NIME Workshop Report -- *abstract appears on pages 13-14*

Topics

The topics covered by presenters at the workshop demonstrated a wide variety of advances in the creation, expression and interpretation of music and musical instrumentation. Here, we briefly summarize some of the participants' approaches to interface design and performance with alternative controllers that were discussed at the workshop. The complete selection of papers can be found at the workshop web site: http://www.nime.org.

New musical controllers for experts and novices

Before the invention of electronic musical instruments, the relationship between instrument design and musical performance was constrained by the physical limitations of the instrument itself and the acoustics of sound production. Electronic instruments, on the other hand, allow the artist to produce almost *any* sound imaginable. Musical communication protocols, such as MIDI (Musical Instrument Digital Interface) or OSC (Open Sound Control), allow artists to connect a variety of sensors or gesture capture devices to any device or network of computers, synthesizers, samplers or other electronic instruments. By taking advantage of methods to track and collect sensory information, performers are able to go beyond the previously limited correspondence between human gesture and the sound produced, allowing unprecedented freedom for experimentation with musical expression, sound design and physicality [2].

It seems natural that some designers use this freedom to retrofit existing musical instruments with new sensors, thus expanding the gestural and sonic capability of the performer. Augmenting an electric violin with position and orientation sensors was the approach taken by Goudeseune, et al [3]. Adding sensors to the eviolin coupled with a motion tracking antenna, allows Goudeseune to translate the violinist's body posture and movements into data interpreted by Max, an object-oriented programming language. The tradeoff, of course, is the increased complexity of the instrument and mapping the tracking data generated by body gestures into sonic information that can be controlled by the player. As Max Mathews noted during the workshop, the violin is an instrument that takes many years of practice to learn; by adding an additional 6 degrees of freedom, the path to mastery of the instrument becomes even more difficult.

Workshop participants approached this compromise between the expressiveness of the controller and its relative complexity differently. The Accordriatron, presented by Michael Gurevich (**Figure 1**), is a gestural MIDI controller with a design based on the paradigm of the traditional squeeze box. This multi-dimensional instrument allows a performer to use a combination of continuous gestural controls such as squeezing, with discrete button inputs and real-time synthesis [4].

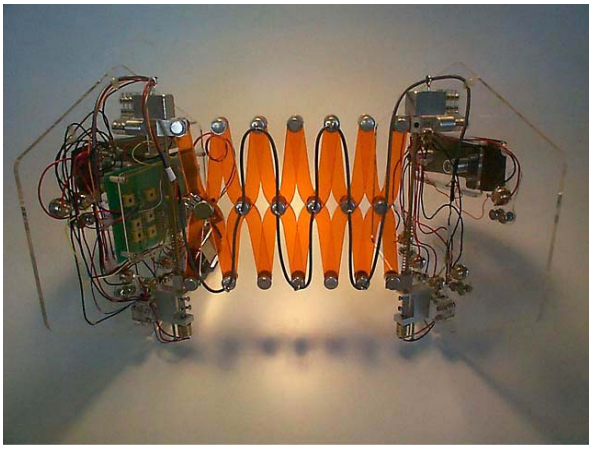

Figure 1: Michael Gurevich's Accordiatron

Not everyone is musically inclined, and for many people, learning to play traditional instruments is intimidating. Can we design musical controller instruments that bring the joy of musical expression to non-musicians? Dominic Robson presented several musical interfaces that do not look like traditional musical instruments, in an attempt to offer more intuitively fun experiences to the user. Robson's Piano Cubes are controllers that consist of two simple jars filled with viscous syrup (**Figure 2**). By simply picking up the jars, anyone can "play" major scale piano arpeggios and adjust the speed and pitch of the music by tilting the jars [5].

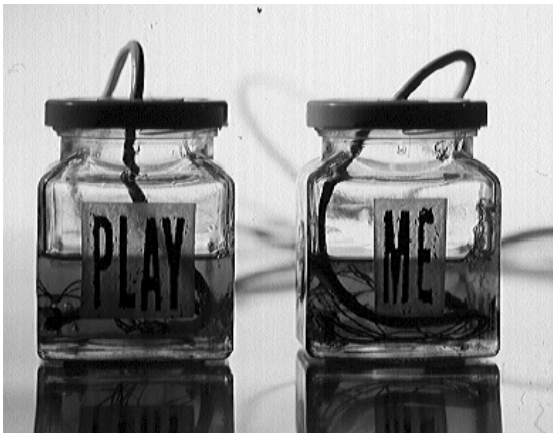

Figure 2. Piano Cubes by Dominic Robson

Joe Paradiso's work “Musical Trinkets” also took a playful approach to musical expression for novices by embedding passive magnetic tags inside a variety of small toy objects (**Figure 3**). As players move the tagged objects in range of a hidden magnetic reader, the toys trigger musical and graphic events via the conversion and mapping of dynamic tag data into MIDI information [6].

In a similar vein, Kenji Mase presented a Sensor Doll that responds musically to physical actions and real-time gestures of the user, as well as a series of water-based musical controllers for creating harmonic compositions determined by water flow [7]. Dan Overholt displayed his 3-D “MATRIX” controller which changes musical sounds and graphics by exerting hand pressure on a moveable surface of push rods. The Matrix allows a player to "sculpt" sounds as they physically engage with the interface surface and simultaneously control signal processing algorithms that affect the sonic and graphical output (**Figure 4**) [8]. To prove the point that literally any object can become a musical controller, Perry Cook brought along a coffee cup retrofitted with multiple sensors and jammed on his Java Mug to the delight of all.

Figure 3. Musical Trinkets by Joe Paradiso

Figure 4. MATRIX controller by Dan Overholt

However widely and wildly different these controllers may be, all have something in common: they do not attempt to extend or resemble existing musical instruments, but employ different metaphors using rich varieties of human activities as the starting point. They approach musical performance as a playful interactive experience directed toward performer rather then audience, and therefore attempt to be intuitive and fun to play with, simple to learn, and enjoyable.

Musical creation and performance

An important goal of this workshop was to bring together musical researchers and designers with musicians and composers who either use alternative controllers themselves or design musical environments for the public.

Curtis Bahn, who has been performing as a member of "*interface*" an improvisatory electronic music duo [9] since 1995, shared his thoughts and experiences of performing electronic music. He noted the importance of a performance-centered view in designing and using controllers, taking into account the venue and the kind of performance being envisioned. He noted that: "… attempts to create the "ultimate musical controller" and … "top-down" approaches to create a design that addresses all needs will fail. We have found that many of the most effective interfaces are those that are "home-brewed" addressing a specific need, instrument, performance style or body".

Just as with traditional music, electronic music can be performed and enjoyed anywhere, anytime. Ryan Ulyate and David Bianciardi discussed issues and challenges from their practical experience designing the "Interactive Dance Club" [10], a performance venue concept that allowed participants to contribute to a shared musical and visual experience (demonstrated at SIGGRAPH 98). Gideon D'Arcangelo presented his approach to designing interactive musical experiences for public spaces, such as museums and exhibits. D'Arcangelo also offered details regarding his modular sound design methods used in the creation of the interactive soundtrack for "Currents of Creativity" - an interactive video wall installation at the Pope John Paul II Cultural Center [11].

As performance venues are not limited to physical space, Sergi Jorda presented "FMOL" (F@ust Music On-line) to show musical possibilities in the realm of virtual performance [12]. Using a screen, keyboard, and mouse based interface for composing experimental electronic music, FMOL has been used by hundreds of Internet composers since it was first introduced in 1998 (**Figure 5**). Jorda noted that FMOL was not created as a tool for composing conventional melodies, such as "Mary had a Little Lamb", which can be handled very well using traditional instruments. Instead, he believes new interface technologies should allow one to compose music that would be impossible to create using traditional instruments.

Figure 5. Sergi Jorda with FMOL

Empiricism and formalism in musical controllers design

With the large variety of controllers and approaches to designing interactive musical experiences demonstrated at the workshop, it seemed natural to ask whether there might be a general set of design principles or formal theories that could be used to guide interface creators in developing new controllers. Perry Cook, a prolific controller designer, presented a list of empirical principles summarizing his years of experience (e.g. "Copying an instrument is dumb, leveraging expert techniques is smart") [13]. Marcelo Wanderley, on the other hand, attempted to investigate and apply formal theories and principles of HCI and apply them to design of musical interfaces. Wanderley believes that usefulness of HCI theories such as Fitts' law, a formula that can be useful in design of time critical applications will allow the translation of performance scores from a variety of musical input devices to be used to create an objective index of performance. [14]

Teaching musical controller design

Building fine musical instruments is a craft that has been perfected over generations and takes a lifetime to learn. Can we teach design methods for alternate controllers and interfaces to create electronic music? Bill Verplank talked about principles, results, and some of the challenges in of establishing a course for students at Stanford University's Center for Computer Research in Music and Acoustics (CCRMA), on designing and building new musical interfaces [15].

Performances

The discussions of musical controllers would not be complete without the actual experience of playing with them or watching and listening to a musician using these alternate controllers to perform. The half-day performance and demo sessions organized at the Experience Music Project in Seattle, provided the opportunity for musical interface designers and invited performers to show their work. This also presented a one-of-a-kind opportunity for the general public to see a variety of new instruments and methods for musical control from all around the world, under one roof.

Figure 6: Max Mathews opens the performance session at the EMP

Live performances included Andrew Schloss and Randy Jones in an interactive piece called "UNI" on Radio Drum and Tactex pad. In this performance the audience was treated to a glimpse of the future of new controllers that will not only play sound but also real-time images. Schloss also played a solo piece for Radio Drum and Disklavier illustrating that new controllers offer possibilities of playing more traditional instruments in ways that would be impossible using the original interface. One exceptional performance highlight included the Radio Drum playing a complex sequences of notes known as Shepard Tones on the Disklavier that would require at least five hands at the same time to perform. Daniel Koppelman also performed on the Disklavier, a composition entitled "There's Just One Thing You Need to Know" by Christopher Dobrian. Koppeman's computer mediated performance using "artificially intelligent" composition and improvisational software enabled the seamless blending of acoustic and synthetic sounds. Koppelman also took advantage of the Disklavier's ability to playback sounds simultaneously while being played in real-time.

Perry Cook performed the West Coast premiere of his piece "7 Minutes from Tibet" using a custom "SqueezeVox" Concertina controller and real-time physical synthesis, which featured Tibetan, Mongolian, and other chant styles blended together. Cook's performance demonstrated a radically different approach to the squeeze box paradigm than the Accordiatron discussed earlier. By retrofitting a conventional squeeze box instrument with goatskin bellows, embedding linear pressure sensors, benders, and re-purposing valves, sliders, vent switches and buttons, Cook is able to engage in ongoing experimentation with different pitch mappings, articulators, and overtone control in performance. Max Mathews, a pioneer in electronic music and inventor of the Radio Drum, was our distinguished Master of Ceremonies for the performance event (**Figure 6**).

Other works that were demonstrated in the JBL Theater and during two sessions in the Demo Labs included the following:

1. **Two Hearts** Musical System, Graeme McCaig and Sid Fels; In this work two people interact with each other to affect each other's heart beats which then coordinate to control navigation in a musical terrain.
2. **Mouthesizer**, Michael Lyons: A small head mounted video camera is used to capture an image of the mouth. The shape of the mouth opening is mapped to MIDI information to control, for example, timbral qualities of musical input for enhanced expression. The acoustics of speech production and the structure of facial expressions inspire the exploration of gesture to sound mappings.
3. **JMax**, Marcelo Wanderley and Norbert Schnell: On a portable computer running jMax (linux) controlled by different input devices such as a drawing tablet and custom devices connected via an analog-to-MIDI interface, variations on the mapping of controller variables to the synthesis inputs were presented.
4. **Eviolin**, Camille Goudeseune: The eviolin is a motion-tracked, pitch-tracked electric violin with two 6DOF magnetic sensors that determine the position and orientation of both violin body and bow. Real-time audio software tracks the pitch, loudness, and timbre of the signal from the violin's bridge pickup.
5. A **Helical Keyboard Client**, Michael Cohen and Toshifumi Kanno: This 3-D interface was inspired by the cyclical nature of octaves and helical structure of a scale, a piano-style keyboard is given a helical warp, one octave/revolution.

6. **Speaking Orbs**, Einar Ask: This interactive sound sculpture allows multiple participants to create a collective ambient composition by passing their hands over the reflective orbs.
7. **Accordiatron**, Michael Gurevich: This gestural MIDI controller for interactive performance can be used to control sound processing and generation in a real-time signal processing environment.
8. **FMOL**: Faust Music OnLine, Sergi Jorda: This demonstration included short musical improvisations using FMOL, a mouse-driven software system for real-time audio-visual composition and synthesis.
9. **Musical Trinkets**, Joe Paradiso: The Musical Trinkets Interface enables any object to become a continuous musical controller by embedding each with a magnetically-coupled RF tag, which identifies each object and turns them into continuous controllers that measure proximity, orientation, and a local variable such as pressure. The objects attain complex musical behavior when brought near a magnetic reader.
10. **Iamascope**, Sid Fels: An interactive, electronic kaleidoscope that combines computer video, graphics and audio technology to allow participants to create striking visual imagery and sound. By applying image processing to the kaleidoscopic image, participants' body movements also directly control music in a beautiful dance of symmetry with the image.

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