

Innovation In Music 2019

03 - 17 December 2019

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Welcome

Welcome to the fourth event in the 'Innovation in Music' conference series (InMusic), this year returning to London at London College of Music, a school of the University of West London. The series provides a forum for the diverse community of practice that is centred around innovation, both in music and its attendant disciplines. InMusic brings together researchers and professionals whom are interested in the future of the music industry, and allows delegates to discuss issues of common interest, exchange examples of best practice, and to disseminate the results of research.

We hope that InMusic '19 will provide an outstanding and unique opportunity for all those interested in the industry's fast-moving changes – to mix and exchange knowledge across disciplines. Participants can also achieve a peer-reviewed publication in the conference proceedings, the best of which will be converted into book chapters for a forthcoming edition with Routledge.

Thank you for coming to the event and we hope that you have an enjoyable and fruitful conference.

Prof. Rob Toulson



Russ Hepworth-Saw-



Prof. Justin Paterson



Mike Exarchos



Paul Oliver



WIFI LOGIN

Guest Username: music@uwl.ac.uk

Guest Password: lcmevent

Cafes and Bars

Here is a list of some of the cafes and bars that are outside the university if you feel like exploring.

Cafes:

Burnt Norton - Excellent Coffee and breakfast 'things', only open fri-mon.

Munsons - Excellent coffee and a nice environment to sit outside and people watch.

Cafe Zee - Great lunch salads and good breakfast, this one is a bit of a walk, but the environment is worth the travel.

Farm W5 - Excellent sandwiches to take away, and it is close to the Xanadu hotel.

Bars:

The Red Lion - A close by pub with great pizza, and a nice outdoor courtyard with a relaxed atmosphere.

The Grange - Nice atmosphere and a slightly more up market feel. This pub is a bit of a walk, but the courtyard is quite lovely. As a bonus, it is half-way to the Double Tree hotel.

The Rose and Crown - A quaint little pub that's not too far from the university. It is slightly hidden behind Saint Mary's Church and covered in flowers.



Production Keynote: Trevor Horn - “The Man Who Invented the Eighties”

As one of this generation’s most decorated producers, Trevor Horn is a true legend in the music industry. After forming The Buggles and recording the chart topping 1979 hit “Video Killed the Radio Star”, Horn went on to produce some of the most recognizable anthems that defined the Eighties, including ABC’s “Lexicon of Love”, “Owner of a Lonely Heart” by Yes, and Frankie Goes to Hollywood’s number one hits “Relax”, “Two Tribes” and “The Power of Love”.

Horn went on to produce hits for Tina Turner, Tom Jones, Barry Manilow, Cher, Boyzone, 10cc, John Legend, Lisa Stansfield, and Robbie Williams, altogether earning him 3 Brit Awards for Best British Producer, 3 Producer of the Year awards, 5 Ivor Novellos, 2 Grammy Awards for Yes’ “90215” and Seal’s “Kiss From a Rose”, and the 2014 MPG Lifetime Achievement Award.

In 2006 Horn created his supergroup The Producers, performing with fellow producers and musicians Lol Creme, Steve Lipson, and Ash Soan. In 2012, the group released their debut album “Made in Basing Street”, and continue to perform covers



***Performance Keynote:
Bruce Woolley - futurist
performer and legendary
songwriter***

Bruce Woolley is an English songwriter, composer, performer and music producer - with many artist credits, including Cher, Grace Jones, the Orb and Nicki Minaj. He is a Theremin enthusiast, and has recently researched and presented a new keynote "Video Killed the Radio Star - How the Future began" - exploring the origins of Electronic Music and the evolution of the record



***Innovation Keynote:
Matan Berkowitz
- Interdisciplinary
artist & entrepreneur***

Matan lives in the nexus of art, technology and positive impact. His award-winning inventions translate physical signals (such as brainwaves, heartbeats and movements) into music, turn everyday objects into instruments and have been displayed at museums, galleries, events and stages worldwide.

Performances:

On the evening of the 5th of December, along with a wine reception, we will be staging an incredible world-first performance from the Radio Science Orchestra plus special guests: space-age pop from the birth of radio to the atomic age and beyond – <http://www.radioscienceorchestra.com/>

VIDEO KILLED THE RADIO STAR: HOW THE FUTURE BEGAN

The Radio Science Orchestra will create a 45 minute audio-visual performance which will focus on the inception and evolution of electronic music – from its electro-mechanical origins, through to the modern digital age. The ensemble will illustrate the epoch with a collection of songs, interstitial sound design, as well as spoken and recorded references to notable luminaries – From Russolo, Cahill, Varese through Stockhausen, Theremin and Moog, to Kraftwerk and beyond.

Archive footage and bespoke films will augment this musical story, which will be narrated by Bruce Woolley.

The lineup will encompass a variety of esoteric instruments, including theremin, concert harp, Moogs, modular synthesizer and Ondes Martenot.

The band will perform together from different studio spaces around UWL, one of which will mix the audio and a multitrack feed will be sent to the auditorium using Dante/RedNet technology. They will be joined in real time by a further remote musician in Edinburgh Napier University (650km away) with a 2-way ultra-low latency connection over JANET. Using a bespoke Max patch, parts of the band's performance will be captured 'on the fly' – processed, and mixed back into the stage sound. Matan Berkowitz will be present in the auditorium and will add synthetic layers, improvising using his self-designed gestural controllers, the 'Airstument'. All of these performances will be spatialized into a 3-D 7.1.7 stage mix using VBAP, and supported by VJ-ed video coverage of all the action.



Modular Synthesizer demonstration by Nino Auricchio

Modular synthesizers present a new, or perhaps rediscovered, paradigm in music creation. This workshop will look to explore different approaches to music making using modular synthesizers. Module types and signal behaviour will be explored along with how the functionality of modules can be altered and expanded dramatically through creative networking of control voltage and manual control.



Technical demonstrations

We are setting up a number of hands-on technical demonstration sessions and installations, including:

- Electroglottography-based vocal-chord to MIDI conversion
- Ambisonic guitar system
- 'Music for Goldfish' - an aleatoric drone installation
- Electroglottography-based Real-time Voice-to-MIDI Controller
- IKO Speaker System Demonstration
- The Floating Sound Lab
- Modular Synthesizers and Performance Practice Demonstration
- Mixed Reality Applications for Musical Performance
- Immersive Audio in Narrative Space Demonstration
- Haptic feedback in Music Production

For more information on rooms and session times, please consult the grey area on the timetable.

Book Launches

Dr Paula Wolfe will be launching her book: 'Women in the Studio'

The field of popular music production is overwhelmingly male dominated. Here, Paula Wolfe discusses gendered notions of creativity and examines the significant under-representation of women in studio production. Wolfe brings an invaluable perspective as both a working artist-producer and as a scholar, thereby offering a new body of research based on interviews and first-hand observation. Wolfe demonstrates that patriarchal frameworks continue to form the backbone of the music industry establishment but that women's work in the creation and control of sound presents a potent challenge to gender stereotyping, marginalisation and containment of women's achievements that is still in evidence in music marketing practices and media representation in the digital era.

Dr Phil Harding will be launching his new book: 'Pop Music Production - Manufactured Pop and BoyBands of the 1990s'.

Pop Music Production delves into academic depths around the culture, the business, the songwriting, and most importantly, the pop music production process. Phil Harding balances autobiographical discussion of events and relationships with academic analysis to offer poignant points on the value of pure popular music, particularly in relation to BoyBands and how creative pop production and songwriting teams function.

Included here are practical resources, such as recording studio equipment lists, producer business deal examples and a 12-step mixing technique, where Harding expands upon previously released material to explain how 'Stay Another Day' by East 17 changed his approach to mixing forever. However, it is important to note that Harding almost downplays his involvement in his career. At no point is he center stage; he humbly discusses his position within the greater scheme of events. Pop Music Production offers cutting-edge analysis of a genre rarely afforded academic attention.

This book is aimed at lecturers and students in the subject fields of Music Production, Audio Engineering, Music Technology, Popular Songwriting Studies and Popular Music Culture. It is suitable for all levels of study from FE students through to PhD researchers. Pop Music Production is also designed as a follow-up to Harding's first book PWL from the Factory Floor (2010, Cherry Red Books), a memoir of his time working with 1980s pop production and songwriting powerhouse, Stock Aitken Waterman, at PWL Studios.

C2IMP Workshop - Publishing Practice-Research Effectively

10:00 – 13:00 on Sunday 8th December 2019 at the University of West London

As a separate and complementary ‘add-on’ to the InMusic conference, the London College of Music, UWL is hosting a workshop by the 21st Century Music Practice (C2IMP) research network on preparing Practice Research outputs for publication and dissemination. After consultation with the Practice Research in the Arts Group (PRAG-UK), the Royal Musical Association’s practice research group and the International Association for the Study of Popular Music’s UK & Ireland group, we have developed a proposed approach that involves the separate publication (on the C2IMP website) of supporting and contextualising materials to highlight and strengthen the ‘research-ness’ of practice research outputs. Attendance will be free to anyone (attending the InMusic conference or otherwise) but will be limited by the space we are able to book. Booking will open closer to the time.

The workshop will be chaired by Professor Simon Zagorski-Thomas and will work through examples of Practice Research portfolio publication and encourage participants to share details of their own good practice in this area. Further details will be found closer to the time on the <http://www.c2imp.org/events> page.

ABSTRACTS

Richard Lightman, United Kingdom, University of Kent

Contextual and Cultural Mediation in the Recording Studio - Two producers, two artists, two cultures.

The relationship between the Producer and Artist in the recording studio has been well documented, but when two distinct cultures merge to try to collaborate and both parties are not only producers but also the artists, the dynamics and relational roles from a technological, musical, hierarchical and cultural perspective become fluid. Within this scenario the boundaries that define the roles of engineers, producers and artists are amplified, questioned and redefined at almost every juncture. The subtexts of culturally diverse difference and technological prowess, create unspoken power struggles between the protagonists, diametrically opposed to the express intent to collaborate.

This paper explores the intercultural mediation between two established producers, Kuljit Bhamra MBE and Richard Lightman who have embarked on a project to fuse two genres, Bhangra and Country, into a new musical exploration; Country and Eastern. The differing approaches to production, recording and mixing, highlight the constant interactive mediation that was employed throughout the process. Territorial claims on studio space and embedding styles in the unspoken struggle for genre dominance within the production process is explored, along with the relational attitudes and interaction between the two producers on a musical level and then again on a technical level. The mediation techniques that have been used in recording studios in the past were employed by both parties fully understanding the implications of those processes. As a consequence, through familiarity, this negated the tried and tested techniques and created an environment that encouraged the development of new methods of collaboration. Although still drawing upon past experience and procedural norms, this required a delicacy of approach to maintain the integrity of the output and the producers themselves.

Richard Lightman is a producer, composer, sound designer and lecturer at the University of Kent. He is the former CEO of the Music Producers Guild and currently sits on the Copyright Committee of UK Music (the umbrella organisation of the Music Industry) and is a council member of the Council of Music Makers (CMM) who represent the creators in the Music Industry.

Oblique StrateTRIZ: Sparking Compositional Breakthrough

The Brian Eno, Peter Schmidt created 'Oblique Strategies' cards were famously used by David Bowie during what is generally held to be one of his most creative periods, the making of the 'Berlin Trilogy' albums in the late-1970s. By all accounts, the idea-triggering cards were used to assist Bowie during the writing of the lyrics, rather than the composition of the music. This was likely because the content of the cards made them easier to connect to words rather than musical notes or structure.

At around the same time Low was being recorded, the West was beginning to become aware of a pioneering piece of creativity research, TRIZ, coming from the Soviet Union. Since 1946, a Soviet research team had been tasked with reverse-engineering hundreds of thousands of technical inventions in order to unravel the 'DNA' underpinning success.

It wasn't until the first decade of this Century that it began to become apparent that the findings of TRIZ were also applicable in music. An ongoing research programme to decode why listeners enjoyed some pieces of music over others demonstrated that the underpinning DNA of emotional excitors in music is precisely the same as that of all technical solutions. And, for that matter, all breakthrough solutions in other walks of life, from literature to business, architecture to app design.

One might expect that knowledge of this 'DNA' would have spread to creators in all of these domains, but so far it largely has not. One of the cited reasons is that said DNA is presented in a dry and mechanistic manner, and as such – unlike Oblique Strategies – does not emotionally engage users.

Oblique StrateTRIZ, then, seeks to achieve the best of all worlds. It offers users a deck of breakthrough-sparking cards combining the DNA of TRIZ, the emotional engagement capabilities of Oblique Strategies, and, for the first time, the language and symbology of musical composition.

The Online Composer-Audience Collaboration

There is a substantial amount of research on the creative process of the composer, and there has been an increasing interest in detailing the relationship between composer and performer. Yet, there is little research about the dynamics between the composer and listener, a subject which merits consideration. Thanks to the internet and online video-sharing platforms, composers can directly interact with their listeners and fans. This paper will focus specifically on Jacob Collier and Andrew Huang, two artists who make use of these online resources to collaborate with their audience by requesting compositional material from them.

The interactions between composer and audience have never been as rich and honest as they can be with the internet. Also unprecedented is the ability to connect with millions of people from the comfort of your home. Online platforms for video sharing are becoming critical tools that can strengthen both the creative process of composers and the appreciation on behalf of the audiences.

This crowd-sourced music is not a new phenomenon, but due to the popularity of these musicians it is now a recurrent dynamic online. Huang, a Toronto-based musician and YouTube personality, is known for his “Fan Mash” series, where he produces a song by processing fan-submitted short videos of random sounds. Collier, a Grammy-winning multi-instrumentalist based in London, England, became widely popular by producing complex reharmonizations from fan-submitted melodies and livestreaming the arranging process for his listeners.

These two young artists have in common a platform for interacting and submitting content; they both share their compositional process as a video and are able to receive audience feedback before, during, and after the creative process. The result gives the audience a sense of participation and identity, ultimately leading to a stronger community. This paper provides a detailed description of their corresponding approaches to audience collaboration, both as a livestream and as a produced video. In addition, it identifies eight categories of discourse with their audience by analyzing two specific YouTube videos and reviewing user commentary.

Andrew Huang and Jacob Collier are two musicians that embrace video platforms like YouTube as a new kind of stage to showcase their work and connect directly with their listeners and viewers. These two artists have different but equally valid approaches to engaging and collaborating with them. In this ever-evolving music-making landscape, I believe their methods are worthy of analysis and consideration for other creators to connect in deeper ways with their audience.

Stephen Partridge, United Kingdom, KAVE Immersive Ltd

Immersive social experiences for large audiences

KAVE is an immersive venue, presenting six-surface projection and 9.1 surround audio. Large audiences experience 360° images that fill every inch of each surface, embellished by directional sound.

Having been early adopters of VR technologies to create live music-based immersive experiences (under the guise of precursor SpacerocketLIVE.com), our team seeks to respond to some of the key challenges that recur as themes in discourse surrounding VR. VR headsets isolate the user (note slump in headset sales this year), leading to discomfort both physically and psychologically. How might this be overcome. And while VR technologies are fascinating and innovations have managed to secure considerable investment, what does a viable business model look like in this field?

KAVE creates, curates and commissions the most compelling immersive content. Our venue can accommodate multiple art forms and content possibilities including live music performance, pre-recorded music (including club nights), 360° films, agency launches/activations, gaming conventions, theatre, dance, and projection-based art.

The KAVE production team has undertaken four years of R&D to hone best practice in the capture and presentation of performance-based 360° video with 9.1 surround audio.

Collaborations with partners including BBC Introducing, Sennheiser and SoulandJazz.com have encompassed more than 60 productions working with an array of talent; from Grammy award winning artists to the brightest newcomers.

KAVE's mobile production unit has captured performances throughout the UK and overseas, at YouTube Space in New York, and last Summer at The San Jose Jazz Festival, via sponsorship from British Airways.

The anonymous construction of a star in the case of pop singer Sia

The anonymous construction of a star in the case of pop singer Sia

This study analyses the innovation in music creation and performance in case of pop singer Sia, who manages to be famous without showing her face. Since 2014 her staged anonymity became, spoken with Philip Auslander, her “musical personae”. This study examines the plural of the word persona – many realizations of constructing the non-present self – using Judith Butlers Theory of Performative Identity Construction (without the focus on gender). Firstly, the strategy of creating the music video will be analyzed, secondly her identity construction in the live performance. While in her first anonymous music video, “Chandelier” from 2014, the dancer Maddie Ziegler became a substitute for Sia herself, the item of a wig became a medium of identification in general. Sia covers up her face with a wig, that has a significant haircut and hair color. Every other protagonist who is linked to Sia is wearing the same wig, which is a storytelling strategy, to show who is affiliated with whom.

In her music videos, Sia’s face is covered in black, in the live performance she sings with her back to the audience or her hair covers up half of her face. But how does this innovation of staged anonymity work? How is authenticity verified? The phenomenon brings the strategy of street artist Banksy to mind. In her Lyric Video “Alive” from 2015 this connection is clearly visualized. The sprayers wearing the wig that signifies Sia with a face covered in black and are spraying the song lyrics on the walls in a typical Banksy stencil style. A closer examination of that video is going to discuss the relationship of pop and the illegal spray act. The Lyric Video is another innovation in video production. Formerly, the upload of music videos on YouTube was illegal in some countries because the release rights were controlled by institutions. Fans created their own videos where the audio file was cut together with a video displaying lyrics in a karaoke style. Now that the music industry changed, artists primarily profit from the music videos on YouTube. Sia expands her possibilities of reception by creating Lyric Videos to tell another story, next to the original music video. Both videos have an equal high production level and in the case of her song “Cheap Thrills” the lyric video from 2016 reached more than a billion viewers. This study discusses the complex act of authenticity as a performative act in the sense of Austins Theory, concerning Sia’s accent, her significant voice crack and the role of the interview situation, where other celebrities verify her identity.

A review of contemporary practices incorporating digital technologies with live classical music

In live classical music events, emerging digital technologies have been primarily employed in social media, digital marketing and online ticket sales, but they have scarcely been used in connection with visual and sonic experiences during live performances (Steijn, 2014). This paper presents an overview of how classical orchestras have embraced digital technologies in the last decade in order to develop and enhance live performances, and discusses the reasons behind their limited use, in comparison to other music genres.

The presented research identifies and groups different modes of incorporating emerging digital technologies with live classical music, including analysis of: experimentations with electronic music and the performance of hybrid electronic-classical compositions; the use of video screens and 3D projections in combination with a live orchestral performance; use of mobile technologies to assist or enhance live classical music; experimentations by live classical music producers with augmented reality (AR) and virtual reality (VR) technologies; and the implementation of artificial intelligence (AI) technologies in live classical music.

Setting a context for the paper is the historical perspective on the first collaborations between classical and electronic music in the 1950s, with the discussion subsequently diverting to more recent projects involving orchestras and techno DJs. This is followed by analysis of movie screenings in concert, architectural video installations and holograms that are used to enhance the audience experience at a live classical music event. The research then discusses specific case studies with respect to mobile technologies, AR and VR, and the use of AI.

The purpose of this research is to classify and cover a wide range of options to illustrate the diversity of digital technologies used by classical orchestras to enhance a live concert performance. Digital technologies used in live performances of parallel music genres, including rock, pop and electronic music will be used to identify future directions and opportunities for live classical music performance, and equally to evaluate live music technologies that are showcased best in the classical realm.

Modular synthesisers and performance practice

Modular synthesisers present a new, or perhaps rediscovered, paradigm in musical performance. Visually there is often a minimum level of observable physical gesture in the use of modular synthesisers, which breaks the traditional paradigm of exertion in musical performance. This broadening of performance practice affords more abstract concepts in musical instrument performance where a physical input gesture from the performer may not produce a corresponding sonic output of a similar dimension. The primary cause for this disruption to the traditional musical paradigm of exertion in performance is the interface and operation of the modular synthesiser. Modular synthesisers are systems where individual modules have specific functionality yet require the performer to connect and manipulate those modules to produce an output. Contemporary modular synthesisers have significant agency in that they only allow for partial control and manipulation by the performer, who must work in sympathy with the technology to arrive as a mutual sonic realisation, where both audience and artist are mindful of the direct influence of the technology itself.

This paper will look to discuss several areas relating to this new paradigm. How important is the apparent complexity of gesture and intensity of physical movement to the audience the performer themselves and other performers in an ensemble? To what extent do modular synthesiser afford the ability to perform in a 'live' manner and what are the factors that dictate how that performance may be interpreted by the audience? Does the apparent disconnect between perceived gesture and corresponding output assist to solidify the abstract nature of the music with the observed performance? Marc Leman in his 2008 book on Embodied Music Cognition and Mediation Technology discusses how musicians performing with synthesisers feel that the "technology stands between what they want and what they get." Is this in fact the case and does the inherent abstraction and enigmaticism of performing with modular synthesisers create the effect desired? Is it in fact the case that the artist is the mediator for the modules within the system? Is the performer a 'ring master' of a kind of 'sonic circus', where the modular synthesiser can be described as having personality?

The Floating Sound Lab: A New Hybrid Immersive Audio Studio

What should be the performance goals of a new immersive studio? This was the question we asked ourselves as we planned the “Floating Sound Lab” a new facility in Shanghai, China. The Lab is a cooperation between Tongji University Department of the Humanities and Yee Sound, a company that focuses on immersive audio for unique applications including special venues, museums, art installations, and business events. The University wanted a space that could be used for research into auditory perception and creation of audio art pieces. Yee Sound wanted a production space that could be used in a flexible manner so that content could be created that allowed for different recording and mixing techniques that did not require a single delivery method or an expected speaker arrangement. Together Tongji and Yee Sound constructed a system with 60 identical main speakers and four subwoofers was designed with a variety of workstations, renderers, custom applications, and production tools. The Lab is equipped to create and reproduce in Ambisonics, Wave Field Synthesis, Vector Based Amplitude Panning, channel or object based, using immersive audio tools from Pro Tools, Nuendo, Reaper, Barco-IOSONO, IEM, DTS, Dolby, G’Audio, Auro-3D. Attention had to be focused on goals that would allow a useful number of participants to be within the listening area of the Lab for content production or for lectures that that the University would conduct. At the same time, a speaker arrangement was desired that would be uniform so that stimulus could be generated from any direction with consistent quality. Evaluation of general interoperability of the various subsystems to be used in the room within the common performance capacity of each method was undertaken so that minimal effort would be necessary to switch from one technique to another.

The presentation will cover the goals used to determine the Lab design, the compromises that had to be factored in for reality’s sake, examine the commissioning of the room and the first projects undertaken in the Lab. Examples of the first projects will be available for playback in a facility provided by the venue.

Adrian York, United Kingdom, University of Westminster

Transforming musical performance: the audience as digital collaborators

Digital technologies have transformed the performance practice, recording and distribution tools, economy and sonic landscape of music in a process of change that began in the early 1980s. Recent developments in control surfaces, motion tracking electronics, wearable technology and hand-held controllers have opened up the possibility of audiences as well as performers interacting with music in ways hitherto impossible. In this new world sound events can be triggered or manipulated through mapped movement, by means of proximity, via phone apps or gaming controllers to create a more immersive experience for the audience through a creative engagement with the music.

This paper will reflect my latest research findings as I explore re-engineering music performance within contemporary jazz as a collaborative improvisatory space.

The presented research explores a significantly more engaged and transformative role for the audience than is currently achieved in contemporary performance.

The composition *Deeper Love* was composed specifically for this research as a

creative vehicle to implement the findings that emerged out of the performances of *The Singularity* and to provide a way to integrate Interactive Musical Participation

into my artistic practice as a jazz musician. Two novel elements were developed for the performances of *Deeper Love*, the first being the creation of the *Deeper Love Soundpad App* (in collaboration with Dr Rob Toulson - available from the Apple

App Store at <https://apps.apple.com/us/app/deeper-love-soundpad/id1441139504>).

The second novel element in the *Deeper Love* performance is the development of sampled improvised lines for the *Deeper Love* audience-soloists using the Wii mote controllers. The melodic structure of these samples is constructed using the modal harmonic and improvisational methodologies of contemporary jazz.

This process of Interactive Musical Performance turns the audience members from being passive receivers of information into audience-performers able to engage in sonic dialogue with each other and with the other performers. This process will be demonstrated within the presentation.

Matthew Evans, United Kingdom, Royal Birmingham Conservatoire

Hearing and Feeling Memories: Exploring Pixel Data Sonification and Haptic Feedback to Create a Multisensory Experience of Photographs

This paper discusses how converting an image into sound can be utilised to generate an auditory and tactile relationship with photographs, a medium which ordinarily affects a singular sense.

Photography is a powerful tool for allowing one to preserve and capture a moment in time. However, the medium can become limited in the way one can perceive it sensorially. By utilising the data of a photograph by the way of pixels, a photograph can be heard via the process of sonification. Sonification is the process of mapping data to sound signals. By sonifying a visual stimulus an image ceases to be singularly visual. By making an image both visual and auditory, the accessibility and experience of that image changes drastically.

The pixel data sonification system presented translates average RGB colour values into data which are converted into synthesised sounds or used to trigger samples. A scan of a static digital image can be ran using the system, or to allow for greater individual exploration in a performative or installation setting, an external webcam can be held and moved to collate the pixel data from a printed image.

In the process of converting an image into sound technologies such as a SUBPAC, a tactile audio vest that was initially created to allow music producers to be able to feel the bass frequency spectrum of the music they are making, can be integrated into the sonification process to allow for the greater amplification of the tangible qualities of sound. In doing so a photograph could be both heard and felt. By utilising the process of pixel data sonification, said data could be used to trigger sounds or to generate a composition.

A photograph can hold particularly poignant emotional value for preserving memories for those who are no longer alive and via the system described, multiple mediums can be generated from an image. In order to generate a clear correlation between subject and sound, the pixel data can be used to trigger sounds that a person feels are particularly reminiscent of the subject. Further exploitation of the qualities generated through the processes described could allow for an integrated multisensory experience of a photograph and in doing so, a photograph could become a way of hearing and feeling a person once more.

Erica Smith, Barbados, Intellect Management Services Incorporated

The Impact of Organisation Governance on the Achievement of Organisational Goals: The Case of the Collective Management Organisations

Driven primarily by technological, legislative and regulatory changes, all facets of the global music industries have been rapidly evolving in the past two decades. As a result, most of the prevailing business models including those of the collective management organisations (CMOs) have been transforming. The rationale of the CMO is that it provides transactional efficiency by facilitating the legal access to musical works and sound recordings to, for example, digital service providers (DSPs) and broadcasters while at the same time ensuring that the holders of the rights in music (songwriters, publishers, performers producers of recordings) are compensated. Given the sheer volume of music being used especially with the establishment of new exploitation models online, the CMO plays a critical intermediary role. In response to the demands of the changing environment, these organisations have been transforming their operations as a result of the need to achieve continued and higher levels of efficiency. In spite of the flurry of efforts to develop alternatives to the CMO and the excitement for the potential use of blockchain technology as a possible alternative or addition to collective management, it is nonetheless expected that collective management will continue to occupy a pivotal position.

This paper will deconstruct the structure and operations of CMOs in small and emerging music markets, particularly in the Caribbean with specific reference to the governance of these organisations. This is against a backdrop where the CMO is positioned as one of the few functioning music industry institutions in the region. The argument presented is that in an environment characterised by weak structures and very few record companies, music publishers, distributors, music unions or other industry organisations, the demands on the CMO are greater than in other more developed territories. Consequently, the conception of the CMO is in practice more broadly understood in this environment. The analysis specifically considers the impact of operational structure on the functioning of CMOs from the perspective of both corporate and not-for-profit governance theories. Recommendations are made for the re-fashioning of these organisations in emerging markets based the application of theory for a more effective response to the changing environment.

Erica K. Smith is a PhD candidate in the Department for Popular Music at the University of Adger, Norway where her research focuses on the CMO in emerging markets. She is also the CEO of the Barbados CMO, the Copyright Society of Composers, Authors and Publishers Incorporated and a creative industries consultant.

Joe Wright, United Kingdom, Integra Lab, Royal Birmingham Conservatoire

Concepts and Issues for the Design of Accessible Music Technology

This paper discusses strategies and issues for inclusion in music, and their application to research, education and the arts. Following on from his presentation at Innovation In Music 2017, Wright reflects on the findings of his PhD research – which explored the collaborative design of exploratory sonic-play instruments with non-verbal young people on the autistic spectrum – and discusses how this knowledge applies to his current and future work.

Design is a persuasive act, and this is evident in currently available accessible instruments. There is, however, a pressing need for artistic resources that enable young people's authentic voices to be heard, regardless of their abilities or ways of being. The second-generation prototypes made for Wright's research represent his attempt to mitigate his own biases as a musician and technologist, and meaningfully include the responses of the young people involved in the project. Four areas of concern are discussed, arising from the making and evaluation of these instruments: the openness of an instrument to a diversity of playing styles; the nature and effects of constraints; sensory coherence, concerning the direction and location of sensory feedback; and accessible choices.

These concepts can be applied beyond the design of artistically-niche musical instruments. Examples are taken from Wright's collaborative work, outlining the development of the inclusive theatre piece, Sound Symphony, and the broader application of design concepts to educational instruments for Leicestershire Music Education Hub. Finally, the paper concludes with a discussion of open questions and issues related to inclusive musical design, the ways in which technology might empower young people to find an artistic voice, and how young disabled people can be included more in the design of new technology for the arts.

Alenka Barber-Kersovan & Volker Kirchberg, Germany, ISKO Lephana University Lüneburg

Chamber Orchestras as the Innovation Motor of Classical Music in Germany

In Germany, where the widespread orchestral scene has been included into the national UNESCO list of immaterial cultural heritage, the last couple of decades the (political) discourse on classical music was dominated by its feared disappearance. This assumption was partially backed also by scientific research, pointing out to the aging of the public and the decline in the sales of sound carries. As further evidences for the presumed crisis of this musical genre the growing competition, increased production cost and decreased (state) subsidies were notified, which forced several musical bodies to merge or even dissolve.

However, as a closer look on the current orchestral practice shows, the dramatic transformation process in the field of classical music is accompanied by innovative practices that contradict the pessimistic views on the future of the orchestra as a musical institution. The crucial impulses for the revitalisation of this musical scene seem to come from (free) chamber orchestras, which already since the 1920ties build a counterpoint to the massive orchestral sound of composers like Wagner, Mahler or Richard Strauß. As a rule, they are not temporary off springs of established symphony orchestras but form themselves as musical bodies of their own right and specialise predominantly in two main musical fields: historical performance practice and “modern” music, under which the art music from the 20th and 21th century is understood.

Though already the internationally renowned chamber ensembles of the 1980ies and 1990ties such as Ensemble Modern or Concerti Köln modified the traditional concert culture according to their needs, the common enumerator of the new generation of chamber formations, which came up during the last two decades, seems to be the radical implementation of innovative strategies on all levels of the musical, performative and organisational practice. Their striving after musical distinction, the experimental approach towards the musical matter, enthusiasm and joyful playing appeal also to a younger generation of listeners, who were not concert goers before.

Based on ethnographic observations, interviews and document studies in the talk proposed the latest trends and innovative developments in the German chamber music scene will be sketched on the example of five prominent chamber orchestras from Northern Germany (Bremer Kammerphilharmonie, Ensemble Resonanz, Ensemble Reflektor, Stegreif Orchester and Orchester im Treppenhaus). Our interpretation offer will consider the following points:

- Preference for flexible legal frameworks
- Democratic internal organizational culture
- Independence, self-government and collective responsibility
- Blurring boundaries between musical genres
- New concert formats and performative practices
- Digitalisation and multi-media projects (Live-Electronic, Dance, Theatre, Film, Literature)
- Audience participation versus audience development and music education
- New audiences and new forms of musical experiences
- New locations and informal performance contexts

Atharva Kasar, United States, Acton-Boxborough Regional High School

Analyzing the Effect of a Percussive Backbeat on Alpha, Beta, Theta, and Delta Binaural Beats

Binaural beats to stimulate brainwave entrainment are generally absent of percussion, relying on the beat frequency to generate pulsing for entrainment. This paper analyzes the effect of adding a percussive backbeat to a binaural beat on brainwave entrainment. Alpha (10 Hz), beta (20 Hz), theta (5 Hz), and delta (3 Hz) binaural beats were created. These beats were duplicated, and appropriately pitched percussion was added to one set of the beats using LTAS analysis. For the preliminary phase, these beats were analyzed through computer simulation, taking into account harmonic and timbre frequency variations, occurrences of pulses, brain rate calculations, and tempo-to-entrainment values, among other factors, to determine frequency following response rates. Through ANOVA analysis, the simulation suggests that specific frequency variations combined with other specific amplitudes, pulse values, and pitches of percussion, specified in detail in the paper, improve frequency following response and intensify brain rate values, therefore stimulating memory and focus-related brain activity, by around 4%. Overall, however, there is still a 15% deterrence of percussion-based binaural beats. The next phase of this research will involve electroencephalography (EEG) and galvanic skin response (GSR) analysis on human subjects. These specifically pitched rhythm-based binaural beats have many implications such as creating a more accessible listening experience for all listeners, especially those with autism and ADHD, as well as increasing the efficiency of binaural beats on memory and brain power for music and auditory therapy.

BTS' "Speak Yourself" World Tour as an intermedial spectacle of attachment: Outcomes and future possibilities for popular music

Named by Time Magazine the "next generation leaders," the Korean group BTS managed to change the perception of K-Pop among the mass media and to influence its depiction as a global lifestyle phenomenon. Altering the marketing strategies developed by the Korean bands in earlier years, BTS's success, however, needs to be localized in the sphere of the unique communication schemes, as well as in the reception and interpretation patterns on the side of the recipients. No other expressive situation offers a better glance into this growing identification of fanbase with both the musical message and the biographies of the group members than a live concert, in case of BTS transformed into multisensory intermedial experience.

It is namely precisely the live show which to the most significant degree unites the group with the audience and, due to the variety of diverse media technologies applied in the proximity of the venue (virtual reality, phone app, mobile phone game...), helps it to stabilize and legitimize the already incorporated image of the band. Seen as an escalation of all means of expression signalized before, a k-pop show in the digital age may be described as a medium of perfect and total recipient-engagement into the structures of the event which, serving as a compass of judgement on quality and attachment matters, dictates the discourse of further genre's existence in fan-created space.

The article relies on the analysis of the shows BTS played during their "Speak Yourself" world tour, with emphasis on the two Parisian concerts on June 7th and 8th. Through the theories from the field of media studies, the text then discusses and explains the performative success of the group's innovative stage presence and searches for an answer for that gradual stabilization of the fan-attachment in a wide range of intermedial solutions. These, applied and repeatedly aestheticized in the span of BTS' career, experience their final accumulation and emotional manifestation during the live show.

Following the crystallization of k-pop's intermedial qualities, the text, analyzing each instance of the group's presence, searches for possibilities of utilizing these diverse audio-visual technological strategies of k-pop in other modern music genres. Thus, the study's aim is to, on the one hand, deliver an in-depth medial analysis of the mechanisms responsible for the immense success of BTS and other k-pop groups in non-Asian countries, as well as, on the other, to consider the uniqueness of their performative tactics by questioning their possible application on different audio-visual milieus.

Such double perspective allows an interdisciplinary glance into this pop cultural phenomenon, looking for the roots of its impact not on the side of the sender and the music industry, but rather in the specifics of media channels used for said communication, as well as in the impression such carefully balanced on various platforms message leaves on the audience, attaching the fans stronger and stronger to the niche of the image the group builds for itself and wishes to preserve in the heterotopic reality of stage.

Agata Kubiak, United Kingdom, University of West London

New Instrument as Creativity Trigger in Composer-Performer Collaboration

The New Instrument Approach is not a very common type of composer-performer collaboration, but despite its rare occurrence, it has potential to make major contributions to the entire domain of contemporary classical music (Czikszenmihalyi, 1996). Historically the development of new instruments together with the improvement and non-standard use of already existing instruments has been a powerful inspiration for many composers. For example the evolution of brass instruments was undoubtedly one of the main factors behind the changing sounds of orchestral music between Baroque and late Romanticism. Other examples include the development of a grand piano, saxophone and ondes martenot among others. Looking at more current examples, Christopher Redgate's oboe as well as Neil Heyde's collaboration with such composers as Fernyhough and Fitch fall under the same category. The role of STEIM (Amsterdam based centre for research and development of new instruments) is also not to be missed when discussing current development in the New Instrument Approach. In this type of collaboration it is necessary for the composer to be present from the very first rehearsal. The music often uses a combination of traditional and innovative notation. Despite the score being mostly completed before the first rehearsal, it is prone to minor-to-severe modifications. The key element of the collaborative practice is the discovery of the 'new instrument', with all its opportunities and the boundaries it has to respect (Redgate, 2017). A lack of historical reference may cause the first draft of a piece to represent either a 'too safe' or 'too risky' approach, therefore establishing possible new solutions on the new instrument, which stimulates inventiveness through creative problem solving. In this paper I will examine in detail the process of the New Instrument Approach using the Kubiak/Szafranski collaboration on 'Six Spiders for electric violin/voice, electric guitar and electronic drone' as an example. Carefully documenting the process of rehearsals of the piece gives us insight on how creative authorship is distributed. I will also look into how the interaction with the new instrument that is 'electric violin/voice' acted as a catalyst and trigger to many of the creative moments identified throughout this year long collaboration. 'Creative moments' are identified by careful thematic analysis of rehearsal transcriptions as well as the analysis of modifications to the score that were progressively introduced.

“My avatar and me”: Technology-enhanced mirror in monitoring music performance practice

Music performance analysis is traditionally based on phenomenological approaches, which aim to accurately describe the artistic process, practice and production (Dogantan-Dack 2015; Borgdorff, 2012; Coessens et al., 2009). An engagement with this kind of “reflective practice method” (Schön, 1983) implies that musicians document and evaluate the different stages of their artistic process commonly by written or oral narrative self-description (Chaffin & Imreh, 2001; Bruner, 1986). An alternative option to this traditional self-questioning data collection comes from the current state-of-the-art technology (Fabian et al. 2014). Examples are the video and audio recordings apt to reproduce a performance and to preserve knowledge as multimedia archives. However, the audio and visual data are also subjected to a final evaluation by the musicians themselves and, therefore, they cannot represent a real added value able to support or complement the validity, credibility and reliability of the artistic interpretations. Nowadays, the high technology used in the empirical studies provides sophisticated software that can process detailed real-time visual and audio knowledge of performance and multimodal knowledge of results (Repp & Keller, 2010; Davidson, 2007; Leman, 2007; Wanderley, et al., 2005). This technology is not only capable of reproducing a performance but also of generating data concerning movement and sound, for instance. The Motion Capture System is an example of a digital recording able to duplicate in an augmented reality the body of the performer and to capture data mapped on a digital model in 3D software, which tracks the parameters concerning gestures (displacement, velocity, acceleration, quantity of motion).

What can these quantitative data say more to musician-researches?
How can this empirical approach be implemented in music performance practice?
Why could a mixed methodology contribute to the development of music performance practice?

This study explored how the application of an empirical approach is useful to a pianist in the self-evaluation of her performance practice. The methodology turned out to be a combination of a qualitative and a quantitative approach by connecting objective results and artistic findings. The idea was to apply technology as an “augmented mirror” (Caruso et al., 2016). Supported by the motion capture technology, the pianist worked on her performance practice by observing her “avatar” reproduced by the system and by analysing the quantitative data of her gestures in relation to her artistic expectations.

This interdisciplinary approach aims to gain a better understanding of the complex and tacit relations between gestures, sound and musical interpretation during the artistic process. On the one hand, this study helps the pianist to refine her piano performance in relation to her gesture. On the other hand, this study offers TO other performers a way to develop their awareness and critical appraisal in evaluating their own performance practice. This pioneering first model to structure music performance analysis is a step towards the achievement of a well-developed and cutting-edge method based on the application of the “technology-enhanced mirror”.

Zachary Diaz, United Kingdom, University of Bristol

“Dilla Says Go:” Innovations in Digital Sampling Techniques in J Dilla’s Donuts and Hip-Hop Production in the “Post-Dilla” Era

The late James DeWitt Yancey, known by his producer name of Jay Dee or J Dilla, is considered by many hip-hop scholars and musicians to be one of the most influential producers of the genre. His techniques of sampling are some of the most creative and intricate in the world of hip-hop beat making and are viewed as virtuosic in their own right. By analyzing his compositional process through selected tracks on his seminal (and final) album *Donuts*, I will be exploring how Dilla used over seventy-five samples from a variety of music genres and artists to create a sonic collage that is one of the most influential instrumental works of hip-hop production. By looking at the overall structure of the album, as well as the specific sampling techniques implemented by Dilla on the tracks “Workinonit”, “Time: Donut of the Heart”, and “Don’t Cry”, I aim to highlight the complexities and nuances involved in transforming the original sampled audio into what Michail Exarchos (Stereo Mike) refers to as “sample magic”. Based on this analysis, I also aim to discuss the influences these techniques had on current hip-hop production, as well as how the culture of beat making shifted after Dilla’s death in 2006. From a plethora of experimental beat makers from the Los Angeles beat scene to the countless producers posting “lo-fi” instrumental hip-hop beats on several online spaces, I will be further discussing Dilla’s influence in these spaces (and beyond) and how his specific sampling techniques and sonic aesthetics from *Donuts* have shaped the current sound and culture of hip-hop production and beat making, looking at specific tracks by current hip-hop producers such as 9th Wonder and Flying Lotus, as well as highlight the plethora of discussions occurring in several online spaces. Finally, I will be discussing the current trend of hardware sampling equipment, such as the Akai Professional MPC and Roland SP-404, on “lo-fi” beat making and hip-hop, and how Dilla’s lo-fi aesthetic influenced this current trend.

Carsten Wernicke, Germany, Leuphana University Luneburg

Musical Interface Designs: Materiality, Agency and Potentials of MusickingThings in Artistic-creative Practices

As part of performative settings and the resulting human-machine interactions, hybrid, digital-material MusickingThings (Ismaiel-Wendt 2016) such as ROLI products, Linnstrument, Eigenharps, Novation Circuit, and others have a specific medial configuration. In their capacity as programmed and programming interfaces (Hardler & Haupt 2016, Dieter 2015), they mediate between culturally sedimented practices of design that are laid out in the respective state of written culture (by code and software) and a physicality (by physical hardware) that can be derived as a hybrid concept from apparatus and human being (Großmann 2013, p. 299). The digital constitution of these processes turns subjects into users and devices into “things” (Ehn 2013): This therefore demands not only affordance (Norman 2013), but also “compliance” (Butler 2001, p. 22). Besides that, informatic processes like social processes are always present, but they unfold their effectiveness on an indexical and symbolic level as well. The materialities, above all the modes of substances, of things are therefore not contingent, but constitutive for the role of things within the thing arrangements embedding them (Eisewicht 2016). The surface of the thing, as the first interface layer, is also constitutive for the ‘why’ and ‘how’ of the use of MTs within a performative setting. Thus, it is not only the effects that emanate from the interface, but also the (im)materialities of the interface layers that must be considered.

This creates opportunities to answer questions about the fundamental transformation of self and world relations through post-digital materialities with empirical approaches based on concrete phenomena. This holds considerable potential for the development of the research field (cf. Jörissen, Ahlers, Donner & Wernicke, in print). Especially when you consider that all music is technological (Prior 2018). Inside our joint research project (funded by Federal Ministry of Education and Research, see: <https://www.leuphana.de/en/midakuk.html>) we try to gain knowledge on aspects of augmentation in creative processes of professional musicians or instrumental teachers, and how these haptic devices and instruments enable or structure/configure collective musical activities, such as jams or improvisation. Therefor we are using a mixed-method designs consisting of mainly qualitative types of data collection.

The presentation will at first focus on the theoretical basics. We will address issues of categorizing new interfaces. By using the method of artifact analysis (Lueger & Froschauer, 2018) we try to frame the research process in general. Following Bruno Latour and Michel Callon we try to understand aspects of agency of human and non-human actors in the field of music-making or production. Therefore, we are also referring to established concepts of interfaces (Galloway 2012, Berry/David 2015, Hardler/Haupt 2016) to determine the role of new musical interfaces in pedagogical and musical environments and practices. The presentation will give first insights on data and findings after the first survey phase of the study.

Christos Moralis, United Kingdom, University of West London

The 'Performable Recordings' model: Bridging the gap between studio and live performance in popular electronic music

The emerging phenomenon of new types of bands or performers, in popular electronic music, who try to bring the studio sound on stage, created a gap between 'human' and 'non-human' that requires performers to work with technology in new ways.

The 'Performable Recordings' model is, 'a type of music production, that enables the artist to perform a musical piece live, using, in real-time, the mixing and post-production processes that create the aesthetics of a studio produced version'.

This research builds upon Moore's tripartition of authenticities and more specifically the two forms of authenticity that are most salient in this process of 'musicking'. These are the 1st and the 3rd person as described in Moore's (2002) model. The 1st person authenticity relates to the extent to which the participants feel that the performers engage in authentic human expression through their performance. The 3rd person authenticity relates to the participants' assessment of what constitutes an authentic sonic example of a musical tradition or genre – in this case, EDM. In addition to what it should sound like, 3rd person authenticity is also concerned with what are the appropriate 'tools' that should be used and factors such as the coherence between aural and visual, employment of skill, performativity and the constant awareness of a 'standard of achievement'.

This paper will be followed by a live performance and demonstration of this concept. The aim is to present this musical process in which all the participants feel that the band is performing authentically while being sonically faithful to the genre or tradition. The key is the combination of machine accuracy with some aspects of human expressive performance in a way that maintains the integrity of the popular electronic musical style.

Retaining pianistic virtuosity: exploring pre-existing gestural nuances for live sound modulation

Musical interfaces can be broadly categorised in Augmented Musical Instruments (AMIs), Digital Musical Instruments (DMIs) and more recently into Smart Musical Instruments (SMIs). AMIs augment an existing acoustic musical instrument while DMIs tend to be a bespoke standalone system, or a modified pre-existing digital instrument/device. SMIs include not only sensors and actuators but also wireless connectivity, on-board processing and can deliver electronically produced sounds as well as haptic and visual stimuli. While all three kinds of instruments are often thriving in academic institutions and other experimental performance, DMIs have proven to have a more commercially sustainable future. Commercial keyboard interface developments such as ROLI Seaboard and TouchKeys provide users with the ability to control live sound modulation parameters through hand gestures. What seems to be a common thread between these two interfaces is the need to modify both the keyboard interface, to accommodate physical ways of transforming gestures into data, and the pianistic technique itself in favour of more ample and trackable gestures. This study aims to address these issues by creating an interface that uses pre-existing gestural nuances in piano playing to control sound modulation parameters.

In this paper we present a comparative study on three keyboard instruments that facilitate live sound modulation through the use of hand gestures: Reach, TouchKeys and Seaboard. Reach is an augmented instrument that uses the pre-existing gestural technique of the pianists on the acoustic piano providing them with nuanced control over sound modulation parameters. The system builds upon earlier work by Granieri, Dooley & Michailidis (2019) where they explore how micro-gestures are used for expressive control. The Reach system uses the Leap Motion Orion SDK, a custom C++ OSC mapper and Pure Data (PD) environment. It provides control over the sound modulation of a live piano feed whilst offering a touch-free experience to the pianist.

The study looks at different levels of gestural invasiveness and the relationship with the pianistic performance to better understand the performative characteristics of these instruments. The study was conducted with six jazz pianists going through various performance scenarios including improvisation. Data is gathered through the analysis of the performances, user experience questionnaires and semi-structured interviews. The study explores in what ways low degree of invasiveness in digital environments can reduce the learning curve of new systems, allowing greater accessibility to music making with technology. We present the methodology and results from the test underlining the importance of the creation of a new framework for gesturally controlled digital, augmented and smart instruments. Results show that musicians were more able to engage with the Reach system at a first encounter

Hussein Boon, United Kingdom, University of Westminster

Improvising Songwriting and Composition Within A Hybrid Modular Synthesis System

This paper discusses a semi-improvised compositional approach, within a hybridised electroacoustic music context. It will feature a live presentation and discussion of a novel form of professional application to expand contemporary, artistic practice.

A central component of this approach is a discussion of the Analogue Shift Register (ASR) including its various digital representations. Historically the ASR emerged during the early 70s with the first example by Serge Tcherepnin, described as a ‘.. sequential sample and hold module for producing arabesque-like forms in musical space’.

A contemporary realisation of the ASR can be found in devices such as Ornament and Crime’s (O&C) CopierMaschine and Turing Machine (Music Thing Modular/Tom Whitwell). The Shift Register, whether analogue or digital, as part of a composing/writing practice can be a potentially more engaging vehicle, due to its self-generative capabilities, than perhaps a sequencer would be for many practitioners. Whilst it is a slightly more ‘esoteric’ device, the lines or patterns developed using these systems can in turn be resampled and integrated into various types of composition. As a practical aid the device can seed results applicable to any electroacoustic medium whether for stage, recording studio or live performance. Outputs can be managed with varying levels of granularity and artists can produce innovative results when combined with knowledge of harmony, oscillator tuning, cv quantisation, alongside the exploration of various generative algorithms. Assisted by these devices, the performer/composer would be able to extend their practice to generate structurally complex pieces using a novel approach that hasn’t previously been realised or considerably experimented with alongside contemporary music making tools

The presentation will demonstrate some approaches that allow for original work to be devised using a modular synthesiser as part of the compositional/songwriting process and will enable discussion of the relative merits of this novel form of professional application.

Sound Objects: Exploring Embedded Computing for Procedural Audio in Theatre

Procedural generation involves algorithmic rather than manual creation. Use of the term in audio contexts typically relates to sounds that are synthesized in real-time according to a set of programmatic rules and is defined by Andy Farnell as “sound qua process, as opposed to sound qua product.” Where recorded sounds are fixed, procedurally-generated sounds are able to be continuously reshaped by real-time input.

Since being foregrounded by *Spore* (2008) from EA Games, procedural audio techniques have been implemented in a variety of video game titles and associated tools are also increasingly built into game engines and middleware. The possibilities of procedural audio have also been explored elsewhere, for instance in the context of electric vehicles and in an online sound effect synthesis service. Here, we explore the use of procedurally generated sounds in theatre. Specifically, we present and discuss two projects we have developed over the last year:

- a relatively simple prop prototype (a 1950s-era SciFi ray gun);
- INTERIOR: a more complex artefact based around a generative radio play.

Props are stage artefacts to enhance a performance. They can convey setting, help performers to assume characters or produce more authentic interactions, and contribute to performer and audience safety. Additional sound reinforcement is often used to bring props to life and can be diffused by house loudspeakers or, in order to avoid the separation of sound and source (thereby creating a form of “schizophonia”), by embedding loudspeakers into the body of the prop so as to create more readily localised points of sound. Samples are typically used in either instance, but -- as fixed/pre-recorded media -- their limited ability to respond to variations in interactions can reduce believability and fracture what Michel Chion calls the “audio-visual contract”.

Our prop prototype adopts the point source model but not only embeds the means of sound diffusion (a small loudspeaker) into its body, but also integrates a low-latency Single Board Computer and simple multi-sensor system. The SBC runs a procedural synthesizer built in the Pure Data (Pd) programming environment and loosely based on physical modelling. Articulated by real-time sensor data, this enables the “voice” of the prop to fluidly and seamlessly respond to even subtle nuances in interaction.

INTERIOR reimagines Maurice Maeterlinck's Interior (a play written in 1895 for toy theatre) as a generative radio play, unique for each listener, that exists within a largely procedurally-generated shortwave radio emulation, itself embedded in a tangible, radio-like artefact that houses a SBC running Pd, plus an integrated loudspeaker. Listeners use a tuning-style knob to scan through a diverse soundscape of signals in order to "find" the radio play. Shortwave radio-like artefacts and errors are extensively modelled using procedural techniques. The effect for the listener is of reaching below the surface and grasping the radio play through a continually evolving and richly textured gauze, with no two "performances" ever the same.

We conclude with a discussion of the practical implications of our findings from the two projects and offer some suggestions for future research.

Shib Shankar, India, India University

Innovative music creation and songwriting

Being a semiprofessional singer-songwriter, composer and producer and as well as PhD scholar I wish to analyse the innovativeness of aestheticism present in my songs with reference to Critique of Judgment (1790) written by Immanuel Kant, philosopher of the modern Western World. What is the relation of judgment of music? What are the characteristics of master composer to cognition? How is pure (a priori) judgment of music possible? I wish to reflect the aestheticism of expression and affect hidden in my songs and homogeneous variations of scales and notes as the songs progress. Though my songs are commercial in nature, often oriented towards a youth market and I focus on recording as per the context 21st century culture by examining how my music will be received in the popular press, in academia, and within fan circles as innovative piece of music. Therefore, I intend to examine diverse opinions, conduct ethnographic studies, and closely analyze the work of western popular musicians. Consequently, I will analyse complex interplay of emotions being semi professional musician on how my music may influence each other and interact with modern innovativeness discourses related to my music.

The music I make is not divorced from the larger developments in the field of world and pop music. My location is that of a semi professional singer-songwriter, composer and producer; I will be using South Asian context. I will interview many diverse students and investigate how affect encoded in my songs leads to change in emotions.

But I find myself under pressure to perform my "authentic" South Asian identity in order to find recognition from an Anglo American or European market that is unaccommodating to artists of colour. Therefore, after finishing the research I hope my songs with having great music and unique innovativeness will be published and could probably be able to probe its integrity.

Samuel Hunt, United Kingdom, UWE

Automated algorithmic representation of music structure using the Interactive Generative Music Environment software

The paper explores the recomposition of existing musical pieces, by representing the music as a series of unique parts and associated representations and transformations between them, inside the IGME software. IGME: (the Interactive Generative Music Environment) is a music sequencer that supports the exploration of generative and algorithmic music techniques. It provides an easy to use interface for exploring generative and algorithmic music techniques, that is built on common music software paradigms. Ultimately promoting a human and computer cooperative, creative system.

This reverse engineering approach to music composition is intended to express the possibility that the pieces of music explored could have originally been composed using the approaches offered by the IGME software. For example, suggesting that if music can be expressed by algorithmic processes then other newer works of music can be encoded/created in the same way. Such a justification can provide a rationale for the creation of the unique compositional processes and workflow that IGME affords to those looking to compose with generative and algorithmic music techniques.

The songs chosen are first imported into IGME in MIDI format, broken into smaller clips (parts) and analysed. This automated process finds unique parts, direct duplicates, transpositions, and transformations (for example inversion, retrograde) using a semi-optimized brute force approach by analysing and comparing every part against each other. Other more complex transformational techniques can be programmed in manual, that are harder to automate effectively. The overall timeline can be visualised to quickly disseminate the structure of the music, using colour to differentiate unique musical ideas, and uses arrow-arcs to show the relationships between different parts. Such a process reduces the overall entropy of the music data and provides an educational insight into the musical structure at a macro level.

The paper discusses the algorithmic make up of several pieces of popular music. In addition, data sets have been pre-computed for several genres of music, showcasing the distribution of musical part types into; unique parts, duplicate parts and transformed parts. The IGME software is provided free of charge to the interested reader.

Corey Ford, United Kingdom, University of West of England

Codetta: Can Block-Based Programming Support Child Educator's Confidence in Teaching Music?

There is an ongoing need to support generalist educators in teaching music. Within Hennessey's (2000) study, all initial teacher education (ITE) students declared having the least confidence in teaching music during their time on placement within schools. Additionally, Hennessey observed that when children are left to compose, the anxiety experienced by teachers reduces as they no longer have to act as performers.

This paper introduces Codetta, a novel music notation system that places the block-based programming paradigm within the context of music creation. Block-based programming has been successfully used to introduce coding to novices, where programs are constructed through the use of colourful puzzle pieces. Notably, Scratch has had wide success engaging child-users (primarily ages 8 to 16) who are motivated through the ability to work on personally meaningful projects (Maloney et al., 2010). Likewise, Codetta affords a self-directed approach for children to explore composition, theoretically lowering educators' anxiety.

Codetta was developed using an iterative approach alongside two ITE student collaborators. They participated in think-aloud sessions that were examined using Stowell, Plumbley and Bryan-Kinns (2008) discourse analysis method. This discovered themes that changed Codettas' design for each iteration.

To evaluate the software's successes, a time-limited version of the software was developed which combined a pre and post-test survey alongside the program. This was advertised to educators of primary aged children through email lists and social media groups. Initially, information was gathered around the participant's prior experience, including their teaching confidence, experience with children and musical competencies. This was then followed by 20 mins free time exploring Codetta and its inbuilt tutorials. Once the users had explored the interface, Likert scale responses were obtained for six dimensions within "The Cognitive Dimensions of Music Notations" (Nash, 2015).

The paper will demonstrate the full results of the experiment, however, a pilot study (n = 14) has suggested that teachers were hidebound by their prior music education experiences.

Chris Rhodes, United Kingdom, The University of Manchester

Viano: Electromyographic Data as a Gestural Tool for Music Composition within Game-Engines

In recent years, wearable sensors have allowed us to utilise previously inaccessible forms of gestural data for use within interactive music composition and live music performances. In particular, data which measures muscle tension (Electromyographic - EMG). EMG data is interesting to use because it allows for better gestural control when generating a desired sonic output (via Digital Signal Processing - DSP), in comparison to other datasets, such as Electroencephalography (EEG). As a result of this improved gestural control, game-engines can be used as a medium to investigate novel music interactions with digital environments and with virtual instruments. As game-engines have arbitrary physical laws (much different from our own real world), they are ideal to explore the use of EMG data when interacting with digital objects, as well as the resulting sonic consequences. In turn, mechanical instrument design is also less restricted. Therefore, many creative possibilities arise for interactive music composition, the way in which we interact with instruments and instrument design.

Moreover, Viano is a live, interactive, game for pianists which aims to study the use of EMG data in music composition within game-engines. Through playing an acoustic piano, the performer affects the timbre of their instrument by interacting with a virtual piano. They also generate sonic material, however, when they play different components of the virtual piano (i.e. performing a 'plucking' gesture to play a virtual string). Furthermore, they are encouraged to play, create and respond to sounds which are produced via this interaction with the virtual instrument. This interaction is made possible by playing various 'stages' of the game through the use of a wearable interface (worn on their right arm) - the Myo armband. Therefore, the Viano project aims to observe: if piano components were digital - what sounds would they make? How would playing with digital piano hammers affect DSP and timbre of an acoustic piano? What extended techniques are possible through digitally augmenting the acoustic Piano instrument? What kinds of interactions will be made possible, with virtual instruments, via the use of EMG data and gestural interfaces?

Paula Wolfe, United Kingdom, Sib Records

Women in The Studio: creativity, control and gender in popular music production (Routledge) by Paula Wolfe

Endorsed as 'crucial', 'captivating' and 'timely', Paula Wolfe's 'Women in the Studio' explores the cultural and historical frameworks that underpin the sustained inequalities of gender, class and race in the music industry and pays particular attention to their consequences for female music producers and artist-producers. As both a working artist-producer and a scholar, Wolfe offers an invaluable and informed perspective. Drawing from a comprehensive body of research made up of personal interviews and first hand observation, collated throughout what has been a key period of change and development in the music industry's history, Wolfe demonstrates the imperative of creative control in the face of the governing constructs forming the fabric of the music industry that continue to present challenges for women's work.

Some feminist technology scholars have drawn attention to 'the potential problematic consequences of technologies for women and [to] the absence of women in historical accounts of technology' (Oudshoorn and Pinch 2003, 4). They have also suggested that 'focusing on users' within studies on technology allows scholars to 'go beyond histories of men inventing and mastering technology' (Wajcman 1991; Lerman 1997 in Oudshoorn and Pinch 2003, 4). Wolfe's focus on the user in this study also allows scholars, in this case of music production and of music technology, to 'go beyond histories of men inventing and mastering' a creative practice inextricably intertwined with technology. Her feminist appraisal of the field of music production is, therefore, appropriate – as well as pertinent and timely – given the growth in self-production practices more generally that this study charts.

The study focuses on two interrelated areas: the disruptive value of the work of the female music production professional and the marketing control that disruption offers the female artist-producer, in particular, when promoting her work. Wolfe does not propose that the female artist-producer merits attention simply by virtue of having produced her own work but demonstrates that the process of taking self-produced work from the studio to the market, and its subsequent reception within a period of significant change within the music industry, reveals a clear line of connection between a historic undermining of the female artist who creates her own music and the contemporaneous undermining of the female artist-producer who controls her own sound. And it is that connection that points to a larger narrative that warrants close analysis. The book argues, therefore, that the situation of the female music producer and the female artist-producer between 2002 and 2018 is characterised by a core contradiction in which the creative liberation proffered by the digital recording technologies and online marketing practices of new industry remain restricted by old industry values sustained through gendered forms of gatekeeping and representation.

Creative considerations for on-screen visuals in electronic pop music performances

Electronic music is at the forefront of contemporary recording practice and DAW-based productions dominate the current popular song charts (Official Charts, 2019 and Strachan, 2017). Many of these productions are created by layering software instruments and samples and cannot usually be reproduced on the fly in the same way as they were created in the studio. This raises the question as to how a DAW-based electronic pop production can be translated into an effective live performance. Conversations with creative practitioners and audio tool developers reveal that usually, the performance needs to offer added value compared to the record, both sonically and visually (Green, 2014). The latter can (among other options) take the form of on-screen visuals. Possible technical implementations include controlling video segments via MIDI to more advanced solutions such as real-time tracking and projection mapping of the performer to the screen (Edwards, 2019).

A difficult challenge for DIY electronic music performers is the fact that usually, the creation of visual content lies outside their field of specialization. Popular electronic music performance tools do not usually make live visuals a core part of their functionality. For example, Ableton Live does not offer a straight forward drag-and-drop functionality for video segments to be triggered alongside music loops, making it necessary for practitioners to use third party tools like EboSuite. Automatic music visualisers do not always fit the artist identity. Performers can also implement their own tools which usually requires an extensive time investment and programming skills. For example, Chunity is a programming environment for the creation of interactive audiovisual software (Atherton and Wang, 2018), based on the Chuck language and Unity game engine. Another option is to project footage of the music performance itself onto a screen, however one difficulty here is that audience members may not understand the functionality of the performance tools used.

The aim of the current study is to investigate creative considerations for on-screen visuals in popular electronic music performances. Differences in genre, target audience, venue size and other stage parameters will likely influence what constitutes perceived quality but in many cases, visuals should be able to adapt flexibly to the music, allow for improvisation and fit the artist identity. While audience perception is important, the preparation of visuals should also fit with the artists' creative process: for example, some artists may prefer to 'hide' behind the technology, while other, more extrovert performers may want the visuals to underpin (but not distract from) their stage presence. The methodology is a mixture of a literature review, artist case studies and an autoethnography where the author reflects on her own approach.

Jez Nash, United Kingdom, University of West London

Motormouth: Sonic Recontextualisation

The Motormouth project is an exploration into pop composition and production using only found sound and the human voice. Matthew Herbert's work is often concerned with making artistic comment on topical issues by means of recontextualising related sonic material and crafting this into musical works. (Herbert 2011) Motormouth draws on Herbert's practices (with the addition of lyrical content) relating the source material to the subject of the work.

This paper considers both the resulting aesthetics of the production methodology, and the educational benefit afforded through the demonstration of sonic recontextualization. The project involves making recordings of car noises, and instantiating a communicative purpose through establishing a context, i.e., crafting the sounds into a backing track. Each recorded car then has a lyric attributed that is related in some way to that particular vehicle. The field-recorded sounds of exhaust notes, slamming doors, indicator relays etc. are shaped through the use of contemporary digital audio tools, such that they can be used as 'regular' instruments. However, the extent to which this modification is applied is deliberately limited such that the field recordings retain their original identity yet are able to be incorporated into pop productions.

The sounds are processed so that they can perform the functions of conventional musical elements such as a rhythm section, harmony and melody, whilst retaining clues as to their vehicular heritage. This sense of duality in the musical elements of each production, affords 'liking' and research explored in this paper will show how familiarity of context coupled with novelty in the artefact can contribute to the 'arousal potential' facilitating this 'liking'. (Berlyne 1970) (Stan g 1974)

There is a pedagogical objective for the project: the arousal potential of the Motormouth works is potentially significant enough to justify methodological analysis, thereby demonstrating and encouraging a broadening of students' sonic palette through considering the affordances of sound existing in an interchangeable context. Students will be surveyed as to the extent to which their composition and production methodologies have been enhanced through the exploration of the possibilities afforded through sonic recontextualisation.

The keynote will feature examples of Motormouth works.

Jon Pigott, United Kingdom, Cardiff Metropolitan University

Speaker Park: An Intersection of loudspeaker design and post-acousmatic composition

Speaker Park was an internationally curated project which brought together a custom installation of 24 hand built, sculptural loudspeakers made by Roar Sletteland and Jon Pigott, with two composers, Antti Sakari Saario and Mari Kvien Brunvoll, who took up residencies working with the system. The project was conceived as a critique of standardised commercial high-end loudspeaker systems of the type typically used for the electronic production and reproduction of sound. Setting up a conversation between composer and speaker designer / maker the project served as an investigation into unusual resonant and diverse approaches to loudspeaker design and how they affect the compositional and production processes. The project was premiered at Borealis international festival of Sound Art and Experimental Music which took place between 6th – 10th March 2019 in Bergen, Norway.

This paper is a first-hand reflection and exposition of Speaker Park by composer Antti Saario and speaker designer / maker Jon Pigott. It will detail the individual approach of each author in developing their part of the project (composition and speaker design) as well as the collaborative insights from the overall process.

Pigott will describe the inspiration for his speaker designs as emerging from an investigation into the physical and formal characteristics of resonant objects such as organ pipes, sound systems and architectural environments where spaces, enclosures, ports and materials all serve to develop unique resonant behaviours. The use of coneless moving coil exciters to maximise the physical and material elements of the sculptural loudspeakers will also be explained. The historical and cultural context for the custom and sculptural loudspeaker will be presented with examples including David Tudor's Rainforest (1968), Francois Bayle's Acousmonium (1974) and The Ondes Martenot among others.

Saario will discuss the commission and production of the fixed media composition A†BSB†R ('Above the Blackened Skies. Beneath the Remains.') (2019) for the Speaker Park project and the associated conceptual framework ('network'). Here, concepts are read as 'active' forces of creativity (Colebrook, 2002) and the discussion will map a Deleuzian enterprise; an emergent set of connections pertaining to the production and the sonic-affective intent of the Speaker Park-A†BSB†R assemblage. Key concepts are affect hit (Massumi, 2015), spectromorphology (Smalley, 1997), composition as collaboration (Harrison, 1996) and ecosophy (Guattari, 1989). The work is nomadic (Deleuze & Guattari, 1988) in relation to the 'state' apparatus of mainstream loudspeaker design, spatial configurations and formats and its approach to spatial strategies afforded by Speaker Park's 'anti-configuration' and spectral constraints (Magnusson, 2006).

These various themes will underpin discussion around predictability within technological design and how this serves to support the model of the technological 'black box'. It will also explore notions of a hierarchical chain of technological concerns extending from endlessly soft and malleable digital tools through to hard material technologies.

Stan Erraught, United Kingdom, University of Leeds

Outsourcing Taste: Are Algorithms Doing all the Work?

'Taste', whether understood as a mark of distinction or of cultural capital (Bourdieu, 1987), or as a technology of the self (DeNora: 2000) has been central to academic investigation of the role of music in social formations. Equally, the music industry has, in the past, relied on the mediation of judgements of taste by an army of gatekeepers – radio, print media, TV – to insert its product into the lives of consumers – feeling that one was buying the 'right' records and that the products of the music business reflected 'who you were' was a very important part of the negotiation between the industry and its audience.

Now, however, the construction of our supposedly personal canon is being increasingly outsourced to algorithms. Streaming services can, with, it seems, uncanny accuracy, discern the lineaments of our taste and guide us towards exactly what we would like, had we the time to research the by now vast archive of recorded sound.

In this paper, I want to ask how much this displacement of critical gatekeeping onto algorithms affects the way the listener values music and whether this presents a serious problem for the recording industry. Is this switch a consequence of music being 'less important' than in previous eras? Or, conversely, are patterns of distribution and consumption themselves producing this effect?

Using a mixture of theoretical perspectives – adapting notions of aesthetic value to what feels like a new paradigm – and empirical testimony, based around a series of interviews with people old enough to have lived through a succession of format eras and who are, or have been, active either as musicians or in other areas of the music business, I want to suggest that the new environment does create new modes by which judgements of taste are arrived at, not wholly removed from the structures of the past, but which also point towards a quite different understanding of taste formation, and which will affect audience formation and sustainability in the future.

Trish Rooney, Ireland, Cork School of Music

The evolution of popular music education: the effects of the implementation of electronic music devices into formal pedagogical practices.

Little research involving the relationship between electronic music and formal education has been conducted (Thompson & Stevenson, 2017, Söderman & Folkestad, 2004; Snell & Söderman, 2014). As music teachers have typically been trained in a formal western classical education tradition (McQueen & Hallam, 2010, Green 2002) and popular music studies usually explore the experiences of rock based popular musicians (Green, 2002, Powell & Burstein, 2017), the experiences of popular electronic musicians and skills typically associated with electronic music production (drum sequencing and synthesis) have been largely ignored in music education, possibly due to the fact that electronic music is not played in a traditional sense (Thompson & Stevenson, 2017).

This piece of action research addresses the gap. In conjunction with the Swedish company 'Teenage Engineering', The Academy of Popular Music in Cork recently investigated the impact of incorporating their PO 33 (Pocket Operator – sampler and step sequencer) into traditional formal music education. A group of six advanced (grade 8) students between the ages of 17 - 20 from the Academy of Popular Music were trained in the use of the PO 33. The group comprised of two electric guitarists, bassist, pianist, drummer and singer, their progress was tracked, and after a month of tuition they created and recorded their own tracks, which they improvised over live. The research has proven to be very insightful and the students themselves found that formal instruction in the PO33 greatly enhanced their learning experience. They reported benefits such as enhanced notational, aural, rhythmic, harmonic and sight-reading skills, and also found the experience to be culturally relevant and fun.

Developing a more nuanced approach to teaching and learning popular music, like what Smith (2013) has termed 'hybridized learning' and a mixture of formal and informal methodologies is important (Rupert Till, 2017). As music educators, it would be wise to welcome a critical attitude towards existing musical practices (Väkevä, 2010) so that the musicians of the future will be as skilled at synthesis and sequencing as harmony and sight reading. Merely supplanting classical guitar with electric guitar is not enough.

The success of this study has led to the development of a longer longitudinal study on the holistic integration of electronic music devices with a larger (50 participants) and younger groups of students (11 to 15) taught in conjunction with their regular theory requirements. The aim of this potentially ground breaking research, is to show the benefits of the fusion of formal popular music education with technological devices, which may have far more potential for young popular musicians' future engagement with and understanding of contemporary music practices.

Paul Thompson, Sam Nichols, United Kingdom, Leeds Beckett University

An Alternative Take: Exploring the Production, Engineering and Performance Aesthetics of 1950s and 1960s Latin Dance Music in New York and Havana.

Performing musicians and artists working within the context of commercial record production have had a mixed, and often fractious, relationship with the recording studio; either embracing the affordances that recording technologies can bring or wrestling with the ways in which it forces them to alter their performance style. The history of Afro-Cuban dance music in Havana and New York has been shaped by the recording industry in a myriad ways and changes in performance practice may well be explained by technological restrictions, enhancements or adjustments within the recording studio context.

Bringing together performers, producers and engineers to record Cuban dance music repertoire from the late 1950s to mid 1960s, the following paper provides an alternative take on the aesthetics of engineering, production and performance (both inside and outside the recording studio) through the use of experiential and experimental archaeological methods to further examine the history of the genre. The recording contexts for the original repertoire were re-staged not simply to investigate the influence of earlier recording technologies and practices but to gain insight into the interaction between musicians within that tradition today and to gain further insights into the history and performance aesthetics of Latin music in both Cuba and the USA.

The following paper discusses a range of strategies and initiatives that have been implemented across the city of Leeds (UK) with a critical evaluation of the ways in which models from other European cities, feedback and opinion from music professionals, consultation from government officials in Leeds and guidance documents from professional bodies and global consultancy agencies (i.e. Sound Diplomacy and the International Federation of the Phonographic Industry) have been implemented in the development of the city's strategy to stimulate music activity around Music:Leeds' three core areas of activity: Creative Development & Business Growth; Placemaking & Tourism; Access to Music.

Composition as an embodied act: a framework for the gesture-based creation of Augmented Reality action scores

New ways for representing and interacting with virtual objects have recently emerged with Augmented Reality (AR) technology. At the same time, the continuous release of new devices specifically conceived for such new developments, and which are increasingly directed towards mass-production markets, contribute more and more to the diffusion of this technology. In such a context there is a great potential for applications addressing musical practices. More specifically, this research deals with the development of a new concept of notation applied to the field of extended techniques. The main objective consists in notating more precisely, intuitively and in a time-effective way extended instrumental techniques and providing a framework for creating new ones.

LINEAR (Live-generated interface and notation environment in Augmented Reality), the proposed application, allows one to draw trajectories and gestures (represented as automated strokes, changing in real-time) directly on the real vibrating body. This type of notation can more closely represent the motion required to produce a specific result, along with its energy and its bodily experience.

Moreover, trajectories can be created in a very immediate way: just playing the instrument. By using LeapMotion (and in future improvement more appropriate motion capture equipment) and audio envelope following, LINEAR detects the beginning and the end of a gesture and stores the position of the hand and fingers at each frame.

The final AR score consists in virtual strokes, changing through time, representing the trajectories of the hand on the instrument. Beyond positions, the time development faithfully represents the original movement: how fast or how slow the virtual line is forming depends on the speed of the generating gesture.

The score itself is created by positioning blocks (related to specific gestures) on a virtual timeline in the same AR environment (i.e. without sitting at the computer, just wearing the headset). In fact, when the application is set in Score Mode, all the saved trajectories are represented, reduced in size, inside blocks whose length is proportional to the duration in time of that gesture. The composer can then drag and drop (with his/her hands) the selected gestures on a virtual timeline. The score is played by the system by referring to that timeline.

The system shows limitations in term of equipment: the Leap Motion cannot provide accurate detection for every position of fingers and hands. Furthermore, the sight of the composer/player should always be directed towards the hands (which are not detected otherwise). Moreover, the HTC Vive Pro used for the development of this system, suffers from low resolution and high latency of the front-facing cameras. Additionally, the tracking provided by the device, although extremely stable in Virtual Reality, shows some imprecision when in AR.

Notwithstanding the aforementioned limitations, AR unprecedented solutions and opens up new rich scenarios (e.g. , the notation of gesture in space and time, almost "as it is", has never been an option for composers, who could only deal with forms of abstract representation).

Rune Palving, Denmark, The National Filmschool of Denmark

Immersive Audio in Narrative Space

In these days where 3D audio is becoming more and more common in cinemas, home and mobile entertainment we want to investigate music composition directly into an immersive format. Different approaches and traditions meet to get new knowledge in methods of music composition and sound production and also realizing that new processes is needed especially in the collaboration between the composer and the music producer. The four musical pieces made also explores the position of the listener. One is a "location", one is a floating "scene", one has a "fixed view" and in the last one the listening position is dynamic. Different narratives and listening positions means investigating a broad variety of techniques. The "location" piece is based on a field recording of a dawn chorus in a forest turned into human voices and then re-recorded back into the forest with a mic and speaker arrays like if the singers were performing in the trees. In the dynamic piece the mic positions and the acoustic ensemble is set but in the mix they are all turned into objects and move around according to the sheets storyboard. Here there is a lot of challenges regarding room acoustics and separation and further research are needed.

Dave Fortune, United Kingdom, The University of Salford

Transparency and Authenticity in the Live Arena: An Exploration of Electronic Music Performance Techniques

In the following paper I examine current practices and conventions of the live performance of electronic music, and create innovative performance tools and methodologies that will augment the techniques currently being employed by practitioners within the field. The practical aspect of this project focuses on the creation of two new instruments created within the MaxMSP environment; these instruments can either be used in conjunction to create a live performance alone, and without the use of any other devices, or be incorporated into a wider setup of other instruments. The development of these instruments culminates in a video recorded performance of my own original studio compositions using the technology I have designed; this element of the research enabled me to assess the value and effectiveness of the instruments as live performance tools.

This paper was, in part, inspired by a previous study I undertook, entitled “Examining Authenticity in Live Performance of Electronic Music”, in which I examined many of the factors that contribute to an effective live electronic performance, as well as some of the challenges that are presented in convincingly replicating studio compositions in a live environment. In this paper, I explore these themes further with a focus on the interaction between the physical, visual, and audio elements of a performance. I first examine a range of performers within the field, and identify areas where I believe there to be flaws in the methodologies they use to communicate musical intent to the audience, especially when compared to established conventions of what constitutes a ‘live’ performance.

In response to these observations, I re-purpose and extend the functionality of pre-existing hardware MIDI controllers to create new instruments using the software platform MaxMSP; these instruments are then employed to create multi-timbral performances of electronic music works. In an attempt to overcome some of the flaws I identify, I mainly eschew the traditional model of ‘live’ instrumental performance in favour of techniques which are more commonly used in the creation of electronic music, specifically sequencing, loop manipulation and signal processing. Crucially, by exploiting the capabilities of my chosen hardware devices, I achieve these aims in a way which is not only incredibly tactile for the performer, but also highly transparent to the audience in terms of which processes are actually taking place, and to what degree the performer is affecting them.

I believe that the findings of this research, as well as being of personal value for my own performance repertoire, are potentially beneficial to the wider electronic music community as a whole. The performance frameworks I have established will hopefully influence other practitioners to take elements of my methodology and develop them further within their own individual performance styles.

Jan-Olof Gullö, Hans Gardemar, David Thyrén Sweden, Royal College of Music

Artists, musicians and music producers: Similarities and differences?

For many years, the Swedish music export has been very successful. Previous research shows that the Swedish music export strongly has contributed to an increased interest among students to study popular music and music production in Swedish higher education. In this study we have a hypothesis, built on observations made in higher education in music, that many of the students who apply to higher education in music often have ambitions to make it as artists rather than becoming musicians. Another assumption is that many of the students who apply to music producer programs in higher education mainly want to study music production in order to learn how record their own songs and create their own repertoire. Therefore they can show limited interest in producing others. Our ongoing study, moreover, clearly indicates that relatively little of the content in higher music education programs is focused on developing talents to full-fledged artists, very little of the musician programs and hardly at all in the music production courses. It is thus possible to identify a gap between what is offered and what probably many students would need based on their overall aspirational goals.

In order to create new knowledge about these issues and with the aim of contributing to the development of higher education in music, in this project we gather diverse data through interviews with key players in the Swedish music industry: artists, musicians and music producers. An important purpose is to identify core characteristics and important differences between these professions. Observation studies are also included in this project. In this paper we present selected results of the study focusing on some of the specific challenges that we have identified in the higher music education concerning the above-described goal conflict. We here especially focus on possible differences and similarities between music producers, musicians and artists regardless of whether it is about music performed live or produced for phonograms or the equivalent. Further more, we address and discuss the problem that programs and courses in higher education not always offer what the students want. In this paper we also present a model of music production. The model is based on results from the study and may be useful in higher education for music producers as well as for musicians and future artists.

Development of an Ambisonic Guitar System

Ambisonics, pioneered by Michael Gerzon (1977, 1985), is a kernel-based 3D surround sound system. The encoding (recording or panning) of the audio is separated from the decoding (or rendering) of the audio to speaker feeds or, more recently, head tracked headphones (by binaurally decoding the Ambisonic sound field). Audio encoded in this way can be rendered to any number of speakers in almost any position in 3D space, as long as the positions of the speakers are known. Moreover, Ambisonics is a system optimised around a number of psycho-acoustic criteria which, when implemented, reduce the variability of audio no matter what speaker arrangement is used for reproduction. This allows for a 'mix once' system where subsequent remixing is not necessary when replayed over different loudspeaker systems or headphones and allows for full 3D reproduction. The Ambisonics system is finally gaining some traction due to its use in Virtual Reality audio, using the ambix standard (Nachbar et al. 2011) but few instruments exist that make use of this 3D spatial audio format, although previous studies into some aspects of the relationship between instruments, performance and spatialisation is available, for example, see Pysiewica and Weinzierl (2017), Graham and Bridges (2017), Bates (2010), Pukette (2007) and Graham (2012).

The system combines custom and off-the-shelf hardware/software to create both a live performance Ambisonic guitar system, and virtual reality (VR) ready, binaural performance instrument. The system comprises of two aspects: firstly as an innovative audio project, fusing the musical with the technical, combining individual string timbralisation with Ambisonic surround sound. And secondly as an artistic musical project, providing alternative experimental surround sound production ideas for the guitarist and music producer, with potential applications in the Sound Arts world as well as commercial musical applications. This paper explores the possibilities of the Guitar as a spatial instrument detailing the technical and artistic processes involved in the production and live performance of the instrument.

Key features of the described system include:

- Multichannel hexaphonic guitar pickups facilitate the guitar system to process individual strings independently for both timbre and spatial location.
- Guitar production timbre and effects are achieved with Line 6 Helix commercial sound processing software for individual string timbralisation.
- Ambisonic surround-sound performance: spatial positioning is achieved using our own bespoke WigWare algorithms and can be heard over either an array of circular (2D) or spherical (3D) loudspeakers, alternatively the user can listen to the output with headphones using binaural implementation.

- Rhythmic gate-switching of individual strings, such that either simple or complex polyrhythms can be programmed or performed live across individual strings (producing similar results to a keyboard controlled arpeggiator).
- ‘Auditory Scenes’ have been developed for presenting combinations of individual string timbres, spatial, and rhythmic arpeggiator parameters.
- The system can be applied to post-production sound manipulation, or as a real-time live Ambisonic performance instrument within a concert environment. These two categories can yield differing production possibilities.
- We have also identified potential applications for guitar training and education.

Dan Banks, United Kingdom, University of Hull

Sonification As a Non-Normative Moderator in Free Jazz

Since the dawn of our existence, humankind has been inextricably linked to planet Earth. Our relationship is beyond symbiotic or mere coexistence; we are, in many respects, a single entity. However, the terms of this relationship have shifted, and our impact and influence on the journey of this planet have changed accordingly. Our transition from foragers to farmers demarks the dawn of this changing relationship. The stark difference of extractable sustenance per hector of land between foraging and farming propelled humankind forward and enabled unimaginable population growth. However, beyond the pragmatic, this paradigm shift perhaps denotes another change: the ground beneath our feet became consumable, and arguably, since that moment, we have been consuming the planet with greater efficacy and sophistication.

The proposed presentation will critically deconstruct and detail a project and album (released by FMR), entitled *Sonifications: The Anthropocene Epoch*. This project utilised sonifications generated from various avenues of climate change data—a somewhat clichéd notion nowadays—as ‘sonic scores’. More specifically, as non-normative sonic moderators in free jazz improvisation, providing a degree of auditory constraint to what would otherwise be entirely free improvisation.

The presentation will utilise a live performance from the musicians involved in the project to give an organic and experiential quality to the discussion. Furthermore, the paper will detail the creative process behind the project, including the generation of the underlying sonifications; demonstrate the result performance in real-time; and critically assess how the use of a ‘sonic score’ can alter notions of space, time, texture and dialogue in free jazz.

Technical Requirements: the performance elements of this presentation require an acoustic piano, drum-kit (no breakables), and bass amplifier. If this is logistically too difficult, the presentation can be delivered with video and audio snippets being substituted for the performance elements.

Jeffrey Lupker, William J. Turkel, Canada, The University of Western Ontario

Observing Mood Based Patterns & Commonalities in Music

In their paper titled “Measuring the Evolution of Contemporary Western Popular Music”, Serra et al. (2012) describe changes and trends related to pitch transitions, the homogenization of the timbral palette, and loudness levels that have shaped pop music over the past 60 years. They also suggest that past songs could be modernized by altering their characteristics to reflect trends of the modern era. Our question is, can we apply similar methods to different classifications of music? Instead of examining massive datasets of pop music over 65 years, can these methods be used to look at any genre of music and perhaps even more interestingly, moods? Moods are increasingly becoming the main method of music playlist consumption with listeners opting for “music to raise your spirits” or “atmospheric rock to help you focus” as opposed to more generic classifications like jazz or rock. Are songs that can be grouped according to mood characterized by similar underlying patterns or metrics?

To obtain data for our analyses, we will use the Spotify API to acquire metadata from each song found in different mood-based playlists. Both playlists created by Spotify and those created by users will be analysed, as we are generally interested in seeing how music is grouped according to mood. To achieve a common key or tonality for testing, each song’s pitch metadata will be transposed according to the techniques outlined by Serra et al. [IEEE CS Conference on The Use of Symbols to Represent Music and Multimedia Objects, 45-48(2008)]. The main study will group frequent pitch vectors (likely those associated with the key of a song) and timbre vectors pulled from the metadata as commonalities, with those that are less frequent being taken as being uncommon (for example, dissonant pitch vectors). We will study transition networks between these vectors in order to determine which vectors are network hubs and whether moods define particular paths between certain pitch or timbre vectors. Furthermore, another area of investigation will be the use of uncommon pitch and timbre vectors and less frequently used transitions to discover where songs deviate from the standard template or if certain moods deviate more than others. Although Serra et al. proved pop music does indeed follow certain templates across the 60 years, there is also room for innovation to attract listeners. That is, we would like to understand how moods affect music composition by either allowing for or obstructing innovative use of pitch or timbre.

These analyses are part of Lupker’s ongoing dissertation research into the application of artificial intelligence in composition. If the results yield differences associated with different moods, machine learning-based programs could be built to assist composers writing music according to a desired mood. The program could make suggestions or predictions for pitch or timbre transitions as the piece is being written. Some of these may not have occurred to the composer, and the program might even suggest ways the composer could break away from the norm to increase innovation within a mood or style.

Tychonas Michailidis, Solent University, Balandino Di Donato, University of Leicester, Christopher Dewey, University of Huddersfield, United Kingdom

SoundSculpt: sculpting sound objects through mid-air haptics and holographic image

There is an increasing demand to make music tools more accessible, easy to use and perform. This focus is not only for musicians but also aimed at the wider public. Developments in haptic and visual technologies enable us to have new design approaches for making and crafting music. In this paper we present the SoundSculpt project which aims to explore the potential of representing sounds as a tangible and visible virtual object allowing users to interact and transform them in space. Through holographic projection and mid-air haptic feedback we provide new ways for representing the spatial and the morphology of sounds. Sound objects have interactive possibilities afforded by their shapes and forms. The definition of sound object differs from the Schaefferian definition of an object sonore (Schaeffer 1966), which refers to a sound event over time (i.e. that has fixed duration) that is perceptually separated from its source (e.g. the sound of a door slamming played through a loudspeaker).

The system is built upon earlier works by Bullock, J, Michailidis T, and Poyade M, (2016) and Bullock, J, Di Donato, B., (2016). In addition, Di Donato and Michailidis (2019) present a system to facilitate the interaction between sound and haptics for digital signage. The system uses the novel visualisation approach proposed by Dewey and Wakefield (2019). This visualisation presents the sound-object as a deformable container whose shape is determined by its associated spectral signature. With an interaction style analogous to moulding and sculpting, the user is able to boost and attenuate the objects constituent frequency components by interacting directly with a visualisation of the container projected mid-air using hand gestures.

The prototype system is developed using Cycling'74 Max making use of the Ultrahaptics device for rendering mid-air haptic feedback and a purpose built hardware for the holographic projection. The user can then interact or sculpt with the sound-object through hand gestures, tracked using a Leap Motion gestural controller and experience the sound-object through vision, touch and hearing.

Our system does not only propose a new concept for multimodal interaction with sound-objects, but aims to provide alternative feedback methods for less able users. Visual and hearing impaired users can have new experiences around sound manipulation and sound morphology.

Electroglottography-based real-time voice-to-MIDI controller

In the field of music technology and performance, despite many controllers successfully mimic the mechanical acoustic behaviour of traditional musical instruments, implementations of the MIDI protocol based on the human voice are complex and unreliable. The complexity of an audio signal generated by phonation makes it highly computational demanding to deduce an accurate reading of its fundamental frequency especially in real-time environments. This project uses electroglottography signals (EGG) to convert singing voice into MIDI messages and create a more efficient system. Electroglottography is a medical technology used to evaluate the behaviour of vocal folds in terms of their degree of contact. Among various information that can be deduced from the readings, EGG presents an output signals featuring a frequency which is effectively corresponding to the fundamental frequency of the relative phonation act. This characteristic allows to extract the exact frequency, and thus the note, produced by a singer. Given that EGG derives its output directly from the vocal folds' oscillation, the harmonic content introduced by the latest stages of phonation are discarded and a simpler signal is yielded. The simplicity of EGG signals, in comparison to conventional audio, offers in turn a much easier and computationally less demanding way of obtaining accurate fundamental frequency readings or, in other words, the singing note. In this project a complete system was developed based on an embedded design. The system is capable of converting EGG signal into real-time MIDI messages and it was constructed using the visual programming language Pure Data combined with the Bela platform. This solution offers a series of advantages in terms of signal processing and MIDI manipulation. The overall performance of the designed system shows a minimal delay of processing where the effective delay between phonation and MIDI message is around 20ms. This fast processing allows the system to be considered a near-real-time application. Moreover, the implementation of pitch-bend messages for the adjustment of the frequency, successfully allows to replicate the exact note produced by the user taking into consideration the microtonal variation between the generated pitch and the theoretical frequency.

Simon Connor, United Kingdom, United Kingdom, University of Salford, University of Huddersfield

Multimodal Landscapes: The Creative Affordances of Head-Trackled Binaural Ambisonics to the Soundscape Composer

Place and the artistic sense of the landscape have been traditionally dominated by the visual medium (Feld, 1996). Sound however, can offer a richer experience; a three dimensional sense of space, time and depth, or 'aural landscape' (Krause, 2013; Emerson, 1999). The availability of portable audio recording equipment in the 20th century has allowed soundscape composers such as Murray Schafer to capitalise on this, in capturing 'real sonic environments' and creating virtual sound worlds, through layering, manipulation and montage (Schafer, 1994). Now in the 21st century immersive and spatial audio has gained considerable exposure, particularly ambisonics, due largely to its incorporation with virtual reality experiences and 360 video. But what does this technology afford the soundscape composer in the creation of immersive sonic environments, and what are its implications on the compositional process?

This paper will aim to answer these questions with regards to creating the soundscape for Field Studies: Odin's Gully, a work-in-progress audio-visual installation. Techniques used to bring the project to life include spatial capture field recording, uses of rendered sound for elevated realism (Chion 1994), the fusion of real world sound with acoustic instrumentation to create perceptual multistability, and the use of head-trackled binaural ambisonics. As this is a collaborative project, the paper will also address how the sound designer/ composer and filmmaker co-create a multimodal conceptualization of landscape. The ultimate aim of the work is to create an immersive and exploratory experience, that teeters on the edge of the real and unreal, with the hope that audiences emerge from this with an altered or expanded appreciation of reality and our natural environment (Norman, 1996, Westerkamp; 2007).

Greg Smith, United Kingdom, University of West London

Electronic Space: Real-time Parameter Transitions and Ambisonic Performance Panning for Live DAW-less Electronic Music

The recent trend for the 'DAW-less' (Digital Audio Workstation-less) live performance of electronic music has seen many artists seeking to develop performative techniques and to configure disparate systems to enable them to play live without relying upon a DAW to sequence MIDI or playback audio.

This generates a problem: whilst most modern hardware instruments are replete with synchronisable modulation sources such as LFOs, envelopes, and step-sequencers, they lack the DAW's ability to transition between settings, something typically done with automation in software such as Ableton Live.

The difficulty in achieving DAW-like multi-parameter transitions is particularly problematic for electronic musicians that rely upon timbral variation for contrast and narrative development, and DAW-less artists striving to achieve this typically find themselves with compositionally compromising workarounds and inefficient duplications of equipment.

Manufacturers are beginning to recognise the need for this kind of transition control for electronic performance setups: Polyend's recently announced Preset can record and save control-voltages as automation for Eurorack modular systems and Native Instruments' new Lock feature allows Maschine users to save and recall parameter snapshots.

The recent developments in virtual reality and 360 degree video tantalise the contemporary electronic musician with their immersive and creative potential, yet despite the technology's apparent coming of age those wishing to exploit spatial cues for musically expressive ends find themselves having to adapt cinema workflows such as Dolby Atmos (installed at the Ministry of Sound in 2016) or apply elaborate and/or bespoke systems such as Max Cooper's 4D Sound.

This paper proposes a control system that uses MIDI to simultaneously save hardware instrument parameters, DAW mixer settings and ambisonic panning coordinates which can then be recalled independently of song position and at a range of measure-multiples allowing musically synchronised spatial and timbral transitions during a performance.

The system uses Liine Lemur to capture and store parameter, channel fader and pan position values and calculates the interpolated transition at measure multiples using Lemur's On Clock script execution.

The system also allows direct interaction with device controls, panners and faders allowing the artist to deviate from any saved state or timbre during a performance, and to recall saved settings as a transition from the newly improvised state, again at a range of measures which can be set independently for instrument controls, panners and mixer channels.

The paper describes an applied example of a live performance using two synthesisers, a drum machine and a sampler from which discrete audio outputs are sent via an interface to Cockos Reaper which acts as digital mixer and third-order ambisonic panning host. The control system was used to save, recall and transition settings for each instrument, Reaper's channel fader positions and Blue Ripple third-order ambisonic panner coordinates for each channel during a live performance.

Michail Exarchos, United Kingdom, University of West London

Making records within records: Manufacturing phonographic 'otherness' in sample-based hip-hop production

Charles Mudede (2003) explains that in the context of hip-hop 'a turntable is forced to ... make meta-music (music about music) instead of playing previously recorded music', and expands that the sampler is 'repurposed to turn one DJ repurposing two turntables into a thousand mini DJs repurposing two thousand virtual, mini turntables'. Looking at sample-based record production through such a lens highlights the multitude of material implications this understanding has on the musicological study of sample-based hip-hop. Thus far, the predominant focus in hip-hop literature has resided upon the motivic, rather than the sonic, and this examination attempts to address the imbalance. Borne out of a wider exploration of the contemporary practice that entails sample-based record producers taking on both the creation of source content and the meta-process (for example, Portishead, De La Soul, Frank Dukes, Kiefer), the study questions what renders a sampled source into a phonographic object that is aesthetically desirable for and usable in the context of hip-hop record production. Furthermore, if all digital sonic capturing can be described as a form of sampling (Kvifte 2007), then what mechanisms, processes and practices infuse sonic signatures of phonographic 'otherness' onto newly created objects, and how can this 'otherness' be defined? Expanding beyond a deterministic approach that simply classifies signal flow variables responsible for the forging of phonographic signatures, the paper deploys an autoethnographic methodology to illuminate phonographic context through 'thick descriptions' (Ellis, Adams and Bochner 2011) of meta processes, extending the understanding of record-production as - a form of material - composition (Zak 2001). Synthesising the technical with the aesthetic, the paper uncovers exponential staging phenomena at the heart of how this 'otherness' is negotiated (and constructed) in practice, and attempts to provide a case study of how the merging of a technical and a musicological theory of record production aesthetics (Exarchos and Zagorski-Thomas 2019) could evolve.

Matthew Lovett, United Kingdom, University of Gloucestershire

Towards a quantum theory of musical creativity

The theoretical physicist Karen Barad's 2007 book 'Meeting the Universe Halfway' was something of a manifesto for using a range of learning taken from quantum theory to rethink how it is that we understand ourselves and our place in the universe.

Key amongst Barad's conceptual innovations was her claim that quantum entanglement operates at the level of both ontology and epistemology, which is to say that, not only is the world that we inhabit governed by the affordances and constraints of quantum behaviour, but so too is the way that we understand our universe.

This paper embraces Barad's challenge to think again about what human creativity is and how it works, and puts forward a toolkit for rethinking musical creativity in terms of a set of quantum concepts. As music production and distribution technologies evolve at seemingly exponential rates, so too must our understanding of what music is, and how we make it. In short, in an era when technological disruption is changing music making and music consumption beyond all recognition, we must ensure that our understanding of music remains equally contemporary, and forward-focused.

In Barad's reading, quantum theory equips us with a range of concepts and structures with which to understand how the paradigm works, including diffraction, entanglement, measurement, complementarity; all of which lead to a reconfiguration of accepted notions of 'objectivity' and 'phenomena'. In this paper, I apply these terms to musical creativity, to build a conception of a musical artefact as a 'quantum phenomenon'. In addition, the paper problematises traditional notions of authorship in the light of both quantum objectivity, and Barad's own neologism, agential realism.

Such an approach presents challenges to a variety of accepted critical perspectives surrounding music; but it is one that enables us to think how genres, histories, identities are both folded into - and emerge from - a piece of music, without resorting to familiar charges of postmodernism, retromania, standardisation, and the like. What a quantum theory of musical creativity allows us to do, is to understand how such concepts are the result of musical practices, rather than the reasons behind

Paul McGeechan, United Kingdom, University of the West of Scotland

Music Technology past and present. The Digital Audio Workstation and other mediated processes.

Examining the production of a large- scale collaborative project comprising of computer-based scoring, programming, found sound manipulation, analogue synthesis and orchestral recording.

The manipulation of field recordings, electronic sound textures and orchestration can help print emotions and the technology that is available at our fingertips today helps negotiate the juxtaposition of these elements. It is the skillful blending of sonics that helps the modern composer define the narrative of their work.

“The tools and practices of electronic music can be combined with traditional musical tools leading to “mixed” pieces in traditional styles or in stylistic hybrids that combine known elements with the new possibilities introduced by the electronic medium”. (Roads 2015)

The digital audio workstation is not only an editing tool but it is an instrument in its own right.

This paper will examine how the advancement of music technology has influenced the way that the modern musician composes, captures and produces music in today's creative environments. It will discuss the application of electronic equipment as a fundamental compositional tool.

“Electronic music is not a style but rather a technique yielding diverse results in the hands of different composers”. (Hiller 2018)

This paper will discuss the impact of music technology from composition through to production. It is the intention to reflect on my professional practice and the influence that music technology has upon the composition, production processes and how this informs the artistic output of the composer.

Scott Harker, United Kingdom, University of West London

Mastering for Streaming: Exploring Accurate Translation

This paper will aim to investigate multiple lines of enquiry and research areas surrounding the topic of mastering for streaming. The paper will use various analytical and research methodologies to explore the possibility of a standardized framework or ruleset that can guide improvements in modern mastering techniques.

The Audio Engineering Society provided a technical document in October 2015 which outlined technical loudness recommendations for audio streaming playback. This was based on information provided by streaming platforms and their normalization algorithms to create a guide outlining loudness targets for mastering engineers. Whilst this document outlines key technicalities that are important to consider when mastering for streaming, initial research has shown that academically, there is a significant lack of investigation into this subject area. Despite this, there is an overwhelming amount of information and opinion from the pro-audio community which is largely anecdotal and developed through practice-based methods. It has been noted that the majority of direction and guidance available in relation to streaming has a heavy focus on loudness, even though there are many other aspects of mastering that are important from an aesthetic or musical standpoint which streaming may affect.

As mastering engineers, it could be argued that not only do we need to be familiar with loudness targets, but also of the tonal imprint that a streaming service may or may not have on the masters that are uploaded. Initial analysis of the different platforms has shown significant sonic differences between different streaming services and has also highlighted the disparities in the algorithms being used. These findings could allow mastering engineers to not only take full advantage of the loudness algorithms, but also prepare for any other discrepancies that may be found through further research. The interviews and other research conducted have confirmed that this area is in need of further exploration, not only to explore new techniques but to give some context to unsubstantiated evidence presented from the pro-audio community.

Alex Stevenson, United Kingdom, University of Oslo

Post-Digital Musicians?: The influence of digital audio aesthetics on musical performance

Throughout the history of recorded music, developments in music technology have consistently impacted on performance practices of musicians. Whilst much of the academic discourse in relation to this has focused on the affordances and/or limitations of these technological developments on musicians, with musicians embracing the (mis)use of technology and developing performance techniques to best exploit the technology at their disposal, another less-explored area has been the impact of these technological developments on musical and sonic characteristics and how these aesthetic considerations have been embraced by musicians into their performance practice by explicitly avoiding the use of the technology.

The democratisation of music technology, and specifically the dominant influence of the DAW in all stages of music production, incorporating both linear and loop-based sequencer aesthetics, the for grounding of digital audio files as source material, alongside well-established 'post-digital' or 'glitch aesthetics', has therefor had significant impact on the practices of the vast majority of contemporary musicians and their approaches to performance, composition, arrangement and production.

Through the use of semi-structured interviews alongside analysis of musical performances and recordings, this paper explores the influence of these (post-)digital aesthetics on contemporary musicians within their practice, highlighting innovative adaptations and modifications of their acoustic instruments, their performance techniques, and their conceptual frameworks for composition and arrangement whilst predominantly eschewing the use of digital audio technology.

Andrea Succi, United Kingdom, University of West London

Defining and developing a sonic signature in music mixing through a modern-day apprenticeship method and a practice-based approach

Previous research into defining sonic signatures shows the existence of categories that they tend to fall into, based on the determining factor for their existence. Agents such as technology/equipment, places (both geographical locations and recording studios), and people (producers, record labels and audience) all contribute to the overall sonic identity of a recording. The research also shows how another prominent external factor that influences the imprint of a sonic signature is musical style – the so-called tropes of the genre – and, finally, the issue of creative collaboration is equally seen as influential to the development of a recording's sonic footprint.

The review of the literature determines that there is no single definition of a sonic signature and that there is no set framework for creating one either, as it is dependent on a large number of factors.

The issue at the heart of this paper is that all these sources are only concerned with the emergence of sonic identities during the recording phase, without addressing the influence of the penultimate step of the process that is mixing, considering that mix engineers are commonly known to have a distinctive style and are hired for their unique trademark. This work intends to take all of the concepts mentioned above and find out how they relate to mixing and aims to create a framework for understanding and developing a distinct mixing sonic signature.

It does so by integrating a practice-based element into the action research design, that resembles the historical apprenticeship model of learning from a mentor. A sample of five mix engineers was chosen based on the two criteria that are most relevant to the researcher's current professional practice: style and setup. By analysing interview transcripts and video recordings of masterclasses of these engineers, a set of techniques, concepts and workflows were created and evaluated in a series of twenty test mixes produced by the researcher, with further evaluation and selection of ten final mixes that showcase the sonic signature developed by the author.

Paul Ferguson, Dave Hook, United Kingdom, Edinburgh Napier University

Breaking geographical barriers to music production

In January 2013 the authors became early adopters of Focusrite RedNet. The RedNet Dante-based audio-over-IP interfaces gave their studios and performance areas very flexible connectivity and this was presented at the first Innovation in Music conference in 2013.

Since then, the use of networked audio in live sound, broadcast and installation has become widespread. Typically, this is through technologies such as Dante and Ravenna and their use is usually restricted to a Local Area Network (LAN) found within a building or venue.

To reach beyond the local network, the authors have previously championed research into the use of tools such as the LoLa video streaming system to connect UK artists with artists in Europe and the USA. This research within the academic community has demonstrated the potential for real-time rehearsal, performance and teaching and now raises the question “is this something that the music industry will ultimately be able to do with our commercial audio-over-IP products and integrate into our production workflows?”

To answer this, the authors will discuss how recent advances in Dante could be used to allow us to connect over much greater distances when coupled with increases in internet connection speeds. They will also look at how real-time networked audio can supplement AVID’s cloud-based Pro Tools project workflow to allow real-time music production over large distances.

In addition to considering technical issues, this presentation will report the findings of a series of case-studies based on recording and performance sessions taken place over distance in real-time. Feedback from musicians, comments from participants, observations, alterations and workflow considerations will be collated, analysed and presented with regard to the experience. The perspectives of musician, engineer and producer will be considered in relation to the current state of real-time distance recording and performance, assessing its validity and practicality in real-world music industry applications at present, and where this may lead in the future.

Tim Hughes, United Kingdom, University of West London

Individualised Music: Todd Rundgren's Interactive Album, No World Order.

This essay examines one of the most ambitious and forward-thinking projects in the career of Todd Rundgren: his 1992 'interactive album' *No World Order*. Since 1967, Rundgren has combined artistic and commercial success with important innovations in many different roles in the music industry. As an artist he has released 357 original songs over 41 studio albums, all of which he produced and engineered. He was also a staff engineer at Bearsville Studios, produced albums for over 60 artists, composed for numerous films and television shows, and made key contributions to the development of video, music video, computer graphics, computer animation, and internet distribution. This resulted in honors such as the BMI Music Award, the Les Paul Award, and selection as a finalist for the Rock and Roll Hall of Fame. Yet *No World Order*—largely disregarded by critics at the time and a commercial failure—stands as one of Rundgren's most impressive achievements.

No World Order is a coherent, album-length piece of popular music over which the listener has an unprecedented level of control. It is a CD-ROM with 933 digital segments of electronic music. The segments were designed to be repeated extensively and recombined in almost any order. Rundgren used a rap vocal style because conventionally sung vocals were more difficult to cut, splice, and reorder. He also hired producers Jerry Harrison, Don Was, Hal Willner, and Bob Clearmountain to create different "programs" (i.e. remixes) from the same segments. Each segment was then assigned values for seven different parameters, or "flavors": Program, Direction, Form, Tempo, Mood, Mix, and Video. Rundgren and programmer Aaron Levine then wrote an interface giving the user control over the center point and width of a range of values for each parameter. They also created 'an intelligence that would select clips automatically...' and wrote 'algorithms for gaussian randomization' (Rundgren, 2018) so that the program would assemble music in diverse ways based on the listener's choices—either in advance or on the fly.

No World Order was created for the Phillips CD-i system and later ported to the IBM and Macintosh operating systems. It combines two of Rundgren's longstanding interests as a musician: audience participation and collage. His use of interactivity has always been oriented toward allowing his audience some control over his music, and No World Order was developed with precisely that goal in mind: 'Much of what Rundgren has done since the late 1980s has pushed the boundaries of the artist-audience relationship, in the search for greater interactivity.' (Tingen, 2004) However, it was unsuccessful for several reasons, including the failure of Phillips' CD-i format, the use of rapped vocals by a white rock musician known for his melodic writing, the numerous difficulties with Rundgren's subsequent 'interactive' tour, Rundgren's rebranding of himself as 'TR-i', and the unfamiliarity of listeners with interactive technology. After discussing the history, nature, and reception of No World Order, I conclude this essay with a discussion of what we can learn from it about music, interactivity, and innovation.

Andy Farnell, United Kingdom

Cyber-security in the creative industry: Why Radiohead got hacked

The creative digital arts, comprising the film, game and music, have mostly been able to ignore computer security threats. Historically, professional music and media production has used dedicated equipment, processors, consoles, synthesisers, effects racks, and transcoders.

Production processes have been mostly offline, personal or built around the small production company. This made us marginal targets, comprising low value assets against which it was hard or impossible to find exploits. But the past decade has seen production process move online, become collaborative, distributed and built around commodity general purpose networked computing, using audio and video over IP and complex asset management databases. Starting with the 2014 Sony hack a series of high profile incidents are bringing the vulnerability of creative industries into sharper focus. In this presentation we discuss the relation between cybersecurity and creative practices, discuss threats and motives, and offer some defensive thinking.

Digital scenographies of contemporary music: between didactics and spectacularization

By rejecting the notion of polarized notes as well as that of clear pulsation, contemporary music of 20th century scholarly tradition has experienced, for about fifty years, a rupture with the public that has never been seen before in the history of music. In response, the young generation of composers seems to us today to want to affirm with vigour a new path, driven by the desire to compose complex, demanding, adventurous music, without however giving up on opening up to new and wider audiences.

This double requirement results in a reformulation of two aspects of their work: one aesthetic, the other communicative: The aesthetic dimension is played out in the continually redefined relationship between scholarly and popular arts as well as in the multiple influences, hybridizations, mutations favoured, throughout the 20th century, by storage and distribution media and multiplied today by digital dematerialization and the Internet. The communicational dimension concerns how to rethink the relationship between contemporary music and audiovisual media (video, radio, press, etc.) and more particularly the possibilities offered by digital image and sound technology to reformulate the situation together.

Today, several international ensembles (such as Nadar Ensemble, Decoder Ensemble, PlusMinus Ensemble, Ensemble Intercontemporain) take into account this dimension of digital scenography, offering composers creative and technical support in this field. This staging is in fact a mediation that facilitates the work's access to the public, which is now entirely part of the work (according to Antoine Hénion's analyses defining music as a sum of mediations). This mediation can have pedagogical and/or performance dimensions that underlie a redefinition of "musical". Indeed, we see the emergence of new forms of multi-modal works where the relationships between the different modalities (image, sound, gesture, text) are continually being re-examined. Thus, in some cases, the image or spectacularization can take precedence over the music and become a screen to listen to and in others facilitate and explain it. Using the examples analysed, we will propose the following typology of digital scenographies: - Visual scores: "Vermont Counterpoint" (Steve Reich, Jason Freeman, 2007)

- Process visualizations: "Piano/Video Phase" (Steve Reich, David Cossin, 2008)
- Gestural revolution: "Generation Kill" (Stefan Prins, Nadar Ensemble, 2012), "Exit to Enter" (Michael Beil, Nadar Ensemble, 2013)
- Games on the lights: "Codec Error" (Alexander Schubert, Ensemble Intercontemporain, 2017)

Stefan Lalchev, Paul Oliver, United Kingdom, University of West London

The Role of Contests and Talent Shows in the Artist Development within the Popular Music Genre and Their Place in the Music Business

“The development of musical talent and expertise is a topic that has a decades-long research history” (Petersen, 2017), but in the context of today’s music industry environment, it has become clear that “It’s not so much about ‘art’ anymore, rather than ‘content’” (Gonneau, 2011). Nowadays, the talent development is left in the hands of the artist himself, who in order to build a successful career needs to start gaining experience and build a fan base as early as possible.

One way of achieving that is through taking part in talent shows and contests, however, despite that such concepts have been investigated by researchers on many occasions, so far no research has managed to determine the right place for these projects in the artist development, and how they affect the process. Furthermore, from an entrepreneurial perspective, researchers have not really investigated such concepts in terms of the inter-relation between their supportive role and their potential to become a viable form of business.

Through structured qualitative interviews conducted with both talent show contestants and contest organisers, along with a self-reflective analysis inspired by autoethnography, this study aims to define the role of live contests and talent shows in today’s music industry. By examining the question from all relevant perspectives, the study establishes that not only contests and talent shows have a specific and very important role in the artist development, but also, by truly supporting young talents, and with a well-developed long-term strategy, such concept could also become a profitable, high-quality business.

Voice Activation in Music Consumption: How consumers use the technology today and will tomorrow

The power of speech technology lies within its convenience to operate smart devices like smart speakers or smart home appliances, so called Internet of Things, by just using the natural, spoken word. Smart speakers are the first crucial and tangible development towards a voice era. The market is constantly growing. According to Deloitte, in 2018, they are the quickest-developing connected device category globally. On holiday season 2017 and 2018 sales figures exploded leading to an adoption of 26.2 % U.S. inhabitants (global market leader) owning at least one device. The underlying potential of these devices is not the speaker, the device itself, it is its voice assistant, the speech interface, that will move beyond smart speakers into various device categories to enhance their operation. Voice Assistants are now installed in over one billion devices worldwide (Voicebot, 2019). The state of literature showed, that smart speakers and their voice assistants are already sustainably integrated into people's everyday lives using simple tasks like "Alexa, what's the weather like today" or "Hey Google, set a timer for 5 minutes". Especially the music industry expects music consumption to rise due to the convenience of voice activated music consumption by just saying "Alexa, play songs from the 80s" instead of operating an app or a smart device by typing. Music listening is also the most common and favoured use case on smart speakers.

To find out how people interact and use music on smart speakers and therefore voice assistants to estimate the actual potential of voice interfaces for the music industry, an empirical study was made. To gather holistic consumer data, a mixed method included as well as a quantitative questionnaire as in-depth interviews with an equal weight of both data types and a concurrent data collection. Both data types complemented each other and were consistent with the state of research in the sense of triangulation, offset and completion. Passive and active consumer behaviour (voice apps) as well as attitudes and opinions in regard to music consumption have been studied. In addition to that the actual potential of voice interfaces for the music industry has been critically reflected. The attention also focused on the active interaction with the artist as a person, that is not seeable through voice interfaces.

Concrete and in-depth data on voice activated music consumption has not been gathered before, what stresses the importance of this empirical study. The data revealed, that consumers today mainly apply simple use cases in general and when engaging with music. As a plain voice interface has limited output functionality compared to graphical interfaces, a more complex application and therefore enabled active interaction with music and the artist behind it, conversational interfaces and artificial intelligence is needed to overcome this limitations. At the end, this dissertation serves proof, that voice will be adopted by the customer in the future and consequently plays a role for the music industry as an added channel to bring music to customers.

Yannis Iliopoulos, United Kingdom,

The application of Gift Economy to the Administration of Intellectual Property in the Creative Industries

The current debate on the devaluation of music, fuelled by the royalty micro payments generated by streaming, is usually perceived as the primary issue in the music industry, but it may be steering the public opinion to the wrong direction. Although monetisation gets all the attention in media as the primary struggle of a new artist today, arguably, there is another layer of complexity, which is not being acknowledged equally; the assignment of intellectual property from the author (creator) to a third party (investor).

There are currently new business models developed by platforms/companies who distribute music and administer rights, which are moving away from the model of assignment of intellectual property, clearly aiming to eliminate the implications of the change of the ownership chain. However, there is also an alternative business model to administer and monetise intellectual property, which appears to be yet unexplored from the investor's point of view: Gift Economy.

Gift Economy, is commonly applied from the creator's point of view, as a critical part of the initial phase of their artist development (free downloads, free streaming, free gigs, free merch etc). Unsurprisingly, the businesses and investors, who exploit or administer intellectual property are not interested in embracing this model.

My research explores whether Gift Economy could attract interest from an investor's point of view, by testing whether it can be a valid and effective model for monetising services provided by businesses to artists and creators.

Marques Hardin, United States, Anglia Ruskin University, Rob Toulson, United Kingdom, RT Sixty Ltd

Music Production utilising Internet of Things Technologies

The Internet of Things introduces a paradigm of ubiquitous, interconnected devices that freely communicate and exchange data worldwide utilising the internet and widespread computing networks. This architecture has delivered major commercial impacts in areas such as smart houses and enterprises, healthcare, industrial and manufacturing, and many others by helping improve productivity, accessibility, and engagement with remote systems. Creative applications for IoT, however, have yet to see substantial evaluation in mainstream research, and music production is one area in particular that presents growing opportunities from an embedded IoT architecture.

Modern music production practices are largely driven by digital software applications. Many music producers, however, enjoy and may sometimes prefer the unique and non-linear characteristics of physical and analogue hardware. IoT can help maintain physical and analogue production practices that are becoming lost or disappearing in modern productions by allowing hardware music systems to be interconnected and remotely accessible through the internet. This inherently gives hardware the ‘best of both worlds’ benefits of analogue attributes and digital accessibility, and encourages the concept of the ‘virtually-extended music studio’ where rare, bespoke, and professional devices can be remotely engaged through virtual computing networks from within a personal working environment. Additionally, this can give greater value to under-utilised devices that are physically hard to access and even incorporate unique acoustic spaces into real-time production scenarios as interconnected reverb and echo chambers.

This academic investigation explores how novel implementations of IoT can impact on music production practice, facilitating collaboration through the utilisation of remote musical resources that can augment modern production techniques and workflows. Through the incorporation and practice-based development of an IoT-enabled music system, this research examines, evaluates, and reviews existing, open IoT technologies that can promote meaningful engagement with hardware devices. The research utilises the developed system to obtain targeted qualitative feedback from recognised music producers, identifying unique opportunities and concerns that IoT-enabled music production can provide. The results of this research identify new forms of engagement and collaboration granted to musical practitioners using networked music systems, and discusses how IoT can provide greater options to express music through non-traditional techniques, as well as establish new markets for the hire and distribution of production equipment.

MAPS

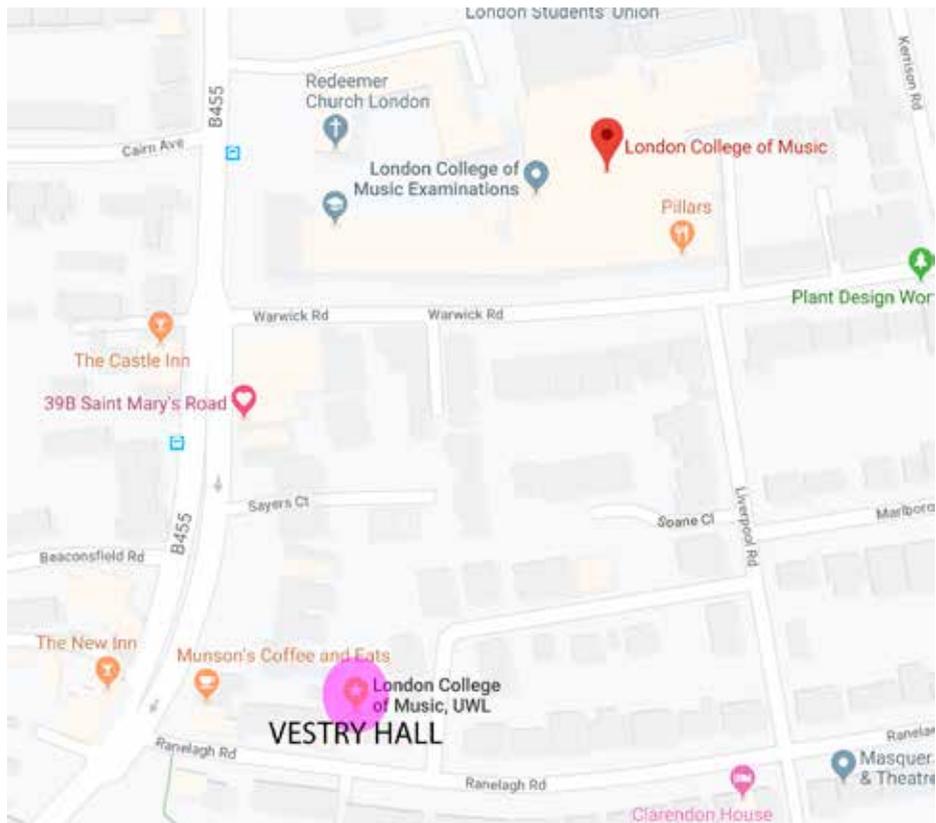


Key

1. St Mary's Road reception
2. Dr William Barry Theatre
3. William Brake Student Services Centre
4. Academic Schools Administration Centre
5. Paul Hamlyn Library
6. UWL Students' Union
7. Weston Hall
8. Lawrence Hall

- Black icons: Food outlets
- Blue icons: Bus stops (Public and UWL shuttle bus)

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Dr Nikos Stavropoulos – Leeds Beckett University

Professor Rob Toulson – University of Westminster

Equality and Diversity

All involved in the organisation of Innovation In Music are committed to encouraging fairness, equality and diversity throughout our event, in terms of the organisational structure, the invited participants and in the encouragement of presenters and paper authors. We welcome anyone interested in the conference themes to engage with us and join us in building a sustainable conference that can represent all corners of the music related industries.

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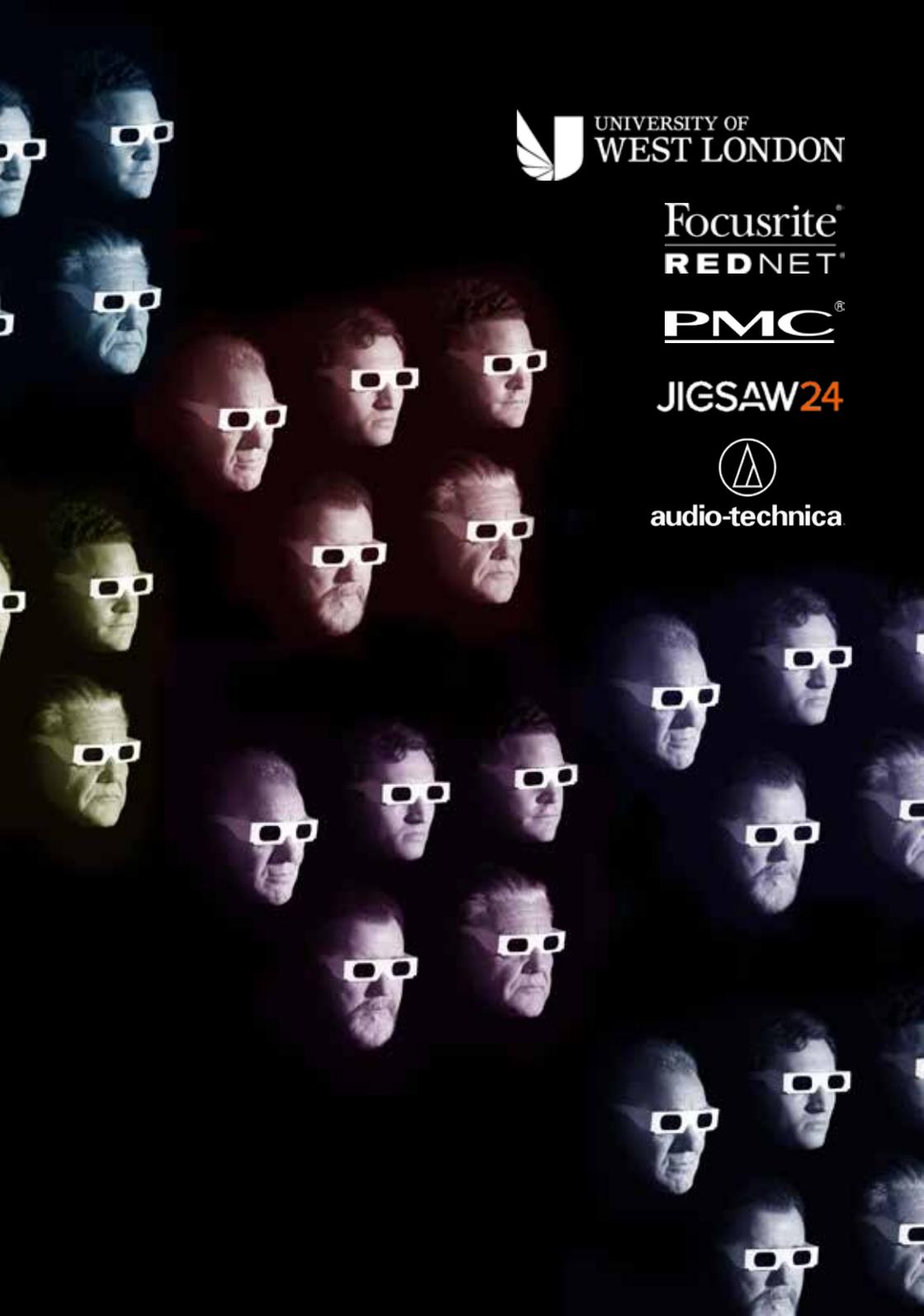
Conference Venue

University of West London

St Mary's Rd
London
W5 5RF
UK

London College of Music is a school within the University of West London. It holds a rich connection with London's diverse music industries, and is situated in the busy creative hub of Ealing.

London is at the heart of the UK and Europe's music industry, providing a thriving network of creative artists and technology innovators, as well as being the focal point of the music industry's business economy. Being hosted in London enables some of the world's most innovative individuals and organisations to engage with the conference and share discussions around innovation in music.



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