Sound Design for

Social Control

Sonic De-escalation and Gambling Sound in

Call of Duty **and** *Overwatch*

Dissertation Project

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Contents

Abstract

In multiplayer first-person shooters *Call of Duty: Black Ops 4* and *Overwatch*, tension and release are applied in sound design to create a multi-level reinforcement schedule facilitating extended play and extended proximity to purchasable micro-transactions. Although this ties in with both the primary gameplay functions and the broader financial goals of the developer and publisher, the artificial extension of a play session creates a feedback loop of stimulation that may increase the likelihood of antisocial interaction between players – which in turn may push players away from the game. A system is proposed to reduce the impact of the feedback loop, and so empirical study would be the next practical step to proving the system's effectiveness and increase its efficiency.

Sound-design similarities were found between opening chance-based 'loot boxes' (bought with real money) to online gambling and betting-machines, raising ethical questions relating to exposing players – including younger members of the target audience - to addictive gameplay loops and chance-based pay-to-play mechanics. The currently ongoing discussion of these systems by national authorities may provide greater direction in future design choices, but a heightened awareness of ethical design may defuse growing animosity to these systems amongst critics and consumers.

1. Introduction

In the face of ballooning production costs since the mid-2000s (displayed in figure 1),[1] both top-tier and small, independent video game development studios have sought new business models to add secondary income streams to bolster product sales.[2] This has imposed a shift in consumer behaviour away from a single, large purchase toward multiple, smaller in-game purchases using real money, which necessitates continued engagement with a product. Simultaneously, the rapid development of high-speed network connections has enabled heavier focus on multi-player games, wherein players endlessly repeat simpler scenarios than typically found in single-player games; scenarios which are generally cheaper to produce, and can keep players engaged for longer than a finite single-player experience through fewer levels played repeatedly, rather than many levels progressed through in a linear fashion as in a single-player game.

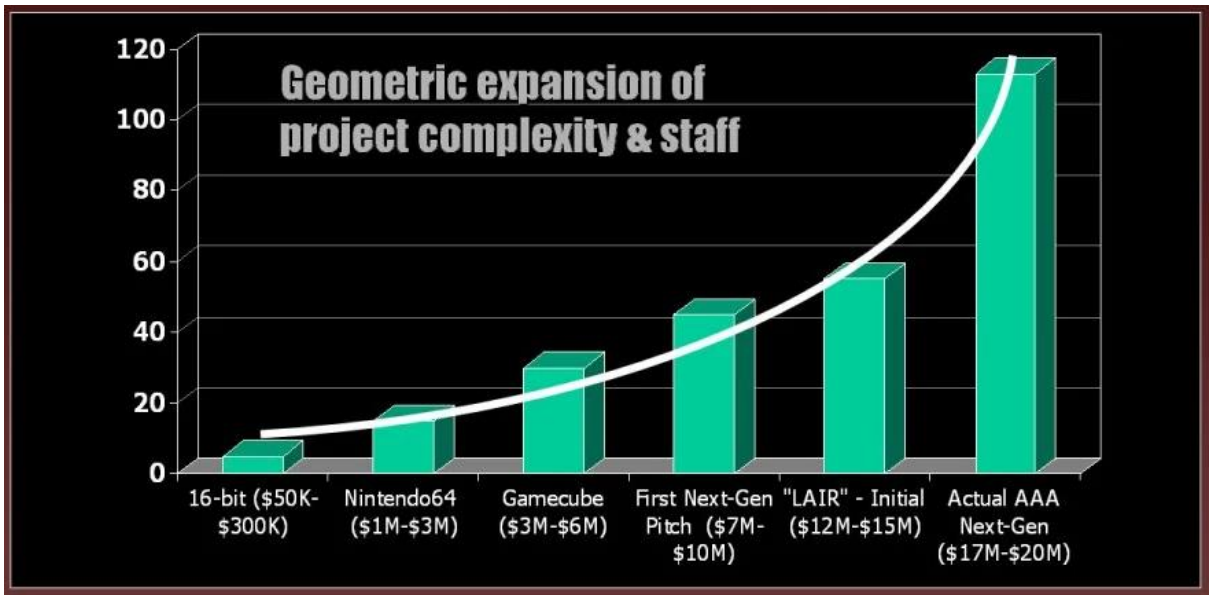

Figure 1: Development Studio Factor 5's production costs as the team expanded between 1987 and 2006.

[1] Owen Brand. 'Reinventing Your Company Without Reinventing the Wheel', *GDC Vault* (2006), https://www.gdcvault.com/play/1013221/Reinventing-Your-Company-Without-Reinventing (accessed 15th March, 2019).
[2] Steve Theodore. 'Why Have Video Game Budgets Skyrocketed In Recent Years?' *Forbes* (2016), https://www.forbes.com/sites/quora/2016/10/31/why-have-video-game-budgets-skyrocketed-in-recent-years/#19f5cdb73ea5 (accessed 11th October, 2018).

A healthy, sociable player-base is a significant contributing factor in the long-term success of a multiplayer game, and so developers must maintain and manage their players to foster a commercially successful product. The 'one more round' impulse to keep people playing is achieved using multi-level reinforcement schedules – a design principle combining sound and visual stimuli to foster behavioural habits which is also commonly found in gambling machines.[3] This system for extended play conflicts with the natural competitive mindset of players against other players (rather than a computer-controlled enemy), where over artificially extended play sessions, the compounding effect of repeated stimuli and competition could raise player arousal to a boiling point that increases the likelihood of antisocial interactions between players. Multiplayer and Massively Multiplayer games (where 'massively' suggests hundreds or thousands of concurrently interacting players, rather than a typical limit of sixteen) thrive on prosocial behaviour, from small positive interactions between friends, to the larger formation of clans, brands, and companies; and so, while positive social engagement may encourage a player to continue a given game, the impact of negative social experiences risks discouraging players, eventually pushing them away. Hostility to new or inexperienced players, sexism, abusive language, and death threats are uncomfortably common negative interactions which developers strive to discourage and prevent, to maintain their player base.[4]

Aural stimuli are effective at suggesting mood to listeners.[5] In film, directors can take advantage of this by inserting sounds at specific time-codes, but in games, the structure of play is indeterminate – composers can't predict exactly how or when a player will act. To facilitate players, game music cues are often designed in minutes-long loops around during certain sections of gameplay, highlighting specific moments with 'stingers', before a segue to an ending coda once a condition (such as "all enemies killed") has been reached. This presents an issue in transcription, in that the structure of the music is largely contingent on the player's progression. Multiplayer gameplay typically involves less music than single player modes, and so this only

[3] Mike Dixon et al.. 'The impact of Sound in Modern Multiline Video Slot Machine Play'. *Journal of Gambling Studies* 30/4 (2014), 913-29.
[4] Matt Wales. 'Blizzard Pledges Harsher Penalites for Naughty Overwatch Players', *Kotaku* (2017) http://www.kotaku.co.uk/2017/07/26/blizzard-pledges-harsher-penalties-for-naughty-overwatch-players (accessed 11th October, 2018).
[5] Carolyn Murrock and Patricia Higgins. 'The Theory of Music, Mood and Movement to Improve Health Outcomes'. *Journal of Advanced Nursing* 65/10 (2009), 2249-57.

affects the transcriptions included here by adding or removing a few bars – but this has been highlighted in cases where this alters the meaning or interpretation of a cue.

In conjunction with the tactile experience of play and the social and narrative context, sound can be used to cultivate mood in players, as well as to encourage and reward successful, prosocial play. This is achieved through semiotics, or musical signposting (discussed by Tagg, whose model is shown in figure 2),[6] by which the game-emitter broadcasts an intended message (the mechanics) to the player-receiver, to prompt the 'adequate response': successful play. The effectiveness of this depends appropriate usage of musical codes that a player would recognise and correctly interpret: a newer player may suffer 'codal incompetence', lacking the experience to interpret sound-symbols, whereas players from a different background may struggle with 'codal interference', where they incorrectly interpret symbols based on their experiences in another context. Several of these systems working in conjunction implicitly teach the player the rules of the game using positive and negative reinforcements to reward or punish behaviour, known as Operant Conditioning. To give a specific example: tense, angular, rhythmic music can alert a player to nearby enemies, and the player-character screaming can suggest that contact with these enemies is painful and negative. On defeating the enemy, this behaviour can be reinforced using an upbeat fanfare to tell the player, 'you win!'

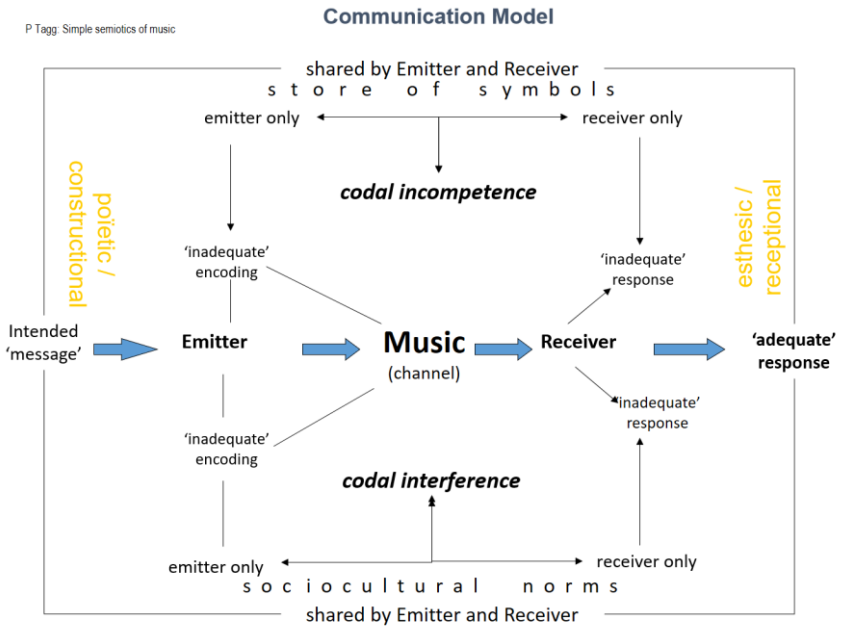

Figure 2: Tagg's model of semiotics in music.

[6] Philip Tagg. 'Analysing Popular Music: Theory, Method and Practice'. *Popular Music* 2 (1982), 37-67.

Fluency in these systems is referred to as immersion, wherein a game feels 'more real than reality' to the player,[7] who can instinctively interpret the systems of the game and project their agency onto the player character in-game to become part of the diegetic experience itself.[8] Misinterpreting these cues can feel frustrating for players, breaking them out of a sense of immersion and reminding them of the nondiegetic reality, that rather than the avatar existing in the exciting fantasy world, they are a normal person playing a video game. This tight relationship between the game rules and the stimuli reporting the relevant information to the player is vital to enjoy the story and atmosphere of a game. When this relationship is made too transparent without additional motivation via narrative or deeper strategic gameplay, games can be criticised as little more than a 'Skinner Box',[9] derived from studies in operant conditioning by Burrhus Skinner, wherein animal behaviour was closely controlled with rewards and punishments, which could be delivered through, among other avenues, light and sound.[10] Extrapolated to game design, this suggests a simplistic game with little motivation, which seeks to overtly control player behaviour to the game's – or the developer's – ends, rather than to guide the player through an experience to maximise their own enjoyment. This style of operant conditioning is strongly present in game sound: as games are interactive, the tactile feel of a game's controls and gameplay are heavily influenced by the impact of sound design, and even minute adjustments in sound length can make the difference between encouraging and discouraging a gameplay behaviour.

This dissertation seeks to examine the efficacy of in-game sound design on mood inducement, with view to suggesting subtle design changes that could reduce negative mood inducements and the associated feedback loop that occurs with continuous play, to decrease the likelihood of antisocial interactions between players. In a multiplayer game, prosocial play typically matches with successful play within the bounds of the game systems, and so prosocial play is taught in the same manner as the core game rules. Antisocial behaviour occurs despite these systems, and while the amount of damage a rogue player can cause can be mitigated, the social impact can pressurise players to quit the game, either temporarily, or permanently. This phenomenon typically affects 1–5% of players – a small but significant percentage, and enough not only to impact the player

[7] Janet Murray. *Hamlet on the Holodeck: The Future of Narrative in Cyberspace* (New York: Simon & Schuster, 1997), 97-99.
[8] Laura Ermi and Frans Mäyrä. 'Fundamental Components of the Gameplay Experience: analysing Immersion', in *Changing Views: Worlds in Play.* Vancouver: DiGRA, 2005. 4.
[9] Shamus Young. 'Skinner Boxing', *The Escapist* (2016), http://www.escapistmagazine.com/articles/view/video-games/columns/experienced-points/15510-Skinner-Boxes-and-How-Games-Use-Them (accessed 15th March, 2019).
[10] Burrhus Skinner. 'Superstition in the pigeon'. *Journal of Experimental Psychology* 38 (1948), 168-172.

base, but also to give a game's community (and the game by proxy) a negative reputation.[11] Due to the various external causes of antisocial behaviour, abusive players are difficult to target – particularly as these interactions may occur outside of the game systems, such as on social media or community pages. As such, prevention is more effective at retaining players than any form of reporting system after the incident has already occurred. Addressing this in chapter three, I consider the way that sounds can contribute to aggressive or antisocial behaviour, and then propose a system that could mitigate this, with a view to keeping players engaged for longer in the long-term, as opposed to in a single session of play.

It is important to be aware that this discussion is concerned with an 'amateur' demographic, suggesting that, while players may invest a large amount of time into the game, they are not members of a professional e-sports team. These groups compete for monetary prizes, and as such are not only highly skilled as individuals, but also highly organised when working as a team. The social dynamics that I am exploring relate to players interacting with randomly assigned, unknown online opponents, whose identity is typically hidden behind an alias, and with whom they have typically not played before. The anonymous nature of these fleeting encounters isolates a player's behaviour from any previously established relationship. In the same way, the role of external factors that cannot be controlled by a game designer is also ignored.

The impact of music on mood in the context of consumer behaviour is well-studied[12] –and heavily practised in restaurant and retail outlets[13] – and so it follows that, to some extent, a similar effect could be found on consumer behaviour in games. However, a degree of care should be taken when leveraging sound design to encourage meta-level behaviour occurring outside the bounds of the game-world, as overt pressure

[11] Brendan Maher. 'Can a Video Game Company Tame Toxic Behaviour?' *Scientific American*, https://www.scientificamerican.com/article/can-a-video-game-company-tame-toxic-behavior/ (accessed 15th March, 2019).

[12] Michael Hul et al.. 'The impact of music on consumers' reactions to waiting for services', *Journal of Retailing* 73/1 (1997), 87-104.
George Bruner II. 'Music, Mood, and Marketing', *Journal of Marketing* 54/4 (1990). 94-104.
Judy Alpert and Mark Alpert. 'Music influences on mood and purchase intentions', Psychology & Marketing 7/2 (1990), 109-133.

[13] Katie Morley. 'Major restaurants installing music systems which make you spend 10pc more', *The Telegraph* (2017), https://www.telegraph.co.uk/news/2017/03/28/major-restaurants-installing-music-systems-make-spend-10pc/ (accessed 11th October, 2018).
Justin Parkinson. 'What is shop music doing to your brain?' *BBC* (2016), https://www.bbc.co.uk/news/magazine-36424854 (accessed 11th October, 2018).

on players to spend is viewed largely as negative and anti-consumer by the gaming community.[14] From an artistic standpoint, any influence goals unrelated to the gameplay or narrative should be balanced against the fundamental semiotic role of music and sound to facilitate and enhance the player experience – but for a development studio to persist, they must create products that are financially successful, with critical reception a secondary goal. This disconnect has fostered several new approaches to long-term monetisation in games, including 'loot boxes': digital stashes of random gear that players can earn through gameplay, but are encouraged to purchase with real money – often via an in-game proxy currency, as with chips in a casino - for extra chances to acquire rare items. The inclusion of chance in these micro-transactions has come to the fore in European legal discussion as the analogy between loot boxes and gambling becomes uncomfortably close.[15] This is in conjunction with a continued perception that games are largely marketed towards children, who are particularly vulnerable to gambling behaviour.[16] This crossover of gaming and gambling is of particular interest given that, as of 2018, more than half of under-18s play multiplayer games[17] – including mature-rated games that young players should be unable to access.[18] The game industry's focus on small numbers of microtransaction big-spenders (referred to as 'whales')[19] creates the uncomfortable suggestion that these players are being primed for future addiction, as a side-effect of efficient-if-unethical design choices.

For the purposes of this dissertation, music and sound are often conflated, but both elements are examined independently across two main case studies, *Call of Duty: Black Ops 4* [20] (henceforth *Black Ops 4*) and *Overwatch* [21] – both multiplayer first-person shooter (FPS) games that broadly follow the same structure of play, but differ in their aesthetic and target markets, reflected in their box art in figure 3. Both games

[14] Tae Kim. 'Gamer anger over micro-transactions will have consequences for Activision, Electronic Arts', *CNBC* (2018), https://www.cnbc.com/2018/01/26/gamer-anger-over-micro-transactions-will-hurt-activision-ea-cowen.html (accessed 11th October, 2018).
[15] Andrew Griffin. 'Micro-Transactions system used in FIFA Ultimate Team, Star Wars Battlefront and other popular games could be banned', *The Independent* (2017), https://www.independent.co.uk/life-style/gadgets-and-tech/gaming/micro-transactions-fifa-18-ultimate-team-star-wars-battlefront-banned-belgium-a8070106.html (accessed 11th October, 2018).
[16] Robert Chambers and Marc Potenza. 'Developmental neurocircuitry of motivation in adolescence', *American Journal of Psychiatry* 160 (2003). 19-53.
[17] OFCOM. '*Children and Parents: Media Use and Attitudes Report 2018*'. London: OFCOM, 2019. https://www.ofcom.org.uk/research-and-data/media-literacy-research/childrens/children-and-parents-media-use-and-attitudes-report-2018 (Accessed 7th, March, 2019).
[18] Family Kids & Youth. '*Young People's Attitude towards Gaming*'. Ascot: Learning Foundation. https://learningfoundation.org.uk/wp-content/uploads/2016/04/FKY-Young-Peoples-Attitude-Towards-Gaming-August-2014.pdf (Accessed March 7th, 2019).
[19] Stephanie Carmichael. 'What it means to be a 'whale' – and why social gamers are just gamers', *Venturebeat* (2013), https://venturebeat.com/2013/03/14/whales-and-why-social-gamers-are-just-gamers (accessed 12th March, 2019).
[20] Treyarch, *Call of Duty: Black Ops 4* (California, Activision, 2018).
[21] Blizzard Entertainment, *Overwatch* (California, Blizzard Entertainment, 2016).

employ loot boxes and reinforcement schedules to keep players invested, and so the music and sound design is examined in isolation in the second chapter, comparing the methods used in each title. The implementation of reinforcement schedules to keep players hooked is investigated in chapter three, while chapter four focuses on the comparison between loot-box sound design and broader gambling sound – including a discussion on ethical design. By the end of this dissertation, I hope to have given the reader a clearer insight into how creating and implementing sound effectively can maximise a game's profitability, without crossing the tenuous line between player-control efficacy and hostile or apathetic design.

Figure 3: *Overwatch* and *Call of Duty: Black Ops 4* box art.

2. Music Analysis

Video-game sound design has two primary functions: an emotional role to increase immersion within the world of the game, and a semiotic role to convey instructions and gameplay information to the player. Although good sound design can achieve both, these two aims are often at odds with each other: nondiegetic gameplay information reminds the player that they are simply controlling a virtual avatar, rather than being immersed in the game-world. When looking at multiplayer games, the nature of 'immersion' changes: it is much more closely tied to competitive investment, where players who know that they are playing against other humans (as opposed to computer-controlled enemies) are much more excited by the gameplay, and the prospect of winning[1]. Due to the necessity of one player losing for another to win, multiplayer games are broadly perceived as more difficult than single-player games built to empower players, and with this challenge in mind, players in multiplayer games are more aware of the user-Interface (UI) cues – and hence more aware of the boundaries of the diegesis due to the raised importance of these gameplay indicators.

Immersion-breaking design here is a reminder to the player of the competitive context, and so when looking at sound and musical design, their diegetic context takes on a more complex role in engaging the player than in a single-player game. Building on this, I will seek to examine the impact of timbre, pitch quality, and frequency of occurrence of sound effects and musical cues on players. Although musical cues are far less commonplace in multiplayer games (to avoid sonically obscuring all-important gameplay indicators and communication), they are commonly used as short 'win' or 'lose' stings at the end of a match to reward successful play, and this system of using sound as a reward will be examined on both the micro- and macro-levels: in both minute-to-minute gameplay, and in match-to-match. To maintain a sociable player-base, the net effect of all sound and music cues on competitive immersion must be considered. With players conscious that they may be bested, online gaming risks catalysing negative social behaviour: arguments, verbal abuse, harassment and death threats are all far from uncommon in online play, and it is in the interests of designers to discourage this kind of behaviour in any way possible, to prevent an exodus of players – who are otherwise not only a marketable feature of the game, but also adjacent to micro-transactions and therefore the source of

[1] Paul Cairns and Anna Cox. 'Who but not where: The effect of social play on immersion in digital games.' *International Journal of Human-Computer Studies* 71/11 (2013), 1069–77.

a secondary stream of income. By examining sound-triggers which may raise competitive immersion – thereby feeding into competitive aggression – I aim to propose a system that would mitigate the effects of these sounds, reducing aggression and decreasing the likelihood of negative social interactions.

2.1 Classifying Sound Cues

When reviewing multiplayer gameplay footage of *Black Ops 4* and *Overwatch*, four types of nondiegetic sound stood out, typically associated with a visual cue. The rate of these sounds' occurrence seemed particularly significant: frequent **'hit-markers'** to indicate successfully shooting another player (with a visual cue shown in figure 4), infrequent **'power-up'** noises to indicate the availability of a special ability, typically through several consecutive kills, or by scoring a point. Occasional **verbal** cues state gameplay events, and **musical cues** punctuate the beginning and ending of a round. For clarity, the occurrence rates can be boiled down to the interval of time between them: short, medium and long, and will be discussed in this context later. I will not address verbal cues: character voices are overtly diegetic, but often from an intangible off-screen location, suggesting a metadiegetic level within the game, but outside of the game-world[2] - and these off-screen lines are often mixed in with clearly diegetic voices, further muddying the waters. Although their role in facilitating gameplay is important, players engage with them on a narrative or literal level, and so deeper analysis here is more relevant to the other three sound types.

Figure 4: *Modern Warfare's* hit-marker visual cue

[2] Jan-Noël Thon. '*Transmedial Narratology and Contemporary Media Culture*'. Lincoln; London: University of Nebraska Press, 2016. 49.

The design of these sound types has remained consistent for over a decade across several high-profile multiplayer first-person shooter games regardless of developer, and gestalt impressions of them can be found as early as Counter Strike[3] almost 20 years ago. This consistency over time suggests that the design choices serve a deliberate function aiming to appeal to – and manipulate – players, above and beyond standard gameplay functions or a designer's idiosyncrasy. Immersion-breaking is a common theme among these sounds: though they fit the aesthetic of the game-world, these nondiegetic cues clearly mark themselves as such through mixing and spatial effects such as reverb. In conjunction with end-of-round musical fanfares, they typically damage rather than promote immersion in the game-world. These reminders of the 'real' context of the game – a competition between human players – may be increasing levels of aggression in players, with a consequent increase in the likelihood of antisocial interactions. This theme of competition will be explored in chapter three.

2.2 Hit-markers

In a Game Developers Conference talk on using sound to improve the feel of a game's mechanics, Jonas Turner discussed adding 'punch' to sound effects by using a 20ms bass-hit in sound effects,[4] describing a preference for low-frequency focus in responsive sound design that can be found across all of the games discussed here. *Call of Duty 4: Modern Warfare*[5] (henceforth *Modern Warfare* to avoid confusion with the case study, *Call of Duty: Black Ops 4*) is described as one of the landmark multiplayer titles that prompted a shift toward mainstream popularity in multiplayer first-person shooters, and can be read as a successful template for future titles both within and outside of the *Call of Duty* series. This sound is an abstract 30ms percussive 'thunk' to perhaps suggest bullets hitting flesh, with a strong low-mid component between 300-500Hz, evident in figure 5. Although a case could be made for diegetic context, the audio mix level and lack of a reverb effect rejects any suggestion of the sound occurring in the game-world, and so it can be labelled as a nondiegetic UI sound.

[3]Valve, *Counter-Strike* (Washington, Valve Corporation, 2000).
[4] Joonas Turner. 'Oh My! That Sound Made the Game Feel Better!' *GDC Vault* (2015) https://youtu.be/1Z5WqC97uZQ (accessed 7th March, 2019).
[5] Infinity Ward, *Call of Duty 4: Modern Warfare* (California, Infinity Ward, 2007).

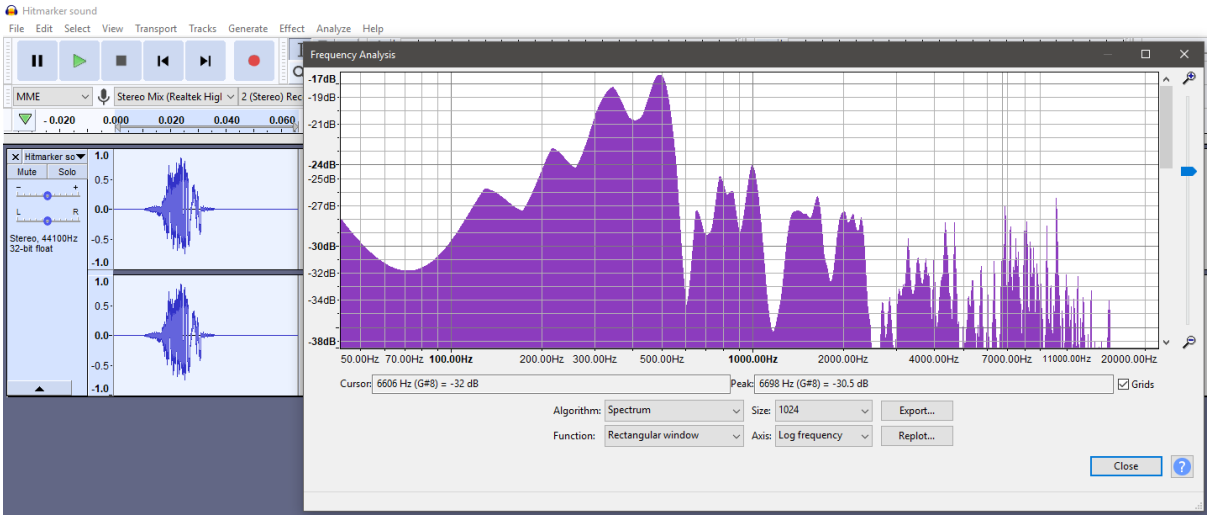

Figure 5: *Modern Warfare* hit-marker frequency analysis, in Audacity

Sound designer Shawn Jimmerson downplayed the importance of realism in the sound when discussing recreating it for *Call of Duty: Black Ops 2*,[6] suggesting that a more representative 'bullet-hitting-somebody' sound was negatively received by players who found it unclear or distracting, and were more interested in gameplay feedback than immersion in the game-world.[7] The consistently low status of realism and immersion in multiplayer sound design priorities suggests a consistent, albeit perhaps not deliberate, decision to break player immersion. Thus, players are reminded between four and eight times a minute by these hit-marker sounds that they are playing a multiplayer game against other humans, indirectly reinforcing the idea of human competition, which Cairns, Cox and others suggest leads to raised aggression.[8] Another unnamed sound designer, when describing the process of making what he called the 'hit-pip' sound for *Overwatch*, used the processed sound of opening a bottle of beer to create a satisfying sound,[9] highlighting its status as a reward. Although the raw sound is not currently available to analyse, the sound is notably higher in pitch (and likely frequency content) than the *Modern Warfare* sound.

From listening to various gameplay clips (but not watching – to avoid any bias from visual indicator), I found that the *Black Ops 4* hit-marker is largely unchanged from *Modern Warfare*, and occurs between four and eight times per minute, depending on gameplay (not including quick repetitions from fast-firing weapons)

[6] As with many other high-profile game series, Call of Duty shirks consistent numbering. Call of Duty 4: Modern Warfare is the eighth game in the series, while Call of Duty: Black Ops 2 is the thirteenth.
[7] Evan Lahti. 'The Origin of Call of Duty's Most Heard Sound'. *PCGamer*. https://www.pcgamer.com/uk/the-origin-of-call-of-dutys-most-heard-sound (accessed 7th March, 2019).
[8] Cairns and Cox, 1069-1077.
[9] James Davenport. 'Overwatch's Hit Sound Effect Is Apparently Powered by Beer'. *PCGamer* (2016), https://www.pcgamer.com/overwatchs-hit-sound-effect-is-apparently-powered-by-beer (accessed March 7th, 2019).

– at a similar rate to *Modern Warfare* a decade earlier.[10] In *Overwatch*, the sound occurs at a similar rate as in *Black Ops 4*, although it is either mixed at lower volume than expected, or else does not cut through the mix as strongly in the more cluttered soundscape[11] – perhaps due to a slightly higher-frequency emphasis in the sound than Turner's suggestion of accentuating bass frequencies, and *Modern Warfare's* 300Hz precedent. From a gameplay-design context, there is precedent to instead accentuate higher frequencies of the sound: there is some evidence to suggest that, in conjunction with a visual cue, higher-frequency sounds (up to 5kHz) are processed more quickly than lower frequency sounds.[12] Although the designers do not specify the nature of their struggle to achieve the ideal hit-sound, it is conceivable that care may have been taken to maximise the impact of the sound in this way, though this may have been a technical choice to prevent the sound from obscuring other gameplay indicators. Nonetheless, this similarity of goals and decisions between sound designers suggests a successful model for the hit-marker sound design.

2.3 Power-Up Noises

'Power-up' noises present a slightly more musical approach. While hit-markers simply confirm that a player's action was successful, power-up sounds must quickly inform a player not only that the state of play has changed, but must also reinforce the typically positive nature of this gameplay change. Since the birth of video gaming, sound indicators have used directional pitch gestures to this end: in *Pac-Man*,[13] eating a power-up pellet prompts a higher-pitched tone as compared to the normal gameplay sounds, and similarly, in *Super Mario Bros,*[14] coins are rewarded with a quickly rising fourth interval while power-ups are accompanied by rising G -A♭ - B♭ arpeggios. This non-functional approach in early game sounds may have been a solution to distinguish sound effects from background music. In *Mario,* the implicitly E♭ power-up sound is juxtaposed in the first level against background music in G, and then onward in various other keys that deliberately avoid E♭. A shift toward non-tonal pitch-gestures was aided by the universal capabilities of modern systems as compared to the limited chipsets of arcade machines which would typically only have between two and five

[10] TmarTn. 'One Hour of Black Ops 4 Multiplayer Gameplay'. *Youtube* (2018), https://youtu.be/4-ucFhvX_NU (accessed 7th March, 2019).
[11] Rhykker. 'Overwatch Gameplay: No commentary (Part 1, All Characters)'. *Youtube* (2018), https://youtu.be/WACsubR4-jk (accessed 12th March, 2019).
[12] Weiping Yang et al.. 'Effects of Sound Frequency on Audiovisual Integration: An Event-Related Potential Study.' *PLoS ONE* 10/9 (2015).
[13] Namco, *Pac-Man* (Japan, Namco, 1980).
[14] Nintendo, *Super Mario Bros.* (Japan, Nintendo, 1985).

sound channels for all music and effects, using only simple waveforms or white noise.[15] In ur-FPS *Doom,*[16] pitch-gestures are used throughout, though curiously reversed: weapon pickup sounds are a falling shotgun-cocking sound, and enemy alerts are typically rising – and then falling on death. It could be argued that *Doom*'s sound design used pitch to reflect the state of play, where high pitch would suggest high tension. The sound design of *Half-Life*'s alien enemies presents a much less consistent pitch-direction,[17] but healing items and shield-chargers both prompt an upward gesture – until they run out, and then trend downward.

These two critically acclaimed FPS games influenced all forms of FPS since, and so it is unsurprising to find that modern FPS sound design in multiplayer games is, while more complex, fundamentally similar. While there are prior examples of successful multiplayer shooters, *Modern Warfare* laid out the groundwork for gameplay, visual design and sound design in modern multiplayer shooting games, which most contemporaries still emulate a decade. In the interests of contextualisation, I will briefly examine the sound design here before comparing case studies. Players unlock 'kill-streak' power-ups for multiple consecutive kills without dying, signified by a visual note of the unlocked power-up as well as a rising pitch-gesture that could be representing some ambiguous form of power-generator turbine in an auditory pun to suggest increased player firepower. This is shown in figure 6 with a line to suggest pitch direction (although no musical pitch is suggested). As with the hit-markers, there is no obvious diegetic source, and the sounds are non-spatialised and so are understood to be nondiegetic. The frequency of these sound effects is contingent on the skill of the player, usually occurring once or twice per two minutes of gameplay.

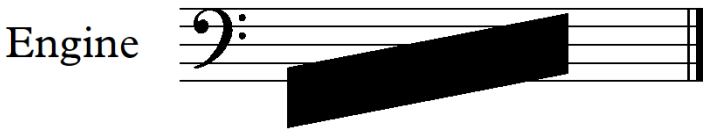

Figure 6: *Modern Warfare* 'Power-up' sound

[15] Karen Collins. *Game Sound* (London: MIT Press, 2008). 20-25.
[16] iD Software, *Doom* (Texas, id Software, 1993).
[17] Valve, *Half Life* (Washington, Valve, 1998).

In *Black Ops 4*, an upward gesture is used in a higher register, but with a short descent before the rising figure, using a more electronic timbre to match the game aesthetic, shown in figure 7 in the same fashion as figure 6. The occurrence rate is similar, but the effect is now paired with a verbal cue specifying the power-up, due to a wider selection of available power-ups.

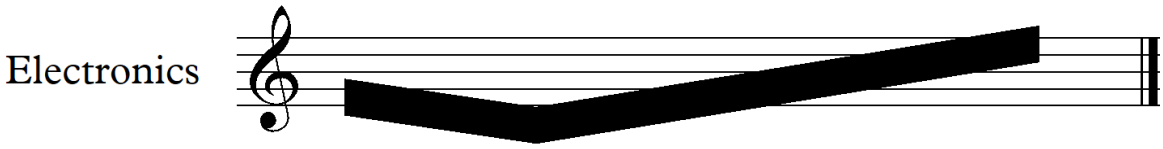

Figure 7: *Black Ops 4* 'Power-up' sound

Unlike the directional gestures in both *Call of Duty* examples, *Overwatch*'s visual kill-streak notifications are accompanied by a static brass octave, which draws much less of the player's attention. This matches the weaker relationship between successful play and power-up availability in *Overwatch* – successful play speeds up the constant, inevitable charge of power-ups, whereas in the *Call of Duty* series, successful play is the only way to unlock them. Taken together, these examples suggest that the sound designers are using pitch movement to draw attention to important gameplay sounds, where a greater degree of pitch movement is ascribed to gameplay indicators of higher importance. This may stem from the players' heightened awareness of movement and change in the game, where changing stimuli implicitly suggest a changing state of play, such as an approaching enemy, or health and shields recharging – versus static stimuli suggesting that nothing is currently happening, implying that the player is safe.

2.4 Musical Cues

In the context of game music, silence and static sound design are described by Karen Collins as a 'boredom switch' to signal that the player must move on,[18] and so the decision to eschew a continuous backing soundtrack in multiplayer in favour of silence (in stark contrast to soundtrack-rich single-player games) perhaps implies that multiplayer gameplay is constantly flowing, and that players must remain constantly engaged, moving toward the action. Instead, the musical cues serve as stings to mark the beginning and end of play. It could, however, be argued that even the cues that mark the end of play employ subtle tricks to railroad

[18] Collins, *Game Sound*, 131.

players toward the next round, rather than giving players an opportunity to end their play session. While the multiplayer musical cues are partly informing the player aurally of game state – an upbeat 'win' fanfare versus a downbeat 'lose' motif – these musical cues form the final layer of the three-part reinforcement schedule, occurring every five to ten minutes, depending on the game. It is not insignificant that these full musical cues – the most emotive and impactful of the stimuli being examined – happen the least often: this multi-level approach is much more effective at engaging the player than any single mode in isolation. Due to the automated editing to keep these cues in sync with onscreen events, the bar counts sometimes vary from the transcriptions of music. These transcriptions seemed to be the default length, but some gameplay footage curtailed certain repeated bars, especially after consecutive rounds.

In *Black Ops 4*, most musical cues include heavily distorted synth tones contributed by *Nine Inch Nails*' Trent Reznor, before shifting to orchestral instrumentation scored by Jack Wall. Interestingly, the win/lose dichotomy is much less obvious than expected; the win cue is a rhythmically and tonally ambiguous set of synth hits, while that for defeat is a quiet, falling aleatoric string cue – and both lead into the same round-end cue. This weak encoding plays down the significance of any win or loss, and perhaps removes a strong ending point for players, who may otherwise see the round end as an cause to end a play session, either through a sense of frustration or completion. The 'full' musical cues are much more fleshed out, formed of an acoustic string and heavy percussion ensemble in the style of Hans Zimmer as well as some additional synthesized layers. This direct stylistic homage refers back to *Call of Duty: Modern Warfare 2*, which Zimmer himself scored[19] – although it is conceivable that in both cases, the instruments may have been sampled rather than performed by live musicians.

At the start of a round, all players hear the same introductory cue, seen in figure 8, although sometimes in an abbreviated form in consecutive rounds, as in figure 9. This cue outlines a i – III – ♭VI – V – i progression in E minor, fading out as it resolves back to the i chord. this resolution occurs between 10 and 20 seconds into the game, depending on the cue, which would typically be the point at which the player is encountering enemies again. The natural ending point is again obfuscated until players are engrossed in another round. In the short variation which plays after several consecutive rounds to avoid grating repetition,

[19] Infinity Ward, *Call of Duty: Modern Warfare 2* (California, Infinity Ward, 2009).

the V – I cadence is curtailed into a weak III – i cadence, which would occur around 10 seconds earlier than the full cue. While likely just a symptom of shortening the cue, this would have the effect of diminishing the feeling of resolution that would occur before the player is fully engaged in gameplay, tying into a broader system to keep them playing.

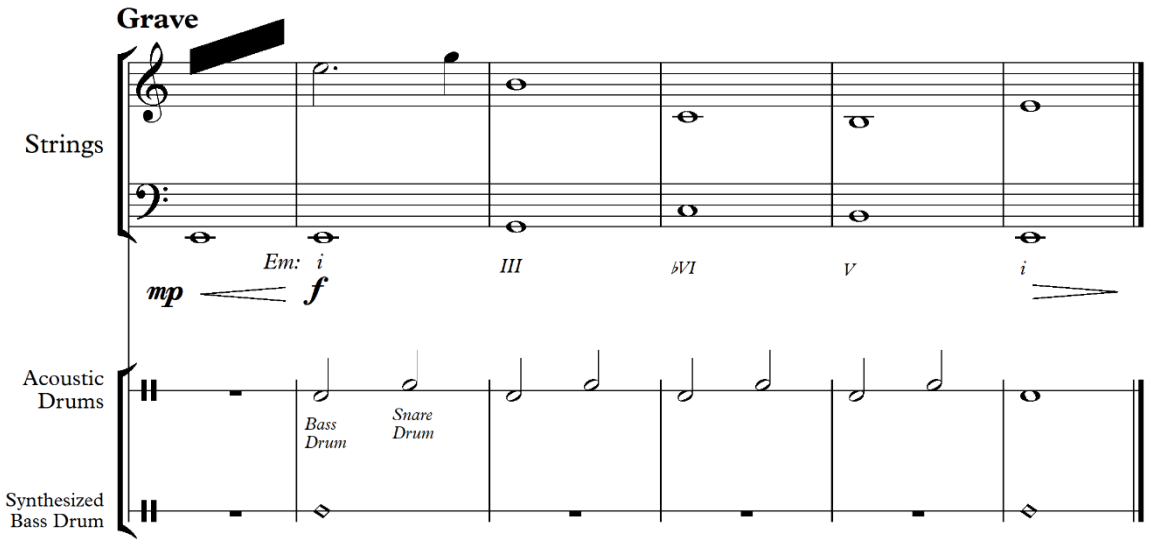

Figure 8: *Black Ops 4* 'Round Intro' cue

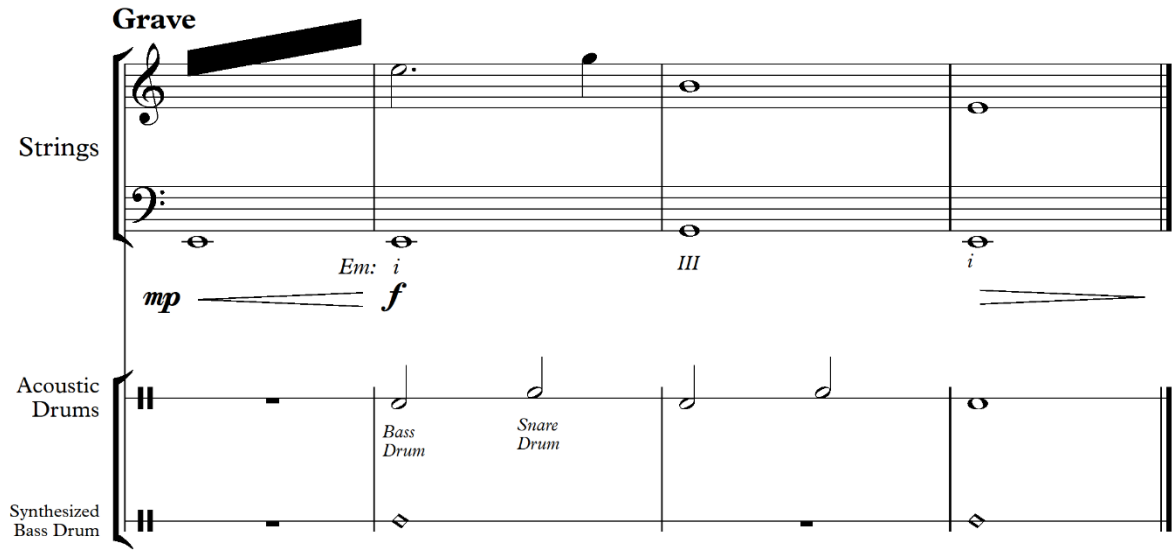

Figure 9: *Black Ops 4* 'Round Intro' short variation

The 'Round End' cue is pictured in figure 10. The cue plays over the 'best play' recording from the round in an exciting, uptempo 5/8, with a rhythmic synth ostinato (outining a similar rhythmic figure to Schifrin's *Mission: Impossible* theme) playing over a natural minor scale in the strings, before a 4/4 rhythmic

phrase which quickly shifts back to the intro music. The string line draws attention to the C in bar 6 by breaking out of the conjunct line and then holding the C – B for two bars each rather than one, strongly implying a ♭VI – V – I progression, resolving upward into the rhythmic phrase only as the player is about to progress to the next round. Depending on the length of the 'best play', certain bars are omitted to ensure that the music matches the cut to the statistics screen, as the next round loads. The uneven rhythmic groupings of 3+2 in the meter contrast against the slow half-time intro cue, at odds with the excitement and action players rush engage one another. This subverted expectation of a chilled round versus an exciting post-game suggest that regular play a state of normality that should not be interrupted, whereas the tense endgame cue asks players to play *just one more round,* where the musical tension will be resolved. In this way, the musical design is used to hold players' attention during 'boring' moments where they may otherwise drift off between rounds – rather than accentuating the already exciting round beginning. The strong resolution in the intro cue, as well as the resolution of the endgame cue being withheld until the last moment before gameplay, suggests a relief of tension once gameplay has begun, encouraging players to continue, rather than quit at the natural breakpoint of a round ending.

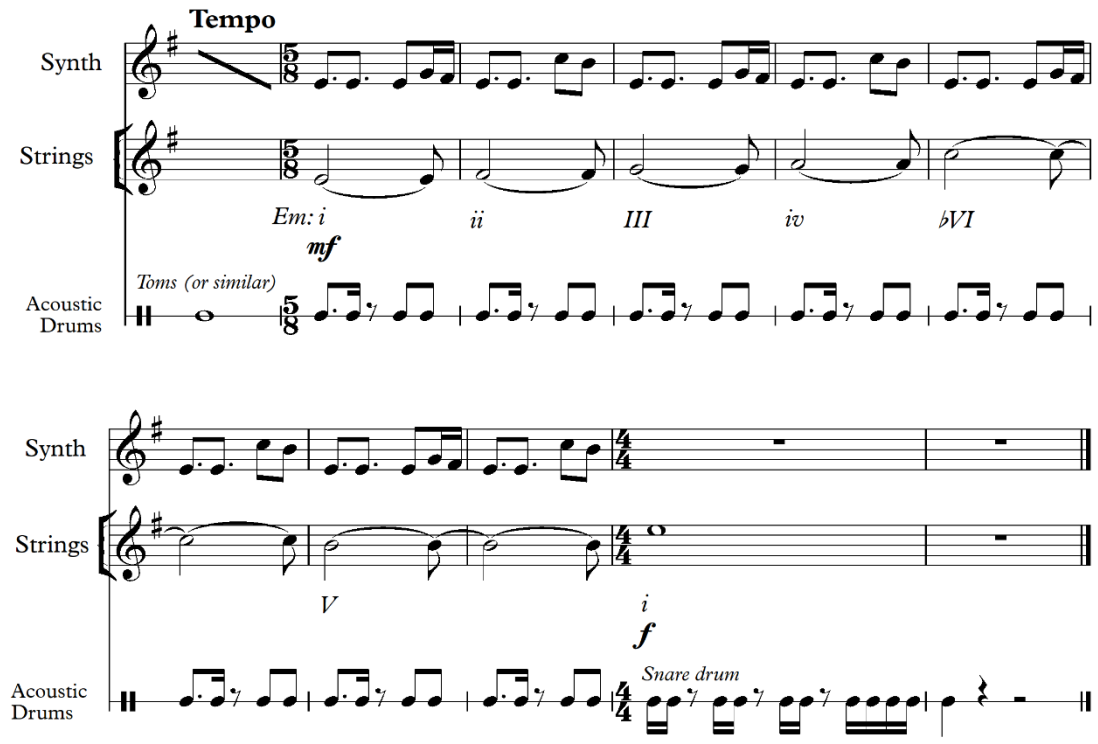

Figure 10: *Black Ops 4* 'Defeat - Round End' cue

Interestingly, an alternative hard rock intro/endgame cue serves the same function while suggesting a different aesthetic, playing on certain maps or game-modes. Both rock cues are in the same tempo, but the 'round end' cue in figure 11 has a strong rock backbeat in two 4-bar phrases, while the 'round start' cue in figure 12 is in half-time, with an accelerating structure of 2+1+1 bars. The cues are phrygian, resolving either ♭VII – I or ♭II – I, and when juxtaposed, present an upwards chromatic key change from D at the end of a round into E♭ at the beginning, suggesting a raising of the stakes, imploring players to continue – but serve exactly the same roles as regular cues, maintaining tension until the player is just about to return to play, and then resolving thereafter.

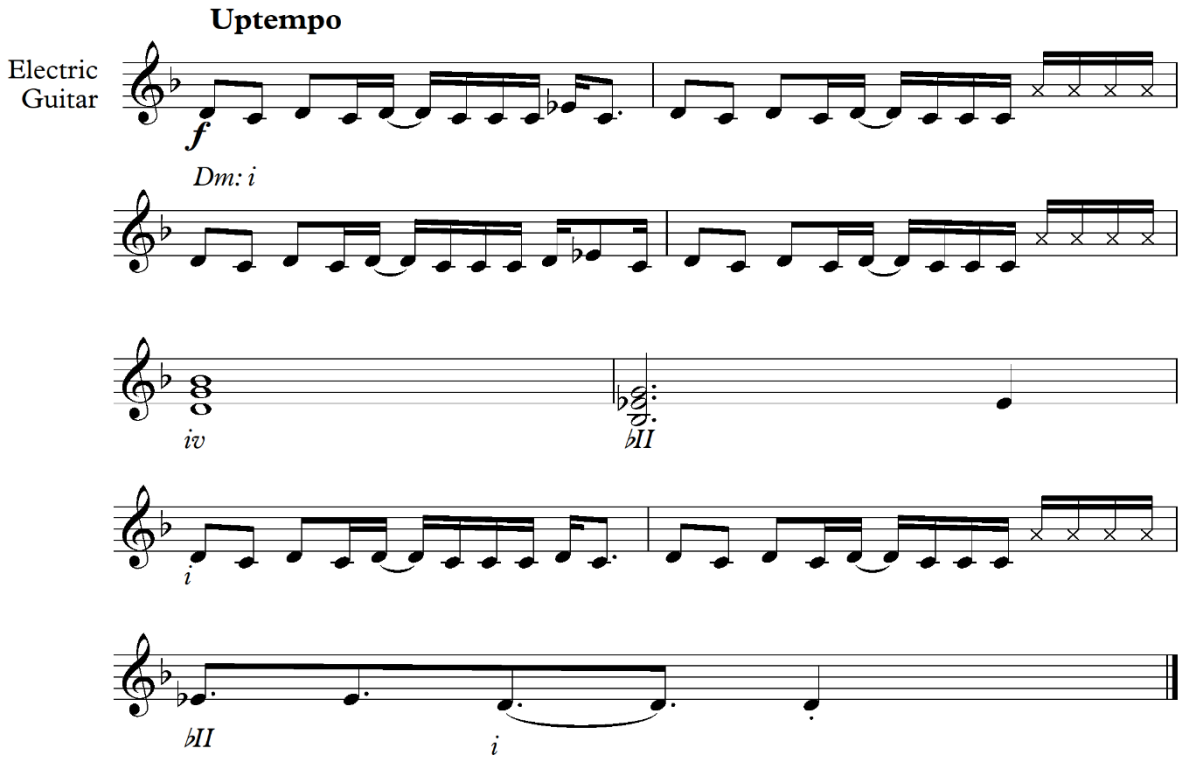

Figure 11: *Black Ops 4* 'Round End - Rock' cue

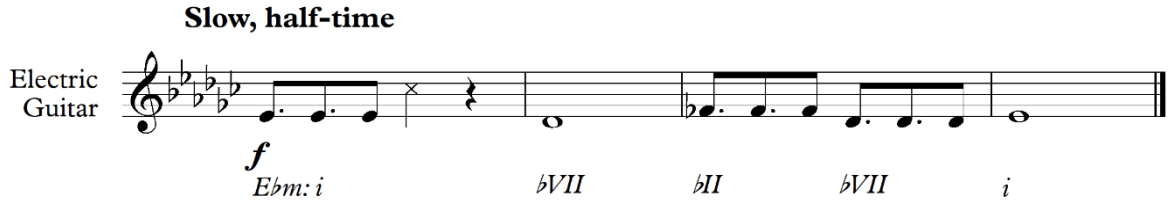

Figure 12: *Black Ops 4* 'Round Start - Rock' cue

In *Overwatch*, the cues are more consistently the same, although the lengths sometimes vary via repeating riffs; some game modes will include a consequence-free 60-second warmup, during which players can prepare their defences. The 'round start' musical cue in figure 13 begins with a looping semiquaver electronic drum loop, but with a half-time backbeat feel, with a synth ostinato suggesting a D fifth chord, lacking the major F♯ or minor F♮. This ambiguous ostinato is then clearly stated as an orchestral D major chord, landing approximately as the round begins, continuing on for around 20 seconds before stopping on a synthesized bass hit. Some subtle ambiguity as well as some more obvious shifts – between the parallel D minor and D major keys underpin the *Overwatch* soundtrack, but beginning and ending in these keys allowing music to loop and flow effectively by using tonally neutral D fifth chords as an interchange between cues.

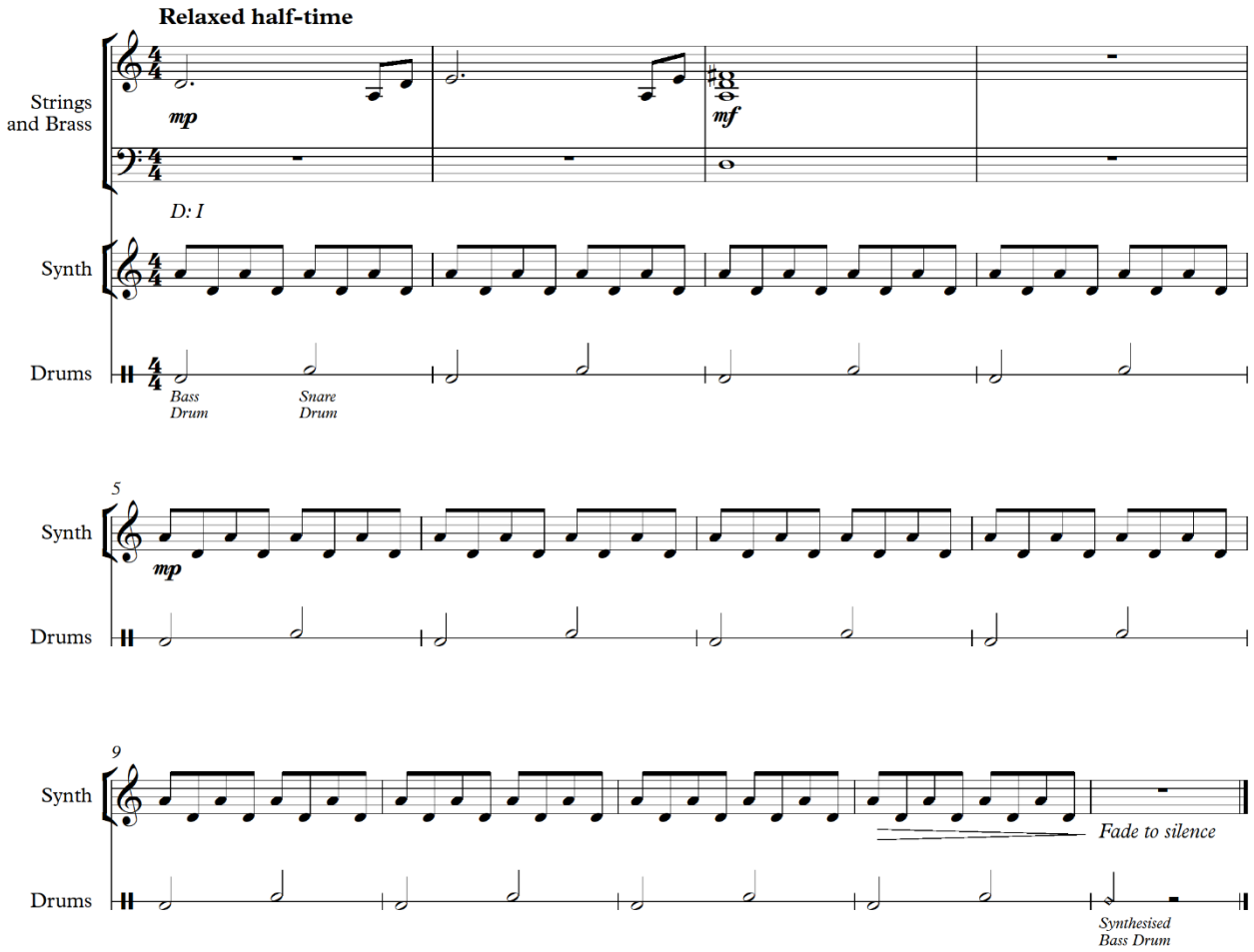

Figure 13: *Overwatch* 'Round Start' cue

In the 'Victory' theme in figure 14, a falling synth pitch marks the end of the round (in a similar fashion to the opposite *Black Ops 4* cue, 'Defeat'), before an orchestral D major chord celebrates the victory over a mix of both acoustic and synthesised drums. Trilling strings cover a shift to what seems to be A minor in ¾ time, with the previously stated F♯ suggesting A dorian until the F♮ in bar 8, after which a clear ♭VI – ♭VII statement in bar 9 could be interpreted as a IV – V in C major. The orchestra quickly cuts out and a variation on the D fifth synth ostinato from figure 13 quietly appears, implying a V – ii interrupted cadence in C, removing any strong sense of resolution. Both the ostinato and a 3+3+2 rhythmic response highlight a B♭, suggesting a tonal centre of D minor, preparing the music to loop back into the 'round start' cue. As with *Call of Duty*, the 'defeat' sting is a variation on the victory sting, with a non-diatonic cluster chord in the strings and brass implying tension rather than the satisfying falling synth that declares victory. The D major chord fades in, and the music segues to the rest of the endgame theme in the same way as victory. Once again, the significance of the result is played down by using the same cue for both victory and defeat, in order to avoid suggesting any finality. The lack of clear statement in the unique musical cues reflects this: with defeat being an implied negative consequence, the tension is confined to a single bar of close harmony, rather than a clearer sign over a longer span of time. Meanwhile the victory cue contains even less unique melodic content, to say nothing of a rewarding fanfare. In both examples, gameplay is associated with low tension: strong diatonic gestures at a relaxed mid-tempo. On the other hand, post-gameplay results, which immediately begin the countdown to another round without player intervention, are associated with high-tension musical features: uneven time signatures and rising gestures, and any break in the music is a quick segue back to the next round cue.

The music seems to keep players in suspense until they are in-play – a much more inconvenient time to quit than between rounds. While it is unrealistic to suggest that the soundtrack somehow entraps players, it is more plausible to suggest that the cues have been refined to suggest this behaviour, to subtly guide players toward the normality of continuing play. It is not controversial to suggest that game developers want players to continue to play their game, but this endless cycle becomes problematic in conjunction with gameplay and sound design which consistently raises player emotion without the payoff of a satisfying conclusion. Nonetheless, the consistency between these two recent high-profile examples, as well as the earlier *Modern Warfare,* highlight the isolated functions of sound effects to reward successful gameplay versus music to

influence players to extend play sessions beyond natural stopping points. The negative impact of this system on player interactions, as well as possible solutions, will be discussed further in the following chapter.

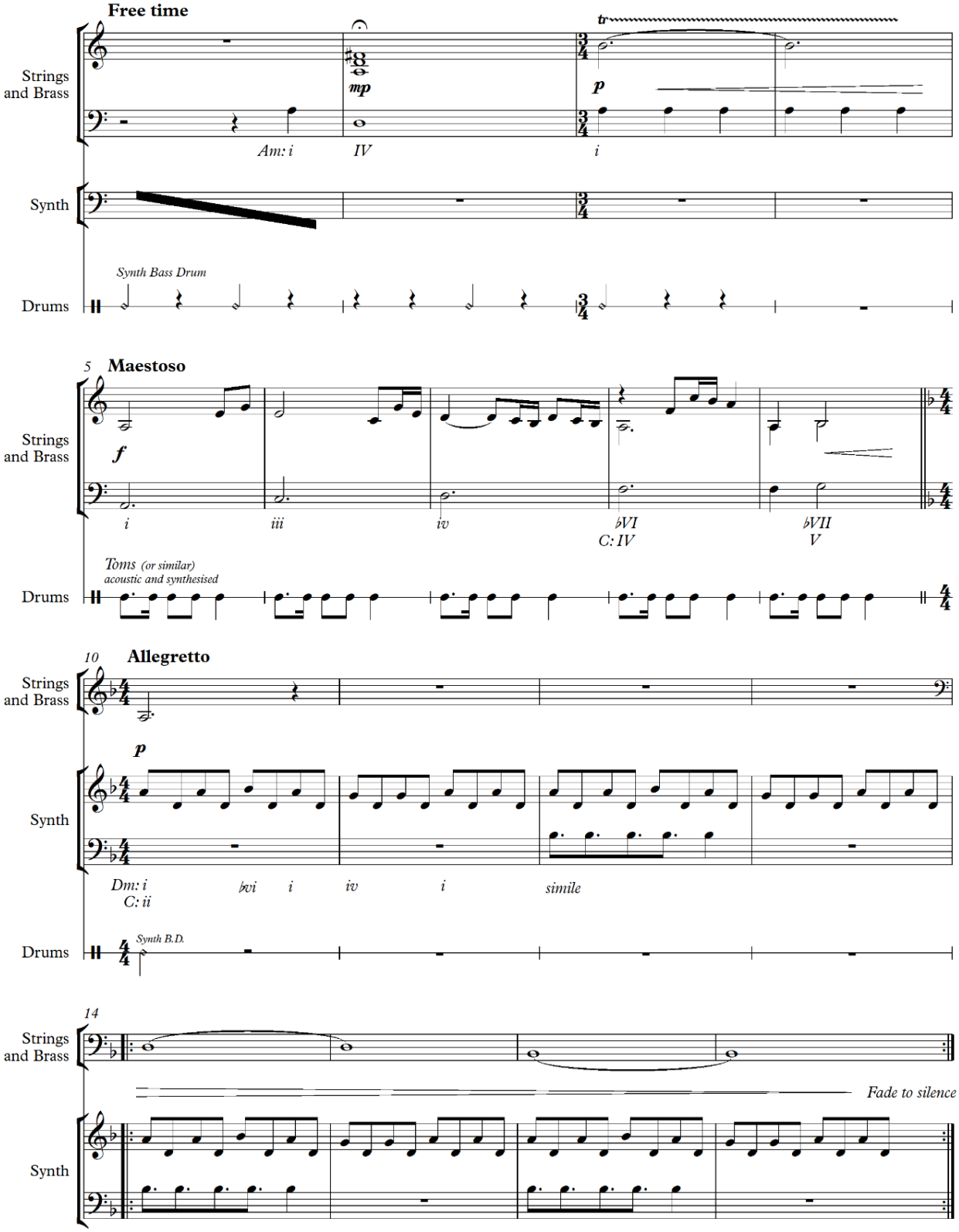

Figure 14: *Overwatch* 'Victory - Round End' cue

3. Facilitating Social Play Through Sound design

3.1 Social Dynamics

The nature of sound-as-reward design suggests a release of dopamine on receipt of the aural stimulus – which was found to be the case when experimenting on rats,[1] with the side-effect of increasing the longevity of memory of the rewarded behaviour.[2] This forms the basis of a reinforcement schedule, which itself forms the basis of all good game design: rather than directly telling a player 'in order to win, you must do this', the sentiment can be conveyed by rewarding correct play with visuals or sound. These positive association can then influence future behaviour, helping players to learn the rules and objectives more efficiently. Taken to the extreme, constant reinforcement pushing players to play 'one more round' creates a feedback loop of arousal in conjunction with the repeated stimuli. When competitive behaviour is considered during multiplayer gameplay, a player's impulse control may be lowered, increasing the likelihood of anti-social interactions between players. While the physiological impact of any given stimulus and its emotional effect are closely related, the intent of this discussion is to target the mood impact of sound design in a practical, design-oriented way. This becomes a challenge when so much sound design is associated with communicating positive or negative feedback to teach players – but it is the role of the sound to support the aims of the game designer, and so to consider the impact of these sounds in isolation is to miss the bigger picture.

The capacity for sound to make a person feel an emotion, rather than to communicate a message, is referred to as Mood Induction.[3] Murrock suggests that rhythm, melody, pitch, harmony and intervals are all individually able to modulate the strength of mood induction,[4] and so the net effect of the sound cues discussed previously will be revisited here in more detail, rather than providing a broader tension-release overview. Interestingly, Murrock omits timbre and instrumentation from her list, before then suggesting that brass, percussion, electronic sounds, and bass are associated with unrest, heightened energy and increased strength. She does not directly suggest that this could induce or affect mood change, and so this omission

[1] Masaharu Kudoh and Katsuei Shibuki. 'Sound Sequence Discrimination Learning Motivated by Reward Requires Dopaminergic D2 Receptor Activation in the Rat Auditory Cortex'. *Learning & Memory* 13/6 (2006), 690-98.
[2] Shunsuke Watanabe et al.. 'Long-lasting Memory of Sounds Combined with Reward in Rats'. *Neuroscience Letters* 311/1 (2001), 25-28.
[3] Collins, *Game* Sound, 131-33.
[4] Murrock and Higgins. 'The Theory of Music, Mood and Movement to Improve Health Outcomes', 2249-57.

suggests that the impact of these stylistic associations – at least in a Western market – must occur on a cultural, extramusical level. Here, we can infer a function of communication, rather than of mood induction.

3.2 Reinforcement schedules

Owing to the incredibly short length of the hit-marker, no emotional context can be imprinted onto the sound itself. Likewise, the unpitched, percussive nature precludes Murrock's approach – and as the rhythm is dictated by the player (or at least the gameplay-context), rhythm is also an ineffective way to explore the effect of the sound. Instead, viewing the sound in context, the sound operates as an intensifier for the broader message that the player has been successful in hitting a target, delivered in conjunction with a visual marker, previously shown in figure 4. Players can recognise this as a positive stimulus through the understanding that their short-term goal – to shoot the target – has been achieved. This prompts a dopamine release, setting up the expectation that repeating the behaviour will repeat the positive stimuli – which is affirmed as a continuous schedule, occurring every single time a successful hit is achieved. This reward, and the anticipation thereof, forms the positive reinforcement necessary to facilitate understanding of play in all levels of player skill. In this case, the reward ratio is small (as compared to the other relevant sound cues), with a short interval of a few seconds between incidences.

Power-up noises are long enough that players can interpret them in more than simply a visceral or intuitive way; in both *Call of Duty* examples, power-ups are associated with strong upward pitch gestures, with no discernible musical interval. Murrock identifies higher pitches as more stimulating than lower pitches, and so a rising gesture telegraphs approaching excitement: the player's power-up. In *Overwatch*, the indicator for a power-up being ready is an octave played (or synthesized) in brass instrumentation. The harmonic stability of an octave stems from the simple frequency ratio between the root and octave notes, where the octave resonates at a 2:1 ratio to the root. This interval-consonance and harmonic stability, as well as the lack of movement or emphasis in the sound, has a far smaller impact on listeners compared to the more dynamic and unstable *Call of Duty* sound. The effect of this sound would compound on itself less than a rising tone over a longer play session, but still fulfils the gameplay function of informing the player about available power-ups. This is made even more explicit by an ever-present, gradually filling meter in the UI, and so there is less ambiguity as to when a power-up may be available, as compared to *Call of Duty*. The relationship between

player mood and these cues is difficult to codify – does the rising pitch excite the player, or is the player excited by the extramusical, learned connotation of the sound? While the simple answer is 'both', there must be a difference in impact between new players versus experienced players, regarding experience with the specific game, as well as with games overall; a given level of game literacy cannot be taken for granted when factoring in the broad audience of both games.

The musical cues form the basis for a more functional analysis. Murrock describes the impact of rhythm as largely unconscious, and the most potent in stimulating action – and then notes that inconsistent rhythm creates apprehension, matching fully with both 'Round End' musical cues, which make use of complex or changing metre. At this post-game state, the player has largely no agency besides the ability to quit until play resumes in the following round, and so the prompting of action seems inappropriate. However, this subversion could be a deliberate choice to frustrate players: it is already assumed that by choosing to leave the game and end play, players remove their ability to relieve the musical tension, but if quitting the game is not seen as an option by a player who is immersed in the gameplay – where the act of quitting exists outside the purview of the game – then in this way, the player is totally powerless to act. Where previously I identified the tension as a purely musical feature, considering the music-agency dissonance adds a further layer of tension to this play scenario. The cues are the most significant, lasting sonic reward, at the longest interval between occurrences. But unlike the other two reward sounds, this is the only type of reward that balances its effect on player mood: after the 'round end' cues are implicitly tense (either through rhythm, or harmonic ambiguity, or withheld resolution), 'round start' cues are down-tempo and rhythmically consistent, with strongly diatonic melodic and harmonic statements, resolving the tension from the 'endgame' cues. Zhang and Gao found that the presence of background music paired with violent or aggressive gameplay would intensify the effect on induced aggression,[5] and so while the discord between gameplay and music could reduce the impact on player aggression, the presence of music at all may serve as a catalyst. When viewed together, these three parts of a reinforcement schedule form a compulsion loop, displayed in figure 15. This schedule is continuous, wherein the stimuli occur every single time the behaviour is fulfilled – this mode of reinforcement is more effective at maintaining a behaviour than partial schedules, where a stimulus may not reliably occur after the player's

[5] Jiulin Zhang and Xuemei Gao. 'Background Music Matters: Why Video Games Lead to Increased Aggressive Behavior?' *Entertainment Computing* 5/2 (2014), 91-100.

action. Thompson asserts that 'most game designers have at least a basic understanding of behavioural psychology and neuroscience,' and so it is difficult to believe that this multi-level system was not actively planned[6] – but its efficacy may work to the detriment of the players in the long-term.

Reward Sound	**Hit-marker**	**Power-ups**	**Music Cues**
Interval	~4-8 seconds	~1.5-2 minutes	~5-10 minutes
Ratio	Small >100ms Percussive hit	Medium ~2 seconds Pitch/ interval information	Large ~30 seconds long Harmonic, melodic and rhythmic content

Figure 15: Table showing three levels of reinforcement

The feedback loop that allows the effect of these sound cues to compound over a play session is displayed in figure 16. Orange sound-groups represent a net increase in excitement, and blue represents a net decrease. Although the intensity of these effects can only be graded qualitatively without empirical study, there is a loop allowing excitement to increase over continuous rounds. Griffiths et al. found that competitive behaviour in video games was modulated by enjoyment as much as hostility,[7] and so this constant raising of qualitative excitement levels suggests a rise in competitive behaviour over the course of extended play. This raised excitement in turn suggests raised levels of impulsivity, which in the context of competitive play is one of the most significant precedents to aggressive and antisocial behaviour.[8] While Cruz and Sofia's findings would also be modulated by the physical impact of sport versus the sedentary nature of video games, the psychological impact, as well as the implications, stand as relevant.

[6] Tommy Thomson. 'Prepare to Die by Simple AI – Dark Souls and Difficulty', *AI and Games* (2017), https://youtu.be/s2S8o3fmJyc (accessed 12th March 2019).
[7] Robert Griffiths et al.. 'Competitive Video Game Play: An Investigation of Identification and Competition.' *Communication Research* 43/ 4 (2016), 468–86.
[8] Rui Sofia and José Cruz. 'Self-control as a Mechanism for Controlling Aggression: A Study in the Context of Sport Competition.' *Personality and Individual Differences* 87 (2015), 302-06.

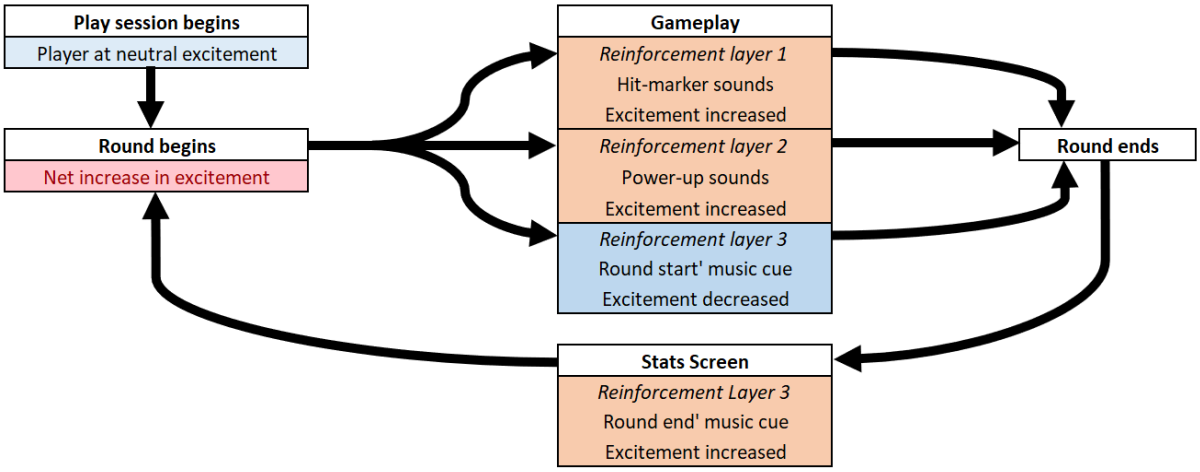

Figure 16: Arousal feedback loops inherent in multiplayer gameplay.

3.3 De-escalation Sounds to Defuse Players

With the systems mapped out, two sound design solutions to reduce the build-up of aggression present themselves: adding in extra 'relaxing' sound design, or else removing the 'exciting' cues. Neither option is ideal: relaxing cues would have to find their place in an already cluttered soundscape, obscuring important gameplay information, while removing the exciting cues removes the conditioning necessary to teach gameplay, while negatively impacting the player experience. Of the two, the latter option could be implemented more effectively, with some smart application. In this case, two further options are presented: reducing the occurrence frequency of the exciting cues, or decreasing the intensity by lowering the volume of the cue – particularly the 300Hz component discussed in chapter two. The former is not ideal, as this would create a partial reinforcement schedule, which could frustrate players with the intermittent tactile feedback. Reducing the volume relative to other sounds preserves the information, while decreasing the impact on the player – in turn, mitigating the sound's ability to raise arousal.

This new system would still frustrate designers seeking to create the most exciting sound design, and so the target of these changes could be filtered down to only players in an extended session: by examining the

average length of play (typically around 80 minutes),[9] designers could maintain normal functionality until after that period, then fading to a new volume mix focused on preventing an excess build-up of excitement. The system is shown in figure 17, and would only affect players already exposed to the repeated stimuli. There is precedent for this: in massively multiplayer games, systems involving long (12+ hour) recharge times are typically implemented to prevent continuous sessions for unhealthy periods of time, although with focus on player health, rather than impact on social interaction.[10]

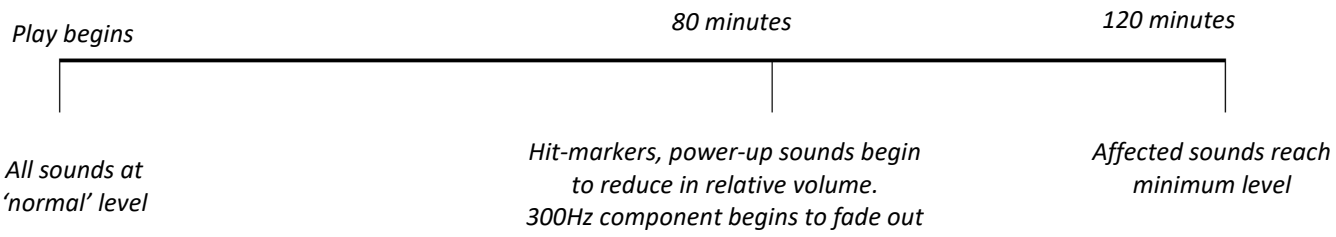

Figure 17: Implementation model for reducing player overstimulation over time

The system may work more effectively on hit-markers and power-up sounds than musical cues, due to the long interval between them, but reducing the impact of both of those stimuli does not completely spoil gameplay: both are still associated with visual cues, and so the player is still presented with the information. This may discriminate against visually impaired players who rely on the sound cues; it is difficult to imagine that sight-impaired players represent a significant portion of the player base for these games which rely on visual cues to locate assailants, but alienating players should be avoided when designing any kind of system. It is possible that this kind of system already exists in some games already – without access to the source code, as well as the skills to interpret it, it would be difficult to discern without playing for several hours and watching out for any minute change in the level and frequency of sound cues.

[9] Limelight. 'State of Online Gaming 2018'. *Limelight* (2018), https://www.limelight.com/resources/white-paper/state-of-online-gaming-2018 (accessed 30th March, 2019).
[10] Jamie Madigan. 'Framing and World of Warcraft's Rest System', *The Psychology of Video Games* (2010), https://www.psychologyofgames.com/2010/03/framing-and-world-of-warcrafts-rest-system (accessed 12th March, 2019).
Wesley Yin-Poole. 'Cyber psychologist calls on MMORPG developers to shorten long quests', *Eurogamer* (2013), https://www.eurogamer.net/articles/2013-08-06-cyber-psychologist-calls-on-mmorpg-developers-to-shorten-long-quests (accessed 12th March, 2019).

4. Gambling Sound

4.1 Modern Monetisation Methods

Although gambling and gaming have diverged since the decline of physical video game arcades, the modern methods of monetisation have incentivised game design that encourages longer play sessions, increasing the likelihood that players pay extra money for additional content. Large 'Downloadable contents' (DLC) including new characters and levels, and smaller cosmetic or inconsequential 'micro-transactions' are purchased with real money, on top of the price of the base game. While this ostensibly provides players with added value, the industry is divided over pressures to charge more money for less content in the base game.[1] Egregious examples of this model ask players to 'grind' through repetitive gameplay for hundreds of hours, unless they pay to unlock the content sooner. An infamous response from Electronic Arts to criticisms of 'pay-to-win or face the grind'-style design in *Star Wars: Battlefront 2*[2] remains at time of writing the most heavily downvoted comment on Reddit.com,[3] in just one of many community outcries against this model of payment. In an extension of this criticism, players were offered loot boxes, which had only a slim chance of containing the content that the player would want; being encouraged to continuously spend real money to win the desired prize by chance is closely analogous to gambling. This is matched in the sound design, through the same systems of reinforcement schedules discussed in chapter three. When examining slot-machine play, Dixon et al. found that players preferred to play with sound,[4] which was often correlated with heightened physical arousal, itself linked with reduced impulse control.[5] In order to explore this link, this chapter will compare sound design in loot-box opening in the two case studies with the typical format, in gambling (both with physical machines and online casino games).

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[1] Trustnote. 'The Future of Gaming: How Micro-transactions are Disrupting the Industry,' *Medium.com* (2018), https://medium.com/trustnote/the-future-of-gaming-how-micro-transactions-are-disrupting-the-industry-c7f5bab1081b (accessed 15th March, 2019).
[2] EA Dice, *Star Wars: Battlefront 2* (Stockholm, Electronic Arts, 2017).
[3] EA Community Team. 'Seriously, I paid 80$ to have Vader Locked?' *Reddit* (2017), https://www.reddit.com/r/StarWarsBattlefront/comments/7cff0b/seriously_i_paid_80_to_have_vader_locked/dppum98/?context=3 (accessed 15th March, 2019).
[4] Dixon et al.. 'The impact of Sound in Modern Multiline Video Slot Machine Play'. 913-29.
[5] Damien Brevers et al.. 'Effect of Casino-related Sound, Red Light and Pairs on Decision-making during the Iowa Gambling Task.' *Journal of Gambling Studies* 31/2 (2015), 409-21.

4.2 Young People and Gaming

The ethics of using sound design to reel in players on gambling machines questionable. In every market which legally allows for gambling globally, it is restricted to players over the legal age, typically around 18. The same cannot be said for video games accused of gambling design; *Star Wars Battlefront 2* was rated 'suitable for ages 13+' by the Entertainment Software Ratings Board, while *Overwatch* was rated 12+ by Pan European Game Information. While both boards include a classification for gambling, loot boxes do not currently fall within that label. While it stands to reason that children of those minimum ages would be playing these games, it is also highly common for children younger than the recommended age to access them: in a 2014 UK survey on young people's attitudes toward age ratings, it was found that a majority of adults were accepting of or ambivalent to young people playing mature-rated games, and these mature games were particularly popular with young males below the rating threshold. It can be assumed that any given popular game will be accessible by, if not popular among, young children. Although the broader questions about the long-term effect of exposure to adult content go beyond the scope of this discussion, a clear link has been found between childhood exposure to gambling behaviour and adult gambling problems,[6] and so developers should be conscious about the implications of their design choices, rather than ignoring the risk presented to this more sensitive audience.

4.3 Sound Analysis

The decision to gamble is mediated by lowered impulse control: rather than some crucial sound cue that would prompt a player to spend money, sound effects raise arousal, which lowers inhibition.[7] Knowing that gambling is broadly seen as unhealthy, gambling games work to lower players' resistance using tension and release in sound design, and this can be seen in the following examples. Two physical machines, *7s to Burn*[8]

[6] Edmond Shenassa et al.. 'Childhood Impulsive Behavior and Problem Gambling by Adulthood: A 30-year Prospective Community-based Study.' *Addiction* 107/1 (2012), 160-68.
[7] Brevers et al.. 'Effect of Casino-related Sound, Red Light and Pairs on Decision-making during the Iowa Gambling Task', 409-21.
[8] Stop and Step. '7s to Burn Bookies FOBT Slot Machine - £2 SPINS', *YouTube* (2016), https://youtu.be/HE6OGaOoKkk (accessed 15th March, 2019).

and *Paddy Power*,[9] and online game *Genie Jackpots*[10] are discussed here. Due to the expense of gathering data first-hand, gameplay was observed via YouTube players, who are typically associated with gambling websites.

With all the examples, the process is initiated by either inserting a coin (sometimes digitally) or placing a bet. A noise signifies the beginning of play, while an ongoing noise builds tension as the wheels of the machine spin. Finally, a satisfying reward noise signifies that a prize has been won. This structure varies from game to game: some constantly play music throughout, but most do not use a sound to signify that no prize was won. As with the 'round end' cues for multiplayer shooters in chapter two, care is taken to downplay the significance of losses to avoid discouraging players or giving them an impetus to quit by breaking a sense of continuous gameplay. The 'reward' sound is variably a single pitch, a short musical cue, or a rhythmic percussive hit. Generalising the sound design to Huron's model of Imagination-Tension-Prediction-Reaction-Appraisal (ITPRA) model,[11] *Genie Jackpots* includes a musical intro which would form the Imagination response, but the other two examples merge this with the Tension phase during the wheel-spin, with a repetitive rhythmic sound that is interestingly absent in *Genie Jackpots*, perhaps thanks to the sense of continuity provided by the music. The player reacts positively to the relief of tension when the repetitive sound stops, and is then sometimes rewarded with a success fanfare to be appraised positively. The fanfares in *7s to Burn* and *Paddy Power* are highly simplistic: physical machines would likely be in a loud social environment, such as a pub, where players may not be able to hear the machine, and so the sound design is seen as less important than an online game, likely played at home. The weak positive reinforcement of the fanfares – as well as the lack thereof for no-win situations – may be appraised negatively by players who imagined and predicted a fanfare to go with their victory. Rather than discourage players, this would likely encourage them to play again, to relieve the musical tension with a winning fanfare. Unlike *Overwatch* and *Black Ops 4*'s consistent reward sound, the *Genie Jackpot* reward cue varies from a percussive hit to an enticing jingle – respectively appealing to the 300Hz visceral punch discussed in chapter two, or the jingling of

[9] Fobt Roulette. '£800 win max bets fobt roulette pt 1,' *YouTube* (2017), https://youtu.be/Fv6fXEOv_mE (accessed 15th March, 2019).
[10] Gambit Slots. 'HUGE WIN! Genie Jackpots Megaways,' *YouTube* (2018), https://youtu.be/8U_7bEqaHY8 (accessed 15th March 2019).
[11] David Huron. *Sweet Anticipation: Music and the Psychology of Expectation* (Cambridge: MIT Press, 2006). 305-31.

coins. The inconsistent reward sound forms a partial reinforcement schedule which is less effective at conditioning behaviour, but increases the tension and excitement of the anticipated reward.

In *Overwatch*, the process of opening a loot box is largely analogous to the gambling examples: the process is initiated by purchasing loot boxes through an in-game menu, with the understanding that they *may* contain desirable rewards that would otherwise take a long time to randomly acquire through gameplay. The player selects the option to open the loot box; it falls down on-screen with a satisfying thunk, with a rising pitch to suggest excitement and tension as the box opens. The tension is released with a musical fanfare as the prizes are presented with a satisfying sound. Fostering the anticipation of reward is the key focus of the sound design here, which can be analysed using the ITPRA model. The weight implied by the percussive sound of the loot box landing fuels the player imagination that it is full of valuable prizes. The rising pitch increases player tension to prepare for the reveal, which the player predicts will be accompanied by a sound to release the building tension. Finally, the box bursts open and the player reacts with relief, and in appraisal, feels positively about the experience thanks to the simple diatonic fanfare in figure 18 that conforms to musical and cultural expectations. This process of release here occurs independently to the value of prizes, as each loot-box reward is presented as an exciting new acquisition regardless of its arbitrary value – which is largely ascribed based on rarity, with some items appearing more commonly than others, and additionally some personal preference for individual character rewards. Once again, the significance of the outcome is downplayed, to promote continuous play.

This fanfare is shown in figure 18. The cue matches the previously discussed cues in orchestration, on what sounds like acoustic (rather than synthesised) strings and brass. The cue outlines an A-major chord rather than the previous D-major tonal centre, and so in juxtaposition with the previous musical cues suggests either mixolydian mode, or dominant rather than function. In addition to the compound triple time and the melody ending on the third of the chord rather than the tonic, the cue lacks a strong sense of resolution: the music only resolves melodically to the tonic A after opening multiple consecutive loot boxes. In this way, the sonic tools used to facilitate continued play of the main game are applied to facilitate continued 'play' when opening loot boxes – a finite resource which can either be acquired through *further* continued play, or by purchasing them with real money.

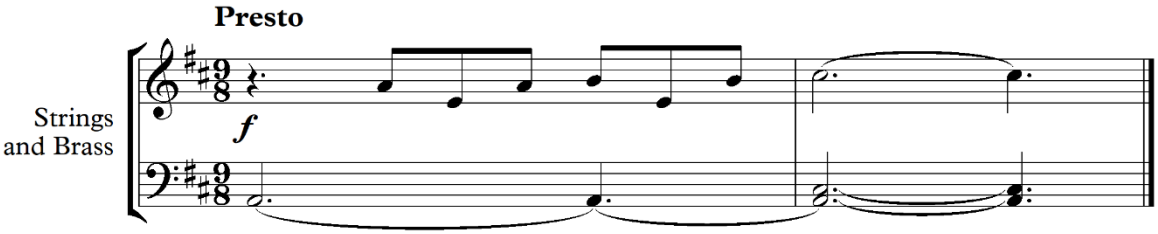

Figure 18: *Overwatch* 'Loot Box Opening' musical cue.

In *Call of Duty: Black Ops 4*, loot boxes were added relatively late, around three months after release under the moniker 'reserve crates', to some criticism from media outlets.[12] In *Call of Duty*, the sound effects are mainly percussive – the crate unlocks with the appropriate diegetic sound, including some electric/lightning sound and visual effects, before the rewards appear with a percussive hit as face-down cards. These are turned over one-by-one with an extra percussive sound for each reward. Here, the process is commented on as it happens by a shady black-market dealer character. Once again, the structure is fundamentally the same: an initiation, as the crate is made available to the player via purchase; a build-up, as the crate is revealed, with lightning visual and sound effects, and then a reward as the prizes 'thunk' onto the screen, matched with satisfying percussive sounds. Although the aesthetic has changed to match the game, the sound design serves the same function, albeit in stripped-down form. Some pundits suggested that the loot-box mechanic was added very late, either due to anticipated criticism, or else a last-minute change of decision by publisher Activision, who initially claimed that loot boxes would not be available. An ITPRA analysis would operate in the same way as the *Overwatch* analysis, although there is significantly less musical information to work from.

While both cases link the act of opening a loot box to excitement using sound (and visual) design, *Overwatch* does so in a more engaging way than *Call of Duty: Black Ops 4,* by capitalising on tension and release in a much more musical way than *Call of Duty*'s percussive/character-narrative approach. Both case studies took a more in-depth approach to sound design than the gambling machines – although *Genie Jackpots* was more complex than the physical machines, likely due to the expectation that players were able to listen

[12] Erik Kain. 'Call of Duty: Black Ops 4's Sneaky New Loot Boxes are a Grand Heist Indeed,' Forbes, https://www.forbes.com/sites/erikkain/2019/02/21/call-of-duty-black-ops-4s-sneaky-new-loot-boxes-are-a-grand-heist-indeed/#4e52b5e14103 (accessed 15th March, 2019).

via headphones, rather than the loud pub/casino scenario of the physical machines. Nonetheless, all examples used variations on a similar system of tension to prolong play, in which the sound design played a part of variable significance. This raises broader questions about the integration of this system, as well as its appropriateness with relation to the audience that the game reaches: parallels to the design of fixed-order betting machine and online-gambling sound design cannot be ignored in good faith without at least alerting consumers. At the time of writing, Belgian authorities have officially declared the loot-box system as a form of unregulated gambling, and as such, publishers have backed away from the system exclusively in Belgian markets.[13] The debate will likely develop as other governments, including UK government, continue to discuss the system.[14]

4.4 Semantics of choice

While skirting questions of gameplay implementation, the subject of how gamers are persuaded through broader game design (rather than sound design) to purchase loot boxes has not yet come up in this analysis: 'fear-of-missing-out' is a significant factor, where players are able to see other players with loot that they currently do not have, and so are forced to ask, 'how can I get that gear?', while being presented with a convenient-if-costly solution. As with the repeated sound stimuli, the effect of this fear compounds over continuous play. Publishers present this as pro-consumer, providing a choice: a player who is highly immersed in the world of the game may be more willing to spend money on items that would (directly or indirectly) give them higher status within the game-world.[15] However, this conflation of immersion and investment hides a significant oversight, in that immersion suggests an emotional relationship with the game, while investment suggests an economic relationship, either monetary or time-investment.[16] A game aiming to be commercially successful should balance both roles, which are far from mutually exclusive: fostering immersion requires a strong focus on the player-experience, which would lead to a time investment by the player. In this context,

[13] Paul Tassi. 'EA Surrenders in Belgian FIFA Ultimate Team Loot Box Fight,' *Forbes* (2019), https://www.forbes.com/sites/insertcoin/2019/01/29/ea-surrenders-in-belgian-fifa-ultimate-team-loot-box-fight-raising-potential-red-flags/#27b6b91a3675 (accessed 15th March, 2019).
[14] John Woodhouse. 'Loot Boxes in Video Games', *House of Commons Library* (2019), https://researchbriefings.parliament.uk/ResearchBriefing/Summary/CBP-8498 (accessed 15th March, 2019).
[15] Geoffrey Tim. 'Micro-transactions exists as a player choice,' *Critical Hit* (2017), https://www.criticalhit.net/gaming/shadow-of-wars-micro-transactions-exist-as-a-player-choice (accessed 15th March, 2019).
[16] Mariia Okuneva and Dmitriy Potapov. 'Consumer behaviour in online games'. *Computers in Human Behaviour* 23/3 (2005), 1642-59.

emotional does not refer literally to narrative investment, but to the player experience, which can simply be the tactile feel of the gameplay mechanics. Due to the interactive nature of the medium, time investment can be forced by adding repetitive content to a game, or arbitrary time limits, as is typical of mobile and social games. This approach is inherently anti-consumer, preventing players from playing on their own terms to artificially extend play. This attitude may be necessitated by the economics of big-budget game design; but, when balanced by immersive design, the choice to spend money to play more effectively is made by the player, not necessitated by the hostile architecture of the game systems.

The impact of sound design on the player decision to spend seems to be largely tied to the same excitement that would make a game fun and exciting anyway, and the anti-consumer applications of these sounds are largely extramusical. Furthermore, the critical reception of the implementation of loot boxes is currently muddied by hyperbole that prevents a focused discussion on effective or ineffective receptions thereof – a subject itself divorced from the financially successful implementation loot-box systems. Although the theory behind leveraging tension and release in sound design to promote continuous play, as well as encouraging spending on loot boxes (or other, non-probability-based commodities), is strong in theory, further practical discussion should focus on the empirical study of play, as well as a better understanding of the relationship between players and chance-based micro-transactions. The ethical discussions on the impact and appropriateness of chance-based systems are divorced from sound design – but as sound and music are the functional tools to maximise the effectiveness of systems, it would behove sound designers to at least be aware of the discussion.

5. Conclusions

While the ideas and arguments presented here are generally functional as relating exclusively to sound design, there is a conspicuous lack of real-world application, largely relating to the very first sentence of the introduction: big-budget video game production has eclipsed the capacity of the bedroom programmer, and to create a reasonable facsimile of the case studies presented here would be impossible without fundamentally building an entirely new game from scratch. While a small-scope game could be built to examine the impact of sound design on short-term habits and behaviour in the scope of limited play-sessions, gathering 12 players to play a small series of rounds would still fail to create the impression of a broader gaming community which these games have so carefully fostered (or the extended marketing that represents these communities in the real world, shown in figure 19).

Figure 19, left: *Call of Duty* adverts on UK bus service. Right: *Call of Duty* advert for the previous game, *World War 2*, on the London IMAX cinema.

Rather than building a game from scratch, modification of an existing game ('making a mod') likewise doesn't exist in the context of these modern multiplayer games: where there previously existed a thriving modding community for large single-player games, the source code and assets have been locked down in modern multiplayer games to prevent players from cheating or hacking to gain a competitive advantage, or else to protect the intellectual property of the developers – which would have seemed inconsequential for the smaller industry of yesteryear.

The greatly expanded industry allows for greater fidelity, more exciting experiences, and social interaction all unique to games as a media. But to study the broader impact of games on players becomes more difficult as the relevant play statistics become crucial industry data that can be used to target game design and get ahead of the competition. Some form of compromise may be necessary to access these first-hand sources – or else, a consolidation of efforts to interview players. This is already occurring: the UK Arts & Humanities Council funds research into video games,[1] while there is a concerted effort by psychologists to probe the subject. Fundamentally, the issues stem from an industry in transition – the graph from figure 1 highlighted the almost hundred-fold increase in scale of development over the last 20 years. Desperate to meet the needs of this massively expanded economic model, the industry has adapted in a way that is perceived to be anti-consumer. There is a mood amongst video-game journalists that publishers seeking to increase profits are responsible for increasingly heavy-handed monetisation methods[2] – which would suggest that the developer is trapped between the uncompromising economics of industry, and the necessity of work. In this frustrating scenario, it is the role of external moderators to judge the appropriateness of unethical design, such as the ongoing dispute between publishers and the Belgian Gaming Commission. As the industry continues to develop and expand, the relationship between developers, publishers, and consumers must be continually examined. The surface-level moral panics over violent content that plagued the industry a decade ago have now given way to a more serious scrutiny of the role of videogames in society and their long-term impact on the player, with the ability to see the positives in the medium as clearly as the negatives. Far from being seen as a hobbyist curio, it is now understood that video games as a hobby transgress age, gender or ethnicity. [3] Developers must return this tacit respect with a confident awareness of the implications of their design decisions. Anything other than a symbiotic relationship between producer and consumer is at best inefficient, and at worst unsustainable.

[1] Arts & Humanity Research Council. 'Video Games Research Networking,' *AHRC* (2019), https://ahrc.ukri.org/innovation/creative-economy-research/previous-ce-research-projects/videogamesresearchnetworking/ (accessed 15th March, 2019).
[2] Jim Sterling. 'The Unreward System,' *The Jimquisition* (2019), https://www.thejimquisition.com/blog/the-unreward-system (accessed 15th March, 2019).
[3] Esports-betting.pro. '2019 Video Game Industry Statistics, Trends & Data', *WePC (2018)*, https://www.wepc.com/news/video-game-statistics (accessed 15th March, 2019).

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