TECHNOLOGICAL FLUENCY THROUGH CIRCUIT BENDING

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General Education

- At the University of Utah: Three of four “intellectual exploration” areas
  - Humanities
  - Fine Arts
  - Social & Behavioral Science
  - Applied Science

- What about technology?
  Engineering problem solving?
  Technological fluency?
  Computational thinking?
Technological Fluency

- Technological *literacy*
  - Implies only basic knowledge of the subject
  - A skills-based idea

- Technological *fluency*
  - Enables manipulation of the medium
  - The ability to handle unintended and unexpected problems
Technology Focus

“Electronic technology is pervasive in our modern world but how it actually works can be a mystery to many people. In this class students will explore the fundamentals of electronic technology with a goal of increasing their technological fluency.”
But not an “Engineering” Course

Through hands-on labs and projects students will gain a fundamental understanding of how electronic things work and what are their capabilities and limitations. This will be explored in the context of making art and noise with electronic components, some of which will be built from scratch, and some of which will be discovered from existing cast-off or broken devices.
Technology / Arts

Engineering Problem Solving

Creative Design Thinking
Making Noise: Sound Art and Digital Media

- Semester-length general education course
- Carries either Fine Arts or Applied Science designation
  - … at least for two years
- Developed through a program sponsored by our Office of Undergraduate Studies
- Introduce technology in an arts context
  - Specifically **Sound-Art**
Textbook

- Handmade Electronic Music
- Nicolas Collins
Circuit Bending

Creatively hacking and re-purposing (upcycling?) electronics in the service of making sound

*Hardware Hacking vs. Circuit Bending*
Curriculum

- Reading assignments
- Listening assignments
- Projects
  - Induction coil recordings
  - Arduino sound
  - Toy hacking
  - Oscillators
- Final project
Readings / Context

- Experimental and electronic music
- Precursor to contemporary Sound-Art

Russolo - *The Art of Noise*
Varèse - *The Liberation of Sound*
Cage - *The Future of Music - Credo*
Ussachevsky - *Music in a Tape Medium*
Stockhausen - *Advice to Clever Children*
Harley - *The Electroacoustic Music of Iannis Xanakis*
Readings / Context
Listening (Ear Training)

- From *100 Exercises in Listening and Sound-Making* by R. Murray Shafer, Arcana Editions, 1992
- Listen to sound/noise around you
- Practice listening/hearing from a critical perspective

Examples:
- Take 10 min and write down all the sounds you hear
- Find a pitched sound in your environment, hum that pitch, walk around the block, what happens?
- Bring an interesting sound to class
- Make lists of old sounds and new sounds
Project: Inductive Coil Recordings

Use inductive coil to record EM noise in your environment.
Project: Arduino Sound

Simple programmed sound using Arduino “tone” library

```c
/* VERY simple tone program */
#include "pitches.h"
int speakerPin = 9; // attach the speaker to pin 9

void setup(){
  pinMode(speakerPin, OUTPUT); // Make speakerPin an output
}

void loop(){
  tone(speakerPin, NOTE_A4); // tone fires up an A4
  delay(1000); // play it for 1 sec
  noTone(speakerPin); // stop the tone
  delay(300); // "play" some silence
  tone(speakerPin, NOTE_B4); // play another tone
  delay(1000);
  tone(speakerPin, NOTE_C3);
  delay(500);
  tone(speakerPin, NOTE_CS5);
  delay(2000);
  tone(speakerPin, NOTE_D3);
  delay(1000);
}
```
Project: Hacked Toy

Circuit Bending - RC timing
Project: Hacked Toy
Project: Oscillators

Very simple Schmitt-trigger oscillators
- Inverters and NAND gates
Project: Oscillators

Very simple Schmitt-trigger oscillators
- Inverters and NAND gates
Project: Oscillators
Final Project - Sound Art

Chosen/proposed by each student

Use “raw material” from previous projects
Final Project - Sound Art
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Conclusions

An attempt to design a new general education course that promotes technological fluency

Through the lens of Sound-Art and Digital Media

Readings and listening for context, projects for raw materials (and learning opportunities), final project for synthesis

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