

2 | Chiptune, Ownership and the Digital Underground

KENNETH B. MCALPINE

Chiptune is an underground – and very distinctive – style of lo-fi electronic music that grew from the first generations of video game consoles and home computers in the late 1970s and early 1980s. Over the years, the style has grown in popularity to become the *chipscene*, a vibrant community of practitioners and fans who create, distribute and consume chip music.

However, while chiptune was defined by the sound chips and gameplay of that early 8-bit hardware, in the late 1980s the worlds of chiptune and gaming began to diverge as advances in technology and the changing practice of professional game development changed the way that video game music was produced and implemented, in turn shifting user expectations and killing the demand for chip music soundtracks.

This chapter explores how that transition occurred and helped to create a distinctive subculture, and it explores how attitudes to ownership and intellectual property in the scene were shaped, in part, by a reaction against the increasingly corporatized world of game development, and by the other countercultural movements that influenced it.

Introduction

Chiptune: for players of a certain age – and, as a child of the 1970s, I certainly count myself as one of them – it is the aural embodiment of video games. There is something about that raw, geometric sound that captures classic video gaming in its most immediate form, a distillation of pure gameplay. It represents a period of gaming in which technical and musical creativity combined in the most exquisite way, as video game programmer-composers ingeniously coaxed the primitive hardware – primitive, at least by today's standards – into feats of musicality that it had never been designed to achieve.¹

¹ See, for example, James Newman, 'Driving the SID Chip: Assembly Language, Composition and Sound Design for the C64', *GAME: The Italian Journal of Game Studies* 1, no. 6 (2017), and my own

That period of game audio, however, was relatively short-lived. The programmable sound generators (PSGs) that served as the voice for the 8-bit machines – Atari’s TIA and POKEY and Commodore’s SID, for example – used simple digital sound synthesis.² While this gave those 8-bit soundtracks a unique and very characteristic sound, it was almost impossible to make those PSGs sound anything other than ‘blippy’.

By the mid-1980s, in a drive towards greater sonic range and fidelity, the PSGs had largely been superseded and were beginning to be replaced by dedicated sample-based hardware, such as the Paula chip that provided the four-channel stereo soundtracks of Commodore’s Amiga,³ and FM and wavetable soundcards in IBM PCs and compatibles,⁴ but it was the arrival of the CD-ROM drive, and particularly that of the Sony PlayStation, that created a fundamental shift in what players could expect from their video game soundtracks.

For some, it heralded the end of an era. Mark Knight, an industry veteran who got his break writing the *Wing Commander* (1990) soundtrack for the Commodore Amiga explains:

In my opinion . . . those new formats killed computer game music. It started with the PlayStation, when instead of being stuck by limitations which forced [composers] to create music in a certain style, in a certain way and using certain instrumentations, suddenly you could go into a recording studio, you could record an orchestra or a rock band or whatever you wanted, really, and then plonk it on a CD as Red Book audio. Suddenly game music didn’t sound distinctive any more. It sounded like everything else.⁵

Just as an industry drive towards filmic realism and shifting audience expectations normalized colour cinema in the 1940s and ’50s,⁶ bringing an end to the era of black-and-white film and its brooding unreality, so

articles ‘All Aboard the Impulse Train: A Retrospective Analysis of the Two-Channel Title Music Routine in *Manic Miner*’, *The Computer Games Journal* 4, no. 3–4 (2015): 155–68 and ‘The Sound of 1-bit: Technical Constraint and Musical Creativity on the 48k Sinclair ZX Spectrum’, *GAME: The Italian Journal of Game Studies* 1, no. 6 (2017).

² In fact, although the PSGs generated their raw sounds digitally, many chips included analogue components in their signal paths. Commodore’s SID, for example, employed digitally controlled analogue filters for post-trigger processing of sounds.

³ Jimmy Maher, *The Future Was Here* (Cambridge, MA: The MIT Press, 2012), 192.

⁴ Peter Ridge, *Sound Blaster: The Official Book* (New York: McGraw-Hill, 1994).

⁵ Mark Knight, interview with author, 13 June 2017.

⁶ Wheeler Winston Dixon, *Black and White Cinema: A Short History* (New Brunswick, NJ: Rutgers University Press, 2015).

to PSG music disappeared from video game soundtracks,⁷ to be replaced by MIDI arrangements, sampled loops and licensed commercial tracks on CD-ROM.

It was a shift that saw video game music take on a more polished and commercial edge. The PlayStation racer *Wipeout* (1995), for example, featured a high-octane electronic soundtrack that was mostly written by composer Tim Wright with some tracks licensed from Leftfield, the Chemical Brothers and Orbital. Sony also licensed music from some non-mainstream acts to create an original soundtrack album that was released to promote the game at launch (Columbia Records, 1995).⁸

Colin Anderson, who, in the 1990s, was Head of Audio at DMA Designs, the company that created both *Lemmings* (1991) and *Grand Theft Auto* (*GTA*, 1997), described how that shift away from sound chips to full production music changed how he approached game audio.

Probably the most significant change was the fidelity of the audio that you could create. [Sampling and CD audio] gave you access to the same resources that the film and television industries would use . . . and that meant for the first time you could use real recordings of real instruments, of real sound effects . . . instead of having to synthesise them.⁹

One of the principal soundtrack innovations introduced by the *GTA* franchise was its in-game radio stations, a feature that created a sense of pervasiveness for its diegetic world, making it seem broader, richer and more multifaceted than the player's direct experience of it.

But, as Anderson continues,

On the downside, we lost interactivity for a while. The synth chips were particularly good because they were being coded at quite a low level. They were really good at responding to gameplay as it moved, and that went away when we started using CD and things like that . . .

⁷ At least for a time. Recently chiptune, along with 8-bit and pixel art, has seen something of a resurgence, as developers use these technologically obsolete approaches stylistically to impart a degree of retro-cool to contemporary games.

⁸ In fact, *Wipeout* was part of a larger marketing strategy to build relationships with DJs, the music industry and fashion, and align Sony and its PlayStation console with 1990s club culture, which, at the time, was becoming more mainstream and represented a huge, untapped market. Arguably this soundtrack was a key component in positioning Sony, which at that time did not have a track record as an independent manufacturer in either console or video game development, as a major player alongside Sega and Nintendo.

⁹ Colin Anderson, interview with author, 29 May 2017.

Expectations changed really quickly as well. Suddenly the novelty of, ‘Hey! This has got a CD soundtrack’, went away, and people were just like, ‘OK, we expect that. Of course it’s going to have a CD soundtrack. What else have you got?’ It was a real game changer in that respect.¹⁰

That shift in end-user expectation proved to be a spur for further innovation, both in the way that music was utilized in games – the move back towards video games with real-time adaptive soundtracks, for example, was as much an industry response to that ‘so what’ factor as it was a desire to create tightly integrated interactive audiovisual experiences – and in how that music was acquired by developers.

For *GTA 1*, [all of the soundtrack material] was 100 per cent completely original material that we recorded in-house [largely] because we were this little software development house based in Dundee that nobody had ever heard of really, and at that time, if you approached the record companies and said, ‘Would you like to license us some music for your games’, they kind of laughed and said, ‘Well, why would we ever want to do that? We’re making ever so much money from selling CDs, thank you very much!’ They just weren’t interested.

In *GTA 2* that started to change. As soon as the game became successful, suddenly people turned up wanting their favourite tracks to be licensed, and [that commercial pressure] increased [with each subsequent release].¹¹

If established artists were prepared to lend the weight of their brand and fan base to a game franchise, and perhaps even pay for the privilege, it is hardly surprising that developers and publishers would embrace that new commercial model, particularly in the high-budget blockbuster development space, where development times and budgets are often huge, raising significantly the overall cost and risk of production.¹²

The age of PSG video game music, then, was brought to an end as much by the commercial realities of video game production as it was by the increasing technical capacity of home consoles. However, while chiptune might have disappeared from games, reports of its demise were greatly exaggerated. Chiptune was about to develop an edge, one that would set it in direct opposition to the corporate world of professional game development.

¹⁰ Anderson, interview.

¹¹ Ibid.

¹² ‘T. C.’, ‘Why Video Games Are So Expensive to Develop’, *The Economist*, 25 September 2014, accessed 8 April 2020, www.economist.com/the-economist-explains/2014/09/24/why-video-games-are-so-expensive-to-develop.

Going Underground

Since the earliest days of gaming, software piracy had been a problem for publishers.¹³ In the late 1970s and early 1980s, the issue was most pressing on tape- and disc-based machines like the Apple II, the Commodore C64 and later the Commodore Amiga and Atari ST, these media lending themselves more easily to analogue or direct digital duplication than did cartridges.

The industry responded directly and technologically to the threat, by combining a range of sophisticated copy protection routines with the threat of legal action against those who circumvented the copy protection to distribute the games.¹⁴

That stance created two parallel but overlapping worlds; on the one side the corporate world of the games industry, and on the other, the world of *crackers*, skilled coders whose self-appointed role it was to strip the copy protection from games and release neutered versions within days – and sometimes hours – of their official release.

Removing copy protection was a complex process, akin to surgically removing a non-vital organ that, nevertheless, forms part of a complex biosystem. The more complex the copy protection, the greater the surgical skill required to remove it. For the cracker this was the primary motivating force, not the resale value of the software or its functionality; they wanted to be able to demonstrate that they were nimbler and more skilled than those who designed the copy protection and all of the other crackers who were scrubbing up in countless other bedroom operating theatres.

Warez crackers, traders, and collectors don't pirate software to make a living: they pirate software because they can. The more the manufacturers harden a product, with tricky serial numbers and anticopy systems, the more fun it becomes to break. Theft? No: it's a game, a pissing contest; a bunch of dicks and a ruler. It's a hobby, an act of bloodless terrorism. It's 'Fuck you, Microsoft.'¹⁵

The first organized groups of crackers, or *cracking crews*, came out of Western Europe, specifically West Germany (JEDI) and the Netherlands (ABC Crackings) around 1983,¹⁶ but by the mid-to-late 1980s crews were working across international borders to produce not only cracks, but

¹³ Ron Honick, *Software Piracy Exposed* (Amsterdam: Elsevier, 2005), 215; Jacob A. Ratliff, *Integrating Video Game Research and Practice in Library and Information Science* (Hershey, PA: IGI Global, 2015), 121.

¹⁴ Honick, *Software Piracy*, 151.

¹⁵ David McCandless, 'Wares Wars', *Wired* 5, no. 4 (1997): 132–5 at 135.

¹⁶ Markku Reunanen, Patryk Wasiak and Daniel Botz, 'Crack Intros: Piracy, Creativity, and Communication', *International Journal of Communication* 9 (2015): 798–817.

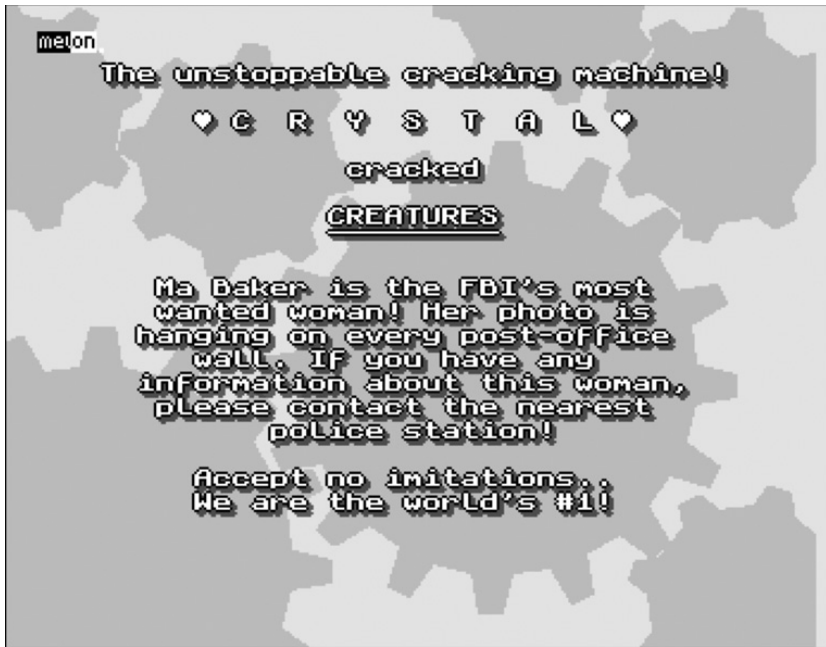


Figure 2.1 The Melon Deznig cracktro from their crack of Thalamus's *Creatures* (1993). The cracktro features the music of Mark Knight, credited as TDK. Note the use of the lyrics to Boney M's *Ma Baker*, an ironic nod towards the illicit practice of cracking. Cracking groups often riffed off pop culture references

sophisticated digital calling cards – crack intros, or *cracktros* – that were displayed onscreen as the games loaded. These combined scrolling text, algorithmically generated plasma and 3-D effects, and music to mark the technical achievements of the crack (see Figure 2.1).

The code to execute cracktros had to be compact and efficient to fit in the boot sectors of floppy disks, so that the cracked game could be uploaded and downloaded easily from bulletin board services via dial-up and rewritten to new floppies. The simple waveforms and sequences of PSG music, which could be stored as space-efficient single-cycle samples and tracker sequences for playback on sample-based systems, lent itself perfectly to this end. Chiptune became the sound of the digital underground.

Over time, the competition to demonstrate both coding virtuosity and graphical and musical creativity became more important than the cracks themselves. End users would actively seek out cracked software for the cracktros, rendering the game an almost insignificant by-product of the cracking process.

The production and sharing of cracktros became an end in itself, and evolved into the *demoscene*, a distributed online community of digital arts practice dedicated to the production of complex real-time audiovisual displays.¹⁷ That combination of anti-commercialism, a distinctive sense of community and a culture of sharing marks a definite point of departure of chiptune, as a constituent part of the crackscene and demoscene, from the increasingly professionalized and corporate approach to video game music production.

It also points to a difference in mindsets. On one side sits the corporate perspective, which recognizes that there is value – and cost – in the production of professional content, be that music or software, and that it is therefore justifiable for a company to protect its investment by using a combination of digital rights management (DRM) and litigation to ensure that only legitimate copies are in circulation.

Set against this, the Hacker Ethic, the core philosophy of hacking culture, which originated from Massachusetts Institute of Technology in the 1950s and 1960s,¹⁸ sets out the intellectual counterpoint to this enterprise-driven process of making intellectual property out of everything, namely the ‘belief that information sharing is a powerful good and that it is an ethical duty . . . to share . . . expertise by writing free software and facilitating access to information . . . whenever possible’.¹⁹

But while that intellectual tension is most often framed and discussed in terms of the lone hacker against the multinational corporation, in practice, its impact can often be felt on a much smaller scale. As Mark Knight says:

A lot of chiptune artists today . . . most of them [have] grown up with the idea that music is just something you share with people for free, so they’re like, ‘Yeah, but that’s just how it is. Why do you have a problem with it?’ . . . But CDs cost money to make. When I did my last album I spent nearly £1000 in software and hardware and that sort of thing. It’d be nice to be able to make that back.

It is frustrating that people complain that you’re asking for money when you release an album for three quid. I’m kind of like, ‘Yeah, do you drink coffee? So you will happily go and pay three quid for a cup of coffee but you’re not happy to pay three quid for an album?’ That really does frustrate me, because . . . I’ve been learning my craft for years. That has value. I buy equipment, I buy strings and this, that and the other, but the concept . . . people don’t quite get it.²⁰

¹⁷ Markku Reunanen, ‘How Those Crackers Became Us Demosceners’, *WiderScreen* 17, nos. 1–2 (2014).

¹⁸ Steven Levy, *Hackers, Heroes of the Computer Revolution, 25th Anniversary Edn* (Sebastopol, CA: O’Reilly Media, 2010), 23–31.

¹⁹ Eric Raymond, *The New Hacker’s Dictionary, Third Edition* (Cambridge, MA: The MIT Press, 1996), 234.

²⁰ Mark Knight, interview with author, 6 October 2015.

I would argue that it's not that people don't 'get it', it's that these perspectives lie at opposite ends of a continuum on which we all sit, and our position on it shifts, depending on context and whether we are predominantly creating or consuming.²¹ It also points to a fundamental shift in how we collectively value intangible products, be they musical works or software.

An Open Letter to Hobbyists

Early in 1975, a young Bill Gates and his friend Paul Allen picked up the January copy of the news-stand magazine, *Popular Electronics*. On the cover was an Altair 8800. Manufactured by Micro Instrumentation and Telemetry Systems (MITS), the Altair, almost overnight, would become a commercial success: its designer, Ed Roberts, worked out that he needed to sell 200 machines to break even; within three months he had a backlog of 4,000 orders.²²

Gates, then a Harvard undergraduate, had been following closely the growing phenomenon of personal computing, and had come to the conclusion that there was value in software as an indispensable counterpart to hardware. Sensing that the Altair represented a breakthrough moment, Gates and Allen called Roberts and offered to demonstrate a BASIC interpreter for the machine, hoping to contract with MITS as a key supplier. In fact, the pair didn't even have an Altair, let alone the BASIC interpreter that they were offering.²³

Roberts agreed to meet them, and in the space of just a few weeks, Gates and Allen had developed an Altair emulator that ran on Harvard's PDP-10 mainframe, and then the BASIC interpreter. The first 'Micro-soft' agreement was sealed in April; Gates and Allen received US\$3,000 immediately, with royalties of US\$30 per copy of 4 K BASIC, and US\$35 for 8 K BASIC for each subsequent sale.²⁴

²¹ There is, of course, another dimension to this debate, which has become particularly nuanced since digital content has become decoupled from physical media, and since recontextualized and reappropriated content has started to be freely shared on social media and media streaming platforms. This has fundamentally shifted notions of ownership, the emotional investment of consumers in content and the role that music and other electronic media have to play in our 'real' and 'virtual' identities.

²² Thom Hogan, 'From Zero to a Billion in Five Years', *Infoworld* 3, no. 17 (1981): 6; Peggy Albrich Kidwell and Paul E. Ceruzzi, *Landmarks in Digital Computing: A Smithsonian Pictorial History* (Washington, DC: Smithsonian Institution Press, 1994).

²³ Jack Schofield, 'Paul Allen Obituary', *The Guardian*, 17 October 2018, accessed 8 April 2020, www.theguardian.com/technology/2018/oct/16/paul-allen-obituary.

²⁴ Centre for Computing History, 'Bill Gates and Paul Allen Sign a Licensing Agreement with MITS – Computing History', (n.d.), accessed 8 April 2020, www.computinghistory.org.uk/det/5946/Bill-Gates-and-Paul-Allen-sign-a-licensing-agreement-with-MITS/.

As they were about to discover, however, the early adopters of personal computing had a very different perspective from Micro-soft on the value of software. At one time, computer software was not something that was bought and sold. As computing hardware trickled out from research labs in the early 1950s, most end users wrote programs themselves, largely because none of the hardware manufacturers provided any for them to use. IBM's first production computer, for example, the 701, came with little more than a user manual.²⁵

Developing applications was a major undertaking that required specialist support. Even relatively mundane programs required thousands of lines of code. They were difficult to debug and needed continual modification and improvement in response to the demands of a changing business environment.²⁶ Most companies maintained a team of programmers to service a single mainframe machine, a significant portion of the overall cost of maintaining and running a computer.

IBM, which, even in the 1950s was an old and well-established company, recognized that if that continued, 'the cost of programming would rise to the point where users would have difficulty in justifying the total cost of computing.'²⁷

In response IBM created *SHARE*, a community of makers and consumers whose key mission was to share information and programs, thereby reducing the overall cost of computing, and in turn making IBM's machines a more attractive and cost-effective option.

From this group came many of the standardized notions of operational computing that continue through to the present day,²⁸ but so too did the idea that software could – and should – be something that was freely distributable. It was a commodity whose main value was in making the leasing of hardware more attractive, rather than as something that had value in its own right.

By the late 1960s, IBM had become the dominant player in mainframe systems. In much the same way as Microsoft achieved with its operating systems throughout the 1980s and 1990s,²⁹ IBM, by power of ubiquity, had

²⁵ Paul Armer, 'SHARE – a Eulogy to Cooperative Effort [1956]', *Annals of the History of Computing* 2 (1980): 122–9.

²⁶ Martin Campbell-Kelly, *From Airline Reservations to Sonic the Hedgehog* (Cambridge, MA: The MIT Press, 2003), 29.

²⁷ R. Blair Smith, 'The IBM 701 – Marketing and Customer Relations', *Annals of the History of Computing* 5 (1983): 170–2.

²⁸ Atsushi Akera, *Calculating a Natural World* (Cambridge, MA: MIT Press, 2006), 263.

²⁹ See, for example, for a comprehensive account of Microsoft's corporate dominance at this time, and the principles of anti-trust legislation, Jeffrey Eisenach and Thomas Lenard (eds), *Competition, Innovation and the Microsoft Monopoly: Antitrust in the Digital Marketplace* (Boston, MA: Kluwer, 1999).

created a de facto standard. By bundling software, IBM was able to provide users with a tight-knit group of products that would work seamlessly together, and that presented a problem: when the choice was to go with an IBM system, complete with training and support, or to try and bring together several applications from different suppliers that had not been proven to work together and which might receive uncoordinated updates and fixes from their individual manufacturers, most customers did not consider it a choice at all.

In 1967, the Antitrust Division of the US Department of Justice began an investigation of IBM, citing IBM's practice of bundling as evidence of the company's anti-competitive practice, and so, on 6 December 1968, IBM announced that it would unbundle the five major services – system engineering, education and training, field engineering, programming services and software packages – that it had previously included free with its hardware, and charge separately for them.³⁰

And so it was, fresh in the wake of IBM's unbundling initiative, and with the concept of software as a saleable product still a relatively novel and untested idea, that Gates found himself colliding head-on with the established mindset that software should be free.

Gates had embarked on a national roadshow to demo the Altair and Microsoft's BASIC interpreter. At one event in Paolo Alto, Gates presented to a hotel packed with members of the Homebrew computing club, many of whom had already built an Altair and were waiting for MITS to release BASIC.³¹ When they saw that the Altairs on display were all running BASIC off punched paper tape, one unnamed member 'borrowed' the tape and ran off a few copies. At the next Homebrew club meeting, there was a cardboard box filled with dozens of BASIC tapes for members to take, with just one condition: you had to make a couple of copies for each one you took.³²

Gates was furious. He wrote an emotionally charged open letter, which set out both the tone and the agenda for the debate around intellectual property that has raged since (Figure 2.2).

History has demonstrated beyond doubt that Bill Gates and Paul Allen were right about the commercial potential of software as a commodity, but the continued growth of the underground *warez* scene, and the legitimate adoption of *freeware*, *Creative Commons* and *open source* as models for publishing and distribution suggest that attitudes around the sharing of digital content remain as strong as ever.

³⁰ Franklin Fisher, James McKie and Richard Mancke, *IBM and the US Data Processing Industry: An Economic History* (Westport, CT: Praeder, 1983), 175–7.

³¹ Fred Moore, 'It's a Hobby', *Homebrew Computer Club Newsletter* 4, 7 June 1975, p. 1.

³² Levy, *Hackers*, 192–3.

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February 3, 1976

An Open Letter to Hobbyists

To me, the most critical thing in the hobby market right now is the lack of good software courses, books and software itself. Without good software and an owner who understands programming, a hobby computer is wasted. Will quality software be written for the hobby market?

Almost a year ago, Paul Allen and myself, expecting the hobby market to expand, hired Monte Davidoff and developed Altair BASIC. Though the initial work took only two months, the three of us have spent most of the last year documenting, improving and adding features to BASIC. Now we have 4K, 8K, EXTENDED, ROM and DISK BASIC. The value of the computer time we have used exceeds \$40,000.

The feedback we have gotten from the hundreds of people who say they are using BASIC has all been positive. Two surprising things are apparent, however. 1) Most of these "users" never bought BASIC (less than 10% of all Altair owners have bought BASIC), and 2) The amount of royalties we have received from sales to hobbyists makes the time spent of Altair BASIC worth less than \$2 an hour.

Why is this? As the majority of hobbyists must be aware, most of you steal your software. Hardware must be paid for, but software is something to share. Who cares if the people who worked on it get paid?

Is this fair? One thing you don't do by stealing software is get back at MITS for some problem you may have had. MITS doesn't make money selling software. The royalty paid to us, the manual, the tape and the overhead make it a break-even operation. One thing you do do is prevent good software from being written. Who can afford to do professional work for nothing? What hobbyist can put 3-man years into programming, finding all bugs, documenting his product and distribute for free? The fact is, no one besides us has invested a lot of money in hobby software. We have written 6800 BASIC, and are writing 8080 APL and 6800 APL, but there is very little incentive to make this software available to hobbyists. Most directly, the thing you do is theft.

What about the guys who re-sell Altair BASIC, aren't they making money on hobby software? Yes, but those who have been reported to us may lose in the end. They are the ones who give hobbyists a bad name, and should be kicked out of any club meeting they show up at.

I would appreciate letters from any one who wants to pay up, or has a suggestion or comment. Just write me at 1180 Alvarado SE, #114, Albuquerque, New Mexico, 87108. Nothing would please me more than being able to hire ten programmers and deluge the hobby market with good software.

Bill Gates
Bill Gates
General Partner, Micro-Soft

Figure 2.2 Bill Gates's *Open Letter to Hobbyists*. This letter sets out clearly the opposing perspectives of the hobbyist community, which had legitimately come to think of software as a freely shareable resource, and Gates's more corporate viewpoint, which sought to commoditize its value. This debate has, if anything, intensified, and has grown to incorporate all manner of intangible commodities, including music recordings

The Incentive to Share

While the technology of sharing is now different – chunks of data shared as torrent files as opposed to cardboard boxes of punched paper tapes – the nature and themes of the debate have remained remarkably consistent as

they have played out across different domains and distribution media and at different points in time. Although there are some notable differences between software development and music publication and distribution, there are also some quite striking parallels. Both, for example, have forced legislators and the public to deal with new technologies that have challenged our fundamental assumptions of what constitutes publication and ownership.

At the turn of the century, piano rolls, for example, were considered to be part of the machinery of a player piano, like the mechanism of a music box, and so not subject to copyright law, despite the fact that the punched paper rolls, unlike a music box, were distinct from the playing mechanism and could easily be swapped for other rolls, which contained all of the detail of the original music manuscript, albeit in a mechanically encoded form.³³

In 1978, novelist John Hershey, a member of the National Commission on the New Technological Uses of Copyrighted Works, argued, in a similar vein, that computer code is dramatically different from other copyright works because the ones and zeroes in a computer program are designed to have

no purpose beyond being engaged in a computer to perform mechanical work . . . [A] program, once it enters a computer and is activated, does not communicate information of its own, intelligible to a human being . . . The function of computer programs are [*sic*] fundamentally and absolutely different in nature from those of sound recordings, motion pictures, or videotapes. [These] produce for the human ear and/or eye the sounds and images that were fed into them and so are simply media for transmitting the means of expression of the writings of their authors.³⁴

In some respects, chiptune represents both of these key characteristics: the machine code routines and data are no more than ones and zeroes designed to control electrical impulses in a machine, and, like the rolls of a player piano, they convey no meaning unless they are coupled with a PSG,³⁵ which provides the machinery necessary to turn that code into sound, and yet few creative coders would challenge the idea that in writing sound drivers and music data, they are encoding both the musical score and the performance characteristics that will realize a musical work; they are not simply performing routine mechanical tasks.

³³ Alex Cummings, *Democracy of Sound: Music Piracy and the Remaking of American Copyright in the Twentieth Century* (New York: Oxford University Press, 2013), 21.

³⁴ Michael Scott, *Scott on Information Technology Law, 2018 Supplement* (New York: Wolters Kluwer, 2018), 2–20.

³⁵ Or at least an emulation of a PSG.

However, such notions remain abstract until they are tested in law, and because of the anti-commercial sharing ethos that is prevalent in the chiptune community, chip musicians have generally been happy for others to appropriate, adapt and cover their work provided nobody makes any money from it.

In an interview, Ben Daglish,³⁶ the prolific C64 composer, described how he felt about new generations of chip musicians rediscovering and using his video game themes:

It's amazing that people are still listening to my stuff, still giving me recognition thirty years on . . . I'm most impressed by the guys who take my stuff and play it live. When I was writing for the SID chip, I could use notes that were never actually meant to be played by human beings [and] there are guys out there who have transcribed those pieces and turned them out as guitar solos . . . In the end, I think it's just nice to be appreciated without having to work for it myself!³⁷

There have, however, been instances where chiptunes have ended up in court: David Whittaker's soundtrack to the classic C64 game, *Lazy Jones* (1984), for example, was reused commercially without permission by the German techno outfit, Zombie Nation, who used it as the central hook in their track 'Kernkraft 400' (1999), while in 2007 Timbaland used elements of the demotune 'Acidjazzed Evening' (2002) in the Nelly Furtado track, 'Do It' (2007).

In both instances the legal challenge failed, and in part, that failure stemmed from the fact that it was difficult to prove ownership and establish the mode of publication. In the early days of the games industry, in Europe and North America at any rate, nobody gave much thought to the value that was present in the intellectual property that comprised the game. Video game music was not something that was imagined to have distinct value, and in most cases, those soundtracks were commissioned verbally – often by telephone – and so today there is simply not the paperwork to go back and prove who owns what.

In some respects, that legal ambiguity presents a real challenge for video game historians who seek to document and archive the ephemeral elements of early gaming culture. Video Game History Foundation founder Frank Cifaldi notes that 'there is no alternative BUT piracy for, like, 99 per cent of

³⁶ Ben Daglish was one of the early pioneers of 8-bit video game music, and became particularly well known for his work on the Commodore C64, scoring works including *The Last Ninja* and *Auf Wiedersehen Monty*. Sadly, during the writing of this chapter, he died, on 1 October 2018. This chapter is dedicated to his memory.

³⁷ Interview with the author, 14 December 2015.

video game history’ due to ‘the completely abysmal job the video game industry has done keeping its games available’.³⁸

That rarity argument – the idea that if the industry is either unwilling or unable to maintain legitimate access to a back catalogue, then end users are justified in using whatever means are available to source the material that they seek – is discussed more fully by Steven Downing,³⁹ and it represents another driver in the underground market for digital content, particularly when the boundaries between the legitimate and the illegitimate are fuzzy or uncontested.

The desire to accumulate and collect is a common feature in most fan communities,⁴⁰ and the chip music community is no exception. The High Voltage SID Collection (HVSC), for example, is an expansive and in-depth online repository of community-ripped C64 SID music files that combine both the copyrighted music data and the music driver code required to play it. It was created specifically to meet the growing demand for the specific sound of classic 1980s video game music in its original form as gamers migrated to new platforms that offered a different – more ‘produced’ – musical experience.

Collections like the HVSC represent the latest manifestation of a culture of illicit supply and demand that goes back to the very beginnings of the recording industry, when bootleggers, playing a role similar to the fans who rip SID music files for the HVSC, stepped in to provide consumer content that was not available through legitimate channels.

Bootleggers and Mixtapes

The term bootlegging rose to prominence in Prohibition-era America,⁴¹ and it first started to be associated with the practice of music recording and distribution in the late 1920s, just as the culture of record collecting started to emerge. An article in *Variety* in April 1929, for example, notes that ‘There is almost as big a market for bootleg disk records as there is for bootlegged books’.⁴²

³⁸ Quoted in Kyle Orland, ‘ROM Sites are Falling, But a Legal Loophole Could Save Game Emulation’, *Ars Technica*, 21 August 2018, accessed 8 April 2020, <https://arstechnica.com/gaming/2018/08/can-a-digital-lending-library-solve-classic-gamings-piracy-problem>.

³⁹ Steven Downing, ‘Retro Gaming Subculture and the Social Construction of a Piracy Ethic’, *International Journal of Cyber Criminology* 5, no. 1 (2011): 750–72.

⁴⁰ Henry Jenkins, ‘What Are You Collecting Now? Seth, Comics, and Meaning Management’, in *Fandom*, ed. Jonathan Gray, C. Lee Harrington and Cornel Sandvoss (New York: New York University Press, 2017), 222–37.

⁴¹ The term derives from the smugglers’ practice of concealing illicit bottles of alcohol in the legs of their boots.

⁴² *Variety*, ‘Bootleg “Blue” Records Lure to College Boys’, *Variety* XCIV, no. 13 (10 April 1929): 1.

Many of the recordings that fans were interested in collecting had been produced in low numbers by small or unstable companies, and major labels like RCA Victor and Columbia were not interested in keeping obscure records in production. Collectors' magazines sprouted up in the 1930s in response to the growing public interest, and this, in turn, boosted the collectors' market, with the value of individual recordings being determined largely by their rarity. Bootleggers began supplying the demand, sourcing and reproducing rare and deleted works without incurring any legal reaction.

Collecting and bootlegging, from the outset, existed in paradoxical symbiosis: fan culture depended on bootlegging, and yet bootlegging undermined the rarity value of the recordings it supplied. The relationship highlighted the long-term commercial value of a back catalogue at a time when the music industry still treated recordings as products of the moment, aimed at contemporary markets and abandoned as consumer tastes shifted.

By the late 1960s, the availability of quality portable recording equipment and cassette tapes meant that an increasing number of unauthorized recordings of live events began to surface. Bootlegs became a valuable commodity in the shadow cultural economy of fan culture that sat – from the perspective of the industry, at least – uncomfortably alongside the more mainstream commercial channels of popular music. It was an economy that relied on an honour system, where those who received tapes from fellow traders and collectors made multiple copies to pass on to others within the community, echoing the sharing culture of many other anti-commercial groups and in particular, the hacker code that had so incensed Bill Gates.

'Home Taping Is Killing Music', cried the British Phonographic Industry (BPI) as the 1980s dawned and twin cassette decks and blank tapes became more affordable, which in turn domesticated music duplication.⁴³ A few years earlier, in 1977, the BPI had estimated that the industry had suffered around £75 million in losses through lost revenue to home taping. A study released by CBS went further, blaming home taping for the loss of hundreds of millions of dollars of record sales, and industry commentators began to predict the death of music just as surely as Gates had predicted the death of professional software.⁴⁴

⁴³ Kathleen McConnell, 'The Handmade Tale: Cassette-Tapes, Authorship, and the Privatization of the Pacific Northwest Independent Music Scene', in *The Resisting Muse: Popular Music and Social Protest*, ed. Ian Peddie (Aldershot: Ashgate, 2006), 163–76.

⁴⁴ Andrew Bottomley, "'Home Taping Is Killing Music': The Recording Industries' 1980s Anti-Home Taping Campaigns and Struggles over Production, Labor and Creativity', *Creative Industries Journal* 8, no. 2 (2015): 123–45.

It was a hard-hitting message that had little impact. It was at odds with consumer experience, who viewed home taping at worst as a victimless crime, but largely, thanks to the subversive DIY ethic of punk, primarily as an expressive and creative act. A whole culture and social infrastructure grew up around the mixtape,⁴⁵ allowing music lovers to spread the word about what they liked, to make statements about themselves or to reinvent themselves to others, or, in the days before the complex personality-matching algorithms of internet dating, to tentatively sound out the personal qualities of a potential life partner. The counter-slogan of mixtape culture? ‘Home Taping is Skill in Music.’⁴⁶

Home taping did not kill music, just as VHS did not kill the theatrical movie release. The emphasis of the rhetoric was wrong. It wasn’t music itself that was under threat, but the commercial framework that surrounded it, and here, amateur taping and informal distribution did, slowly, begin to change the way that commercial music was produced and distributed: streaming content, peer-to-peer file sharing, aggregators, online music collections like the HVSC and netlabels have all changed the way we access and consume music, and all have their roots, at least in part, in the digital underground.

Rather than move with the times, however, and embrace and adapt to disruptive technologies and changing public attitudes towards content, particularly as music became decoupled from physical media and labels could no longer justify charging consumers for simply accessing content, the industry reacted slowly and heavy-handedly, targeting the technology and the cultures of practice that grew up around them. As early as 1974, the BPI had threatened legal action against ‘hardware manufacturers whose advertising of tape equipment emphasises its potential for home-copying of copyrighted material such as recorded music.’⁴⁷ Ten years later, the BPI made formal complaints to both the Advertising Standards Authority (ASA) and the Independent Broadcasting Authority about Amstrad’s advertising for their music centres, which highlighted the ease with which its two-in-one cassette deck could duplicate tapes. Their complaints were dismissed. The ASA pointed out that it was not unlawful ‘to advertise [the] features and capabilities of lawfully constructed appliances’.⁴⁸

⁴⁵ For a discussion of mixtape culture and video games, see Michael L. Austin, ‘From Mixtapes to Multiplayers: Sharing Musical Taste Through Video Games’, *The Soundtrack* 8, no. 1–2 (2015): 77–88.

⁴⁶ Bob Dormon, ‘Happy 50th Birthday, Compact Cassette: How it Struck a Chord for Millions’, *The Register*, 30 August 2013, accessed 8 April 2020, www.theregister.co.uk/2013/08/30/50_years_of_the_compact_cassette/.

⁴⁷ Bottomley, ‘Home Taping’, 234.

⁴⁸ Bottomley, ‘Home Taping’, 235.

What the BPI was trying to do, of course, was protect the interests of its members, but it was doing it by demonizing the fans who were their bread and butter, in the process stoking mistrust and disenchantment that would further erode the sell-through music market. It was a counterproductive attack aimed in the wrong direction. A survey by tape manufacturer Maxell, for example, showed that 'premium' cassette users, those who were apparently killing music, actually bought twice as many records as non-tape-users,⁴⁹ lending some credence to the notion that – amongst the fan community at any rate – collectors are likely to seek illicit copies for consumption to augment legitimate hardware and software that is bought for archival purposes.

Conclusion

Chiptune exhibits several significant links to and parallels with other, established areas of cultural practice. In particular, the increasing commercial pressures of video game development contributed – in part – to a schism between the production and consumption of video game music: this led, on the one hand, to an increasingly corporate and professionalized approach that has seen video game soundtracks evolve to become a tightly produced and interactive form of media music, and on the other, to chiptune becoming one element of a manifestation of a set of co-operative and anti-commercial community values that can trace its roots back through computer hacking to the bootleggers who supplied content for the early record-collecting community.

That anti-commercial ethos, however, and the pervasive culture of sharing, not just within the chipscene, but more broadly within the different subcultural groups that lurk beneath the increasingly corporate digital mainstream, certainly poses a challenge: as Bill Gates noted, who will create professional content – be that music or games or productivity software – if nobody is prepared to pay for it? History, however, suggests that content will still be produced both commercially and – to a very high standard – within deprofessionalized communities like the chip music scene.

That anti-commercial ethos, however, does impinge on the community itself, as musicians who invest heavily in the music they produce find themselves unable to recoup that investment by charging for product.

⁴⁹ Maxell, 'People Who Buy Maxell Tape Buy Twice As Many Records As People Who Don't', *Billboard*, 28 May 1983: 29. Similar arguments can be made about video games, where customers often purchased physical media copies for their software collection, and either made or sourced copies to play.

Perhaps more significantly still, the anti-commercial ethos provides the rationale for the continued adoption of stringent music DRM, which commercial publishers use to protect their intellectual property (IP). Again, however, history has demonstrated that while DRM may well reduce casual sharing, it seems to have little impact on piracy; instead, it primarily inconveniences legitimate customers by limiting what they can do with their legally purchased content.⁵⁰ As Dinah Cohen-Vernik et al. discuss, since DRM-restricted content is only ever purchased by legitimate users, only they ‘pay the price and suffer from the restrictions . . . Illegal users are not affected because the pirated product does not have DRM restrictions’.⁵¹

Contrary to conventional wisdom, then, it seems that because DRM restricts the legitimate buyer, thus making the product less valuable, and increases the cost of the product, the effect is that fewer people are willing to buy; instead they make an active decision to source their music illegally. That inconvenience may also play a role in driving new listeners to grass-roots subcultures like the chip music scene, where sharing is the default, and the boundaries between creation and consumption are less distinct.

But what of those scenes today? Interestingly, while both the chipscene and the demoscene evolved both conceptually and technically from video game hardware, it is the social and performative expressions of that hardware that have seen both scenes flourish into vibrant contemporary movements.

A hacked Nintendo Game Boy took the sound of chiptune from the desktop to the stage,⁵² and created a new generation of chiptuners who brought with them new musical influences, particularly the sound of contemporary electronic dance music, giving the chip sound a harder, more aggressive edge.

In the intervening years, the scene has grown in scale – thanks largely to social media allowing geographically remote performers and audiences to form communities of practice – and in significance; the lo-fi sound of chip music has been adopted by a number of major commercial acts, including Beck, Kraftwerk and Jme.

⁵⁰ Cory Doctorow, ‘What Happens with Digital Rights Management in the Real World?’, *The Guardian Technology Blog*, 6 February 2014, accessed 8 April 2020, www.theguardian.com/technology/blog/2014/feb/05/digital-rights-management.

⁵¹ Dinah Cohen-Vernik, Devavrat Purohit and Preyas Desai because, ‘Music Downloads and the Flip Side of Digital Rights Management’, *Marketing Science* 30, no. 6 (2011): 945–1126 at 1011–27.

⁵² See Kenneth B. McAlpine, *Bit and Pieces: A History of Chiptunes* (New York: Oxford University Press, 2018).

In a similar way, interest in the demoscene has surged, reaching a peak of activity in the early 2010s, with the informal DIY parties of the late 1980s and early 1990s growing to become huge international stadium events attended by tens of thousands of people, all gripped by the spectacle of competitive creative coding.

Ultimately, however, while there are links in both chiptune and the demoscene with hacking, bootlegging, mixtapes and gaming, both groups exhibit a collective and very distinctive form of self-identity, and by staying true to their core ethos – of using technical constraint as a mechanism through which to explore creative expression – they demonstrate that there is value in creative ideas distilled down to their most fundamental form and expressed well.

Few members of the chipscene would disagree that a big part of chiptune's appeal comes from it being unconventional and musically heterodox, both in terms of its production and its sound, and these are characteristics that I think demonstrate that these scenes are distinctive and well-established subcultures. Chiptuners and demosceners are quite happy to occupy that space. After all, as one unnamed blogger is quoted as saying in an article in the *Pittsburgh Post-Gazette*: 'Hoping to god this genre never goes mainstream. It's too [expletive] brilliant to get run over by the masses.'⁵³

⁵³ Dan Majors, 'Artist of the Chiptunes Genre Featured at Unblurred', *Pittsburgh Post-Gazette*, 2 June 2012, accessed 8 April 2020, www.post-gazette.com/ae/music/2012/06/01/Artist-of-the-chiptunes-genre-featured-at-Unblurred/stories/201206010264.