USC | IMSC

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ENGINEERING RESEARCH CENTER

MuSA.RT

music on the spiral array . Real-time

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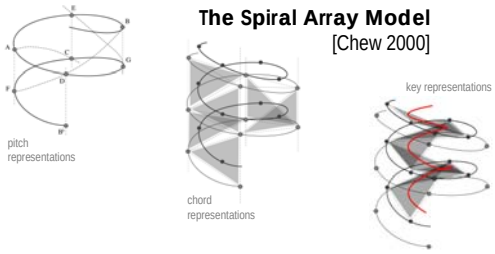
sensory interfaces

Research goal | a collaborative research project integrating real-time music processing and content-based graphical rendering in interactive immersive environments

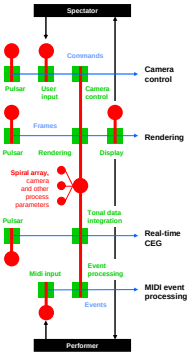


The Spiral Array Model
[Chew 2000]

research approach

We use the Spiral Array model to quantify, analyze and visualize tonal patterns. The Spiral Array model [Chew 2000] is a geometric model for tonality rooted in the theory and perception of music. It has been shown to be an effective tool for assigning context-appropriate pitch spellings to MIDI numbers [Chew and Chen 2003], for chord tracking [Chew 2000] and for key-finding [Chew 2001].

accomplishments



We designed the MuSA.RT system using the SAI architectural style, and implemented the MuSA.RT Opus 1 and 2 prototypes using the open source Modular Flow Scheduling Middleware (MFSM, mfsm.SourceForge.net).

The system (see graph to the left) consists of four independent data streams defined by the composition of well-studied architectural patterns [Francois 2003].

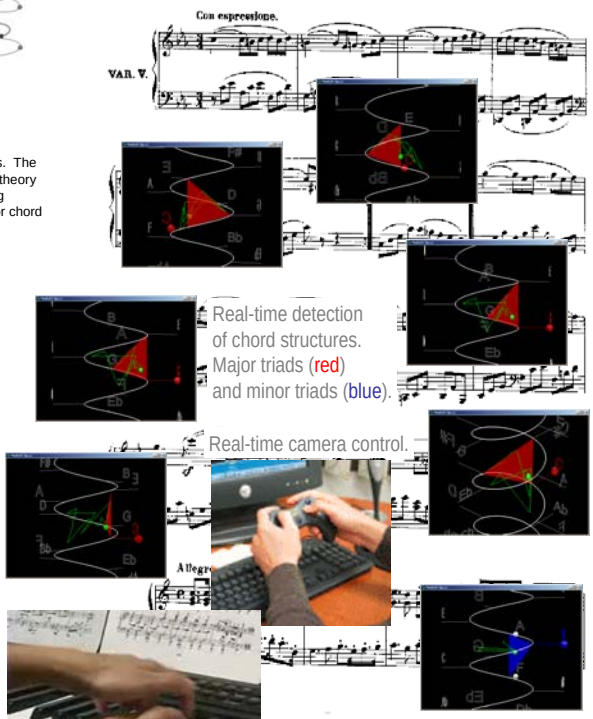
The pictures to the right illustrate the rendering of the Spiral Array's analytical structures. The graphics preserve the inherent simplicity and elegant geometric for the model while providing an informative and visually pleasing dynamic picture.

The MuSA.RT system was demonstrated at the ACM Multimedia conference, held in Berkeley, CA in November 2003 [Chew and Francois 2003]. The picture to the left shows the demonstration setup. Live input from a MIDI keyboard is analyzed and rendered in the Spiral Array space in real-time. The two-hour demonstration received excellent reviews.

Plans

MuSA.RT Opus 3 will integrate the latest pitch spelling and key tracking algorithms. A voting technique for chord tracking is currently being developed for more robust chord recognition. More publications and demonstrations are being prepared for the MuSA.RT system in the coming year.

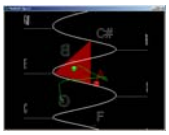
A defining feature of tonal music is the unfolding of pitch structures over time. Real-time tracking of tonal patterns in music has widespread applications in music analysis, information retrieval, performance analysis and expression synthesis. Each piece of music consists of a sequential arrangement of notes that generates pitch structures over time. An expert listener is able to ascertain the keys and harmonic patterns traversed over time. But a novice or a computer would benefit greatly from a geometric model that can provide visual cues and numeric quantifying of these tonal properties.

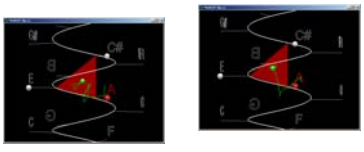


Real-time detection of chord structures. Major triads (red) and minor triads (blue).

Real-time camera control.

Pitch spelling, mapping MIDI to pitch names [Chew & Chen 2003]





Real-time detection of keys (not shown). [Chew 2001]

Role in IMSC | an experiment in complex, cross-disciplinary multi-modal real-time system integration that serves as a model for larger scale integration experiments