

Chapter 14: Case Studies

Research Questions

An important part of the research behind this book consisted of many discussions and interviews with digital musicians of all types and at all stages of their careers. The aim of this research was to build up a picture of shared ideas and practices in digital music. The picture that emerged was, not surprisingly, very diverse, but some common themes could be detected and several key questions arose. In order to examine these questions further, several artists were selected as Case Studies. These were chosen from a range of backgrounds and each represents a different approach or way of working. There are representatives from the USA and Latin America, Europe and Scandinavia, Canada and Japan, from academia and the commercial world, from pure digital to mixed-media backgrounds. Many areas of music are represented, including popular and electro-acoustic, film and television, multimedia and installation work, networked music and new media, music for theatre and dance, laptop work and instrumental performance.

Each musician was asked to supply a short biography, a description of their creative use of technology, and answers to the following questions:

- *What music do you make?*
- *Why do you make music?*
- *Is any of your sound-based work not ‘music’, as such?*
- *Do you consider yourself a performer, a composer, a technologist, an engineer, some combination of these or, indeed, something else?*
- *What is the cultural context for your work? Are you influenced by music in other cultures? And the other arts?*
- *What skills and attributes do you consider to be essential for you as a digital musician?*
- *Do you have any other useful or relevant things to say about being a digital musician today?*

The answers echo a number of the key themes that have been explored in this book, sometimes from some unusual or particularly interesting angles. Musicians may not always be objective about their own work, but they can have a way of cutting to the heart of the matter that is illuminating.

What follows is an edited selection from the interviews, which draws out areas of remarkable similarity and difference, and points to some interesting avenues for further investigation. The complete interviews may be read on the book’s website, along with creative projects contributed by the artists themselves. But first, let’s meet each of the case studies in more detail.

Biographies

Oswald Berthold (OB)

enter world. awakening of the internal program. learned to play an instrument. formed a band. acquaintance with more instruments including electronic devices. left home. meet computer. short studies in music technology. meet internet. establishment of a studio and founding of a collective that lives until today. embeddance in an electronic music scene. playing concerts. start learn programming. playing more concerts. doing regular work in website construction. shifting interest to installations. picking up studies in computer science. still going. vacillate between art and science.

Nick Collins (NC)

Nicholas (Nick) Collins has indulged in both mathematics and instrumental composition in the past. His interests run the gamut of topics in electronic music, but particular specialisms include algorithmic composition, live electronica, machine listening and interactive music systems.

He was born near Oxford, grew up in Burntwood, Staffordshire, received a first degree in mathematics, a masters in music technology, worked for Sony for a year on film SFX software, then became a programmer and part-time lecturer in London. Nick escaped to Cambridge to sort out a PhD, where he also learnt the dark art of writing in the third person about himself. He is now a lecturer in computer music at the University of Sussex.

Julio d'Escriván (JE)

I am a composer and creative music-technologist. I studied music traditionally, my instrument was the classical guitar, but I was interested in electronic music from very early on. Because of this I experimented with electric guitars, synths, recordings and tape delays in the late 70s. I went to what is today Anglia Ruskin University where I studied composition with John Hopkins. Later, I studied composition for a year at Cambridge University (Trinity Hall) with Robin Holloway and then at City University London with Simon Emmerson and Robert Saxton where I took my PhD in Electroacoustic Composition in 1991.

I have worked as a composer of music for media since 1989 (it started as a way to fund my living expenses at the end of my PhD) but I have been a full time academic only since 2005. I was also a consultant for Yamaha Research and Development in London, on sampling and synthesizer voicing projects between 1989 and 1991. Before I became an academic, I supported my more experimental sonic explorations by being a music producer for my own small company bitBongo Music. As such I have produced (written, directed session musicians, recorded, etc.) music for commercials, TV documentaries, TV and radio sound IDs and edited several CDs of popular music as well as scoring a few film soundtracks. I have also worked extensively for A&E (Arts and Entertainment) Latin-America, a U.S. cable network that is part of the HBO group as an in-house composer. Since 1991, I

have recorded music for a great variety of brands including Kraft, Pepsi, Gatorade, P&G, Nabisco and also for the Venezuelan banking industry.

Ambrose Field (AF)

Ambrose Field writes music which combines human performance and digital technology. He is a three time award winner at the Prix Ars Electronica, Linz, with honorary mentions for digital music in 1997, 1998, 2006. Field's work crosses style and genre boundaries, and explores new territories resulting from an unusual cinematic approach to source material. BBC Radio Three commented that Field's work is 'Music pushing against its boundaries and aspiring to the visual'.

His latest project, *Being Dufay* is recorded on ECM has achieved international critical acclaim. He has been a guest of studios as diverse as Recombinant Media Labs/Apshodel to Hungarian National Radio, researching creative answers to new digital opportunities.

Rob Godman (RG)

Working as a composer, sound designer and programmer, Rob has a passionate interest in how sound behaves acoustically and has developed a number of techniques for controlling and building virtual spaces for use within live performance and installation. His fascination in the work of the Roman Architect Vitruvius has led to frequent conference engagements and appearances on documentary TV shows.

An enthusiastic collaborator, Rob has worked on experimental and large-scale commercial music and sound design projects including the interactive installation *The DARK*. Other research and compositional interests include interactive audio (live and responsive), multi-speaker sound projection, programming, commercial expectations and industry requirements, collaborative methods and cross-arts. He is also a Reader in Music and Programme Leader for Composition at the University of Hertfordshire.

Chris Joseph (CJ)

I am a writer, artist and musician who works primarily with digital text, sound and image. My past projects include ‘Inanimate Alice’, a series of interactive multimedia stories, and ‘The Breathing Wall’, a digital novel that responds to the reader’s breathing rate. I am editor of the post-Dada magazine and network 391.org, and a founding member of The 404, a group of digital and traditional artists exploring early modernism within new media.

Thor Magnusson (TM)

I studied music from a young age and was involved in various bands in Iceland until I moved out of the country in my early twenties. My academic background is philosophy, focusing on the philosophy of mind, language and aesthetics, but also on Indian philosophy. Through the philosophy of mind, I got interested in computing and AI. When I learned programming, it became obvious that a meta-machine like the computer is a fantastic tool for creating musical instruments and compositions, so I’ve spent over a decade now

researching and creating digital instruments and algorithmic/generative music. I am the co-founder (with Enrike Hurtado Mendieta) of the ixi software project, which concentrates on experimenting with graphical user interfaces in musical software. We also have a label and regularly run workshops across Europe where we teach audiovisual software development for artists and designers. At the moment I teach at the University of Brighton and the University of Sussex and have a research fellowship with the Creative Systems Lab, concentrating on human-machine interaction and intelligent tools for musical production and playing.

Kaffe Matthews (KM)

Playing classical violin from the age of 7, singing badly in one band but getting further with bass and drums in the next, in 1985 I discovered electricity, listening and with that, my current trajectory. Since then, acid house engineering, electrically reconstructing the violin, Distinction for a Masters in Music Technology, introducing and running a Performance Technology course at Dartington College of Arts, establishing label Annette Works and in 2009 launching the audio research lab, AudRey in London's east End. I also set up a collective wholefood shop and did a Zoology degree along the way.

Since 1990 I have been making and performing new electro-acoustic music worldwide with a variety of things and places such as violin, theremin, Scottish weather, desert stretched wires, NASA scientists, melting ice in

Quebec and the BBC Scottish Symphony Orchestra. Currently I am researching 3D composition for outdoor enjoyment through Hammerhead sharks in Galapagos and sustainable vibratory interface design with '*music for bodies*'.

My 2004 collaboration *Weightless Animals* was awarded a BAFTA. I received a NESTA Dreamtime Fellowship in 2005 and an Award of Distinction, Prix Ars Electronica 2006 for the work *Sonic Bed_London*. In February 2006 I was made an Honorary Professor of Music, Shanghai Music Conservatory, China and in 2009, a patron of the Galapagos shark conservation society.

Randall Packer (RP)

Randall Packer is internationally recognised as a pioneering artist, composer, educator and scholar in the field of multimedia. His book and accompanying website, *Multimedia: From Wagner to Virtual Reality* has been widely adopted as one of the leading educational texts in the field. He is concerned with the aesthetic, philosophical and socio-cultural impact of new media in an increasingly technological society.

In 1988, he founded Zakros InterArts and has since produced, directed and created critically acclaimed new-media performance, installation and net-specific works. Since moving to Washington, DC in 2000, his work has explored the critique of the role of the artist in society and politics. He founded the virtual government agency US Department of Art and

Technology in 2001, which proposes and supports the idealised definition of the artist as one whose reflections, ideas, aesthetics, sensibilities and abilities can have significant and transformative impact on the world stage.

Pauline Oliveros (PO)

Pauline Oliveros (b. 1932) has influenced American music extensively in her career spanning more than 60 years as a composer, performer, author and philosopher. She pioneered the concept of Deep Listening, her practice based upon principles of improvisation, electronic music, ritual, teaching and meditation, designed to inspire both trained and untrained musicians to practice the art of listening and responding to environmental conditions in solo and ensemble situations. During the mid-'60s she served as the first director of the Tape Music Center at Mills College, aka Center for Contemporary Music followed by 14-years as Professor of Music and 3 years as Director of the Center for Music Experiment at the University of California at San Diego. Since 2001 she has served as Distinguished Research Professor of Music in the Arts department at Rensselaer Polytechnic Institute (RPI) where she is engaged in research on a National Science Foundation CreativeIT project. Her research interests include improvisation, special needs interfaces and telepresence teaching and performing. She also serves as Darius Milhaud Composer in Residence at Mills College doing telepresence teaching and she is executive director of Deep Listening Institute, Ltd. where she leads projects in Deep Listening, Adaptive Use Interface. She is the recipient of the 2009

William Schuman Award from Columbia University for lifetime achievement.

Synthia Payne (SP)

Synthia Payne is an award-winning scholar and artist originally from Los Angeles, California. Her pioneering live Internet music shows occur on a global scale - literally musicians from all over the world playing together in real time. Synthia was technical director for John Gunther's multi-location telematic concert performance at CU Boulder's ATLAS theatre between participants from CU Boulder's Jazz Studies onsite, NYU's Steinhardt School, and Korea's KAIST. And she was a featured vocalist and improviser in an online concert with the Stanford Laptop Orchestra. Synthia is adjunct faculty for The University of Denver's Digital Media Studies department, and is developing curriculum for classes in telematic arts collaboration. Synthia holds an MFA in Digital Arts and New Media, and a BA in Film and Digital Media with an electronic music minor, all from UC Santa Cruz.

Quantazelle (Q)

A self-proclaimed "multi-hyphenate," Liz McLean Knight - the sole woman behind Quantazelle - is thoroughly immersed in technology, fashion, music and the often-surprising overlaps between. When attempting to circuit bend battery-powered music toys for an upcoming music performance, she discovered that electronic components can be turned into elegant jewelry and started an entire tech-fashion line called Zelle.

While devising a content-management system for her online experimental electronic music magazine, Modsquare, she learned various web-based programming languages and related technologies, having a head start from her one-time computer-science college major. With that knowledge she then started an online store, Fractalspin to sell not only her jewelry but also accessories and gear for the technologically-sophisticated yet fashionably-minded crowd.

Desiring to assist similar artists reach a greater audience as well as provide gear for electronic musicians, she started Subvariant - a record label and accessories company behind the well-received Electronic Musician's Emergency Adapter kit. As laptop-DJ Liz Revision, she selects both experimental ambient and glitchy techno in response to the aura of each night. As Quantazelle, she combines complex percussive programming, sonic innovation and engaging sound design together with an approachable melodic sensibility and often booty-shaking result.

John Richards (JR)

John Richards' work explores performing with self-made instruments and the creation of interactive environments. He performs regularly with electro-noise improvisers kREEPA and the post-punk group Sand (Soul Jazz Records), and he is actively involved in the performance of improvised music and community music projects. In 2002, his work with kREEPA helped initiate the OIK project at STEIM, Amsterdam that involved the hacking of commercially

available hardware to create economic musical interfaces. He has worked with many leading improvisers and musicians in the field of live electronics and has performed extensively across the globe, predominantly in Europe, as well as Japan, Australia and the USA. He completed a doctorate in electro-acoustic composition at the University of York, UK, in 2002, and he is currently part of the Music, Technology and Innovation Research Centre at De Montfort University, Leicester, UK. Since 1990, he has also taught improvisation at Dartington International Summer School.

Sophy Smith (SS)

I am a classically trained musician (piano, French horn, singing), but I stopped orchestral performance when it was no longer necessary for my formal education. My undergraduate degree was in inter-arts and this cross/interdisciplinary approach to my work led me to complete a MA in contemporary performing arts. It was during this course that I began to write music. My undergraduate degree course had no music technology provision, and so my compositions were all for orchestral/vocal ensembles. This had a direct effect on my future compositional development and style, as I am essentially self-taught in all aspects of music technology. This lack of experience (and equipment!) resulted in my early music technology experiments involving any cheap lo-fi equipment I could access, and using it in any way I could find: for example, cheap 1980s sampling keyboards, electronic toys, tape recorders and four-track machines. When I began to work

as a professional composer, my reliance on sound-based and sample-based work was too restricting for the different types and styles of music that I was being asked to write, and so I learned sequencing and editing software and techniques to widen my skills.

My professional work covers a wide range of work. I currently work as a professional composer, writing music mainly for dance and theatre companies as well as running my own live art company Assault Events. The company creates original devised performance events as well as planning and delivering a range of specialist residencies. We also undertake research and consultancy projects for clients including the Creative Partnerships, regional arts organizations and local education authorities.

Atau Tanaka (AT)

Atau Tanaka is a Japanese/American composer and researcher. He bridges the fields of media art and experimental music, artistic and scientific research. His work seeks the continuing place of the artist in democratised digital forms. He creates sensor-based musical instruments, searching for the idiomatic voice in the interface. He composes for network systems, considering data transmission delay as the acoustic of the network. His works include solo and ensemble concert works and exhibition installations. His work in the 1990s with the trio Sensorband continues today in gestural sound-image performance with Sensors_Sonics_Sights. He publishes theoretical writings and conducts fundamental research at Sony CSL Paris to develop and document his socio-

artistic approach. His work has been presented at Ars Electronica, SFMOMA, Eyebeam, La Villette, ICC, V2 and ZKM. He has received support from the Japan Foundation, the Fraunhofer Society, the Daniel Langlois Foundation and is mentor at NESTA.

Martyn Ware (MW)

Martyn Ware was a founding member of both ‘The Human League’ and ‘Heaven 17’ and is one of the UK’s most successful and in-demand producers. His work includes Terence Trent d’Arby’s *Hardline* album and hits for Tina Turner and Marc Almond. Martyn has also worked extensively writing music for film, theatre, television and radio. His most recent venture is The Illustrious Company, formed with long-term collaborator Vince Clarke (of Erasure, Yazoo and Depeche Mode), which makes original music soundscapes often in visual contexts. They recently staged a series of events called ‘The Future of Sound’.

Interviews

What follows are edited responses by the Case Studies to the various questions, annotated to draw out particular issues of similarity and difference, features of interest and relevant personal aspects. The complete interviews may be read on the website.

Please describe your creative use of technology, particularly digital technology.

The strongest impression to emerge from the answers to this question was the extent to which technology is both inspirational in itself and provides a direct link to the sources of inspiration.

My creative process is completely suffused with digital technologies. I use them for inspiration; to create text, images and sounds; to edit, program or otherwise manipulate those elements; to allow the reader/audience to respond to and influence the work's ('interactivity'); to collaborate with other artists around the world; to publish, distribute and promote my work; and many other related uses between and besides. (CJ)

I have been interested in the use of interactive technology for musical expression. I perform with musical instruments built from sensor systems, create network music infrastructures, sound-image installations and participative mobile locative music experiences. (AT)

My use of technology is compositional, I am not interested in developing technological tools for others to use (although I am happy to share the few ones I make). I use digital technology to synthesise, record, manipulate and perform sound. [...] In recent works I have used smartphones and video game controllers, which are now rather common in electronic music performance. At the moment of writing I

am creating a new work for video game player as performer (projecting the game progress to the audience) and an electroacoustic ensemble that includes a laptop section and reacts to the game much in the spirit of silent film. (JE)

i am interested very generally in wave phenomena as they are evident in, or rather, constituent of all of nature's processes. sound then seems well suited for conveying information about the trajectories of these processes' variables, particularly as they unfold along time, be they external and tapped or simulations. this suggests a toolbox equipped with devices such as supercollider, octave, R, and a good text editor, a lot of glue, utilities and scripts of diverse provenience and a box filled with I/O apparatus, sensors, soldering iron and such. (OB)

I am actively exploring: machine listening and interactive music systems (for example, works for piano and electronics, baroque instruments and electronics, computer systems supporting improvisation), computer generated composition (including a series of 'infinite length pieces' in musical areas from nonstandard tuning systems to automatic electronic dance music), laptop performance (from live coding, to live audiovisuals). (NC)

Digital technology is a tool for creating sounds as well as putting them together, and having both these elements in one place means that I can work quickly and allows me to be much more flexible and effective. Digital technology is ideal as it allows me to quickly re-edit/and alter pieces of music, which is vital in the situation I compose in where I often compose in the rehearsal studio with the dances/actors whilst they are devising. This allows the work to be a much more collaborative experience than it would if I had to keep going back to a large analogue studio or writing for instrumentalists who were not present. (SS)

I use all technology that I can get hold of. (TM)

All the artists take a creative approach to the particular software and hardware they use, with some favouring modular solutions such as Max/MSP or programming languages such as SuperCollider that encourage a 'self-built' approach to music-making.

I use programming languages like SuperCollider and MaxMSP/Jitter to structure the sequencing of the sound objects and give form to my musical ideas. I often work in a live-coding style with SuperCollider, this allows me to test complex ideas very quickly and to create interesting variations easily with minor changes to the code. In

the end, I like leaving the music ‘fixed’, which often means that a similar sound process is applied in the same section of the music but with constrained randomness in selected aspects when the code is re-run in performance. This makes the most of variability but ensuring you can recognize the piece on a second hearing! (JE)

On the computer, I work most of the time in a programming language called SuperCollider, which is specifically designed for audio programming. My work with SuperCollider can be roughly divided into two areas: (a) building instruments that are designed for live improvisation and are therefore quite flexible, allowing for spontaneousness; (b) algorithmic compositions where I create software that generates music that is never the same when you listen to it. I always try to make software that supports working with acoustic instruments, hopefully creating a symbiotic relationship between the acoustic and the digital. (TM)

My work is based in performance and has incorporated nearly every form and genre of new media. Currently I am working with HD video and surround sound for an upcoming music theatre production. (RP)

I compose using an Apple Mac running Logic Pro, Pro Tools and Wave Burner. I use soft synths including Absynth and Sculpture. My

music also uses a wide range of samples which I manipulate in Logic. I use the technology both as a palette where I can create and mix new sounds and as a canvas where I can compose the work. (SS)

I'm a Mac addict. I had one of the first Macs in the country in the 1980s. The Mac is central to just about everything we do, from composition through to soundscape assembly, through to 3-D surround-sound convolution. We use a proprietary system that has been built with our advice by Paul Gillieron Acoustic Design which enables us to move things around in three dimensions and actually see where things should be in a wire-frame diagram. It can move up to sixteen different sound frames simultaneously at 25 frames per second. We also use Logic, an industry standard product, as a front-end. We also use Macs for all our business needs, designing websites, etc. And, although we are famous for using analogue synths, nowadays we use virtual instruments as well, so more or less everything we do is mediated through technology. (MW)

Self-devised instruments are also common, especially where digital technologies are combined with acoustic or analog technologies. John Richards, for example, describes his approach to instrument building as follows:

The Kreeback instrument [is] a modular environment of analogue DIY electronic devices, audio hardware and digital bits and pieces patched together to create a feedback labyrinth. The instrument's name is derived from my work with the group kREEPA and the idea that sound creeps back on itself. Since 2000, I have been developing the instrument and approaches towards performing with it. Some of the modified 'physical' objects tend to catch the 'eye'. However, as far as the ear is concerned, digital technology plays a big part. I have been hugely influenced on different levels by object-orientated programming languages. I initially conceived the feedback network of the Kreeback instrument using Max/MSP and the inputs and outputs of an audio interface. Despite being quite a different instrument to the one I currently use, the genesis of the instrument is here.

[...] In regards to specifically digital technology I currently use in performance, the Nord Micro Modular is used as a 'module' in the Kreeback instrument. The programming language of the Nord offers great flexibility, and its small size, robustness and control features make it a really powerful device to help coerce and steer the feedback produced by the other modules that make up the Kreeback instrument. For example, using a mixing desk as a matrix, I can use a low frequency oscillator (LFO) from the Nord to modulate some of the

analogue signals. Within the digital domain of the Nord I also have created feedback labyrinths and networks that I control with MIDI: there are feedback loops within feedback loops within the overall instrument. Having worked with Max/MSP, programming the Nord was an extension of the same modular approach. (JR)

Finally, Quantazelle made this amusing observation:

What's great about computers is that they are amazing tools that allow you to completely stretch, distort, invent and reinvent sound like no other instrument. And, there's usually an "undo" command. :-)

What music do you make?

The Case Studies were mostly reluctant to describe their music in any way that would enable it to be 'pigeon-holed' into a particular genre or style. Some found this a difficult question to answer. The most common descriptor is 'electronic':

I make mostly electronic music. I am interested in stylistic crossovers between experimental electronica and classical, jazz, rock, pop and ethnic musics. (JE)

Music involving humans and technology. (AF)

Strangely, I found this a rather difficult question. I know what I don't do. (RG)

Electronic music in a wide range of styles, often with collaborating singers or musicians who are part of the 391.org network. (CJ)

I make experimental electronic music, but I use the word 'electronic' music only because to most people, the word 'electro-acoustic' means nothing. In fact, I make both electronic and electro-acoustic music. (KM)

Perhaps "edgy experimental- yet- melodic electronic" or "glitchy- yet- catchy instrumental electronic." It continues to evolve as I do. (Q)

Improvisation features in several of the answers.

I mostly play with improvisation bands, using a mixture of acoustic instruments and electronics, but I also enjoy improvising with other electronic musicians which happens frequently in various club or festival settings. (TM)

Currently I improvise music with my Roland V accordion (all digital). I use my Expanded Instrument System (EIS) to process my instrument and spatialize the sounds. I also compose music for acoustic and electronic instruments and voices. (PO)

I make music with my voice and I play synthesizer keyboards mainly in collaborative improvisations with others, and most often taking place in real time online sessions with people from all over the world via Internets. (SP)

Most answers prefer to describe the music in terms of the medium for which it is created:

I make music as a function of the medium or infrastructure for which I am composing. I seek out the sonic voice of the chosen medium. (AT)

My collaborator, Vince Clarke from Erasure, and myself compose together, creating soundscapes for exhibitions, events, etc., etc. We also do Hollywood-quality sound design in three dimensions. So, the work we do ranges from 3-D 'narratives' that have nothing to do with traditional music, through to traditional music pieces that are rendered in three dimensions. (MW)

I mainly write music for dance and theatre companies for touring shows. This involves creating soundtracks of between 40 and 75 minutes in length, comprising of a number of shorter tracks. Usually, all these tracks are ‘written through’ so that the soundtrack is heard as a complete piece of music without gaps. The type of music I write depends on the movement/action that it works with, but includes orchestral pieces, sound-based work, vocal work and electronic dance music. I think I am more defined by my approach to composition through collaboration with other art forms rather than a particular style. (SS)

I also make generative music in the form of software, the latest piece in a collaboration with Runar Magnusson where we used field recordings from Iceland to create ‘schizotopic’ soundscapes where the pieces/ locations are never the same. We intend to release the software so the user can generate an endless amount of music and share with others. (TM)

I’ve created a lot of collaborative works with other artists that might be described as ‘installation’. I write concert-hall works for instruments and electronics where live performance and perception of

‘liveness’ is an integral part. Space [or acoustics] – in the widest sense of the word – is an important part of my work. (RG)

I used to create fixed products including ‘impossible tape music illusions’ but, more recently, have often concentrated on full time on live performance. The various facets of this include an audiovisual experimental electronica duo (live improvisation of mappings), designing systems for real-time interactive situations and competitive live coding battles. (NC)

Some of the case studies go into more detail about the music itself:

Although a lot of the music I have created has dense textures, complex rhythms and could be considered as ‘loud’, I am also interested in extreme contrasts, the use of silence and sparse musical landscapes. Similarly, the idea of contrast in my music is also explored through the relationship between the performer’s involvement and non-involvement (total process) in performance. (JR)

[...] put extremely, it’s not making music but rather transforming music. consider music as the continual evaluation of a vector valued function of multiple variables. whew.

phenomenologically it's again a progression, one of parameterised sounding entities, elements that vary mostly microscopically, that recur among diversely different timescales, maybe slowly evolve. hums, hisses, buzzes, tonal drones, optionally and quasi periodically pulsed, also blips, squeaks, tweets, squirts, grunts and other more short lived creatures. (OB)

Why do you make music?

The answers to this question were clearly very personal and deserve to be quoted in full. Despite their variety, some common threads do emerge: a sense of compulsion, of absorption and of necessity. To put it simply: it is not a matter of *wanting* to make music, but rather a matter of *having* to make music, for whatever reason.

i slipped into this, not noticing myself and now i can't find a way out.
(OB)

The answer to this would itself vary based on the work and the time of day. But here is a selection of responses:

- to make social contact with people I'd be too shy to talk to, to assist communal forgetting of the everyday, for particular functions (a club event, promoting dancing) to undermine

particular functions (deliberately awkward music disrupting dancing)

- to create artefacts as a challenge to my own and other's intellectual and emotional states
- to become lost (or transcendent, meditative?) in the flow of composition and performance. I can achieve such direct flow in more intellectual pursuits (though I also play piano in traditional musicianship and can become lost there in a motor memory assisted kind).

I'll stop before your patience wears thin . . . (NC)

I make music because I love it. It's one of the few things I am able to do that is a reward in itself. (JE)

Firstly, for the audience. I'm not interesting in making music nobody is going to hear.

Secondly, to explore, define, create and seek out new things. (AF)

This is a question I often ask myself, and a difficult one to answer. The best answer I can give for now is that it is a kind of compulsion – a need that must be satisfied to remain happy and sane. I think part of the reason may be that when I make music I often feel completely absorbed in the process/moment, to an extent that comes more rarely

when creating with other forms. I almost want to say that it is a more 'pure' form of creation, but maybe better would be to say that it is more immediate, and there is something in that immediacy that makes it a hugely enjoyable activity. (CJ)

For me, music is an outlet of ideas and states of mind that I am dealing with. I get inspiration from everything I hear, see or read, and working with music in an environment like SuperCollider allows one to experiment from a very basic level. To me, SuperCollider is an experimental laboratory of sound, a research tool, a workshop for instrument building, a compositional environment and a musical instrument, all at the same time. Sound is an important part of my world, and researching and experimenting with sound and its physics is for me a meditative process of understanding the environment. For example, recording sound in nature gives me a richer and deeper 'presence' and 'experience' of the nature itself. It is as if the ears become hypersensitive. I imagine this is analogous to a painter painting nature or even a hunter that has to pick up signs from the natural environment in order to find the prey. (TM)

I don't know. I just know that that is what I have to do. But, if you want a story: in the mid-1980s, when I was in a band playing bass and drums, I went to West Africa for a couple of months. I lived with some

drummers, and they taught me traditional rhythms on tam-tams, and, within that, I learnt very simple things about how the texture of the skin on your hand, and the shape of the hand, and the tightness of the drum skin and the shape of the drum, these tiny, tiny details, would change the sound of the drum when your hand hit the skin. The changing of that sound would alter the pattern and so completely alter the music and its meaning. Also, how the simple patterns, simple cells, interlocking with each other, would produce music of great complexity. I came back to Nottingham, where I was living at the time and had this epiphany – I just had to make music. Sound essentially is my medium. It's not emotional expression, or personal experience. I'm more of a channel. Overall, making music and using it is a continuously questioning journey that never stops which makes some sense of living. (KM)

I make music to expand my mind and because I enjoy it. (PO)

Because I can. (RP)

Tapping into a creative process is exhilarating and can be very satisfying. When I am creating music there is a connection between my deepest psyche and the waking world that helps me live well. I

remember at a very young age thinking that making music was something I could do for my whole life without reservation. (SP)

I feel that I have a particularly unique audio perspective on creating music that's not dependent on any particular instrument, machine, plug-in or genre to make it sound like it came from me. I've participated in this Iron Chef of Music competition put on by the krac5ive label, but which has worldwide participation via the Internet and various "nodes" (physical meet-ups) throughout the world. The idea is that they give you one audio sample, and two hours, and you can use any program or effect to create a track from that one sample, but you can't use any other instrument. I thought it was absolutely fascinating how everyone who participated took the same source material but used it in completely different ways. And I was able to recognise the ones that were produced by my friends, because it just *sounded like them*. Even though all of us who participated started from the same place with the same materials, we each produced something uniquely different. I sort of feel that way about what I do - I have a particular approach that sounds like me that you'll never hear anywhere else, even though there are people using the same software and plug-ins as I do. I feel as if I'm contributing something unique to all the available recorded electronic music. If I ever stumble across

anyone who sounds like I want to sound, but doing it better, I'll just retire and subscribe to all their future albums. (Q)

I do not really have a rational answer to this question. Making music is part of my fabric as a human being and is something that has always been there. I have sometimes thought about how I might stop making music, but these thoughts have been fleeting. (JR)

I enjoy creating things from scratch – music is one of my outlets for doing this! I find it challenging and stimulating and hugely enjoyable. I do not write much music for its own sake but rather enjoy writing music for collaborative things (e.g., environments, events) in which music is one of a number of parts that go to make the whole. I can't remember choosing music – I just can't remember doing anything else! (SS)

I continue to make music because ideas continue to come, and I have been unsuccessful to stop making music despite efforts. (AT)

Because it's the only means I have of making a living. And for pleasure. I tolerate no interference with the creative process. I never have done, throughout my career as a musician and writer, composer and producer. One of the conditions of me working is that I can't deal with working by committee, particularly when composing. For that

reason, we don't do much work with the advertising world, for instance. The presumption in that kind of world is that if they pay you enough money they have the right to interfere. I'd rather earn less money and provide a clean path towards resolution of a creative idea. And it's my life, and has been before I got signed as a professional musician, since about 1972 when I bought my first synthesiser and started playing with imaginary bands, with my mates in Sheffield. It makes me laugh when people talk about retirement, because I'll be doing this until the day I die, if I can. (MW)

Is any of your sound-based work not 'music', as such?

There was a clear split down the middle on this question, with six Case Studies answering unequivocally 'yes', seven unequivocally 'no', and three being unclear either way. The 'no' replies were generally simple (some being one word answers, some a little more elaborate), for example:

No. I consider everything I make with sound to be music. (KM)

No. This is not a value judgement though, I simply don't make documentary forms of pieces, field recordings or sonifications. (AF)

Music that does not arise from the Western traditions of melody, harmony and rhythm but from sound orientation is often said to not be music. This is a misunderstanding of music arising from the sounds of 20th and 21st century life. For me both traditions are music. (PO)

Well I suppose my mother might say yes, but I don't think so. (Q)

I regard it all as music. Some people would say: 'that's not music'. It all has an artistic element. (MW)

Some of the 'yes' answers make a distinction between various forms of sound-art or sound design and music:

Because of my personal history all my work with sound responds to a musical sensibility. Yet I would say that according to newer definitions of sonic art, music itself as we understand it historically may be better understood as a particular form of the arts of sound but not the only standard by which all work in sound is measured. (JE)

This gets a little tricky but I think there is a distinction between music and sound art. I've created a few harsh noise pieces, and I like to do what might be considered acousmatic or musique concrete. I like to call it sound collage. (SP)

Aside from the creation and manipulation of sounds as part of my multimedia works, many of my longer sound pieces would probably be better described as something other than music. What that something is, I wouldn't like to say . . . (CJ)

Yes, some of my research is on the effects of sound on the mind or direct explorations of sound physics. I don't consider that necessarily 'music', and it changes according to contexts, so it's quite hard to answer this question really. (TM)

I describe myself as a composer mainly although I'm very interested in the composition/sound-design crossover. I find it quite amusing how we get very messed up with these types of labels. 'Composer' seems to be about right for me – an organiser of sound. As an academic, I find myself researching areas that might not be considered music. (RG)

Oswald Berthold is the only Case Study positively to embrace the idea that he does not create music:

most of it, yes. it appears to me i have arrived at this definition by searching for a local optimum in personal manoeuvring space. i enjoy a lot of music 'as such' but i enjoy in a very similar manner many more temporal structures occurring in my immediately perceptible surrounding and wonder about the imperceptible. (OB)

Do you consider yourself a performer, a composer, a technologist, an engineer, some combination of these or, indeed, something else?

This question prompted some lengthy answers, with the majority of the Case Studies seeking once again to avoid defining themselves as any one thing in particular, preferring instead to be hybrids or to resist *any* categorisation.

Some were quite clear, however:

I'm a composer, as most of my time is spent looking for new forms and structures, and creating the raw materials for pieces from scratch. (AF)

I am a composer of media. (RP)

Mostly a performer and composer. I don't really see myself primarily as a technologist, as first and foremost I write music, and the digital technology is my means for doing this. I definitely don't see myself as an engineer, probably as I have no formal training in this area. My music often drives my engineering-orientated collaborators mad as my engineering is 'wrong'! In terms of engineering, I tend to experiment until I find what I like, rather than knowing what to look for. Really, I suppose, I see myself as a facilitator of sorts. (SS)

I am a composer who performs, an artist who uses digital technology as his canvas. (AT)

Good question. Nowadays, less of a performer, although during the 'Future of Sound' events I MC the whole thing, because I'm the most famous person involved and it's my baby anyway, so I can do what I want! I like public speaking now, whereas it used to horrify me. I've turned from a performer in the music sense to a performer in the didactic sense. Since I've had children (now aged eleven and nine), I've become much more interested in distributing the experience I've acquired over thirty years.

I think of myself more as a composer now, in the real sense of the word, than a writer. I'm a producer-composer. The skills I acquired as

a producer were invaluable in terms of organizing the material required to get a message across, especially in the complex world of 3-D sound and how that information is imparted to the observer.

I don't like the word 'technologist', but I have become fascinated by technology. Our 3-D sound needs to be, or rather often is, accompanied by visual imagery. Interesting new forms come out of that collaboration. So I have become, of necessity, much more *au fait* with all the technologies that are out there to do with interaction, with digital manipulation of information, infomatics and new forms of coding that enable you to do things that weren't previously possible in combining digital visual generative work and sound. So, I've expanded my skills base to incorporate a lot more things. (MW)

Selections from the 'hybrid' answers will illustrate the complexity that this question can engender:

I'm probably a hybrid of most of these although I'm never sure what a technologist is. (RG)

clearly, all of the above and then some. maybe not quite a generalist but at least a student in many disciplines. (OB)

I've made the comparison before of nineteenth-century composer/pianists and twentyfirst-century composer/programmers. People are an implicit and untangleable blend of characters and change as the context suits; so I can be any of the above, but certainly, happy to be labelled a digital musician where this might simply mean someone working at the cross-disciplinary juncture of these types.
(NC)

After thinking about it for the last few years, I still consider myself a composer first but these days I also think of myself as a creative technologist. By this I mean that I am not interested in technology per se but in how it can be (mis)used for artistic purposes.
(JE)

Any of these terms would fit some part of my practice, which is why I always have difficulty answering the question 'What do you do?'. I tend now to describe myself as a writer and artist, which is sufficiently vague to cover and leave open all possibilities. (CJ)

All of these in addition to being an inventor. As with the term 'music', I don't find it productive to define myself (neither for myself nor others), so it depends on context what mask one might have to wear. In fact I prefer the term 'musician' as it is vague and

meaningless enough. I consider everybody a musician, just of varied skills, practice and maturity. (TM)

I am a person who makes music through constant questing. [...]

I am a performer. I can get into showing off too, one of the reasons I no longer go on stage – I don't want audiences to get distracted by my prancing about rather than just listening.

I am a composer in different ways. I compose on the fly in live performances, improvising and working with software to create chance events to which I respond then and there. I also slowly make carefully constructed, thought-out pieces for dance and film. [...]

Part of the skill which I have been trying to acquire through practice with the live work is to ask: is this decision I am making now the best one? Is it right? (Whatever that means.) Is that interesting? Is this a decision that's worth making? Or should I actually not do what I think I should do? Of course, I begin with an idea, launch off, I'm playing and I have no idea what will come next, like life really. So sometimes it's great, and then slam, a disaster, and I have to deal with that. And all witnessed with an audience.

I'm not a technologist. I use digital technology as my instrument, my tool. I'm not an engineer either. But I got into what I do now because I went to work in a recording studio in the early days of acid house and discovered that you could use technology to make sound

accessible as a material. At that point, I stopped making conventional tunes and began to play with what the machines might do, crashing and coming up with things I would never think of. That's where the collaboration began, and I began to feel that music-making was really possible. I also made the decision then not to be an engineer but to use the studio and its gadgets creatively. I wouldn't be doing all this if computers didn't exist. (KM)

Online musicians have to be able to set up their computer, get online, mix and perform all at the same time. I am an improviser first, but I am also listening for form and content in a way that constitutes real time composition. I am also engineering the Internet connection and the computer and audio equipment, and mixing. The simultaneity of one person performing all of those functions at once is perhaps unique. (SP)

I'd say all of those on some level. These days, I've toned down the actual "performance" of my shows a bit (haven't worn a costume in forever, haven't done any costume changes or participated in any laptop cage matches in quite a while) and have just been focusing on the sonic experience that I create as a sound technologist in a live setting. Plus, just creating all the musical intricacies in one track requires a few days of such focused nerdery in front of my laptop that I

kind of run out of time and energy to think about how I could make it more "performative" in a live setting. (Q)

I have found it increasingly difficult to call myself a 'composer', although I am, at times, clearly composing. There is a lot of baggage with the term 'composer', some of which, I do not like. For example, the composer as someone that sits at the top of a musical hierarchy, the limited reference of the term in regard to Western culture, and the composer as something distinct from a musician. [...]

I am also a technologist, engineer, designer, programmer and artist. However, for cultural reasons I do not call myself any of these. To be, for example, a sculptor, you have to earn the right to be called this: have a studio and exhibitions, a commitment to sculpting. [...]

Furthermore, I feel very strongly that the distinctions associated traditionally between science and the arts are perfunctory. In the UK, for example, people study to become a Bachelor of Science or Arts. It is clear that many students do not fit into either of these categories.

This is also true of the majority of digital musicians. (JR)

What is the cultural context for your work? Are you influenced by music in other cultures? And the other arts?

Several clear themes emerge from the answers to this question: the importance of non-Western musics; the influence of visual culture; the role of the internet; and a general sense of eclecticism and wide-ranging and open-minded appreciation of many forms of music.

I'm definitely influenced by music from all around the world. I've always been very eclectic in my tastes, from way back before even I was involved in making music. I don't think 'ooh, I've just discovered music from Mali, or Tuvan open-throat singing'. Everything is music to me. I can't alter the context for my work. Everyone knows I'm an electronic musician. We've always tried to do electronics with soul, and that's what interests me, not just in musical terms but also in personal terms. I only work with people who approach what they do with soul, with a sense of humanity, of generosity and openness to new ideas. So the context for me is *innovation*, I think. I'm more interested in new forms than I am in perfecting existing forms. (MW)

I have lived in several countries in my life so feel no direct identity with one particular culture. I draw upon the different cultures of my background in ways that I could not have if I had not left them. Also, I believe that there is a culture of technology, as well as a culture that questions technology. My works sits at this intersection, ultimately embracing a visceral vision of digital sound. (AT)

[...] I am influenced in some way or another by all music I hear, but I don't think that I am hugely influenced by any particular music in other cultures. I am influenced by any music that I like and find interesting – usually something that has an instant emotive hit! Some of my music does have different cultural nuances, but this is really because the sound itself reflects what I want to convey in the music for a particular scene or dance sequence. I am very influenced by the other arts as I have a very cross/interdisciplinary approach to my composition. This manifests itself in two ways, either in creating collaborative work with other disciplines or experimenting with different creative processes and concepts used in other art forms. If my music is influenced by anything, then it is a combination of my past experiences as an orchestral instrumentalist and vocalist and a desire to create music that will connect with people and that they will find interesting and enjoyable. (SS)

Culture of the Amateur. Although most of the people I play with are highly skilled in music, engineering, and technology, most of us don't make a living playing or engineering music. Probably most online musicians would love to play music full time, but few of do. However, this avoids having to worry about financial or commercial gain from the music we play. There is a cultural context in academia as

well because of the experimental nature of real time online collaboration. [...] My musical creativity resonates strongly with African tribal music, and with the Carnatic music of India. Language and poetry are also strong influences and when I am composing in real time I like to vocalize on nonsensical syllables that I develop into English words. I have done several projects that utilize video art, dance and theatre. A new interest is brain music and triggering sounds with brain waves. (SP)

My work has been performed in festivals ranging from Early Music Events in the Vienna Konzerthaus to hardcore Dance Music Festivals in the middle of rural Italy. I don't specifically locate my music in any cultural context. I do however bring a wide range of historical ideas into my compositional process. I am also influenced by my own past experiences. I think it is important as a world citizen to know about music from as many cultures as it is possible to find out about. I'm currently enjoying researching Pansori. However, I will not try and emulate Pansori in any of my pieces. Some of the structural decision making may inform how I approach a new work I'm engaged with, but that's about it. (AF)

My major musical influences would probably be post-war popular musics, principally rock, pop and electronic music; the

classical music I played in orchestras when I was younger; and Dada. But there are a huge number of other influences that wax and wane. I am certainly influenced by the other arts and digital arts in particular.

(CJ)

My work is influenced by social and political issues. I recently completed a political music theatre work entitled *A Season in Hell* a project of the virtual government agency I created shortly after 9/11, the US Department of Art and Technology. (RP)

About two years ago, I started to realize that I no longer wanted my work to be available just to those who already know about the kind of music I make; the largely young, male, white audiences who come to galleries, warehouses, basements, cellars and so on to enjoy shows. I think that experimental electronic music, if you can find a way into it, can be profoundly rewarding, even life-enhancing. It gives you a way of tuning in to what life is like through your ears, through listening. If you listen, rather than look all the time, it can transform your life. [...]

(KM)

1 white elitist western art music, sound art, sound hacking, slow code, media art + theory. 2 in no way directly. only through the filter of being published on recording media. 3 i draw inspiration from all over movies, literature, people, visual, sculptural, electronic and/or performing arts, physics, biology, mathematics, electronic and hacker culture, (in ad-hoc order) and other unworldly terrain. generally i go with the notion of arts and sciences overlapping, a tendency to syn rather than sci. (OB)

I am interested by all musics, but am especially drawn to those of counter-cultures and experiments. Of course, from a Western perspective, sometimes the mainstreams of other cultures can seem like subversive voices! All arts and sciences are good sources of human richness. In particular, I'm actively involved in multimodal art (audiovisuals). (NC)

My context is a mixed baggage of urban/world music popular idioms with a health dose of South American and Latin folklore, and other ethnic elements as well as high brow pretentious European concerns which I can afford to never take very seriously because I am not a European by birth. Like a lot of my contemporaries I am particularly sensitive to visuals and visual art-forms like cinema and

video. I also practice photography and my music today is very dependent on it. (JE)

Strangely (again), I found this a rather difficult question. I've never felt a terribly strong sense of cultural identity. Am I part of an experimental and/or academic culture? Hope not..., although I'm glad to say that the perception of such an identity/culture is now largely over generalised and frequently inaccurate. Travel is an important part of my life as an artist and having the opportunity to exchange ideas with other, not necessarily like-minded, people is crucial. It forces you to question your thoughts and ideas. I'm not conscious of exploring techniques from other cultures but suspect I do so subliminally (with particular relation to pace and time in time-based arts). I enjoy being slightly outside of my comfort zone and working with other artists and disciplines can make that happen. Collaborative working is fascinating. For the most part, my collaborations have been successful on an inter-personal level but I remember a hideous occasion when I felt I was being bled-dry of ideas so that the other artists could pilfer them. I like human beings for the most part and am fascinated in how we communicate (or don't) and relate (or don't!) with each other. (RG)

The cultural context of my work is a mixture of the cultures of experimental music and academia. I play regularly in various concerts

and music festivals, but over the past years I have been working on my project – ixi audio – in an academic setting, and that has taken me to various academic conferences and festivals. I enjoy both worlds, although I think the most interesting stuff musically is happening outside the academic settings. As for music from other cultures, I have to admit being obsessed with Indian music (and philosophy), and this has had strong influence on my own musical practice. I studied music in India for a while, which was an enlightening experience. I'm also interested in various African musical cultures, such as those of western Africa – Mali and Morocco in particular. (TM)

I grew up in Houston Texas listening to the sounds of nature and of music lessons given by my mother and grandmother. I started playing the accordion when I was nine years old. I played other instruments in school musical organizations. I was always attracted to sounds and music that was new to me or unfamiliar. I became exposed to world music via Henry Cowell's radio programs and Radio KPFA in Berkeley California. Music broadcasts of all kinds were very influential for me. Performance Art became influential in the 1970s. I had been interested in dance since making music for many dancers including Anna Halprin in the 1960s. (PO)

Here in Chicago, the only stations that play instrumental music are the classical-music station and two low-signal-power college stations, one that plays dance music and one that plays absolutely anything from field recordings to noise punk. There really isn't a mainstream cultural channel that my work would fit into, although I can think of about twelve Internet-based podcasts or websites that are a near-perfect fit. And that's why the Internet is just so wonderful - you can discover all kinds of new music and network and interact with people with the same connoisseur-level taste in this kind of music that you wouldn't find in mainstream cultural channels. [...] I think gamelan is really interesting. It's heavily and sometimes complexly layered, with different parts coming in and out with variations or in another time signature. Some of it reminds me of earlier Autechre. (Q)

'The Twenty-First Century is a Better Place for Me.' This is the title of a paper I have had an idea for, although I am struggling to start the paper due to the enormity of the issues it keeps throwing up. In brief, the idea for the paper was to attempt to place my and other people's work within a cultural context. Being born in the 1960s, I have been fortunate to experience making music in more traditional ways with acoustic instruments such as the piano and double bass, as well as witnessing the incredible rise of the PC and being part of the digital era. Also, through teaching, I have seen the emergence of the

first generation of purely digital musicians. Consequently, I am a polyglot musician: I speak many musical languages. I remember at university where I was studying music, there were those who could improvise and those who could not. Never the twain met. I suppose one of my attributes as a musician was that I could move across different musical terrains. It seemed completely natural. I had learnt some of the canon of Western classical music; I played in a jazz band and spent a good many years of my youth playing ‘axe murdering’ bass in a punk band. I also have experienced the dissemination boom of music. By this, I mean the opportunity to have on CD, for example, a vast range of music from around the globe. [...] (JR)

What skills and attributes do you consider to be essential for you as a digital musician?

Several of the Case Studies (AF, RG, TM, AT, MW) mention in their replies to this (and the next) question that they do not consider themselves to be ‘digital musicians’, but rather just musicians who work with digital technology:

I don't consider myself a digital musician, but simply a musician that makes use of digital technology as part of what I do. I think all instruments afford certain ideas and work processes and it

would be limiting to constrain oneself to one tool or technology. (TM)

I'd argue that there isn't such a thing as a 'digital musician'.

Digital is a meaningless semiotic consequence of the information age.

The idea of musician will prevail for all time. (AF)

A musician is a musician, digital or not. This being said, we need to move beyond the vocational skill set often associated with musical training. Today, knowing the physics of acoustics and the physiology of auditory perception is more important than knowing functional harmony. (AT)

Others (NC, CJ, JR, PO, SP, Q, SS) seem happy enough to accept the label:

I love being a digital musician as digital technology gives me the tools to be an extremely creative and flexible composer. (SS)

This difference illustrates the points made in the Preface and throughout the book about the relative transience of the digital as a culturally and musically defining characteristic. The phrase "digital musician" is merely a convenient 'shorthand' way of describing musicians who work with digital technology. Yet, as all the Case Studies agree, there are skills and attributes that are peculiar to musicians who work with digital technologies.

Half of them listed programming skills, knowledge of acoustics and psychoacoustics, and computer knowledge as essential. A quarter suggested that knowledge of mathematics is very important, and DSP, synthesis, recording, production, archiving and patching skills were all highlighted as essential. On the human side, more than half the respondents agreed that *persistence and determination* are the most important attributes. An ability to conduct background research, to be flexible, to be open-minded, to have good networking skills, a sense of humour, an ability to collaborate, to have a good imagination, and other similar attributes were all singled out. Many of the replies also highlighted the importance of staying abreast of current developments while also being literate in past music.

verbalised positively in the order of descending generality:
humor, curiosity, persistence, luck, classical literacy, having readily access to electronic calculating machinery of recent make including libraries of open software for their operation, literacy in mathematics, the internals and black magic of aforementioned machinery. (OB)

Some are in common with and critical to an acoustic musician: dedication/enthusiasm, networking, effort/practice, but some are exclusive, these are possibly more what you're asking for: computer programming ability in a number of languages (i.e., Super-Collider, C, MATLAB); instrument builder's/system designer's spirit – desire to

tinker and explore potential (and the necessary patience to defer outcomes here, plus the necessary impatience not to spend the entire time designing); grasp of electronic musician's music theory: psychoacoustics, DSP, discrete math, representations/formalisms; ability to be operating system and platform/software free; essentially to reach to ideas independent of particular implementations (helping with future proofing in this over anxious environment of upgrades – we should have a moratorium on progress for some years and take advantage of what we have right now!); live electronics/interfaces.
(NC)

A deep interest in synthesis, recording and production of sound. Some computer coding skills. Technological shamelessness. A high threshold for embarrassment from failure. (JE)

[...] The 'traditional' skills of listening and imagination are extremely important to me. I enjoy reading a score on a train (without the iPod accompaniment) and I find it depressing when my students' ask me what I'm doing (and why!). Learning how to code has probably been the most liberating side of my work with technology. I detest being told what to do (by anyone/thing!). Being told what to do by software and hardware is unforgivable. Coding goes some way to alleviating that situation so I probably would describe programming as

essential to the digital musician. [...] As my work explores acoustics a great deal, clearly having knowledge of the physics behind spatial movement of sound is essential too. (RG)

As with any musician, a basic love of music, an ability to be happy sitting alone for (sometimes long) periods of time, and an awareness of copyright; for the specifically digital musician, an interest in learning new musical softwares and other related digital skills. Beyond that, there are lots of useful skills, but probably none essential. (CJ)

Personally, I think knowledge of a programming language and sound physics is the most important. [...] For specific things like algorithmic composition, machine learning, signal analysis or other generative approaches I think a textual programming language suits better than graphical environments, but that's just my opinion/experience, and I acknowledge that people's minds work in different ways. (TM)

All kinds of skills, but the main one has been collaborating with other people, such as programmers and other musicians. [...] Another important skill is to jettison stereo and to work with the acoustic properties of the space you are in at the time. I'm no longer a

soloist. Now I work with other people and aim for a wider audience. I would add that awareness and gentle perseverance are also essential skills! (KM)

My transition from forty years of analog music making began in 1991 with my first piece that was recorded digitally. This was about the time that digital recording became 16bit. Up until that time 8 bit recording was not sufficient for use with my EIS as recorded delay was essential. I continued my transition when I joined the faculty at RPI in 2001. Since then I do my best to stay current with all the acceleration of changes in digital music technology. Ability to continue learning is essential. Ability to work with team members is essential. There is no way to know all that you need to know. (PO)

The ability to integrate ideas with technical skills. (RP)

Research and networking are important skills, and being relentless. Even the most knowledgeable digiticians get stuck and have to look stuff up so don't expect someone with more experience to have all the answers for you! Be a contributor of knowledge. Don't let technical problems get you down. Don't let computers intimidate you. Get comfortable with wiping your hard drive and re-installing everything from scratch. (SP)

File management and archiving is something I should be better at and really is a skill the digital musician needs. Over the years, I have created thousands of files that are now sprawled across many hard disks. I sometimes feel it is easier to create a new sound rather than try to retrieve a file I made, for example, five years ago. Also, understanding ins and outs and patching skills is essential. The binary world has no in between with regard to this. Being a digital musician is not any different for me from being a musician in general, where, for example, I would want to experiment, explore and find the 'edges' of the medium. (JR)

Technically: keeping up on current technologies, upgrades, plug-ins, processor speeds, available VSTs. Knowing how to optimise the performance of one's computer for digital audio, keeping an eye on the sort of peripherals and MIDI interfaces and whatnot that become available, and looking at tech news to think about the future of one's set-up as technology progresses.

Professionally: networking and sharing ideas with fellow digital musicians, having a local peer base, having an Internet peer base, being committed to the larger digital musician community and helping out others with talent (either by sharing knowledge or helping to connect musicians with labels or musicians with venues to perform in),

not letting one's ego get in the way, keeping in touch with people in the press who've been supportive in the past, as well as labels or promotions crews that have booked me.

Mentally: commitment, goal orientation, foresight and planning ahead, just doing things that are musically fun (like DJing privately or in a low key setting and not being constrained by a genre, or entering remix contests for the fun of it), collaborating with other musicians, having another income stream so I don't have to care if my music is commercially viable, going to music events that aren't electronic just for a change of pace. (Q)

In no particular order . . .

- creativity to work within 'constraints' of technology
- ability to use the technology creatively and push its boundaries
- flexibility
- patience(!)
- knowledge of music outside the digital domain – trying different compositional approaches, etc. (SS)

[...] we need to move beyond the vocational skill set often associated with musical training. Today, knowing the physics of acoustics and the physiology of auditory perception is more important

than knowing functional harmony. (AT)

You need a degree of talent, a good ear. I'm not a talented musician in the traditional sense: I struggle to play keyboards properly, I can only read music at a snail's pace, I never had any formal training. The important thing is that I can conceptualise how I want something to sound, based on the timbres and melodic aspects – counterpoint, etc. I can hear a multitrack going on in my mind that I just have to get out. If I can't play some things I know people who can, or I can programme it.

Open-mindedness is very important. [...] What I would encourage digital musicians in particular to do is: take a step back, do a little thought and research about what you want to achieve before you start. [...] What digital musicians have to aim for is to escape the normal, pre-set paths that are offered to us at all times. All musicians, myself included, can go for the easy option, the lazy way, and it is always on offer today, particularly in computer composition. The most valuable advice I can offer people starting out on this path is: take a step back, look at what you trying to achieve and do a bit of research. Make it hard for yourself. Limit your palette, even. Deliberately limiting yourself can enable more unique creations. (MW)

Do you have any other useful or relevant things to say about being a digital musician today?

Some of the Case Studies had nothing more to add, others made quite lengthy remarks. Space does not permit these to be reproduced in full here (they may be viewed on the website), so a pithy selection will have to suffice:

The avenues for truly experimental new music are highly centred on digital technology. However, a few of the debates and themes seem to me chimerical or unnecessary: there's nothing special about laptop music, cognitive skills have a lot in common with physical skills, and we shouldn't be too biased against either. (NC)

It doesn't matter how complicated your Max or Supercollider patch is if you have nothing to say musically. I have to confess (at the risk of never being employed in an institution focusing on digital technology again!) that I have little interest in technology per se. When the sound that is being delivered is purely a means of demonstrating the technology, we have a serious problem. (RG)

The relative ease with which anyone can create electronic music today is a great thing; however, it sometimes obscures two important issues. First, that the majority of people in the world do not have the resources (financial or other) to become digital musicians (or

digital artists of any description). Second, traditional music theory and skills can greatly help electronic musicians with their art. (CJ)

The future is very exciting. We are in the early stages of virtual synth abilities. I do quite a bit of lecturing, and one warning flag I'd raise is that the standards in universities and colleges are not generally agreed. [...] We're all under more time and financial pressure than ever before, but I would still urge people to go off-piste from time to time, and even to start with a blank canvas, no presets. (MW)

It is exciting to observe how the music industry is being transformed at the moment which creates lots of opportunities for "digital" musicians, for example where the app is replacing the mp3. The interconnected locative mobile media devices give composers and musicians fantastic possibilities for interesting musical composition. (TM)

Digital makes us appreciate analogue – not just for the specific sound qualities of certain historical instruments but for the qualities of analogue electronics as a medium of sound transmission. You can keep adding to analog, you can feel analog. Digital is not in the impossibility of acquiring these capabilities, but the digital musician must sensitise himself to this potential. (AT)

I'm asking more from technology. I set up the rules and the ingredients, and something different must happen. That's why I'm making installations. Let's replace a few of these new gyms with huge multichannelled sound systems for people to come and spin around their favourite disco, opera or swing CDs. (KM)

It is no longer possible to be concerned only with music; we live in a global world where interdisciplinary approaches are critical to artistic expression. (RP)

Being a digital musician is not just about the practical application of technology but also a way of being or thinking. (JR)

The digital musician of today has to be ready for change! (PO)

Discussion Questions

- What music do you make?
- Why do you make music?
- Is any of your sound-based work not 'music', as such?

- Do you consider yourself a performer, a composer, a technologist, an engineer, some combination of these or, indeed, something else?
- What is the cultural context for your work? Are you influenced by music in other cultures? And the other arts?
- What skills and attributes do you consider to be essential for you as a digital musician?