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SOFTWARE SEQUENCERS AND CYBORG SINGERS: POPULAR MUSIC IN THE DIGITAL HYPERMODERN

Nick Prior

It has been almost twenty years since Andrew Goodwin's classic essay, 'Sample and Hold', claimed that pop music had entered a new phase of digital reproduction.¹ If the digital sampler was postmodernism's musical engine, then hip hop was its recombinant form, and the erosion of divisions between original and copy the celebrated consequence. Popular music had become an engorged repository of itself, its history ransacked as source material for a kind of stitched-together melange of past fragments. For Goodwin, sampling had undermined received ideas of human creativity and craft, deconstructing notions of the romantic author and pouring into pop a distinctly post-human sensibility. In fact, as divisions between human creativity and machinic automation blurred, it became impossible to tell whether a sound had been produced manually, synthesized or reproduced digitally. The 'strange case' of the handclap was a particularly postmodern parable. Techno musicians had favoured the sound of a first-generation synthetic clap produced by the Roland TR-808 drum machine over a more natural-sounding successor provided by Roland's TR-707 because the former, while sonically non-mimetic, had become the 'real' signature of electronic music. In other words, the synthetic sign had replaced the organic referent to become the 'real'. In which case, digitalisation accompanied a wholesale transformation towards postmodern culture as a regime of surface over depth and play over seriousness.²

But an air of ambiguity pervades Goodwin's essay, and rightly so. As he puts it, 'pop might be eating itself, but the old ideologies and aesthetics are still on the menu' (p272). Indeed, to this day, discourses of authorship and authenticity continue to lubricate pop's sense of itself as trading in talent and originality, while 'aura', far from disappearing, is alive and well in attitudes to the immediacy and presence of the live performer. Meanwhile, the co-mingling of analogue and digital technologies in the studios and bedrooms of musicians is testament to the complex interweavings of socio-technical forms and their convergence in practice, while a distinctly 'modern' medium, vinyl, continues to be valorised by DJs as containing 'warm' qualities flattened by digital reproduction. Hardly *postmodern* then, if the prefix is taken seriously as a wholesale departure from the conventions, practices and forms of the modern era. Indeed, we might speculate, twenty years after the orgy, that the term postmodern was always a lazy, totalising and fashionable shorthand that could never have captured the full complexity and range of phenomena it was supposed to cover.

In this essay I want to examine music's technological mediations, linking this to more recent attempts to theorise the shifting nature of contemporary popular music. The basic argument is that we can learn a lot about where we are in the history of popular music by looking at conditions of cultural production, not merely at single styles, techniques or devices such as the sampler. I

want to suggest that an examination of recent production techniques and technologies labelled 'digital' can tell us significant things about contemporary musical cultures, including how they are meeting broader tendencies towards flexibility and de-materialisation in social practices at large, but that this meeting takes place in an extended moment of cultural acceleration and intensity - a hypermodern moment. This moves music onto terrains that threaten, stretch and play with boundaries between human and machine, as well as real and simulated, although not always in expected ways.

The focus of attention will be on digital recording practices and changing forms of musical creativity, not merely because so much attention has been heaped upon the digital - in music in characterisations of so-called 'network economies', in the business of globalisation and the rise of new media - but also because it is an apposite time to grasp Walter Benjamin's 'now of recognisability' and assess how these technologies align with new and old habits of thought and practice, before they slip unnoticed into convention.³ Given a literature already heavily skewed toward the effects of digital downloads on consumer practices and regulatory regimes, this essay is an attempt to fill in the picture at the 'front-end', as it were, and to take issue with authors who blackbox composition or consign it to magic (or musicology).

Already, many challenges present themselves, here. Firstly, how does one write an account of digital technology in popular music given the predominance of a particular, rock-based narrative more at ease with questions of virtuosity, counter-culture and analogue instruments such as guitars? Secondly, how does one avoid the overly uncritical and exuberant embracing of all things digital as revolutionary and transformative without suggesting that nothing has changed at all? Thirdly, how does one align these developments in popular music with epochal characterisations (such as hypermodernity), given the real dangers of eliding precision and ignoring the lack of fit between specific cultural forms and historical formations? After all, there can be no neat overlap of style, context and technology in music precisely because each takes a relatively distinct historical journey. Which is not to say there aren't interesting correspondences between these categories, merely that one has to be precise with their usage and be wary of collapsing one term into another.

With these warnings in mind, I shall begin with a discussion of the digital recording studio and the role of the computer in favouring (rather than determining) particular kinds of creative processes, and I will pursue the outcome along three lines: 1) digital mediation intensifies the elasticity of the musical text as digital code lends itself to repeated creation, formation and iteration. The contemporary UK pop band, Gorillaz, and the rise of the 'mashup' will form case examples of 'cut and paste' conventions in music, where flexible composition and stylistic eclecticism are products not only of an ever-expanding industry, but of digital sequencing practices conducive to the remix; 2) digital technologies accentuate a dispersed and mobile creativity, unhooking the making of popular music both from a single place, such as the recording studio, and from physical co-presence. Here, informational flow becomes an increasingly dominant mode by which objects, including digital music, are produced and circulated; 3) a radicalised co-mingling of machines with creators raises, more starkly than ever, the problem of agency. It suggests that musicians should best be seen not as organic masters of an inert set of technological tools, but as partners in complex human-machine assemblages that make

it increasingly difficult to separate human creativity from technological 'affordance'.⁴ This is apparent even with the voice, conventionally seen as that most 'natural' expression of unmediated humanity.

DIGITAL FORMATIONS

How should the place of the digital be explained and by what historical periodisation? Is it a phase, a rhetoric, a technology? Well, first we need to be clear on the distinction between analogue and digital. According to the German media theorist, Friedrich Kittler, digital technology 'functions like an alphabet but on a numerical basis. It replaces the continuous functions into which the analogue media transform data, which are generally also continuous, with discrete scannings at points in time as equidistant as possible'.⁵ Technically, in other words, digital devices do not represent or store data as continuously variable relationships, but translate all input into binary forms of 0s and 1s. Hence, the digital photograph, rather than being a cluster of continuous pigmented dots, is composed of a grid of cells with specific addresses and attributes - 'a series of steps rather than a continuous slope', to quote Lumenfeld.⁶

But the digital is more than simply a technical term to designate systems. What we are really talking about with the digital is a *formation* of discourses, artefacts, techniques and practices that revolve around an increasing reliance on complex, computerised systems. Formations are loose configurations, less rigid than institutions but characterised by constituent material and non-material elements sharing enough properties in common to produce systemic effects. So, digital formations are both myriad devices and commercial claims, often hyped in nature, regarding their function; they are both ways of talking, in the sense of established discursive repertoires that help constitute technological realities (alongside other powerful terms such as 'cyberspace', 'electronic', 'virtual' and so on), and everyday routines that are engaged with the construction and consumption of binarised information. More a set of meanings, objects and practices than a technology *tout court*, the digital represents characteristic forms of organising an increasingly interconnected and computerised world expressed in everyday behaviours and relations. To abstract the technological artefact from these relations is to make the mistake of attaching to technology an autonomous power disembedded from human activity, knowledge and social structure. Indeed, the ubiquity of digital technology is inseparable from the rise of globalisation and the expansion of a free-market capitalism increasingly reliant on rapid modes of communication.⁷

According to Charlie Gere, while many of the binary technologies of the digital originate in the post-war climate of cybernetics and early information technologies, a distinctive digital formation is marked by the artefacts, forms of communication and meanings associated with a society 'supersaturated by digital technology'.⁸ These include older, analogue media like television, recorded music and film being inserted into digital production systems or converging with digital forms such as the Internet, mobile phone and video games in a ubiquitous mediascape. Hence:

To speak of the digital is to call up, metonymically, the whole panoply of virtual simulacra, instantaneous communication, ubiquitous media and global connectivity that constitutes

much of our contemporary experience. It is to allude to the vast range of applications and media forms that digital technology has made possible, including virtual reality, digital special effects, digital film, digital television, electronic music, computer games, multimedia, the Internet, the World Wide Web, digital telephony and Wireless Application Protocol (WAP), as well as the various cultural and artistic responses to the ubiquity of digital technology, such as Cyberpunk novels and films, Techno and post-pop music, the 'new typography', net.art and so on.⁹

MUSIC IN BITS / BITS OF MUSIC

As far as music is concerned, however, it is not just discrete styles like electronica and techno that are under question. The global conquest of computers has reconfigured the way nearly all music is created, distributed and performed, as sound is increasingly encoded into binary data-forms. Arguably, all popular music will have a digital life. For a start, an increasing proportion of today's musicians use computers, software and other digital equipment as compositional tools, sound sources and even as musical instruments. In fact, it is rare these days to find a recording studio that is not populated with a range of digital machinery, often built around a central computer, which records, process, mixes and masters the sounds. On a smaller scale, independent musicians across all styles are exploiting the powerful capabilities of digital home-recording setups to produce professional-sounding music while taking advantage of an organisational diffusion in the distribution, marketing and publishing of music. The rise of micro-independent labels and informal file-sharing networks has joined the possibility of mainstream artists (most recently, the British band Radiohead, albeit as a one-off stunt), bypassing the usual channels of distribution associated with the recording industry by allowing consumers to download their songs directly from the Internet or to remix their own versions using constituent digital parts.¹⁰ Not that this constitutes a sudden dissolution of large-scale corporate models of the industry. The disproportionate influence of a small number of industry players (multimedia companies like Sony BMG, EMI, Universal and Warner) continues to be a defining characteristic of music's cultural economy. Co-existent with this concentration, however, are subtle shifts in consumer-driven behaviours that signify more diffuse, bottom-up processes of participation and production, from file-swapping and bootlegging to hacking and mashups, to which I shall return below.

As for musical formats themselves, the shift to CDs in the early 1990s and, more recently, to MP3s, constitutes two of the most dramatic transformations in patterns of retail and ownership in popular music, including how music is bought, and where and how it is listened to. The recent availability of recorded music over the Internet in digital formats has posed a challenge to traditional models of the recording industry, including rights of ownership, while iPods and MP3 players have become icons of a highly aestheticised urban experience, the rhythms and moods of which are micro-managed by increasingly mobile consumers.¹¹ Indeed, if, as Virilio claims, the hypermodern can be defined as a heightened state of commodification, speed and mobility, then digitalised music is one of the paradigmatic forms of this extended moment of modernity.¹² In this respect, it joins an intricate network of globalised exchanges and circuits of

information and contributes to complex processes of technological convergence. When translated into 1s and 0s, music is both hyper-mobile and dispersed across multiple media sites combining previously separate processes of production, distribution and consumption. This is particularly evident as the tools of composition themselves become digitalised.

SOFTWARE SEQUENCERS AND SYNTHESIZERS

In December 2000, the Swedish software company Propellerheads launched *Reason*, an all-in-one virtual music production studio. Rendered in a Graphic User Interface as layers of hardware racks, *Reason* is a software emulation of hardware devices such as drum machines, analogue synthesizers, samplers and sequencers. Using *Reason*, musicians compose whole songs by inputting MIDI data and organising the digital units to generate drum patterns, orchestral sounds, synthesizer melodies and effects. It is possible to mix songs with the virtual mixing console and master the outcome as an audio file, or even flip the units around to see how they are configured and re-patch the wires as if they were hardware. After a song is finished, *Reason* allows musicians to upload songs to Internet forums, fire them off to record companies or swap them with others for development.

Now into its fourth version (at the time of writing, May 2008), *Reason*, like other convergent digital studios, represents software's increasing hold over independent and mainstream music-making. It is one of a host of software studios on the market, including *Cubase*, *Logic*, *Acid*, *Fruity Loops/FL Studio* and *GarageBand* - the latter bundled free with Apple's operating software and all of them are capable of professional-sounding music, the likes of which would have cost thousands of pounds in a recording studio just a few years ago.¹³ Such programmes have made a significant impression on the routines and practices of music-production, not least in the way they reconfigure what, where and how writing takes place. For a start, the rise of industry-standard protocols like Musical Instrument Digital Interface (MIDI) and Virtual Studio Technology (VST) has ended the universality of analogue hardware in music-making. In an initial phase of digitalisation in the 1970s and 1980s, analogue-to-digital converters (A/D) allowed continuous sound to be coded into discrete numbers and paved the way for sound to be manipulated digitally. The MIDI protocol, on the other hand, constituted a standardised language through which digital instruments like synthesizers and drum machines could pass information back and forth to one another. From the late 1990s, a subsequent phase of digitalisation has witnessed a radical softening of the tools of cultural production, giving rise to software emulations of a host of hardware precursors, most notably in the form of soft synthesizers. These are software plug-ins that emulate the sounds and graphic representations of older synthesizers such as the Moog, the DX7, the Prophet and the Mellotron.

Thousands of soft synths have been manufactured, making it one of the biggest growth areas of the musical instruments industry. Like other high-tech commodities, music software undergoes processes of development, iteration and marketing that establish its presence in a market driven by competition between developers and by the constant cycle of versions, upgrades and improved algorithms. In fact, the speed with which these new digital instruments have been manufactured, marketed and adopted is testament to the dynamism of digitally-

enabled economies and the loops of innovation that define capitalism.¹⁴ In such a context, the commodity is not erased, but becomes more transitory and circulatory, less a finished article than an on-going process that feeds a logic of ceaseless expansion. This is particularly the case with soft synths, which are marketed as space-saving, but cutting-edge, ways of making music in a market already saturated with devices claiming to do the same things. Dedicated software companies, such as Native Instruments, have been joined by older manufacturers, such as Roland and Korg, to become key players in a largely networked economy of digital goods.

Change is not always received as positive in popular music, however, and the rapid availability of software instruments has also produced debate and uncertainty. A recurrent question concerns how faithful the sounds of these emulations are, with sceptics pointing to a lack of 'warmth' in soft synths compared to their analogue precursors. Here, the digital algorithm is a crude emulation ('not quite a copy') of the somewhat more unpredictable characteristics of timbre, tuning and tone in analogue circuitry. Soft synths are also flat and intangible representations of a 'real thing' and therefore lack the human tactility and interface of hardware, a fetish for which is reinforced by technostalgic discourses of the 'original'. Indeed, such debates often tell us more about the discourses and ideological positions of the protagonists than they do about any essential qualities of the sound itself. They also reprise cycles of suspicion, innovation and acceptance of novel technologies (including the phonograph) for undermining ideas of the unique performance and presence of the body across the history of music as a whole.¹⁵

In any case, rarely do new sound technologies make their precursors obsolete, and the current co-existence of hardware/software configurations illustrates the complexity of technocultural formations. But they do assign them different positions in the overall system and point to a potential shift in modes of music-making as well as in the nature of the works themselves. In many ways, digital editing programmes are to music what word processors are to writing; they imply a set of relations between humans and machines that inflect the practice of writing in significant ways. Routines of composition become shaped by the aesthetics of the layout and the cognitive processes they call upon.¹⁶ Hence, musicians who had previously composed and recorded using analogue tape (such as a four-track portastudio) often speak of the leap of thought and practice needed to handle composition using a digital audio workstation.¹⁷ Thinking digitally, as it were, requires a shift in the attachments, modes and haptic efforts needed to compose within technospaces comprising windows-type arrangements, menus, scroll bars and cursors.

This doesn't mean that the computer or its interface 'determines' the actions of creators in a straightforward way. The history of technology and music are histories of misappropriation, accident and contingency precisely because of the way objects are used and misused in practice. Even the most rigid of software applications can be open to misinterpretations, hacks, errors, bugs and incompatibilities that change its function or produce contingent outcomes - anything from re-written code to a total system crash, from a misaligned MIDI note to lost music data. The code and the interface do set significant limits, however, and users are configured to respond to the software in relatively appropriate ways.¹⁸ Cut-and-paste actions are fundamental to the way digital music data are shuffled around the space of the composition, as blocks of MIDI information are edited and re-positioned in modular formations along a timeline. This means

that the act of composition is as much a result of cursor movement, scrolling, and clicking as it is of playing notes on a keyboard or strumming a guitar. As code has become a visual representation of a studio, with its simulations and icons, so the user has been presented with a surface on which to skim and play. Writing music in this way constitutes a flexible practice, subject to the speed of a copy/paste key combination or undo stroke, while the interface represents the work as a malleable digital landscape. Certainly, the stasis of the needle and the nascent malleability of magnetic tape are superseded, here. Digitalised composition increasingly takes place as a conversation between visual representation and composer, as the simulations, icons and windows of the graphic user interface beckon the composer into increasingly supple routines and processes, as some case examples will illustrate.

GORILLAZ, MASHUPS AND MOBILE MUSIC PRODUCTION

The contemporary UK pop band, Gorillaz, is the brainchild of former Blur frontman, Damon Albarn, and Jamie Hewlett, animator for the popular comic *Tank Girl*. The band is well known for its status as a 'virtual band' because of its refusal to appear as anything other than four animated characters. Even during 'live' performances the band performs behind a screen as shadows or as animated projections, while the playful deconstruction of what it is to be a successful band (suggested by the title of the band's DVD, *Phase One: Celebrity Take Down*) rests on a paradoxical appropriation of the codes of fame and merchandise.¹⁹ It is hard not to fall into a conventional postmodern reading, here. We have moved into Baudrillard's fourth order of the image, the simulacrum, where there is no longer any real to suspend. Gorillaz do not project a fantasy image as a proxy for a real band, nor do they create an illusion of correspondence to a deferred presence. The cartoon image conceals nothing like a real object; it only refers to itself as a play of signs through which the band is made manifest.

But we do an injustice to the complexity of Gorillaz's music if we stop there. In an article on Gorillaz's hit single 'Clint Eastwood', John Richardson points to two important ways in which digital recording technologies inflect core features of the musical text.²⁰ First, the digital removes any vestiges of permanence from the production as the song enters into a state of constant iteration and transformation. This gives rise to a proliferating series of versions that radicalise the concept of the 'remix'. The modern remix, with its roots in dancehall, disco and dub reggae, is not invented with digital production, of course. In fact, the production of dance floor remixes was a feature both of multi-track recording devices and of DJ techniques in the 1960s and 1970s. What software applications such as *Logic* do, however, is favour the instantaneous malleability of music on screen, as moveable chunks rather than as potentialities achieved through the employment of laborious tape edits or tools such as razor blades. The 'original' *Geep* version of 'Clint Eastwood' had already sprung a series of remixes in the style of Garage and Drum 'n' Bass. More recently, the issue of two further Gorillaz albums of outtakes, b-sides and remixes ('D-sides' and 'G-sides') reveals the cut-and-paste approach to production and composition. Here, musical phrases become interchangeable units that appear and reappear across songs, as two sound engineers associated with the Gorillaz project explain:

I think the reason why we worked in a different way is because we've got this whole *Logic* thing going on, so instead of working in a linear world where you're using tape, you've got a hell of a lot more flexibility ... At the beginning loads of songs merged into each other. Say if we had four tunes, all those four tunes would be made up of all the same bits ... We'd keep swapping bits around, and whatever it sounded best in, we'd leave it in that song and take it out of the other song.²¹

Richardson argues that *Logic's* arranged window, in particular, provides a digital space composed of individual parts that show the structural coordinates of the song as well as the infinitesimal transformations that are possible when parts are magnified and edited. To this extent, software permits greater speed and textual plasticity than ever because of the way the composition is visually fragmented. Like other new media forms - as defined by Lev Manovich - software-produced music is neither something fixed nor is it merely reproducible in identical copies, as an orthodox Benjaminian reading would have it. Instead, it offers itself up as potentially endless versions - both authorised and unauthorised.²²

Secondly, this hyper-plasticity leads to significant levels of stylistic eclecticism and hybridisation. Post-structuralist analyses of contemporary culture regularly point to the blurring of genres and the erosion of boundaries between styles as a characteristic feature of postmodern hybridisation and aesthetic fragmentation.²³ Such processes, it is claimed, accompany a levelling of taste hierarchies and an explosion of difference, in which high and low culture are intermingled and social class and consumption undergo a progressive de-alignment. Often, this leap of logic - explaining shifts in social stratification according to changes in the nature of cultural forms and vice versa - is belied by empirical studies that continue to show clusters of taste organised around high and low culture, as well as complex homologies between social background and taste preferences in music.²⁴ Moreover, adherence to genre categories continues to be an important structuring device through which music is packaged and made familiar.²⁵

Still, it is undeniable that *modern* processes of social differentiation identified by sociologists such as Durkheim, Weber and Bourdieu have intensified to such a degree that, in popular music at least, the pool of labels and genres has not only deepened, but spawned unprecedented levels of cross-fertilisation. According to Bourdieu, the shift to modernity is defined precisely by the emergence of fractured cultural fields within which differentiated positions, schools and movements are distributed.²⁶ A hyper-differentiated cultural field is a space of proliferating positions and classifications in which a logic of differentiation inevitably leads to overlap and partial de-differentiation.²⁷ Even a cursory review of record shops or on-line networking sites like *myspace* reveals the extraordinary diversity of this genre soup and the crossovers therein. Core genres such as blues, rock, rap and punk are joined by a never-ending list of global hybrids and subgenres, from J-pop, crunk, hyphy and screamo to zouk, ghettotech, Canto-pop and concrete.

In an article on what they call 'stylistic morphing', Sandywell and Beer point to digital practices as a pre-condition for recent transmutations in genre. They argue that stylistic landscapes of music have become more liquefied and populated by provisional styles under constant composition and decomposition within the digital spaces of samplers, sequencers and

software studios. Hence, 'what were previously regarded as formal and invariant categories of popular culture become fluid repertoires, subject to further digital transformation and interpretation'.²⁸ Popular music has always been defined by voracious practices of borrowings and splices, of course: the constant interchanges between blues, gospel, rock, jazz, funk, soul and so on are well known. Yet, the extent and range of these interchanges are unprecedented, as morphing between, within and across genres is pushed to the extreme. Current genre milieus are certainly less rigid and predictable than they used to be and this can be attributed, in part, to a softening of production practices and associated technologies.

The rise of the musical mashup is a case in point. The mashup involves the meshing of styles, songs and albums into a single text. Mashups are single compositions combined of elements of two or more songs from disparate genres or periods. They most often comprise the vocals of one song mixed or overlaid with the instrumentation from another. Deriving from the practices of DJs and hip-hop's proclivity for sampling across a range of styles, the mashup combines not just beats or short musical phrases (early digital samplers could only hold a second or two's worth of material) but whole songs or albums thrown together. Famously, in 2004, The Beatles' *The White Album* was mashed with hip-hop artist, Jay-Z's, *The Black Album* by Danger Mouse to produce *The Grey Album*. Using readily available audio software, Danger Mouse spliced unauthorised digital instrumental samples from The Beatles with a *cappella* phrases designed by Jay-Z.²⁹ Though limited to just 3,000 copies, *The Grey Album* circulated informally in Internet forums and peer-to-peer sites and became one of the year's most popular and critically-acclaimed albums.³⁰

The mashup brings together unlikely bedfellows in the 'arrange' window of digital sequencing software. It takes sampling and remixing to another level. Tellingly, mashup beginners are advised to set aside some time to import as many songs as possible into their chosen software application, align the tempos and pitches and start to listen out for interesting combinations. Matching the tempos of two songs using turntables and vinyl was always possible, but software has unhooked tempo from pitch so that any two songs made in different keys can be brought together in harmony. This makes all combinations possible as vertical limitations between styles are compressed into an endless series of folds, with each genre activating another.³¹ Whole radio programmes, such as 'The Remix' on London's XFM, are devoted to the development of the mashup form, while its links with avant-garde practice, from cubist montage to situationist *détournement*, point up the potential shock-value in bringing together two objects never meant to occupy the same space.

Gorillaz's 'Clint Eastwood' is no mashup, but it does display similar levels of stylistic eclecticism. This is obvious from the start, as the song begins with a lazy hip-hop drum sample, joined by a dub organ on the offbeat, indie vocals, a rap, a psychedelic ascending synth line, a distressed Country and Western piano trill and a series of digital effects borrowed from dance and electro. Indeed, 'Clint Eastwood' is definitively digital, not only in the copy-and-paste compositional technique but also in the multiple, globalised points of reference that are performed in the piece. These are not merely 'musical' references, but cross-media references to anime, to Western films and to computer games, which make for a product potentially open to diverse audiences, generations and markets. In this sense, the song almost performs its own technological auspices, filling the audio space with stylistic combinations and effects only possible

in the digital studio. These include sonic representations of spatiality in the piece, which, as Richardson notes, progressively deconstructs the conventional placement of figures in the areas associated with them in the mix such as the lead singer proximate to the listener and panned to the centre. Instead:

as the song progresses ... the virtual fingers of the producer enter the equation as panning pandemonium is unleashed. Here, playfulness in postproduction replaces sensory realism as the decentering influence of the DJ/producer is felt, and scratching, piano and melodic parts all go walkabout, swinging alternately hard to the right and left.³²

In short, the spatial and temporal confusions that are often associated with the condition of hypermodernity, where the duration of events is compressed to the speed of light and where geography is annihilated by flow, are reprised sonically. For Richardson, at least, the temporalities and spatialities implicit in 'Clint Eastwood' undermine naturalistic assumptions about the finished text and the space of performance, particularly the ideal of the 'live' space of the linear stage conventionally replicated in production. But there is another way in which the digital conflicts geometrical space and that is, increasingly, by unhooking the sites of cultural production from a single location, such as the recording studio.

Making music on the move by using laptops, wireless networks and portable studios has become an increasingly prominent practice amongst musicians, DJs and producers.³³ The laptop, in particular, is the archetypal nomadic device: quick, portable and powerful, but flexible enough to be used as an all-in-one mobile production studio. For musicians, the key attribute of the laptop is the way it makes creativity possible in myriad spaces, so that productivity can continue beyond the physical confines of the home or studio. Trains and planes are common sites of digital composition and well-known acts such as Steve Vai and Björk have made entire albums in this way.³⁴ Not that this must be a strictly solitary undertaking, nor one that involves physical co-presence. With the development of wireless recording technologies, musicians can now create songs with others across global networked servers or produce ready-to-go material on tour. At the time of writing, for instance, American producer Timbaland is set to produce a 'mobile album' using a Verizon self-contained mobile recording studio installed on a bus. He will, it is claimed, be writing and recording a song a month, each with a different artist, while touring the United States. Meanwhile, musicians from various genres and backgrounds are beginning to use digital communications networks, as well as regular mail systems, to remix, swap and develop songs remotely, without ever having to meet in person.³⁵ In a recent case, collaborators within the American group *The Postal Service* wrote a whole album's worth of material this way, sending each other packages containing *Pro Tools* files for additive development, whilst Brian Eno and David Byrne collaborated in a similarly remote fashion to complete the album *Everything That Happens Will Happen Today* with Eno providing the instrumental work and Byrne separately adding vocals. The album was released, initially, as a streaming digital download free from digital rights restrictions and label ownership.

If, as Sterne argues, the studio should best be seen as a network connecting 'bodies and sounds in space, a particular ordering of practices and attitudes', then the recent, digital twist

lies in how this space has become dematerialised, detached from locality and dispersed into the 'space of flows'.³⁶ Mechanisms of mobility are re-ordering urban and commercial infrastructures, for sure, but they are also changing how musicians make culture, where they congregate and through what means and mediations. Even 'live' music, historically constructed as a singular moment of co-presence in time and space, is transformed. The real-time webcasting of gigs and live events in virtual environments such as *Second Life* have not only pushed out the boundaries around place, locality and materiality, but have made 'liveness' itself a more porous and malleable category. Hence, streaming webcasts of highly-staged performances by acts like Paul McCartney have transformed the very meaning of the term 'live' and its imbrications with its putative other, 'recording'.³⁷ All of which means that if music was always 'inherently mobile', then digitalisation implies a re-conceptualisation of how music travels, where creativity takes place and, most importantly for the next section of this article, how humans and machines interact.³⁸

CYBORG SINGERS

There's a moment on Britney Spears' 2007 album, *Blackout*, when the unthinkable happens - Britney disappears. Or, at least, her voice seems to vanish as the southern drawl loses its distinctive timbre and presence, to be replaced by something altogether less human. The hit single, 'Piece of Me', doubles processes of objectification in a careful layering of form and content. In essence, the song is a media confessional that self-stages her persona as a commodified 'thing' - cut up, twisted and sold back as spectacle. The refrain, 'you want a piece of me', is sung flatly, as if the Britney object had already been divested of much of its signature personality: the same process that affords fame transforms the celebrity into a series of prepared headlines ('I'm Mrs "extra extra, this just in"'). After being processed through various effects units and digitally splintered, the vocal's dehumanisation is complete. By the final verse, Britney's voice jumps whole octaves in digital steps, giving the sense that the voice-machine has been pushed to its limits and is on the verge of malfunctioning. There is no emotive expression left, only a husk made of 1s and 0s switched backwards and forwards from effect to effect.

Just as Britney the image is a floating signifier made real in the process of mediatization, so her voice becomes an artifice of machinery.³⁹ She is subject to the digital crotchets of pitch-correction software such as *Auto-Tune*, not because the software creates a faultless vocal performance (the hyperreal of the human voice), but because it acts as a de-humaniser (the hyperreal of the machine). As a studio tool, *Autotune* turns the vocal into a series of interrupted chops, stutters and warps - less palliative treatment than act of deconstruction, her identity under constant assemblage and erasure. This applies as much to gender as it does to any other identity markers. At regular intervals on *Blackout*, Britney's pitch-shifted vocals plummet to lower registers, creating gender uncertainties and oscillations, an effect reinforced by the regular pairing of her voice with that of Danja's, her producer, whose own heavily-mechanised voice corrugates the songs.

We have been here before, of course, not least with Cher's hit 'Believe'. In 1998, 'Believe' reached number 1 in the UK charts and became synonymous with the vocoder effect that was to spark a renewed interest in the device, as well as a host of copycat hits by pop stars such as

Madonna, Victoria Beckham, Steps and Kylie Minogue. The vocoder (or voice encoder) itself had begun life as a military information tool. It was developed in the 1930s and 1940s as a telecommunications application that could analyse the frequency characteristics of speech, cut it up into encoded chunks and synthesise it. Once encoded, the voice could be securely transmitted via narrow bandwidth channels and the tool proved significant in World War II as a scrambling device, famously scrambling conversations between Franklin Roosevelt and Winston Churchill.

Even before it had entered popular culture, in other words, the vocoder had sutured to the body and the body politic. It extracted, fractured and reassembled the human voice, encoding its harmonic content (known as formants) and transforming it into the language of the machine. In part, the originary presence of human speech as it forces itself through the vocal chords and the glottis had been deconstructed and reconstructed in electronic form, cleaved to but not entirely disappearing into the machinic. This is what makes the sound of the vocoder so arresting: the body appears to be disassembled and reassembled. We still recognise the voice, but it is shrouded, encoded, perhaps even haunted by the non-human - cyborg for sure, but not absolutely post-human. Kodwo Eshun puts it thus: 'The vocoder turns the voice into a synthesizer. Electro crosses the threshold of synthetic vocalization, breaks out into the new spectrum of vocal synthesis. It synthesizes the voice into voltage, into an electrophonic charge that gets directly on your nerves'.⁴⁰ The key term here is synthesis: the voice is processed, enmeshed and embalmed in the electronic; it is dispersed into voltage, flattened and reconstituted. And in this moment of synthesis, the vocoder hints at the junctions (if not reconciliation) between human and machine.

We search in vain for Barthes' 'grain of the voice', here, and find not an absence of the human but its transmogrification into the smooth space of flattened sonic frequencies and machinic imaginaries. It's not that the voice has disappeared, but that its register is meshed with the machine to produce a third entity - a cyborg voice that breaches certain expectations about where the 'human' is or can be. As Frith writes: 'as listeners we assume that we can hear someone's life in their voice ... we hear singers as *personally* expressive'.⁴¹ The container and inscriber of this expressiveness is the material body as it represents the locus of personhood. What happens, then, when this life is no longer so fleshy? The Daleks, Darth Vader, The Cylons of *Battlestar Galactica*, Hal from *2001*, Metal Mickey - all are examples of machinic vocalisations that reinscribe versions of the human voice within less-than-human bodies. We certainly don't attach the same status to these voices, but we still recognise the utterances as belonging to the realm of language and meaning. Vocoder seems to add to these confusions because we're never quite sure where the body is, how human it is or where it comes from.

It wasn't until the 1970s that the vocoder found its way into popular music. Bands such as Kraftwerk were progenitors of a machine aesthetic with origins in Italian Futurism but deifying the artificial tropes of the robot as it played out in the early computer age. Alongside the cool timbres of the synthesizer, the vocoder fused the ideals of pop-standardisation with robotics, giving expression to a long-held fascination with the human *as* machine. By the 1980s and 1990s, pop's repertoires had opened up to such an extent that the vocoder had become a stalwart production feature in many mainstream songs. What was an analogue technology associated

with slightly left-field, highly technologised acts had become a well-used digital studio tool, but one that continued to play with expectations around identity, vocalilty and the body.⁴²

In the hands of the French electro-pop duo Daft Punk, for instance, the heavily treated vocals had become 'robotocised', yet the content of the lyrics addressed practices considered absolutely human: love, life, emotion, sex. Even the title of the group's third studio album, *Human After All*, pointed to the humanoid con(fusions) concerning how the songs were produced, by whom and with what. This was clearly not the warm intimacy of Frank Sinatra (an intimacy, lest we forget, made possible by the electrical microphone), but something altogether less 'pure' and logocentric - the signature sound of the cyborg produced by the synthesizing properties of the vocoder. In contemporary R&B, equally, big-name producers such as Sean 'Puffy' Combs, Missy Elliot, Timbaland and The Neptunes have, in various ways, blurred the line between performer and machine with a host of studio manipulations of the voice, including the vocoder effect and lo-fi distortions redolent of cell-phone conversations. On Timbaland's production of Ginuwine's 'Pony', for example, the producer's signature lagging beats are joined by a 'talk box' bass line and filtered vocal samples that ghost their way into the mix. The alignment of vocal phrases to rhythmical rather than harmonic elements in the songs of Mary J. Blige brings the singing voice closer to the automated patterns of the machine, whilst the insertion of human 'beat boxing' on Justin Timberlake's 'LoveStoned/ I Think She Knows Interlude', again produced by Timbaland, completes the circle. The track features not a drummer striking an analogue kit, nor a digital machine simulating this kit, but a human voice attempting to replicate the sonic repetitions of the drum machine, simulating the simulation.

By the time of Cher's hit, the voice's representational practices had been subject to both analogue and digital transmutations that showed how popular music could, in form and content, explore the ambiguities of technology-mediated identities. In an essay on 'Believe', Kay Dickinson traces the contradictions inherent in the track and the position that Cher's body occupies in the song. On one hand, Cher's digitally processed voice does not seem to emanate from an inner essence; it does not form a singular presence. Indeed, it undermines the imagined ideal of the voice as an unmediated and authentic expression of personality. It therefore stands in opposition to the 'organic' relationship between self and voice, opening itself to charges of mass-cultural gimmickry. At best, the vocoder is seen as a passing fad; at worst, a cheap contrivance that distracts the listener from the lack of talent hidden underneath. On the other hand the elaborate use of the vocoder and the now ubiquitous software processor *Auto-Tune* on the track, opens up a series of questions regarding what kinds of bodies are sonically and materially present. 'For the first time in its history', writes Dickinson, 'the vocoder is now much more readily conjoined with if not the female voice, then at least the "feminised" one', and this has potentially deconstructive implications.⁴³ After all, if the female body and its voice are seen as the natural instrument for female musicians, then the vocoder de-aligns the voice's 'grain' from its gender. It suggests the inseparability of the voice from technological mediations at a time when the microphone is still popularly seen as a transparent facilitator of the singer's personality, when lyrical content is valued over the means of expression and when (particularly female) singers are regularly castigated for miming, using ghost singers or pitch-correction tools. It also hints at a series of questions about where bodily self and technology begin and end, and whether hard-and-fast

distinctions between these categories make sense any more.⁴⁴

These are, of course, questions within the conceptual territory of cultural theorists such as Kodwo Eshun, Donna Haraway and Sadie Plant - authors who explore how ever more intimate interactions between humans and technology might present opportunities for subjugated populations to exercise greater political control and power. Such questions of 'liberation' and 'freedom' are never simple, not least because they are criss-crossed by countervailing tendencies including, in this case, Cher's own position in a largely patriarchal record industry and the fact that the track was written, devised and produced by six different songwriters, two different producers and an executive producer, all of them male. On listening to the track one also gets the feeling that the vocoder and pitch-shifting effects are used more sparingly than on tracks performed by male groups such as Kraftwerk and Daft Punk, in order to give due sonic space to Cher's more conventionally double-tracked female vocals.⁴⁵ Nevertheless, it is worth noting that the vocoder's use does at least force us to think about perceptions of the human and the machine and the complex oscillations between the organic and the inorganic.

As Haraway insists, the point is not to science-fictionalise the cyborg, but to keep in mind its metaphorical and analytical power as a way of making sense of these interchanges. It is an 'imaginative resource suggesting some very fruitful couplings' across time and space, not just in the present.⁴⁶ After all, we are, to quote Hayles, 'natural-born cyborgs ... who have, since the dawn of the species, excelled in enrolling objects into [our] extended cognitive systems'.⁴⁸ Music is saturated with such enrolments and mediations because musicians are in constant feedback with artefacts, formulas and systems. Even classical music, supposedly a 'purer' form of expression than pop, is unthinkable without the presence of scores, notations, instruments, halls, chairs, music stands and so on, while ancient Greek music, according to Kittler, was inseparable from the lyre, the bow and the mathematical ratios that dictated where musicians should pluck.⁴⁹ But rarely are these even seen as 'technologies', consigned as they are to the status of instrumental facilitators that respond to the masterful and purposive actions of the human agent - literally and figuratively as conductor. In discourses of rock, equally, a dual fetishisation of equipment and player is regularly tipped in favour of the instrumentalist as virtuoso and the affirmation of a staunchly anti-technological authenticity. Here, the artifice of technology taints the idea of creativity, getting in the way of natural expression and craft - the irony being that rock's vision of unmediated communication between performer and audience is wholly dependent on the multiple modes of electrification and staging that make such an encounter possible.⁵⁰

If the chain of interactions between humans and non-humans is to be taken seriously, the belief that technologies are passive tools waiting for their organic masters to give them life should be rejected. Alternative formulations of how complex human-machine assemblages work and fit together depend upon a much more charitable approach to the role of technologies in holding things together. In contemporary popular music, this relationship is already playfully explored via the tropes of machine music.⁵¹ High academic theory echoes this exploration in the guise of Actor Network Theory, an approach to the agency of *things* - people, objects, animals, or anything connected to anything else.⁵² If we entertain, for a moment, the idea that all the multiple associations between humans and non-humans are constitutive of musical cultures and networks, then it is no longer tenable to bestow absolute agency upon the human as if it were

a manifestation of pure humanity, stripped of the modulating properties of objects.

Bringing the object back in requires a shift in conceptions of agency and the social with particular resonances in music, since belief in the irreducible singularity of the creator has been absolutely formative to music's birth and development. This shift returns music technology to a mode 'other than that of instrumentality, efficiency or materiality' (to quote Bruno Latour), opening up our understanding of the multitudinous interconnections between human and other objects in emergent musical fields.⁵³ It is not just that technology *impacts* upon music, *influences* music, *shapes* music, because this form of weak technological determinism still implies two separate domains. Music is always already suffused with technology, it is embedded within technological forms and forces; it is *in* and *of* technology. It is certainly not a peripheral tool that enables a pre-existing creative humanity to come spilling into sonic communities, nor is it a soul-less distraction that is somehow false or falsifying. 'We construct our technologies, and our technologies construct us and our times', writes Shelly Turkle: 'our times make us, we make our machines, our machines make our times'.⁵⁴

POPULAR MUSIC IN THE DIGITAL HYPERMODERN

But what times *are* these? Throughout this essay I have been hinting at the extensions to the modern wrought by late twentieth- and early twenty-first-century developments in the ways in which societies are organised, structured and experienced. Employing the term hypermodern is not merely a semantic move, but a historical one that provides a better description of this moment as a radicalisation of modern modes of life that were always fissured, fast-paced and contradictory. To conflate this moment with a unique state of free-floating chaos, absolute flux and groundlessness is descriptively trite and historically inaccurate. We are not beyond modern modes of culture and society associated with large-scale industrial capitalism.⁵⁵ If anything, capitalist modernity continues to be a highly adaptive and constantly mutating formation, a set of networks permanently under construction.⁵⁶ But we are seeing significant extensions and restructurings of this edifice and the digital is one important catalyst to the emergence of this networked society because digital formations help to loosen, soften and make malleable contemporary social, cultural and economic forms, extending and magnifying processes of commodification across the globe, as well as speeding up information and capital.

As for popular music, if we have entered a digital phase, then the digital doesn't overhaul cultural modernity but radicalises it and stretches its limits. It changes our expectations about what belongs in music, what music consists of, who is making music and how. Digital music technologies are not in themselves 'revolutionary', but they are unique in their combinatorial potentials, in how they combine and re-purpose old analogue hardware, as well as in how they simulate new forms. Software, in particular, subtends entry into the hypermodern as a regime of cultural expansion, flexibility and global complexity. In doing so, software affords different kinds of phenomenality, creativity and play. It is not that one can find a *trace* of software in contemporary music production, as if hunting for an occasional presence where the code pokes through is enough. It is much more than this. Software is the condition of possibility for much that goes on in processes of production, whether in the composition, the editing, the mixing

or the mastering. Using a Digital Audio Workstation changes the way music is written and produced not *just* because musicians, producers and engineers are employing new tools to do things they have always done, but also because the digital shifts the way these personnel conjure up musical forms and structures, as well as the thought processes that give rise to them. Seen in this way, the computer and its software are not tools, but mediators that act as part of the traffic between humans and non-humans in everyday life.

But the temptation to overplay these shifts, while it is understandable, should be resisted. Timothy Taylor, for instance, argues that the 'advent of digital technology in the early 1980s marks the beginning of what may be the most fundamental change in the history of western music since the invention of music notation in the ninth century'.⁵⁷ Such claims are dramatic but unhelpful, for they assume what they set out to assess, ignoring the long-term curvature of cultural history and reducing complex processes of reconfiguration to the terms of absolute revolution. Clearly, no techno-cultural form springs into existence fully formed. There is always a period when the divisions between different modes of operation are undefined, so that the co-existence of the analogue and digital is an inevitable product of complex histories of development. Moments of co-existence can also be disorienting to those societies engaged in them and some of that disorientation takes a taxonomic form, a confusion of categories as well as a resistance to change.

The real challenge, then, will be to capture the shape and significance of digital technologies as they unfurl and to examine how they are enmeshing human agency in data flows, thereby shifting the routines and habits of music in expanded domains of cultural production. For our engagement with digital information technologies is one of the most stunning and rapidly-growing phenomena of recent times. It extends the possibilities of cultural production into interesting new spaces, while reconfiguring collaborative practices and the means and relations of music-making. It is these coalitions, forces and realities that deserve our scholarly attention as the speed of contemporary culture is cranked up to hyperdrive and as popular music takes another turn in an already convoluted historical journey.

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NOTES

1. Andrew Goodwin, 'Sample and Hold: Pop Music in the Digital Age of Reproduction', in S. Frith and A. Goodwin (eds), *On Record: Rock, Pop and the Written Word*, New York, Pantheon, 1990.
2. Fredric Jameson, *The Cultural Turn: Selected Writings on the Postmodern 1983-1998*, London, Verso, 1998.
3. Walter Benjamin, *The Arcades Project*, Rolf Tiedemann (ed), Howard Eiland and Kevin McLaughlin (trans), New York, Belknap Press, 2002, p464. Benjamin used this term in *The Arcades Project* to describe the ability of images to flash up at particular crucial moments and encapsulate the meanings of a whole historical formation, thereby producing insights into their epistemic foundations.

4. The idea of 'affordances' stems from James Gibson's theories of perception and Donald Norman's work in Human Computer Interaction. It refers to the 'action possibilities' inherent in the properties of objects or environments and the skewed likelihood of them being used or perceived in certain ways. The concept has been taken up in Science and Technology Studies as a way of overcoming the extremes of technological determinism and social constructivist perspectives. See Ian Hutchby, 'Technologies, Texts and Affordances', *Sociology*, 35, 2 (2001): 441-456.
5. Friedrich Kittler, 'The History of Communication Media', *ctheory*, 114 (1996): 9, <http://www.ctheory.net/articles.aspx?id=45>
6. Peter Lunenfeld, *The Digital Dialectic: New Essays on New Media*, London, MIT Press, 1999, pp xv-xvi.
7. Manuel Castells, *The Rise of the Network Society, Vol. 1, The Information Age: Economy, Society and Culture*, Oxford, Blackwell, 1996. Castells argues that the restructuring towards a global networked economy is dependent upon digital information technologies (such as the Internet) that integrate financial markets and allow capital to flow freely. The very mechanisms of an adaptive capitalism depend upon flows of non-material digital goods (capital, information, images, software) zipping around the globe at hyper-speed.
8. Charlie Gere, *Digital Culture*, London, Reaktion Books, 2002, p197.
9. *Ibid.*, pp11-12.
10. As is the case, at the time of writing, with Radiohead's song, *Nude*. In many ways, this echoes small-scale models of cultural production that have always (as with punk, for instance) threatened to meet the idea of a top-down industry with a more bottom-up, self-organized and loosely structured cultural economy.
11. Michael Bull, 'No Dead Air! The iPod and the Culture of Mobile Listening', *Leisure Studies*, 24, 4 (2005): 343-355.
12. Paul Virilio, *Open Sky*, London, Verso, 1997; John Armitage (ed), *Paul Virilio: From Modernism to Hypermodernism and Beyond*, London, Sage, 2000; Steve Redhead, *Paul Virilio: Theorist for an Accelerated Culture*, Edinburgh, Edinburgh University Press, 2004.
13. GarageBand allows users to compose, record and mix tracks, incorporate pre-recorded loops out of thousands provided and export finished songs to iTunes. It has been associated with a potential democratisation of music creation towards low budget producers and remixers, although any claims to distributed creativity have to be met with a certain amount of suspicion given residual hierarchies in the acquisition and use of gear. See Nick Prior, 'Putting a Glitch in the Field: Bourdieu, Actor Network Theory and Contemporary Music', *Cultural Sociology*, 2, 3 (2008): 301-319.
14. Tiziana Terranova, *Network Culture*, London, Pluto, 2004.
15. Jonathan Sterne, *The Audible Past: Cultural Origins of Sound Reproduction*, London, Duke University Press, 2003.
16. Johnson writes of his relationship to word processing, as follows: 'the computer had not only made it easier for me to write; it had also changed the very substance of what I was writing, and in that sense, I suspect, it had an enormous effect on my thinking as well'. See Steven Johnson, *Interface Culture: How new Technology Transforms the way we Create and Communicate*, New York, Basic Books, 1997, p145.
17. Megan Perry, *Wired: Musicians' Home Studios*, San Francisco, Backbeat Books, 2004; Paul Théberge, *Any Sound You Can Imagine: Making Music, Consuming Technology*, London, Wesleyan University Press, 1997.
18. To evoke the language of media and technology studies, users are only free to make what they will of software texts within certain interpretative contexts that restrict the range of possible uses. See Keith Grint and Steve Woolgar, *The Machine at Work: Technology, Work and Organization*, Cambridge, Polity Press, 1997.
19. It is paradoxical precisely because, to follow Bourdieu, the large-scale field of production to which the Gorillaz belong consecrates each and every intervention within a logic of subversion or conservation. In particular, Albarn's own renown places him in a position already defined by the accumulated history of the field such that whatever he ends up doing will be defined as music (as opposed to politics, critique or anti-music). See Pierre Bourdieu, *The Field of Cultural Production*, Cambridge, Polity Press, 1993.
20. John Richardson, 'The Digital Won't Let Me Go: Constructions of the Virtual and the Real in Gorillaz' "Clint Eastwood"', *Journal of Popular Music Studies*, 17, 1 (2005): 1-29.

21. Sam Inglis, 'Tom Girling and Jason Cox: Recording Gorillaz' "Clint Eastwood"', *Sound on Sound*, 2001, <http://www.soundonsound.com/sos/Sep01/articles/gorillaztracks.asp>
22. Lev Manovich, *The Language of New Media*, London, MIT Press, 2001.
23. Andreas Huyssens, *After the Great Divide: Modernism, Mass Culture, Postmodernism*, Bloomington, Indiana University Press, 1986.
24. Tony Bennett, Mike Savage, Elizabeth Silva, Alan Warde, Modesto Gayo-Cal, David Wright, 'Cultural Capital and the Cultural Field in Contemporary Britain', CRESC, University of Manchester, Working Paper 3, 2005.
25. Keith Negus, *Music Genres and Corporate Cultures*, London, Routledge, 1999.
26. Bourdieu, op. cit., p164.
27. Stephen Crook, Malcolm Waters and Jan Pakulski, *Postmodernization: Change in Advance Society*, London, Sage, 1992; Scott Lash, *The Sociology of Postmodernism*, London, Routledge, 1990.
28. Barry Sandywell and David Beer, 'Stylistic Morphing: Notes on the Digitisation of Contemporary Music Culture', *Convergence*, 11 (2005):113.
29. Michael D. Ayers, 'The Cyberactivism of a Dangermouse', in Michael D. Ayers (ed), *Cybersounds: Essays on Virtual Music Culture*, New York, Peter Lang, 2006.
30. A series of subsequent mashups of Jay-Z's album with songs from Pavement, Prince, Metallica and The Wu-Tang Clan has kept *The Grey Album* endlessly looping, while his website still makes available a toolkit containing the software and audio files for DJs and others to continue the process of musical recapitulation.
31. Madonna's pop vocals from 'Ray of Light' articulating over The Sex Pistols' punk guitars from 'God Save the Queen', for instance, in the case of Mark Vidler's 'Ray of Gob'.
32. Richardson, *ibid.*, pp15-16.
33. Nick Prior, 'OK Computer: Mobility, Software and the Laptop Musician', paper presented at the conference *Information, Communication and Society*, University of York, September 2006.
34. Freshers at the influential Berklee College of Music are even asked to buy a laptop, MIDI keyboard and a copy of *Reason* at the start of their studies. See Mark McClusky, 'The Incredible Shrinking Studio', *Wired News*, October, 2003, <http://www.wired.com/news/digiwood/0,1412,606639.html>
35. Every few months, LA-based Jimmy Tamborello would send Seattleite Ben Gibbard CD-Rs containing electronic snippets of songs; Gibbard would add vocals and melodies and send them back for further development, and so the process would continue.
36. Sterne, op. cit., p236.
37. Mark Duffet, 'Imagined Memories: Webcasting as a 'Live' Technology and the Case of Little Big Gig', *Information, Communication and Society*, 6, 3 (2003): 307-325.
38. John Connell and Chris Gibson, *Soundtracks*, London, Routledge, 2003, p45.
39. This adds another layer of meaning to Spears' heavily criticised comeback performance at the 2007 MTV Music Video awards in Las Vegas. On stage the singer looked stiff and disinterested as she performed the single 'Gimme More'. But in many ways it was the perfect reprise of a superstar-turned-automaton by the over-burdening demands of a highly technologised industry.
40. Kodwo Eshun, *More Brilliant than the Sun: Adventures in Sonic Fiction*, London, Quartet Books, 1998.
41. Simon Frith, *Performing Rites: Evaluating Popular Music*, Oxford, Oxford University Press, 1996, p186.
42. The shift from the vocoder as an analogue device to the vocoder effect as a studio production tool is subtle but it leads to a much more flexible use of the technology. For instance, vocalists originally had to sing through

the device for the effect to be heard. Any changes in the effect would necessitate a re-take of the whole track. Now, however, digital vocoder effects can be added at a later date, leaving the singer's tracked vocals open to endless *post-hoc* manipulations and transformations.

43. Kay Dickinson, "'Believe'? Vocoders, Digitalised Female Identity and Camp', *Popular Music*, 20, 3 (2001): 337.

44. Hence, if we extend questions of identity and representation to cover black cultural practices, then the vocoder's use in contemporary R&B calls up the possibility of a black posthumanism and the subjectivities that are possible when spillages between race, sound and technology are explored: not necessarily an anti-humanism, but the human's virtual embodiment in the synthesizing properties of the 'sound machine'. See, Alexander Weheliye, 'Posthuman Voices in Contemporary Black Popular Music', *Social Text*, 20, 2 (2002): 21-47.

45. Sue Sillitoe, 'Recording Cher's "Believe"', *Sound on Sound*, February 1999, <http://www.soundonsound.com/sos/feb99/articles/tracks661.htm>. Interestingly, an historical postscript to this article suggests that 'Believe's' producers used the software plug-in *Auto-Tune* on the track to provide the 'stepped' quality of the vocals but kept its presence a trade secret - this was the first time it had been used in a commercial recording. It may well be that the producers did not, strictly, employ a vocoder at all, although what became known as the 'Cher effect' is, in some respects, indistinguishable from that produced by the vocoder.

46. Donna Haraway, *Simians, Cyborgs and Women: the Reinvention of Nature*, London, Free Association, 1991, p150.

47. N. Katherine Hayles, 'Traumas of Code', *Critical Inquiry*, 33, Autumn (2006): 139.

48. Antoine Hennion, 'Music and Mediation: Toward a New Sociology of Music', in M. Clayton, T. Herbert and R. Middleton (eds), *The Cultural Study of Music: A Critical Introduction*, London, Routledge, 2003; Friedrich Kittler, 'Number and Numeral', in *Theory, Culture and Society*, 23, 7-8 (2006): 51-61.

49. Simon Frith, 'Art Versus Technology: The Strange Case of Popular Music', *Media, Culture and Society*, 8 (1986): 263-79.

50. David Bell, *Science, Technology and Culture*, Maidenhead, Open University Press, 2006.

51. Bruno Latour, *Reassembling the Social: An Introduction to Actor Network Theory*, Oxford, Oxford University Press, 2005.

52. Bruno Latour, 'Morality and Technology: The End of the Means', *Theory, Culture and Society*, 19, 5-6 (2002): 248. The concept of 'mediation' is one recent attempt to do justice to these entanglements. Antoine Hennion, for instance, a colleague of Latour, has identified 'mediation' as a term that shows the active role played by non-humans in co-producing the work at each stage of its meaning. Mediation suggests a dynamic exchange of properties between all elements subsisting in the creative equation, human and non-human. See Antoine Hennion, 'Music and Mediation: Toward a New Sociology of Music', in M. Clayton, T. Herbert and R. Middleton (eds), *The Cultural Study of Music: A Critical Introduction*, London, Routledge, 2003.

53. Sherry Turkle, *Life on the Screen*, London, Simon and Schuster, 1995, p46.

54. Alan Pred, 'Re-Presenting the Extended Present Moment of Danger: A Mediation on Hypermodernity, Identity and the Montage Form', in G. Benko and U. Strohmayer (eds), *Space and Social Theory*, Oxford, Blackwell, 1997; Gilles Lipovetsky, *Hypermodern Times*, Cambridge, Polity, 2005.

55. Nigel Thrift, *Knowing Capitalism*, London, Sage, 2005.

56. Timothy D. Taylor, *Strange Sounds: Music, Technology and Culture*, London, Routledge, p3.