Portfolio of Compositions and Exegesis:

Conflict and Resolution -

modelling emergent ensemble dynamics

by

Luke Adrian Harrald

Submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

Elder Conservatorium of Music
Faculty of Humanities and Social Sciences
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Contents

Volume 1 Scores and Exegesis

***All scores are transposed.**

*** All scores are transposed.**

Appendices

*** All scores are transposed.**

Volume 2 Electronic Documentation

Video Documentation (Disc 1)

***Surroundings* (third movement)**
Performed by Topology at the 2005 Australasian Computer Music Conference at the Queensland University of Technology, Brisbane. Reproduced by Permission.

Irene's Myth 3
Performed by Katherine Howard and Lilly Leaver as part of the 2005 Sight Specific Music concert series, with the artwork of Annette Bezor, at the Greenaway Art Gallery, Kent Town. Reproduced by Permission.

CONflict
Project 2 footage from a performance in 2005 at 'The Apothecary', Hindley Street, Adelaide. Filmed by Tristan Louth-Robins. Project 3 footage from a shopfront installation in the 'Project 3 Street Cinema'. This event was part of the 2006 Adelaide Festival of Arts. Filmed by Michael Yuen. Reproduced by Permission.

***Drowning* (Build Shots)**
Unfortunately, there was no footage taken of *Drowning* actually installed in the gallery prior to its untimely demise. These photos were taken during the building and testing phase of the project, and the shots are accompanied by the recording used in the alternate loop-based set-up described in Figure 5.2.2.

Monuments
Monuments was created at the studios at the Centre de Creation Musicale Iannis Xenakis in Paris, France. This particular version is a stereo mix of the work, which is normally presented in quad surround.

fr@gm3nT
Performed by Derek Pascoe and Luke Harrald as part of EARPOKE, a one off concert at 'Jive', Hindley Street, Adelaide in November 2007. Filmed by Jacob Morris. Reproduced by Permission.

AUDIO CD (Disc 2)

Track 1: *PARADOX eleven*
Performed by Luke Harrald, Matthew Timmis, Hugh McLean (guitars), Katerina Stevens (violin), Allye Sinclair (cello) and Joe Fragnito (percussion) in 'Multiplicity', a one off concert in the 2004 Adelaide Fringe Festival.
Recorded live by Luke Harrald.

Tracks 2, 3 & 4: *Surroundings*
Performed by Fiona Corston (piano), Wendy Heilingenberg (violin) and Katherine Howard (cello). This is a reproduction from the compilation CD 'Sight Specific Music Volume 1', recorded by Radio Adelaide and released commercially by the Greenaway Art Gallery in 2006. Reproduced by Permission.

Track 5: *Irene's Myth 3*
MIDI mock-up produced using Finale 2008.

Track 6: *Give in to Light*
MIDI mock-up produced using Finale 2008 and Garritan Personal Orchestra. Bullroarers performed and recorded by Luke Harrald.

Track 7: *fr@gm3nT*
Performed by Derek Pascoe and Luke Harrald for the 2007 Tyndall Assembly concert series at the Gallery De La Catessen. Recorded live by Tristan Louth-Robins. Reproduced by Permission.

DATA DVD (Disc 3)

The data on this DVD can be navigated by opening the start.html file on the disk.

Software: *IPD Score Generator* 2.0, and a version of *ENSEMBLE* that was used for a performance of *fr@gm3nT* at the 2007 Australasian Computer Music Conference. Please note that the software has not been widely tested, and that no support will be offered for these applications. The applications are MaxMSP standalones for OS X only.

Media: All the content from the video and audio disks in .mov and .aiff formats for computer playback.

Digital Exegesis: Written Documentation in .pdf format.

The 9:13 Commercial Release (Disc 4)

Donated by Sacred Cow Films.

Abstract

This portfolio of compositions explores Game Theory as an approach to generative composition and interactive computer music. Inspired by the notion of Performance Indeterminacy, software has been developed that attempts to simulate the interactions of improvising performers using a multi-agent system based on the 'Iterated Prisoner's Dilemma'. Composition activities and programming activities have formed a symbiotic relationship throughout the creation of the portfolio as each has constantly informed the other. Stylistically, the works presented fall into the experimental genre, although individually they address a wide range of aesthetic goals.

The main contribution of this portfolio is a new approach to generative composition based on behavioural models, creating a sense of form bottom-up through modelling the social dynamics of music performance. Through this approach, the direct modelling of musical structures is avoided; instead larger scale forms emerge through the interactions of an ensemble of 'improvising' agents. This method offers a departure from previous complex systems work in the area of music, creating computer models of specific musical situations. Links between the Iterated Prisoner's Dilemma and music are also established and combined with current music technologies.

Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis, when deposited in the University Library, being made available in all forms of media, now or hereafter known.

Signature: _____

Date: _____

Acknowledgements

This portfolio would not have been possible without the combined help, encouragement and criticism of many friends and colleagues over the years. I am grateful for their contribution to many aspects of this submission as follows.

First and foremost, special thanks to my principal supervisor Stephen Whittington for his ongoing support and mentorship throughout the duration of this project. Our conversations have been critical in shaping the concepts presented in this submission, and you have helped me through many difficult times during the candidature. Special thanks must also go to Derek Pascoe for his collaboration on the work *fr@gm3nT*, and to Hugh McLean for his collaboration on the installation *CONflict*. Both your contributions were instrumental in shaping these works.

Thanks to Matthew Phipps and Sonya Humphrey for having enough belief to run with an experimental soundtrack for their short film *The 9:13*, and for donating the commercial copies of the film for inclusion in the portfolio.

Thanks also to my other supervisors, Professor Charles Bodman Rae and Professor Graeme Koehne, and to Head of Post Graduate Studies, Associate Professor Kimi Coaldrake.

Many others have contributed to this submission through interesting conversations, organising performances, or commissioning new work. Thanks to Michael Yuen (Project 1, 2 & 3 concert series), PJ Noack and Lilly Leaver (Sight Specific Music concert series), Tristan Louth-Robins (Tyndall Assembly concert series), Peter Bentley, Tim Blackwell and the Live Algorithms research network, David Burraston, David Harris, Gordon Monroe, Sebastian Tomczak, and finally, Robert Axelrod for his encouragement and kind words of support.

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Finally, special thanks to my wife, Melanie Harrald for her loving support, patience and understanding throughout the many trials of this project. Without your support, I may have walked away many times.

The following materials have been reproduced with thanks, by kind permission:

Figures 4.4.1, 4.4.2, 4.5.1 and all materials relating to the Sight Specific Music series appear courtesy of Paul Greenaway.

Figure 5.1.4 and all materials relating to Projects 2 and 3 appear courtesy of Michael Yuen, left photograph in Figure 5.1.4 by Tristan Louth-Robins, right photograph by Paul Armour.

Figure 5.4.1 appears courtesy of the Estate of Stan Brakhage and Fred Camper (www.fredcamper.com)

Figure 6.4.1 and the recording of *fr@gm3nT* at the Tyndall Assembly appears courtesy of Tristan Louth-Robins.

The performance of *Surroundings* by Topology appears courtesy of Greg Jenkins (QUT).

The video of *fr@gm3nT* at EARPOKE appears courtesy of Jacob Morris.

The 9:13 appears courtesy of Sacred Cow Films.

Figure 2.1.2 was generated by the author using the software 'Life 32' by Johan Bontes. Available at: <http://psoup.math.wisc.edu/Life32.html> (14/2/2008).

Figure 2.2.1 was generated by the author using a Java applet by Serge Helfrich. Available at: <http://prisonersdilemma.groenefee.nl> (14/2/2008).

This submission has spawned three publications available on the author's website (http://www.lukeharrald.com.au):

Harrald, L. 2007. 'Collaborative Music Making with Live Algorithms'. In *Proceedings of the Australasian Computer Music Conference (ACMC07)*. Fitzroy, Australia; ACMA. 59-64.

_____. 2005. 'Fight or Flight: towards the modelling of emergent ensemble dynamics'. In *Proceedings of the Australasian Computer Music Conference (ACMC05)*. Fitzroy, Australia: ACMA. 68-74.

_____. 2003. 'Artificial Life: model for musical innovation'. In *Proceedings of the Australian Conference on Artificial Life (ACAL2003)*. Canberra, Australia: UNSW. 128-141.

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