Richard Hoadley
Research Excellence Framework:
Portfolio Submissions for UoA 35 Music

4 Outputs

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pdf and html online versions: **http://rhoadley.net/research/ref2014/**

Introduction
Richard Hoadley is a composer and technologist who in recent years he has focused on the role of electronic technology in musical composition and performance, and particularly on the development of devices designed to enable physical interactions with digital algorithms and software for the algorithmic generation of music. Most recently he has added methods for the live presentation of algorithmically generated notation (to be played by human musicians in real-time), and is investigating methods of creatively and technically linking physical activity, algorithmic generation and notation in seamless performance environments. In addition he is exploring the use of these methods in therapeutic contexts.
Research Interests
Composition, algorithmic and automated composition, live notation, hardware/software interfacing, human computer interaction

Richard Hoadley: output 1	
Type	**Composition** with technical and academic underpinning, including paper presentations and publications
Title	**127 Haiku and automated algorithmic composition**
Year	2009-11
Details	**One Hundred and Twenty Seven Haikus** is a primary instance of a sequence of work developing automatic, algorithmic music creation within the framework of the SuperCollider programming environment. The composition has developed from earlier work using hardware synthesisers and computers (**The Copenhagen Interpretation** (1999)), and hardware synthesisers and SuperCollider (**Many Worlds** (2008)). Using SuperCollider alone allows a degree of sophistication in these areas on construction unparalleled elsewhere in music software. In 2010 I created a new version, **One Hundred and Twenty Eight Haikus** which included bespoke, self-designed and constructed hardware interfaces (also see **Triggered** below, output 2) and elements of live-coding, (see co-authored NIME paper on live coding, below).
	The work has spawned a number of research items: both performances and papers. One of the most important has been the co-authored NIME paper (2011) which investigates live aspects of algorithmic coding. It is also a result of a collaboration which has been very fruitful in many other respects.
	A final aspect of the work, and of the collaboration mentioned above was the commissioning of **128 Messages**. While this involves similar algorithmic processes, these are triggered and controlled using mobile devices. This was sponsored by the 'Enterprising Academics' scheme and first performed during the *Sounds Like Mobility* conference in Cambridge in 2011.

Impact	**Performances** (2008) **Many Worlds** Semi-automatic music for Yamaha TG synthesiser and computers Kettles Yard, Cambridge, 11th May info: http://rhoadley.net/comp/manyworlds.php audio: http://rhoadley.org/sounds/manyworlds/ManyWorlds05n.mp3 (2009) **One Hundred and Twenty-Seven Haiku** Automatic performance/composition with custom software Kettles Yard, Cambridge, 10th May info: http://rhoadley.net/comp/haiku/index.php audio: http://rhoadley.net/sounds/127/127Haiku_128k_090507_101239.mp3 (2010) **One Hundred and Twenty-Eight Haiku** Automatic performance/composition with custom hardware and software. Kettles Yard, Cambridge, 9th May info: http://rhoadley.net/comp/128haiku/index.php audio: http://rhoadley.net/sounds/128/128HaikuLive.m4a (2011) **One Hundred and Twenty-Seven Messages** Crowdsourced composition and performance controlled by mobile devices. Presented at 'Sounds Like Mobility' Conference, Cambridge, 17th May Commissioned through 'Enterprising Academics' scholarship http://rhoadley.net/comp/messages/index.php **Publications** (2011) **A principled approach to developing new languages for live coding** Samuel Aaron, Alan F. Blackwell, Richard Hoadley and Tim Regan, Proceedings of NIME (New Interfaces for Musical Expression), Oslo (ISBN: 978-82-991841-7-5) http://www.nime2011.org/proceedings/papers/K04-Aaron.pdf **Papers** (2011) **Analysis of algorithmic music generated through physical embodiment** Seventh International Conference on Music Since 1900/International Conference of the Society for Music Analysis, University of Lancaster, July http://rhoadley.net/research/abstracts/analysis_algorithms_richard_hoadley.pdf (2010) **Towards embodied control of algorithmic music** Music and Numbers, Canterbury Christ Church University, 14 - 15 May (Abstract published in ISBN 978-1-899253-76-0)
Appended evidence (on disc)	1. recording of **One Hundred and Twenty Seven Haikus** (01_127Haikus_128k_090507_101239.mp3) 2. recording (live) of **One Hundred and Twenty Eight Haikus** (02_128HaikusLive.m4a) 3. pdf of 2011 co-authored paper **A principled approach to developing new languages for live coding** (03_K04-Aaron.pdf) 4. programme (pdf) for May 2009 performance (04_127HaikusProg_v04b.pdf 5. programme (pdf) for and May 2010 performance (05_KY_Frame-breaking_v01.pdf) 6. abstract for Music and Numbers (06_Music and Numbers Abstract.pdf) Please also see above for URLs of available online resources

Richard Hoadley: output 2

Type	**Composition** with technical and academic underpinning, including **paper presentation** and **article publication**
Title	**Triggered: composition and performance environments involving bespoke novel hardware and software interfaces (Gaggle, Wired, Metapiano and Hanging Glyphs)**
Year	2009-2012
Summary	A series of compositions and performances each lasting 10-15 minutes, developing over time and according to purpose and location, reinforced and investigated by a variety of demonstrations, paper presentations and article publications. The compositions involve significant hardware and software design and implementation.
Details	One of the principal locations for the creative use of the **Gaggle** and **Wired** interfaces has been the collaborative music-dance production, **Triggered.** Triggered began when myself and a colleague were invited to contribute to the British Computer Society's Human Computer Interaction conference held in Cambridge in 2009, collaborating with a troupe of dancers led by the choreographer Jane Turner. For this I prepared an experimental interface called the Gaggle which uses multiple ultrasound sensors and an Arduino board to interface with various functions and algorithms written in SuperCollider. This has resulted in a number of events and outputs, some of which are included in this submission. My part in the collaboration includes composition, software and hardware construction and prepared and improvised performance. The performances, along with the conference itself, were covered by the press, both national and local.
	Triggered examines the nature of electronic and digital interfaces for musical expression through the specific use of sensors the data from which is used to control multiple (and changing) musical parameters developed using the music and audio language SuperCollider which provides a structured environment essential for developments such as this.
	The **Hanging Glyphs** (http://rhoadley.net/comp/glyphs/ http://katyprice.wordpress.com/2011/06/19/triggered-photos/) were themselves a collaboration between myself, Katy Price, a writer and lecturer in English at Queen Mary University. The hangings are paintings made on rough canvas with conductive paint allowing interaction with musically expressive algorithms. The resulting algorithmic material was intended to reflect the graphic design. The **Metapiano** is an experimental interface inspired by Alexander Calder and designed and built by myself. Both items use capacitive touch and force resisting technologies; the name **Metapiano** was chosen as in this instance the main sonic output is a synthesised piano controlled by algorithms, themselves largely controlled by the interface.
	Submitted videos show the development of my part of the **Triggered** project. Aesthetic and musicological aspects of the work have been examined in a number of papers, including two articles presented and published at **ICMC 2012** and I**SEA 2012**.
	Touching Sound Work on Triggered, both hardware and software has contributed significantly to the Touching Sound project and it's development of GISMOs (generic interfaces for socio-musical orientation).

Impact Factors	**Performances and demonstrations** (2012) **Conway Hall Confidential: Three Sounding Sculptures** Sculptural algorithmic installation, April 13th-14th, Conway Hall, London http://rhoadley.net/comp/calder/conway_confidential_info-s.pdf (2011) **Triggered** Sculptural custom hardware and software interfaces and automatic composition for performers and dancers, June 13, Kings Place, London http://rhoadley.net/comp/triggered/kingsplace2011.php (2010) **Triggered** Sculptural custom hardware and software interfaces and automatic composition for performers and dancers, with Tom Hall, Jane Turner, Cheryl Frances-Hoad. - **Performance** for *CoDE New Materialism Conference*, Anglia Ruskin University, Monday 21st June 2010. http://www.anglia.ac.uk/ruskin/en/home/microsites/code/code_events/code_events_archive/new_materials_symposium.html - **Performance** for *Correspondence*, a weekend of Creative Practice, London Metropolitan University, Saturday 26th June 2010. http://www.londonmet.ac.uk/thefacility/events/correspondence.cfm (2010) **MIST (Museums, Interfaces, Spaces, Techologies)** Invited **performance** using custom built hardware and software, AHRC Workshop, 22nd-23rd, Cambridge March 2010. http://moodle.expressivespace.org (2010) **Cage Musicircus** Performance using Wired, Gagglina and Gaggle to the collaborative performance, Kettle's Yard, Cambridge, 10th November 2010. http://rhoadley.net/images/cage_musicircus-s.pdf (2009) **Gaggle: Hardware and Software Interface and Composition** Hardware, software, composition and performance commissioned by British Computer Society HCI conference 2009, Cambridge, September. http://rhoadley.net/comp/gaggle/ **Publications** (2013) **Touching Sound: Vulnerability and Synchronicity** Sam Aaron, Phil Barnard, ian Cross, Santinder Gill, Tommi Himberg, Richard Hoadley, Helen Odell-Miller, Rob Toulson, and Bonnie Kempske Proceedings of the CHI2013 workshop on Designing for and with vulnerable people http://di.ncl.ac.uk/vulnerability/files/2013/02/Aaron_DFWVP2013.pdf (2011) **The Metapiano: composing and improvising with sculpture** Proceedings of International Symposium for Electronic Arts, Istanbul, 2011 http://isea2011.sabanciuniv.edu/dr.hoadley (2011) **Sculpture as music interface** Proceedings of the International Computer Music Conference, University of Huddersfield, 2011 (ISBN: 978-0-9845274-0-3) http://quod.lib.umich.edu/cgi/p/pod/dod-idx/sculpture-as-music-interface.pdf?c=icmc;idno=bbp2372.2011.089 (2010) **Form and function: examples of music interface design** Proceedings of the HCI2010 Conference, Dundee http://rhoadley.net/texts/hci2010/hci2010_submission_108.pdf (2010) **Implementation and development of sculptural interfaces for digital performance of Music through Embodied Expression** Proceedings of the Electronic Visualisation and the Arts Conference, London, (IBSN: 978-1-906124-65-6) http://ewic.bcs.org/content/ConWebDoc/36096 (2010) **Implementation and development of interfaces for music performance through analysis of improvised dance movements** Proceedings of the 128th Audio Engineering Society Convention, London, (ISBN: 978-0-937803-74-5)

continued	**Papers and presentations** (2012) **Touching Sound: technologies for mediated interaction in music therapy** Sam Aaron, Ian Cross, Satinder Gill, Tommi Himberg, Richard Hoadley, Helen Odell-Miller, Rob Toulson 7th Nordic Music Therapy Congress, University of Jyvaskyla, Finland, June 13-17 http://rhoadley.net/research/abstracts/NMTC2012_abstract_final.pdf
	(2010) **Implementation and development of interfaces for music performance through analysis of improvised dance movements** SuperCollider Symposium, Berlin, September 23rd-26th http://supercollider2010.de/conference.html
	(2010) **Intimate physical control of musically expressive algorithms** with Satinder Gill, DMRN+5: Digital Music Research Network One-day Workshop 2010 Queen Mary, University of London, Tuesday 21st Dec 2010
	(2009) **The development of music interfaces through improvised dance movement** Paper presented at *Collaborative Processes in Music Making: Pedagogy and Practice*, University of Surrey, 11th November http://78.158.56.101/archive/palatine/events/viewreport/1577/index.html
	Workshops (2011) **Touching sound: an interactive workshop concerning human computer interaction in health and music** This research seeks to describe, implement and analyse work that investigates unique methods of articulating and implementing expressive gesture through physical interaction with objects. Led by Richard Hoadley and Satinder Gill. Anglia Ruskin University, 21st June.
	(2011) **Performance Innovations Workshop** Exploring sensor technologies in developing new composition, resulting in a performance sharing. Led by Jane Turner with composers/music technologists Richard Hoadley and Tom Hall London Metropolitan University, 9th June. http://www.performanceinnovations.org

Appended evidence	**Performances** 1. Video of one of the HCI2009 performances (01_triggered_hci2009_100mb.mp4) 2. A short video of Cambridge academic Maureen Thomas improvising with the Gaggle at the Museums, Interfaces, Spaces and Technologies conference, Cambridge 2010: (02_gaggle_mist2010.mp4) 3. Videos of two parts of the 2010 performance of Triggered during the CoDE New Materialism Conference (03_triggered_cambridge2010_01_intro.mp4 and 4. 04_triggered_cambridge2010_5_conclusion.mp4) 5. A video of excerpts from the Kings Place performance of Triggered (05_triggered_2011_kings_place_excerpts_subtitles_3m06s.mp4) 6. (06_triggered_2011_london_excerpts_subtitles_3m06s.mp4) 7. video of the 'hands' gismo (07_touching_sound_pilot.mp4) **Papers and publications** 8. pdf of 'Touching Sound: Vulnerability and Synchronicity' (08_Aaron_DFWVP2013.pdf) 9. pdf of 'Implementation and development of interfaces for music performance through analysis of improvised dance movements' (09_AES 128_14.pdf) 10. pdf of 'Implementation and development of sculptural interfaces for digital performance of Music through Embodied Expression' (10_ewic_ev10_s10paper1.pdf) 11. pdf of 'Form and Function' (11_hci2010_submission_108.pdf) 12. pdf of 'Sculpture as Music Interface' (12_HoadleyICMC11.pdf) 13. pdf of 'The Metapiano' (13_HoadleyISEA11.pdf) 14. pdf of 'Touching Sound' NMTC abstract (14_NMTC2012_abstract_v2.1.pdf) **Programmes** 15. A scan of the public programme for the event (15_triggered_kp_programme.pdf) 16. A scan of the Conway Hall Confidential programme (16_ConwayHallFlyer-complete-s.pdf) 17. Electronic version of the ARU New Materialism programme (17_aru_new_materialisms_programme.pdf) 18. Electronic version of the MIST programme (18_MIST_booklet.pdf) 19. Electronic version of the Kettles Yard Cage Musicircus performance (19_ky_cage_musicircus-s.pdf) 20. Electronic version of programme for 'Correspondence' (20_correspondence_flyer_back_3.jpg)

Richard Hoadley: output 3	
Type	**Composition** with technical and academic underpinning, including paper publication and presentation, and software publication
Title	**Calder's Violin**
Year	2011-13
Nature	An automatic algorithmic composition for synthesised piano and live violin. The violin part is notated live using information from the same algorithms that are used for the 'piano' part.
Details	**Calder's Violin** is a composition amalgamating algorithmic composition with live notation. The audio programming environment SuperCollider is used to define a series of musical functions and these functions are then distributed in time. A number of the algorithms used are developments of those used for the **Metapiano**, now augmented to enable the output of standard music notation. Each musical function includes a variety of parameters allowing significant variation between evaluations and these variations represent a significant part of the compositional detail. The distribution in time is generally linear, although there are a number of occasions in the scheduling where less predictable variation is allowed to influence the timing and ordering of events. The algorithmic scheduling of events is a significant aspect to be developed and exploited in future research.
	The functions mentioned above include code for the conversion of algorithmic data into a format suitable for its display in conventional musical notation in real-time. This means that the violinist's part is not determined in detail until just before the moment of performance. The general style and mood of the music is intended to be quite predictable, however.
	The result of this programming is, it is hoped, a balance between composed, improvised and performed electroacoustic music. Although there are very few predetermined pitches or durations, the piece has clearly recognizable musical characteristics and structures and so to that extent represents an amalgamation of different styles of and approaches to music.
	The engine for the real-time notation is provided by **INScore**, software developed by Dominique Fober at the French music research institute GRAME. My work with INScore has featured in a number of Dominique's papers on the project (http://www.grame.fr/ressources/publications/INScore-ID12-2.pdf), and I was invited to present this work at the 2013 INScore workshop in Saint-Etienne (http://www.youtube.com/watch?v=n8N-07H57Gc).
	The SC class developed for myself provides a simple method for linking INScore with SuperCollider; its development continues at present.

Impact	**Performances**
	(2013) **Calder's Violin**
	performed by Mifune Tsuji, 20th October 2013, INTIME Symposium, Coventry University
	http://www.coventry.ac.uk/research/research-directory/art-design/intime-experimental-music/intime-symposium-2012/
	(2012) **Calder's Violin**
	performed by Marcus Barcham-Stevens of Plus Minus at City University on April 17th 2012 as a part of the London 2012 SuperCollider Symposium http://www.sc2012.org.uk/live/concert/
	video recording: https://vimeo.com/42338675
	(2011) **Calder's Violin**
	performed by Mifune Tsuji, 2011 October 22, as a part of the Cambridge Festival of Ideas 2011
	Festival website: http://www.cam.ac.uk/sites/www.cam.ac.uk/files/foi2011.pdf (p21)
	video recording: https://vimeo.com/30975652
	Papers
	(2012) **Notating algorithms**
	Symposium for Performance of Electronic and Experimental Music (SPEEC), University of Oxford, January 6-7
	symposium website: http://www.music.ox.ac.uk/speec/
	presentation: http://rhoadley.net/presentations/SPEEC002s.pdf
	(2011) **Real-time generation of music notation using algorithms and physical movement**
	DMRN+6: Digital Music Research Network One-day Workshop 2011, Queen Mary University of London, Tuesday 20th December
	presentation: http://rhoadley.net/presentations/DMRN11_002s.pdf
	Publications
	(2012) **Calder's Violin: Real-time Notation and Performance through Musically Expressive Algorithms**, ICMC 2012
	paper: http://quod.lib.umich.edu/cgi/p/pod/dod-idx/calder-s-violin-real-time-notation-and-performance-through.pdf?c=icmc;idno=bbp2372.2012.035
	Software
	SC Class: INScore
Appended evidence	1. video recording of performance by Mifune Tsuji, October 2011 (01_hoadley_calders_violin_oct11.mp4)
	2. video recording of performance by Marcus Barcham-Stevens (02_calders_violin_sc2012)
	3. video recording of performance by Mifune Tsuji, October 2013 (03_calders_violin_intime2013_rehearsal2.mp4)
	4. pdf of concert programme from SC Symposium (04_sc2012_concert_programme.pdf)
	5. pdf of *Real-time Notation and Performance through Musically Expressive Algorithms* (05_calder-s-violin-real-time-notation-and-performance-through.pdf)
	6. SC beta class: INScore.sc and help file INScore.html
	7. pdf of INTIME 2013 symposium booklet (07_INTIME 2013 Progr Bklt2.pdf)
	8. pdf of INTIME 2013 programme (08_intime_2013_programme.pdf)

Richard Hoadley: output 4	
Type	A series of related original **composition**(s), **software** and **hardware** items, investigating automatic, live, algorithmic composition with live generation and performance of musical notation, including technical and academic underpinning, to include paper presentation and software publication.
Title	**The Fluxus Tree**, (also related, **Fluxus**, **Player Piano, Three Streams** and **Quantum²)** (algorithmic composition, physical interaction, live notation display)
Year	2012-present
Details	These compositions extend and deepen the use of both algorithmic techniques and in particular the use live notation. If Calder's Violin successfully applied this to the single line of a violin part, these pieces seek to do the same for a two staved piano part. It is hoped in the future to extend the method further to multi-player ensembles. In addition, they seek to investigate the use of physical movement, especially by skilled performers such as dancers, in the generation of notation which is then performed concurrently by skilled instrumental musicians. To this end, in addition to the above compositions and interfaces, a specific set of interfaces, including two versions of **Threads** and two **Flexi-fluxuses** as well as a prototype experimental interface, the **Digiphone**, has been developed and used in papers and presentations such as **Notating Musical Movement**.
	The sequence of compositions **The Fluxus Tree**, **Three Streams** and **Quantum Canticorum** show this investigation into the mediation of live notation with physical activity. The Fluxus Tree and Quantum (the latter a more mature and sophisticated piece) each utilise the movements of one or more dancers. Three Streams, a short *proof of concept* piece, requires only one performer/controller (myself) and one musician. Three Streams has that name because of its joining of the three research streams of algorithmic composition, live notation and physical interaction. Quantum Canticorum makes use, for the first time, of the Microsoft interface the Kinect, providing skeleton-tracking data used to trigger and modulate expressive algorithms and the live generation of notation.
	As can be seen from the below there has been some interest in these pieces and together they have received 11 performances and four demonstrations nationally.

Performances, publications and presentations	**Performances** (2013) **Quantum^2** - a dance and music performance piece Richard Hoadley and Jane Turner (Turning Worlds Dance Company) A part of Quantum, Ruskin Gallery, Anglia Ruskin University, Cambridge, UK, Sunday 27th October 2013 http://www.cam.ac.uk/festival-of-ideas (2013) **Quantum^2 Canticorum** - a dance and music performance piece (excerpt from **Quantum^2**) Richard Hoadley, Jane Turner, Ann Pidcock, Gareth Stuart Deptford Town Hall, 18th October, Notation in Contemporary Music Symposium, Goldsmiths symposium website: http://ncms2013.tumblr.com (2013) **Quantum^2** - a dance and music performance piece Richard Hoadley and Jane Turner (Turning Worlds Dance Company) Sensations Festival, Chelmsford, Saturday 27th September 2013 empty shop (opposite Superdrug), Meadows Shopping Centre 3pm (2013) **Three Streams** with Kevin Flanagan, soprano saxophone Dorkbot Cambridge, Makespace, 16 Mill Lane, Cambridge CB2 1RX, 14th August, 1900-2130 http://dorkbot.org/dorkbotanglia/ (2012-2013) **The Fluxus Tree** **Four performances** of an interactive sculpture for dancer using data from sensors to help generate notation live, which is then played by the composer and 'cellist Cheryl Frances-Hoad. Jane Turner, Cheryl Frances-Hoad and Richard Hoadley. http://rhoadley.net/comp/fluxustree/ 1. Performance at *Musichoreography*: duets for dancers and instrumentalists, Kings Place, London, April 14 2013; programme: http://rhoadley.net/comp/progs/kings_place_programme.pdf 2. Performance at INTIME 2012 Symposium, October 19-20 2012, University of Coventry, UK; video recording: https://vimeo.com/68260523 3. Performance at LIVE INTERFACES: Performance, Art, Music, September 7-8 2012, ICSRiM, School of Music, University of Leeds, UK; video recording: https://vimeo.com/49482055 4. Performance at Degrees of Synchrony: an original dance and music performance investigating the boundaries between synchronisation and simultaneity, May 13 2012, Kettle's Yard, Cambridge (2012) **Fluxus Tree: Phase Transitions** An interactive sculpture for dancer using data from sensors to help generate notation live, with Jane Turner and dancers, 28th October, Festival of Ideas, Cambridge; video recording showing types of interaction: https://vimeo.com/53709296 (2013) **Three Streams** Three Streams is an automatic composition centred around interactions with novel interfaces including the Digiphone and the Kinect for XBox. These interactions generate electronic sounds and music notation live: Cheryl Frances-Hoad ('cello, CMPCP Performance Studies Network International Conference Cambridge UK, 5th April 2013; video recording: https://vimeo.com/64441375 (2012) **Fluxus** An automatic composition for computer generated piano and piano. The pianist's music is generated live in performance Cheryl Frances-Hoad ('piano), 13th May, Kettle's Yard, Cambridge; video recording: https://vimeo.com/43422893 (2012) **Fluxus** automatic music for piano and computer Composed by Richard Hoadley, performed by Richard Hoadley, January 17th, Cambridge, UK as a part of *Future Fluxus*

continued	**Papers** (2013) Ways of Making People Move: mapping and interpretation in the live generation of augmented musical scores Notation in Contemporary Music Symposium, Goldsmiths, October 19-21 2013 (2013) Invited presentation at the **INScore workshop for dynamic scores** Universite Jean Monnet, Saint-Etienne, for Grame, Lyon, France, 29th April 2013 presentation: http://rhoadley.net/presentations/grame_2013-s.pdf youtube video of presentation (and workshop): http://www.youtube.com/watch?v=n8N-07H57Gc (2013) **Live, algorithmically generated notation, creativity and performance** Performance Studies Network Second International Conference, Cambridge University, April 2013 http://rhoadley.net/presentations/live_algorithms_cmcpc-s.pdf (2012) **The Fluxus Tree: Notating Musical Movement** Intime Symposium, Coventry University, September 19th presentation: http://rhoadley.net/presentations/fluxustree_intime006s.pdf (2012) **Notating Musical Movement** CoDE Research 1st Annual Conference, Anglia Ruskin University, March 27-28 presentation: http://rhoadley.net/presentations/code2012.pdf **Workshops** (2012) **Technologies for Mediated Interaction in Music** AHRC Digital Transformations Moot, London, November 2012
Appended Evidence	1. video recording of **Fluxus** performed by Cheryl Frances-Hoad at Kettles Yard, May 2012 (01_fluxus_edit_120513.mp4) 2. video recording of **The Fluxus Tree** in performance at LIPAM Leeds University, September 2012 (02_fluxus_tree_lipam_130908.mp4 (fluxus_tree_lipam_130908.mp4) 3. video recording of **The Fluxus Tree** in performance at INTIME Symposium, Coventry University, October 2012 (03_fluxus_tree_intime_rearcam_121020.mov) 4. video recording of **Fluxus Tree Phase Transitions** Excerpt (04_foi_rh_types_of_interaction_clips_edit.mp4) 5. video recording of **Fluxus Tree Phase Transitions** public interaction clips (05_foi_rh_types_of_interaction_clips_edit.mp4) 6. video recording of **Three Streams** (06_threestreamsfull.mp4) 7. video recording of **Quantum^2 Canticorum** performed at Deptford Town Hall, 18th October, Notation in Contemporary Music Symposium, Goldsmiths 8. pdf of Festival of Ideas website containing information about **Quantum^2** 9. pdf of Festival of Ideas brochure 10. pdf programme for Grame/INScore workshop 11. pdf of programme for Kettle's Yard concert, May 2012 12. pdf of Kings Place programme, April 2013 13. pdf of LIPAM programme, September 2012 14. pdf of abstract for Notations Symposium, Goldsmiths, October 2013 15. pdf of performance programme, Notations Symposiuim, Goldsmiths, October 2013 16. pdf of programme for Sensations Festival, Chelmsford, September 2013