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3.1 Recording and production

'The first thing about recording' ambient music composer Brian Eno has written, 'is that it makes repeatable what was otherwise transient and ephemeral' (Eno 2004, 127). Some of the biggest changes to musical culture in the twentieth century were the result of newly emerging recording technologies. As Brian Eno (1948-) suggests, sounds that once had to be performed live could now be captured, packaged, collected and distributed in ways unimaginable in the previous century. This effected both the creation and consumption of music. When used as an instrument to manipulate or make music – a process known as 'phonography' (Eisenberg 1987) – the tools for sound reproduction generated textures and structures difficult to replicate in live performance. In fact, audio engineering technologies saw the advent of reverb, echo, overdubbing, splicing and digital processing, techniques essential to genres as diverse as *musique concrète*, acousmatic sound art, dub, electronica, hip-hop and turntablism. Not only did these technologies give rise to new types of musician, from the studio engineer and producer to the DJ, they also encouraged collaborative ways of working rarely seen before.

The new technologies also had a profound impact on the ways in which music was created and consumed. Local oral cultures, significant performances and innovative styles could easily reach global audiences, enabling influence to move rapidly through musical communities, while the ability to reproduce sounds at the flick of a switch generated new ways of listening. For the first time, music lovers could enjoy private listening in their own homes on the radio and home audio technology, or, as the century progressed, on the go via mobile media like transistor radios, Walkmans and MP3 players; on the other hand, communal forms of listening became commonplace, as music was piped into a variety of public spaces and experienced in the background of everyday activities. Sound recording technology also enabled changes in creative practice so radical that scholars like Eric Clarke have argued that 'it is recording that changed music so profoundly in the twentieth century, rather than the changes in 'musical language'' (Clarke 2007, 48).

Building on Mark Katz's (2004) identification of seven ways that sound recording technologies have transformed musical practice – tangibility, portability, (in)visibility, repeatability, temporality, receptivity, manipulability – this chapter traces the celebrations of recording across the century. But it also outlines the considerable anxieties that the new technology caused for musicians and listeners alike, particularly in the century's early decades. For our case-studies, we first focus on how early dub artists used the recording studio as an instrument in 1970s Jamaica, before exploring the different ways of listening that recorded music generated across the century.

Technology through the century

Although technological progression was rapid, it's useful to identify four broad periods of profound change. The first begins in 1877 with Thomas Edison's phonograph (figure 1), closely followed by Emil Berliner's gramophone in 1887, two inventions that enabled sound to be captured and reproduced for the first time. By the dawn of the new century, wax records could preserve and disseminate sonic material, and early recordings of Italian tenor Enrico Caruso and the Original Dixieland Jazz Band (1917) provide a fascinating glimpse into the century's early musical culture, tastes and aesthetics.

<insert figure 1 here>

- Enrico Caruso singing 'Verdi's 'Questa o guella' from *Rigoletto* (1832): recorded in 1904 in Room 826, Carnegie Hall (Victor)

With the advent of radio in the 1920s, with its associated electrical microphones, the early period of acoustic reproducibility gave way to the electrical era. In the hands of HMV and Bell Telephone Laboratories, radio technology was used to extend the frequency range of recordable material to acquire a greater sound fidelity. The new microphones also enabled a spatial fidelity by capturing the sonic ambience of performance space to give a greater sense of aural realism (Doyle 2004, 33) on the one hand, while also encouraging 'softer and more intimate' (Dibben 2003, 319) vocal styles through close miking. This technique, particularly apparent in the recordings of Bing Crosby and other crooners of the time (Doyle 2004), increased the proximity between singer and audience and had a lasting impact on future songwriting and performance practice. As we shall see below, the mediation enabled by the microphone also effected pop and art musics.

- Bing Crosby, 'White Christmas' (1942)

Although these early years saw the advent of audio engineers, who specialised in studio equipment, at this stage, the role most often involved faithfully capturing what was in front of the microphone, as the editor of *High Fidelity* magazine wrote in 1951: a record should 'recreate as perfectly as possible, for the individual listener in his home, the *illusion* of the live performance' (Fowler 1951, 8). The idea of an 'individual' listener engaging with music at 'home' marks an extremely significant moment in our story. Short-playing shellac phonograph records (or 78s) and their eventual replacement by the long-playing vinyl disc (LPs), were tangible, portable and repeatable (to use three of Katz's points), making music

readily available for domestic consumption. In the previous century, unless you played an instrument yourself, engaging with music was usually a communal activity, undertaken in a public space. Recorded music took music into the home, where people could listen on their own as and when they liked. Although we'll learn more about this in our second case-study, it's important to note here that as music performance became tied to physical objects, it became a commodity (Adorno 1941, 17-48) and the music industry as we now know it began to emerge. By the years following World War II, the industry was in full force, as Albin Zak III writes: 'Columbia Records alone reported a sales increase of 850 per cent from 1945 to 1946, and all the other large companies registered profit increases of at least 100 per cent in the same year'. (2012, 43). By the end of the 1940s, the vinyl 45 rpm single (also known as the 7") and increasing radio play was revolutionising the production and sale of popular music yet again (Peterson 1990). These developments in the US music industry would soon be mirrored in other countries across the world.

By now, the third period of technological change was in full swing. The 1950s saw record companies moving away from direct-to-disc recording in favour of magnetic tape, which had undergone significant development in Germany during the war. Not only did the format offer an enhanced sound quality, it also enabled audio information to be manipulated and edited after capture. As we've seen, it became one of the first technologies to be treated creatively by mid-century composers like Pierre Schaeffer, Pauline Oliveros, Daphne Oram and Pierre Henry (➔*Instruments*). By 1955, one of the most significant developments in the history of recording occurred. Multitrack tape recording, pioneered by Les Paul (1915-2009) amongst others, allowed users to mix, splice, sample, reverse and drop in sounds rather than simply capture live performance, a process that marked the transition of recording from a process of preservation to an artform (Eisenberg 1987). Whereas before, records were usually cut live following intense rehearsal, now different takes could be combined, multiple parts added and sounds fundamentally altered in post-production. Virgil Moorefield, in his aptly named book, *The Producer as Composer* (2015), charts this process, describing the changing soundscape as a move from the 'illusion of reality' to the 'reality of illusion' (109). British producer and audio engineer Joe Meek (1929-1967), for instance, was a pioneer of composite recording and kickstarted techniques that were later to become normal studio practice, like close-miking, and the compression of an audio signal to reduce loud sounds and amplify quiet ones into the mid-range.

The century's fourth period of recording began in the 1970s, with the development of digital sound encoding, pioneered by Sony, and signalled by the first all-digitally recorded album to be released by a major label; Ry Cooder's 1979 *Bop Till You Drop* (Warner Bros.). In 1982, ABBA's *The Visitors* became the first all-digital pop record to appear on CD. By the 1990s, digital audio had replaced analogue technology in most major studios. Digital Audio

Workstations (DAWs) and software such as Pro Tools could record, edit and produce audio files from a single workstation – the computer – giving engineers and producers precise control over a sound's treatment and placement. Because digital capture enabled a larger dynamic range without degradation of signal quality no matter how many tracks were added, the new workstations could accommodate unlimited overdubs, which could be easily moved around and edited.

One of the most controversial studio interventions of the digital age came with the pitch-correcting technology Auto-Tune, which launched in 1997 as a hardware and a DAW plugin. Although the manipulation of a voice to evoke particular connotations in listeners – what Serge Lasalle calls 'vocal staging' (2001, 56) – can be found throughout recording history, Auto-Tune enabled engineers to re-pitch off-key notes and smooth out the tiny fluctuations natural to the singing voice, a practice that has been embraced by many performers. Auto-Tune has also attracted many detractors, however, who complain that the retuned voices sounds inauthentic and de-humanised. Although for many the idea of recording and technology remained a source of anxiety, as we shall discuss below, others turned these negative attributes into positive creative material by setting Auto-Tune to its highest level and embraced the resultant 'unsettlingly robotic tone.' (Milner 2009, 232: ➔*Instruments*). By the beginning of the twenty-first century, pitch-altering software had become so prevalent that Simon Reynolds called it both '[e]poch-defining' and 'epoch-defacing': 'Few innovations in sound-production have been simultaneously so reviled and so revolutionary' (2018).

The last decades of the century also saw an important shift in audio dissemination. As the 1980s unfolded, the medium of tape augmented the possibilities for engagement. Where the LP enabled home listening, the compact cassette and portable tape recorders (like the Walkman, released in 1979), gave rise to the beginnings of mobile media and a diversification of listening practices. The next shift came in 1988, when the compact disc (CD) sales began to overtake vinyl. Able to produce the entire sound spectrum without distortion, CDs offered an enlarged storage capacity and, read by a laser beam rather than a record stylus, did not degrade when played. However, by the 1990s, their dominance over the market was challenged by digital audio storage like .wav and .mp3, which reduced file sizes through digital signal compression to allow large amounts of virtual data to be easily stored and transported. By the end of the century, Apple's iTunes and the iPod (both 2001) signalled the beginning of a new era of sound reproducibility.

Echo, reverb and the virtual spaces of rock 'n' roll

The increasingly specialised nature of the studio gave rise to new types of musician, who were highly skilled in certain technologies. The audio engineer, for instance, provided the technical skill necessary to capture and manipulate sounds in a certain way, and there sprung up several significant collaborations, including Leanne Ungar who engineered records for Leonard Coen, and Susan Rogers who worked with Prince on his *Purple Rain* album (1984). The music producer, on the other hand, would usually assume overarching control over all aspects of the recording session, and could be involved with writing and arranging the material as well as managing the actual recording sessions. Forging unique sonic aesthetics, producers like Quincy Jones, Nile Rodgers, John Culshaw, Rick Rubin, T Bone Burnett, Denis Bovell, Daniel Lanois and others (who we will meet below), became as renowned as the artists they recorded. The examples below show how a producer can create an artist's unique sound.

- Michael Jackson (with Quincy Jones), 'Bad', *Bad* (1987)
- Emmylou Harris (with Daniel Lanois), 'Goodbye', from *Wrecking Ball* (1995: written by Steve Earle)

While these roles became increasingly distinct as the century wore on, the formative years saw a more unified approach to recording, with many early studio owners, like founder of Sun Records Sam Phillips, who produced work for Elvis, Roy Orbison, Johnny Cash and Howlin' Wolf, taking on multiple roles not only to maintain their independence, but also to keep costs down (Williams 2006; Bell 2008). This is particularly apparent for Cordell Jackson (1923-2004, figure 2) who, in 1956, became one of the first women producers, when she side-stepped the male-dominated environment of Sun Records to engineer and arrange rock'n'roll albums in her home studio for her self-founded Memphis label, Moon Records (Currans-Sheehan, 2009).

<insert figure 2 here>

It was during these years that some of the most notable developments in studio technique began to coalesce into a style that was to have a lasting effect on popular culture. Several musicologists (Lacasse 2001; Dibben 2003; Doyle 2004) have identified a history of real and imagined sonic ambience that exists around the edges of recorded music, with Nicola Dibben suggesting that '[t]he history of recording contains within it a chronicle of virtual space' (2003, 319). Early on, virtual space was most often signalled by the (often artificial) addition of echo – 'the presence of one or more slightly delayed repetitions of a discrete source sound' – and reverb – a 'reverberant-sounding continuation of the source

sound as though the sound has been recorded in a highly resonant acoustic space' (Doyle 2004, 32).

In his work on the recording strategies of early popular music production, Peter Doyle (2004) argues that room ambience and reverberation entered practice during the 1920s, when electric sound recording gained greater fidelity, noting that more room tone was used for orchestral recordings than popular songs, while dance music had little or no reverb. By the 1940s, Bill Putman, working with tape, became an early pioneer of the techniques, producing the first hit song to add artificial reverb, the Harmonicats' instrumental hit 'Peg O' My Heart' (1947). Four years later and Les Paul introduced the mainstream audience to tape echo, close-miking and multitracked voices in his number 1 hit, 'How High the Moon' (with Mary Ford, 1951).

- Les Paul and Mary Ford, 'How High the Moon' (1951)

But it was with the advent of rock'n'roll in the latter half of the 1950s that echo and reverb was pushed to the front of recordings at the hands of Leonard Chess at Chess Records and Sam Phillips at Sun Records, who pioneered his own unique technique known as slap back echo delay. Most often, echo was added from the control room rather than the studio, so the musicians were unaware of the manipulation as they performed (Guralnick 1995, 237). Doyle (2004) refers to the result as "pictorial' spatialising – reverb and echo effects deployed in combination with certain lyrics to render aural vistas' (32) and uses Elvis's (1935-1977) 'Heartbreak Hotel' (1956), recorded with Chet Atkins in Nashville's RCA studio, as a clear example of such a construction. The sonic ambience was taken from the studio's hallway and fed into the studio, allowing the performers to play into and respond to the reverb as the song developed. This ensured that the effect integrated into the song and made aesthetic sense: 'the reverb is more or less 'authorised' by the references in the lyrics to the baroque, horror film-like hotel located in the noirish 'Lonely St'' (45).

- Elvis, 'Heartbreak Hotel' (1956).

The music producer as creator

When the input of a producer became such that new sounds and textures were formed, their role transformed from what Adam Bell describes as 'a recording *facilitator* to a recording *creator*' (Bell 2008, 33). At this point, Michael Chanan explains, 'the essential activity of the musician, the performance of music, becomes more and more fragmented' (Chanan 1995, 144). This creative involvement could be structural: in the 1930s and '40s, for instance,

American producer Teo Macero developed a cut and paste tape editing method of production that he later used to manipulate the sounds of Miles Davis's (1926-1991) *Bitches Brew* (1970), famously using 19 edits and loops during the post-production of the first track, 'Pharaoh's Dance' (Tingen 2003).

- Miles Davis, 'Pharaoh's Dance', from *Bitches Brew* (1970)

But it could also be ambient: Paul Théberge argues that stereo sound complicated authorship as 'the overall musical texture was increasingly given to the sound engineer and producer' (Théberge 1997, 216). Sometimes, the sonic stamp of a producer could be such that entirely new genres were generated. Jamaican Sonia Pottinger (1931-2010), who produced albums for Culture, Toots & the Maytals and The Ethiopians amongst others, was instrumental in forming the reggae sound for the 1960s and 1970s, for instance, while Silvia Robinson (1935-2011), founder of hip-hop label Sugar Hill Records in Harlem, produced the Sugarhill Gang's 'Rapper's Delight' (1979), widely regarded as the first rap track to reach a wide audience.

It was American producer Phil Spector (1939-2021), however, who became known as pop's 'first auteur' (Bannister 2007, 38). His 'wall of sound' aesthetic that drove tracks like The Crystals's 'Da Doo Ron Ron' (1963, co-written by Spector) and The Ronettes' 'Be My Baby' (1963), was created by using Ampex three-track recorders (figure 3) to build a wash of instruments doubling and tripling parts to create an unprecedented depth of texture and sound. Capturing backing tracks live in a single take, Spector would then place the lead vocal on the second track, before filling out the third to form reverberant echo chambers unlike anything heard before. His unique sound and deep involvement in most areas of the recording process led to a diffusion of authorship and initiated what Chanan describes as 'power struggles for aesthetic control of the finished product' (1995, 144-145).

<insert figure 3 here>

- The Crystals, 'Da Doo Ron Ron' (with Phil Spector, 1963)

But the distribution of authorship did not have to result in a power struggle: it could also generate productive collaborations. The work that resulted in the long partnership between The Beatles and their producer George Martin (1926-2016), was highly creative, for example (Williams, 2006, 297-298; Zagorski-Thomas 2014) and Olivier Julien (2009, 162) notes a 'gradual integration of arranging and recording into one and the same process' from 1963 to *Sgt. Pepper's Lonely Hearts Club Band* (1967). While *Sgt. Pepper* was hailed a great success, some reviewers critiqued the 'special effects', which they saw as 'dazzling but

ultimately fraudulent' (reprinted in Skinner Sawyers 2006, 99). Others questioned whether the complicated textures could be performed live (Moorefield 2005, 55). The integration of arranging and recording is particularly apparent in the 1967 single 'Strawberry Fields Forever', whose innovative techniques, like reverse-recorded instruments and tape loops, took 55 hours of studio time to perfect (1998 / 2005, 194). However, the song marks an important moment in the shared creative process between musicians and producer. Martin and sound engineer Geoff Emerick decided to splice the song together from two separate takes. Because both had been played at slightly different tempos, when placed together, they created a small shift in the pitch: 'Although the splice is nearly undetectable', writes Katz, 'the slightly altered speed of Lennon's voice helps give the song it's dreamlike quality' (2010, 47). Martin used a similar technique on *Sgt. Pepper* to juxtapose two very different fragments – one by Lennon, the other McCartney – to produce 'A Day in the Life'. This intervention was so significant that album reviewer John Gabree was compelled to ask 'whether we are to credit the group, the producer or the engineer … Shouldn't we laud Martin instead of the quartet?' (1991, 135; quoted in Kimsey 2008).

- The Beatles, 'Strawberry Fields Forever', *Sgt. Pepper's Lonely Heart's Club Band* (1967)

In other cases, the notion of authorship did not arise. The recording process for The Beach Boys' *Pet Sounds* (1966), one of the century's first concept albums (Lambert 2008), is a key example here. While his bandmates were on tour, Brian Wilson wrote, arranged, recorded and produced most of the album. After extensive rehearsals with carefully chosen musicians, Wilson shunned Capitol Studios in order to make use of the different equipment and strengths of a variety of recording spaces (Granta 2017, chapter 5). When the other members of the band returned from their tour, he taught them their parts individually before overdubbing their vocals, making extensive use of multitracking to layer the different components, a process that afforded him ultimate control over the final mix. For more on the rock album, see ➔*Work and Notation*.

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Case Study 1: Lee 'Scratch' Perry and the emergence of dub music

In the main chapter, we've seen how recording technology profoundly impacted twentieth-century musical culture. Here we focus on dub, a genre characterised by heavy bass and rhythm that developed in the 1970s studios of Jamaica and flourished at the hands of producers and studio engineers like King Tubby (1941-1989) and Lee 'Scratch' Perry (1936-).

The music emerged as a positive space away from the postcolonialism, economic depression and political instability that was shaking Jamaica at the time, as Michael Veal (2007) explains: 'Infused with Rastafari-influenced themes of African repatriation and Old Testament allusion, dub provided a collective imaginative escape, an optimistic teleology for the displaced victims of the African diaspora.' (80-81). This positive space was crafted by dub artists who worked the studio to forge distinctive new sonic and cultural aesthetics that became a fundamental motivator of punk, trip-hop, jungle, drum and bass, ragga and electronica.

Dub is hard to define. Although primarily a studio practice, it originated as part of Jamaica's live sound system culture. Some (Barrow and Dalton 1997, 199) have broken the emergence of dub into three phases beginning with 'instrumentals' of existing reggae songs, and the more creative intervention known as 'versions', which were produced for local sound systems deejays to 'toast' over (a particular style of rap). Versions were cut on 'dub plates', acetate discs that could be made cheaply, but degraded swiftly. In the small Jamaican market, studios were able to generate income through multiple customised versions for different sound systems to use.

Dub music emerged from these early live-music practices. The verb 'to dub' evolved in the industry to refer to the process of making a double of a recording. In music, the term also involves copying but refers more positively to the creative remixing and layering of pre-existent tracks to produce characteristic echo- and reverb-heavy rhythm sections (the 'riddim'). Original vocals are often removed or edited into ethereal snippets, keyboard and guitar tracks are temporarily omitted to give a greater sense of space, and samples – from other songs, TV, the natural world – are mixed into the riddim or combined with new vocal lines. The genre emerged around 1972 when engineer King Tubby, who, having found success with his Kingston sound system, got hold of a dub cutting machine, a two-track tape recorder and a four-track mixing desk (Partridge 2007, 316) and began to overdub and mix music brought to him by other producers. Christopher Partridge (2007) explains that 'The renewing and reinventing was not simply musicological, but it was also technological, in that the very equipment used to produce the music was itself often a modification, a version of an original piece of equipment' (316). Having worked as an electrical engineer, Tubby, for instance, made his own echo delay unit 'by passing a loop of tape over the heads of an old two-track machine' (Barrow 1994). In 1973, Tubby worked on *Blackboard Jungle Dub* with Lee 'Scratch' Perry and The Upsetters, a record many consider to be the first fully dub album (although this is debated; see Katz 2000, 173).

- The Upsetters, 'Rubba, Rubba Words', from *Blackboard Jungle Dub* (1973)

Perry quickly became one of the genre's pioneers, collaborating with Bob Marley and the Wailers, the Congos, The Beastie Boys, Mad Professor and The Clash, whose punk anthem 'Complete Control' (1977) marked an important merging of aesthetics, cultures and radical political views. Having worked in other studios as vocalist, songwriter, producer and engineer, Perry had wide-ranging skills that enabled him to set up his own studio in his garden, the Black Ark (1973-1983), named after the Ark of the Covenant, with its house band – the Upsetters. Although Perry's equipment was good quality, it was not cutting edge. While European and US studios were working with 16 or 24-tracks, many Jamaican studios were still working with 8. Perry supported his Echoplex delay unit, Roland space echo and phaser unit with a four-track Soundcraft board and a Teac 3340 recorder (Partridge 2007, 326; Bradley 2000, 325; Katz 2000, 180).

- The Congos, 'Solid Foundation' from *The Heart of the Congos* (1977)
- The Clash, 'Complete Control' (1977)

Perry turned the potential restrictions of his equipment into innovative techniques and Steve Barrow and Peter Dalton (1997) explain that 'the Black Ark sound exemplified the Jamaican approach of making maximum demands of minimal resources' (183). Limited to four-tracks, Perry had to bounce material to make room for more layers, resulting in a reduced sound quality that quickly became a unique part of his disorientating aesthetic – or as David Toop puts it, 'supernatural soundworlds' (2000, 114) – characterised by a density of distorted echoes, reverb and jump-cuts: '…the sound that I get out of the Black Ark studio, I don't really get it out of no other studio. It was like a space craft. You could hear space in the tracks' (Perry quoted in Toop 2000, 114). Space resonates through tracks like 'Rubba, Rubba Words', from *Blackboard Jungle Dub*: 2.40 minutes in and an abrupt yet playful oscillation between raucous ensemble and quiet bass solo draws attention to Perry's studio techniques. But it's also more than this. Veal (2007) notes that 'dub's deconstruction of traditional song structures evokes a sense of discontinuity and ominous indeterminacy and reflects the psychic spatial and temporal discombobulations of ganja, the Rstafari's sacramental herb' (2007, 80-81).

Spatial and temporal discombobulation can also arise from Perry's use of real-world sounds. In 'Kojak', from his *Revolution Dub* album (1975), for instance, snippets from radio and British comedy and samples from Bunny Clarke's 'Move Out of My Way' (1973) are scattered over a pre-existent track propelled by an early drum machine. Here, echo, repetition and the remediation of existing sounds conjure up the aesthetics of alienation, recollection and dislocated time that fuel the 'collective imaginative escape' mentioned above.

- Lee Scratch Perry, 'Kojak' from *Revolution Dub* (1975)

Here, then, we have an example of a genre born in the recording studio and driven by producers who far exceed our traditional understanding of the role. In fact, for many, a more creative designation has been preferred. Veal (2007), for instance, refers to the dub mixer as a "soundscape' composer concerned with regulating the musical parameters of (electronically manipulated) texture and soundscape as much as the traditional parameters of melody, rhythm, and harmony' (18), while Jeff Stratton refers to King Tubby as a 'postproduction composer' (2005). It's clear to see from this brief introduction, that dub is a genre sculpted by technology (Bradley, 2001). For early producers like Perry, the studio was an instrument that could generate new material from old.

Liveness, authenticity and the ideal performance

By now it should be clear that the twentieth-century recording studio was not simply a place to capture and transmit sounds, but also a site to create and manipulate them (Bell 2008, 37). While the producers above used technology creatively to craft new and imaginative soundworlds, others, including those working in the art music sphere, explored its potential for generating perfect renditions of particular pieces. Composers who perform have often recorded and re-recorded their own works to demonstrate 'the right way' to play a certain piece, for instance. Stravinsky made a point of recording his changing interpretations of his own works, for instance (see Chanan 2000, 122-4). Evan Eisenberg (1987, 113) says that some composers – he names Stravinsky, Schoenberg and others – have used recording to reinforce the idea of the 'Masterpiece'. But the lure of a reconstructed, 'perfect' rendition was also appealing to producers and performers. Walter Legge, arguably the first art music producer to assemble pieces from multiple (sometimes microscopic) takes, to produce a performance that would be impossible live explained that 'I decided that recording must be a collaboration between artists and what are now called 'producers'. I wanted better results than are normally possible in public performance.' (Legge cited in Eisenberg 1987, 96). For Canadian pianist Glenn Gould (1932-1982), one of the earliest musicians to embrace recording technology, the promise of 'a more cogent experience than is now possible' (Gould 1966, quoted in Andersson and Andersson 2006, 97) led him to retire from public performance in 1964 to concentrate entirely on studio work. For him, the opportunity to cut and splice takes in order to cut mistakes, accidents and inelegant passages threatened the very future of live concerts. Instead, music could be constructed and manipulated over time, using takes from different sessions, locations, equipment and engineers, enabling the

performer to 'assume something of an editorial role. Inevitably … the functions of the performer and of the tape editor begin to overlap' (Gould 1966, quoted in Cox and Warner 2004, 118). Writing of his recording (Columbia Records, 1964) of Bach's Fugue no. 20 in A Minor from Book 1 of *The Well-Tempered Clavier* (BWV 865, 1722), Gould explains that although takes 6 and 8 appeared at first satisfactory, the privilege of subsequent and repeated listening revealed 'monotonous' defects (118) that prompted him to create 'one performance to consist alternately of takes 6 and 8' (118). This opportunity for combination, he argued, enabled musicians to 'transcend the limitations that performance imposes upon the imagination' (118).

- Bach, Fugue no. 20 in A Minor from Book 1 of *The Well-Tempered Clavier* (BWV 865, 1722) recorded by Glen Gould (Columbia Records, 1964).

Ideal performances represent a technological intervention into the precarities of live performance. But this was not always desired and other artists sought to maintain – or give the illusion of – the spontaneity of a live setting. For some, this involved extreme measures: John Cage (1912-1992) famously hated records and claimed he didn't own any, sought to actively incorporate recording materials – digital tape, microphone, speakers, record players – into live performance to keep music live and relevant. In fact, David Grubbs begins his book, *Records Ruin the Landscape* (2004), with a general observation that:

> Most genres in experimental and avant-garde music in the 1960s were ill suited to be represented in the form of a recording. These various activities – including indeterminate music, long-duration minimalism, text scores, happenings, live electronic music, free jazz, and free improvisation – were not only predicated on being experienced in live performance, but they can also be said to have actively undermined the form of the sound recording. (1).

For Grubbs, such music was intended to be different in every performance, so to pin it down to a single ideal iteration made little sense.

This question was also pertinent for other types of music. To capture the 'authenticity' of liveness, for instance, became particularly important for many recording folk musicians. Bob Dylan (1941-), for instance, is often seen as a primarily performing artist who is wary of the studio: there are many anecdotes about his reluctance to spend time laying down tracks, and many of his recordings give the appearance that they were captured live (which isn't to say that multiple takes and versions were not worked through beforehand: for more on the intellectual and obsessive study of Dylan, known as Dylanology, see Weberman, 1969). Building on the myth of spontaneity, Paul Williams (1990, 1992, 2004) has suggested

that the artist's apparently dismissive position on his recorded material, together with his proclivity for radically rearranging songs in live settings, destabilises the idea that his studio recordings represent his definitive voice. The cult of the specific performance that developed around Dylan pervades his reviews, which regularly describe live rendition of songs (even in their mediated, recorded form) as more instinctive and expressive than the recorded version. This view positions Dylan's recorded material as working drafts to be later developed in a live setting (Negus 2010, 213-214).

The impression of a raw, live performance is also important to other genres and requires skilful production knowhow to reduce the studio's mediating presence. A good example of this can be found in Steve Albini's production work for Nirvana's *In Utero* (1993). The album is described by drummer Dave Grohl as sounding:

> like a band in a room but there's some sort of sonic element to it that nobody else could get … I remember when we were making *In Utero*, one of the things Steve [Albini] talked about was trying to record or mix or equalise a band in a way that seemed natural without the vocals seeming disconnected from the music, like, I think what he tried to do was present the song to the listener in a way that sounded entirely real … I swear we would do one take and he would hit stop and say 'what's next?' (2013).

- Nirvana, 'Heart Shaped Box' from *In Utero* (1993)

Of course, such appearance of liveness in fact involves extremely careful technological skill. Sound planes, spatialization and stereo, compression and equalization, amplification and proximity have produced artificial forms of crystal sonic clarity – or hyperreality – that have become naturalised (Zagorski-Thomas 2014; Théberge 2004). For Jordi Roquer (2018, 17), 'the truth is that technology has substantially conditioned our perception of sound reality: we have been seduced to participate in an audio virtual reality experience that we now accept as natural.' Drawing our attention to Dylan's 34 studio albums, for instance, Keith Negus, finds significant 'audible evidence' (2010, 214) of a producer's input. For him, studio rearrangements and Dylan's songwriting process demonstrate a 'phonographic imagination' that has been shaped by listening to recorded music and the development of a clear studio aesthetic.

For some musicians and scholars, the normalisation of a perceived and idealised performance has changed our expectations of music in concert. Recorded music, in other words, has influenced our musical ears, as Mark Katz writes: 'When the phonograph was invented, the goal for any recording was to simulate a live performance, to approach reality as closely as possible. Over the decades, expectations have changed. For many – perhaps most – listeners, music is now primarily a technologically mediated experience. Concerts

must therefore live up to recordings' (2004, 26). Katz uses music historian Joseph Horowitz's description of the Chicago Symphony's "machine-like' and 'precision-tooled'" live performance of Brahms's Symphony No. 1 (Op.68, 1876) as an example of a concert rendition that sounded as though the orchestra had been "fed through the giant speakers'. In other words, 'they sounded like a phonograph record'" (Katz 2004, 267).

The studio as an instrument: deskilling verses enabling

The reception of recorded music was not without its anxieties. Throughout the century there was concern that with ample access to reproduced sounds, people may be less compelled to learn instruments or specific skills. This worry was voiced early on by one of the very earliest stars of the phonograph, the marching band composer J P Sousa (1854-1932), who speculated that the availability of recorded music would lead to what we now call 'deskilling' – the progressive loss of musical skill among the population as a whole, as people could rely on recorded sounds rather than learning to make them themselves (Eisenberg 1987, 148). The worry was that this would result in a reduction of communal music making.

We could argue, however, that in fact, the opposite has happened: technology has enabled new types of musician, from the producer and audio engineer to the studio-based performer. Offering room to experiment, the studio has also drawn the attention of composers, from those working in the electronic music studios to those sound-tracking films (➔*Instruments*; ➔*Music and the Moving Image*). Like performers, composers have used studio technology to fundamentally change compositional methods. Speaking of his creative process, Brian Eno, who can't read or write music, refers to

> in-studio composition, where you no longer come to the studio with a conception of the finished piece. Instead you come with actually rather a bare skeleton of the piece, or perhaps with nothing at all … Once you become familiar with studio facilities … you can begin to compose in relation to those facilities … In a compositional sense this takes the making of music away from any traditional way that composers worked … (2004, 129).

- Brian Eno, *Ambient 1: Music for Airports* (1978).

Recording technology may have led to fewer people taking up acoustic instruments, then, but it also gave access to techniques of music-making which do not require traditional performance or instrumental skills. It is not that producers and engineers lack musical skills; it is that they have developed newer kinds of creative ability. Aden Evens, for instance, says that music that arises through digital processes replace the physical and acoustic gestures of

fretting, bowing, picking and hitting, with the technological gestures of cutting, pasting, dubbing, duplicating, so it's not what instrument someone plays but rather what part of the production process they enable (Evens 2005, 124-125, 90).

We've noted above that the recording studio saw the advent of new and specialised roles in the process of music recording and production. And yet, as the tools for digital music reproduction became more affordable, the merging of roles became increasingly common. It wasn't long after major recording studios turned to digital audio workstations in the late 1980s that home studios became readily available, giving rise to the bedroom producer, an artist who can work alone with low-cost technology. Folktronica artist Fourtet, whose first two albums (*Dialogue* 1999; *Pause* 2001) span the turn of the new century, for instance, produced his work using just a DAT Recorder, a Creative Labs Soundblaster Live soundcard on his Windows PC and a hi-fi.

During the century, technological process and the equipment for reproduction has been foregrounded as an intensively creative force in and of itself. Turntablism is an excellent example of this. As we saw in ➔*Postmodernism*, early Hip Hop DJs isolated and manipulated pre-existent beats and samples in live, sometimes competitive ('battle') settings. Although by the 80s, the turntablist was being displaced by the rapping MC and digital sampling equipment, later artists Kid Koala, DJ Shadow and DJ Spooky moved into more experimental areas, while DJ networks like San Francisco's Sister SF helped to promote and support female DJs in the male-dominated arena.

Where are all the women?

You will have noticed that this brief foray through the rise of the music producing role has been dominated by men. In fact, writing in the '70s, Simon Frith and Angela McRobbie (1978) noted how the whole music industry, including 'popular musicians, writers, creators, technicians, engineers and producers' was 'male run' (373-4). And yet the under-representation of women in studio roles has been particularly enduring for several reasons. First, and particularly in the early years, women were largely excluded from studio spaces, as Paula Wolfe explains: 'Historically, music production knowledge and skill have been accessed and developed in the professional recording studio, a site gendered as a male space of creativity' not only because of the enduring association of technology as a male-dominated expertise, but also because of the producer's strong association 'with notions of power and control' (Wolfe 2012; see also Negus 1992). In fact, in 1959, Decca Records told electronic music pioneer Delia Derbyshire, who later assumed a revolutionary role at the Radiophonic workshop alongside Daphne Oram and became a founding member of White Noise, that 'they didn't employ women in the recording studio' (Derbyshire quoted in Niebur 2010, 98).

- White Noise, 'Here Come the Fleas', from *An Electric Storm* (1968)

Second, the hostility of mainstream studios, and its impact on the gendered perceptions of recording creativity, has had a lasting and negative effect on women assuming audio production or engineering roles (Théberge 1997, 451). Several musicologists (Whiteley 2000; Leonard 2007) have identified how far reaching the gendering of music production and its technologies has been, noting how media outlets and even journalism has tended to perpetuate these 'patriarchal assumptions' (Mayhew 2004, 232) in their language. To help counter this, the more recent feminist discourse of Tara Rodgers, developed in her *Pink Noise* project, introduced an alternative, and more organic female (rather than 'feminine') language around music technology and sound (re)production (2010, 26).

But this does not mean that women did not produce music: rather, that their work has not always been recognised. Above, we've acknowledged the pivotal work of Cordell Jackson, Sonia Pottinger and Silvia Robinson, but there were also others. Ethel Gabriel, for instance, became the first female producer to work for a major label (RCA Victor from the late 1950s to 1984). Not only did she oversee significant developments in early stereo sound in her production work with Elvis, Henry Mancini, Perry Como and on two Grammy-nominated albums (1967 and 1969), she also pioneered computer restoration techniques (for Caruso's early recordings). Kate Bush has produced all her work since *The Dreaming* (1982), while Sylvia Massy produced Tool's extremely successful *Undertow* album in 1993. Although not always highly visible, then, there has been an important female presence in the history of music production, so it is astonishing to note that during the century, not a single (non-classical) Grammy was awarded to a women producer, despite nominations including Janet Jackson (1990), Sheryl Crow (1998) and Lauryn Hill (1999). Notably, these nominations are for women who produce their own music, which suggests that power-conflicts and studio accessibility prevented women from successfully infiltrating studio practice, even as the century closed.

Collectors and curators of sounds and cultures

If we now turn our attention to recorded music as a product, to be sold, bought, collected and distributed, we can see that audio technology has held an important part in the shaping of musical tastes and the configuration of canons during the century. Speaking about the arrival of records, Evan Eisenberg notes that 'Music is now fully a commodity, exchangeable for the universal commodity, money.' (1987, 20). Music's emerging double role as a live and recorded medium at the start of the century connected it to the art verses commerce debate

that was already underway in the other arts (➜*Copyright and the Music Industry*). In the 1940s, Adorno became one of the subject's most vocal opponents, targeting the collector whom he regarded as one who amasses music's *objects* without real concern for its *content*: the point for these music collectors is the collecting, not the music. When the music object is part of a 'lifestyle' rather than a specifically musical interest, music, he argues, can be said to have been commoditised (1941; we'll explore this more in our Listening case study).

Yet for others, recorded material played a positive role in the preservation of musical events and cultures. Dying or changing traditions could be sonically preserved, ensuring access to lost or changing practice. The recordings made of Alessandro Moreschi (1858-1922), the last castrati, in 1902 and 1904 give us a glimpse into a world that no longer exists, for instance, while ethnomusicologist Gilbert Rouget's 1946 recordings (released in 1948 by Pathé and La Boîte á Musique) of Pygmy culture in Gabon and Middle-Congo, open doors to remote locations and cultures. Oral traditions – like Irish traditional music – can be frozen in time (Eisenberg 1987, 102) to capture part of an ongoing process, and the behaviour of audiences (did they participate, listen attentively, go about their business?) can provide vital historical clues about the tastes and behaviours of earlier concert practice. Also embedded in recorded music is significant detail about gesture and nuance that can reveal essential information about the techniques, rhythms or performance styles that were important to particular groups of musicians and their audiences. Lillian McMurray's (1949-1998) label Trumpet Records (1951-55), for instance, produced early recordings of Mississippi Delta musicians such as Elmore James, whose raw, vivid and unique style is extremely difficult to convey in words.

The dissemination of these frozen archival moments quickly assumed significant pedagogical importance. Although access to all kinds of music is commonplace for us today, at the start of the twentieth century, the opportunity to easily experience new and diverse sounds was revolutionary. In 1919, for instance, an article in *Musician* stated that recorded music could provide music teachers with 'a world-laboratory and Musical History Museum at small cost, no matter how remote … from the acknowledged centres of music.' (quoted in Katz 2010, 69). Recorded music also opened new avenues of influence amongst musicians, who used records to expand their practice by emulating and responding to a great range of performers. A good example of this is the way that many jazz musicians in 1950s Philadelphia learned to play, as saxophonist Sam Reed (1935-) explains:

> Well, we would listen to whatever the guys would play on the records at that time, everybody had a record machine, and whenever anything new came out we had it. Everybody was basically listening to what the other person was doing … and trying to imitate whatever they did, in sound or in structure, and then work it out to see exactly what he was doing. (Reed quoted in Perchard 2006, 28).

While Reed treats recorded sounds as part of a learning process, they could also initiate a revival of interest in forgotten styles. Harry Smith's (1923-1991) compilation of blues, jazz, folk and gospel 78s recorded between 1927 and 1932 in his 6-album *Anthology of American Folk Music* (1952), for instance, has been credited with initiating the subsequent American folk music revival. For the first time, collectors and curators could shape and disseminate aural historiographies and cultural narratives, choosing what to save and what to leave out (see ➔*Canons* for more on this process). At times, the perspective of the collector drew criticism. In her work on the early blues folklorists, for example, historian Marybeth Hamilton (2009) argues that what has become known as the Delta Blues is a mythology created by the 'Blues Mafia' that included Alan Lomax, who recorded Leadbelly in the Southern penitentiaries, sociologist Howard Odum who used a cylinder phonograph to capture simple, repetitive folk tunes and Oxford- and Columbia-educated Dorothy Scarborough (figure 4), who journeyed for 4 years from 1921 to collect black folk songs. For Hamilton, these educated, white, middle-class folk scholars and collectors, were instrumental in crafting stories of black, poor musicians that ultimately determined what we have come to understand about artists like Robert Johnson, Muddy Waters, Howlin' Wolf and others. And yet, these folklorists, she points out, 'were born in the era of segregation' and 'made racial assumptions that were hackneyed, condescending and often offensive.' (2009, 18).

<insert figure 4 here>

Case Study 2: Listening to recorded music

Recorded music allows us to re-listen. Where previously music was experienced as a live, often social activity, audio technology enabled new forms of private and communal engagement that altered 'the site, situation and practice of consuming music' (Clarke 2007, 48). Although the personalised listening experience was not new to the century – think of Wagner's speculation (1870) that Beethoven's deafness attuned his inner ear to a more profound realm, or the transformation of rowdy opera audiences into the attentive, emotionally involved audiences of the nineteenth century who often listened with eyes shut (Johnson 1995), for instance – the increasing affordability of domestic listening devices in the 1950s allowed engagement with music to now become a solitary activity.

The changes to listening practice that recorded music afforded were not universally embraced. Leading the early negative response was Theodor Adorno (1934), who argued that phonograph music represented 'nothing more than … acoustic photographs', which turned

embodied events in a 'two-dimensional model of a reality that can be multiplied without limit, displaced both spatially and temporally, and traded on the open market' (278). For him, the poor sound quality and restricted dynamic range of early recordings prevented full engagement with the music and failed to provide the same aesthetic sophistication as a live concert. This, he argued, resulted in a distracted attention that prevented listeners from forming critical and informed judgements. Even worse, such distracted attention could lead to a regression of listening in the concert halls (1938). Although coming from a completely different position, John Cage also reviled against the embalming and stultifying nature of recorded material, arguing that captured music lost its fleeting, immediate, spontaneous life; moreover, repeated listening to such music reduced its process to a museological artefact (Grubbs 2014).

While Cage's position remained consistent, Adorno's did not, and he later suggested that the repeatability of long-playing records (LPs) in fact gave rise to a more musicological and studied form of listening: the ability to re-listen to certain passages 'foster[ed] a familiarity which is hardly afforded by the ritual of performance' (Adorno 1969, 285). As time passed and the quality of recorded material improved, engaging attentively with recorded music became increasingly complex. Listeners not only had to grapple with musical material, but also with the subtleties of recording itself, as Axel Volmar (2019) argues: spatiality, definition and studio practice formed 'new ideals of listening emerged that shaped the ways listeners engaged with reproduced music' (297).

These new ideals of listening produced different forms of engagement that Kier Keightley (1996) has described in terms of location within the sound: 'Initially omnidirectional microphones gave a faithful point of audition that sounded like being seated at a concert; stereo sound gave a hyperrealism, immersion' that allowed the listener to be 'transported (mentally) elsewhere' (169). This enabled 'a virtual escape from domestic space' (150). For Vomel (2019), such sonic escapism was particularly significant during the Cold War, when recordings 'nurtured the evolution of affective, subjective listening practices' (405).

Initially, immersion and subjective listening practice was restricted to the home by the cumbersome equipment. With the advent of mobile media later in the century, all this changed. Earplugs augmented the intensity of the interior experience yet again, enabling sound to seemingly emanate from 'inside the head of the listener' (Toop 2011, 44), and 'transform[ing] what it means to 'hear' in the world' (Bull 2014, 105). With the release of the Sony Walkman in 1979, this profound sonic experience could be taken out of the home for the first time. By the arrival of the iPod at the century's end (2001), mobile media allowed users to individually soundtrack their environment. Michael Bull (2014) explains this in terms of a new introversion: 'users often report being in dream reveries while on the move,

turned inward, away from the historical contingency of the world, into the certainty of their own past, real or imagined, enclosed safely within their own auditory soundscape' and this 'realigns the relationship between public and private space' (109).

While home stereos and mobile media could provoke intensely personalised experiences, recorded music could also do the opposite. In a speech given in 1964, Benjamin Britten (1913-1976) lamented that:

> Bach wrote his *St Matthew Passion* for performance on one day of the year only – the day which in the Christian church was the culmination of the year, to which the year's worship was leading. It is one of the unhappiest results of the march of science and commerce that this unique work, at the turn of a switch, is at the mercy of any loud roomful of cocktail drinkers – to be listen to or switched off at will, without ceremony or occasion (Britten 1978 [1964], 119).

For Britten, music like the Passion was written for a particular occasion and suffers when removed from that ritual. At the heart of his criticism is the notion of attention. If private listening could induce profound and attentive listening, then music that jostles with other activities and sounds runs the risk of being ignored. This does not necessary mean that the music is not being heard however; nor that it is unable to affect those hearing within earshot. Anahid Kassabian has described the 'ubiquitous listening' of contemporary life (2013) as a catalyst to new modes of auditory engagement, for instance. Musak – a brand name for background music production, but also now used as a generic term – has been used throughout the century to encourage certain forms of communal behaviour. Piped into shops and lifts, background music remained unobtrusive, yet works on the subconscious of those in earshot to encourage them to behave in a certain way; either for marketing purposes, by encouraging shoppers to linger and buy more, or as a mood modulator to keep people calm in stressful situations.

Of course, we must be mindful that not everyone hears music in the same way (Drever, 2019). As the final decade of the century gave rise to new audio formats, such as the MP3 (➔*Copyright and the Music Industry*), the complicated nature of an 'ideal' listener was taken seriously by production companies. Jonathan Sterne (2012, 149), for instance, identifies a 'composite listening subject written into the MP3.' The format's development, by the International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC), involved a series of listening tests conducted in 1990-91 that sought to shape a sound acceptable to people in a variety of listening situations: 'MP3s may confront an almost infinite and unmeasurable multiplicity of listeners, but they do so within a surprisingly limited set of contexts and aesthetics of 'good sound'' (Sterne 2012, 182-183).

Recorded music, then, created an anxiety amongst musicians and listeners due to its reductive aspects. But it has also encouraged us to listen differently, to engage with more sonic elements and to shift between levels of attention as we pass through our everyday lives.

Conclusion

Audio recording has had a profound impact on the ways in which music has been created, performed and 'consumed' in the Twentieth Century. New technologies have refreshed creativity, given rise to different types of musician, and opening the doors to original sounds and effects. Recording has enabled music to be disseminated and curated in ways that have brought together communities and forged exciting ways to learn about and respond to existing practice. It has also been used as a musicological tool for creating canons and collecting histories.