New hardware/software enhancements of performers and their instruments

Dr Zubin Kanga
Three Symbiotic Strands of Research

- **Artistic Research**
  - New works created by teams of leading artists and technology researchers and industry partners

- **Technological Development**
  - New extensions and applications to the technologies used by the industry partners

- **Ethnographic, Analytic and Critical Perspectives on Innovations**
  - Publications drawing together research on the process of collaborative creation of new works, analysis of the new works and their technological interactions and critical perspectives on groups of the works and their relevance to wider trends in music.
Industry Partners across a range of technologies including:

- **ANT Neuro**: Global leader in EEG and EMG brain-scanning devices.
- **Plux**: Biosignal sensors for medical and artistic use.
- **Mi Mu**: Sensor-gloves with multiple motion sensors.
- **Austella**: Virtual Reality and Video Game developers, specialising in immersive visuals.
- **ROLI**: Touch-sensitive keyboards and surface controllers.
- **Air Sticks**: Motion sensor activated drumsticks for virtual percussion playing.
- **Sense/Stage**: Wireless Sensor Infrastructure for Live Performance and Interactive, Real-Time Environments.
- **TouchKeys/Bela**: A range of new hyperinstruments
- **Gestrument**: Gesture-musical control interfaces for use with motion capture.
- **Soundbrenner**: Wearable haptic metronomes that can be programmed and networked.
- **59 Productions**: Design studio and production company, specialising in large-scale theatrical and public art technology.
Music Technology Researchers

- Chris Melen and PRiSM (Royal Northern College of Music)
- Andrew McPherson (Queen Mary, University of London)
- Atau Tanaka (Goldsmiths, University of London)
- Thor Magnusson (Iceland University of the Arts)
- Eduardo Miranda (University of Plymouth)
- Christiane Neuhaus (University of Hamburg)
Workstreams

- Extending the Body (eg. motion sensors)
- Remaking the Old (eg. analogue synthesizers)
- Video-Body Interactions
- Hyperinstruments (eg. new hybrid digital/acoustic instruments)
- Music and Virtual Reality
- AI and New Human Computer Interactions
- Internet and Mobile Interactivity
- Hybrid Installation Works
- Hybrid Staged Works
Performing WIKI-PIANO.NET
## WIKI-PIANO project (2018-2020)

<table>
<thead>
<tr>
<th>21 Performances Including:</th>
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<tr>
<td>Huddersfield Contemporary Music Festival</td>
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<td>Podium Festival (Esslingen)</td>
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<td>Resonator Festival (Sweden)</td>
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<td>Tura New Music (Perth)</td>
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<td>The Cube (Graz, Austria)</td>
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<td>Cambridge Music Festival</td>
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- Internet-based score with 25,974 edits by 868 unique users.
- Articles in *Leonardo* and *Tempo*
- 2 conference papers: **Tracking the Creative Process in Music Conference** (Lisbon 2019) and, **Getting it Right: New Music, New Technologies conference** at Guildhall, co-presented with the LSO (2019).
- International Media attention in the Times, BBC World Service, BBC Radio 3, GDR Radio, WDR Television, Limelight Magazine, Sydney Morning Herald...
Taking the Auspices by Ben Carey (live 3D animation and live electronics)
Novel Piano by Kate Neal (with stop motion animation) and Rhythm City by Tristan Coelho
More of *Rhythm City* by Tristan Coelho at Kings Place, London
Scorsese Etudes by Nicole Lizée (using manipulated films of Martin Scorsese)
David Lynch Etudes by Nicole Lizée
Hammerklavier by Michael Finnissy/Adam de la Cour (L)
And Heart of Glass by Alwynne Pritchard (R)
At London Contemporary Music Festival
AI and Machine Learning
Historic Approaches to live AI interaction in music

- George Lewis’ Voyager system
- IRCAM’s OMax system
- François Pachet's Continuator
- Oliver Brown’s Zamyatin system
Voyager therefore amounts to an improvising musical assemblage that “incorporates a dialogic imagination”; the mode of interactivity that it embodies is grounded on “negotiation, difference, partial perspective”… In a reflexive and parodic anthropomorphism, Lewis has designed into the system a quasi-human agency and subjectivity replete with expressive powers, an aesthetic imagination, and a capacity for intersubjective negotiation, while all of these are taken to be fuelled by a machinic ‘experience’ of alterity.

Benjamin Carey is a Sydney-based composer, improviser and educator. He makes electronic music using the modular synthesiser, develops interactive music software and creates audio-visual works. Ben’s research and practice is concerned with musical interactivity, generativity and the delicate dance between human and machine agencies in composition and performance.

Ben completed a PhD in interactive musical composition at the University of Technology Sydney in 2016, and is currently Lecturer in Composition and Music Technology at the Sydney Conservatorium of Music, University of Sydney.
_derivations (2013)
ZK: It needs enough material of the same type to make each type of material work.

BC: It’s funny isn’t it. It’s something that has no form built into it but the way that that sampling works kind of enforces a way of dealing with its capacity. You realise that if you give too much too soon or do too much crazy stuff too soon, it limits your formal trajectory.

and later, in an interview:

BC: The software is agnostic towards material - completely. Its analysis is based on spectral characteristics across a phrase... so, although it won't 'match' a melody, it can relate the timbre of the input to anything similar in its database. So when other musicians have performed with it, they have explored a range of traditional and extended techniques in order to see how the matching would work. When matching using a pre-defined database, a saxophone player has tried to coax out percussive sounds from the database using key clicks and slap tongue (Joshua Hyde), whilst a recorder player using the live sampling approach has set up contrapuntal gestures using breathy articulations followed by sustained tones (Alana Blackburn).

Performance of _derivations by Ben Carey by Joshua Hyde (saxophone): “buoyancy”
I think software like this influences and constrains less than it directs and controls performers. The mode in which you were working definitely influenced your structural choices. You knew that you could nudge the software in a certain direction over time, creating a formal arc for your performance. Although this might sound like a form of performer control, I think it's actually a type of interactive constraint on the possibilities of the performance. The synthetic 'shadowing' of your sound also brought out a tendency to explore in a limited harmonic space. I have observed other performers setting up these kinds of structures using this performance mode, for sure.

– Interview with Ben Carey, 29 May 2015
The musical text is, in effect, the boundaries and constraints of such a human-machine musical interaction as influenced by the machine’s perceived capabilities. Navigating these possibilities in a truly interactive sense is the task laid out for the musician. Interpretation can therefore be characterised as the navigation a space of potential relationships between human and machine agency, a context envisaged and brought forward by a system developer to a live performance context.

ZUBIN KANGA

Benjamin Carey  //  _derivations

[piano & electronics]
ZUBIN
KANGA
PIANO EX MACHINA
Future Projects with PRiSM

- Machine Learning for Composition
- Long-term process rather than live interaction: 75-100 generations over 10 days.
- More sophisticated and controllable sonic outputs, but these are then fixed for use in live performance (although other types of interaction using these audio tracks is possible.)
Beethoven 32 Piano Sonatas Reimagined

Sensor-based Instruments
Patrick Nunn completed his PhD at the Royal Academy of Music in 2009. He studied with Simon Bainbridge and Jonathan Harvey and held the position of Hyperbow Researcher producing two important works for the technology. His wide range of instrumental and electro-acoustic works have received numerous awards including *Pareidolia I* for bass clarinet, electronics and sensors (Sonic Arts category, 2012), the most recent of six shortlisted works and one winning work in the British Composers Awards.

His collaborators have included the BBC Concert Orchestra, National Youth Orchestra of Great Britain, Kreutzer Quartet, Thalia Myers, Piano Circus, Icebreaker, Ballet Rambert, and Gogmagogs. He is currently Lecturer in Composition at the Royal Academy of Music. His music is published by Cadenza Music and by the ABRSM and appears on the NMC, Red Sock and SFZ record labels.
I want to avoid too much of a one-to-one interaction, but then you lose the controllability. There’s a fine dividing line.

Patrick Nunn (workshop 23 April 2014)
The saying should be “Never work with children, animals and Max/MSP”
– Patrick Nunn (7 November 2013)
One thing I want to explore is this idea of influence. So you’re already in a transformation but your movements can nudge it in certain directions. So although you have control, the control is only nudging the cycles of the process. Otherwise if you just use the electronics and you do something [gesturing] and oh look, you’re changing the sound, you’re changing the dynamics. It’s a little crass. I think it’s more exciting if you can set it up where you don’t quite know what the end result is going to be. It’s more like pushing something along a path. Nudging it forward rather than picking it up and putting it from side to side.

– Patick Nunn (workshop, 7 November 2014)
Morphosis for piano, live electronics with sensors (2014)
Details of sensor-Max/MSP relationship

PRESET 1 (Start of score)

Granbuffer 1+2
LEFT: (s1) BACK/DOWN>FORWARD/UP – Scans playback position (start>end)
LEFT: (s3) CENTRE>LEFT or RIGHT – Decrease position randomness
RIGHT: (s4) BACK/DOWN>FORWARD/UP – Increases pitch randomness
RIGHT: (s6) CENTRE>LEFT or RIGHT – Decrease grain duration

Harmoniser 3
BOTH: (s3+s6) CENTRE>LEFT or RIGHT – Increases amplitude independently

Comb filter
BOTH: (s2+s5) LEFT to RIGHT – Increases mod freq independently
BOTH: (s1+s4) BACK/DOWN>FORWARD/UP – Increases amplitude independently
**Preset 7** (Page 4, 3rd system, double bar line)

**Granbuffer 1+2**

**LEFT:** (s1) BACK/DOWN>FORWARD/UP – Scans buffer 1 playback position (start>end)

**RIGHT:** (s4) BACK/DOWN>FORWARD/UP – Scans buffer 2 playback position (start>end)

**LEFT:** (s3) CENTRE>LEFT or RIGHT – Decrease buffer 2 position randomness

**RIGHT:** (s6) CENTRE>LEFT or RIGHT – Decrease buffer 1 position randomness

**LEFT:** (s1) FORWARD/UP >BACK/DOWN – Increases buffer 2 pitch randomness

**RIGHT:** (s4) FORWARD/UP >BACK/DOWN – Increases buffer 2 pitch randomness

**LEFT:** (s3) CENTRE>LEFT or RIGHT – Decrease buffer 1 grain duration

**RIGHT:** (s6) CENTRE>LEFT or RIGHT – Decrease buffer 2 grain duration

**Harmoniser 1**

**BOTH:** (s1+s4) FORWARD>BACK – Increases amplitude independently

**Harmoniser 2**

**BOTH:** (s2+s5) CENTRE>ROLL OUT – Increases amplitude independently

**Harmoniser 3**
There’s more movement from your hands than I imagined. There are moments when there was lots of gesture stuff going on, when I need to restrict the movement that the computer senses. At the moment it’s going right off the spectrum and coming back.

–Patrick Nunn (14 May 2014)
Jon Rose

A polymath, he is as much at home creating large environmental multimedia works, performing improvised music, inventing musical instruments (such as the interactive MIDI bow), creating radiophonic works, writing cultural criticism, as he is playing the violin on a concert stage. Central to this practice has been 'The Relative Violin' project, a unique total artform and output, rich in content, realising almost everything on, with, and about the violin and string music in general. Most celebrated is the worldwide Fence Project; least known are the Relative Violins created specifically for and in Australia. In 2016, after decades of sporadic existence in Europe, his own violin museum 'The Rosenberg Museum' was finally exhibited in Sydney under the rubric 'The Museum Goes Live'.

Jon Rose has worked with the Kronos String Quartet, John Zorn, Derek Bailey, Butch Morris, John Cage, Joel Ryan, Peter Kowald, Borah Borgmann, Tristan Honsinger, Mari Kimura, the Soldier String Quartet, Borah Bergman, Sainko, Tristan Honsinger, Tony Oxley, Cor Fuhler, Steve Beresford, Eugene Chadbourne, Bob Ostertag, Malcolm Goldstein, Jim Denley, David Moss, Miya Masaoka, Barre Phillips, George Lewis, Gunter Christmann, Misha Mengelberg, Elliott Sharpe, Elena Kats-Chernin, Christian Marclay, Richard Barret, Gerry Hemingway, Pierre Henry, Ilan kov, etc
Steel on Bone
New hardware/software enhancements of performers and their instruments

Dr Zubin Kanga