

IN PURSUIT OF IMPERFECTION

The Affordances of Lo-Fi Production Techniques & How They Are Applied in Contemporary Electronic Music

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ABSTRACT

Decades after advancements in music technology delivered affordable, high quality production tools to the masses, lo-fi production techniques and aesthetics retain an enduring appeal for electronic musicians; this study seeks to better understand why, defining a framework of five key areas through which the topic can be explored.

In the context which it appears in this document, the term “lo-fi production techniques and aesthetics” refers to those artefacts and approaches which were once very difficult to avoid when producing music but which now, being no longer unavoidable, are deliberately introduced for artistic purposes.

Although important research into this field exists, this specific area of study remains underexplored and provides serious potential for additional investigation. The work of theorists such as Brøvig–Hanssen and Danielsen (2016), Théberge (2001), and Harkins (2019), reveals much about the complex relationship between music technology and those who use it. This study explores the work of creators through their own words, focusing not on the effect the interaction between musicians and music technology has upon society as a whole (the way in which it has affected distribution, consumption and attitudes towards music, for example), but upon the fertile ground relating to the actual aesthetic appeal of music technology and what motivates artists to gravitate to specific tools of the past, particularly when so many more modern, theoretically superior alternatives are so readily available..

INTRODUCTION

Throughout the history of music technology, it is generally possible to divide the effects created by a piece of equipment or tool into two areas: those which are intentional (and, therefore, desirable) and those which are unavoidable (usually as result of some inherent limitation of the technology itself). As technology has grown increasingly powerful and capable with each passing decade, from wax cylinders to phonograph records, magnetic tape to digital media, many of the obstacles which created noticeable traces in early iterations of a tool are overcome or mitigated via countermeasures subsequently developed to mask or bypass these deficiencies, but that which is seen as a lamentable shortcoming by one group of practitioners is often celebrated by another. It is upon this latter area which this study seeks to focus.

It should be noted that this study is particularly focused upon the period following the introduction of non-destructive audio editing, alongside the introduction of the Digital Audio Workstation, which developed to the point where, in 1996, Steinberg introduced the concept of Virtual Studio Technology in their third iteration of flagship DAW, Cubase. The Software Development Kit that accompanied the introduction of the VST standard created the basis for the ecosystem of virtual instruments and effects which remains dominant today, although the processing of MIDI was not possible until 1999 and the release of VST 2.0. Notably, this lack of provision for a unifying inter-application standard, allied with the sheer diversity of hardware devices software engineers are required to support, which continues to hold the Android mobile platform back in music-making terms. Apple devices benefit from the Audio Unit Version 3 (AUv3) standard, which replaced the now-deprecated Inter-App Audio (IAA) framework; Android, on the other hand, has no comparable standard. The significance of the interconnectivity between applications that the introduction of VST provided cannot be overstated and it is especially relevant to key areas of this discussion where practitioners refer to using (or electing pointedly not to use) plugins to replicate the behaviours of lo-fi tools and techniques.

As Brøvig–Hanssen and Danielsen (2016) point out, although the process of the mediation of music has been referenced in some studies, these tend to focus upon the sociological perspective

and the effect that digitisation has had upon the music industry itself (the way music is distributed, marketed, obtained, consumed) and how that in turn has affected society. The ongoing digitisation of life continues to fuel studies into digital media distribution and music technology is clearly relevant to such conversations. How something can at once be disposable and yet intangible, what virtual ownership means, and what effect this has upon society at large, have been just some of the recurring themes of studies since the late 1990s. What these studies rarely focus upon, however, is the way in which these forms of digital distribution affect the music itself.

Brøvig–Hanssen invokes Marin (1991) and the concept of transparency and opacity within mediation, which provides a vital tool for this study. In this metaphor, mediation can either be transparent (the window, not being the focus of the gaze, simply enables one to regard the view beyond it) or opaque (scratches and blemishes upon the glass announce the presence of the window itself, rather than providing an unspoiled vantage point of the view beyond it, drawing attention to itself and away from outside). This concept is most useful and explains the desire to achieve digital perfection whereby traces of the medium upon which something is recorded, for example, are entirely absent upon playback. Some windows are intended to provide a view, others exist to offer light; both are valuable and appropriate, depending upon the circumstances. Where Brøvig–Hanssen focuses upon digital signatures, this study seeks to examine the appeal of lo-fi aesthetics as a whole and explores why, when transparent tools exist, opaque methods, both in actual (physical) and virtual (simulated) senses, continue to appeal.

Glasgow (2007) refers to the transparency of recording media specifically in relation to hi-fi and lo-fi discussions, highlighting that it is in the nature of the recorded music industry to constantly proclaim current technologies to be the best yet, only to deride them as inferior to their inevitable replacement products, such is the nature of consumerism. Also notable in Glasgow's work is an examination of the various theories surrounding what the purpose of recorded media is and what a listener's expectations are. Here, transparency is used to gauge the accuracy in which a recording faithfully conveys a performance. Where this study deviates most significantly from such concepts is that the notion of capturing a performance cannot account for music which is not performative (non-linear recordings), relies upon technologies which mean that it could never be performed live in the traditional sense (multi-track recordings, studio techniques, solo

recordings whereby a single individual plays all instruments and creates all sounds). To return to an earlier point, this is because such studies focus upon the nature of recorded music from the perspective of the listener.

The history of popular music production can be told as a series of stories about how technologies and ways of using them overlap with innovations in musical practice and style.

(Brett, 2019, p. 179)

It is possible to discern myriad ways in which technological innovations have influenced the development of music, from the advent of multi-track recording and the revolution it heralded, through to the development of autotune and beyond. The process is neither unidirectional nor linear, however. New genres and techniques create the need for new tools; new tools provide the scope for new genres and techniques. At any point, technologies largely seen as outdated and inferior can be adopted by new generations or new genres, as enamoured by their deficiencies as others are contemptuous.

Had the creators of video game music in the 1970s and 80s been provided with the option to create music in higher fidelity and with fewer limitations than the 8-bit programmable sound generator (PSG) chips native to arcade and early home gaming systems of the time allowed, it is likely that many of them would have chosen to do so. That contemporary chiptune producers elect to eschew the plethora of developments in music technology introduced in subsequent decades highlights that, whilst undesirable to many, these limitations, and the sonic trademarks they created have a great many celebrants.

The key question that sits at the heart of this study is that of why, when tools which enable the creation of the highest quality musical productions are as affordable as they have ever been, are the sounds of technological failure or sonic inadequacy still appealing?

To create a piece of work which provides the possibility of drawing meaningful conclusions, it is important to identify limitations. The guitar amplifier technique employed by Jimi Hendrix (“diming the amp” by turning all the dials up to the maximum in order to generate overdriven distortion) fits squarely within the topic of “the sounds of technological failure” but, as his output

was cut short in 1970, it clearly falls outside the period in discussion. It should be noted that the musicians whose output and methods are explored within this work are all currently active.

Having outlined the overarching question, the object is then to identify additional areas of similarity and difference with the intention of developing a framework for further discussion and analysis. Additional questions therefore become important.

What specific lo-fi techniques are being used?

Why are they particularly attractive to the musicians in question?

How does the use of technology inform their process?

The answers to these questions allowed for the categorisation of results into the five areas around which this study is organised: limitations of the medium for artistic effect; conforming to genre ideals; nostalgia for lived pasts and lost futures; the signature of unpredictability and the sound of failure; technological primitivism. This is discussed further in the Methodology section where an explanation of how these categories came to be defined also appears.

Any study into the use of music technology is not that of statistical data and hardware specifications, regardless of how many such elements it might include or how important such information might be, it is the story of people; those responsible for creating the technology and those who choose to use it.

This study really began in 1988 when a £10 WH Smith voucher became a cassette copy of Stylus Music's *Hip-Hop and Rapping in the House* compilation which was allied with a red, Phillips personal cassette player, accompanying sponge-clad headphones and an incalculable quantity of AA batteries.

If one were to compile a list of all the equipment used in the creation of those 20 tracks, it would feature many the machines and approaches mentioned in this study. In 1988, this was not regarded as lo-fi music on any level, utilising the kind of hardware which, although edging ever closer to affordability, would remain beyond the reach of average musicians for several years yet. Although after the introduction of affordable home recording, thanks to the introduction of the 4 track cassette in 1979 with TEAC's first affordable multitrack unit, the Tascam 144 Portastudio, this release predates the digital home studio era which would arrive with the

introduction of Steinberg's *Cubase* in 1989, Mark Of The Unicorn's *Digital Performer* in 1990 and Digidesign's *Pro Tools* in 1991. These recordings were tracked out in high-end studios using state-of-the-art equipment. Such is the nature of technology; the units in question are now widely regarded as lo-fi relics, although not universally, and it is the intention of this study to explore what motivates contemporary electronic musicians to embrace them and their inherent deficiencies still.

Harkins (2019) builds upon the social construct theories of technology popularised by Bijker and Pinch (1984), particularly highlighting the concept of *interpretive flexibility*, whereby the original designer of a device desires it to service some specific need or serve a particular purpose and imbues the tool with a set of functions, but, when placed in the hands of the end user, these functions are often applied in previously unexpected and unimagined ways.

Taylor (2001) acknowledges the difficulty in placing music technology within established frameworks such as actor-network theory or structuration theory because either top-down or bottom-up models run into severe difficulties when more complex technology is concerned. Whereas, Taylor suggests, more simple, single purpose technologies (door handles, for example) can be more easily fitted into a structural model, technologies which have more an eclectic range of use are far more difficult to accommodate. It becomes very difficult to argue that the technology can dictate how it is used, or that the user can dictate what the technology. Both things are both simultaneously true and false: the technology can dictate how it was designed to be used, but not what other uses it may be put to, just as the user can dictate how they wish to utilise the piece of technology but cannot dictate what functions are built into it.

Additionally, how the tool is used at the time of release may well change over time as the qualities it has reveal themselves to be unusual, exemplary, or generally desirable for reasons which were often unforeseen (and unforeseeable) at their inception and time of release. Just as "the funky drummer," Clyde Stubblefield, couldn't have imagined how influential his recorded performances in the 1960s would become to the creation of hip-hop in the 1970s and 1980s, and the Winstons could not have foreseen how their "Amen Brother" drum break would help to birth to an entire musical genre in the 1990s, Roland were entirely unaware of the role their TB-303 Bassline synthesizer or TR-808 and TR-909 drum machines would go on to become in the

creation of a myriad of musical genres in the years following their release, from house and techno to Miami bass, ghetto tech, trap and beyond.

Advancements in music technology cannot exist independently of developments in musical production techniques and genre, but the line between blazing new trails and the notion of giving the people what they want always presents itself as a difficult balancing act to negotiate. A product which is deemed to be too ahead of its time can fail to find a market which ultimately could have severe consequences for the company producing it; a product that adheres too strictly to current trends could offer too little beyond the scope of existing products and therefore fail to enthuse and inspire the intended audience (again, with potentially dire commercial consequences). Whereas products like Moog's Minimoog Model D and ARP's Odyssey represented well-timed moves towards placing affordable tools in the hands of musicians (previously unable to attain the heights of the huge Moog modular system or similarly out-of-reach ARP 2600) both companies subsequently experienced first-hand the catastrophic consequences of developing products that were too out there for the market to embrace.

Methods

To explore the question of why, when tools which enable the creation of the highest quality musical productions are as affordable as they have ever been, the sounds of technological failure or sonic inadequacy are still appealing, an approach which embraced both primary and secondary sources was employed.

The latter comprising books, articles, and scholarly research; the former including first-hand interviews with artists and software developers, interviews via journalistic articles and direct recordings of artists via podcasts and other available media sources. In addition, some close textual analysis of music was also necessary, and the study draws upon first-hand experience of many of the technologies discussed within it, both hardware and software. Having identified artists who were either renowned for their use of lo-fi techniques or for the perceptible presence of a lo-fi aesthetic in their work, the next step was to establish differences between their respective choices. This allowed for the creation of loose bracketing which became more codified into the five areas which became the central pillars of the study.

When examining what specific lo-fi techniques were being used it became clear that there was a distinction between those who had ideological connections to the equipment itself and those whose concerns were solely aesthetic. For example, some producers sought the sound of classic hardware samplers whereas others felt that using anything other than the actual vintage units themselves was a compromise they were unwilling to make. It is interesting to note that there was very little evidence of these perspectives being in any way prescriptive insofar as the musicians were unconcerned whether others adopted the same working methods or followed the same rules as they did. Discovering that the producers they had originally modelled their sound and approach on no longer used the revered units was of no conceptual importance and it is very difficult to suggest that it had any impact on how much they enjoyed their subsequent work, particularly as so many additional contributory factors existed.

Having determined that there was a clear distinction between the appeal of the ideological and the aesthetic, it was possible to look at why these approaches were particularly attractive to the individuals. This revealed a difference between those enamoured by the sound itself (notions of certain techniques or pieces of equipment just sounding “right”) and those who sought to imbue their work with a sense of nostalgia, evoking a specific feeling or emotion connected with certain experiences or periods of time. It is interesting to note that many of those upon whose shoulders modern theorists stand are practitioners as much as academics. As it pertains to the nature of this subject, this is a salient point.

Although others may have contemplated what potential new timbres, tones and musical forms as-yet-unimagined instruments might afford them, it was Edgar Varèse who publicly (literally: in public, as part of his lecture series) pondered the way in which “instruments obedient to my thought and which with their contribution of a whole new world of unsuspected sounds, will lend themselves to the exigencies of my inner rhythm.” (Varèse, 1966, p. 11)

This tradition of artists examining their own practices to better understand their motivations and assess the successes and failures inherent in their workflows is an established characteristic of artistic growth. Although not always as analytical and thorough as Varèse, interviews with contemporary electronic composers often touch upon the concepts behind their latest work or engage in a discussion regarding those guiding principles which informed it. Frequently, although often dismissive of their own talents and exploits, artists are keen to expand, at length

and with what we are given to assume is much apparent transparency, about their working methods and artistic decisions. Regarding this study, this point is also significant.

An assessment, often by the practitioners themselves, of the working practices of contemporary electronic music production lies at the heart of this research. The accompanying documentary features material collated from a disparate array of sources; the resulting film being a tapestry of curated extracts from existing footage rather than interviews undertaken specifically for the purpose. That such interviews are available is a notable signifier of both the times in which the study takes place and the nature of the artists whose work and practices it documents. It is possible to suggest that this is a study which could not have taken place at any other time. It is, in a manner akin to the music created by those upon whom it focusses, both of its time and about it.

Just as the personalities in the documentary reveal their processes (not only their own words, but with their literal voices) so do their processes reveal their personalities. Does the nature of Stefan Goetsch (better known as Hainbach) mean it was inevitable he would gravitate towards reel-to-reel tape, vintage lab test equipment and the more esoteric electronic instruments? Or is the reverse, that the tools he uses define who he is an artist, true?

In attempting to answer these and other associated questions, distinct themes arose. Five key concepts emerged: loose categories under which the motivations of individual practitioners could be identified. These five concepts stand as the pillars upon which this study is constructed:

- Limitations of the medium for artistic effect
- Conforming to genre ideals
- Nostalgia for lived pasts and lost futures
- The signature of unpredictability and the sound of failure
- Technological primitivism

One additional motivation which was considered is what can be categorised as “the aesthetics of necessity” or the ethos of “do what you can with whatever you have.” Although not directly covered by this study, it is an extension of three areas: technological primitivism; limitations of the medium for artistic effect; and staying true to genre ideals. Whilst the other options are deliberate aesthetic choices, the affordability of modern high-fidelity options makes it problematic to argue that lack by necessity is a valid motivation in the post-compromise era,

particularly amongst the artists being discussed. Whilst this may have been more appropriate in previous eras, the nature of production tools in the modern era is such that a £4 app such as Elf Audio's Koala Sampler (which can be installed and successfully operated on a vast array of iOS and Android devices) provides access to the kind of functionality and sound quality that would have cost thousands of pounds in the 1990s and at least several hundred in the 2000s.

Interestingly, the TEAC engineer responsible for giving the Tascam Model 144 the title Portastudio (which, in a similar way to how "Moog" became a stand-in term for any synthesizer, regardless of brand, much of the general public referred to portable cassette-based multitrack recorders) was Andy Bereza. A key figure in audio technology for his work with Allen & Heath, TEAC, Fostex, Bandivè and others, Bereza is also father to Marek, creator of the Koala Sampler app which seeks to put sampling technology in the hands of as many people as possible in much the same way as the Portastudio (and various other "portastudios") brought affordable multi-track recording to the masses.

It is outside the scope of this study to discuss the ubiquity of mobile devices as it pertains to the nature of society in general, but it is important to note that, in an era where powerful touch-screen computers are readily available to the vast majority of those who wish to access them, anyone currently using devices which are incapable of producing audio of at least CD-quality does so because they have elected to, not because the option was unavailable to them.

It is important to note that the categories identified are not mutually exclusive, with multiple categories being applicable to both approaches and individuals alike. There is overlap between the nostalgic appeal of hardware samples and their inherent technological limitations compared with modern alternatives, for example. It is difficult to imagine this not being the case.

WORKING DEFINITION

Historical origins of “lo-fi”

The sonic *leitmotif* of bygone eras (vintage musical equipment, recording and production techniques) stands as a cultural touchstone. Just as enthusiasm for retro sporting shirts, analogue cameras and 8-bit videogames have become recognisable traits of a social-media driven collective twenty-first century identity, the adoption (or simulation) of outmoded musical *modus operandi* is similarly well-established (Pinch & Reinecke, 2009). Although it is etymologically accurate to assert that the origin of the phrase “lo-fi” can be clearly traced, and is irrevocably connected, to its elder, more socially acceptable sibling (“hi-fi”), as the term enters its fifth decade, the time for it to be defined by that which it is not has surely had its day.

The genus of the term lo-fi appears to be the introduction of the hi-fi and lo-fi soundscapes concepts by Schafer (1977); the former being akin to the quiet ambiance of the countryside, with landscape allowing distant sounds to be heard more easily (just as the uninterrupted topography of the countryside allows objects which are further away to be more easily seen); the latter being analogous to the city, with an abundance of noise that serves to obscure distant sounds and blend them into elements of a broader sonic stew (just as the wealth of buildings and other human constructs obscure views of the horizon). These concepts are interesting as starting points, but do not necessarily serve to help this study. Hi-fi = clarity; lo-fi = congestion, is an outdated, simplistic model, which is intended not as a slight upon Schafer’s work, but an acknowledgement of the advances made, and avenues explored in the decades since its publication. Schafer still has relevance to this study, however, as his description of the immediacy of the lo-fi soundscape (“everything is present at once”) highlights one of the reasons contemporary practitioners are drawn to it. Schafer saw lo-fi as being undesirable, which locates his views with some degree of chronological accuracy. Notions such as kitsch came to apply to aspects of digital culture which simply did not exist at the time.

The overkill of hi-fi gadgetry not only contributes generously to the lo-fi problem, but it creates a synthetic soundscape in which natural sounds are becoming increasingly unnatural while machine-made substitutes are providing the operative signals directing modern life. (Schafer, 1977, p. 91)

Although this study will not explore the concept of lo-fi as a genre, it's interesting to note that Schafer's observation of how "Moozak reduces music to ground. It is a deliberate concession to lo-fi-ism" is oddly portentous of a style of music which effectively embodies and celebrates two elements he found so utterly distasteful. We can conclude with certainty that Schafer does not subscribe to the eternally revolving YouTube playlists providing "lo-fi beats to relax and study to".

What is most valuable about the original definition of lo-fi as being the undesirable, cheaper-to-achieve opposite of hi-fi is that it highlights the forward-thinking nature of audio technology at the time. The recording of music, having moved on from wax or celluloid cylinders and wire recorders, had been centred upon magnetic tape since the 1940s, constantly striving for better, clearer sound at increasingly affordable prices. Although the arrival of the cassette tape in the 1960s made home-recording a much more realistic prospect, there was the natural pay-off versus its high-quality reel-to-reel forebears (unsurprising, considering that the format reduced the width of the magnetic tape from 2 inches to 1/8"). The drive to improve this sound quality, the relentless quest for the highest possible fidelity, remained ever-present, with Dolby introducing noise-reduction technology within a few short years of the cassette tape format appearing. The advent of digital recording, which would announce a new era of sound technology, was still around the corner, arriving in the 1980s, which is an important milestone to note when contemplating the early derision of lo-fi.

Digitalization

In terms of sampling technology, although British musician and innovator, Peter Zinovieff, had created the EMS Musys in 1969, and the more popular Synclavier had appeared in 1975, the first commercially available digitally sampler, the CMI (Computer Musical Instrument) Fairlight, was still some years off (not appearing until 1979) and these units were vastly out of reach of all but the most affluent. More prevalent were units like the Chamberlin and Mellotron, which had been around since the early 1960s, but the same characteristic facets which now make such units

desirable (a tendency towards slipping out of tune, inconsistencies of sound across the keyboard) would come to be regarded as negative traits before the 1970s ended.¹

During the 1980s the progress of digital sampling would be meteoric, leaving an indelible mark on music production, but, just as the plight of Moog and ARP had illustrated previously, ascent to and descent from the heights of success could be equally rapid. E-Mu and Ensoniq, two companies responsible for releasing some of the most iconic hardware samplers in the mid-1980s, would, before the 90s ended, be acquired by games-focused personal computer audio interface manufacturer, Creative Technology, and consigned to the history books.

The important distinction regarding digital sampling and recording is that, until accurate audio fidelity was achievable and affordable in home studios (taking that to mean, for the purpose of this study, the introduction of the Red Book CD standard in 1980 which established 44.1kHz sample rate at 16-bit resolution as the yardstick) the primary focus of many audio technology companies was twofold: to continually push the limits of audio recording and reproduction capabilities; and to reduce the cost of audio recording and reproduction equipment.

The process of digitalization, as Théberge (2015) states, cannot be seen as some overnight process, heralded by the introduction of one single technological development, but instead should be viewed as lengthy, gradual, and disjointed. A “process through which both musical and technical possibilities have reconfigured one another” (Shepherd and Devine, 2015, p. 300)

Recording audio on videocassette at 44.1kHz and in 16-bit quality became possible in 1979 and by the 1980s PCM (Pulse-Code Modulation, a method of allowing analogue audio to be recorded digitally) units had become popular in recording studios, largely replacing the 2” analogue tape models which had dominated the industry for several decades. 1987’s introduction of the Digital Audio Tape (DAT) would bring high-quality 2 track recording to a more compact format and by the early 1990s ADAT (Alesis Digital Audio Tape) made it possible to use to S-VHS cassettes for 8-channel multi-track recording.

¹ For many years, prog-rock keyboardist, Rick Wakeman, was rumoured to have set fire to his Mellotron in a fit of pique and frustration. This has been since refuted by Wakeman himself in numerous interviews, but the sensationalist anecdote, as is their nature, continues to persist.

This is not merely incidental history. It is essential information to consider when understanding the changing relationship that the audio community has had with lo-fi technology.

Towards the end of the 1980s and early 1990s, advancements in recording and sampling technologies were clearly leading towards a convergence of the twin aims, with increasingly high-quality audio being available in more affordable units. The home computer had a key role to play in this. Between 1989 and 1991, saw Digidesign's *Sound Tools* (a forebear to *Pro Tools*) and Steinberg's *Cubase* would arrive on Mac and Atari ST, respectively. By the mid-1990s, hard disk recording, non-destructive editing and a slew of technological advancements had become commonplace in the audio recording and processing arena; by the early 2000s, the Digital Audio Workstation (DAW) was firmly established, and a new digital era of home-recording had arrived.

As McLuhan stated in his 2003 lecture: “we live simultaneously in all the cultures of the past. All of the past is here, and all of the future is here. This is a peculiarity of the instantaneous, the vibes, the acoustic resonance, the acoustic interface which has become the very pattern of our lives.” (McLuhan, 2005, p. 213). In referencing Keats and his views on the importance of the multitude, McLuhan also engages with the theory of music as a conversation between now and the past indeed between all pasts and all potential futures. This element is tied closely to one of the five key areas of lo-fi as aesthetic: that of nostalgia, both for pasts (real and imagined) and potential futures, especially those lost to the annals of history-that-never-was, having been promised via science fiction literature and but never delivered.

With the onset of affordable music production tools in the form of myriad compact hardware devices, the ubiquitous software DAW, and even mobile applications for tablets and smartphones, the original motivation for utilising tools with sub-standard audio fidelity (get by with what you can afford) no longer rings true. Where the first hardware samplers offered bit depths some distance short of the dizzy heights of 16 at a cost which placed them many leagues beyond the grasp of anyone other than the most wealthy, modern iOS and Android applications provide a sound quality which is indistinguishable from Compact Disc (so long shorthand for: ultimate audio fidelity) for little more than the price of a cup of coffee. The fact that the devices which are required to run said applications require no small outlay in themselves should not be disregarded, but societal relationships with handheld technology renders this point moot:

smartphones, like broadband connections, have become modern staples, regarded as essentials. For users to be without them is seen as a form of cruel and unusual torture. Contemporary western teenagers, and, ever more frequently, even pre-teens, view the possession of a smartphone as a basic human right.

This brief discussion of the relationship between society and its mobile devices hints at the very heart of one of the most prescient elements of this study: that of the way in which a practitioner adopts, interacts with, and shapes the technology by which it can often be defined. Weber's chronicling of how the introduction of the Walkman created an entirely new way for consumers to experience and interact with music is most revealing in this regard (Weber, 2009). Teenagers adopting the new technology and subsequently embracing the concept of creating their own space (through compilation cassettes, recording from records and a variety of other sources) and then taking that space with them thanks to a set of headphones and this new portable listening device, revolutionised the way music was consumed at the time and laid the foundations for the Discman, portable MiniDisc and ultimately MP3 players to take the fore. All these developments are instrumental to the way in which society has experienced, embraced, and developed nostalgic connections to lo-fi aesthetics, whether through the hiss of cassette, the compression of MiniDisc or the digital artifacts inherent in low bitrate MP3s.

Technological developments have been employed as cultural marking posts since time immemorial: from prehistoric examples like the discovery of fire through the industrial revolution and onwards towards radio, television, the internet and beyond. Geeta Dayal (Grosse, 2019) posits that the history of electronic music is the history of the twentieth century and, when accounting for such elements as the military uses of wire recording and magnetic tape, Leon Theremin's connections to espionage and so on, it is a statement which becomes hard to argue with.

LIMITATIONS OF THE MEDIUM FOR ARTISTIC EFFECT

The first of the five areas this study addresses might be described as desirable failure; where a tool or technological approach has been surpassed in terms of sonic fidelity, but many practitioners feel that the process of improving the quality of a tool has diminished it, removing what they see, not as flaws, but features which provided vital character. As a result, rather than discard these technologies, users embrace them despite supposedly superior alternatives. Key to this concept is the fact that equipment which achieves the original aim of the tool more successfully has been developed and brought to market, but the original tool failed to some degree in a way which made it of interest and therefore desirable to some users.

In the world of audio, sometimes ... noise was undesirable, but other times we thoroughly enjoyed it – such as the sound of 2 inch tape, or certain mic pres. Sure they add noise to the signal, but in certain cases, it's a noise that we find aesthetically pleasing. (Siebum, 2018)

When Roland released the TB-303 in 1981 (Reid, 2004) it was famously intended to be simulation of an electric bass guitar (Bacon, 1982). Just as had been case with the TR-808 Rhythm Composer the previous year, traditional musicians were unimpressed and the market for the new device was slow to build. Designer, Tadao Kikumoto, who had developed the TR-808 and would go on to design its sibling, the TR-909 (another device which was similarly maligned at the point of release) had done both significantly less and a great deal more than he had originally intended. Although the sounds it produced were unsuitable for its original purpose (one might express mild concern about anyone who mistook the tones of the TB-303 for an electric bass) the now iconic synthesizer went on to become hugely popular with electronic musicians who celebrated it for the very qualities that caused it to struggle to replicate accurate bass guitar sounds. Just as the TB-808 Rhythm Composer was a failure if viewed as a like-for-

like replacement for an acoustic drumkit, the TB-303's failure to be a guitar was another glorious success, not only for Kikumoto², but for electronic musicians and electronic music itself.

It would be easy to dismiss mentions of these instruments as outside the remit of a study on lo-fi production techniques, but they serve to highlight an especially important point. The failure of electronic instruments to fulfil the role they were originally intended to serve has been celebrated by musicians for four decades, at least. That which is rejected by one sector of the public is often embraced by another: many of the pieces of equipment mentioned in this study are indisputable evidence of this. The failure of early samplers to accurately capture the sounds fed into them without introducing artifacts of their own is the reason why they are still revered today. The TR-808 kick drum sound is so iconic that even now, 40 years after release, it is impossible to imagine listening to a vast array of genres and not hearing it (or an approximation of it). The heartbeat of early hip-hop is the chest-pounding kick of the 808; the booming sine wave swells that define Miami bass are the speaker-rupturing 808; the entire low-end of trap beats rely on the swollen thump of the 808. Session musicians in the 1980s, who had been happy with the less leaden-footed bass drum of the 808's forebear, 1977's CompuRhythm CR-78, felt 1981's vintage to be too unrealistic to provide their rhythm tracks. Kikumoto had been, as was to become his nature, very much ahead of his time.

When a sound goes beyond the usual frame of musical reference, it becomes necessary for external descriptors to be called into play. When Michael Karoli, guitarist of kosmische rock pioneers, Can, developed his signature tone it was likened to the noise of a tattooist's needle (Parkes, 2012), the relentless, piercing quality iconically abrasive; when attempting to convey the singular sound of the TB-303 Bass Line synthesizer, one word, entirely abstract in a practical sense, yet with an appropriacy which is beyond question, constantly appears: "squelchy."

In music, noise is the signature of unpredictability, outsideness, uncontrolledness. The 'purest' (technically, the 'least noisy') instruments are also those traditionally used to evoke feelings of innocence, tranquillity, dreaminess and so on. Think of the impotent flute, the (literally) emasculated castrato. Then think of the instruments that always are

² It certainly wasn't regarded as a success at the time, however. The unit was manufactured for just 3 years, but its longevity has meant that subsequent units, such as the boutique TB-03, and virtual versions, ensured that the company did well from the product over a 40+ year span (so far)

used to evoke something-else-about-to-happen, something-about-to-enter-from-outside - the drums, the cymbals, the gongs and the shimmering high frequencies of strings.

One history of music would chart the evolution and triumph of noise over purity in music. The Renaissance looked for clear, pure tones and coherent, stackable voices. Since then, it has been outside all the way, with composer after composer looking for more raspy and complicated timbres. Indeed, if one measured noisiness of instrumentation on a scale of 100, the classical palette would stop at about 50, but the rock palette wouldn't even start until about 30 (and would then continue all the way out to about 90 - a figure constantly rising).

Distortion and complexity are the sources of noise. Rock music is built on distortion: on the idea that things are enriched, not degraded, by noise. To allow something to become noisy is to allow it to support multiple readings. It is a way of multiplying resonances.

It is also a way of 'making the medium fail' - thus giving the impression that what you are doing is bursting out of the material: 'I'm too big for this medium.'

(Eno, 1996, pp. 194-195)

Just as the booming 808 kick became the defining characteristic of Miami bass and the resonant squelch of the 303 gave birth to acid house and acid techno, the digital artifacts inherent in the time-stretching facility featured in the Akai S-series rackmount samplers made an indelible mark on drum and bass. In the decades following the emergence of the genre in the early 1990s, time-stretching has been perfected. Modern DAWs such as Ableton Live utilise near transparent time-stretching techniques to allow users an unprecedented level of control over the length and pitch of their samples with almost no audibly perceptible degradation. For some users, however, this is a step too far. To many, the signature sound of Akai's time-stretching algorithm was not a defect requiring improvement but instead an iconic signifier of innovative producers pushing machines to do more than they were initially intended to. For those still in pursuit of these trademark sounds, assorted options exist.

If the MPC defined the sound of hip-hop in the 1990s, then the S900 and its siblings defined the sound of dance music. (Fintoni, 2016)

London-based hip-hop and drum and bass producer, Pete Cannon, who releases music via his own N4 Records imprint, is renowned for his YouTube videos featuring original Akai S-Series samplers, the S-950 and S-1100, which he sequences using a Commodore Amiga running a software tracker called OctaMED. Far from a purist, Cannon typically creates music in Ableton Live, but the motivation for him to utilise this Amiga/Akai setup appears to be threefold: part of the attraction is undoubtedly an exercise in nostalgia, both for his own early productions (an Amiga was the first tool Cannon used to make music with) and for much of the music he was inspired by - DJ Zinc used OctaMED to create his 1995 classic, genre-defining track “Super Sharp Shooter” for example (Morrison, 2020); another part of the appeal is as a learning tool, whereby the limitations of the setup, the decisions they force him to make, and the techniques he employs to overcome them, inform his DAW production; but the primary reason for the presence of the vintage units in his studio is simply because of the sound they offer. Of course, it is possible to replicate the qualities inherent in these hardware units using modern software tools. D16’s Decimort, Inphonik’s RX950 and waveTracing’s SP950, to name just three, all offer approximations of the S-Series sound with an impressive degree of accuracy. By having a range of software emulations alongside the original hardware devices in his studio, Cannon’s approach is focused upon the aesthetics of this method of production.

This perspective of retaining both the original machinery and the software emulations is common in hip-hop circles, particularly amongst those producers who have been using the hardware units since before they were considered vintage. One such example is Paul Huston (Prince Paul) who utilises software for the convenience of it but retains a “nothing sounds quite like the real thing” outlook when it comes to classic samplers:

When you look at all this new technology, everything sounds very sterile. Everything is clean and super quiet. It kind of lacks something. When I plug [the Akai S-900] in, it's like, "Wow, this is hip hop." It makes a big difference...a way bigger difference than having an MPC or something. It has its own character. (Sorcinelli, 2013)

This is not to suggest that the appeal of vintage equipment is limited to those old enough to remember the original units. “Young artists and designers choose media for their own particular material aesthetic qualities (including artefacts), regardless of whether these are a result of analogue material properties or of digital processing.” (Cramer, 2015, p. 20)

An additional option for those seeking to recapture the original Akai sound without the purchase of an original unit (or, indeed, any kind of purchase at all) is freeware project, Akaizer. Although it has not been updated since 2017, perhaps because its creators feel that the role it served has now been covered and surpassed by more recent options, Akaizer was undoubtedly a labour of love for people who sought to secure that original Akai sound both for use in their own productions and for others to utilise.

It would be remiss to mention the Commodore Amiga without taking the opportunity to link to its relevance to other areas of interest to this study. The Commodore 64 audio chip, known in technical terms as the MOS Technology 6581/8580 Sound Interface Device, has become celebrated in chiptune circles. Referred to simply by the acronym for Sound Interface Device (SID), the chip was developed by Robert Yannes, who, confident in the ability of such chips to provide products of significant importance to the field of music production rather than seeing them be restricted to computer gaming purposes, would go on to co-found Ensoniq and, in doing so, bring iconic hardware samplers such as 1985's Mirage, 1986's ESQ-1 and 1988's EPS-16 into the marketplace. The latter of these units, along with 1990's revised EPS-16 Plus, 1992's ASR 10 and 1997's ASR X, remains one of the most revered hardware samplers amongst hip-hop beatmakers, counting luminaries such as Run the Jewels/Company Flow producer, El-P (Jaime Meline) and The Alchemist (Daniel Alan Maman) amongst their more celebrated userbase.

With Yannes and others gone, Commodore moved away from the SID chip, featuring the Glenn Keller designed MOS 8364R7 chip, referred to as "Paula," in their new Amiga personal computers. Utilising this chip, Amiga owners who did not own expensive external hardware samplers such as the Akai S-Series, were still able to create music with tracker software such as OctaMED. Cannon has mentioned that, although he has a pair of modified hardware samplers now, it was through using the onboard sampling capabilities of the Amiga itself that he cut his teeth in production³. Interestingly, alongside more universally acknowledged options such as the

³ Benjamin Petit, better known as drum and bass icon, DJ Zinc, has spoken on Twitter of how OctaMED was "like being stuck in the matrix" (Petit, 2010) but the popularity of hardware units like the Polyend Tracker are testament to the longevity of this approach.

MPC60 and SP1200, one of the presets included in D16 software's Decimort vintage hardware sampler emulation plugin is entitled simply: Paula.

The attention to detail required to make accurately modelled virtual versions of vintage equipment is such that coders go to extreme lengths to ensure that all the idiosyncrasies of a device are faithfully reproduced. British duo, Dave Spiers and Chris MacLeod, started GForce Software in 2003 with the intention of funnelling their love of vintage synthesizer hardware into virtual devices. Rather than utilising existing core code libraries, GForce elect to model the operational designs and inner workings of the hardware they are emulating from component level, ensuring that any deficiencies inherent in the original hardware synthesizers remain present in their virtual recreations. Other creators have adopted a similar approach. When attempting an accurate modelling of the E-mu SP-12 sampler, John Nolting, who records under the alias Flesh O.N.E., undertook an array of analytical tests, alongside analysis of the original schematics taken from the E-mu service manual, to ensure optimum accuracy (Yeh et al, 2007). Whereas Nolting's research was undertaken as part of his Master of Arts study at Stanford Center for Computer Research in Music and Acoustics (CCRMA), producing a tool which he reserved for personal use, waveTracing founder, Thomas Drugeon, utilised the published research results in the creation of his SP950 device, providing both a free-to-use web-browser-based utility and a downloadable plugin (Drugeon).

As with many areas of this study, it is often difficult to decide under which section certain topics are more suitably located. The notion of chiptunes is one such example, but, since the discussion regarding Bob Yannes and the SID chip appeared within this section, it seems appropriate to place it here.

Lo-fi, eight-bit audio quality grew in popularity for certain music styles at a later date (Vail, 2014, p. 50)

Like visual artists who choose work in low-resolution, blocky, 8-bit graphics, musicians whose work is inspired by the 8-bit sound chips which were commonplace in home video game systems in the 1980s relish both the nostalgia of the format and the limitations it imposes upon them. Like the *Moog Plays The Beatles* album I liberated from my parents' record collection when I moved away to university in my late teens, there is often a kitsch humour to be found in the selection of music an artist chooses to create using this toolset. Unlike Wendy Carlos' ground-

breaking *Switched on Bach*, Marty Gold's 1969 album, although only a year after Carlos' own, is regarded as a novelty record rather than an attempt to legitimise the Moog (and synthesizers in general) by covering well-known songs to illustrate to the public what the instrument could do. For the album, Gold enlisted Walter Sear, a renowned synthesist who had already worked on several albums for Dick Hyman, some of which also featured cover versions of The Beatles songs. With their decidedly easy listening approach, it is not difficult to connect Hyman, Gold and other early synthesizer adopters to music that inspired artists on the Ghost Box artist roster. The nature of the music itself produced on these late 1960s albums was at once very futuristic (the synthesizer was still very much a new and mysterious box-of-many-wires to both fellow musicians and casual listeners alike) and very traditional, frequently relying on cover versions of pop hits to appeal to listeners in the same way Blue Note jazz records would often feature at least one take on a chart-topping hit of the day.

Although chiptune versions of popular or traditional songs obviously exist, the appeal is more about using the nostalgia-drenched sounds of childhood video games than the "I made it a version of X song simply because I could" approach.

For his debut full length release, Californian beatmaker, Donell McGary, known under the chosen name Dibiase (sometimes stylised Dibia\$e) allied his chiptune influences with boom-bap style beats to create an album which, even down to the title, very much wears its heart on its sleeve. *Machines Hate Me* (released by Alpha Pup in 2010) features 15 instrumental tracks that, according to reviews at the time of its release, ask the question: "are we making new memories here or listening to whispers from the distant past?" (d'Apice, 2010) a line which also could be applicable to discussions surrounding hauntology. This raises the important question, however: why should it be that both could not be the case?

Although the appeal of nostalgia is frequently presented as a form of automatic response to a sense of dissatisfaction with the way things are (not purely within the sphere of music, but also in more general terms), "technostalgia" is more than a return to an ideal past, but an attempt to mediate between past and present to achieve a particular sound and feel" (Pinch & Reinecke, 2007). As a culture "addicted to its own past" (Reynolds, 2011) it is only to be expected that contemporary musicians press forward with at least some degree of focus on that which has gone before. Even the most innovative and forward-thinking electronic musicians must be aware of

that which has gone before otherwise it would be impossible to ensure that they do not repeat it. In the same sense, even the most dogmatically puritanical attempt to recreate Bach will be filtered through three centuries of technological advancement (Hennion, 2002) even if that is restricted to the manner in which the live performance is amplified (for those experiencing a concert first-hand), the medium upon which the performance is captured, duplicated and circulated (for those listening to recording), and the manner in which both the instruments themselves have been created and the performers have been taught. It may sound pedantic, but it reinforces the notion that the nature of music technology is such that it must move forward even when it looks back, and vice-versa.

What all these technologies have in common - the TB-303 and its failure to be a realistic bass guitar, the TR-808 and its failure to simulate acoustic drums, the 12-bit sampler and its failure to transparently record and replay the sounds stored within it, the 8-bit sound chip and its failure to accurately represent musical instruments – is that inherent in each of these failures were the traits which would see them live long beyond their original product life cycle. Although the original units are, in many cases, long out of production, having been replaced by theoretically superior models designed to fulfil the same role in a more efficient manner, the original, iconic units remain sought after both literally and virtually.

This clearly relates to the question of why, when tools which enable the creation of the highest quality musical productions is as affordable as it has ever been, the sounds of technological failure or sonic inadequacy retain their appeal. It is an artistic preference, akin in some respects to electing to employ a spring reverb over other reverberation options. The spring reverb cannot hope to replicate a physical reverb chamber, for example. The sound it outputs will always contain a metallic quality that is as desirable to some musicians as it is objectionable to others. These pieces of equipment, whether physical or virtual, each have an undeniable, distinctive character. Their appeal, therefore, is because of their limitations, rather than despite them. The attraction of limitations is a concept which links to the next of the five identified categories, conforming to genre ideals, however, whereas this chapter essentially deals with the aesthetic qualities of these tools and techniques, the subsequent section approaches the concept from a more ideological perspective. **CONFORMING TO GENRE IDEALS**

“DJ Shadow is the Jimi Hendrix or Jimmy Page of the sampler!” declared a promotional sticker attached to the front cover of ‘Endroducing...’ the debut album of Californian hip-hop producer, Josh Davis. The quote, undoubtedly something that self-promotional guru, James Lavelle (owner of the Mo’Wax label which released the record) leapt upon gleefully as soon as he read it, is attributed only to the NME (New Musical Express), a weekly British music journal popular during the period of the album’s release in (1996)⁴. Without straying too far into the murky waters of whether the general record-buying, NME-reading public needed this analogy to legitimise the sampler in some way, what was clear from the comparison is that Davis was doing something with his instrument, the sampler, that was comparably virtuosic to the great guitarists mentioned and the things they could achieve with their instruments. Hendrix and Page needed “just” their guitar (conversations about Marshall amps, head units, stomp-box effects pedals and so on notwithstanding...); Davis needed “just” his sampler.

When approaching the creation of music in a well-established style or genre, artists are faced with a series of options and, whether consciously or not, they make specific decisions based upon how they approach the creative process. The choices here are clear. A creator can either:

- Utilise any tools available to them

or

- Use a restricted toolset based upon predetermined factors

In both instances, the artist may elect to acquire new tools (physical or virtual) to help them with their forthcoming productions. In case of the former, the tools selected could be drawn from any era or style and, significantly, utilised in any manner the musician sees fit to employ them, and, in the case of the latter, the toolset may be restricted to anything for any reason.

In 2000, Grand Royal, the record label created by Adam Horovitz, Adam Yauch, and Michael Diamond (better known collectively as: The Beastie Boys) released a 16-track compilation

⁴ The statement does not appear in the original NME review of ‘Endroducing...’ which is credited to Simon Williams and archived at: <https://web.archive.org/web/20000817212832/http://www.nme.com/reviews/reviews/19980101000116reviews.html> so, one can only conclude that it was taken from either a review from an earlier DJ Shadow release or some broader article in which Davis was referenced.

entitled 'At Home with the Groovebox.' Featuring a mix of artists who had worked with the label previously (Mark "Money Mark" Ramos-Nishita, Cibo Matto, Bis) and friends/personal heroes (Beck, Air, Sonic Youth, Jean-Jacques Perrey, Gershon Kingsley), the album's content was dictated by one central premise: that all songs had to be created solely upon the Roland MC-505 Groovebox. Taken as an isolated experience, there are numerous accounts of such limitations being celebrated, but what of those people who choose to do it for an entire album, an entire career or even an entire genre?

When Josh Davis' journey into hip-hop production began, it was via the intricate DJ mixes he created for Bay Area radio station, KMEL (Wilder, 2010). Utilising a 4-track tape recorder, a pair of turntables and DJ mixer, he would go on to create both the demo tape which would attract the attention of Mo'Wax head, Lavelle, and his first releases on the label (in addition to the work he released on Dave "Funken" Klein's Hollywood BASIC imprint). When he felt that he had taken this approach as far as he could, he took the next logical step for somebody whose sound was created from sequenced fragments of the music of others: he bought a sampler. The unit in question was an Akai MPC60 – a piece of equipment that has come to be revered in hip-hop circles in a fashion shared by a select few now-legendary samplers (the E-mu SP-12 and SP-1200, the Ensoniq series (EPS, EPS 16+, ASR-X) and precious few others).

In an interview shortly after signing to UK-based record label, Ninja Tune, Vaughn Robert Squire (known by his hip-hop production alias, Sixtoo) remarked that "I just wanted to sample records and was very concerned about the process of true school hip-hop records. And I think I clung to that for a lot longer than I should have, in terms of my growth as a musician." (Wheeler, 2004). It is interesting to note that Squire acknowledged the bonsai effect that such restrictions can have upon an artist, forcing them to remain in a state of artistic arrested development. His use of the phrase "true school" refers to the essential tenets of a concept which is sacrosanct in hip-hop culture: the importance of "keeping it real."

The rules of hip-hop are not to be found in any book. There is no sacred text wherein it is written that:

- One must only sample from vinyl records, and, even then, only from original pressings (no represses)
- One must not sample from other hip-hop artists

- One must solely use hardware samplers

Yet, in the late 80s and early 90s (a period described by some as hip-hop's second golden era) these are all elements which became incontrovertible regulations set in stone for all to follow, the breaking of which was to break not only with tradition but to disrespect the culture. There are many other rules, of course, but taking these as examples it is possible to assume that the first two are matters of principle (something which will be returned to later) but the third is more difficult to locate. There is an extent to which it could also be seen as another convention, yet it also has a significant aesthetic element to it which is of paramount importance.

Hank Shocklee, part of The Bomb Squad production team responsible for Public Enemy's ground-breaking contributions to hip-hop, touches upon two elements behind the appeal of hardware samplers that provide an explanation behind why so many people choose to "keep it real" with vintage hardware samplers despite the plethora of modern options. "They've mastered the computer to the point it does things the SP-1200 can't do. [But] we would have better records today if people said, "Look, you've got five hours to make a record." The problem is that people got all day. They got all week. They got all month. They got all year. So thus, you in there second-guessing yourself. With the 1200, you can't second-guess yourself, man. You got 2.5 seconds a pad, man." (Detrick, 2007)

Returning to the importance of sampling vinyl records, Shocklee also has significant insight to share regarding how this was also an aesthetic decision as much as a matter of tradition. The following quote is taken from a discussion regarding the implications of sampling laws and how they impacted hip-hop producers once lawsuits and sample clearance entered the creative fray, but it highlights much more than just the legal ramifications: "We were forced to start using different organic instruments, but you can't really get the right kind of compression that way. A guitar sampled off a record is going to hit differently than a guitar sampled in the studio." (McLeod, 2011)

The process of creating a production in this manner, then, is twofold, in terms of aesthetic development. Samples are coloured both by the nature of vinyl recordings and what is often referred to as the character of the hardware sampler.

As many hip-hop producers have found, electing to avoid sampling from records whilst seeking to attain the “golden age” sound is not simply a case of recording an instrument into a sampler of that period. The standard 1960s and 70s approach to making records involved a complex, multifaceted process, incorporating a multitude of steps, all of which combined to create the sound that beatmakers seek to employ in their work. Even if only a single note is sampled, the way in which that note is played has a bearing upon the sound, so the first stage is clearly the player themselves. The player has elected to choose a specific instrument, which will include several different variables key to achieving that sound. Taking an electric guitar, for example, the strings will be important, the tuning and weight of them, whether a plectrum is used, or the strings are picked or plucked, what pickups the guitar uses and where, in relation to those pickups, the strings are played. Even the type of guitar lead may have a bearing upon on the sound, and the signal path is clearly important. Will the sound be re-amped (played through a guitar amplifier and then recorded with a microphone)? If so, which amp will be used, which microphone and where, in relation to the amplifier, will it be placed? This is without taking into guitar pedals to colour the sound, what settings are dialled into the amplifier and what pre-amp is being used to take the microphone signal into the recording desk. Of course, the desk itself has a role to play. Additionally, the recording itself is key, not just the medium itself, but the machine being used and the skill and preference of the engineer. All these factors play a role in getting “that sound” – and this is before the recording is mixed and mastered, all of which introduces many more steps, as does the cutting of the record and the equipment used to play the record back before it enters the sampler. In his examination of the role live instrumentation plays within hip-hop, Exarchos (2022) discusses how musicians such as Frank Dukes engage with this issue. Dukes, whose Kingsway Music Library series has seen him gain production credits on a string of popular hits, undertakes a meticulous process of sample-creation to ensure that the music is not only melodically interesting, but also aesthetically accurate.

As far as the character of the sampler itself, taking the E-mu SP-1200 as an example, it offered significantly less than the highest fidelity. The bit depth was only 12, rather than 16, and, at 26.04kHz, the sample rate fell some considerable distance short of the 44.1kHz Red Book standard. Yet speak to anyone who prefers (or simply has any experience with) using the SP-1200, and they will quickly point to the “golden sound” it gives to samples that are processed through it. With a lower bit depth and sample rate, how can it “give” anything when logic

dictates that it can only subtract? Why is less, in this instance at least, consistently seen as more? The question is clearly a semantic one. Lowering the bit depth and sample rate of any given sound will introduce additional frequencies which were not present in the original recording thanks to what is effectively a rounding process. The process which sees computer graphics become blocky when the resolution is reduced is echoed in music. When the sound quality is reduced, artifacts are introduced through a process of harmonic distortion. It's the same reason guitarists use bit-crushing (bit depth reduction) effects pedals to serve a similar role to a more orthodox distortion stomp-boxes on their pedal boards: because bit depth reduction *is* distortion. Guitarists liked it because it allowed the sound to cut through the mix of other sounds much more effectively than a clean, unaffected guitar tone; samplers, in many senses, feel similarly.

To give some idea of how popular bit-crushing is with guitarists, simply look at how many different pedals are on the market at present. Ranging from sub £100 models such as the Mooer Lo Fi Machine and Sonicake Wave Crush; the £100-£200 range including the Electro Harmonix Mainframe and Catalinbread Heliotrope; the sub £300 range including the Meris Ottobit and Red Panda Bitmap 2 (£300); up to the £450-£600 for the WMD Geiger Counter Pro and Hexe Bitcrusher III. In addition to these there are also hybrid pedals, where bit-crushing is combined with delay (Dreadbox Sonic Bits), reverb (AC Noises' AMA), multi-effects (Dr. Scientist Bitquest) and more.

In addition to the array of pedals, all these effects can be reproduced with modern software alternatives without necessitating the use of cumbersome, expensive, and increasingly difficult-to-obtain original samplers. Many modern standalone units feature bit depth and sample rate reduction utilities as part of their suite of native effects, as do DAWs. D16 Group's Decimort is one of the more lauded software effects plugins for musicians who wish to go beyond stock DAW effects. Featuring an array of customisable options, and (as with previously mentioned "Paula" preset) even presets relating to specific vintage hardware models, producers can access that vintage sound without ever stepping out from inside the box. This extends even to mobile production, with products such as Inphonik's RX950 (also available in VST format), Toneboosters' BitJuggler, Klevgrand's Degradier and numerous others all offering a range of sample-colouring options with both bit-depth and sample rate control as well as presets and various additional features.

At this stage it is important to point out that bit depth and sample rate are not the only notable aspects of the SP-1200 that produce the signature sound. In the segment of the SP-1200 manual relating to special effects, author, Craig Anderton, states that: “Pitch transposers can fatten up a drum sound by adding harmonics or sub-harmonics to the drum sound” (Anderton, 1987, p. 65). This refers to the use of external units alongside the SP-1200, but the SP-1200 can transpose samples natively, without the need for additional effects. As a method of circumventing the limitations that the short amount of sample time the unit afforded its users, samples were frequently recorded in at higher speeds (therefore taking less physical space within the available internal memory) and then pitched back down to the original speed. During this process, as Anderton pointed out in the manual, yet more additional harmonics are added to the sound.

Although the unit was initially slow to catch on in some circles, the SP-1200 established itself as a hip-hop staple with a significant market share. “E-mu’s SP1200 sampling drum machine was first released in 1987 and discontinued in 1990. But, as with many other drum machines, it was being used extensively in hip-hop, and therefore E-mu revised it and re-released it in 1993, with production continuing until 1998.” (Russ, 2009, p. 337).

In contrast with hauntology, which is a conversation with past futures which never came to pass, the “keep it real” outlook is a conversation which stoically allows the future to pass it by. If hauntology seeks to remain in an eternal now-ness wherein imagined versions of the late 1950s, 60s, 70s and early 1980s are all occurring simultaneously in the present day (with musicians taking their pick of whatever tools may be made available to them) those who are determined to eschew modern technology in favour of classic or vintage equipment reside in an eternal then-ness, utilising setups which would be more familiar to those working in 1991 than 2021.

Any quantitative study of hip-hop production – particularly one confined to the pages of a book – is destined to be outdated by the very subject of its analysis. At best, these studies can seem prophetic, and though we try, these pages will never really turn fast enough (Tabron, 2015, pp. 135-136)

Like the ancient proverb about how the passing of time ensures that it is impossible for a person to step into the same stream twice⁵ so too the nature of music technology ensures that those who

⁵ they are not the same person; it is not the same stream.

work within music production have a constantly evolving toolset at their disposal. That which was impossible yesterday is accessible today; that which is inconceivable today will have become *de rigueur* by tomorrow. For those who labour in the frozen moment of genre ideals this never needs to be a consideration. Far from the restrictive cilice it could be portrayed as, the liberating aspect of this purist approach is not difficult to see. If a producer restricts themselves to only using tools which were created decades earlier, there is no need to fear the looming spectre of GAS (Gear Acquisition Syndrome) which whispers in the ear of many an electronic musician, suggesting that the productions they create could be *even better* if only they had that latest shiny new piece of equipment or plugin. (Herbst & Menze, 2021)

We're so used to working on skinny, small things - portability and compactness rule everything around us - that to sit down at an SP-1200 feels like taking command of the bridge of a spaceship by comparison. It's just so, so wonderfully *big*. (Horton, 2012)

It is worth noting that recent years have seen not one but two different hardware re-interpretations of the SP-1200. Firstly, ISLA Instruments released the S2400 which, according to marketing material, seeks “to recreate the sound of one of the world’s most iconic sampling drum machines and bring it up-to-date with modern features.” This was followed by original SP-1200 creator, Dave Rossum, duplicating “the original analog and digital electronics of the landmark 12-bit drum machine sampler as closely as is possible thirty-five years after its debut.” Although a range of contemporary samplers exist, such as Elektron’s Digitakt and Octatrack, Teenage Engineering’s OP-1, OP-1 Field and OP-Z, and even Rossum’s own Assimil8or, the appeal of classic units clearly remains strong. It is possible to draw similarities between these classic hardware units and the allure that vintage guitars, such as Gibson’s SG and Les Paul, and Fender’s Stratocaster and Telecaster, still hold for guitarists. Musicians who want *that* sound get *that* instrument, and where Epiphone or Squier models exist in the guitar world, software and virtual equivalents exist for vintage sampling hardware.

Just as the notion of conforming to genre ideals held a connection to the chapter which preceded it, the following chapter looks at the notion of tools that evoke a specific genre or era from the perspective of nostalgia almost as a celebration of nostalgia itself.

NOSTALGIA FOR LIVED PASTS AND LOST FUTURES

To haunt does not mean to be present, and it is necessary to introduce haunting into the very construction of a concept. Of every concept, beginning with the concepts of being and time. That is what we would be calling here a hauntology. Ontology opposes it only in a movement of exorcism. Ontology is a conjuration. (Derrida, 1993, p. 202)

Although the all-encompassing form of mass culture which came to prominence throughout western society in the post-war decades was sufficiently tasteless to Theodor Adorno, Max Horkheimer, and their contemporaries at the Frankfurt School, it was a pale facsimile of what popular culture would subsequently become. The blurring of the boundaries between highbrow art and low brow entertainment in the twenty-first century has provided a rich and fertile ground for sociological exploration, but it was the period towards the end of the twentieth century that gave rise to a phrase which has become synonymous with one of the pillars upon which this study stands: hauntology.

First coined in relation to the shadow of Marxism that lay heavily across post-war politics (Derrida, 1993), the term has taken on distinct associations with a specific approach to, and genre of, contemporary music. Many musical imprints are frequently associated with the phrase: Buried Treasure, and A Year in the Country, for example, but the one name that appears most regularly is Ghost Box Records, a joint venture between school friends Jim Jupp (who records for the imprint under the alias Belbury Poly) and Julian House (whose musical output appears under the name The Focus Group). Allied with House's mid-century inspired graphic design, the musical output of Ghost Box exemplifies the concept Fisher identified of a promised future that never happened:

What haunts the digital cul-de-sacs of the twenty-first century is not so much the past as all the lost futures that the twentieth century taught us to anticipate (Fisher, M., 2012, p. 16)

As Derrida used the phrase to highlight the spectral omniscience of Karl Marx, author Mark Fisher employed it to highlight that uncanny sense of alternate history which seeps into the work

of Jupp, House and their associates. Ghost Box artists and their releases occupy a space upon which the futures described within those science fiction dramas which so effectively captured the imaginations of post-war Britons (in titles such as Nigel Kneale's landmark 1953 BBC series, *The Quatermass Experiment*) left an indelible mark on generations to come. Although not old of an age to have experienced this period first-hand, titles like Belbury Poly's 'The Willows' (a nod to Algernon Blackwood's early twentieth century narrative fiction of the same name) and Mount Vernon Arts Labs' 'The Séance at Hobs Lane' (an invocation of the previously mentioned *Quatermass Experiment* television drama) betray obvious links to the period.

Although the influence of mid-century fictional narratives upon the thematic references and visual style of hauntology is interesting, of obviously more significance to this study is the sonic nature of their inspirations. 1959's third visit to what might be described as Kneale's "*Quatermass* franchise," *Quatermass and the Pit*, introduced a sonic identity to proceedings the significance of which is simply impossible to overstate. Although the original theme music was taken from a library of stock recordings which were commonplace at the time, the distinctive sound design which captured and conveyed the palpable sense of other-worldly dread central to science fiction pieces of the time came from the group of individuals widely acclaimed as being the originators of electronic music in Britain: The Radiophonic Workshop.

When interviewed, Jupp has spoken frequently about how Ghost Box exists in a sonic and aesthetic space which spans from around the 1960s to the 1980s. Although in some interviews he has suggested the two-decade span between 1958 and 1978, or the period between 1963 and 1983, the essential era he is referring to is quite clear, plus the slightly fuzzy-at-the-edges nature of the period lends itself well to the Ghost Box aesthetic, standing as a temporal metaphor for the allure of media and production techniques of that period. Where the early electronic music of Tristram Carey, Delia Derbyshire and their peers meets the library productions of Graeme Miller and Steve Shill (whose *Moomins* theme tune is often cited as a particular highlight), the ubiquitous Alan Hawkshaw, and other KPM luminaries is where the label's roots firmly lie. "It's the lo-fi recordings and slightly wonky improv nature of some of those recordings that make them so evocative," Jupp has stated.

Dolan suggests that "the use of simplistic forms, odd instruments, old electronics and amateur performances ... cultivates an aesthetic of memory" and that the "dreamy and atmospheric

textures, often sound more like they are performing memories of songs than the songs themselves.” (Dolan, 2010, p. 464) Almost as though the sentiments of Tenacious D’s “Tribute” are being played out for emotive rather than comedic effect (“This is not / the greatest song in the world / This is just a tribute. / We couldn’t remember / the greatest song in the world / This is just a tribute”) the essence of hauntology is not the “oh, if only you had been there” lament of a tall tale but something closer to “oh, if only *there* had been there in the first place.”

Simon Reynolds, whose 2006 article in *The Wire* has a strong claim to include the first documented appearance of the term hauntology as a musical genre, suggested (in the same piece) the alternative term “eldritchtronica” (Reynolds, 2006) which I suspect many of those who it would have described may have railed against, partially because hauntology is not necessarily dark or brooding (although it obviously can be); partially because the overtly Lovecraftian inspiration stands at odds to the characteristically British sensibilities of hauntology (plus Lovecraft’s racism and bigotry makes any reference to his lexicon problematic, to say the least); and partially, of course, because it is often the nature of the artist to reject any label which is applied to their output.

The desire to celebrate “a past in danger of being buried by modernity” (Pilkington, 2012) is key. Just as the underappreciated brutalist architecture which dominated urban spaces in the post-war reconstruction period has been widely replaced by sleek, modern structures in recent decades, so the blend of often unreliable DIY devices and off-kilter musicianship of Jupp and House’s 20-year golden period⁶ has been superseded by the all-conquering perfection of grid and quantisation.

In a 2014 interview which took place on-stage at the London Short Film Festival (excerpted in the short documentary that accompanies this study), House was asked about the possibility of a future version of their label, one made by the next generation of music-makers which therefore drew upon a more recent span of time than their end-of-the-1950s-start-of-the-1980s era. His

⁶ The stretch covering the period between approximately the end of the 1950s and the beginning of the 1980s. It is pleasingly curious to note that the name of the label originates from a term which the two founders felt was a fitting description of a television (and not the “paranormal research devices” that frequently appear in cursory internet searches under the phrase “ghost box”). Expanding their time limits slightly, it is conceivable to suggest that the date which sits at the latest point of the bookends coincides with the juncture at which the “ghost box” grew beyond the boundaries of its 3-channel limits and a fourth, imaginatively titled terrestrial television station took to the airwaves. Channel 4 broadcasts commenced in November of 1982.

response outlines the unique nature of the period the label focuses upon, but also highlights key aspects of the appeal of the lo-fi aesthetic to the contemporary artist: “Digital, wired, internet culture appears to be in a perpetual wide-awake state whereas I think what Ghost Box is about is something half-asleep, half-remembered: a trace of something that you grew up with rather than a definite concrete thing that’s constant and there all the time.”

But what of the production techniques employed by these artists? The approach is dictated by the desired end-result, not the tools which are utilised in its production; unlike other aspects of this study, the proponents of this branch are happy to embrace a variety of production methods, both vintage and cutting edge, because it is the sound itself that remains all-important, not the physical means of production. The production techniques applied can be:

- entirely authentic, utilising analogue synthesizers as sound sources, recording directly to multi-track tape, and refraining from using computers entirely.
- completely inauthentic, using modern DAWs (digital audio workstations) to sequence software emulations of instruments and effects.

or

- some fusion of the two.

The only consideration is that it is authentically inauthentic, as it were; the only yardstick being aural rather than methodological. Does it sound right? Or rather: does it sound wrong in the right way?

Unlike the slavish retro-worship and tiresome recycling that characterises so many contemporary musical artists – stuck in a past they can’t get out of – the artists on Ghost Box hold firmly to the notion that the past is irrecoverable and, for that reason, all the more interesting. It must be re-imagined, rather than copied. This impulse is, as Jupp describes it, “a nostalgia for nostalgia.” (Hennings, 2009)

Whilst describing what he referred to as the fictionality of the American way of life, Baudrillard touched upon a phrase which in many ways could have been specifically written to describe the motivation of those musicians whose work sits under the umbrella of hauntology: “we are condemned to the imaginary and to nostalgia for the future.” (Baudrillard, p92). In all

disciplines there are artists who like to imagine what their forebears might have created with the tools that became available after the period in which they were active. What might renaissance painters have made of digital drawing tablets? How would the creators of early electronic music have applied samplers and modern DAWs? Artists motivated this sense of nostalgia for nostalgia are not interested in such questions.

What seems to unite these diverse pieces of music is their attempt to capture the grain of earlier playback technologies and recording methods. (Zuberi, 2007, p. 285)

There is a sense of “what if nobody knew how people made the music they make, and the only barometer was the end result?”

Whereas those who conform to genre ideals tend to focus upon utilising the technologies of the past to create music which remains true to the essence of the time in which the technologies were developed, those drawn to nostalgia for lived pasts and lost futures are concerned with alternative realities. There is no fixed genre upon which notions can be placed, nor from which ideals can be derived. Instead, it is the vague nature of feelings, tones and moods that inform their perspective. This is music that stems from the suggestion of a memory, therefore, although the method of getting there can be largely seen as irrelevant, the destination itself is all-important.

In this regard is both connected to and distinct from the following area of discussion. Although they share a connection to tools and techniques designed to create imperfections, the signature of unpredictability and the sound of failure is not a desire to connect to a specific time period, or, it can be said, any era at all, it is instead the embrace of unpredictability as the catalyst for chaos.

THE SIGNATURE OF UNPREDICTABILITY AND THE SOUND OF FAILURE

Whereas those who embrace the limitations of the medium for artistic effect have a fixed idea of what the tools will provide – the TR-808 will be a severely flawed replacement for an acoustic drumkit with unwavering consistency – the notion of unpredictability and the sound of failure fulfils a different purpose: that of unreliable collaborator. A device that fails in the same way consistently is useful for a specific result, whereas a device that fails in different ways each time it is used adds an element of risk, movement and individuality.

For creators of a certain age, pre-internet era media formats and their inherent failings are often cited as being instrumental in defining both their tastes and their musical sensibilities. Formative years accompanied by the extraneous, theoretically unwanted noise which accompanied the misrepresented sounds inherent in copy-of-a-copy-of-a-copy cassette recordings made this inevitable. Even those rare tapes recorded from original albums, borrowed from friends (or friends' elder siblings) were not safe from degradation, both from a hungry Walkman, always in danger of chewing the odd cassette, and from a youthful, enthusiastic, but less-than-expert dubbing engineer who would accidentally saturate the medium by making recordings with the original source playing way too loudly. To some, all these things have an intrinsic beauty to them, especially when one considers that the original recordings were themselves created using samplers incapable of producing high-fidelity reproductions of any sounds that went into them, outputting 12-bit, 26k versions of whatever the original source material might have been.

Whatever you now find weird, ugly, uncomfortable and nasty about a new medium will surely become its signature. CD distortion, the jitteriness of digital video, the crap sound of 8-bit - all of these will be cherished and emulated as soon as they can be avoided.

It's the sound of failure: so much modern art is the sound of things going out of control, of a medium pushing to its limits and breaking apart. The distorted guitar sound is the sound of something too loud for the medium supposed to carry it. The blues singer with the cracked voice is the sound of an emotional cry too powerful for the throat that

releases it. The excitement of grainy film, of bleached-out black and white, is the excitement of witnessing events too momentous for the medium assigned to record them.

Note to the artist: when the medium fails conspicuously, and especially if it fails in new ways, the listener believes something is happening beyond its limits.

(Eno, 1996, p. 283)

This notion of the desirability of fallibility, of revelling in the limitations that a piece of technology may have (either by the nature of the original design or by virtue of some flaw or defect) is the point at which the mask slips, the guard drops and a gap in the all-conquering machine's armour appears. It is *homo ex machina*: the point at which the humanity is revealed within the technology. To err, after all, is human.

Envisaged as a means of storing and documenting audible events, the tradition of recording inaugurated by the phonograph ruptured the metaphysics of sonic presence and opened up the interstitial spaces of copies and recordings. This opened the door to a new kind of music making, one based in a foregrounding of interference, citation and secondary processes, a plastic art working within and through the grain of the machine. (Hemment, 2004, p. 80)

In one appearance within the documentary, Hazel Mills speaks of analogue synths and “the idea that something has a kind of human quality to it that isn't perfect.” When describing her defective Roland Juno-106 synthesizer (which has, in her words “a dying voice chip”) she praises the unpredictable qualities of the tones it produces: “she's sort of making these wonderful sounds as a result of that because it's not completely perfect.”

Marcus Fischer echoes these comments when discussing part of the appeal of working with tape. “It's so easy to make a perfectly clean recording and you can control ... every aspect of the way something is placed in space. You can do it on an iPad or on your phone, practically. It's so easy these days and leaving ourselves open to chance and these random aspects, I feel like people start to crave that a little more. There's this little spark of discover that happens you leave yourself open to that.”

This notion of fallibility being the door through which a device's humanity can appear appears frequently when artists are discussing their love of vintage equipment (both instruments and recording devices).

While technological failure is often controlled and suppressed - its effects buried beneath the threshold of perception - most audio tools can zoom in on the errors, allowing composers to make them the focus of their work. Indeed, "failure" has become a prominent aesthetic in many of the arts in the late 20th century, reminding us that our control of technology is an illusion, and revealing digital tools to be only as perfect, precise, and efficient as the humans who build them. New techniques are often discovered by accident or by the failure of an intended technique or experiment.

(Cascone, 2000, p.15).

Randall Taylor, widely known under his pseudonym, Amulets, creates music utilising 4-track cassette recorders loaded with short tape loops. A YouTube video, uploaded in 2017, wherein he explains the process of creating these looped cassettes has, at time of writing, garnered 189,000 views⁷. In his description of how he interacts with his live setup (the 'Suitcase of Drone' housing a variety of 4-track machines and guitar effects pedals) he speaks of their unpredictability and lack of rigid accuracy as being akin to working with an unreliable collaborator: "If you're playing with a drummer with a certain style, you're going to adjust your playing to that, and I definitely consider my 4-tracks like my bandmates ... They're not always reliable, just like bandmates. And so, the tape loops themselves, they're doing their parts and they're playing their parts and so I'm adjusting to that."

It's a concept shared by others.

Sarah Davachi agrees that "there's something about the older instruments, the older modules, that is so wildly, not unpredictable, but it's just ... living, like this thing that moves and breathes on its own that I think you just can't really recreate digitally or even in a modern analogue sense. There's too machine stability. There's too much control."

⁷ https://www.youtube.com/watch?v=hER3s1NPr_U 189,427 as of August 7th, 2021

To the extent that lo-fi aesthetics emphasise the role of technology, they also grant it a certain amount of agency in shaping the recorded output – whether that is by influencing the length of a song by letting it end when the tape runs out, or by adding a sonic character of its own, e.g., in the form of tape hiss or wheel-grind. In doing so, the recording technology stops being a mere machine and instead becomes a musical instrument – or even a musical performer. (Supper, 2018, p. 266)

For musicians who frequently work alone, the opportunity to introduce an element of “not me-ness” into their music has an attraction which is easy to understand. Although many musicians speak of feeling compelled to make music because they had sounds in their mind that they wanted to hear coming through speakers, but which would not exist unless they made them themselves, these same artists will freely admit that they do not regularly listen to the music they make because they are too close to it and cannot hear past the flaws or mistakes. Collaboration is often a method of bypassing this self-consciousness, allowing musicians to focus, not on their own parts, but on the parts that are not them, as it were. Whilst collaboration in a literal sense can be a complicated process to mediate when very driven and individual artists attempt to pool their talents, introducing a collaborator with whom they cannot argue or have disagreements regarding artistic directions offers an opportunity to benefit from the positive elements of collaboration whilst avoiding the negatives. It is an element which manufacturers and designers of instruments (both physical and virtual) have made moves to incorporate in their products for some time.

Fallibility by design

Slater (1998) wrote about what he referred to as “chaotic FM synthesis” whereby cross-coupled frequency-modulated oscillators were utilised to unpredictable effect in terms of both pitch and timbre. Although the piece was published in 1998, the article refers to experimental tape recordings he made in 1970 utilising a Buchla Music System 3 modular synthesiser. The pursuit of imperfection, although seen now through a contemporary lens, is clearly not a modern concept.

Two of the most famous modules in Don Buchla’s 200 series modular synthesizer are the 265 and 266, both of which are titled: Source of Uncertainty. Although Buchla was already addressing the concept of randomness in his 100 series (via the 165 module) it was incredibly

simplistic compared to the 266 which provided unprecedented control over the level of unpredictability it would introduce.

Suddenly, randomness was no longer just a toss of the dice: the 266 made it possible to determine just how many sides the dice had, and which sides were most or least likely to come out on top. (Mitchell, 2019)

It is this notion of shared control, rather than the complete relinquishment of it, that is most appealing. For a musician seeking to represent an accurate vision of “my sound” it would be implausible for them to hand over control entirely to an external agency. A curated version of uncontrolledness, wherein a specific set of parameters can be defined and dictated, is instead the preference. Whether this stems from a single randomness module housed within a larger modular rig or an unpredictable device within a broader musical setup, this notion of carving out a place for randomness to co-exist within a controlled environment is popular. Hainbach speaks of contrast being “where music thrives.” When describing the appeal of Scottish duo Boards of Canada, he explains that “you’ve got a solid hip-hop beat underneath all these wobbly sounds that are like broken tape machines and so it’s always the reliable partner and the morphing stuff that creates a huge and beautiful contrast.”

In an article which appeared in Raspberry Pi magazine, MagPi, Richard D. James (Aphex Twin) explained how he has utilised a programme called Midimutant, designed by friend, Dave Griffiths, to create interesting FM patches to use within his music (McManus, 2018). The notion of recruiting an external body to create tones which the artist will then sift through and curate a body of sounds from is akin to the way bands like Radiohead employ a guitar technician to design and create tones for them to utilise in their music. The difference being of course that the collaborator here is virtual rather than physical.

The sequencers, configured to generate pseudo-random patterns, were also controlling the oscillators, filters, modulators, and amplifiers. And I was also controlling the sequencers. It was a complex network of modular interconnections which, as intended, caused a certain balance between predictability and surprise. Because I was sharing control of the music with the sequencers, I was only partially controlling the music, and the music, consequently, contained surprising as well as predictable elements. The surprising elements made me react. The predictable elements made me feel that I was exerting some

control. It was like conversing with a clever friend who was never boring but always responsive. I was, in effect, conversing with a musical instrument that seemed to have its own interesting personality.

(Chadabe, 1997, pp. 286-287)

Although vintage in concept, modular synthesis is more popular in the modern era than ever. Since Dieter Doepfer's introduction of the A-100 system in the mid-1990s, the Eurorack-format modular synthesizer has grown beyond anything he could have predicted. From those 10 individual modules from one single manufacturer to hundreds of manufacturers creating thousands of modules, Eurorack has cemented its place itself within the music industry.⁸

Tony Rolando is the founder of Make Noise, one of the most innovative and popular Eurorack companies in the field. Having created the Make Noise Wogglebug, a module which is described as "a continuation of the "smooth" and "stepped" fluctuating random voltage sources pioneered by Don Buchla within the Model 265 "Source of Uncertainty,"" it is unsurprising that Rolando agrees with the concept of the modular synthesizer as unseen/unreliable bandmate:

Music made with the modular system is, in my opinion, a pure and interesting collaboration between human and machine. It displays well the beauty and the blemish in both (human and machine) and allows for the process of collaboration between the two to be more visually represented to the spectator. This makes it more interesting because we as listeners are invited to view more of the process and details. It might be less perfect by judgement of mainstream music taste, but perhaps more exciting to those of us seeking a deeper connection to the music. (Nagle, 2020)

Whilst the fallibility of cassette tapes and the nature of modular synthesis may seem to have little in common, it is the similarity of purpose to provide a counterpoint to order and predictability

⁸ When attempting to evaluate how widespread Eurorack use is, it is impossible to speak in absolutes and therefore some degree of informed estimated comes into play. Popular modular synthesis site, Modular Grid, which enables users to create virtual layouts for their synthesizer systems, has a site membership of nearly 79,000. How many of those members are, or even were, owners of modules remains unclear. Some users are no longer actively involved in Eurorack; others were only ever curious to discover what level of investment it might take to secure their own system; others still have never been members of Modular Grid but have extensive modular setups.

which unites them. In a time when much electronic music adheres to the strict, rigid confines of a grid, disorder can, for those who seek to employ it, provide a comforting respite.

The next and final chapter of the study can be seen almost as an extreme extension of this approach. Whereas the tools and techniques discussed in this chapter can be viewed as a method of introducing a “humanising element” – the unreliable collaborator – to work alongside more predictable tools, technological primitivism embraces DAW-free workspaces as much from a philosophical perspective as an aesthetic one. In a world where one’s daily life can be dominated by screens, the appeal of a musical production setup that contains none has perhaps an obvious appeal.

TECHNOLOGICAL PRIMITIVISM

The oxymoron of technological primitivism seems fitting to visit as the final area of study as it epitomises the nature of the topic. What we are discussing here is not primitive in any traditional sense. Just as previous sections have looked at the absurdity of referring to machines once considered the very pinnacle of innovation as “lo-fi” or “low-tech” devices, similarly it is with a firm grasp of irony that musicians who, without getting into a semantic debate of what does or does not constitute a computer, eschew the use of a DAW in favour of a standalone, monitor-free approach, can be referred to as “technologically primitive.” The rationale for this approach is varied but centres upon a series of themes.

In the modern world of hot-desking, virtual workplaces, and online life (Julian House’s earlier concept of the “perpetual wide-awake state”), the desire to avoid the trappings of a laptop/desktop centred 9-5 existence when exploring creative pursuits is easy to understand. Typical comments express sentiments such as “after spending the day staring at a monitor, the last thing I want to do is do more of the same when making music.” There is a sense that, when all the mundane aspects of life take place behind a computer screen, it becomes a place where creativity goes to die.

Ben Wilson (DivKid) speaks of making a departure from “sound work that had to be very clean and high quality” to being “more interested in the rough recording that captures some ambience

than anything else at the minute really.” His explanation of the appeal of this is simply that: “it’s just real and it comes across to the listener ... It puts them in a space much easier than trying to create an artificial space with tweaking all these layers in the mix in a production.” This quest for the real (or reel, in the case of those who prefer to record to tape rather than digital alternatives) away from what is often regarded as “digital perfection” is a strong motivator.

The notion of capturing a performance in a physical space with the aim of placing the listener in a specific location is one which largely (although not completely) precludes the involvement of a DAW. Although it is possible to take a laptop to an isolated location, those who prefer to perform in such places tend to remove themselves from a studio environment specifically to avoid such elements. Sixtoo’s *Duration* project, although created within his home studio, was played, and recorded in locations around the Halifax, Nova Scotia environment he called home. Speaking about the process he discussed his desire to connect with the city through his music in both a physical and conceptual manner.

I hooked up beats and I did visual installation pieces in outdoor environments, and wherever I left those markers I broadcast the sound and re-recorded it. I went back to Halifax six months later and most of them had been stolen or replaced by city workers, but I think a lot of people who might've never heard my record might've gotten something out of those installations. (Wheeler, 2014)

In his book of Ableton Live-related production techniques, Dennis DeSantis outlines a series of approaches (not dissimilar to Eno’s ‘oblique strategies’ cards, but less open-ended and abstract, more direct, and informative). Constructed in a problem/solution format, one of the book’s more intriguing categories is entitled “Arbitrary Constraints” which references Stravinsky’s method of limiting his field to maximise his own creativity. (DeSantis, 2015)

Whatever diminishes constraint diminishes strength. The more constraints one imposes, the more one frees oneself of the claims that shackle the spirit. (Stravinsky, 1947, p. 65)

Applying this concept to the sprawling, nigh-on endless array of tools computer software provides, it is clear to see that, if Stravinsky found constraints useful when working with the limited options he had in the 1940s, it is even more applicable with the myriad of tools and techniques available to electronic producers working today. Removing the DAW from the

equation is one obvious step towards introducing these arbitrary constraints which, allied with the removal of the all-conquering computer screen, is a very appealing option for many. The introduction of Eurorack modules featuring computers (and even screens) makes for an interesting additional branch of discussion.

Through this concept it is possible to explore the way in which musical context shapes the intentions of the creator and the tools they choose to employ. Between 1967 and 1968, producer and engineer, Tom Wilson, hosted a radio show on WABC-FM in New York) called The Music Factory which was sponsored by MGM-Verve. The third episode featured guest appearances from Lou Reed and John Cale, both of whom Wilson knew well from working with the Velvet Underground. Reed discusses a desire to “work on a tape that would take up every minute of every hour of every day of the entire year and it would be just one extremely long tape and it would fit into your wall, and it would be personalised.” It’s impossible to ascertain to what extent Reed was remotely serious, of course, as the notion of creating one absurdly long continuous mix of music would have been essentially impossible at the time and but this off-the-cuff remark touches upon two interesting notions which have come to pass in the half-century that has passed since the interview took place.

Firstly, streaming music has provided access to an almost limitless supply of music, meaning that the bespoke playlist soundtracking every moment of every day that Reed spoke about is now very much achievable. In the spirit of primitivism, listeners no longer require complex hi-fi setups to experience this kind of music as a very basic smart speaker and internet connection can provide this function easily, but the focus of the creator is much more significant.

The second area of interest is an extension of DAW-lessness and the spirit of eschewing not only digital audio workstations but also digital distribution and often recording in general. To circle back to concepts touched upon in earlier parts of this study, there is an established trend amongst electronic musicians, and one which is apparently more prevalent amongst those who seek to embrace that sense of paradoxical technological primitivism whereby they choose to sidestep computers but instead embrace the incredibly complex realms of synthesis afforded by modular systems (either via actual modular synthesizers or via what one might describe as “desktop modular” whereby a series of units are connected to one another view a central sequencing hub to otherwise provide an experience not dissimilar from a unified Eurorack system). Just as

people would, in the days before television, play music instruments as a pastime, never seeking or desiring an audience, there is a trend for people to do the same thing with electronic music setups, simply replacing a family piano, for example, with something much more technologically advanced but which serves the same purpose. As an escape and respite from screens and digital life, the appeal of “switching on to switch off” as it were is quite a potent metaphor for this section of the study, just as the notion of simultaneously looking back (to a time pre-television when instruments were played in the home for pleasure by a large portion of society) whilst looking forward (towards technological advancements which have placed previously impossibly expensive electronic instruments in the hands of regular musicians).

Sterne (2005) highlights the initial importance of sound fidelity as “necessary for the medium to function as a vanishing mediator” but this is in relation to recordings being utilised as faithful representations of a performance (as a replacement for a piano at family gatherings, for example) and cannot reflect instances whereby the creator of the recording does not require (or desire) the mediator to vanish. Taken to its logical conclusion, technological primitivism hints at the notion of removing the mediator completely. Sounds exist for as long as the machines are running and cease to exist as soon as they are powered down. To be enjoyed in the moment, shared only by those who were present to hear them at source.

CONCLUSION

This study sought to address the question of why, when tools which enable the creation of the highest quality musical productions are as affordable as they have ever been, the sounds of technological failure or sonic inadequacy still appealing. It did this through a study of what specific lo-fi techniques were being used, an exploration of what the attraction of these techniques were, and an examination of how the use of these technologies informed their process.

In answering these questions, a five-part framework was created which provided a structure for the presentation of the findings, allowing areas of similarity and difference to be collated into relatively robust categories. This framework is not without flaws, particularly as there can be some degree of overlap between the categories, but it provides a skeleton which the findings can flesh out, whilst also offering the opportunity for further discourse.

Many studies focus upon the sociological effects of the relationship between humans and music technology often they centre upon societal effects and impacts, frequently looking at the deterministic view of how technology has shaped society and the voluntaristic approach of how society shapes the technology it uses. These have obvious merits and significances to this study, as has been discussed, but they don't seek to engage with the sense of perpetual feedback provided by musicians who constantly examine, refine, and redefine their relationships with the tools they use. This is one of the ways in which this study differs and why such work is lacking and therefore necessary.

Each of the five parts of the framework provides opportunities and justification for further research.

Those who embrace the limitations of the medium for artistic effect swim against the current of popular opinion regarding the approaches and equipment they favour, essentially seeking out that aspect of an object that makes a bad tool good (albeit not a conventional way). "Doing things wrong on purpose" is clearly not a new idea. When pioneering hip-hop DJs in the late 1970s manipulated records by hand to create scratching, the notion of even touching the grooves of a record was unheard of. Similarly, Jimi Hendrix's use of overdriven Marshall amplifiers in the

1960s, where he famously turned all the dials up to the maximum amount, was certainly not the way they had been designed to be used. There is a rich tradition throughout the history of recorded music of this form of innovation; the artists referenced in this study celebrate the failures of tape, limitations of early digital equipment and unpredictability of low-tech devices, and in doing so can be seen to contribute to this heritage.

Conforming to genre ideals sees the celebration of previous technologies by those who, at the time of their release, could often not have hoped to afford them, either because they were too young to have the means available, or because the objects themselves were so cutting edge that their price tags were prohibitive (or, of course, both). The idea that good tools become bad because subjectively better tools have been subsequently released is firmly rejected in this manner and it engages with much broader topics of social study regarding the disposability of technology and the financial and environmental cost of a consumerist approach which demands perpetual progress. Yesterday's great is frequently still great, despite the claims of today's marketing material. Many modern options exist when it comes to producing hip-hop, for example, but, despite both hardware and software alternatives, there remains a significant array of producers who gravitate towards the traditional tools that were available to those who crafted their personal favourite records (even when the producers who created those records have long since replaced the tools they once used with modern equivalents).

Nostalgia for lived pasts and lost futures engages with wider concepts including the notion of how digital archives conflict with memories and how the inability of society to avoid recycling the popular culture of the past leads almost inevitably to some sense of a perpetual present. UNKLE's debut album, *Psyence Fiction*, opens with the phrase "Somewhere in space, this may all be happening right now" and, in many senses, it is – right here, wherever we happen to be. Some producers speak of the significance of a certain film soundtrack that they heard, not through the official soundtrack recording, presented as a polished studio performance, but experienced on a well-worn VHS copy of the film itself, recorded directly from a television broadcast onto a previously used cassette that still holds elements of bleed-through from early recordings. This has similar connotations to the way a certain smell might conjure up a childhood memory, whereby an aroma can instantly transport somebody back to their youth, and it engages with the same sense of nostalgia.

The signature of unpredictability and the sound of failure is perhaps the area most aligned with seeking the notion of how electronic music production can appear to become more human by the notion that mankind is present within the failures and randomness of machines. A tape loop that drifts in and out of time, an analogue synthesiser which has oscillators that don't retain accurate tuning, these are elements which can bring a desirable, unplanned-for aspect to the production process of a musician wishing to step outside what is sometimes seen as the sterile environment of the DAW.

Technological primitivism engages with the appeal of not only lo-fi aesthetics and approaches but in a sense the desire to withdraw from the always-on nature of digital interconnectivity. The computer, and the internet especially, has enabled such a vast number of new possibilities, both in everyday life and for music producers of all styles and genres, but the inherent certainty of computers can create a longing for uncertain and imprecision. The connectedness of things and others can clearly foster a desire to disconnect from much of the outside world to reconnect with notions of self. Self-expression, self-ownership, the self as both performer and audience, which is a fascinating notion.

Areas of potential future research include an examination of the role DIY culture plays within the appeal of lo-fi aesthetics, both in terms of the artists creating their own physical instruments (everything from circuit bending and DIY analogue kits to fully realised short-run production models such as Scott Campbell's OM-1) and of creating their own virtual devices (whether using frameworks such as Reaktor and Max For Live or more traditional code-based environments). The role that hybrid devices play within this is fascinating. Hardware units such as Monome Norns, the Axoloti Core and Critter and Guitari's Organelle provide a framework for combining computer code (in environments such as Supercollider and Pure Data) and physical instruments, allowing musicians to create very bespoke setups that can essentially be both high tech and lo-fi at the same time.

Live coding is another area of interest. Musicians are eschewing software devices with elaborately designed graphical user interfaces in favour of text-only coding environments which interface with modular synthesizers and standalone hardware devices in real time. It raises interesting questions about the nature of technological primitivism and those who prefer to avoid

traditional software DAWs whilst engaging in a practice which often necessitates a computer and monitor.⁹

The suggestion that lo-fi tools provide an opportunity for musicians to relinquish a degree of control in their music is one that warrants further exploration. With many of those featured in the documentary discussing the organic qualities of unreliable, vintage equipment, the question of how this connects to the presence of a human element in electronic music consistently arises.

When researching the nature of lo-fi tools on hi-tech devices, the Koala Sampler community provided some interesting insights. Although the app runs on both Android and iOS devices, the iOS framework is intriguing because it provides opportunities for apps to interact with other apps thanks to Inter-App Audio (IAA) and Audio Unit Version 3 (AUv3) connectivity. With reference to remaining true to genre ideals and “keeping it real,” the fact that some users view utilising anything beyond the in-built effects and features of the Koala app itself as some form of “cheating” is fascinating and suggests that the mindset is not restricted to a period of time or even just to hardware devices. With the predominant style of music created with Koala being beat-focused, it is possible to suggest that this is a convention of the broader hip-hop genre, although many of those most committed to these principles are of a younger generation, not connected to the “keep it real” era of the 1990s and early 2000s.

As a study which is essentially focused upon human behaviour, it is unsurprising that this research has unearthed at least as many questions as it has answered.

⁹ Often, but not always. For those who absolute refuse to employ a computer, Monome’s Brian Crabtree has created a module called Teletype which provides both a small screen and USB keyboard, allowing both live coding and coded blocks in what he describes as an “algorithmic ecosystem”.

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