The Music of Science, the Science of Music
(*New Music and Multimedia meet Science: see www.australysis.com/FindOut.html*)

Program notes and participant biographies

New Acoustic and Electro-acoustic sound and multimedia works presented in conjunction with the MARCS Institute for Brain, Behaviour and Development, at its Performance Space, Western Sydney University, Milperra, Sydney, Australia. A video on the science of new music and intermedia creation and performance accompanies four videos of performances with introductions and discussions about the creative processes involved. Total duration: c 3h.

austraLYSIS members (performance, discussion):
Prof. Roger Dean (Director, Keyboards, Computer)
Dr, Sandy Evans (saxophones)
Dr, Phil Slater (trumpet)
Prof. Hazel Smith (text performer)
Dr. Greg White (Computer)

Guest artist commentators:
Dr. Felix Dobrowohl
Dr. Charles Martin
Dr. Jo Thomas (UK)

MARCS Institute for Brain, Behaviour and Development discussants:
Prof. Kate Stevens (Director)
Dr. Simon Chambers
Prof. Roger Dean
Prof. Peter Keller
Dr. Jennifer MacRitchie
Dr. Eline Smit

Sound projection and recording: Felix Dobrowohl
Live video dual-camera recording by Learning Futures, Western Sydney University:
Sam Dessen and James Trembath

Videos 1, 2, 4, 5: Works from austraLYSIS performances, with creator discussions. Video 3:Talks on the ArtsScience and ScienceArts of music creation and performance.

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Video 1: selected complete works from an austraLYSIS performance in 2018: part 1. c.49 minutes

Introductions to the project and the videos by Prof. Roger Dean and (at 4'10") Prof. Kate Stevens. c. 8minutes

At 8'40"
Remembering Louis and Cecil; linked to Ostinato, by austraLYSIS/Roger Dean (2018/1996): acoustic and electroacoustic sound; c. 14 minutes
     Remembering ... , released on austraLYSIS' 2015 album *History Goes Everywhere* (Tall Poppies), involves a literal rendering on the piano of one of Couperin's unmeasured preludes — a 17th century prototype for drastic improvisational transformation — integrated here with solo and ensemble improvisation on its materials. In 2018, in response to the death of pioneer African-American free improvising pianist Cecil Taylor, we regularly preceded this piece with a short tribute to him. These sections are followed by Roger's rhythmic/harmonic *Ostinato*, with a virtual (computer-realised) bass/drums vamp, again progressively transformed.

At 22'40:
Prof. Hazel Smith on using language with sound. c. 4minutes
At 26'20":
The character thinks ahead, by Hazel Smith (text), Roger Dean (composition, programming) and austraLYSIS (2018): AI-generated and written text (performed and displayed), speaker, acoustic and electroacoustic sound; c. 10 minutes

The spoken text of *The character thinks ahead* plays on the word 'character' and the different ways in which it is used: for example as a unit or symbol in computing or language; as a person in a play, novel or film; or as a way of describing an individual's distinctive ethical, mental and emotional qualities in relation to their behaviour. The text also grapples with what it means for the computer to think ahead during the process of text generation.

The screen displays computationally generated extensions of the spoken text and other text. In the top left-hand display panel, the generation is based on learning character associations, in the top right-hand display, word associations. In the bottom part of the screen there are three distinct elements to the display. A changing word cloud in the middle highlights features of the ongoing texts. To the left of it is a dynamic spectral visualization of a (pre-recorded) rendering of the live speech: this is live-transformed to provide a sonic output visualized spectrally on the right.

The displayed texts are generated by 'deep learning' neural nets, on the basis of prior exposure to texts. Deep learning nets consist of several layers of nodes, with multiple nodes in each: a node is a computational unit that processes incoming information (previous text) so as to learn associations and make predictions. Commonly, when the input is text, the intended prediction is either the next character or the next word. The net learns by comparing its prediction with what actually occurs. The net is only 'deep' in the sense that there are multiple layers, but with enough layers and enough information input, as in Google's Go player or Wavenet, sufficient semblance of learning can be reached that performance is impressive. Our nets are much smaller and need to be trained on a relatively small amount of input information, such that they relate to it detectably. Because of the wide range of sources on which the learning is based, the reader may find resonances of Nietzsche as well as Smith.

Hazel performs her own text, and its sound is transmuted algorithmically in real-time in the company of saxophone and piano sounds.

The piece has been developed between 2016 and 2018.

At 36'10":
Fields, by Roger Dean, trumpet: Phil Slater (2018): Premiere performance, 4-channel live electro-acoustic sound and live trumpet, c. 6minutes

This provides a series of changing and interacting sonic environments that juxtapose land and sea. The soloist (Phil Slater) creates a changing niche in collaboration with these environments. The process has relationships with ecology, and with the dispersion of biological and cultural traits and ideas.

At 42'00":
Dr. Phil Slater on improvising environments and their impacts. c. 8 minutes.

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Video 2: selected complete works from the same austraLYSIS performance in 2018, part 2. c. 35 minutes.

Prof. Hazel Smith: On considering art as polemical statement. c. 4 minutes.

At 4'00":
The Lips are Different, by Hazel Smith, Roger Dean and austraLYSIS (2018): Premiere performance, video, displayed and spoken text, acoustic and electroacoustic sound; c. 6 minutes.

The lips are different is about the case of Suaad Hagi Mohamud, a Somali born Canadian citizen. She went to visit relatives in Kenya, but Canadian officials would not let her board the plane home to Toronto because they said she did not look like her passport photo: in particular they claimed that 'the lips are different'. Though she gave convincing evidence of her identity, the Canadian authorities would not accept that

she was who she said she was and she was detained for several months. The matter was only resolved when she belatedly took a DNA test that proved she was telling the truth.

   The lips are different comprises real-time video written in the platform Jitter, improvised music, and text which is composed, sampled, and acoustically and visually processed.

At 10'40":
Dr. Sandy Evans on improvising with mutable rhythms, pitch and timbre, and introducing the next piece. c. 10 minutes.

At 21'20":
Babbles, by Roger Dean; saxophone, Sandy Evans (2018): algorithmic rhythm morphing function by Andrew Milne, for virtual instruments and saxophone; c. 6 minutes.

   Babbles uses *Xronomorph* (software conception and implementation by Andrew Milne, Steffen Herff, Roger Dean from MARCS, and others).

   Xronomorph is a novel rhythm-generating software application based on ideas of rhythmic evenness and balance operating at multiple hierarchical levels. A given level is subdivided to form the next, so that notes generally get shorter the higher the level reached. In Xronomorph there can be a continuous range of subdividing values and several different base pulse rates at each level: the normal Western subdivisions by 2 or 3 are not alone. The resultant patterns are still metrical, but in a more complex way than most. Most importantly, the software permits continuous changes in the divisor values and in pattern duration. *Babbles* exploits this potential for continuous changes to provide a rhythmic challenge and complement to the performer(s).

At 26'30":
Dr. Charles Martin on his following piece, and on creating performable environmental sound. c. 3 minutes.

At 29'50":
In the Snow Nest, by Charles Martin and austraLYSIS: Premiere, interactive sound patch, with real time video by Roger Dean and acoustic and electroacoustic sound; c. 4 minutes.

   Amongst Charles' musical outputs are several freely available apps for use in group improvisations, particularly intended for percussionists to create non-percussive sound fields. We incorporate his 'Snow' and 'Birds Nest' works in this performance, together with austraLYSIS.

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Video 3 Music Science/Arts Science (speakers from the MARCS Institute).
What can science tell us about music and intermedia art? With some brief illustrative musical examples. c. 47 minutes.

Prof. Roger Dean on practice-led-research and research-led-practice. c. 2 minutes.

At 2'00":
Prof. Kate Stevens: approaches to the science of music and dance. c. 10 minutes.

At 11'40":
Dr. Jennifer MacRitchie on how musicians use their bodies in performance. c. 6 minutes.
   Includes the *Magnetic Resonator Piano* in performance (instrument by Andrew McPherson; performer, Roger Dean; recorded by Andrew McPherson, 2012; excerpt)

At 17'20":
Prof. Peter Keller on interpersonal coordination and its impacts. c. 5minutes

At 22'30":
Dr. Eline Smit on making music with unconventional pitch systems. c. 8 minutes.
   Includes: *Bowling Along* (an improvised miniature by Roger Dean, using the Bohlen-Pierce pitch scale system:50seconds); and

Pan Pitches (excerpt: composition for continuous pitch piano by Roger Dean)

At 30'50":
Dr. Simon Chambers: audience reception and the curation of unfamiliar music. c. 6 minutes.

At 36'50":
Prof. Roger Dean on cognitive modelling, and artificial intelligence (AI) and the generation of novel music by machine learning. c. 10 minutes.
        Includes: *Musicker Plays* (generated by a machine-learned model, *Musicker*: excerpt); and
        MicroPostMinimalism by *Musicker* (guiding the responses of *Musicker* by means of the structure of its inputs)

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Video 4: selected complete works from an austraLYSIS performance in 2019: part 1. c. 32 minutes.

Prof. Roger Dean: introduction to the video and the first piece. c. 2 minutes.

At 3'20":
Louis Meets Pelog, by austraLYSIS (2019: piano, virtual piano, trumpet, saxophone and 4-channel electroacoustic sound, presented in stereo on the video); c. 7 minutes.
        We have recorded this Couperin Fantasia 7 (a so-called unmeasured prelude, from the 17th century) twice and also researched on it; a version is on the first Milperra session (Video 1). But we continue to develop new interpretations. This time, reflecting on the fact that originally the piece was heard with a tuning system that preceded our current equal temperament, and was dramatically different, we present a version including a Javanese tuning system, and an additional set of continuous pitch variations on the material.

At 10'00" :
Dr. Felix Dobrowohl introduces his piece that follows. c. 2 minutes

At 11'40":
GrinDrone, by Felix Dobrowohl (2019): Premiere, 4-channel electroacoustic sound alone; c.5 minutes)
        Many new fields of artistic endeavour have been initiated as a result of basic research work which was not originally intended for that purpose. Whilst this is more often the case for technological progress and its subsequent utilisation for creative purposes (e.g. all kinds of computer music and digital arts), new findings in the field of audio perception seem also very well suited for influencing and informing musical practice to some degree. *GrinDrone* was created in an attempt to put this principle of research-led practice into … practice. With my research focussing on miniscule timbre changes, it made most sense to go about creating a piece which could roughly be placed in the Drone (or drone-based) music genre. Its primary aim is to try to create a rather ominous soundscape, with difficult to define spatial and sonic attributes. A secondary goal is, given its main inspiration from Drone music pop-stars Sunn O))), to emphasise the physical impact of very loud, low frequency sounds. A big stretch of the overall playtime therefore focusses on comparatively low fundamental frequencies of around 50Hz.

At 17'30":
Dr. Jo Thomas (UK) introduces her electroacoustic piece, and the special opportunities within glitch music and digital sound more broadly. c. 5 minutes.

At 22'40":
Ultra Tonal, Jo Thomas (2010). Australian premiere: 2 channel sound alone. 1.Tula. 2. Ultra. 3. Shine. c. 9 minutes.
        1. Tula The meaning of the name Tula is strength. Tula exists in two worlds. One is a light-hearted phonetic pattern, which sings throughout the work. The other is an impending rhythmic world of micro sound and glitch.
        2. Ultra Ultra is the Brother of Tula. This work is an embedded world of continuum and stasis. The sea and the raw physicality of contemporary ballet inspired this work.

3. Shine Shine explores the very human need to shine when times are not so light. A very deliberate association to human agency breath and body is made through this work incorporating the winding of gentle micro melodies and subtle rhythms.

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Video 5: selected complete works from the austraLYSIS performance in 2019: part 2. c. 35 minutes.

Prof. Roger Dean: discusses rethinking notation and harmony in the next piece. c. 2 minuites

At 2'30":
Comparative Views, by Roger Dean (2018): for instruments and 2-channel live electroacoustic sound; c. 5 minutes
A composition for improvisers with irregular repeating rhythmic structures. No pitches are specified, but a rhythmic accompaniment continues throughout on the piano.

At 7'00":
Prof. Hazel Smith: on using words with images to imagine personal and communal history. c. 4 minutes.

At 11'30":
Heimlich Unheimlich, by Sieglinde Karl-Spence, Hazel Smith and Roger Dean (2019): for ensemble, speaker, animation and 4-channel audio, c. 12 minutes.
Heimlich Unheimlich is a performance work consisting of collages by Sieglinde Karl-Spence, computerised manipulation of the images by Roger Dean, text by Hazel Smith and music by austraLYSIS.

The piece is taken from a larger ongoing project by Sieglinde Karl-Spence and Hazel Smith that uses their different childhoods as a starting point. It focuses on two characters who have names related to forms of cloth that sometimes appear as body parts in the collages. One character is Hessian, a German girl born towards the end of the second world war who migrates with her family to Australia when she is still a child and eventually becomes an artist. The other is Muslin, a violinist and poet born to a Jewish family in England after the second world war, who migrates to Australia as an adult. Specific musical material is assigned to each. In Australia Hessian and Muslin become friends.

Heim in German means home, so *Heimlich Unheimlich* could translate loosely as *Homely Unhomely.* However, this is not a literal translation. Heimlich more usually means secretive or hidden while unheimlich means uncanny, so the meanings of the two words overlap. The relationship between heimlich and unheimlich is discussed in Freud's essay 'The Uncanny'.

The piece uses photographs from the family albums of Sieglinde Karl-Spence and Hazel Smith, embedded in complex graphical constructions. The images are algorithmically organised so the order will be different each time it is performed.

At 23'20":
Dr. Greg White: introduces the virtual rhythm section, and algorithmic control in jazz-oriented improvisation. c. 3 minutes.

At 26'40":
Blue Note, by Greg White (2017-9): for computer and instruments; c.7 minutes.
Blue Note is the first of a series of improvisation pieces that combine software acoustic instruments and real acoustic instruments. For this performance, the software instruments are jazz upright bass and jazz drum kit, and the acoustic instruments are piano, sax and trumpet. The computer performer shapes the software acoustic instrument macro and meso time scale dynamics, density and texture, while the underlying algorithms determine micro detail. The contrast between the distributed human/machine control of the software instruments and the acoustic instruments who simultaneously control both macro and micro elements will become apparent as the piece progresses

At 33'30":
Prof. Roger Dean: retrospect and prospects. c. 1 minute.

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Biographies

About austraLYSIS:

austraLYSIS (formed 1989) incorporates LYSIS, the former European contemporary music group, which commenced in 1970 in the UK. Both were founded by Roger Dean (double bass, keyboard, composer, computer interaction) and Hazel Smith (violin, text-creator). LYSIS was co-founded with John Wallace (trumpets, composer), Ashley Brown (percussion), and Colin Lawson (clarinets). austraLYSIS has premiered, commissioned and/or created more than 150 musical compositions and new media works. It has appeared in most parts of the world, including Europe, Asia, North America, and Australasia. It has made more than fifty commercial sound recordings, intermedia CD-Roms and works for radio and the Internet. Its broadcasts have been heard all over the world.

austraLYSIS is committed to both composed and improvised new music, sound art and intermedia work. Originally primarily a performance group, austraLYSIS presented a concert devoted to the work of Stockhausen on the South Bank in London in 1980, in association with the Philharmonia Orchestra and the composer himself, and similarly focused on the work of Xenakis, Cage and Reich, as well as work by numerous less well-known composers, in presentations in Australia and elsewhere. The group also placed particular emphasis on work from Australia and the UK and collaborated with some of the most imaginative performers involved with contemporary music, sound and new media in Australia. austraLYSIS is now primarily a creative group, producing electroacoustic and computer-interactive music and multimedia works. Composers, improvisers, writers and video artists who are members include: Keith Armstrong (installation and video artist); Daniel Blinkhorn (composer and audio-visual artist); Sandy Evans (saxophones); Phil Slater (trumpet); Hazel Smith (writer and performer); Greg White (computer interaction; sound design). Two members currently work in the US: David Worrall (Australian composer and visual artist, currently working in Chicago) and from the USA, Will Luers (video artist and writer, Portland, Oregon). Another member, Torbjörn Hultmark (trumpet, soprano trombone, electronics), is based in the UK.

austraLYSIS frequently relates its sound works and performances to other artistic media. For example, in the case of the visual arts, it has performed compositions by the artist Tom Phillips (UK); collaborated with Alan Davie (UK); created music related to the painters Fred Williams and Michael Johnson (Australia) and Frans Widerberg (Norway); and worked with Australian artists such as Sieglinde Karl-Spence and Darani Lewers. Similarly, it has developed music/movement works such as *TimeDancesPeace* with the theatre and dance group Kinetic Energy. austraLYSIS has also created a number of text and sound pieces which were commissioned by the ABC including *Bird Migrants* (2014), The *Afterlives of Betsy Scott* (2007), *Returning the Angles* (2003), *The Erotics of Gossip* (2001), *Nuraghic Echoes* (1996), and *Poet without Language* (1991), all by Hazel Smith and Roger Dean — *Poet Without Language* was the ABC's nomination for the Italia Prize in 1992. austraLYSIS collaborates with other ensembles, notably in 2010 (and again in 2012) with the enterprising vocal ensemble Halcyon. The combination of vocal and electroacoustic expertise has allowed both rare and premiere performances.

austraLYSIS' breadth of style is illustrated on its many recordings and on those of its member musicians. Amongst austraLYSIS' numerous CD releases are *History Goes Everywhere* (2015), Dean's double album *MultiPiano* — piano and computer interaction — (2013), *Sonic Stones* (2006), *Present Tense* (1997), *The Next Room* (1994) and *Moving the Landscapes* (1992), all on Australia' s leading label for new music, Tall Poppies. The double CD *Resounding in the Mirrors* was released on the UK label Future Music Records (2001). In addition, *Windows in Time* (1994) represents a range of austraLYSIS's work, with music from Xenakis to Cresswell, as well as by members of the group. austraLYSIS also contributed to Hazel Smith's sound and performance-text CDs, *Poet Without Language* (1994) and *Nuraghic Echoes* (1996), both on Rufus Records. In addition, substantial works of audio and intermedia feature on CD-Rom are included in Hazel's book *The Erotics of Geography*: poetry, performance texts, new media works (TinFish Press, Hawaii, 2008) — her most recent book is *Word Migrants*, Giramondo, 2016. One of austraLYSIS's recordings was listed as a Record of the Year, by Records and Recordings, UK, and several have been nominated for ARIA awards. An

austraLYSIS album with Torbjörn Hultmark was released in May 2018 on Bandcamp (for digital download) and seems to be the first album featuring soprano trombone, piano and electronics.

austraLYSIS undertakes commissions and engagements for arts centres, festivals, broadcasting, recording and for international touring. It has completed thirteen overseas tours since 1990, and in 1992-3 performed all over Australia. In one such tour it was featured in three events at the leading new music festival in UK, Huddersfield, and on BBC Radio 3. It has previously been supported by the Australia Council as a 'Key Organisation' for its creative and performance work, and its work is presented by the ABC and other international broadcasters as well as in multimedia formats. austraLYSIS is also concerned with educational work and other means of fostering appreciation. Examples of such work include Roger Dean's presentation of an ABC radio documentary on improvisation, and in 2010 two programmes for the BBC in London on Australian Jazz; his books *Creative Improvisation* (Open University Press, UK), *Sounds from the Corner* (about Australian contemporary jazz, Australian Music Centre), *The Oxford Handbook of Computer Music* (OUP, 2009) and the *Oxford Handbook of Algorithmic Music* (OUP, 2018); Hazel Smith's books *The Writing Experiment* (Allen and Unwin) and *The Contemporary Literature-Music Relationship* (Routledge); and Smith and Dean's jointly edited book *Practice-led Research, Research-led Practice in the Creative Arts* (Edinburgh University Press, 2009).

Web site: www.australysis.com (extensive listening and viewing is freely available on the site, as well as fuller biographies of the individual member musicians).
Contact: rogerdeanalysis@gmail.com; or roger.dean@westernsydney.edu.au

About The MARCS Institute for Brain, Behaviour and Development, an interdisciplinary research institute of Western Sydney University:
The MARCS Institute builds on 20 years of research into human interaction across the lifespan. The Institute is renowned for outstanding fundamental science and impactful translational research. The Institute collaborates with universities and research partners across the world. More than 120 researchers work in 12 specialist laboratories to better understand brain function and support wellbeing. The MARCS Institute embraces a sweep of disciplines from software-, electrical- and biomedical-engineering through to developmental psychology, language science, cognitive neuroscience and music science.
See https://www.westernsydney.edu.au/marcs.

About individual participants from austraLYSIS and MARCS (alphabetical):

Dr. Simon Chambers' primary research interest is in cultural sociology, having completed his PhD at the MARCS Institute in 2020. His doctoral research focussed on the field of Australian art music and developed new approaches to mapping spaces of musical practice to inform our understanding of people's engagement with unfamiliar music. In 2008 he led the development of a major digital research infrastructure project at the Australian Music Centre and has since worked on music research projects ranging from Australian cultural fields to the value of music exports and the development of personalised recommendation algorithms. He has previously worked in digital strategy at ABC Radio and is currently a consultant analyst at the Australasian Performing Right Association (APRA) as well as an academic researcher.

Prof. Roger Dean is a composer/improviser, and since 2007 a research professor in music cognition and computation at the MARCS Institute, Western Sydney University. His research folds into his creative work, currently particularly by means of deep learning computational models for music generation. He founded and directs the sound and intermedia creative ensemble austraLYSIS, which has appeared in 30 countries. He has performed as bassist, pianist, piano accompanist and laptop computer artist in many contexts, from the Academy of Ancient Music and the Australian Chamber Orchestra, to the London Sinfonietta, and from Graham Collier Music to duetting with Derek Bailey and Evan Parker, and performing with leading improvisers particularly from Europe and Australia. About 70 commercial recordings and numerous online digital intermedia pieces represent his creative work, and he has published more than 300 journal articles. Current research concerns improvisation and computational creativity, affect, roles of acoustic intensity and timbre, and rhythm generation and perception. With Hazel Smith and Will Luers, he won the 2018 international Robert Coover prize for a work of electronic literature. In 2021-2 austraLYSIS is preparing a duo album, of sound and intermedia, featuring diverse pairings: such as human/computer, human/environment,

text/improviser, image/improviser. Prior to 2007, he was a full professor of biochemistry in the UK, foundation CEO/Director of the Heart Research Institute, Sydney, researching on atherosclerosis, and then Vice-Chancellor and President of the University of Canberra.

Dr. Felix Dobrowohl was a Senior Technical Officer based in MARCS and now occupies a similar position in the linguistics department at the University of Potsdam, Germany. He has a background in Audio Engineering, Experimental Psychology, Cognitive Science and Musical Performance and Production. Previously, Felix has held a variety of positions including working as a classical musician in solo, chamber music and orchestral settings, as an audio engineer and Tonmeister for Pop/Rock and classical recordings and completing a PhD at MARCS as an experimental psychology researcher studying human perception of musical timbre. His research uses interactive music manipulation interfaces to understand and explore listeners' processes behind mixing music and behind their preferences for different types of sound.

Dr. Sandy Evans (saxophones, composer**).** Sandy is an internationally renowned saxophonist and composer with a passion for improvisation, new music and intercultural creativity. She has played with and written for some of the most important groups in Australian jazz since the early 1980s and has toured extensively in Australia, Europe, Canada and Asia. She leads the Sandy Evans Trio and Sextet, and co-leads the internationally acclaimed Clarion Fracture Zone. She is a member of MARA!, Waratah, The catholics, the Australian Art Orchestra (AAO), Ten Part Invention and austraLYSIS. With composer Tony Gorman she co-leads the acclaimed 8 piece ensemble GEST8. Her composition Testimony' about the life and music of Charlie Parker with poetry by Yusef Komunyakaa was published in 2013 by Wesleyan University Press.
Sandy has a keen interest in Indian classical music. She collaborates regularly with Sydney-based Indian musicians Sarangan Sriranganathan and Bobby Singh and recently released the CD 'Kapture', a tribute to South African freedom fighter Ahmed Kathrada. Her CD Cosmic Waves featuring South Indian mridangam virtuoso Guru Kaaraikkudi Mani and Sruthi Laya is released in India on Underscore Records.
She has been awarded an Australia Council Fellowship, a Churchill Fellowship, an OAM, Bell Award For Australian Jazz Musician of The Year 2003, a Young Australian Creative Fellowship, APRA Award for Jazz Composition of the Year and three ARIA Awards. Sandy's suite "When The Sky Cries Rainbows', recorded for ABC Jazztrack won the AIR Award for Best Independent Jazz CD in 2011. Sandy has a PhD from Macquarie University where she received the Vice Chancellor's Commendation for Excellence. Sandy inaugurated the Jazz Improvisation Course for Young Women run annually by the Sydney Improvised Music Association. She is a Lecturer in Music at UNSW.

Prof. Peter Keller is a Professor of Cognitive Science and Director of Research, at MARCS. His research aims at understanding the behavioural and brain bases of human interaction in musical contexts, specifically, the sensory-motor and cognitive processes that enable ensemble musicians to coordinate with one another.
Peter has served as Editor of the interdisciplinary journal 'Empirical Musicology Review' (2010-2012) and as a member of the Editorial Board at 'Advances in Cognitive Psychology' (2005-2015). He is currently an Associate Editor at 'Royal Society Open Science' and a Consulting Editor for 'Music Perception' and 'Psychomusicology: Music, Mind, and Brain'. Peter has previously held research positions at Haskins Laboratories (New Haven, USA), the Max Planck Institute for Psychological Research (Munich, Germany), and the Max Planck Institute for Human Cognitive and Brain Sciences (Leipzig, Germany), where he led the Max Planck Research Group for Music Cognition and Action.

Dr. Jennifer MacRitchie's research focuses on the acquisition and development of motor skills in instrumental performance, and how these can be used to promote health and wellbeing. She has conducted research in a variety of environments, typically collaborating with academics across fields from engineering, music psychology, music therapy, physiotherapy and nursing, and external industry partners including those in aged care, music education, and local health. She completed M.Eng in Electronics with Music at the University of Glasgow, going on to complete her PhD in the Science and Music Research group there in 2011. She then moved on to a three year postdoctoral position at the Conservatorio della Svizzera Italiana in Lugano, Switzerland, looking at translation of empirical research into impacts for students studying at the conservatory. Jennifer joined the MARCS Institute for Brain, Behaviour and Development at Western Sydney University in 2014 for a research lectureship in music perception and cognition, moving to Senior Research Fellow in Health and Wellbeing across the wider university in 2017. Here, her research moved from looking at

expert performance to considering how these skills are acquired by novices, particularly studying older adult health and wellbeing. She is currently an Adjunct Research Fellow at MARCS continuing research into older adult music education with colleagues, and co-supervision of PhD students. Meanwhile, she joined the Music Department at the University of Sheffield in 2021 to take up a UKRI Future Leaders Fellowship, designing new musical technologies for older adults (particularly those living with dementia and their carers).

Dr. Charles Martin is a specialist in music technology, musical AI, and human-computer interaction from Canberra, Australia. He creates new technologies that extend and augment creative interactions. Charles' research has examined individual and group interactions with intelligent systems. He is an active percussionist and computer musician with works described as "a thing of rare beauty" in The West Australian, that have been performed throughout Australia, Europe and the USA and presented at international conferences on music technology and percussion. Charles has released a number of musical apps such as MicroJam, PhaseRings, and Snow Music (used here). He is a Lecturer in Computer Science at the Australian National University where he leads research into intelligent musical instruments.

Dr. Phil Slater is a trumpeter, composer and improviser living and working in the Illawarra region of NSW, Australia. He is the leader or co-leader of several groups, including the Phil Slater Quintet, Band of Five Names, Daorum, and The Sun Songbook. He has performed and recorded with a variety of artists including the Australian Art Orchestra, Archie Roach, Ruby Hunter, Sandy Evans, Missy Higgins, Andrea Keller, Paul Grabowsky, Lou Reed, Bernie McGann, Genevieve Lacey, Katie Noonan, Vince Jones, amongst many others. Phil has contributed original music to theatre, film and television projects including productions by Sydney Theatre Company, Belvoir, Legs on the Wall, Bangarra, Force Majeure and Sydney Dance Company. He has received the National Jazz Award, the Australian Jazz Bell Award for Jazz Musician of the Year, and Best Contemporary Jazz Ensemble, the Freedman Fellowship, and the Limelight Award for Outstanding Contribution to Australian Music. His recent recording *The Dark Pattern* (2019) was nominated for an ARIA Award, and Australian Independent Recording (AIR) Award, the Australian Music Prize (AMP), the APRA Art Music Award, and was voted Top Ten recordings of 2019 by New York City Jazz Records magazine. He holds a PhD from the University of Sydney, is interested in ecological and enactive accounts of skill acquisition, expertise and performance, and is a Lecturer in Jazz Studies at the Sydney Conservatorium of Music. Phil has been a member of AustraLYSIS since 2001.

Dr. Eline Smit finished her PhD at the MARCS Institute for Brain, Behaviour and Development at Western Sydney University, Australia in 2021. Her PhD research focused on the perception of affect using unfamiliar musical systems. She held a MARCS Institute PhD scholarship and was also awarded a Transdisciplinary & Innovation grant from the ARC Centre of Excellence for the Dynamics of Language to study the impact of music on implicit word learning. Before moving to Australia, Eline completed a BA in Arts & Humanities magna cum laude at the University of Utrecht and an MA in Musicology at the University of Amsterdam. She also studied classical piano at the Royal Conservatoire in Antwerp, received a BA cum laude. As a pianist, she debuted with the second piano concerto of Shostakovich in Antwerp with the Flemish Symphonic Orchestra. As a true Dutch person, she really enjoys riding her bike around Sydney in her spare time.

Prof. Hazel Smith is an Emeritus Professor in the Writing and Society Research Centre at Western Sydney University. From 2007-2017 she was a Research Professor in the Centre, and was previously at the University of New South Wales. She is author of *The Contemporary Literature-Music Relationship: intermedia, voice, technology,cross-cultural exchange*; *The Writing Experiment: strategies for innovative creative writing*; and *Hyperscapes in the Poetry of Frank O'Hara: difference, homosexuality, topography*. Hazel has contributed numerous articles on subjects as diverse as contemporary literature, contemporary poetry, electronic writing, the creative writing process, creative writing pedagogy, contemporary intermedia and relationships between literature and music.

Hazel is also a poet, performer and new media artist, and has published four volumes of poetry, three CDs of performance work and numerous multimedia works. Her most recent volumes of poetry are *Word Migrants,* and *The Erotics of Geography.* Formerly a professional violinist, she is a member of austraLYSIS, the sound and intermedia arts group. She has performed her work extensively in the US, Europe, UK and Australasia. In 2012-13 she was a recipient of an Australia Council for the Arts Literature Board Digital and New Media Writing grant. She has had five large-scale commissions from the Australian Broadcasting

Corporation, and in 1992 her collaboration with Roger Dean, *Poet Without Language,* was nominated by the ABC for the prestigious Prix Italia Prize. In 2016 her collaboration *motions* with Will Luers and Dean was included in the *Electronic Literature Collection 3:* the premier international anthology of electronic writing. Another collaboration with Luers/Dean, *novelling*, was published by New Binary Press in 2016, and won the Electronic Literature Organisation's international Robert Coover award in 2018. Hazel collaborated with artist Sieglinde Karl-Spence on a major exhibition of text and image, *Heimlich Unheimlich*, shown in the Broadhurst Gallery, Hazelhurst Arts Centre, Sydney (2020) and in Perth in 2021. She founded *inflect,* an online international journal of new media writing based at the University of Canberra (2004-6), and is now co-edits *soundsRite,* a journal of new media writing and sound. Her website is at www.australysis.com.

Prof. Catherine (Kate) Stevens, a cognitive scientist, is Director of the MARCS Institute for Brain, Behaviour & Development at Western Sydney University. She holds BA (Hons) and PhD degrees from the University of Sydney. Kate conducts basic and applied research through the temporal arts – music and contemporary dance. She also applies methods from experimental psychology to investigate human-machine interaction (e.g., design of auditory warnings; human-avatar and human-robot interaction). Kate is author of more than 200 peer-reviewed papers. She is Editor-in-Chief, *Music Perception* (University of California Press), Professor in Psychology and Pro Vice-Chancellor STEM at Western Sydney University.
Podcasts and research materials are available here: http://katestevens.weebly.com

Dr. Jo Thomas is a British composer. She won the Prix Ars Electronica Golden Nica in Digital Musics and Sound Art for her work Crystal Sounds of a Synchrotron. Jo is working across the spectrum of sound design, solo live work and collaboration. Her work is available from Holiday Records, Entr'acte NMC and Naxos records.
Her music is often improvisational and she engages performing with large landscapes of composed sound. She has been commisioned by PRS Women Making Music Fund and the Britten Pears Trust Fund. In 2016 she created new record for the company Holiday Records, and was one of four composers to pilot the new Mini Oramics machine originally designed by Daphne Oram and re constructed by Tom Richards, AHRC funded and supported by Goldsmiths. Also in 2016 she went to Switzerland with the artist Urslé von Mathilde for a new site specific text piece for performance in Bern. Her music was presented at the Trondheim Biennial in March 2016 and in April 2016 she presented a new collaboration with artist Florence Peake. Throughout her career her work has been profiled internationally, working with organisations in Italy, France, California, Brussels, Switzerland and Australia. She has taught composition as a university lecturer, and run large scale and left field music pojects for theatre, film documentary and dance.

Dr. Greg White is a performer, composer, producer, programmer and educator, with a PhD that explores the convergence between composition, performance and production in realtime software environments. Currently he is postgraduate course coordinator at the Higher Education Leadership Institute (HELI) specialising in broadening the scope of what are considered scholarly activities. Previously he developed creative media masters programs in Australia, UK, France, Italy and Germany as Dean of the Graduate School of Creative Media at SAE Institute. He has been a core member of the innovative inter-media group austraLYSIS (1991 until the present) and jazz/world music group Gest8 (2004-10). His creative output has been presented at the British Film Institute, Cannes, Clermont-Ferrand and Sydney film festivals; Huddersfield (UK), New Crowned Hope (Vienna), Festival International d'Art Lyrique, (Aix en Provence, France), Lincoln Centre (NYC), Auckland, Wangaratta, Sydney and Melbourne festivals; all major museums and galleries in Australia's eastern states; all major theatre companies in Sydney; on many web projects (including William Duckworth's 48hour Cathedra Project in 2001 with Roger Dean) and in many national and international multimedia collaborations with artists such as Ross Gibson, Kate Richards, Richard Vella, Norie Neumark, Lynette Wallworth and Susan Norrie.