Music Computing Lab

International Music Computing Research Workshop 2008

Centre for Research in Computing

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Sponsored by The Computing Department and the Centre for Research in Computing (CRC), in association with the Music Department

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Presenters
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Dr Sergi Jordà, *Universitat Pompeu Fabra de Barcelona*
Prof Marc Leman, *IPEM, Ghent University*
Thor Magnusson, *University of Sussex*
Dr Alan Marsden, University of Lancaster
Prof Eduardo Miranda, *ICCMR, University of Plymouth*
Alex McClean, *Goldsmiths, University of London*
Prof Philip Tagg, *Université de Montréal*
Prof Lawrence Zbikowski, *University of Chicago*

Performers
Thomas Risell http://www.youtube.com/user/MarloweDK
Stephen Bingham http://www.stevebingham.co.uk/
Lawrence Zbikowski
http://humanities.uchicago.edu/faculty/zbikowski/
Alex McLean http://doc.gold.ac.uk/~ma503am/alex/feed/
Jamie Forth http://doc.gold.ac.uk/~ma503am/alex/

Data Capture Morgan Davies, Richard Morris

Overview

The aim of the workshop is to bring together international researchers to report on and exchange ideas about the state of the art in music computing research. The programme combines research with musical performances linked to research themes.

Within Music Computing, the workshop will explore two overlapping sub-themes: embodied music cognition and its implications for music computing; and computer based generation of music as a means of composition. Perspectives will include AI-based, human-centred, algorithmic, statistical, interactive, and sensor-based.

Programme

Marc Leman
IPEM, Ghent University
Embodied music cognition and mediation technology

Modern digital media tend to handle music as encoded physical energy, while the human way of dealing with music is based on beliefs, intentions, interpretations, experiences, evaluations, and significations. How can this gap be closed? What kind of mediation is needed to bridge the gap? And how can engineers, psychologists, brain scientists, and musicologists contribute to this? What would be a good approach in handling these questions? In this presentation we will offer a framework for dealing with the above questions. It is based on a hypothesis about the nature of musical communication, which is supposed to be rooted in a particular relationship between musical experience (mind) and sound energy (matter). In this mind/matter relationship, the human body can be seen as a biologically designed mediator that transfers physical energy up to a level of action-oriented meanings, to a mental level in which experiences, values, and intentions form the basic components of music signification. The reverse process is also possible: that the human body transfers an idea, or mental representation, into a material or energetic form. This two-way mediation process is largely constrained by body movements, which are assumed to play a central role in all musical activities. The embodied music cognition approach assumes that the (musical) mind results from this embodied interaction with music. The approach can be considered an extension of, or perhaps an alternative to, the classical (disembodied) music cognition approach.

Torsten Anders
ICCMR, University of Plymouth
Music constraint programming with Strasheela

Strasheela is an expressive constraint-based music composition system. Users declaratively state a music theory and the computer generates music which complies with this theory. A theory is formulated as a constraint satisfaction problem (CSP) by a set of rules (constraints) applied to a music representation in which some aspects are unknown (variables).

This talk first introduces the field which studies musical applications of constraint programming in general. It then motivates and outlines the design of Strasheela as a generic music constraint system. Several application examples are presented.

Thor Magnusson,
University of Sussex
The ixiQuarks: Audio tools merging GUIs and code

In this presentation we look at the ixiQuarks [1], an environment of instruments and effects built on top of the audio programming language SuperCollider. The rationale of these instruments is to explore alternative ways of designing musical interaction in screen-based software, and investigate how the semiotics of interface design affect the musical output. The ixiQuarks are software instruments based on a non-realist design ideology that rejects the simulation of acoustic instruments or music hardware and focuses on experimentation at the level of musical interaction. In this environment we try to merge the graphical with the textual in the same instruments, allowing the user to reprogram and change parts of them in run-time. After a short introduction to SuperCollider and the Quark system, we will describe the ixiQuarks and the philosophical basis of their design. We conclude by looking at how they can be seen as epistemic tools that influence the musician in a complex hermeneutic circle of interpretation and signification.

[1] http://www.ixi-audio.net/software>http://www.ixi-audio.net/software (follow the ixiQuarks link)
For a screenshot: http://www.ixi-audio.net/thor/ixiQuarks.jpg> http://www.ixi-audio.net/thor/ixiQuarks.jpg
For a recent ICMC paper on the system: http://www.ixi-software.net/thor/ixiQuarksICMC.pdf>http://www.ixi-software.net/thor/ixiQuarksICMC.pdf

Tom Collins,
The Open University
The generalized interval system and its application to musical analysis

In 1987, the American music theorist David Lewin published 'Generalized Musical Intervals and Transformations', a work which extends the foundations of post-tonal music theory, most notably drawing on Allen Forte's 'The Structure of Atonal Music' (1973). Lewin's principal concept, the Generalized Interval System (GIS), is by no means limited to the analysis of post-tonal music, however, as I will demonstrate. From a mathematical perspective, the GIS can be viewed as the actions of groups on sets. Meanwhile, musicians and musicologists have acknowledged that the GIS captures the perceptual equivalence we attribute to two passages of music where one has been derived from the other via some combination of transposition, rhythmic shifting and scaling. This talk attempts to make the GIS more readily accessible, by introducing the archetypal examples, as well as more elaborate incarnations.

The second half of my paper will address some of the applications of the GIS. There are many, but one in particular is as follows. Most musicians possess the ability to transcribe music-that is, to listen to an extract and give an account, in staff notation, of what they have heard. There is software on the market (e.g. www.widisoft.com) which automates such a process, with varying degrees of success, although the

output is a Musical Instrument Digital Interface (MIDI) file, i.e. not in staff notation. This MIDI file contains raw information, such as the pitch, onset, duration and relative amplitude of each note, which the user must edit and align to ensure that the MIDI file converts to a legible score. An algorithm is suggested which uses the GIS as a starting point for automatic alignment of the raw information.

Marcello Gimenes,
ICCMR, University of Plymouth
Emergent worldviews: An ontomemetic approach to musical intelligence

Interactive Musical Environments (iMe) is a computer system based on distributed software agents that simulates the emergence and development of musical styles. Agents apply perceptive algorithms and extract a number of musical features from recorded and live performances that are, as a result, assimilated into their memories. These features are simultaneously perceived and cognitively processed in ways that conform to models of human memory. iMe analyses the dynamics of the style development by evaluating the behaviour (memory's relative relevance) of the perceived structures (musical memes) during simulations of learning and creative processes. The system is designed to identify connections amongst different styles according to the possible influences agents can have over each other along their musical career. iMe also allows a comprehensive musical communication experience between software agents and human musicians via collective music improvisation. The system has good potential to be used in areas such as the investigation of musical styles in general and the study of creativity.

Eduardo Miranda
ICCMR, University of Plymouth
On composing with disembodied voices: Sacra Conversazione Opus 3

Sacra Conversazione Opus 3 is a piece in five movements for strings orchestra, percussion and synthesized voices, which was premiered at the Peninsula Arts Contemporary Music Festival 2008 in Plymouth. The piece was inspired by an evolutionary metaphor whereby simple vocal sounds evolve to vowels, syllabic forms, then to words, phrases, and so on.

This talk will focus mainly on the technical challenges I have encountered to compose the piece, which required research into phonology and technology for synthesising vocal sounds. I used physical modelling and formant synthesis techniques to generate simulations of immature vocal tract control and voice development, often producing surreal vocal passages. Analysis-resynthesis techniques were employed to dissect sampled speech from a variety of languages (Amharic, Catalan, Cantonese, Croatian, Dutch, French, Galician, German, Hebrew, Hindi, Irish, Persian, Swedish, Thai, and Turkish), in order to re-synthesise new (non-existent) utterances by combining segments from these languages. The piece is entirely “sung” in a non-existent artificial language.

Examples will be given and a movie of the concert (excerpts) will be shown.

Lawrence Zbikowski
University of Chicago
Music, Analogy, Embodiment

In this presentation I offer a theoretical account—illustrated through practical examples—of ways the sound materials specific to music correlate with embodied knowledge. Key to this correlation is the cognitive process of anlogy, through which musical sound structures are connected to images, movements, and ideas. Some of my examples will be drawn from music for social dance, which is based on a correlation of specific bodily movements with specific musical figures. These examples will highlight the essentially dynamic character of both movement and music; other examples will explore this feature of musical analogies more generally, especially in cases that do not appear to involve embodiment directly

Pat Hill
The Open University
A Brief Introduction to Aspect-Oriented Music Representation

The composition of music in many idioms involves the exploitation of a finite set of recurrent, recombinant musical fragments. Any given fragment may, as a consequence, appear in arbitrarily many structures, in its original or transformed state. Such a fragment is said to *crosscut* the musical structure, in the sense that the modification of such a fragment implies that revisions should be made to related structures.

Drawing inspiration from Aspect-Oriented Programming techniques in computer software, Aspect-Oriented Music Representation (AOMR) is an approach to music representation that aims to help reduce the problems associated with crosscutting. In overview, AOMR enables music fragments to be encapsulated and associated with user-defined areas of compositional interest. New fragments may be generated by specifying transformational and combinatorial relationships with other fragments, by reference to their area of interest. In this way, AOMR separates structure from content, and enables crosscutting fragments to be stated once, with any subsequent revisions to a fragment being automatically propagated to all related fragments.

In order to remain recombinant, each fragment must be independent of its ultimate temporal location. AOMR provides an approach to the arrangement of fragments within a temporal framework, and enables the content of fragments to be conditionally modified, based on factors such as location, context and provenance.

In this session we will describe the principal concepts of AOMR and suggest some ways in which an AOMR implementation might be usefully employed as a music representation for computer-generated composition systems.

Alex McLean & Jamie Forth,
Goldsmiths, University of London
Live Coding

Live coders program in conversation with their machine, dynamically adding instructions and functions to running programs. They make no distinction between creating and running software - execution of a program is controlled through edits to its source code. Live coding has recently become popular in performance, where software is written before an audience in order to generate music and video for them to enjoy. The history and practice of live coding will be illustrated with demos of the feedback.pl and SuperCollider live coding environments.

Alex McLean & Jamie Forth,
Goldsmiths, University of London
Music in conceptual space

The theory of conceptual spaces, proposed by Gärdenfors (2000), is a geometrical system of knowledge representation. Conceptual spaces are based on sets of dimensions, where abstract concepts or properties can be reasoned about in terms of spatial relationships. Central to the theory is a notion of similarity, which is defined directly in terms of spatial distance. Gärdenfors argues for the conceptual level as a potential bridge between the traditional symbolic and sub-symbolic forms of representation. Our research investigates the use of geometrical methods in the domain of creative music systems. We will discuss musical rhythm, and percussive timbre, in terms of conceptual spaces, both of which utilise multiple levels of representation in order to address the particular demands of each problem. We will present software implementations of such spaces, which for future work, we hope to explore with creative musical agents.

Gärdenfors, P. (2000). Conceptual Spaces: The Geometry of Thought.(Cambridge, MA: A Bradford Book, MIT Press).

Sergi Jordà
Universitat Pompeu Fabra de Barcelona
Musical interfaces

Alan Marsden
Lancaster Institute for the Contemporary Arts
Progress Towards Schenkerian Analysis by Computer

Schenkerian analysis is the most influential and sophisticated method used by musicologists to describe the structure of pieces of tonal music. Its similarity to parsing according to a grammar has stimulated a number of projects to examine the possibility of making such analyses by computer. Yet in spite of decades of research, beginning with Michael Kassler's doctoral dissertation in 1967, no-one has yet reported successfully derivation of a Schenkerian analysis from a score by computer. It has become clear that the impediment is not implementing the rules of Schenkerian analysis in computational form (though there is room for research into precisely what those rules are). The real impediment is what is not expressed in the rules: the decisions which a musician makes, often without even being conscious of

them, between the many possible interpretations permitted by the rules. This presentation will report on work which avoids the inherent exponential explosion of the solution space, allowing discovery and testing of heuristics for finding good solutions. The solution space still remains problematically large, however. Currently only small fragments can be tested, but nevertheless the software is able to analyse examples from actual scores.

Simon Holland
The Open University

Whole body interaction with Tonal Harmony

We are developing an extension of Harmony Space (Holland 1989, 2001) to provide a whole body spatial interaction system for harmonic structure for musicians learning to improvise. Beginning improvisers typically get stuck on “noodling” around individual chords from moment to moment and are unable to interact meaningfully with the strategic, longer term harmonic elements (e.g. chord progressions and modulations) typically essential to higher-level structure in western tonal music.

Harmony Space draws on cognitive theories of harmonic perception, providing consistent uniform spatial metaphors for virtually all harmonic phenomena, which allow them to be translated into spatial phenomena such as goal-direction trajectories, whose length, direction and target all encode important information. Other important harmonic phenomena are translated into judgements about proximity and whether a trajectory stays inside a specific area of the space or not.

Previous work has shown (Holland 1989; 1994) how screen-based versions of Harmony Space can be used in learning, performance, composition and analysis. For example, the chord progression for John Coltrane’s ‘Giant Steps’ comprises a complex sequence of key modulations and is considered to be difficult to play and remember. Analysis of the chord sequence in Harmony Space represents the progression as straight lines (of V I and II V I) chords moving leftward through the space.

Iterative user-centred design will be used to extend the Harmony Space representation to provide musicians with a large floor projected representation of the harmonic relationships of music they are currently playing. In initial scenarios, the moving harmonic structure projected will simply be that of a backing track, and players will play games that involve the physical pursuit of the spatial track of pre-existing harmonic trajectories. In later team-based scenarios, the harmonic structures projected will those generated partly by what musicians play, and partly how they move. Notes will be sensed either directly in the case of electronic instruments, or sensed using microphones and pitchtrackers in the case of monophonic acoustic instruments.

We predict that well designed whole body interactions of this kind will improve harmonic understanding, which will transfer to improved performance in a wide variety of musical tasks, including improvisation.

Presentation in Association with the Music Department

Philip Tagg
Professeur de musicology, Université de Montréal

Austria and Shampoo: Musogenic conceptualisation and functional embodiment

"Austria" and "shampoo" are pretty disparate concepts. This presentation will show how these two logocentrically incompatible notions are closely related in terms of gesture, movement, spatiality, energy, tactility and cultural reference. Such musogenic notions, I argue, are central to the formation of non-verbal semantic categories which function as socialisation patterns regulating emotional and evaluative behaviour in any culture. If musicologists abandon their wonted production-based formalism and if colleagues from related sectors of social or cultural studies can admit to their own competence as members of a musically, as well as verbally and visually, defined culture, then we may be able to start sorting out a few of the numerous "functional embodiment" categories that circulate 24/7 in the audiovisual media.

Performances

Thomas Risell,
Copenhagen
Electric Bass
http://www.youtube.com/user/MarloweDK

Thomas Risell is an electric bass player with an extensive following on youtube (as MarloweDK) for his virtuoso bass performances. In performances of great interest to music students, bass players and ethnomusicologists alike, Thomas performs 'play-alongs' in front of a video camera to celebrated popular music recordings of the last forty years, particularly funk, with both left and right hand technique recorded in full detail. Thomas recreates, with great precision, demanding performances by such bass virtuosi as James Jamerson, Bernard Edwards, Larry Graham, Louis Johnson, Marcus Miller and others. These performances are not rote reproductions, but active and imaginatively re-created performances that re-create precisely, within all audiblely perceptible limits, such details as expressive variations in micro-timing.

Many of the celebrated recordings which Thomas targets have a musical quality which seems to be far greater than can be readily accounted for by conventional musical analysis. One hypothesis is that part of this quality may lie in musically meaningful variations in their microtiming.

Following a recent hypothesis by Andy McGuinness that appears to model elegantly and parsimoniously the microtiming in at least one celebrated funk recording, Thomas has kindly agreed to visit the Music Computing Lab, where, with the generous assistance of ethnomusicographers from the Music Department and a sound recordist from the Pervasive Interaction Lab, we
plan to make ethnomusicology grade audio and video recordings of key performances for subsequent analysis

Stephen Bingham
Feltwell, Norfolk, UK
Violin and Electric Violin
http://www.stevebingham.co.uk/

Steve Bingham studied violin with Emmanuel Hurwitz, Sidney Griller and the Amadeus Quartet at the Royal Academy of Music from 1981 to 1985, where he won prizes for orchestral leading and string quartet playing. In 1985 he formed the Bingham String Quartet, an ensemble which has become one of the foremost in the UK, with an enviable reputation for both classical and contemporary repertoire. The Quartet has recorded numerous CDs and has worked for radio and television both in the UK and as far afield as Australia. The group has toured in Europe, the Middle East and Australia and has worked with distinguished musicians such as Jack Brymer, Raphael Wallfisch, Michael Collins and David Campbell. The Quartet's educational activities have included residencies at London's South Bank Centre, for several UK festivals and at Radley College. The Quartet is also known for it's many performances of new works by some of the best young composers in Britain.

Steve has appeared as guest leader with many orchestras including the BBC Scottish Symphony Orchestra, the Scottish Chamber Orchestra, English National Ballet and English Sinfonia. He has given solo recitals both in the UK and America and his concerto performances include works by Bach, Vivaldi, Bruch, Prokofiev, Mendelssohn and Sibelius, given in venues as prestigious as St. Johns' Smith Square and the Royal Albert Hall.

In recent years Steve has developed his interest in improvisation, electronics and World music, collaborating with several notable musicians including guitarist Jason Carter and players such as Sanju Vishnu Sahai (tabla), Baluji Shivastrav (sitar) and Abdullah Ibrahim (piano). He has appeared on three World music CDs with Jason Carter and is a guest artist on the CD "Confusion Rides", by singer/songwriter Mark Fawcett. Steve's debut solo CD "Duplicity" was released in November 2005, and has been played on several radio stations including BBC Radio 3 and Classic FM.

Lawrence Zbikowski,
Music Department, University of Chicago
Classical Guitar
http://humanities.uchicago.edu/faculty/zbikowski/

While primarily known for his contribution to the application of cognitive science research to elucidate problems in musicology, Lawrence Zbikowski is also a practical musician, performing works by Heitor Villa-Lobos, Domenico Scarlatti, Fernando Sor, Augustin Barrios, Leo Brouwer and others. Professor Zbikowski's practical musicianship is a valuable complement to his research presentations, often providing musical illustrations to theoretical points made in a following talk.

Lawrence Zbikowski is the author of Conceptualizing Music: Cognitive Structure, Theory, and Analysis (OUP, 2002), which was awarded the 2004 Wallace Berry prize by the Society for Music Theory. His research focuses on the application of recent work in cognitive science (especially that done by cognitive linguists and cognitive psychologists) to various problems confronted by music scholars. These problems include the nature of musical syntax, text-music relations, the organization of improvisational traditions, and the structure of theories of music. During 2003-2004 he was a fellow at the National Humanities Center, where his project concerned the development of a cognitive grammar of music. This work is the subject of his next book, By Crystal Fountains: Music, Language, and Grammar. He is presently director of a special project for the University of Chicago Division of the Humanities on creativity and cognition. He is co-chair, with David Huron, of the 2009 Mannes Institute on music and the mind, at which he will also serve as a member of the faculty.

Alex McLean and Jamie Forth
Goldsmiths, University of London
Live Coding
http://doc.gold.ac.uk/~ma503am/alex/feed/

Live coders program in conversation with their machine, dynamically adding instructions and functions to running programs. Here there is no distinction between creating and running a piece of software - its execution is controlled through edits to its source code. Live coding has recently become popular in performance, where software is written before an audience in order to generate music and video for them to enjoy.