achieved toward the end of levels a briefer, more intense version of the previously looped theme is cued.

<sup>5</sup> One of a number of ‘middleware’ software packages used by composers that allow better communication between a game engine and digital audio workstation.

instances would ideally occur without abrupt interruption to the music. To mitigate this indeterminacy of length, Gordon and the audio development team chose to very briefly fade out the ongoing score during glory kills, and implemented what Gordon terms ‘looping rises’, which were based on a Shepard tone. By utilising the distinguishing elements Shepard (1964, p. 2346) describes as a “continuum of frequency and ... perceived pitch,” a tonal sound of seemingly infinite rising could accompany the player’s action. This almost approximates an exemplification of ‘micky mousing’, which Zehnder and Lipscomb (2006, p. 245) summarise as using music to comically emulate “the physiognomic structure of physical motion,” as proposed in earlier work (Davies 1978). Similarly described by Lerner (2014), Whalen (2004), and Neumeier and Buhler (2001), such actions require synchronised kinaesthetic and aural components to achieve the desired effect. *DOOM*’s glory kills however comprise a number of ‘finishing moves’ by which the protagonist smashes, rips apart and mutilates enemies. If given a musical moniker rather than classed as a sound effect, the ‘looping rises’ would constitute a stinger, a musical punctuation (Zehnder and Lipscomb 2006) tied to the glory kill action.

So linked are the aberrative sound effects and musical cues in *DOOM* that it can become difficult to distinguish between the two. Munday (2007, p. 53) has gone as far as to suggest the argument that “sound effects have begun to supplant the environmental function hitherto assigned to music.” Collins (2013, p. 3) cites film sound designer Walter’s descriptor that “most sound effects ... fall mid-way” between noise and music. Reznor’s music for the depraved gameworld of *Quake* amalgamated sound effects, electronic atmospheres, ambient noises and music (Mernagh 2000). The commensurate relationship in the 2016 *DOOM* contrasts celebrated ambient soundtrack games such as *Silent Hill* (Konami 1999), described by Roberts (2014, p. 138) as using music “as a continuous atmospheric signifier of danger”, and about which Whalen (2007, p. 76) has emphasised the use of static to convey musical “pitch modulation, rhythm and repetition.” Elsewhere, Whalen (2004, n.p.) describes composer Akira Yamaoka’s score as evolving to a “cacophonous ringing of metallic noises and atonal chaos,” causing a conflation of music and ambient sound effect elements. The use of white noise in *DOOM* is a correlative example. This signal sound has proved particularly effective in the horror genre, so much so that it inspired both title and plot of *White Noise* (Sax 2005), and is still used in contemporary games such as *Resident Evil 7: Biohazard* (Capcom 2017). What distinguishes Gordon’s soundtrack however is the use of white noise not to provide sustained pads of sonic ambiguity, but as a higher frequency articulation of the sub sine part.

The incorporation of 1993 *DOOM*’s chainsaw sound effect mentioned above goes to more intertextual

narrative considerations, while completely new sound effects created for the 2016 series reboot required different attention. One such example, pervasive to sound design in car racing games (Donnelly 2014), is the implementation of sound effects and music within the single frequency spectrum. An example of this in *DOOM* is a ‘chain gun’, which is capable of such a high rate of fire that when the trigger is depressed and held, the discharged rounds result in a sustained sound pressure level, and thus, a tone. A firearm’s acoustic resonance spectroscopy measurement (Haag 2002) can therefore impact upon the composition of music. This in-game firearm sound effect was designed to rest at a low concert D note, aligning with the score, which was strategically composed with a D root note, thereby avoiding a clash of frequencies (GDC 2017). These examples highlight the design and implementing the music (and sound effects) of *DOOM* to accommodate changing states of play. The music provides a musical intelligence that at any one time may provide the player with both a substantiated diegesis, and individualised soundtrack experience.

## 9. CONCLUSION

This paper has sought to elucidate the singular technical construction and musical composition of the score for *DOOM*. Through detailed descriptions of Gordon’s inspired use of analogue equipment, it has demonstrated the ‘corruption of sound’ philosophy behind much of the game’s music. By exploring links between aural and visual elements in games, and applying game design practices, connections between the music and overall game narrative are presented. In addition to musically portraying the highly abstract gameworlds of *DOOM*, plot themes are represented by music design, and in-game experiences are accentuated and underscored by the score style. With death and violence the predominant (and existentialist) indicators on a barren planet Mars and seemingly secularist depiction of hell, Gordon’s score discourages nihilistic wallowing in favour of merciless rampaging. This encapsulates the celebrated gameplay of the original *DOOM* game, evidencing deliberate narratological links within the series. Players receive sonic information from the 360 degrees of their gameworld environment (Morris 2002), perhaps particularly so in FPS games (Munday 2007). As a full aural component of gameplay, the score and sound effects for *DOOM* are so designed, providing clues relating to changing states of play, and adapting to the player’s extemporal actions. Summers (2016, p. 77) offers the summation that “[m]usic, through texturing the game, represents a core part of how the game (its characters, worlds and actions) are understood by players. Music does not simply ‘underscore’ games, but it is part and parcel of the actions in, and worlds of, games.” Such a statement is germane to the description of *DOOM*, insofar as the music giving the game as much of its character as the plot and environments. It is concluded here that Gordon’s composition is a truly

unique game score, and like its 1993 predecessor, is patently *DOOM*.

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