EMBEDDED SYSTEMS AND KINETIC ART

A NATURAL COLLABORATION

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Erik Brunvand and Paul Stout

Kinetic Art

- Kinetic art contains moving parts
  - Depends on motion, sound, or light for its effect
- Kinetic aspect often controlled by microcontrollers
  - Using motors, actuators, transducers, sensors
- The artwork can react to its environment
  - Distinct from "computer art"
  - The computer is usually behind the scenes

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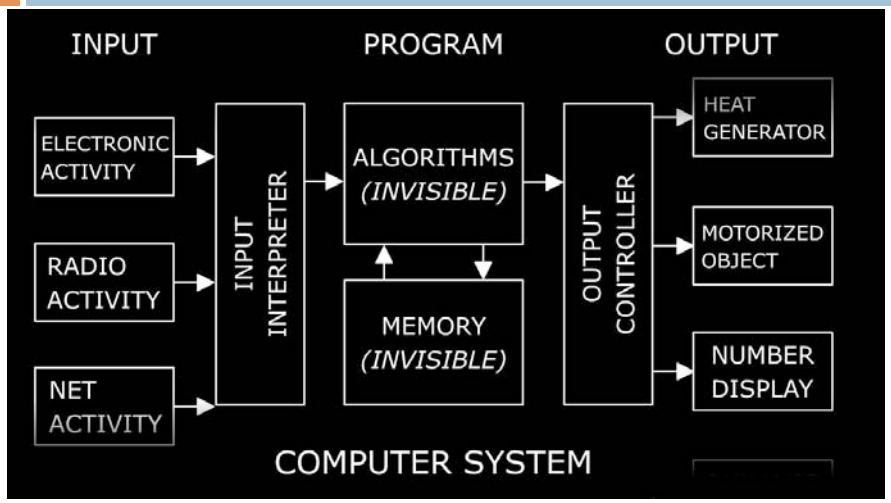
Jim Campbell's "Formula"



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Embedded Systems

- Computer systems that are embedded into a complete device
  - Often small or special purpose computers/ microprocessors
  - Designed to perform one or a few dedicated functions
  - Often reactive to environmental sensors
  - Often designed to directly control output devices

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Embedded Systems and Kinetic Art

- Cross-college collaborative course
  - Brings Art students and Computer Science and Engineering (CSE) students together
  - Design and build embedded-system-controlled kinetic art
  - Goal is that both groups of students benefit
- Fundamental nature of ***Design***
  - Engineering design vs. creative design?

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Class overview

- Basic reactive programming with embedded systems
  - Electronics fundamentals
  - Sensors and actuators as I/O
- Basic 3d art concepts
  - Formal elements: aesthetics, proportion, balance, tension
  - Material studies and mechanical linkages
- Studio-based instruction model

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Class overview

- Individual and group projects
  - Everybody tries everything individually
  - Also work in interdisciplinary teams
- Design and build kinetic art
- Finish with a gallery show of results
  - 2009/2010: *Invisible Logic*
  - 2010/2011: *Intersectio*

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Intersectio

Studio Instruction Model

- Collaboration, design-thinking, interaction, learn-by-doing
  - Explore a multitude of design alternatives
  - Evaluation of those alternatives in peer critiques
    - Both at formative and completed project phases

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Enhancing Creativity

- Creative design and design-thinking are powerful concepts
  - One definition: enhanced creativity is generating many potential solutions instead of gravitating quickly to one
- Kinetic art is serious stuff…
  - … but not regular CSE projects
  - CSE students have the freedom to explore without worrying about getting it "right"

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Course Infrastructure - HW

- Controller – Arduino
- Sensors
  - Potentiometers/knobs, light, motion (PIR), distance, vibration (piezo), sound, temperature, etc.
- Actuators and transducers
  - LEDs, servos, DC motors, DC stepper motors, sound, etc.
- Other parts
  - LED drivers, transistors, resistors, diodes
  - LCD displays, SPI/I2C peripherals
  - Power supplies, soldering stations, wire, etc.

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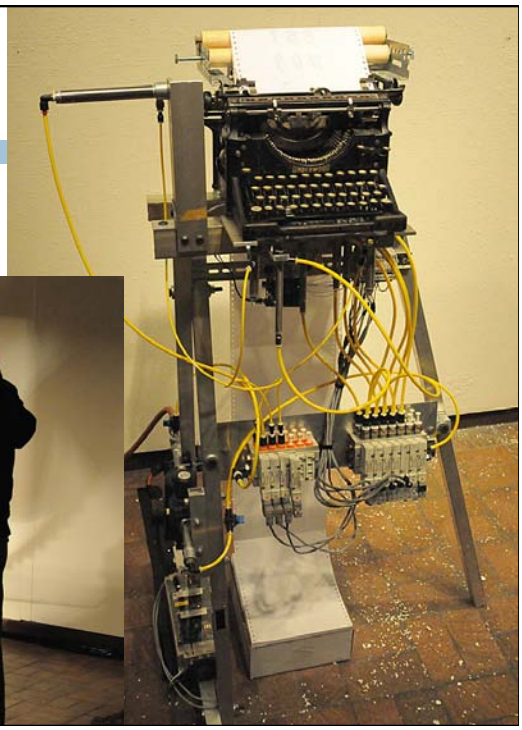
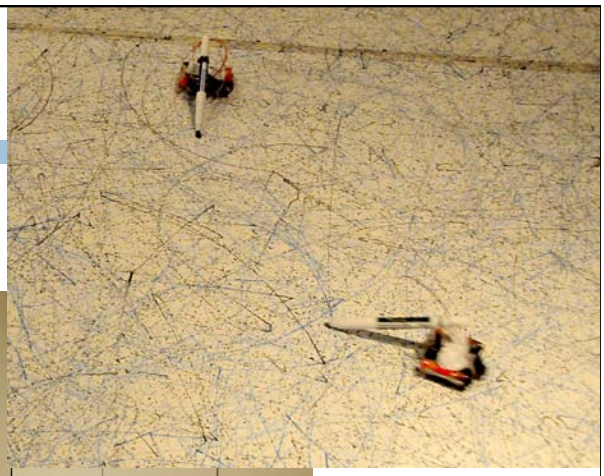
F2009: Invisible Logic



F2009: Invisible Logic

F2009: Invisible Logic



F2010: Intersectio

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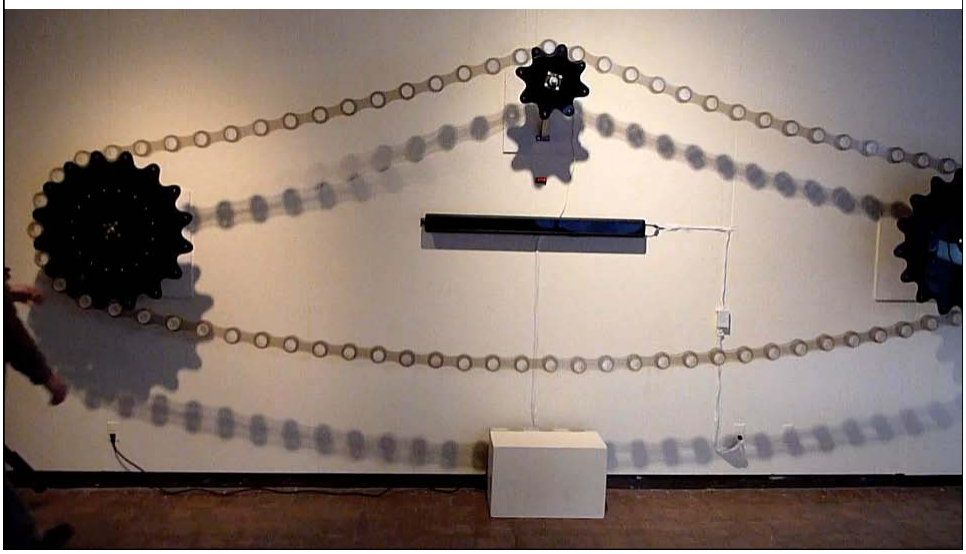
F2010: Intersectio



F2010: Intersectio

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Student Comments

- I now have a much better understanding of how to "think about art" and also saw an entirely different side of engineering.
- Artists have a completely different mindset and it was nice to get a new perspective on things. It really made me learn to appreciate the creative thinking they brought to the table.
- I enjoyed it and already have suggested it to several artists and engineers I know!
- I feel more competent in both [art and engineering] having experienced each side in a new way.

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Conclusions

- Embedded systems and kinetic art is a natural collaboration
  - Exploration of fundamental design concepts
    - Design-thinking is a natural complement to computational-thinking
  - Studio instruction model is fascinating
  - Both groups of students benefit from working with each other
  - Cross-college collaboration – just the beginning!
- Erik Brunvand, School of Computing, elb@cs.utah.edu
- Paul Stout, Dept of Art and Art History, paul.stout@gmail.com

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Extra Slides

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F2010: Intersectio

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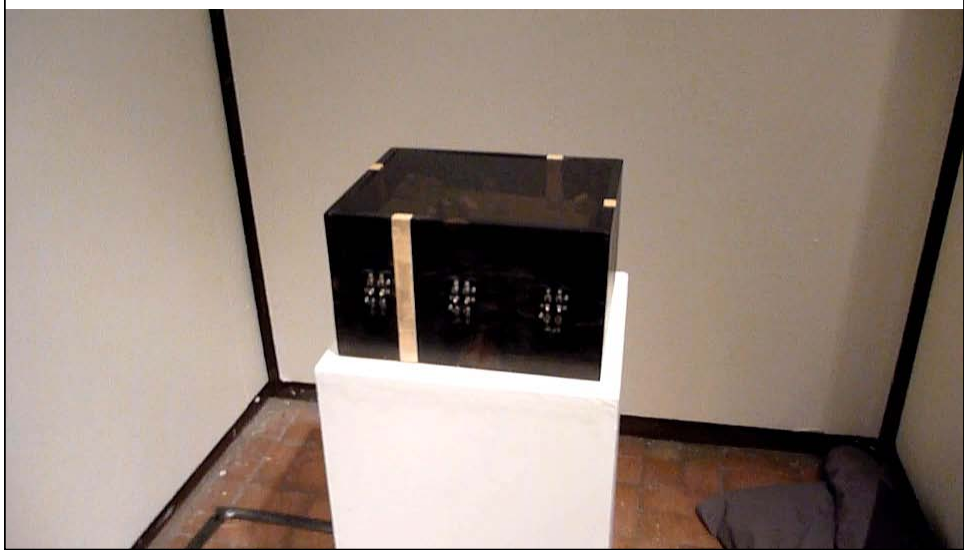

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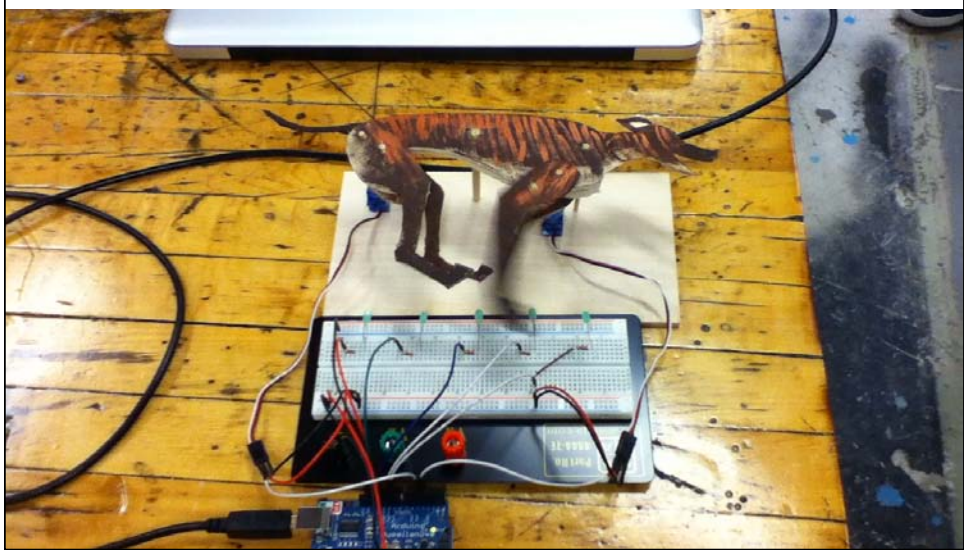

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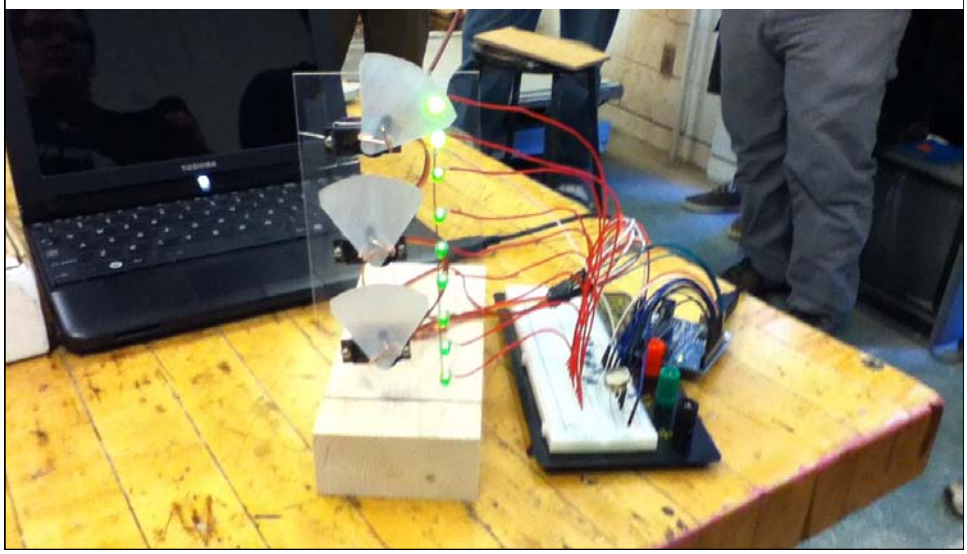

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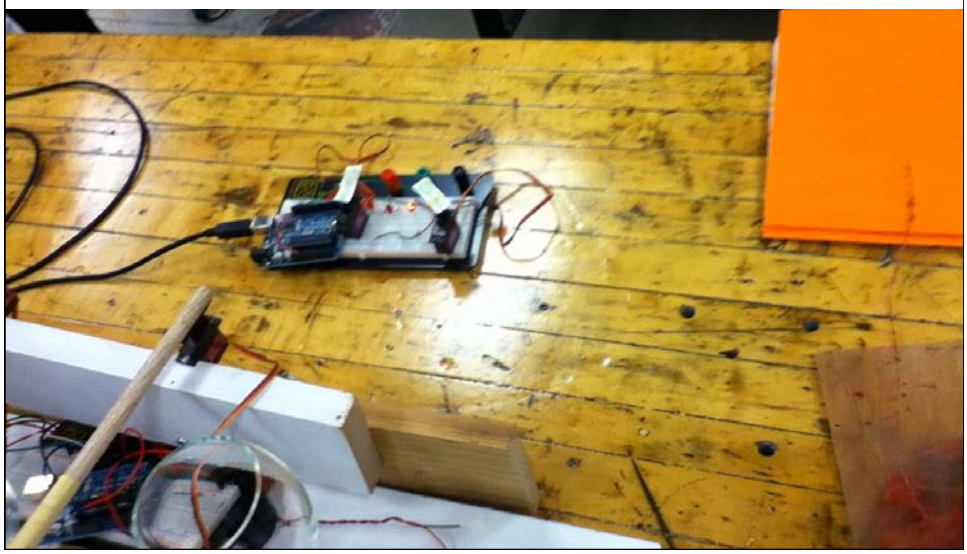

F2010: Intersectio

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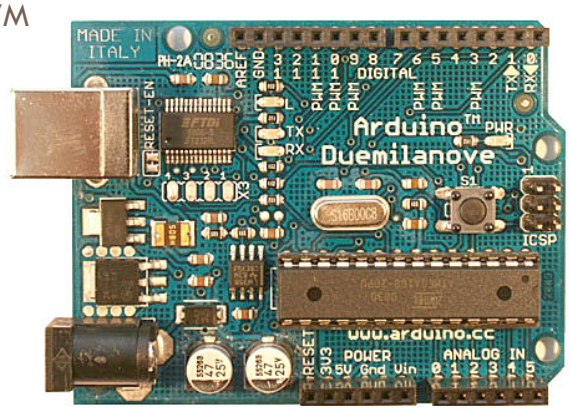
Course Infrastructure - Controller

- Arduino embedded controller - Open-source HW
  - Based on Atmel AVR
  - Digital I/O with PWM
  - Analog inputs
  - Programmed over USB
  - Inexpensive



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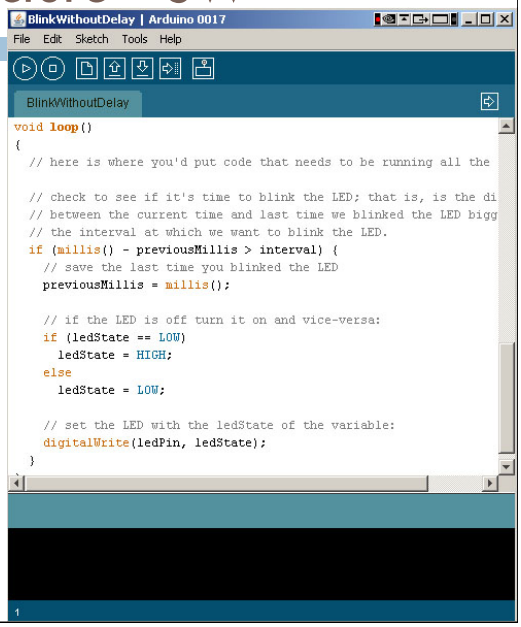
Course Infrastructure - SW

- Arduino open-source integrated development environment (IDE)
  - Good news – basically C
    - gcc is the back-end
  - Bad news – basically C
    - Moderately steep learning curve



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Course Infrastructure - Art

- Studio space for construction
- Wood and metal shops
- Materials collection
- Gallery space for final show

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