Electromagnets and the Acoustic Piano:

A Brief Overview of Current Research and Music for the Genre

Jonathan Taylor de Oliveira

jtolive@bgsu.edu

Introduction

- Why electromagnets and piano?
  - Once Upon a Time…
    - John Cage – Prepared Piano
- The acoustic sound world of the piano is AMAZING!
- Introduction to electromagnets
- Three main researchers
  - Per Bloland
  - Andrew McPherson
  - Eduardo Miranda

The Electromagnet and the Piano

- Not so young after all…
- Richard Eisenmann
  - *Elektronisches Klavier*
  - 1886 – Electromagnets used to activate piano strings
- Alvin Lucier (b. 1931)
  - *Music on a Long Thin Wire* (1977)
  - *Music for Piano with Magnetic Strings* (1995)
- Peter Adriaansz (b. 1966)
  - *Waves: four pieces for E-bow piano, sines and live-delay* (2007)

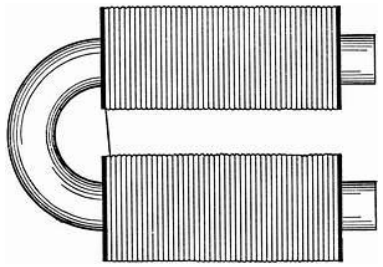

Image 1 – Horeshoe Electromagnet

Image 2 - EBow

Recent use of electromagnets for piano

Image 3 – Setups by Per Bloland, Andrew McPherson, and Eduardo Miranda, respectively

Per Bloland

- Master of Music degree – University of Texas at Austin
  - Kevin Puts
  - Russel Pinkston
  - Bruce Pennycook.
- D.M.A. in composition - Stanford University
  - Mark Applebaum
  - Brian Ferneyhough
  - Chris Chafe
  - Erik Ulman.
- Music has been performed at
  - SEAMUS, Darmstadt, and Bowling Green New Music Festival.

- Assistant Professor of Composition and Technology - Miami University, OH

Electromagnetically-Prepared Piano (EMPP)

- Design developed with Edgar Berdahl, Steven Backer and Julius O. Smith III
  - Twelve electromagnets positioned over strings

- Dual function
  - Filter
    - Single Sine Wave at A4
    - Single Sawtooth at A4
    - Gershwin's *Rhapsody in Blue*
      - Undampened
      - Dampened
  - "Loudspeaker"

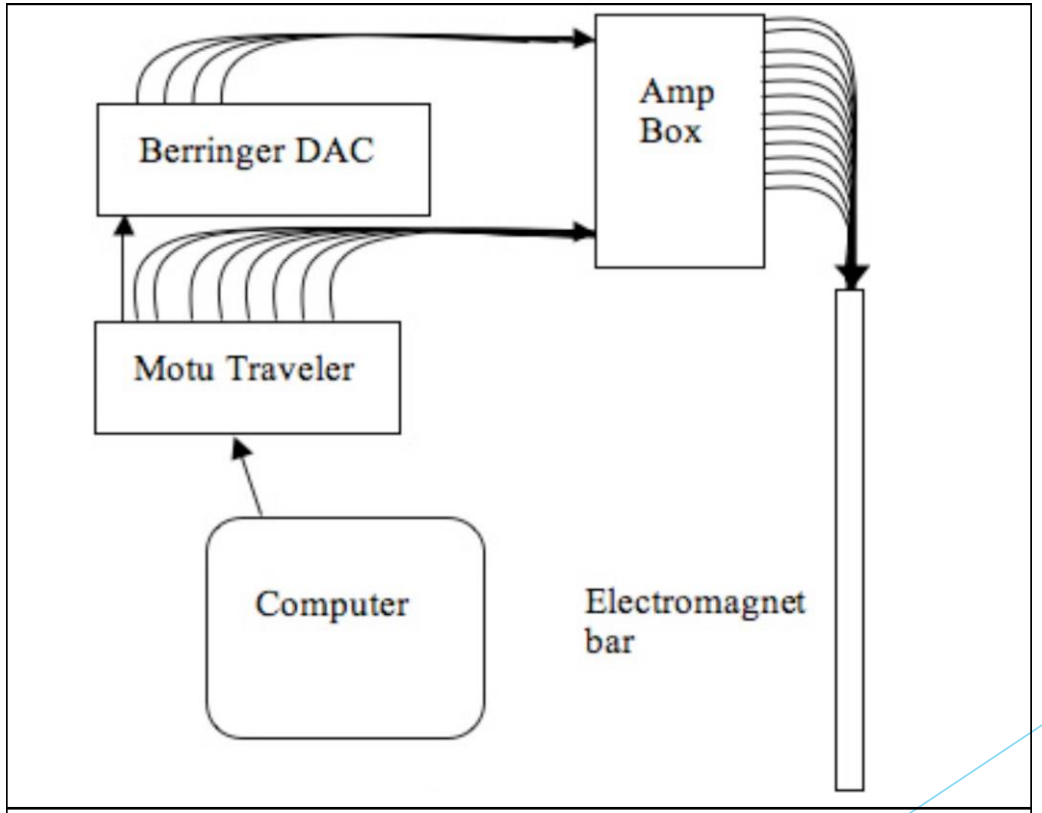

Image 4 - Signal Flow

Elsewhere is a Negative Mirror (2005)

- Digital signal controlled by Max/MSP
- Complex routine
  - First pedal (damper)
    - Sustaining the notes played by the pianist
    - Raising the dampers
  - The second pedal (sostenuto)
    - Silently depressed chords, activated by electromagnets
  - The third pedal (una corda)
    - Trigger the patches on the computer.
  - *Elsewhere is a Negative Mirror* (2005)

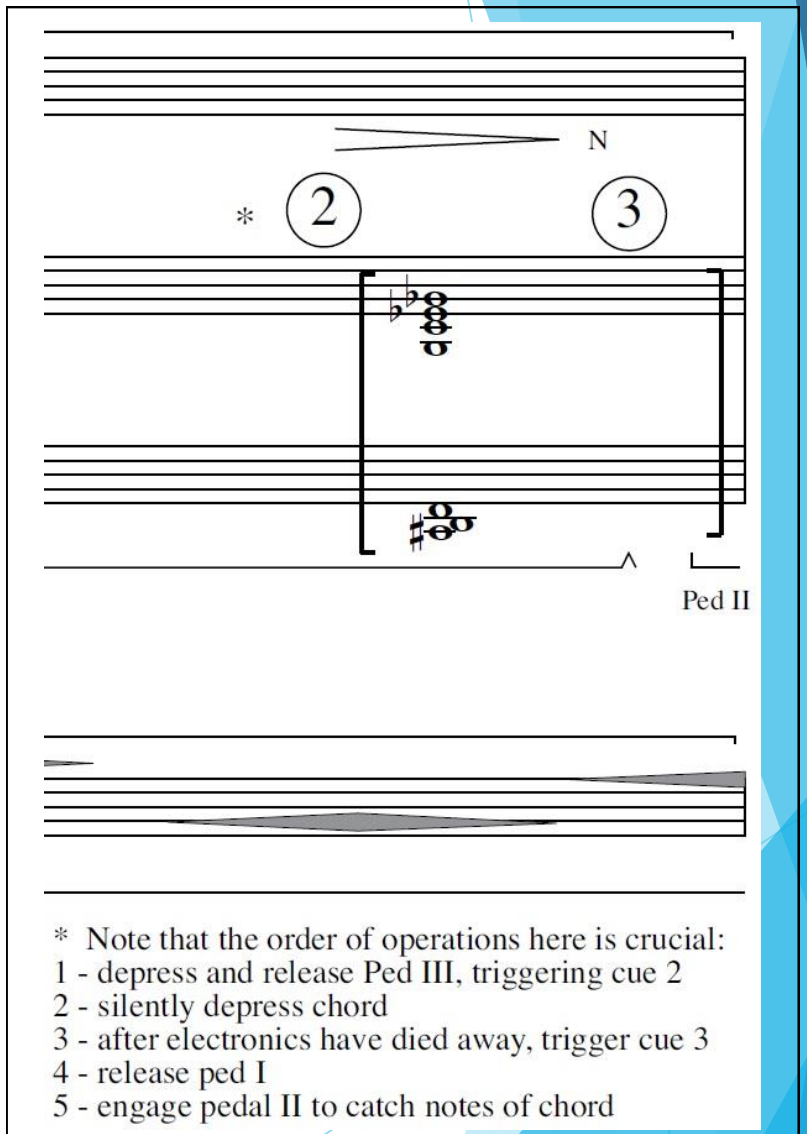

Image 5 – *Elswhere is a Negative Mirror*, page 1

Andrew McPherson

- Double major at MIT
  - Music
    - Viola with Marcus Thompson
    - Composition with Peter Child and John Harbison
  - Electrical engineering
- Master's Degree in engineering - MIT
- Ph.D. in composition - University of Pennsylvania
  - James Primosch, Jay Reise, Anna Weesner, and Maurice Wright
- Now Lecturer in Digital Media at Queen Mary, University of Londo

Magnetic Resonator Piano

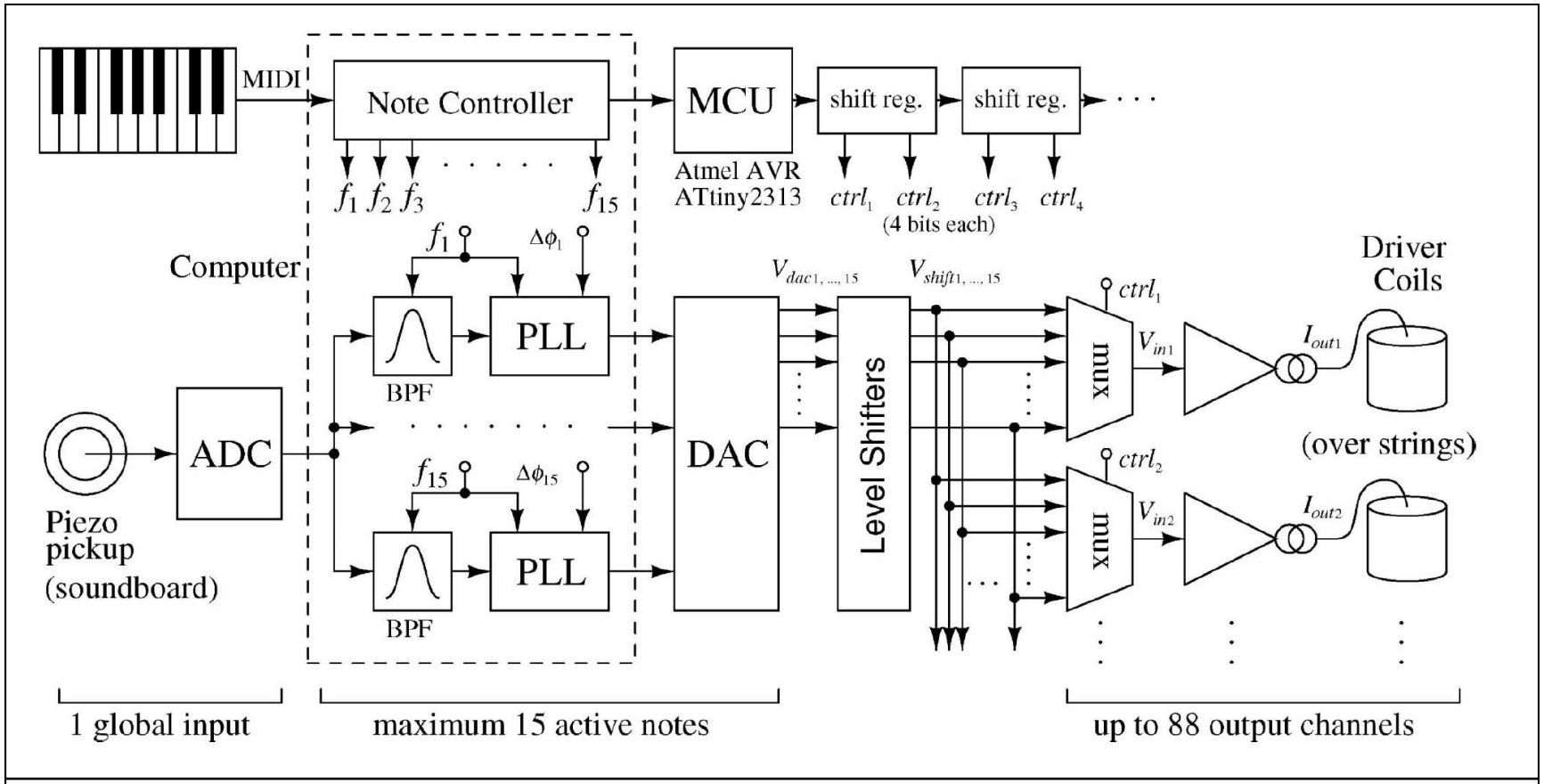

Image 6 – Diagram for the Magnetic Resonator Piano

- Performer's control of the electromagnets
  MIDI keyboard (*Secrets of Antikythera – 2009)* or Piano Bar sensor

Eduardo Reck Miranda

- Data-processing technology/composition - Universidade do Vale do Rio dos Sinos
- Philosophy at the Universidade Federal do Rio Grande do Sul
- Master of Science degree in Music Technology - University of York
- Ph.D. in Music and Artificial Intelligence - University of Edinburgh.

BioComputer Music

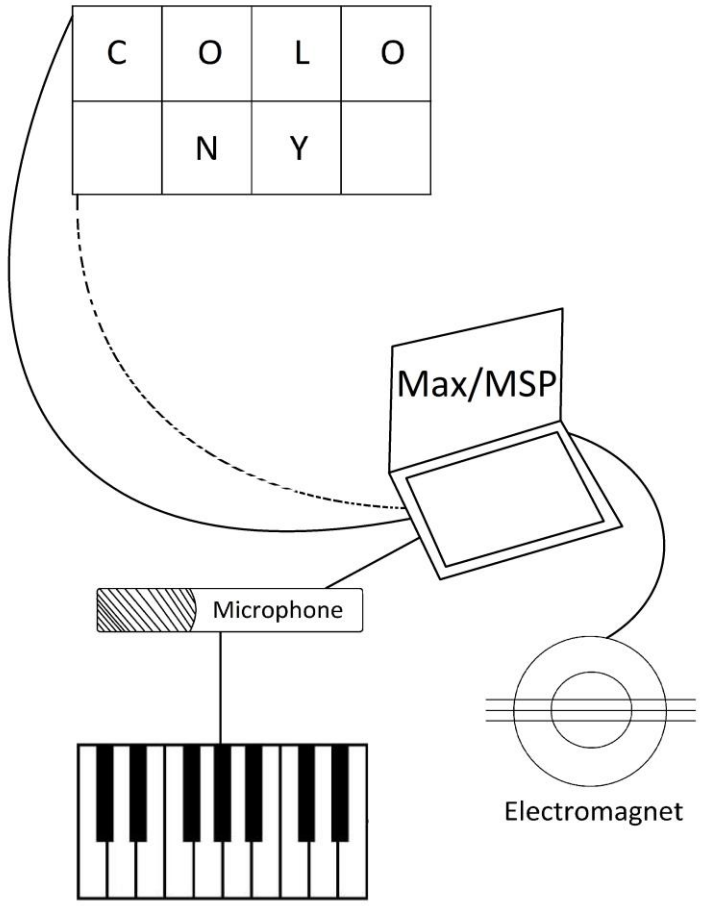

Image 7 – Diagram for BioComputer Music

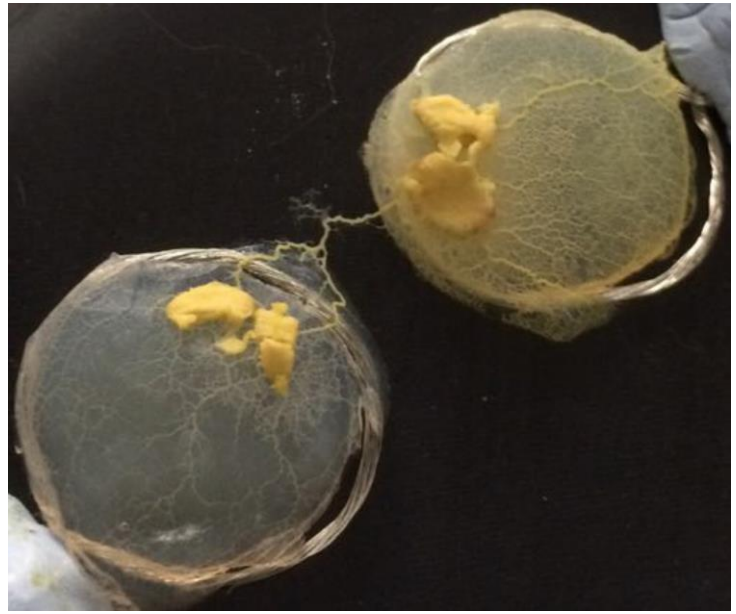

Image 8 – *Physarum polycephalum*

- BioComputer Music

Conclusion

- Differences in design stem from difference in purpose
- The EBow possibility of continuous sound
- Electromagnetically-Prepared Piano
  - Piano strings as filters and loudspeaker
- Magnetic Resonator Piano - augmented texture, timbre and technique
- BioComputer Music
  - Similarities to Bloland's and McPherson's designs, but…
    - "Give a voice" is given to biological events

References

- Berdahl, Edgar; et. Al. “If I Had a Hammer: Design and Theory of an Electromagnetically-Prepared Piano.” *International Computer Music Association* Volume 2005, 2005. 29 Apr. 2018, https://quod.lib.umich.edu/i/icmc/bbp2372.2005.209?rgn=main;view=fulltext
- Bloland, Per. “The electromagnetically-prepared piano and its compositional implications.” Paper presented at the International Computer Music Conference, Copenhagen, Denmark, (2007).
- Bloland, Per. *Biography*. 30 Apr. 2018, www.perbloland.com/?p=Biography.
- Braund E., Miranda E.R. “BioComputer Music: Generating Musical Responses with *Physarum polycephalum*-Based Memristors.” *Kronland-Martinet R., Aramaki M., Ystad S. (eds) Music, Mind, and Embodiment. CMMR 2015*. Lecture Notes in Computer Science, vol 9617. 2016.
- *EBow*. 30 Apr. 2018, http://www.omega.be/guitares/effets-guitares/accessoires-effets/ebow-bow-plus-electronique-pour-guitare.html
- _____. 30 Apr. 2018, https://tonereport.com/blogs/tone-tips/drop-the-pick-on-purpose-5-alternatives-to-try.
- McPhersen, Andrew. *Biography*. 29 Apr. 2018, http://andrewmcpherson.org/index.html
- Miranda, Eduardo, R. *Biography*. 30 Apr. 2018, http://www.composers21.com/compdocs/mirandae.htm
- *Moog Piano Bar*. 29 Apr. 2018, https://www.sweetwater.com/store/detail/PianoBar--moog-pianobar
- McPherson, Andrew. “The Magnetic Resonator Piano: Electronic Augmentation of an Acoustic Grand Piano.” *Journal of New Music Research*, Vol. 39, No. 3, 2010.
- Miranda, Eduardo, R. *Biography*. 30 Apr. 2018, http://www.composers21.com/compdocs/mirandae.htm

Thank You!

Electromagnets and the Acoustic Piano:

A Brief Overview of Current Research and Music for the Genre

Jonathan Taylor de Oliveira

jtolive@bgsu.edu