New hardware/software enhancements of performers and their instruments

Dr Zubin Kanga

UK Research and Innovation

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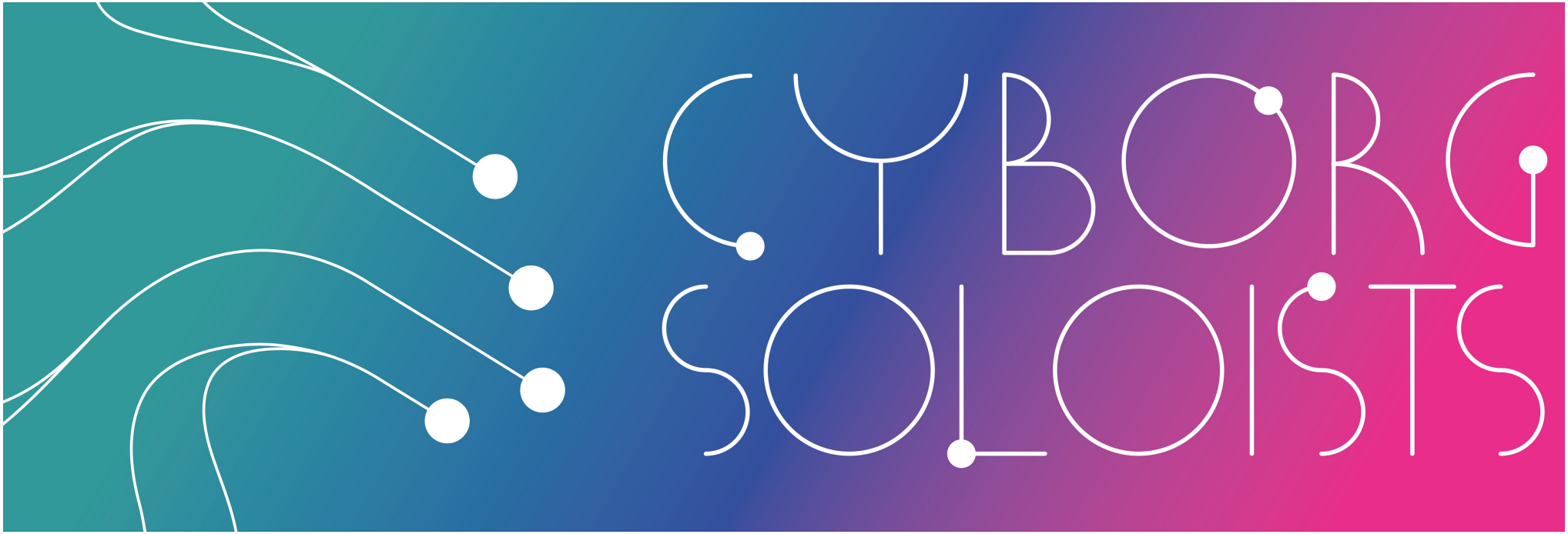
CYBORG
SOLOISTS

Three Symbiotic Strands of Research

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- **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

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

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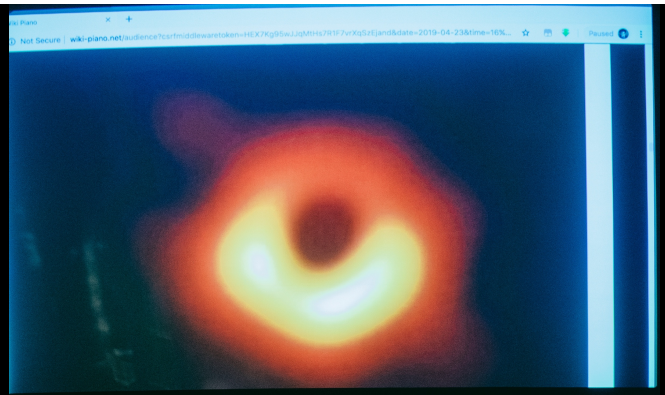
- Chris Melen and PRiSM (Royal Northern College of Music)
- Andrew McPherson (Queen Mary, University of London)
- Atau Tanaka (Goldsmiths, University of London)
- Thor Magnusson (Iceland University of the Arts)
- Eduardo Miranda (University of Plymouth)
- Christiane Neuhaus (University of Hamburg)

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)

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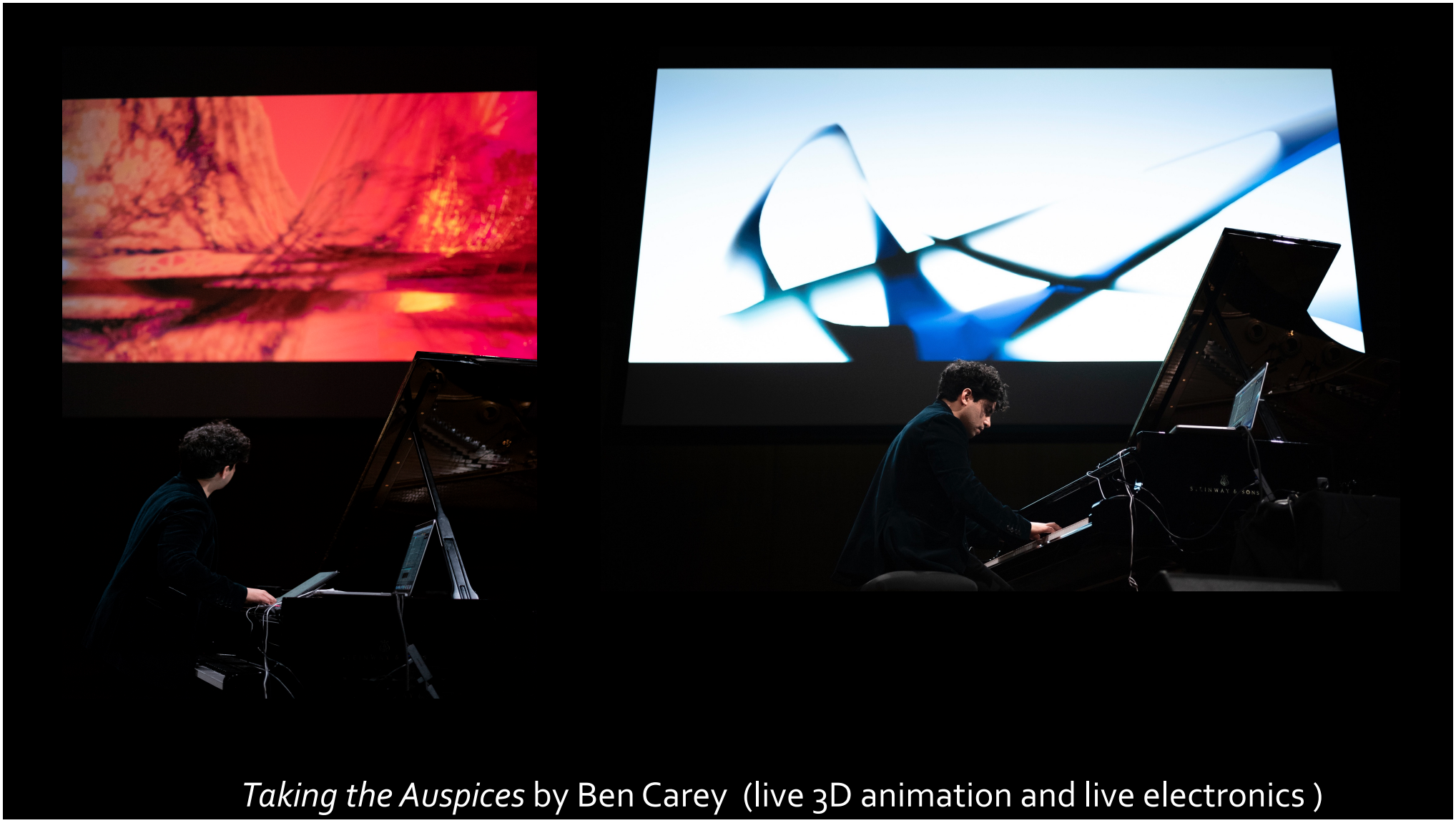
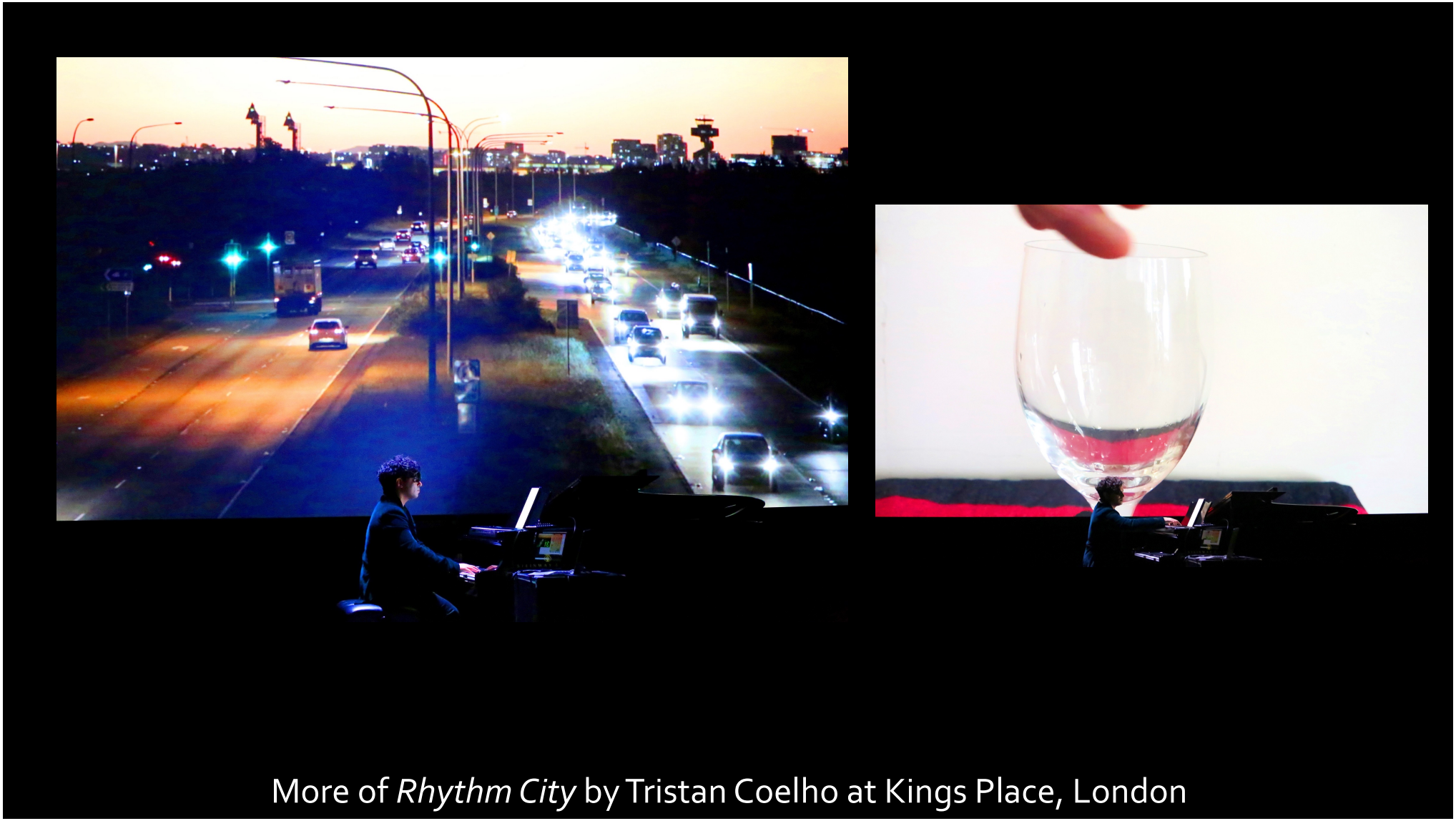
21 Performances Including:	
Huddersfield Contemporary Music Festival	Klang Festival (Copenhagen)
Podium Festival (Esslingen)	Darmstadt Summer Courses
Resonator Festival (Sweden)	Southbank Centre (Melbourne)
Tura New Music (Perth)	Nonclassical (London)
The Cube (Graz, Austria)	November Music (Den Bosch)
Cambridge Music Festival	Upcoming: Dublin, Rotterdam, Berlin, Reykjavík

- 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

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Historic Approaches to live AI interaction in music

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- 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 negotation, while all of these are taken to be fuelled by a machinic 'experience' of alterity.

– Georgina Born on George Lewis' Voyager (1995), writing in Georgina Born: "Digital Music, Relational Ontologies and Social Forms", *Bodily Expression in Electronic Music, Perspectives on Reclaiming Performativity*, ed. Deniz Peters, Gerhard Eckel and Andreas Dorschel, 2012.

Ben Carey

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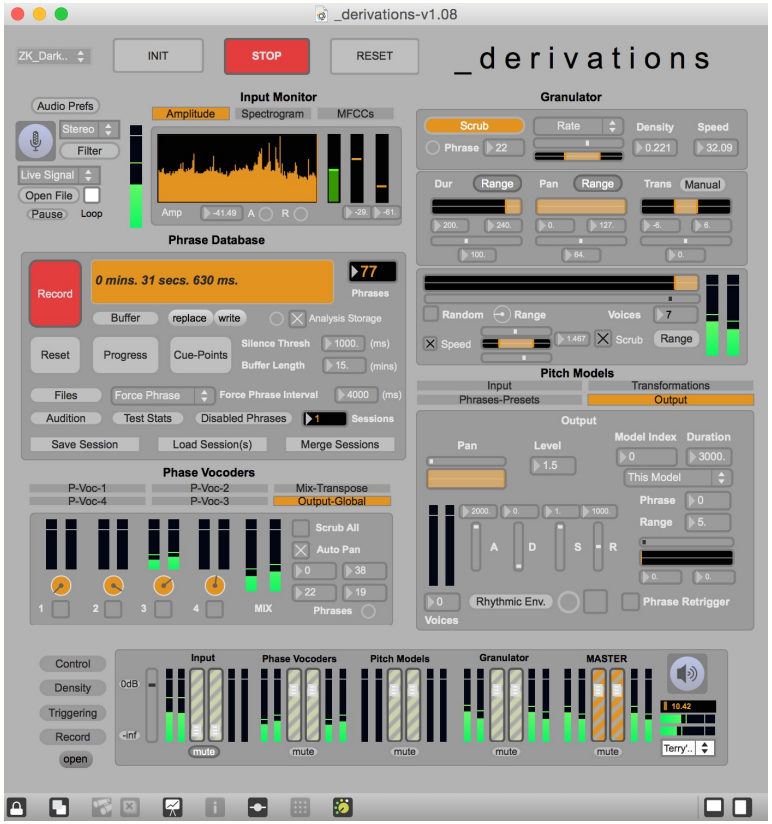
Benjamin Carey is a Sydney-based composer, improviser and educator. He makes electronic music using the modular synthesiser, develops interactive music software and creates audio-visual works. Ben's research and practice is concerned with musical interactivity, generativity and the delicate dance between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

– Workshop recorded, 30 April 2015 and interview with Ben Carey, 29 May 2015.

Performance of _derivations by Ben Carey by Joshua Hyde (saxophone): “buoyancy”

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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

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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.

– Ben Carey, "Interpretation in human-machine improvisatory performance" (blog post), 2015.

ZUBIN KANGA

Benjamin Carey // _derivations

[piano & electronics]


ZUBIN
KANGA
PIANO EX MACHINA

Future Projects with PRiSM

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- 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

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https://soundcloud.com/user-922563269/sets/beethoven-32-piano-sonatas-mu-law-quantisation

Sensor-based Instruments

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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.

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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)


SONS

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The saying should be “Never work with children, animals and Max/MSP”

– Patrick Nunn (7 November 2013)

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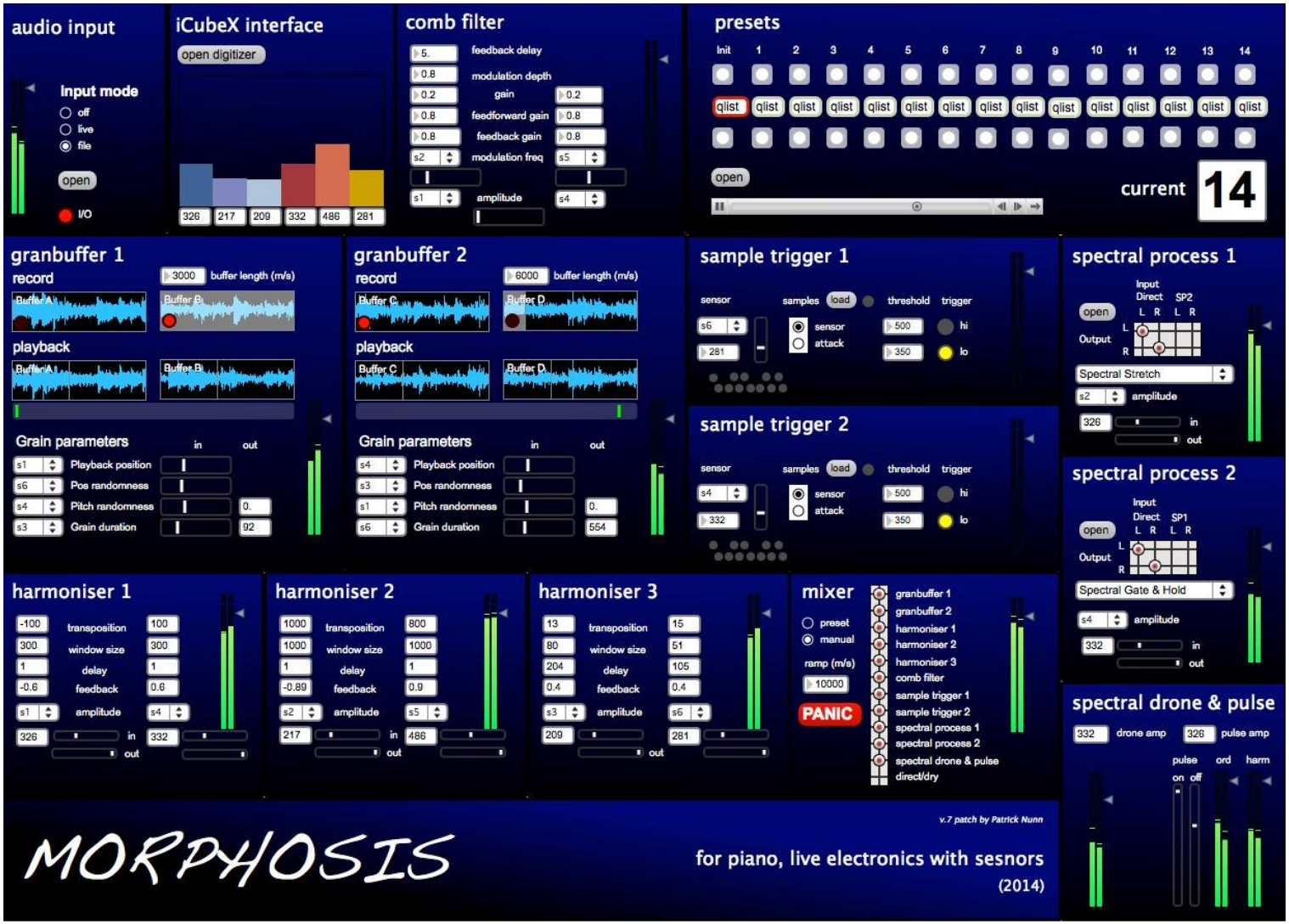
One thing I want to explore is this idea of influence. So you're already in a transformation but your movements can nudge it in certain directions. So although you have control, the control is only nudging the cycles of the process. Otherwise if you just use the electronics and you do something [gesturing] 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)


audio input
Input mode
off
live
file
open
I/O
iCubeX interface
open digitizer
326
217
209
332
486
281
comb filter
feedback delay
modulation depth
gain
feedforward gain
feedback gain
modulation freq
amplitude
presets
Init
1
2
3
4
5
6
7
8
9
10
11
12
13
14
qlist
open
current
14
granbuffer 1
record
buffer length (m/s)
Buffer A
Buffer B
playback
Grain parameters
in
out
Playback position
Pos randomness
Pitch randomness
Grain duration
granbuffer 2
record
buffer length (m/s)
Buffer C
Buffer D
playback
Grain parameters
in
out
Playback position
Pos randomness
Pitch randomness
Grain duration
sample trigger 1
sensor
samples
load
threshold
trigger
sensor
attack
hi
lo
sample trigger 2
sensor
samples
load
threshold
trigger
sensor
attack
hi
lo
spectral process 1
Input
Direct
SP2
L R L R
open
Output
Spectral Stretch
amplitude
in
out
spectral process 2
Input
Direct
SP1
L R L R
open
Output
Spectral Gate & Hold
amplitude
in
out
spectral drone & pulse
drone amp
pulse amp
pulse
on off
ord
harm
harmoniser 1
transposition
window size
delay
feedback
amplitude
in
out
harmoniser 2
transposition
window size
delay
feedback
amplitude
in
out
harmoniser 3
transposition
window size
delay
feedback
amplitude
out
mixer
preset
manual
ramp (m/s)
PANIC
granbuffer 1
granbuffer 2
harmoniser 1
harmoniser 2
harmoniser 3
comb filter
sample trigger 1
sample trigger 2
spectral process 1
spectral process 2
spectral drone & pulse
direct/dry
MORPHOSIS
v.7 patch by Patrick Nunn
for piano, live electronics with sesnors
(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

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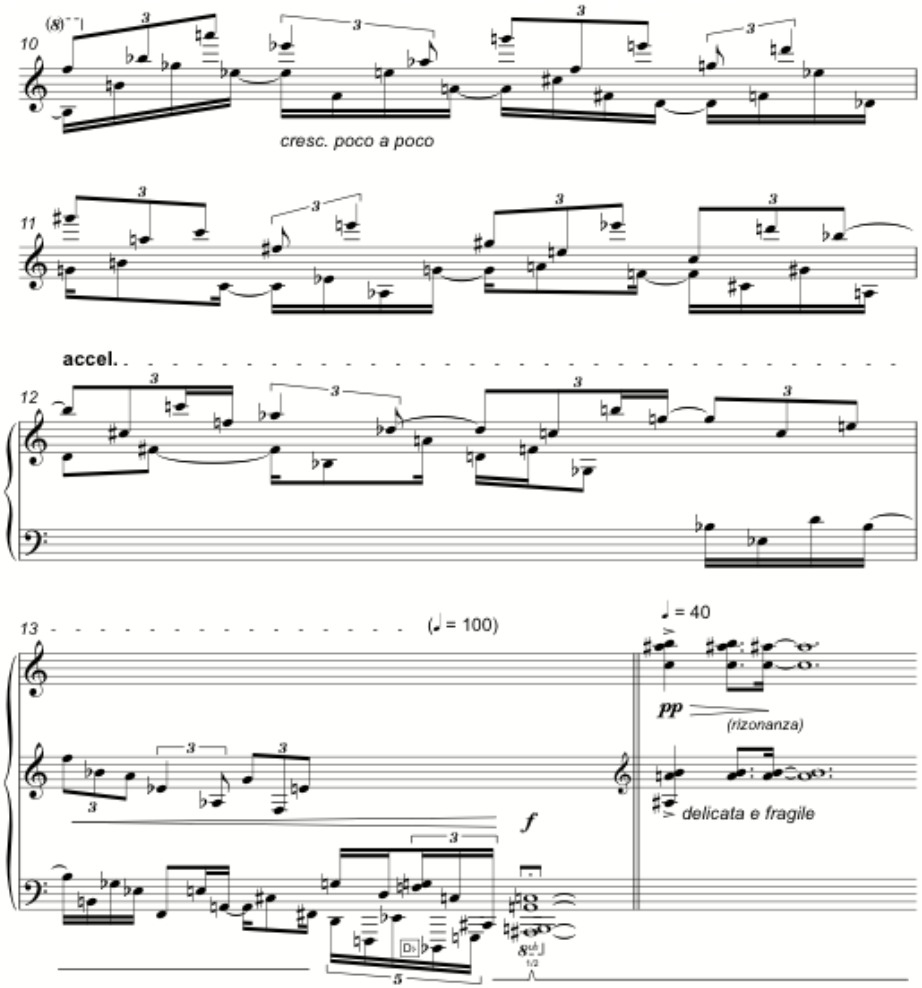
There's more movement from your hands than I imagined. There are moments when there was lots of gesture stuff going on, when I need to restrict the movement that the computer senses. At the moment it's going right off the spectrum and coming back.

–Patrick Nunn (14 May 2014)


10
(8)
cresc. poco a poco
11
accel.
12
13
(♩. = 100)
♩ = 40
pp
(rizonanza)
delicata e fragile
f
D♭
8vb
1/2
5


21
loco
f
pp
p:ff p:ff
molto sostenuto
25
loco
p
f p
ppp
p
ppp p
mp
f mp


YAMAHA

Jon Rose

A polymath, he is as much at home creating large environmental multi-media 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


STUART & SONS

Steel on Bone

New hardware/software enhancements of performers and their instruments

Dr Zubin Kanga

UK Research and Innovation

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