Chapter 17. Meeting 17, Interfaces: Live Electronics and Circuit Bending

17.1. Announcements

• Due Thursday, 12 November: Sonic System project Draft
  Bring prototypes, sketches, ideas to class for discussion
• Bring laptops for more work with PD and Martingale
• Quiz next Thursday

17.2. Motivations for Live Electronics

• Music as performance and theater
• Cage’s observation on the problem of speaker music (Holmes 2008)
• Engaging and extending improvisation

17.3. Listening: David Tudor

• Tudor began working with Cage and Cunningham in the 1950s developing live electronics for dance
• David Tudor, Rainforest, 1973
• A series of pieces beginning in 1978
• Sounds are played through transducers affixed to solid objects; objets filters and project sounds, as speakers; contact mics on objects are used to amplify sounds sent to conventional speakers (Collins 2009, p. 48)
• David Tudor, *Pulsers*, 1976

• Manipulation of feedback (Holmes 2008, p. 187)

• David Tudor, *Toneburst*, 1975

### 17.4. Listening: Gordon Mumma

• 1950s: Gordon Mumma, with Robert Ashley, begin staging weekly performances of live electronic music at the Space Theater (Holmes 2008)

• 1961: begin ONCE festival of contemporary music, continues until 1965 (Holmes 2008)

• 1966-76: Robert Ashley, Gordon Mumma, David Behrman, and Alvin Lucier form Sonic Arts Union (Holmes 2008)

• Gordon Mumma, *Hornpipe*, 1967
• “The cybersonic console monitors the resonances of the horn in the performance space and adjusts its electronic circuits to complement theses resonances”: a form of feedback (Holmes 2008, p. 390)

• A long tradition of works for solo instrument and live electronics

• Do we hear interaction, or cause and effect?

• Do we hear a duet, a solo, or something else?

17.5. Listening: Robert Ashley

• Narrative and storytelling music in multimedia

• Robert Ashley, *Automatic Writing*, 1974-79

• Released in 1979

• Compared to minimalism, called text-sound composition

• Closely miked spoken voice performing involuntary speech

• Idea of four characters: two vocal, two instrument (2008, p. 392)

• Robert Ashley, *The Wolfman*, 1964

• Employs slow, modulating feedback controlled by a vocalist’s mouth (2008, p. 186)
17.6. **Ensemble-based Live Electronics**

- Ensembles of live electronics performers, sometimes mixed with acoustic or conventional electronic instruments
- 1960s: Musica Eletronica Viva (Holmes 2008, p. 963)
- AMM: touring group of jazz and electronic musicians (Holmes 2008, p. 963)
- SuperSilent

17.7. **The Isolation of the Input Interfaces**

- The modular synthesizer integrated sound production, sound design, and input interfaces
- Modular synthesizers explored modular input devices: keyboards, modulation wheels, buttons, sliders, and knobs
- With the establishment of a common control language (voltages, MIDI, OSC, etc.) input interface devices are decoupled from sound production devices

17.8. **The Controller**

- Input interfaces as a modular component separate from sound producing components
- Input interfaces make no sound: they only provide data output
- Input interfaces may use voltages, MIDI, OSC, or other languages to communicate to sound producing entity
- With a common input language many input interfaces become interchangeable

17.9. **The Parameterization of Musical Events**

- Western notation began parameterization of sound-events into discrete symbols
- The modular synthesizer suggested the description of musical values in isolated units
- Synthesis and processing parameters: envelope shapes, filter frequencies and shapes, processing parameters
- The use of controllers forces explicit parameterization
17.10. Mapping

- Translation of one sequence of values to another
- May involve scaling and shifting values
- One-to-one map from one range to another; map from one type of scale to another scale
- Example: 0, 1, 2, 3 (integers) to C, C#, D, D# (pitches)
- Example: .25, .5, .75, 1 (unit interval floating-point values) to \textit{pp}, \textit{mp}, \textit{mf}, \textit{ff} (dynamic symbols of Western notation)

17.11. Mapping Input Data to Musical Parameters

- Each input type is (often) applied to a single parameter
- If the input has multiple two or more dimensions of control, each dimension can be applied to a different parameter
- Musical mappings are aesthetic, creative choices

17.12. Models of Traditional Instruments: Piano

- Keyboard controllers without sound sources and the keytar
- 1980: Moog Liberation (14 Lbs)
Liberation is a self-contained, mobile musical instrument with an unbelievable number of performance options. It is completely polyphonic, yet features a separate lead synthesizer with two oscillators, unique Moog sound and total synthesizer variability. Individual mixer controls allow you to choose a final output of either one or both oscillators, ring modulation, noise generator, polyphony or any mix of those functions.

The left-hand controllers and force-sensitive keyboard combine to provide for more nuances, effects and musical subtleties than you have ever imagined. Yet they are there at your fingertips. Comfortably.

Only 14 pounds for complete portability. Outstanding features. Affordable price. From Moog, of course... we're the people who started it all!

• Roland AX-7 (6 Lbs)
• C-Thru Music Axis 64
17.13. Models of Traditional Instruments: Guitar

- Conventional guitar used as a MIDI controller
  
  YouTube Video (http://www.youtube.com/watch?v=JTjoy_CQn1g)

- Casio DG 20
17.14. Models of Traditional Instruments: Aerophones

• Example: Yamaha WX5
• Example: Akai EWI 4000s

You Tube (http://youtube.com/watch?v=N4Ex1sC4xMc)

• Example: Yamaha Bc3a
Single parameter breath controller
• Example: Morrison Digital Trumpet

17.15. Models of Traditional Instruments: Percussion

• 1988: Akai MPC60
• Example: Akai MPD-16
• Example: Roland Handsonic HPD 15
17.16. Data Input: Sliders and Knobs

- Example: Evolution UC-33
• Example: Novation Remote Zero

• Example: Evolution X-Session
• Example: Bitstream 3x
17.17. Data Input: Touch Pads

- Example: Buchla Thunder (1990)
YouTube (http://www.youtube.com/watch?v=GYBEoZXxym4)

- Example: Novation Remote 81

- Example: Korg KAOSS
• Haken Continuum

Three parameters on touch surface (x, y, and pressure)
YouTube (http://www.youtube.com/watch?v=Mrmp2EaVChI)

- Example: Monome
  YouTube (http://www.youtube.com/watch?v=LuV9Eg6HC34)
  YouTube (http://www.youtube.com/watch?v=14HG0QOp-0g)
  YouTube (http://www.youtube.com/watch?v=F0A8xR8ieek)

- Example: Yamaha Tenori On ($999.99)
Example: Snyderphonics Manta ($700)

Triggers that report amount of finger surface area as a parameter
17.18. Data Input: Light and Infrared Sensors

- Photoresistors have been used in custom electronics since the 1960s
• Example: Roland D-Beam
17.19. Data Input: Spatial and Movement Detection

- Radio signals and theremin style antennae have been used since 1960s
  Contemporary accelerometers offer an expensive and widely-used option
• Example: Radio Baton, Max Mathews (1980), developed with Oberheim

Each baton has provides three parameters: x, y, and z position
• Example: The Hands, Michel Waisvisz (1984)
17.20. Data Input: Joysticks

• Example: Novations Remote 81

• Example: JL Cooper Panner
• Example: Logitech Dual Action Gamepad
• Example: Logitech Force
17.21. Data Input: Modular and Programmable Input Devices

- Mawzer Modular Interface
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• JazzMutant: Lemur
17.22. Controller Case Study: Logitech Dual Action

• Standard USB input device: preferred for low cost, high ergonomics
• 10 buttons, 1 pad controller, 2 x/y analog joysticks
• Developed as an interface in conjunction with other controllers for performances with KIOKU

KIOKU site (http://www.kiokugroup.com/)
17.23. Controller Case Study: Filtered Noise with Joysticks

• Various types of noise filtered with a low-pass and high-filter
• Joystick A: y axis controls amp; x axis high pass filter
• Joystick B: y axis controls filter resonance; x axis controls low pass filter
• Buttons trigger diverse noise sources

17.24. Controller Case Study: A Synth Bass with Joysticks

• Synthesized bass tone made of square and sine waves
• Joystick A: y axis controls amplitude; x axis controls pitch bend
• Joystick B: y axis controls low pass filter; x axis controls square wave width
• Buttons trigger pitches
• Pad switches octave

17.25. Controller Case Study, Variable-Speed Buffer with Joysticks

• Looped samples
• Joystick A: y axis controls amplitude; x axis controls playback speed
• Joystick B: x axis scales end position of loop
• Button opens envelope
• Pad switches samples within a two-dimensional grid

17.26. Circuit Bending

• Modification of conventional electronics for creative musical (aesthetic) output
• Applied to battery-powered toys, effects, old synthesizer, or any electronic device that makes noise
• The interface is extended to include modifying circuit boards
• Often results are obtained from blind experimentation
17.27. Reading: Ghazala


• Examples: incantor, bent Speak and Spell
www.anti-theory.com (http://www.anti-theory.com/bentsound/incantors/incantor_straight_03.mp3)


• How does chance electronics relate to chance music?
• What does Ghazala mean when he refers to the immediate canvas?
• Why is the metaphor of a coconut useful in understanding circuit bending?
• For Ghazala, is anti-theory against theoretical understanding of music and circuits?

17.28. Circuit Bending: Documentary

• What is Circuit Bending (2004) by Derek Sajbel

YouTube (http://www.youtube.com/watch?v=w6Pbyg_kcEk)