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Mark Havryliv
University of Wollongong

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Playing with Audio:
The Relationship Between Music and Games

A thesis submitted in partial fulfilment of
the requirements for the award of the degree

Master of Creative Arts – Research

from

UNIVERSITY OF WOLLONGONG

by

Mark Havryliv

Bachelor of Music (Composition)
Sydney Conservatorium of Music, 2004

School of Music and Drama
Faculty of Creative Arts
2005

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Abstract

Real time audio signal analysis opens up possibilities for interactive musical compositions where game strategy is controlled using audio signal input produced by a musician. It also introduces the possibility of using a musician's sense of game play to shape a musical performance.

The author argues that new musical compositions based on games require further development before musicality can be expressed through the framework of a game.

In such compositions, games

Game design theory provides the backdrop for an examination of musical compositions based on games. In these compositions, games are referenced either by engaging the idea of game play or focusing on game structure. The same is true of electronic games that in some way relate to music. These games typically allow little individual musical expression; an 'ideal' musical performance is determined by the game's developers.

The author argues that new musical compositions can be developed in tandem with new games technology in which musicality can be expressed through the framework of a game.

Statement of Originality

This thesis describes a number of compositions and musical applications.

The concept of *Metris* was developed in collaboration with Terumi Narushima. *Metris* is a version of Tetris, (Alexey Pazhitnov, June 1985). The first version of *Metris* is an extension of a Java version of Tetris by Per Cederberg, 2003 (<http://www.percederberg.net/home/java/tetris/tetris.html>). The GUI and game engine are by Per Cederberg.

The bell synthesis model is by Terumi Narushima. Its implementation in original Java code is my own. All code managing audio output, including wave-table and additive synthesis, is my own work and uses no third party Java audio tools. The second version of *Metris* also uses Narushima's bell model. All the code for *Metris*, including Bell Editor, is entirely my own work.

The concept of *Battle Metris* was developed in collaboration with Terumi Narushima. *Battle Metris* is a version of 'Battle Tetris', which has at its origins Alexey Pazhitnov's 'Tetris'. I am unable to verify the origins of 'Battle Tetris'. All network code in *Battle Metris* is my own work. All musical material played in *Battle Metris* is mine, with the exception of material derived from Narushima's bells.

Mark's Egregious Game of Life is based on other Cellular Automata applications, especially 'Mirek's Celebration', developed by Mirek Wójtowicz, 2001, (<http://www.mirekw.com/>). It implements the '.lif' file format used in 'Mirek's Celebration'. All code in *Mark's Egregious Game of Life* is my own original work. Other composers have used CA for audio synthesis. However, the concept of using object-oriented cell relationships for synthesising audio using CA is, to the best of my knowledge, my own.

Medium Racing uses Pure Data, developed by Miller Puckette. Audio analysis in *Medium Racing* is performed using the *fiddle~* object, developed by Miller Puckette. All other Pd code used in *Medium Racing* is my own. The concept of the MIDI2Xbox is my own. I designed the circuitry based on the AVR microcontroller using technical information found on the Atmel Website¹. I programmed the microcontroller using assembly language in Atmel's AVR Studio 4. Without the existence of circuit schematics for the Xbox controller, I designed and built an interface between an Xbox controller and the microcontroller. I designed and built the enclosure for the MIDI2Xbox.

The concept of interactive musical composition for mobile phones was proposed by A.Prof. Greg Schiemer in the ARC Discovery Project "Pocket Gamelan: tuning musical applications for wireless internet". All the code for *pd2j2me*, developed for this project, is my own original work.

I'm Wrong, You're Right was presented in this thesis is a reworked version of a work presented for assessment on the 3rd of November, 2003. It was reworked by appropriating game design theory presented in this paper. Otherwise, this thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of my knowledge, the thesis contains no material previously published or written by any other person, except where due reference is made in the text.

Mark Havryliv

16th December 2005

¹ AVR 8-Bit RISC from Atmel, 2005 <<http://www.atmel.com/products/avr/>>

Prologue

In this thesis I investigate the musical possibilities of using real time audio signals as controlling agents in an electronic gaming console where game strategy is controlled using audio input produced by a musician using conventional musical instruments. This opens the way for a new kind of games interaction based on musically expressive signals rather than emotionally neutral mechanical controllers. Here composing music fuses with designing a game in which audio signals control the game's trajectory and where a musician's sense of game play shapes its performance. My folio of creative work includes interactive compositions that take initial steps in this direction.

At the point where this coalescence takes place, 'playing' a game and 'playing' music becomes one and the same thing. It is necessary therefore to address a potential source of confusion for the reader, namely, the similarities between concepts that apply in both music and games as well as overlaps in the terminology used to describe them. This happens in Chapter 1 Games and Game Controllers which clarifies the frames of reference necessary to assess the effectiveness of a controller for an electronic game.

Chapter 2 A Survey of Music and Games, is the first of a 2-part review in which I survey musical compositions inspired by or based on games. It looks at ways in which various composers have made connections between music and games.

The second part of the review, Chapter 3 Music as a Motivator in Electronic Games, covers electronic games in which music is a significant part of the game design. Game design theory provides a backdrop for the discussion in both parts of the review.

Chapter 4 From *Metris* to *Battle Metris*, presents my work, *Battle Metris*, an electronic game which allows a new type of musical experience for observers and participants which is a mixture of the individual participant's musicality and sense of game play. The work includes original code developed in Java.

The Epilogue summarises further steps required to achieve the goal of this thesis. These steps include development of original tools. These include *Mark's Egregious Game of Life*, an audio synthesis framework based on artificial life (unpublished) and *pd2j2me*, which exports musical applications created in an object-oriented graphical music composition language such as Pure Data into the Java 2 Micro Edition where they can be used with mobile hand-held devices.

The thesis contains an Appendix on CD ROM which includes four refereed papers, scores and code for four musical applications. Two of the papers are directly related to this thesis; the first, entitled "Metris: A Game Environment for Music Performance", describes the development of *Metris* and *Battle Metris*; it was presented at CNNR, Pisa, on 26th September 2005; the second entitled "Pocket Gamelan: a Pure Data interface for mobile phones", describes the development of *pd2j2me*; it was presented at NIME'05, University of Victoria, Canada, on 28th May 2005. Papers are provided as PDF files as is a score comprising parts for six performers. Code presented in the appendix includes *Metris*, performed at Pisa, 26th July 2005, *Battle Metris*, performed at 1/4_inch, Faculty of Creative Arts, University of Wollongong, 20th October, 2005 and *Medium Racing*, performed at Sonic Connections, University of Wollongong, 12th September, 2004. The code for *Metris*, *Battle Metris* and *Mark's Egregious Game of Life* exist in versions that have been tested running under Windows XP.