Design Thinking *meets* Computational Thinking:

Kinetic Art and Embedded Systems

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School of Computing
University of Utah
Salt Lake City, UT USA

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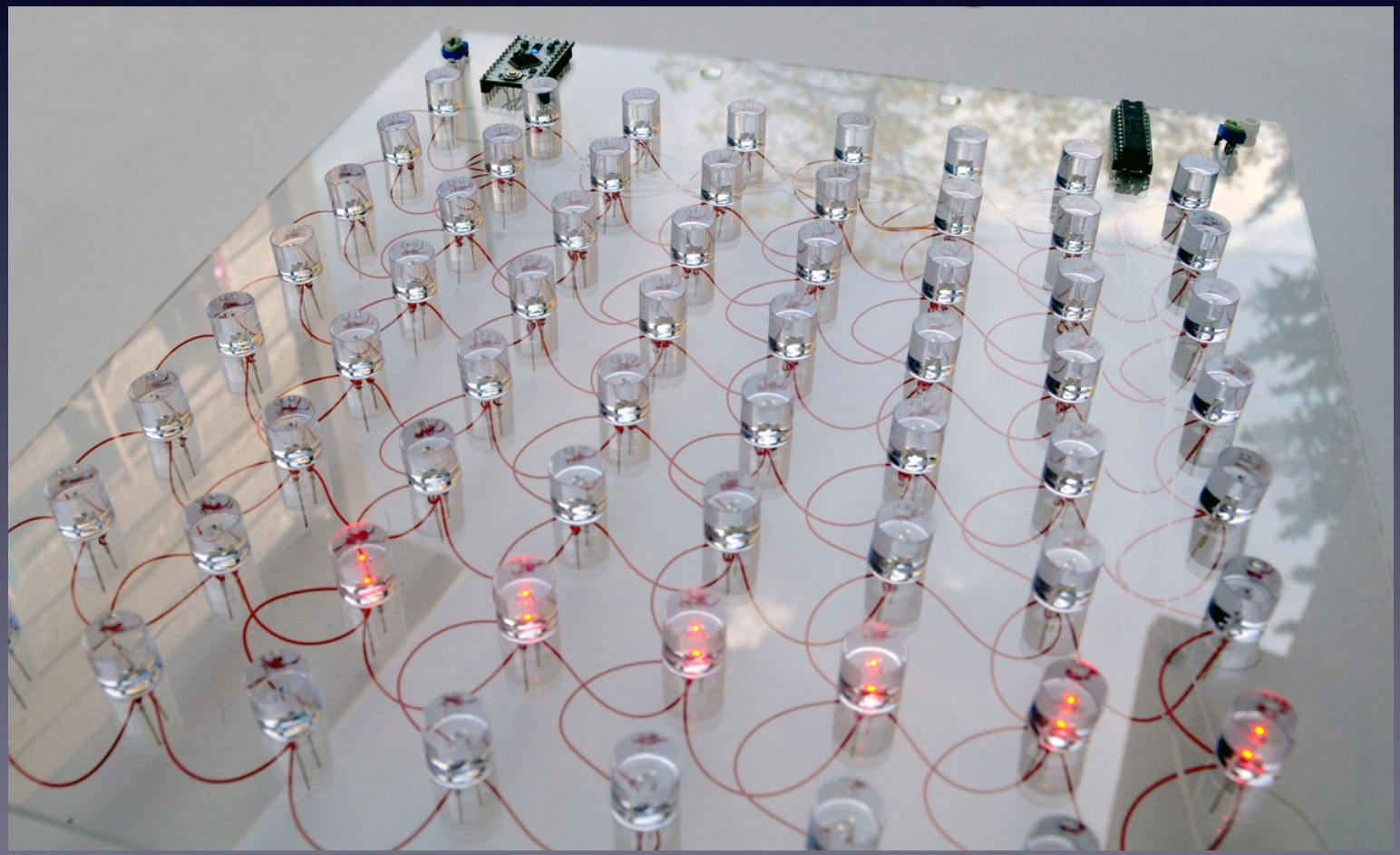
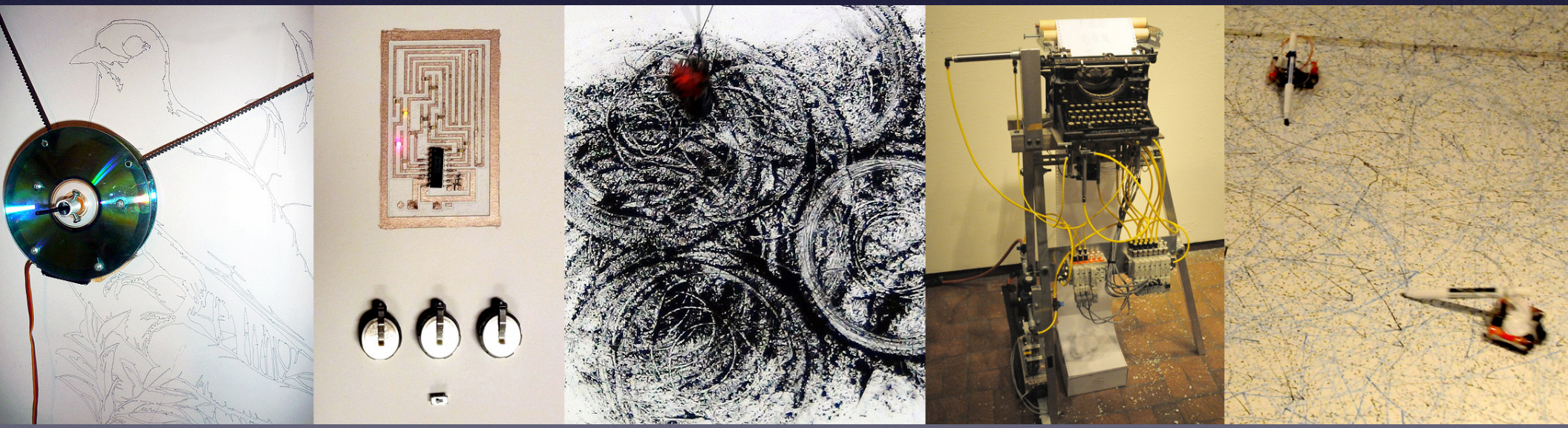
Agenda

I argue that arts/technology collaboration is a powerful framework for enhancing ideas in both arenas



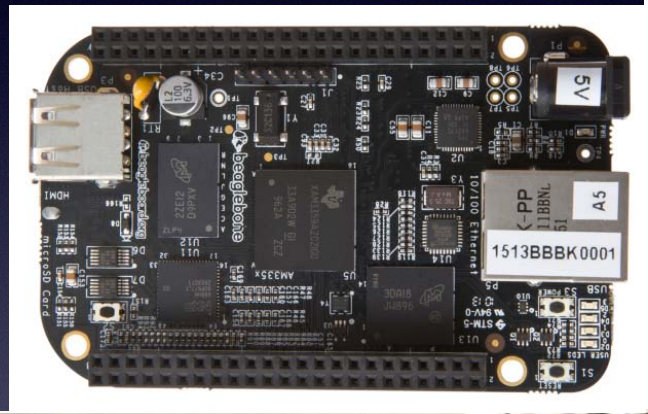
Context

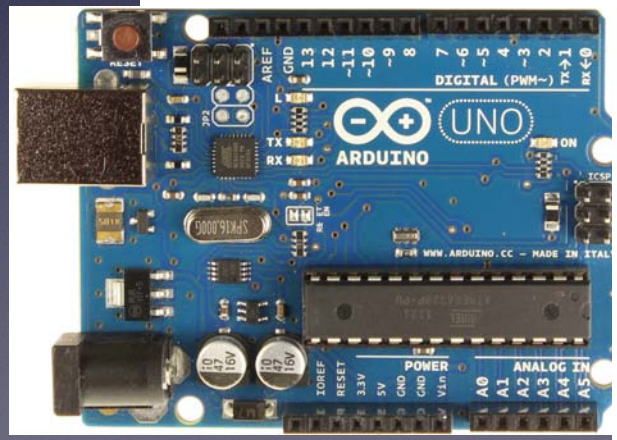
I frame this in the context of ***kinetic art***
and its connection to ***embedded systems***



Embedded Systems

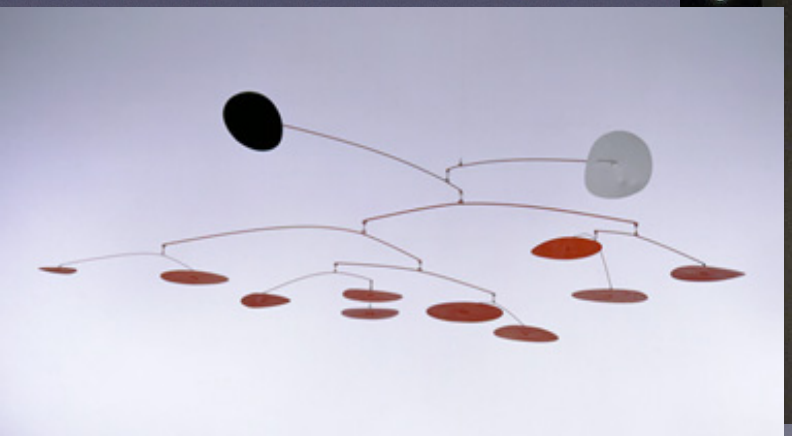
- Computer systems that are embedded into a complete device
  - Often small or special purpose computers or microprocessors
  - Designed to perform one or a few dedicated functions
  - Often reactive to environmental sensors
  - Often designed to directly control output devices

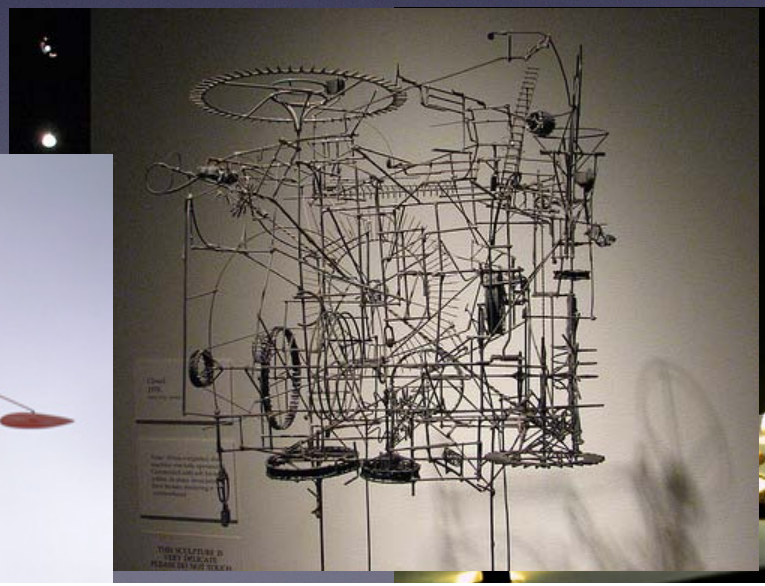




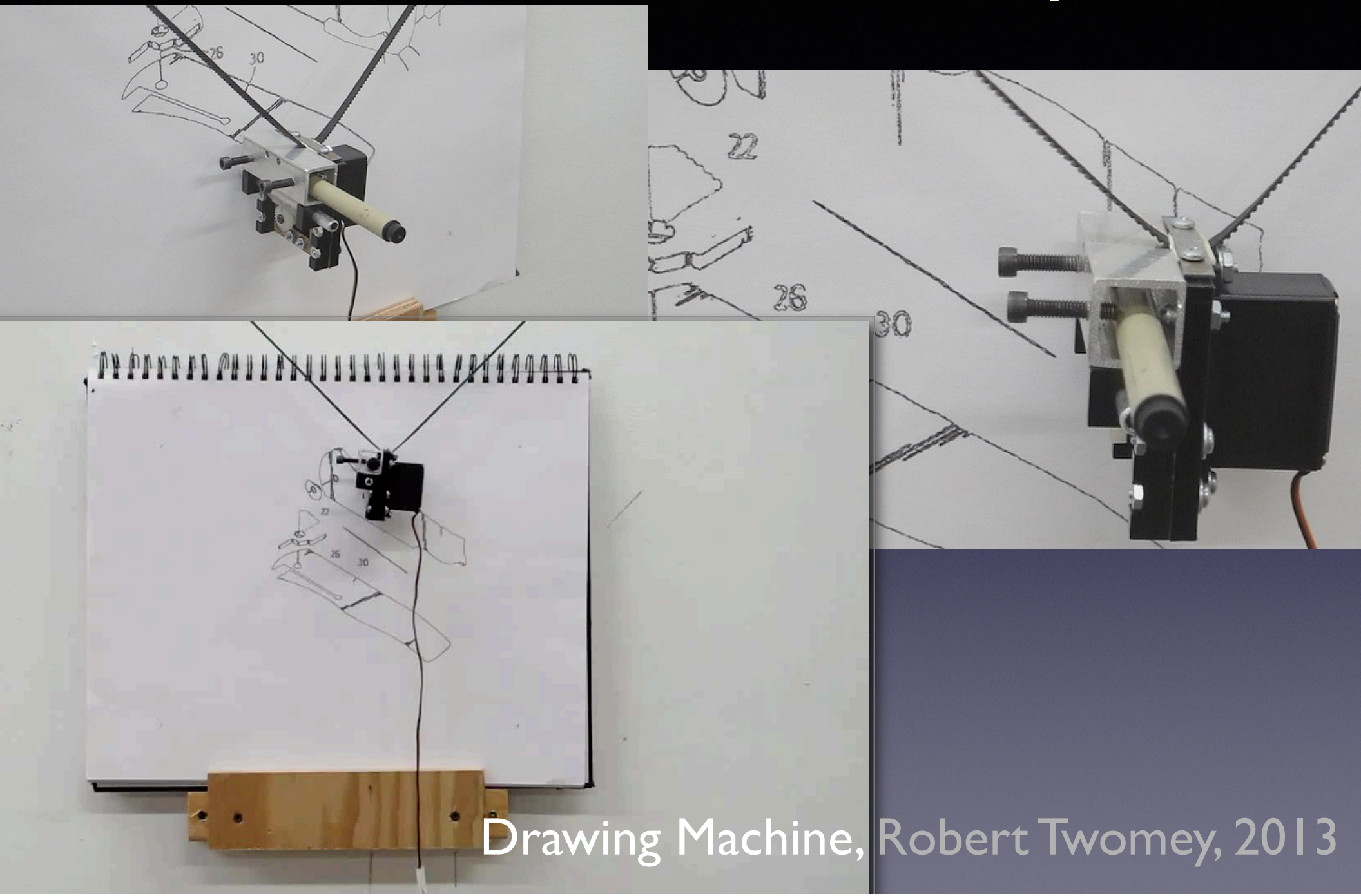
Kinetic Art

- Contains moving parts
  - Depends on motion, sound, or light
- Often controlled by microcontrollers
  - Motors, actuators, transducers...
- Often reactive to environment

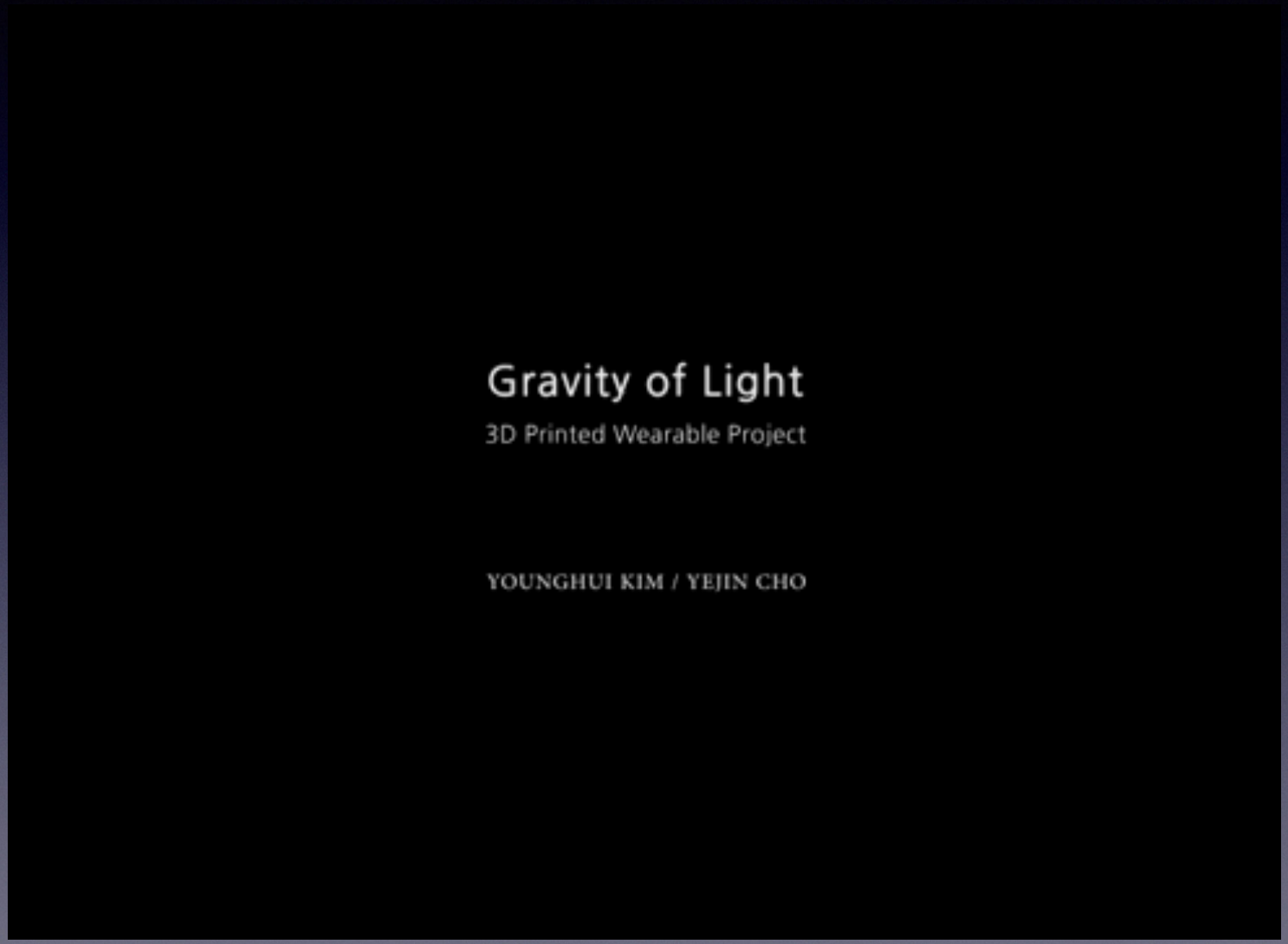




SIGGRAPH Art Gallery



CHI Interactivity



Background

- Short survey of kinetic art
  - The avant garde in the 1920's
  - Small steps in the 1950's
  - The computer age
- Outline for a collaborative class
- Examples

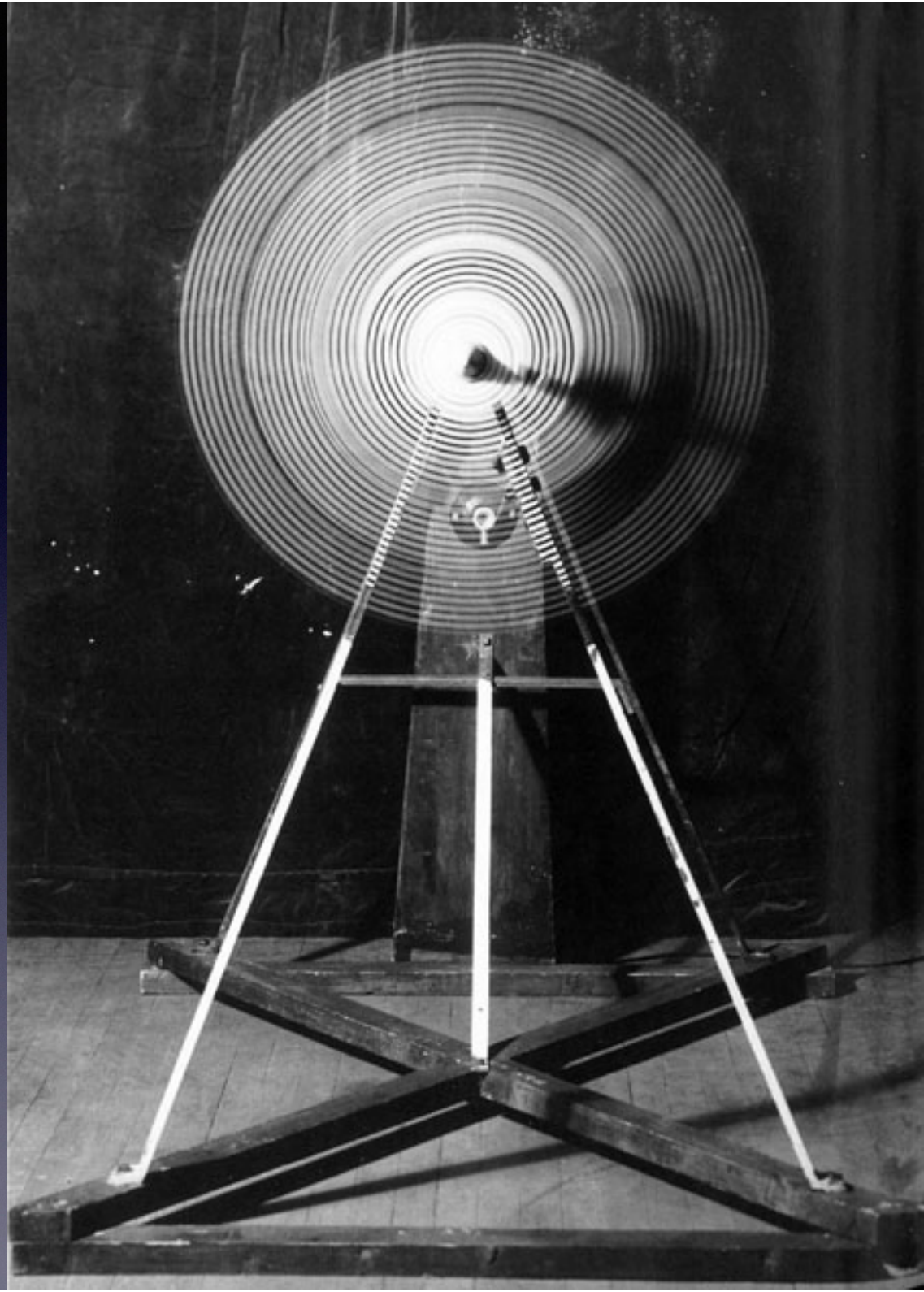
Naum Gabo
(1890-1977)

- Kinetic Construction (Standing Wave) 1919-1920

Marcel Duchamp
(1887 – 1968)

- Rotary Glass Plates (Precision Optics) 1920

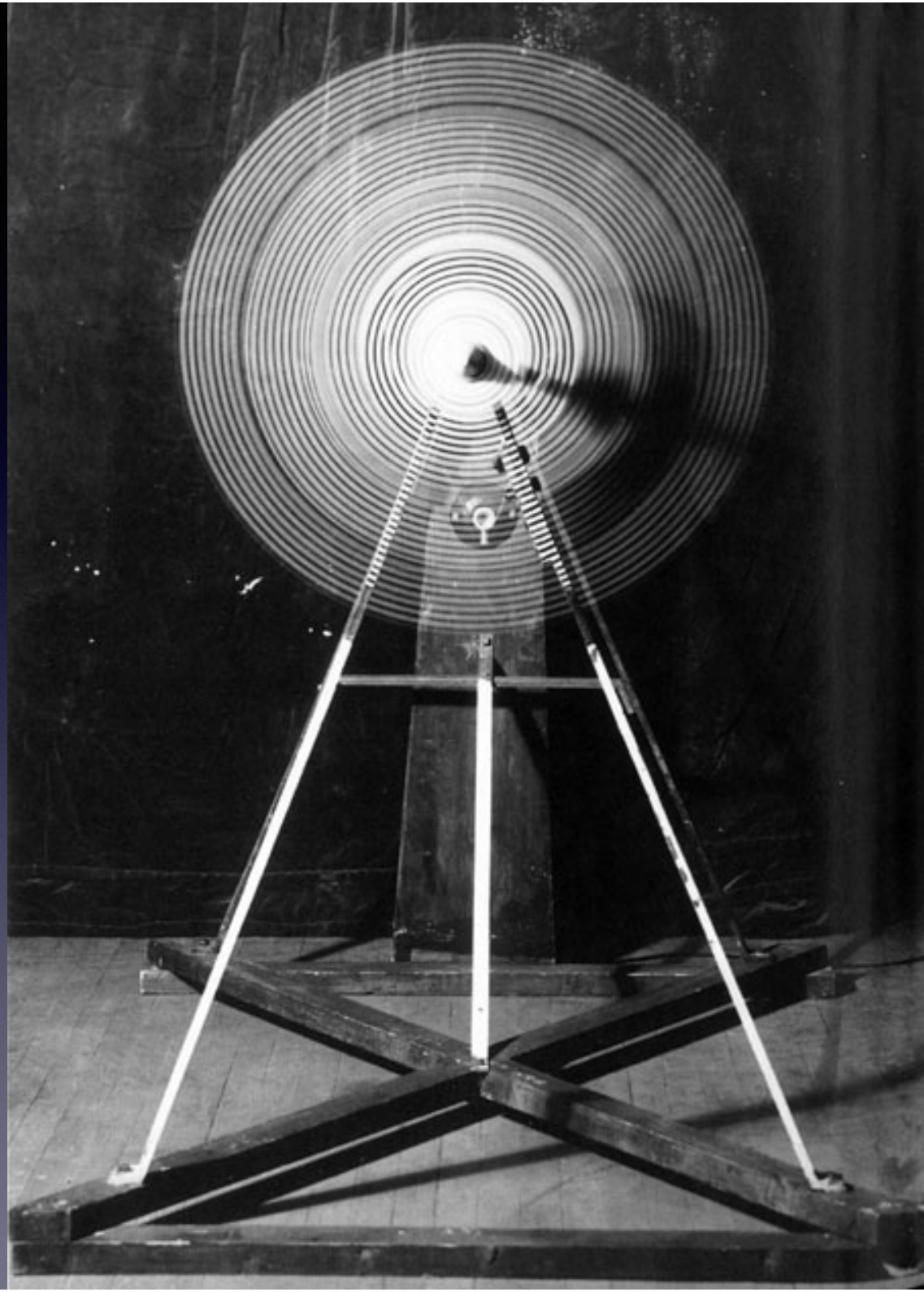
- Built with the help of Man Ray



Marcel Duchamp
(1887 – 1968)

- Rotary Glass Plates (Precision Optics) 1920

- Built with the help of Man Ray
- Rumored to have almost killed Man Ray…

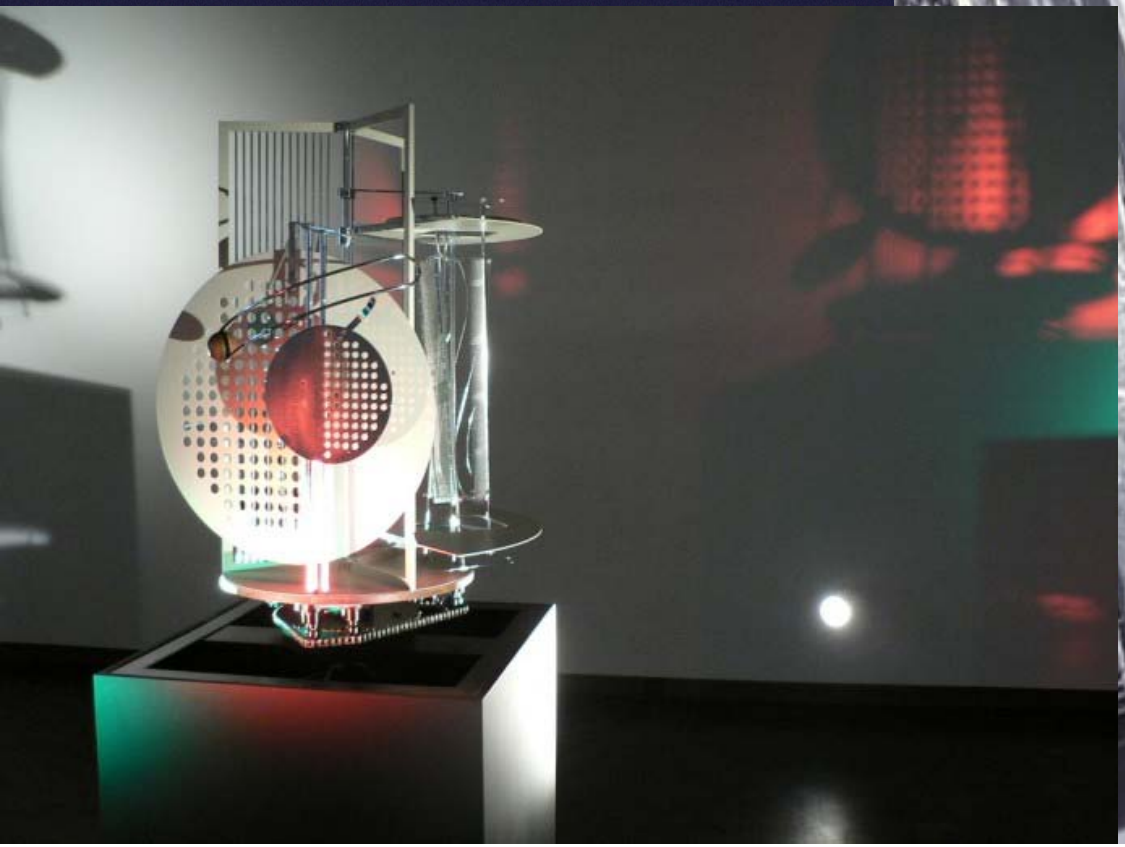


Marcel Duchamp
(1887 – 1968)

- Rotary Demisphere (Precision Optics) 1925

László Moholy-Nagy (1895-1946)

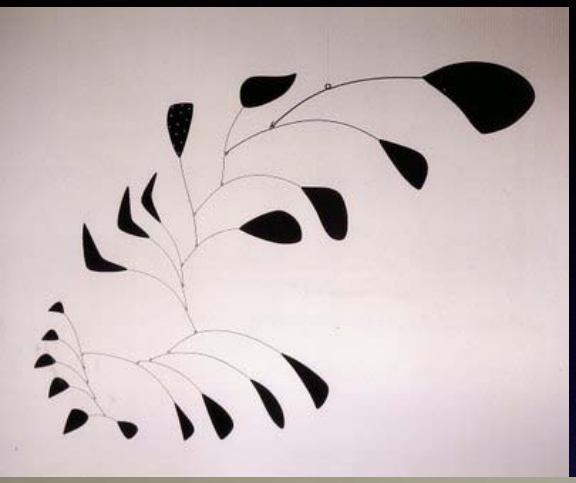
- Light-Space Modulator (1922-30)



László Moholy-Nagy (1895-1946)

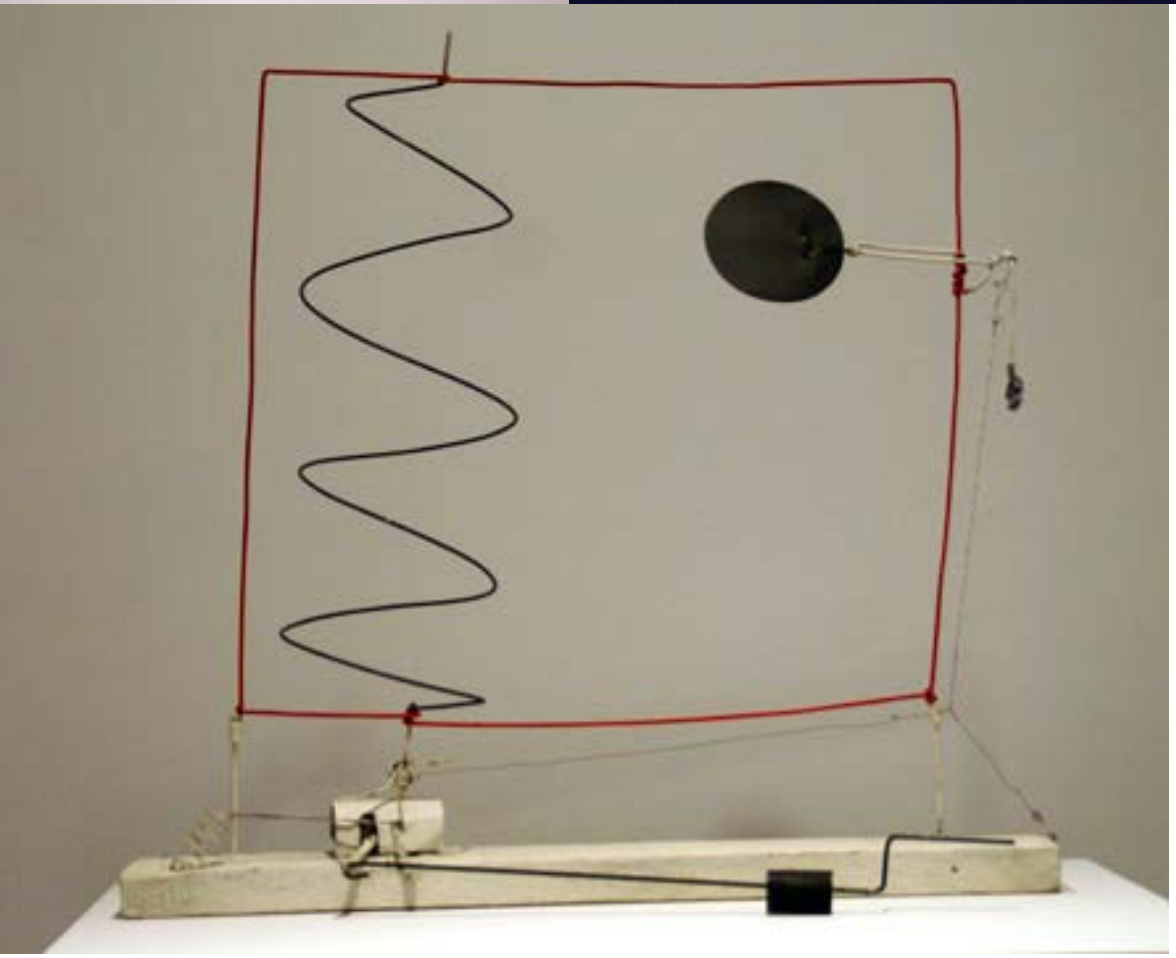
- Light-Space Modulator (1922-30)

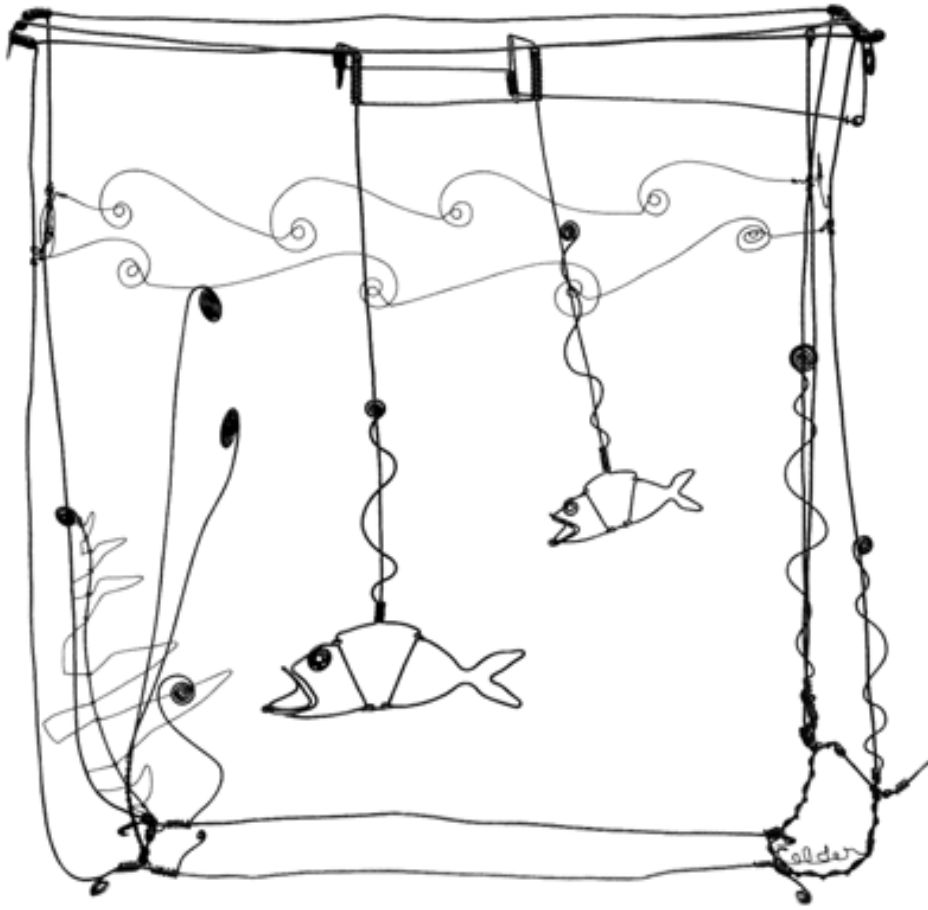
Alexander Calder



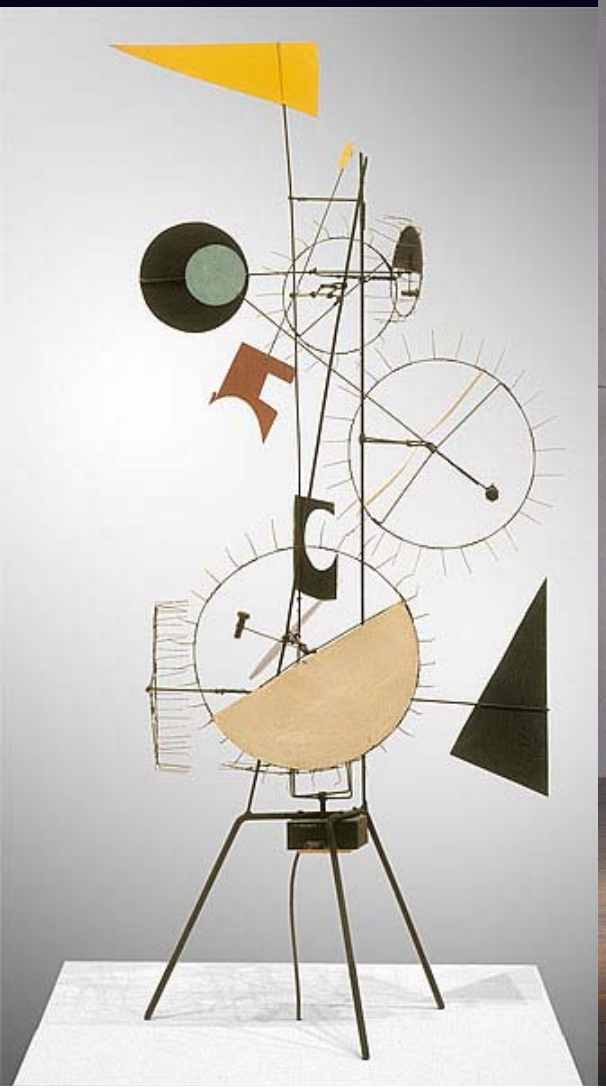
(1898 – 1976)

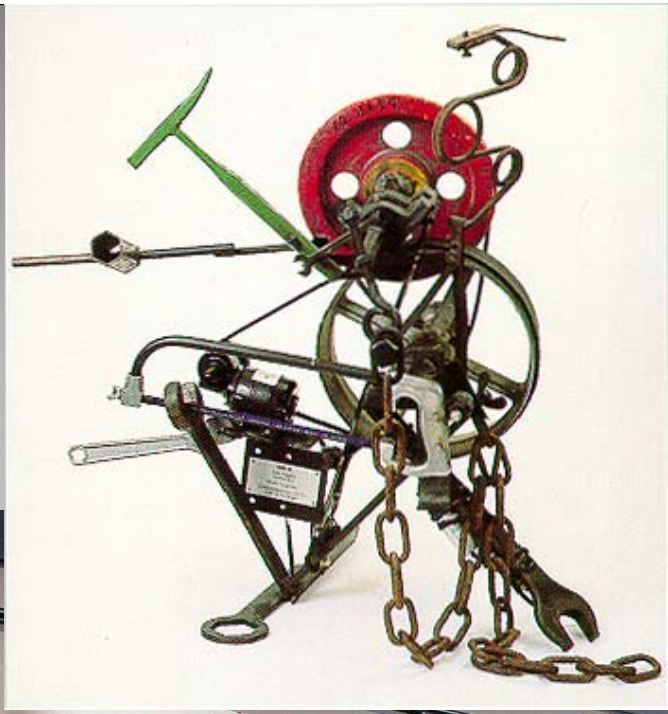
Mobiles and Stabiles
Wire and Circuses

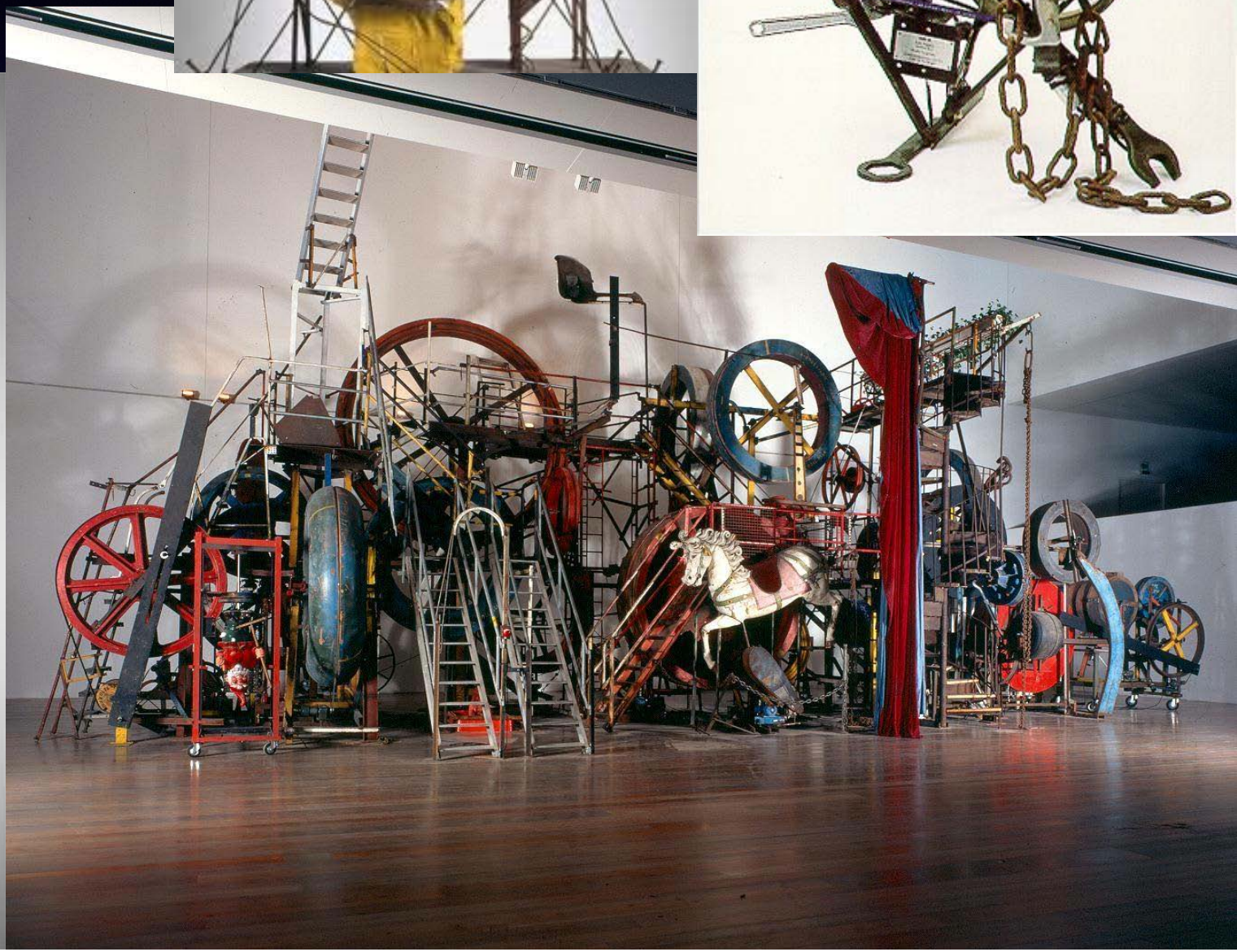




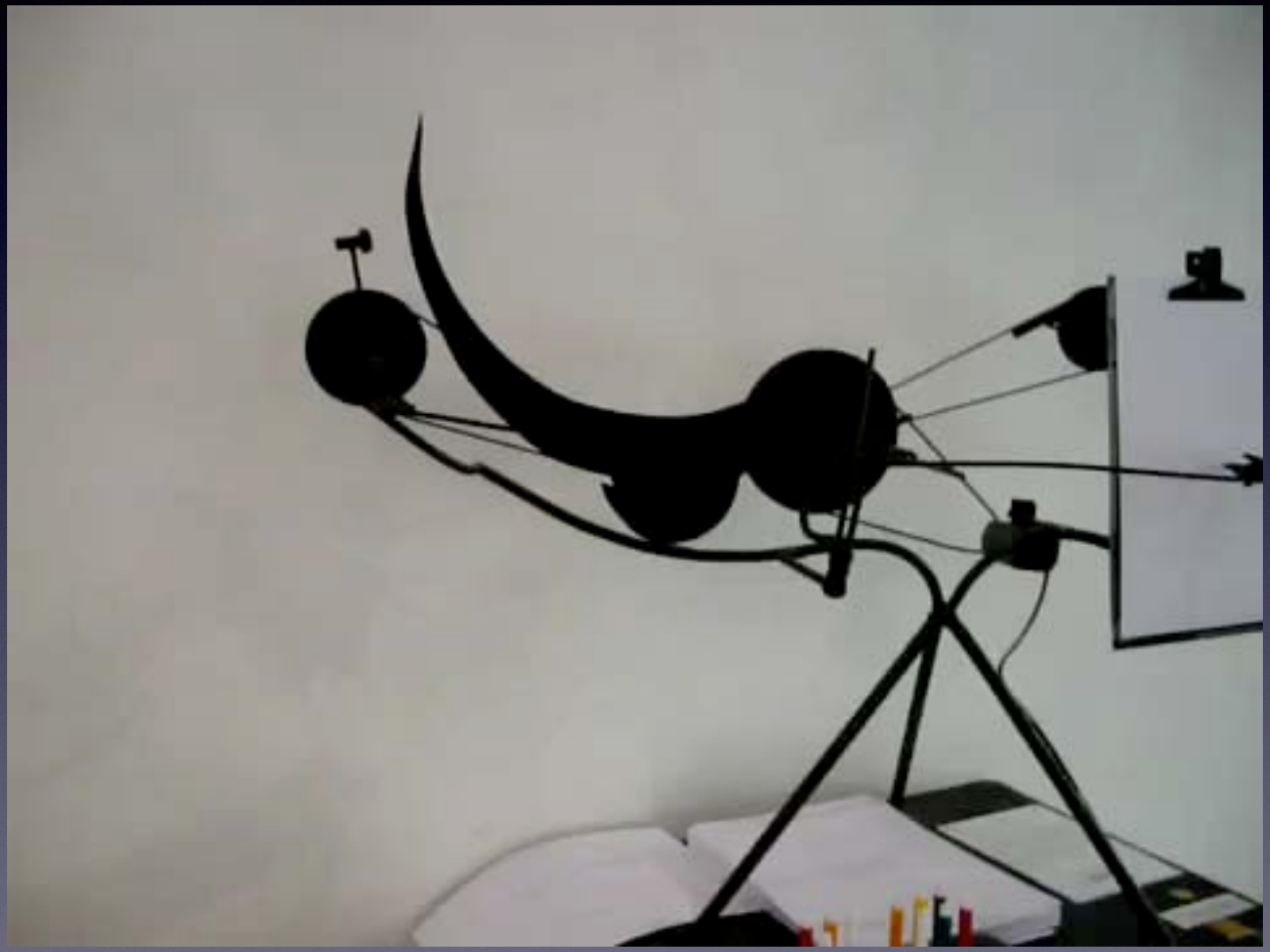
Jean Tinguely







Jean Tinguely (1925 – 1991)



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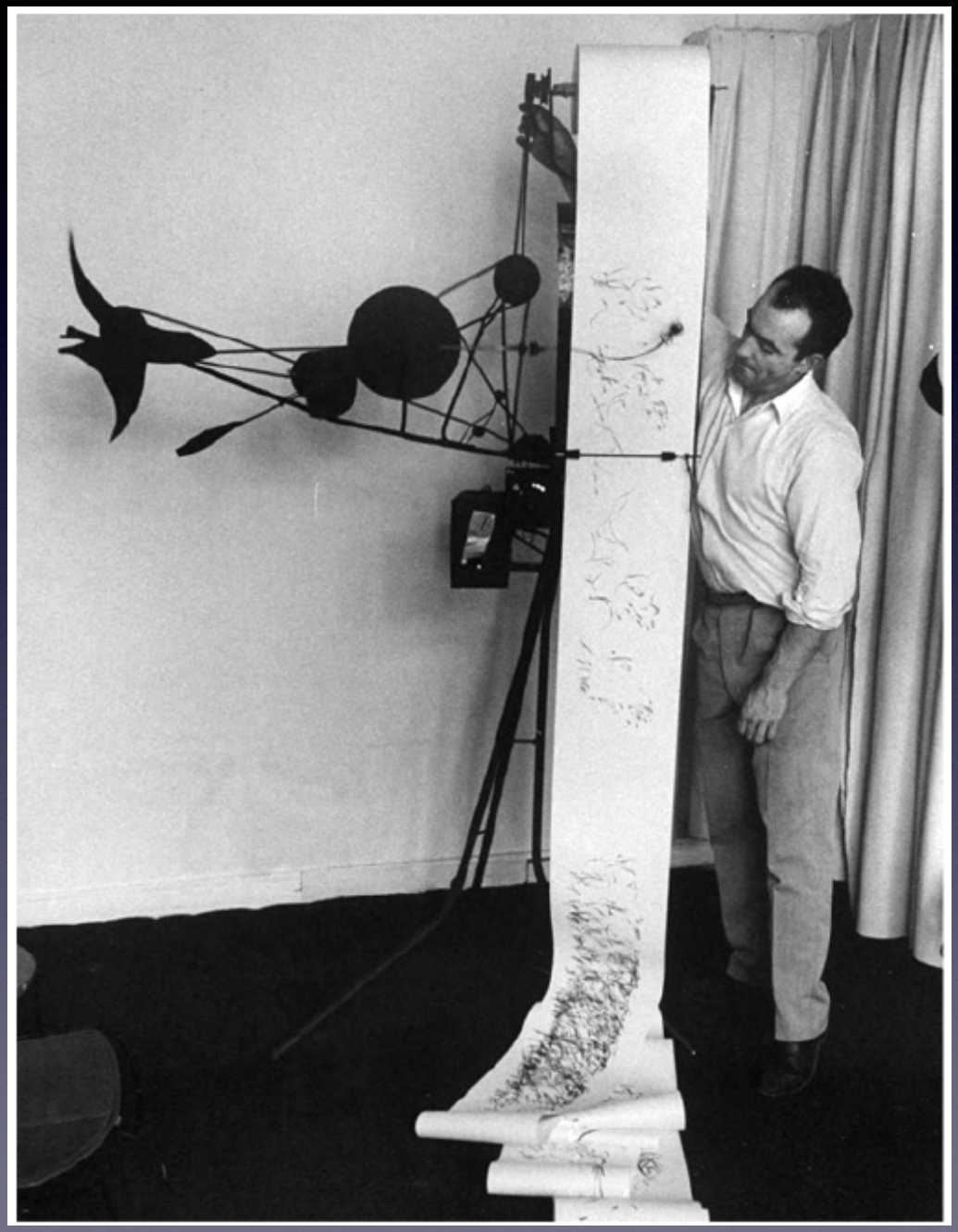
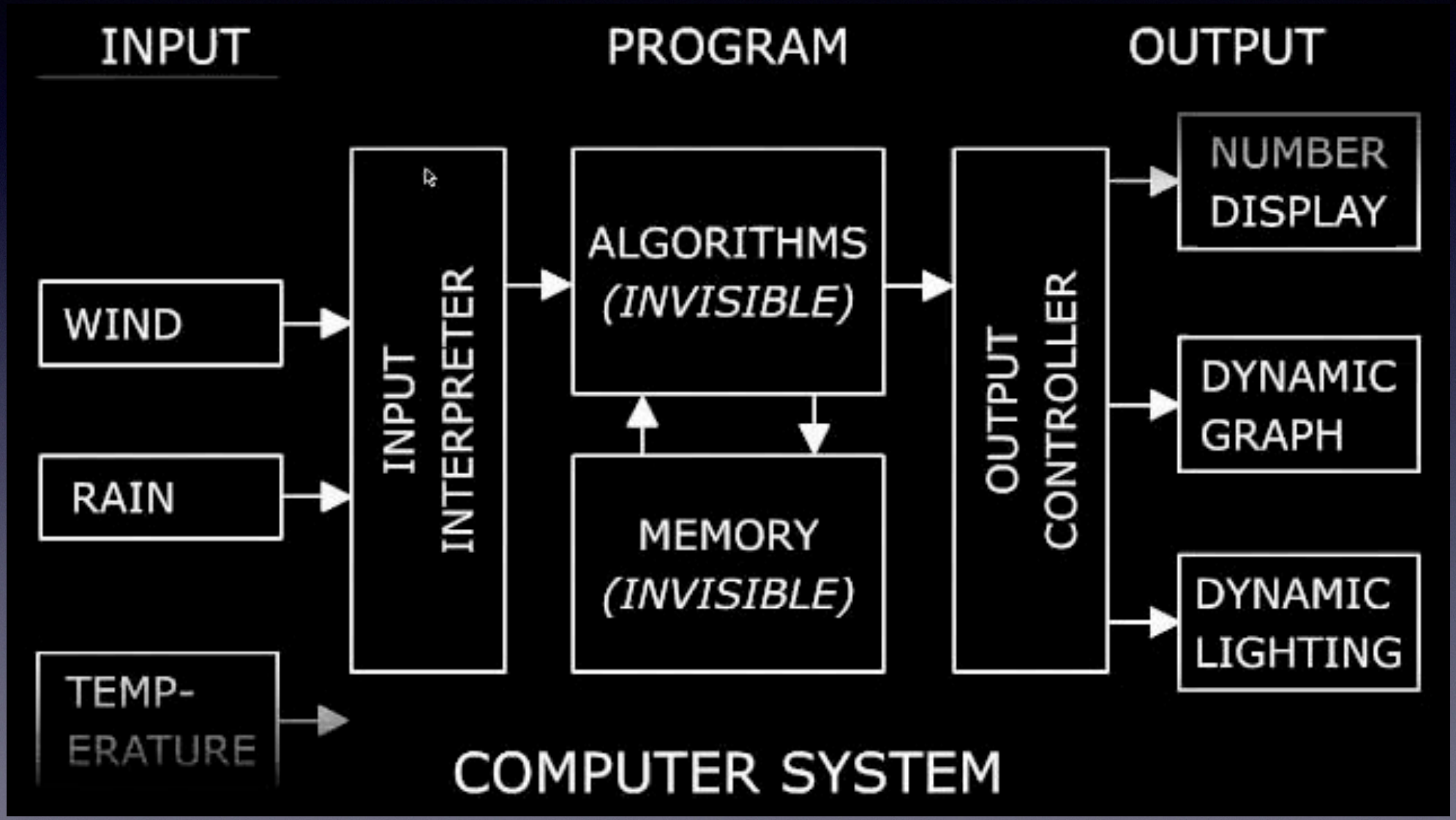


Metamatics

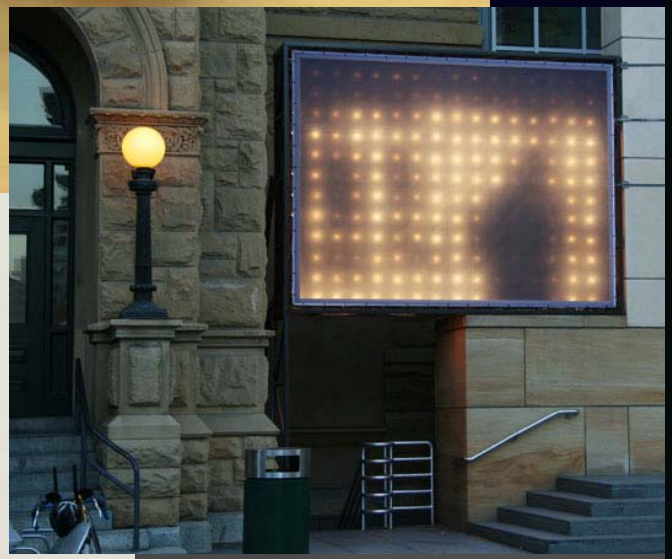
Jump ahead to the Computer Age

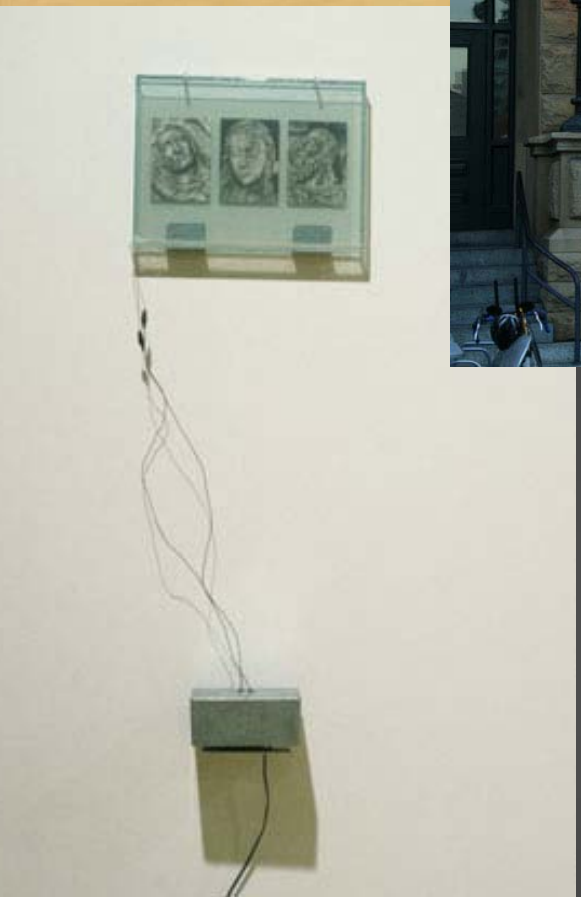
- Electronic control
  - microprocessors or discrete electronics
- Mechanical actuators
  - motors, servos, relays, solenoids, etc.
  - speakers, buzzers, other noise makers
- Lights
  - LEDs, light bulbs, EL wire, etc.
- Sensors to interact with the viewer
  - distance, movement, sound, temperature, vibration, etc.

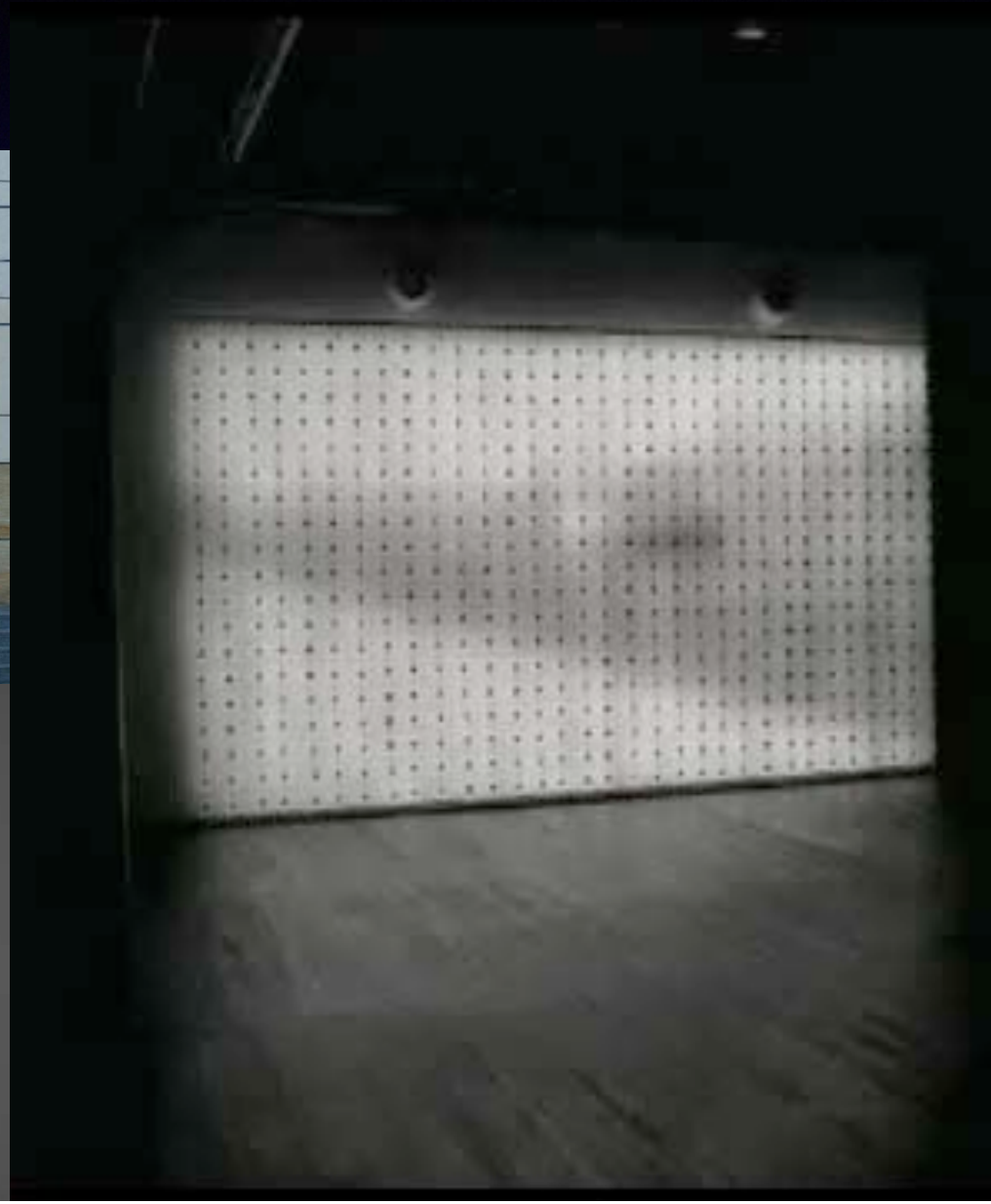
Jim Campbell's Algorithm



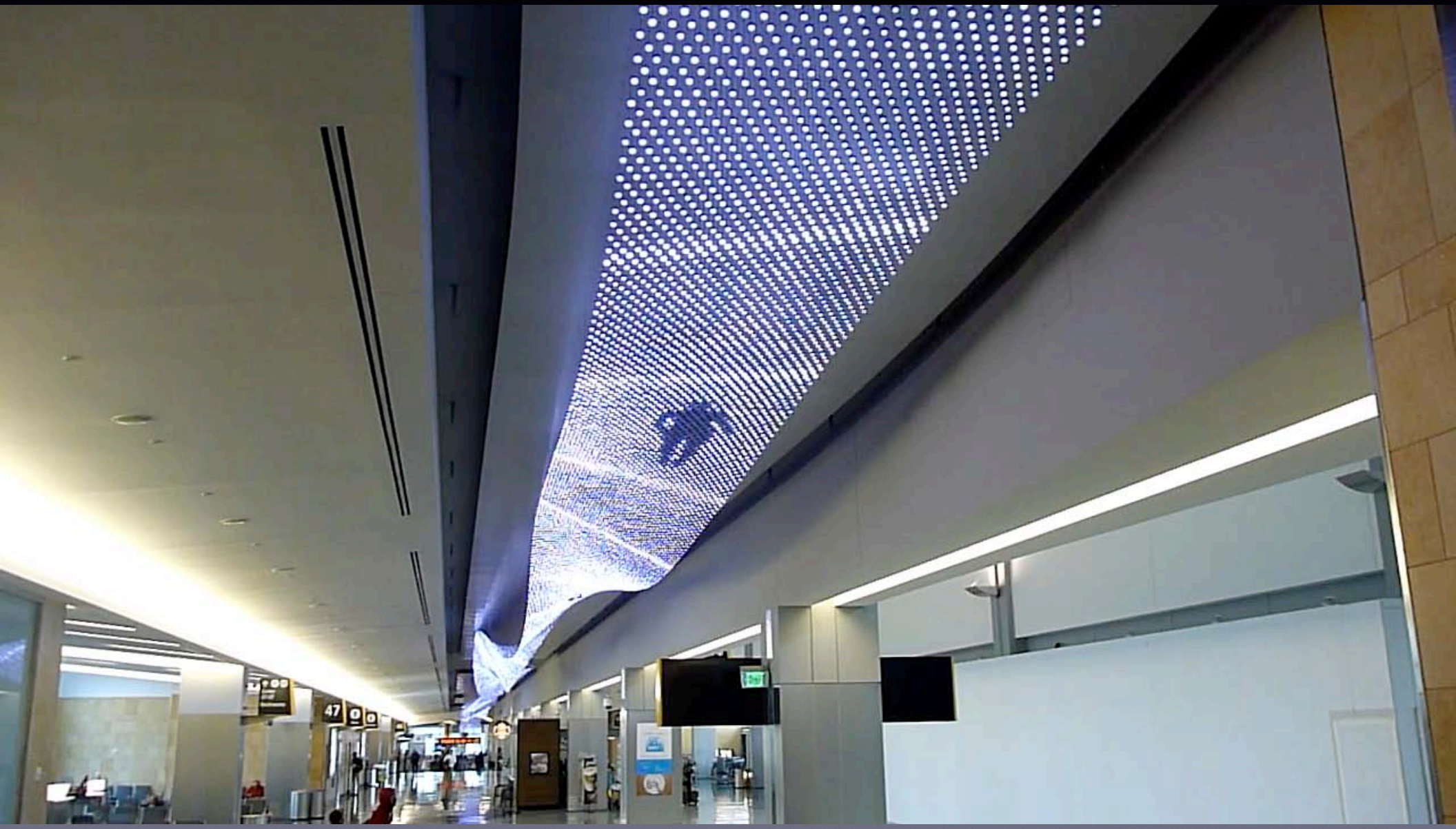
Jim Campbell (1956 -)



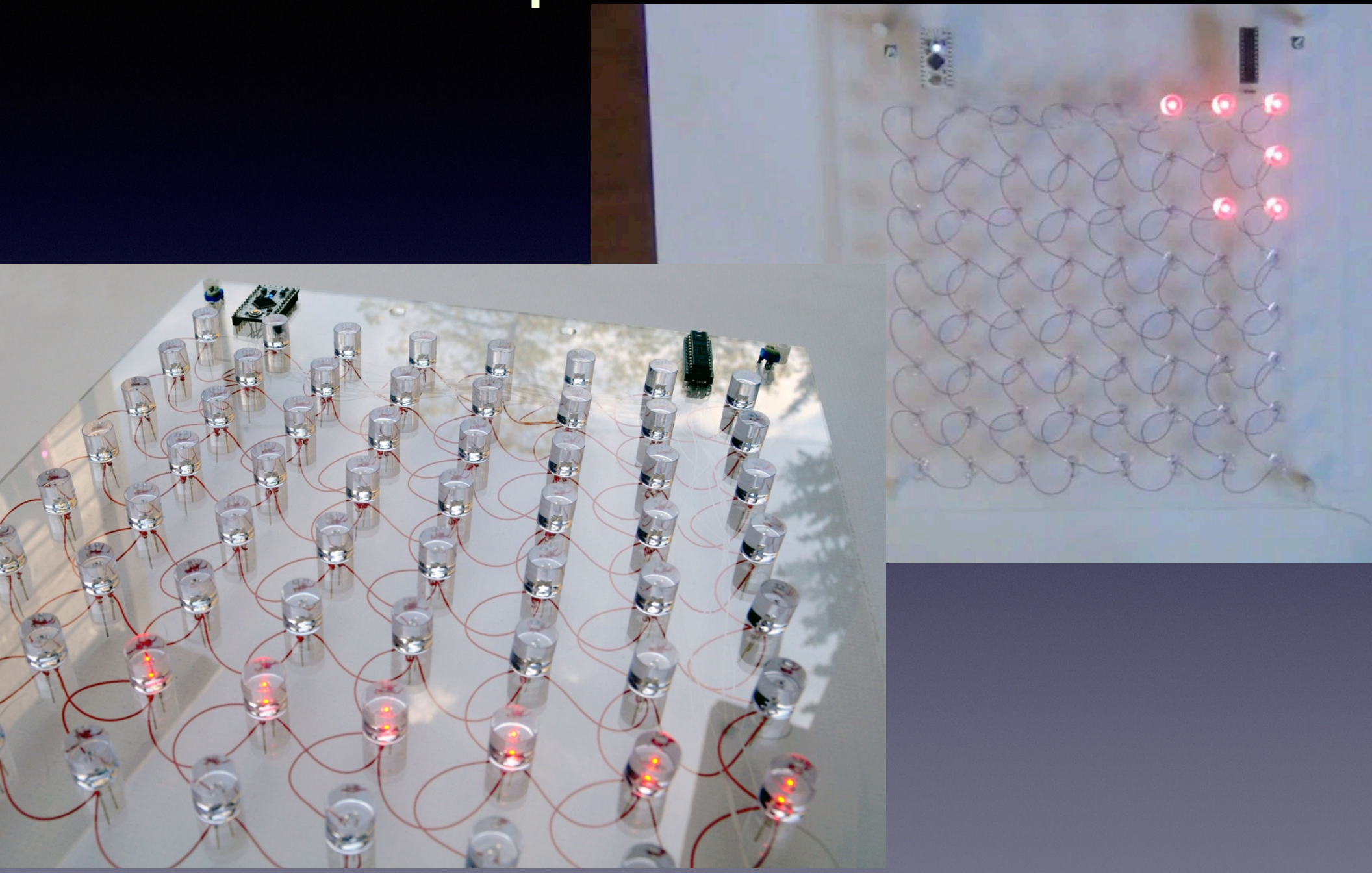




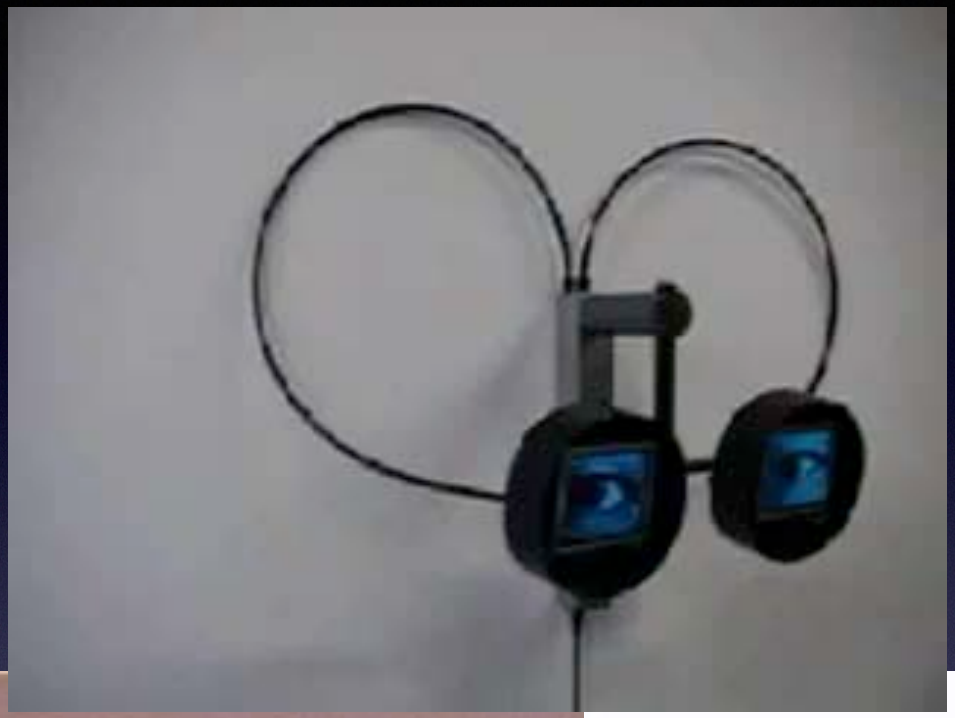
Jim Campbell

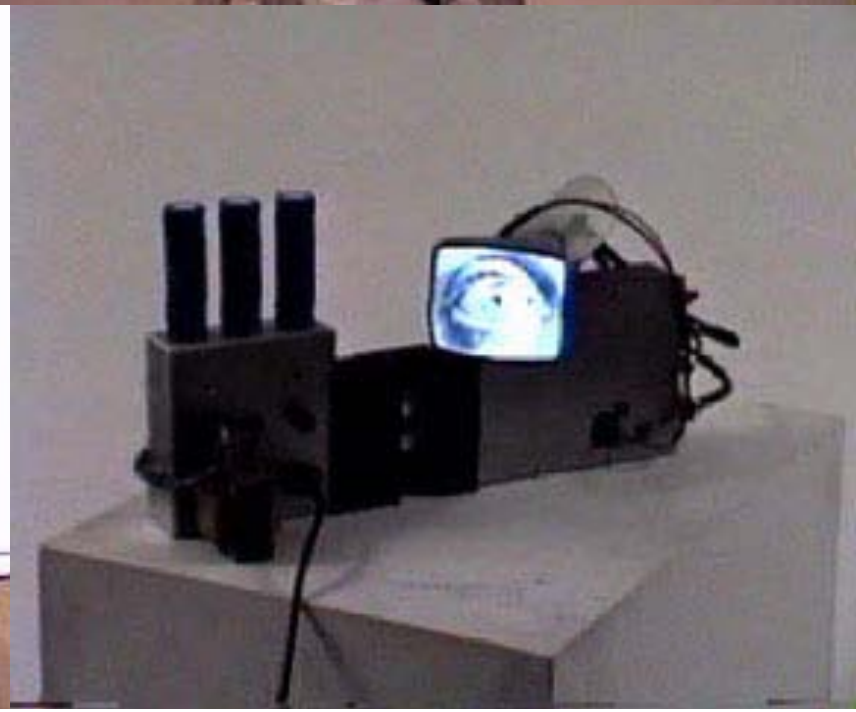


Serpente Rosso



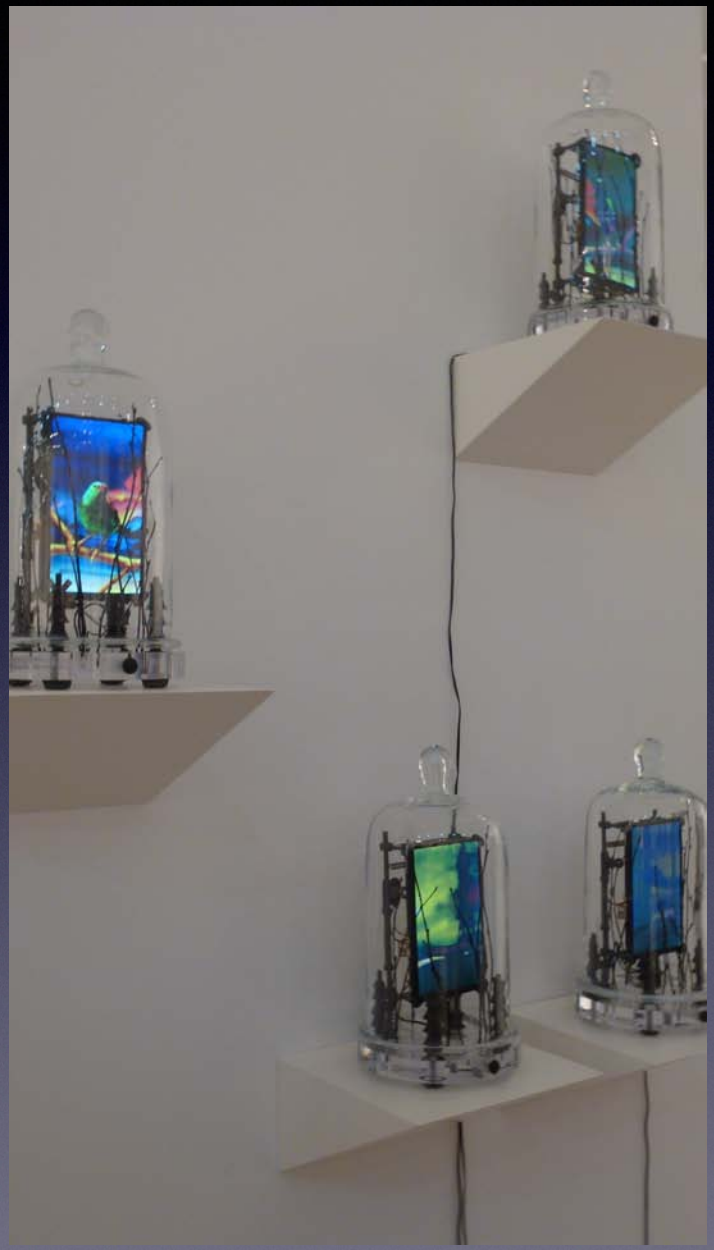
Alan Rath (1959 -)

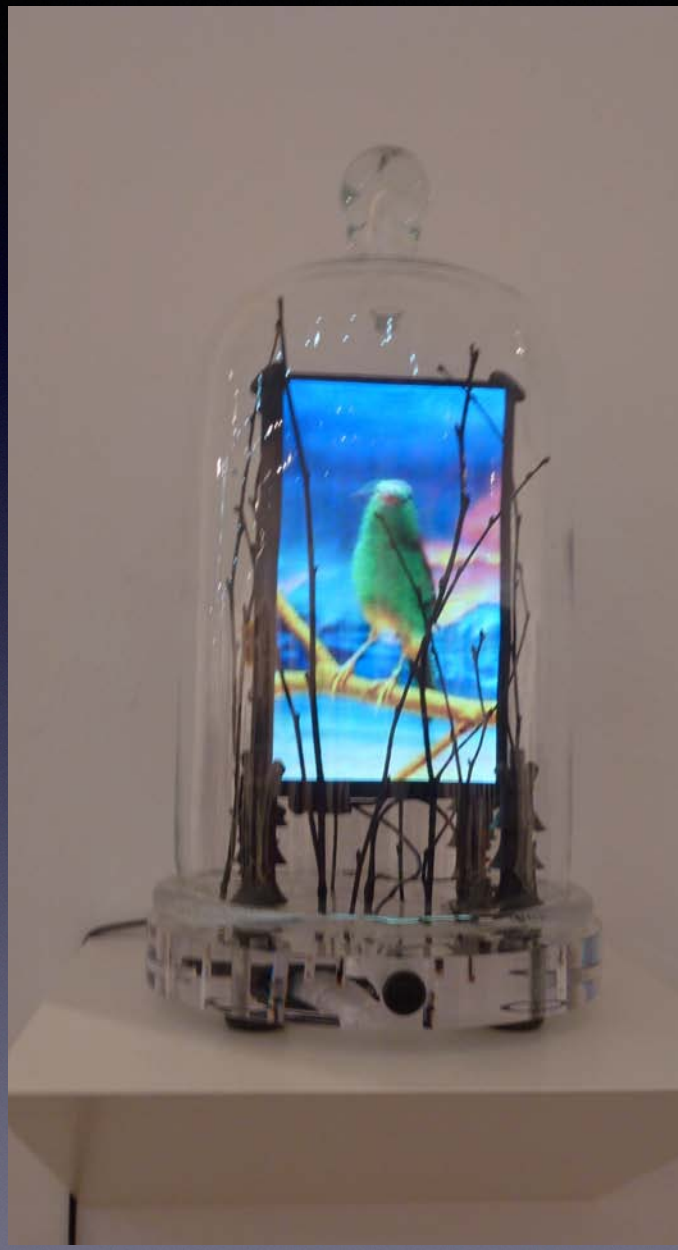




Alan Rath (1959 -)

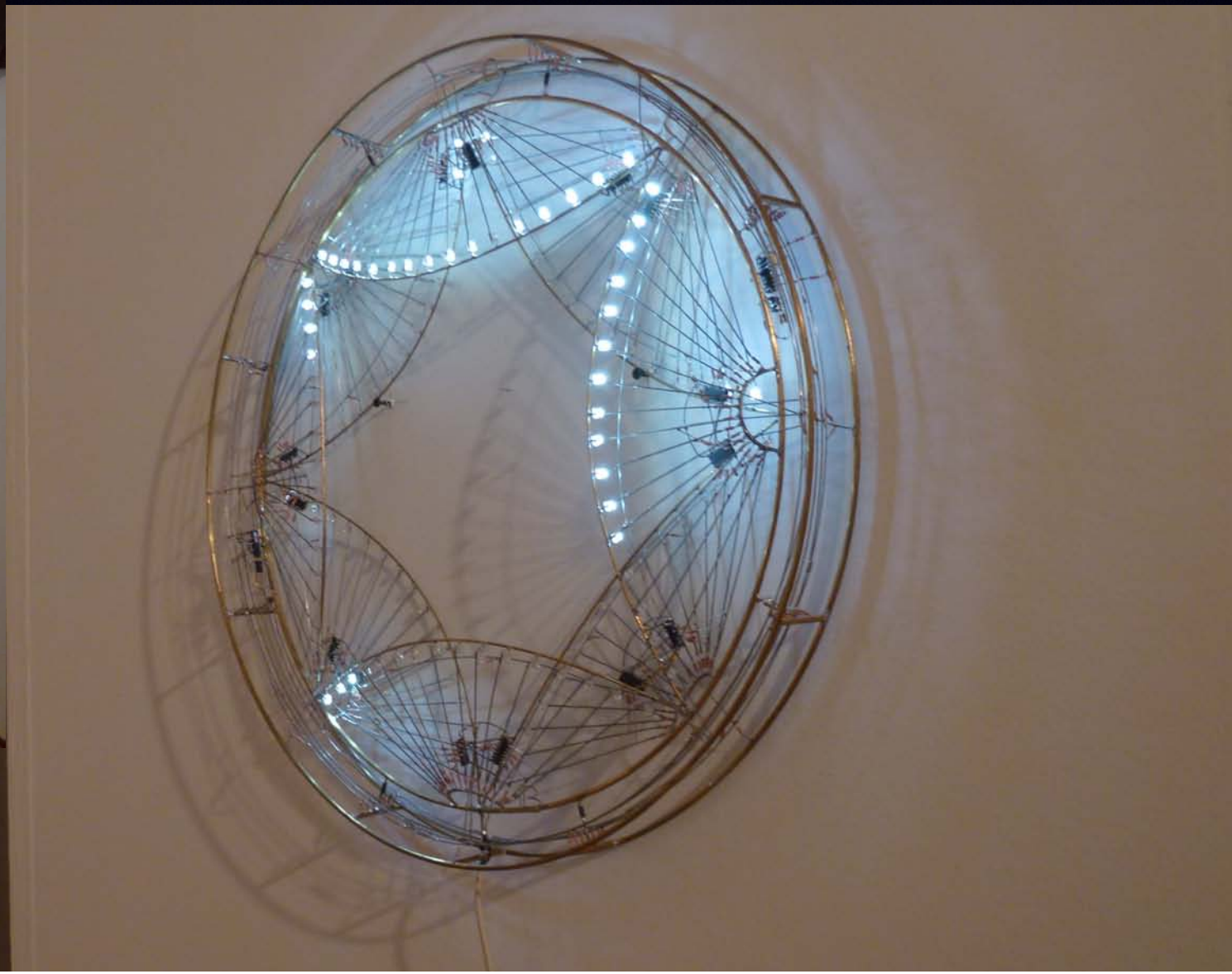
Art Basel, 2013





Alain Le Boucher

Art Basel, 2013



Alain Le Boucher

Art Basel, 2013

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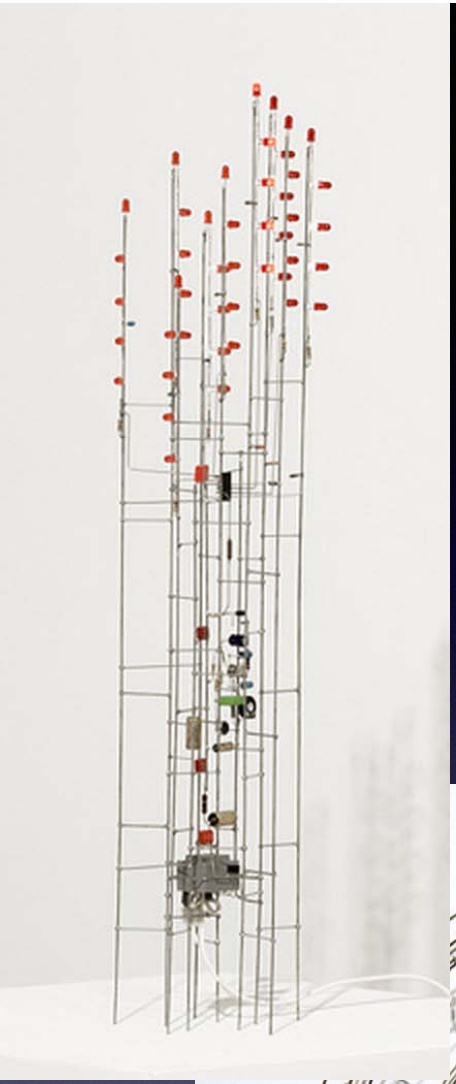
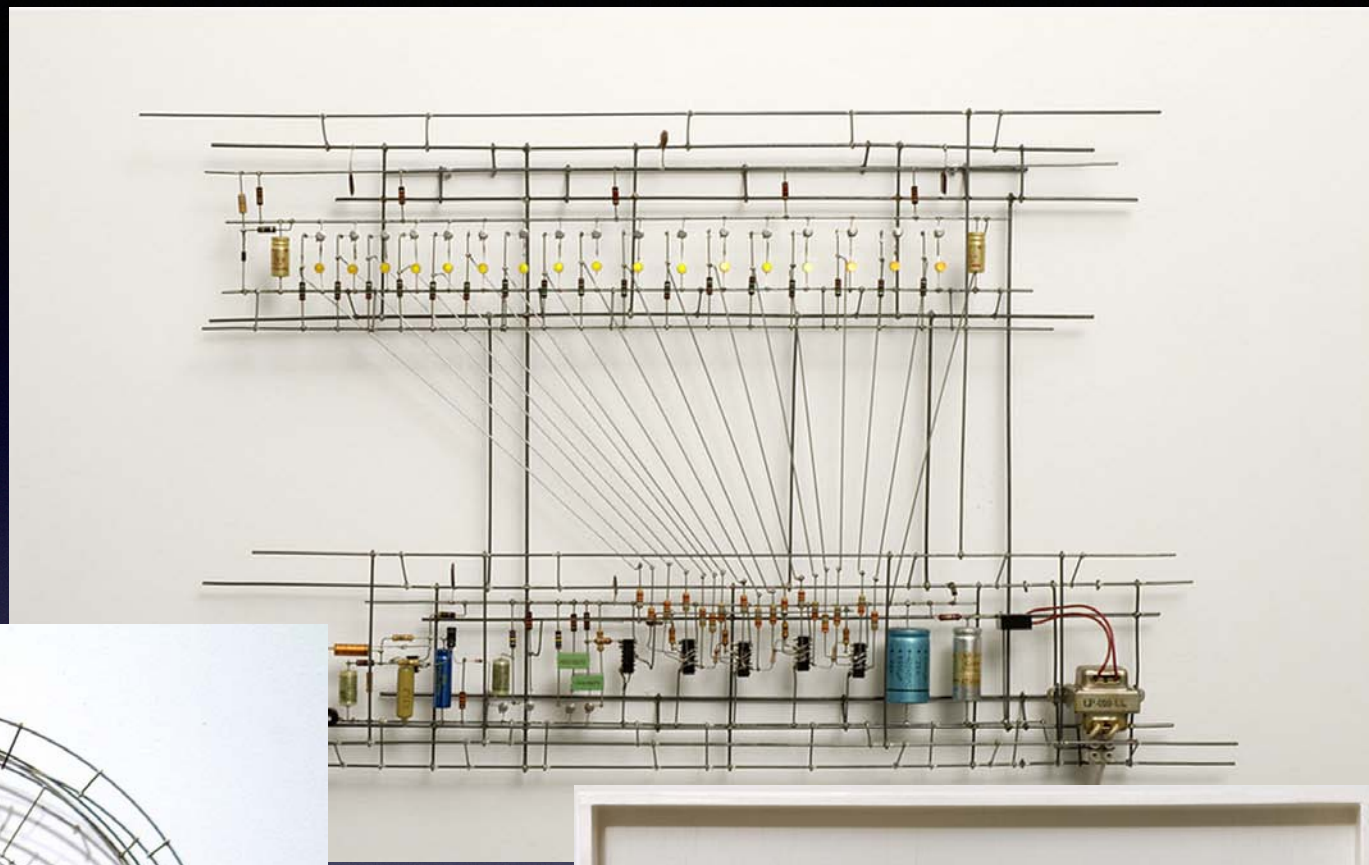
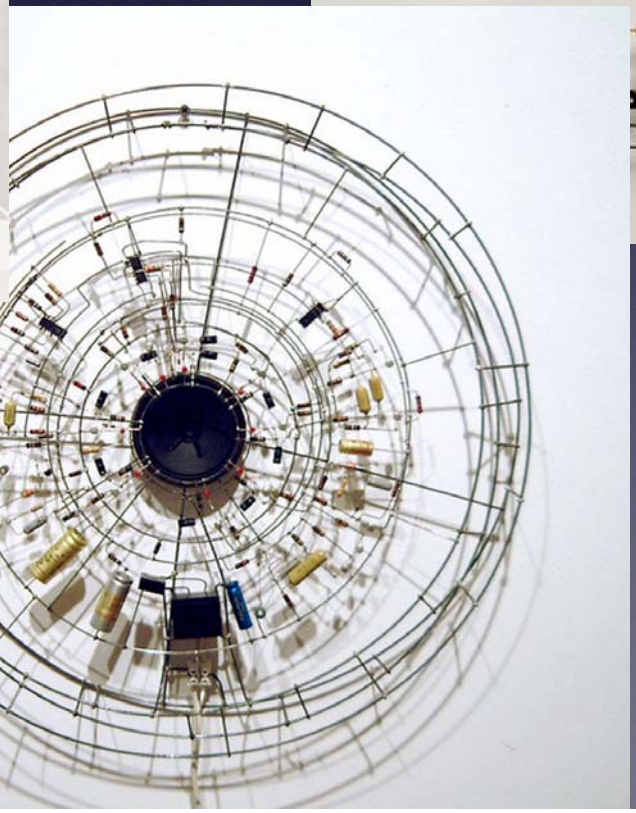
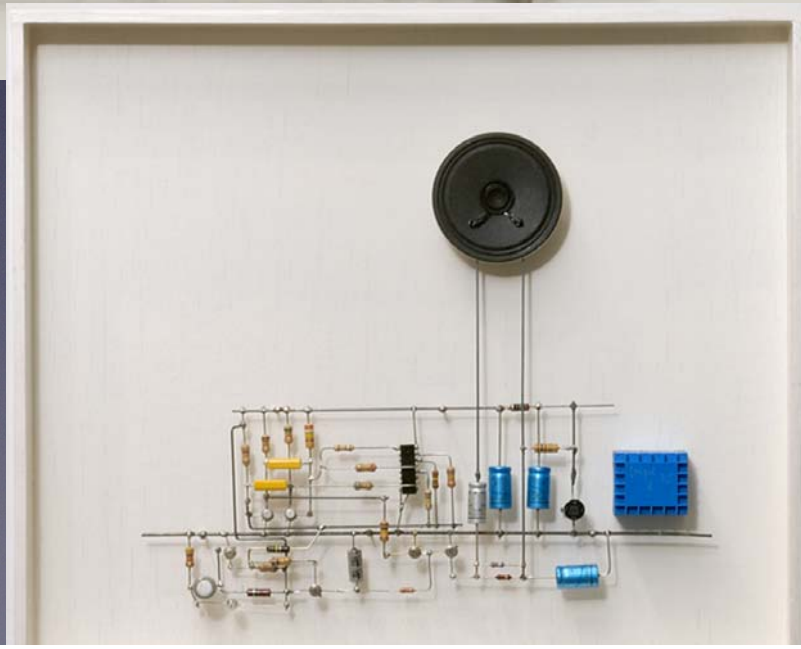
Art Basel, 2013

Peter Vogel (b 1954)









Peter Vogel (b 1954)

Soundwall Performance II

Jack Dollhausen

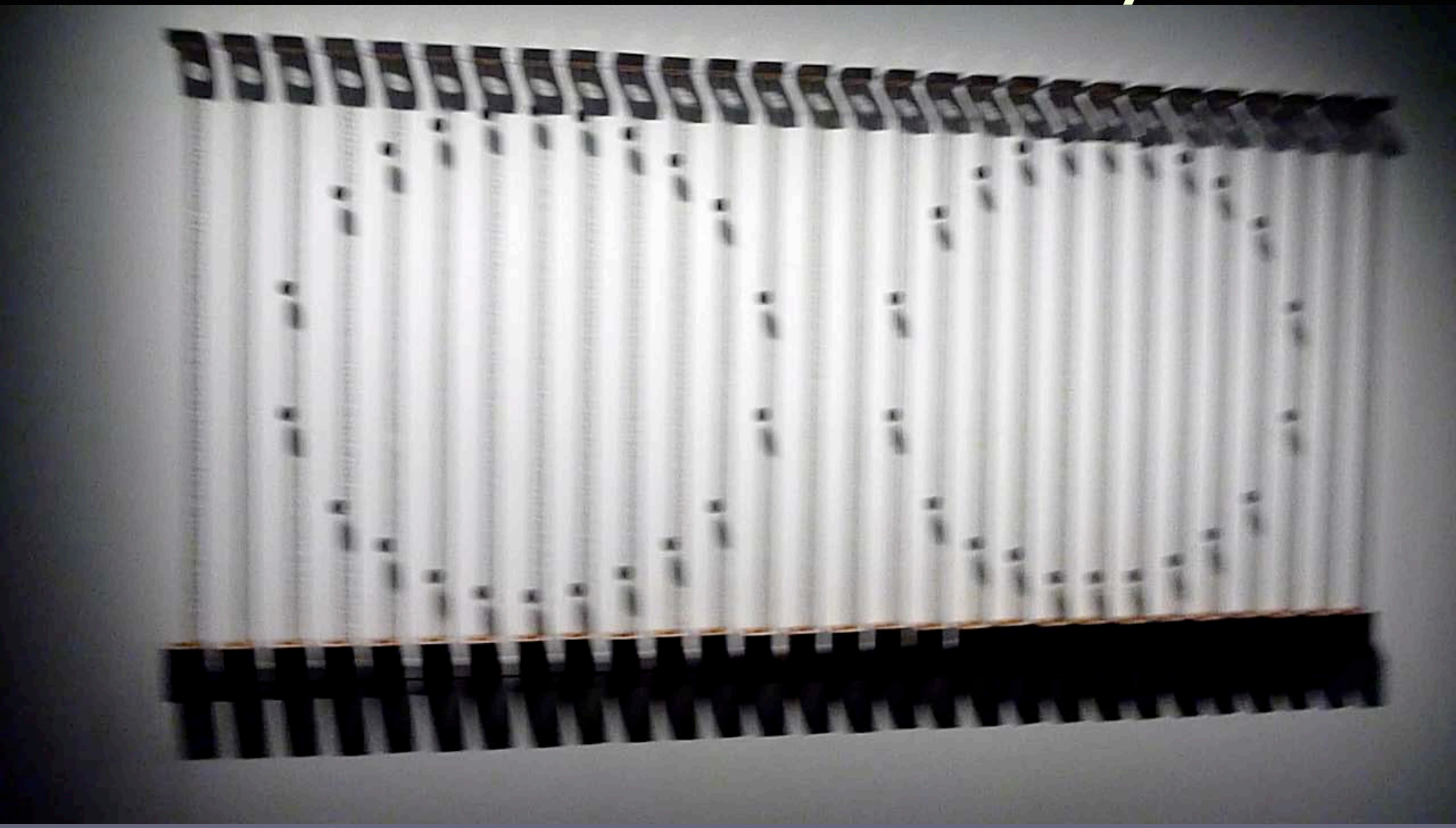
Leo Villareal (b1967)

Leo Villareal (b1967)

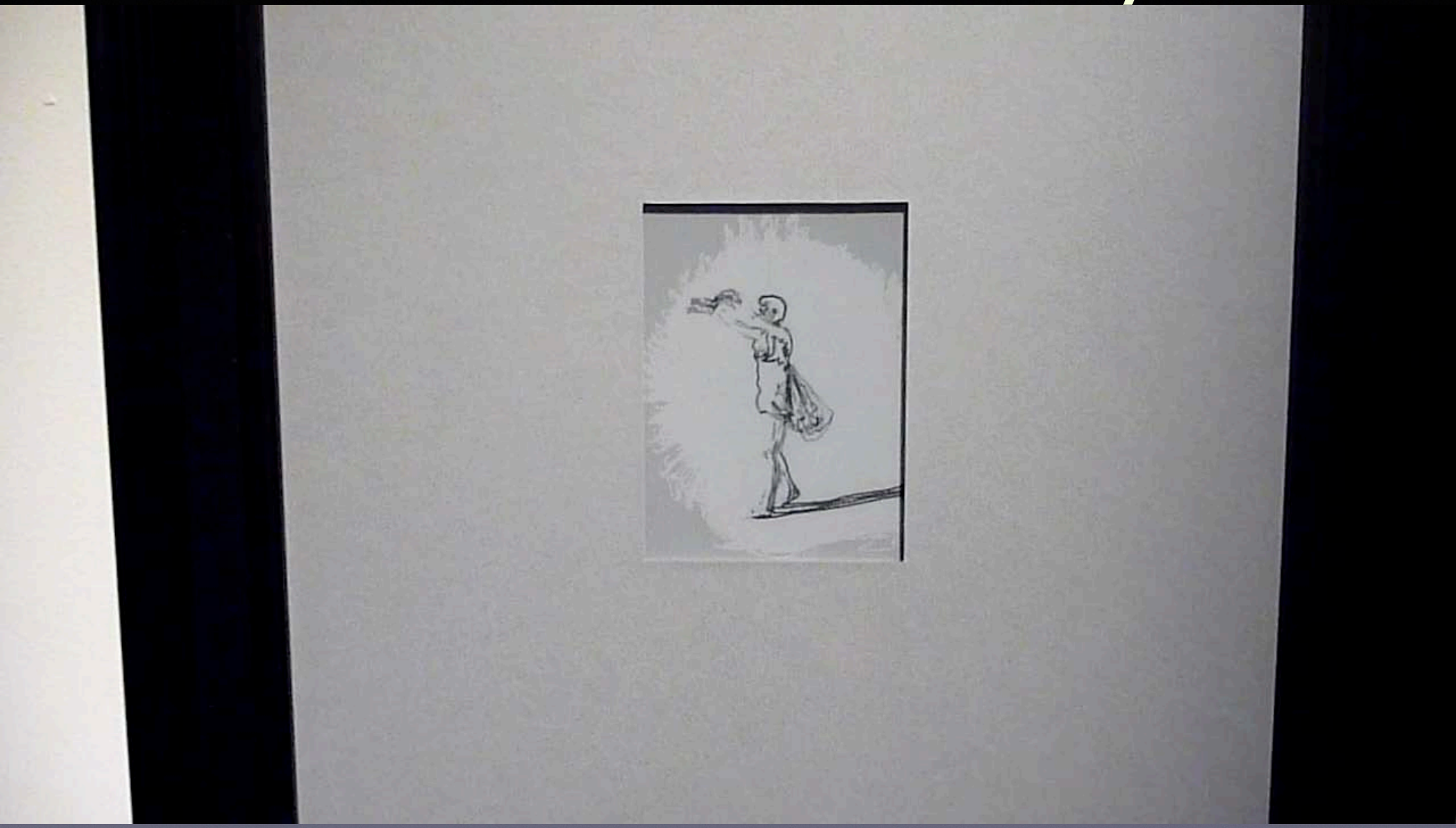
CMU Campus

Jenny Holzer (b1950)

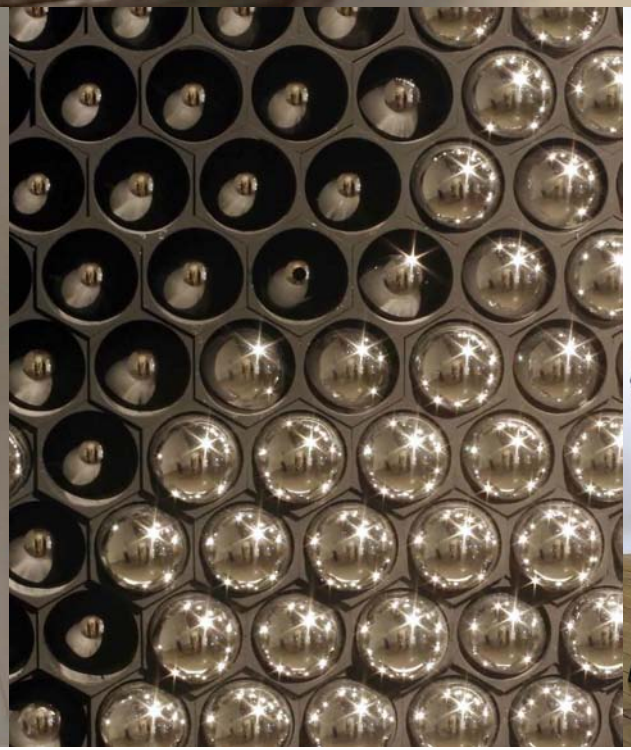
SIGGRAPH Art Gallery



SIGGRAPH Art Gallery

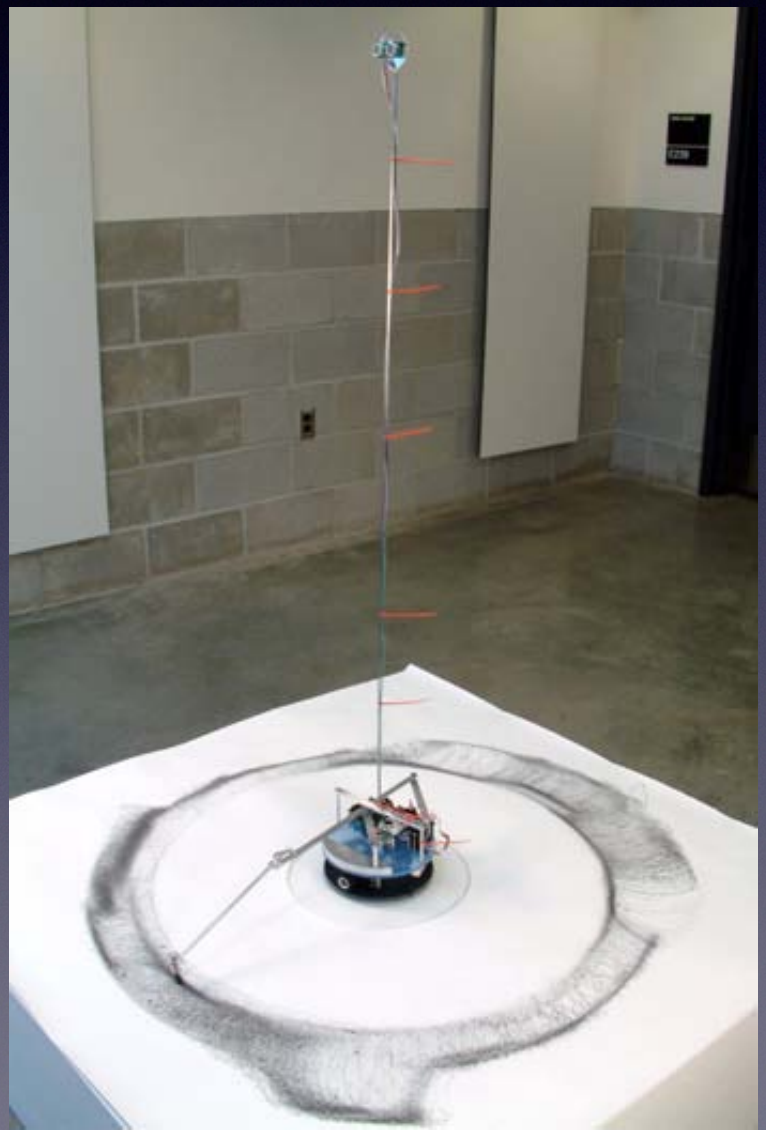


Daniel Rozin (1961 -)



David Bowen

University of Minnesota, Duluth

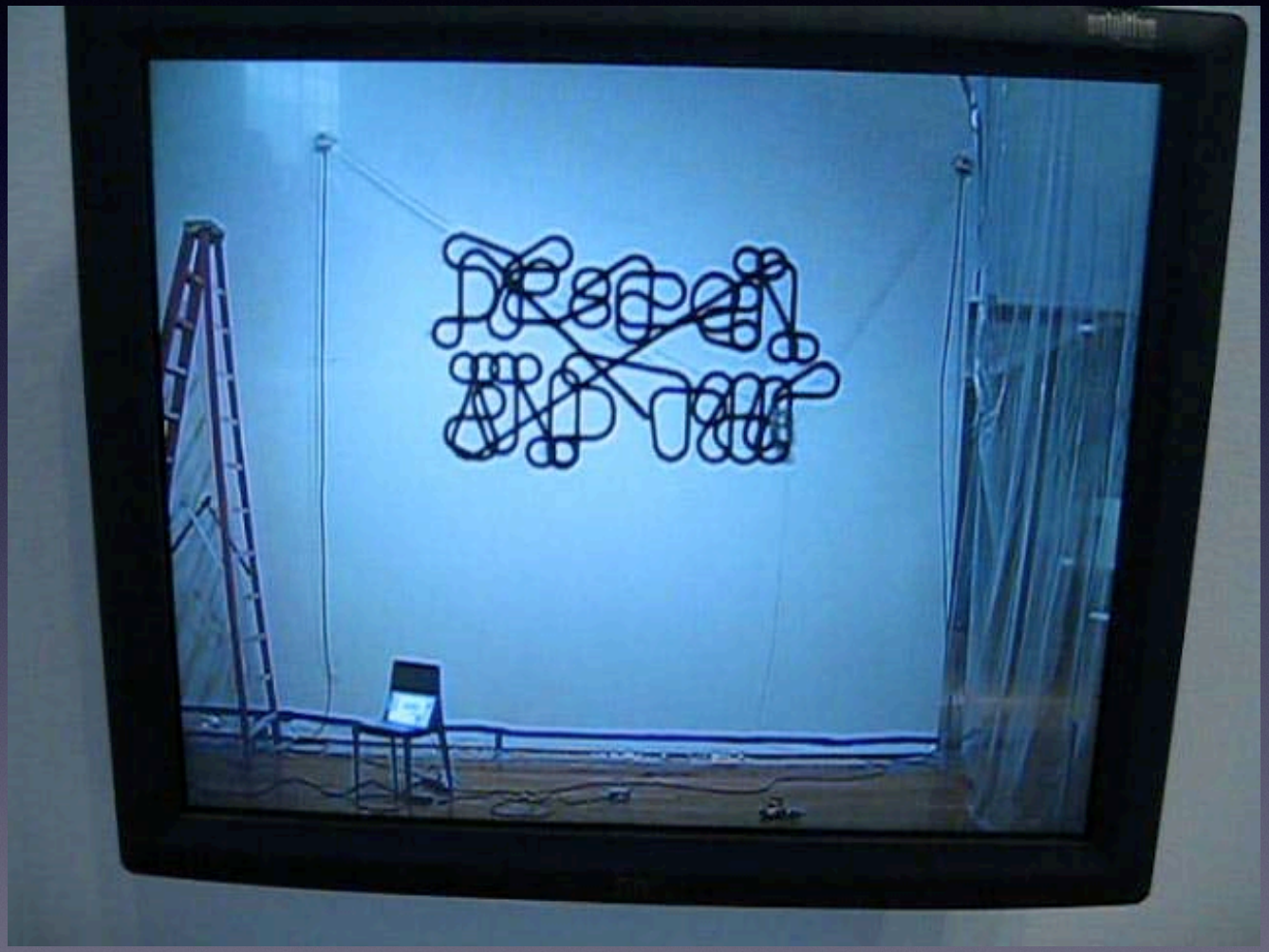


David Bowen

Tele-present wind

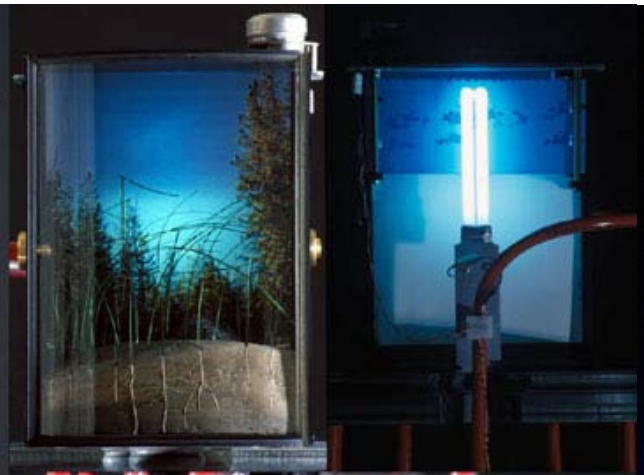
Rebecca Horn

Hektor - painting device



Patrick Tresset

Jim Pallas

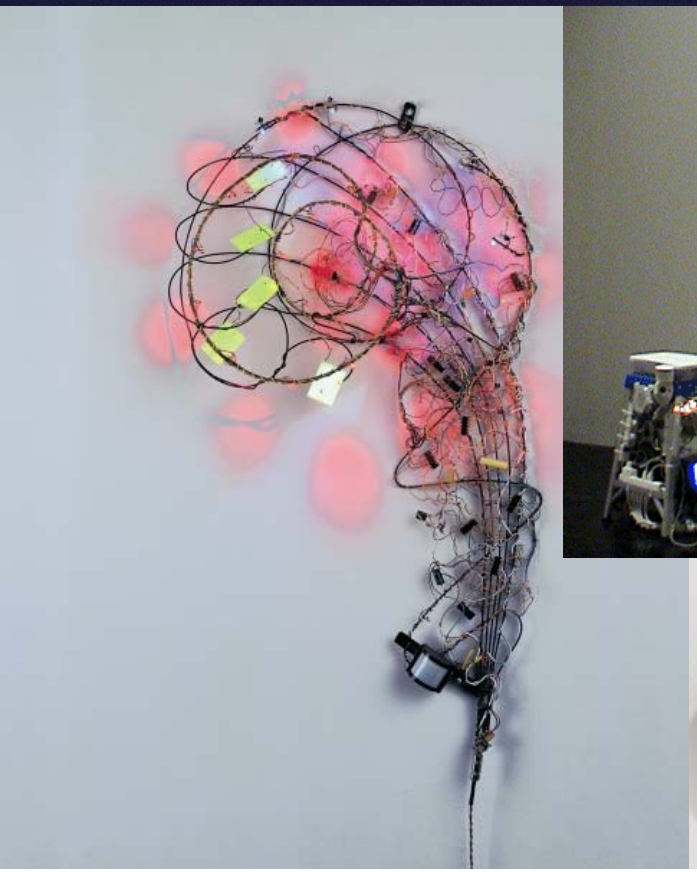


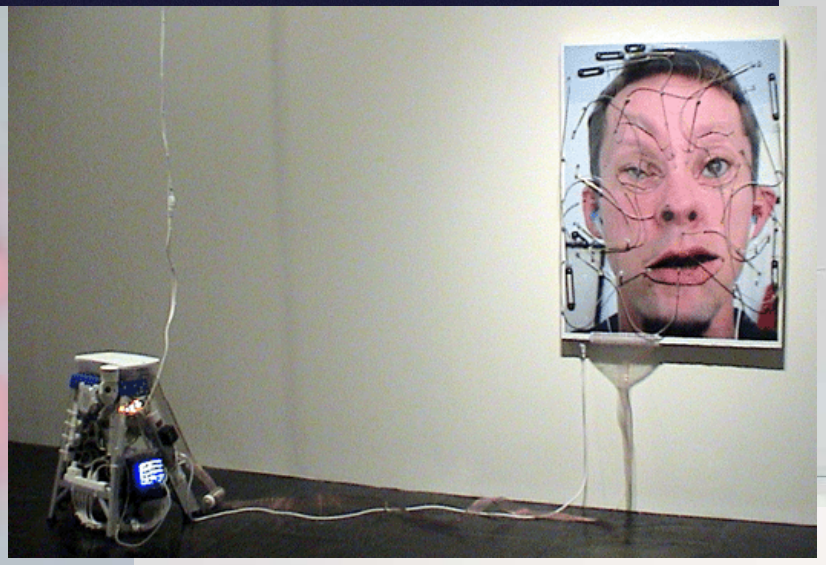
Paul Stout

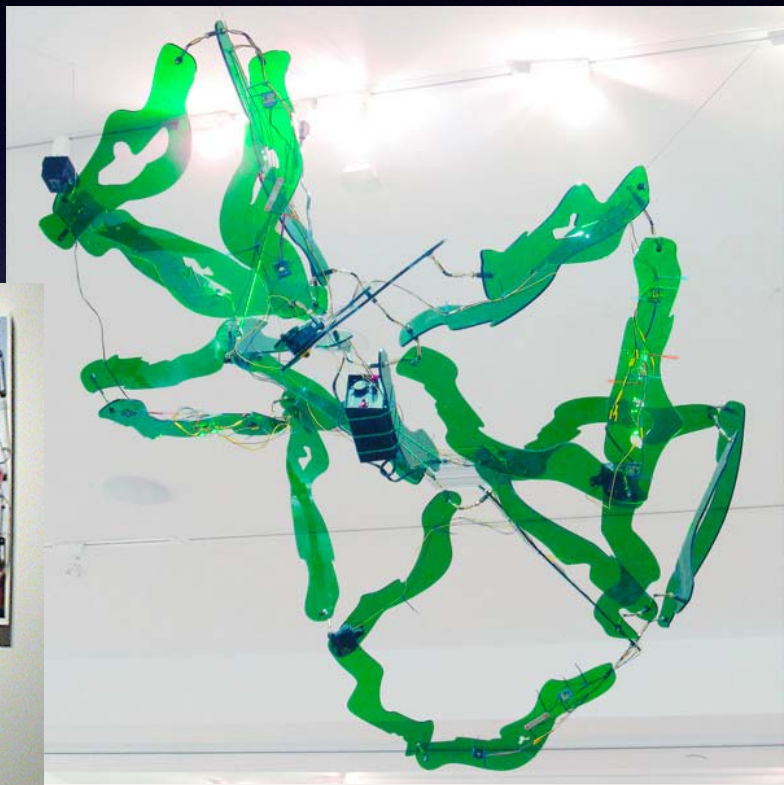
THE UNIVERSITY OF UTAH

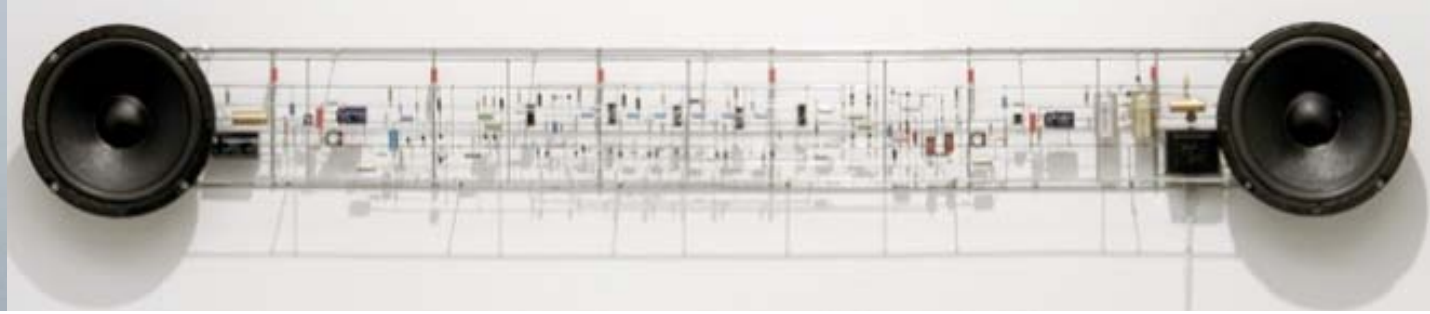
Lots of others…

Sabrina Raaf, Ann Hamilton,
Meridith Pingree, Roxy Paine,
Tim Hawkinson, Krzysztof Wodiczko, etc…







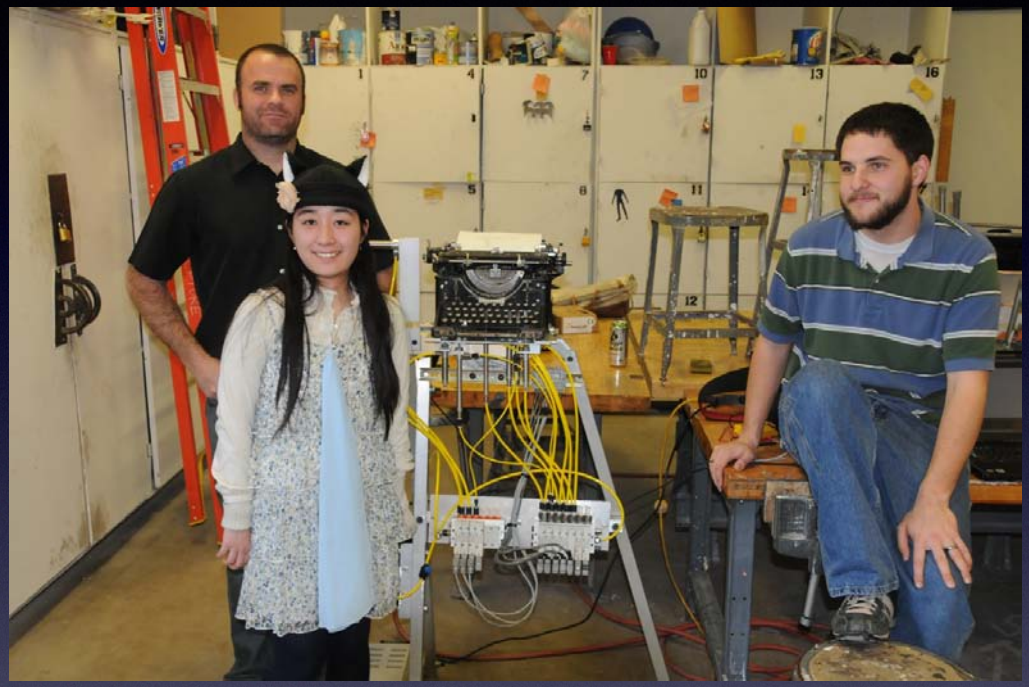


Cross-Disciplinary Class

- Bring Art students and Computer Science and Engineering (CSE) students together
  - Design and build embedded-system-controlled kinetic art
  - Goal is benefit for both groups of students

- Fundamental nature of *Design*?
  - Design thinking vs. computational thinking?

Class Overview: CS5789



- 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

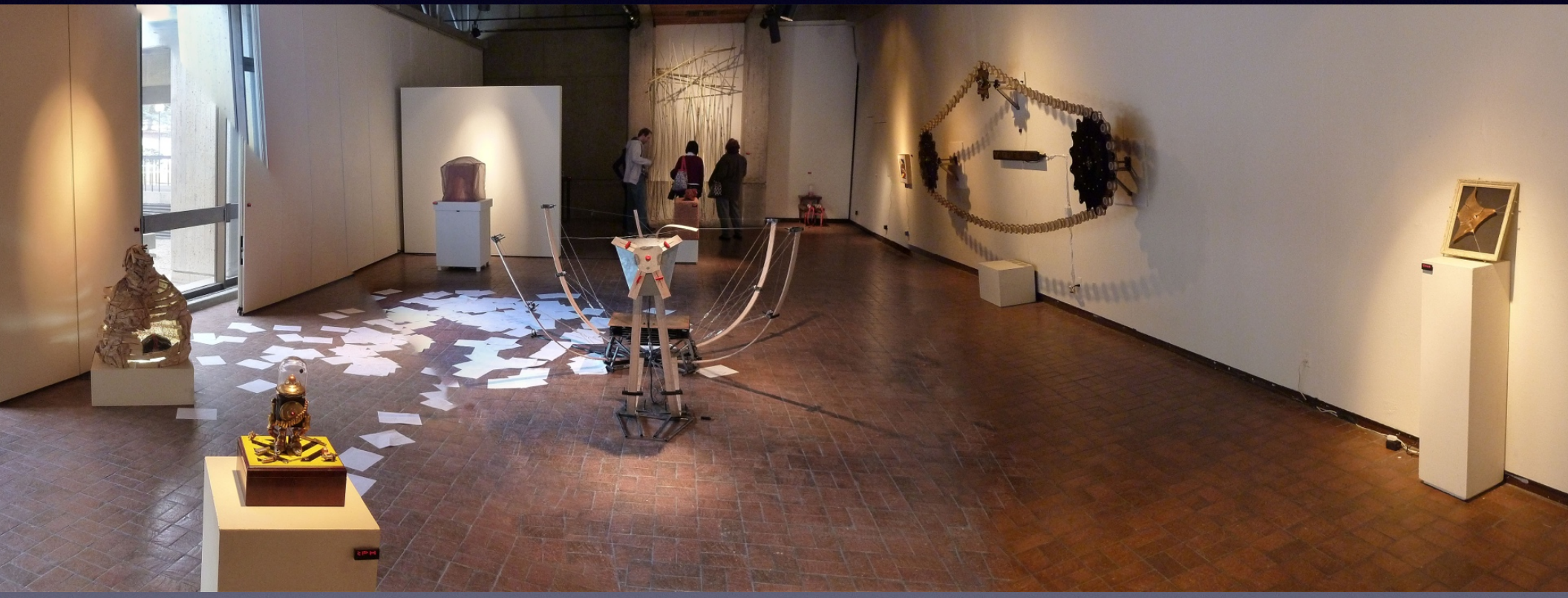
Class Overview

- Individual and group projects
  - Everybody tries everything individually
  - Also work in interdisciplinary teams

- Finish with a gallery show
  - 2009/2010: Invisible Logic
  - 2010/2011: Intersectio
  - Spring 2012: Drawing Machines
  - Spring 2014: Input/Artput
  - Spring 2015: C:\Art\Run

Intersectio

Examples of Student Projects



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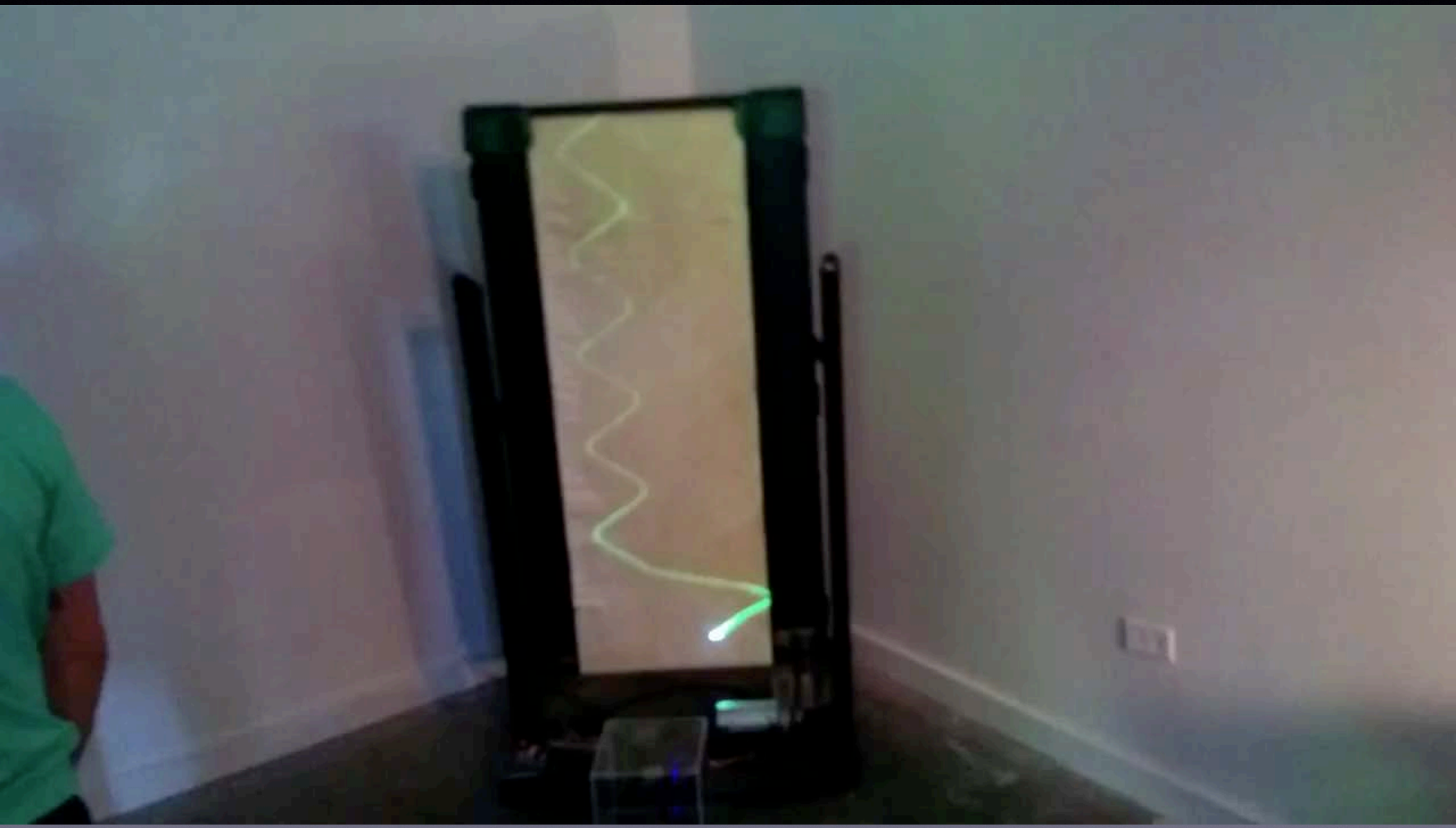

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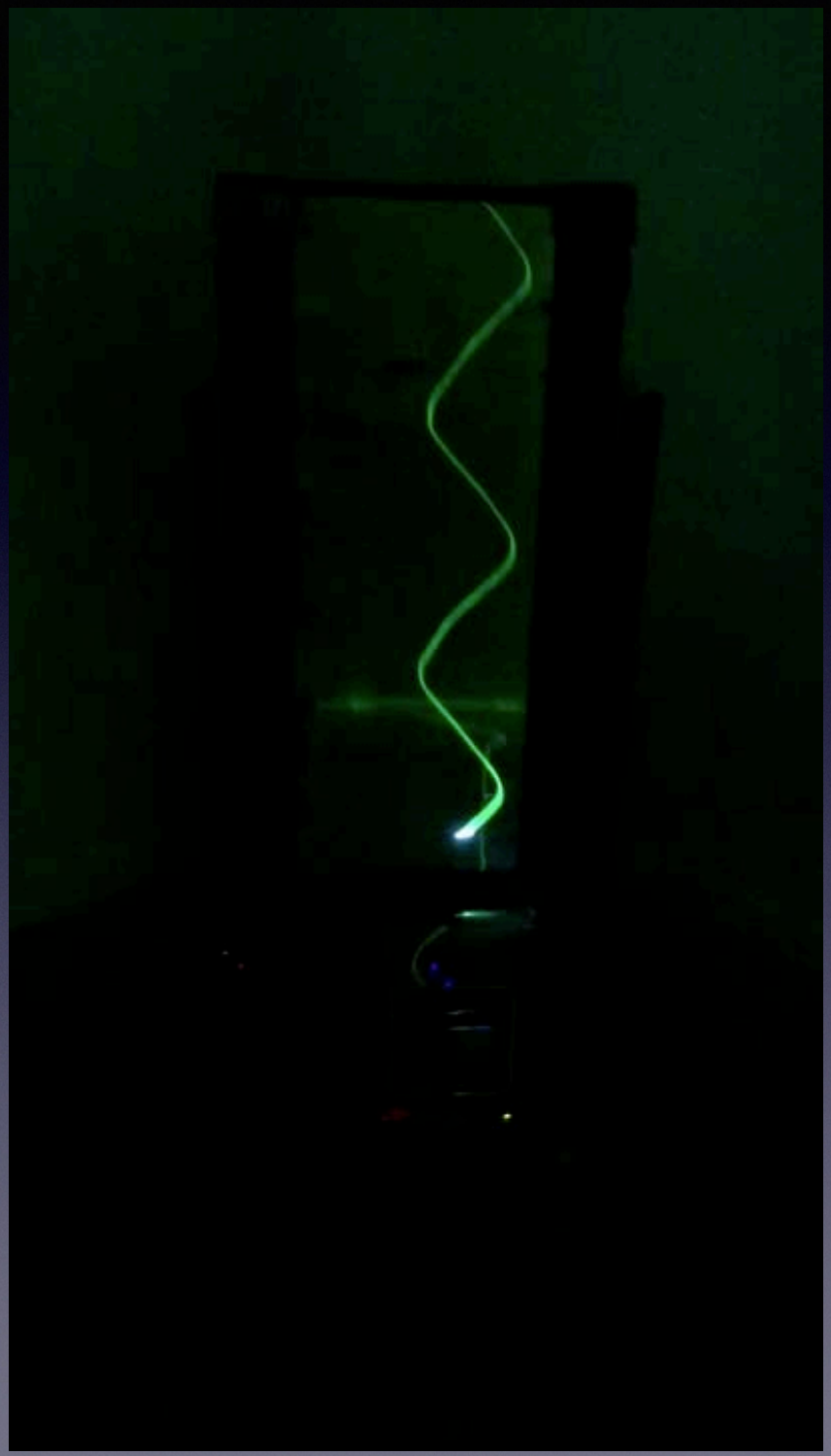
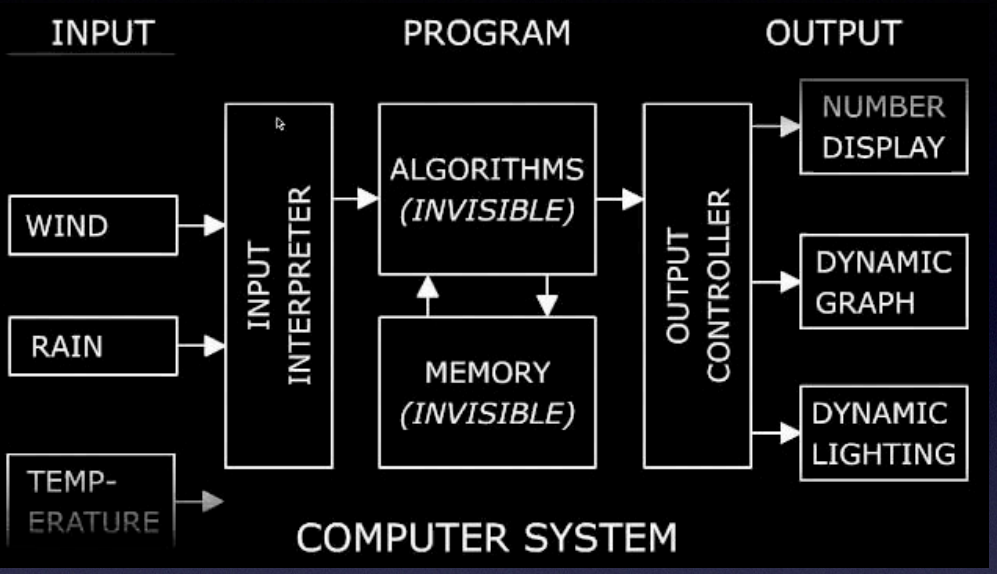


Conclusions

- 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!

Contact



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