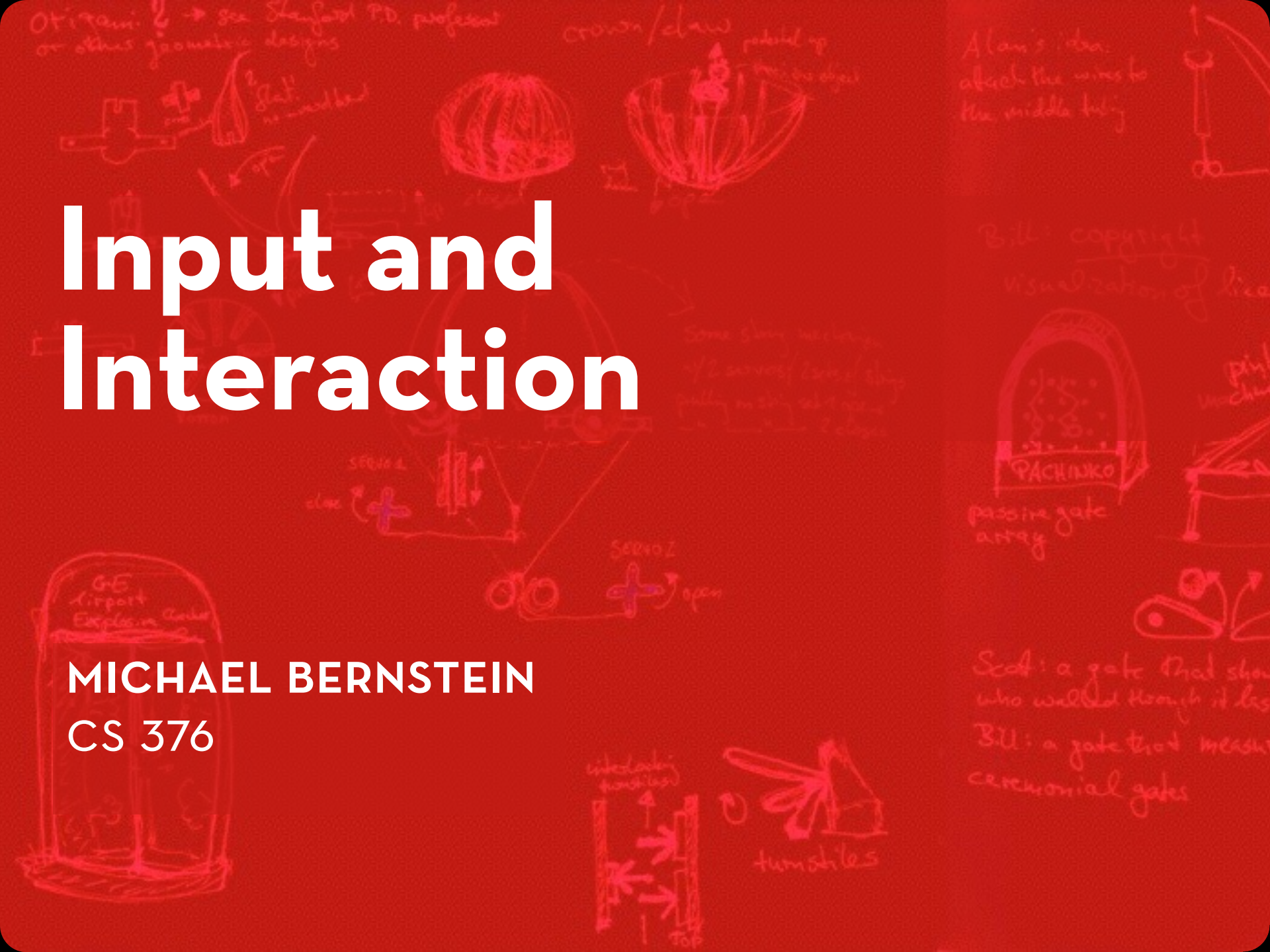
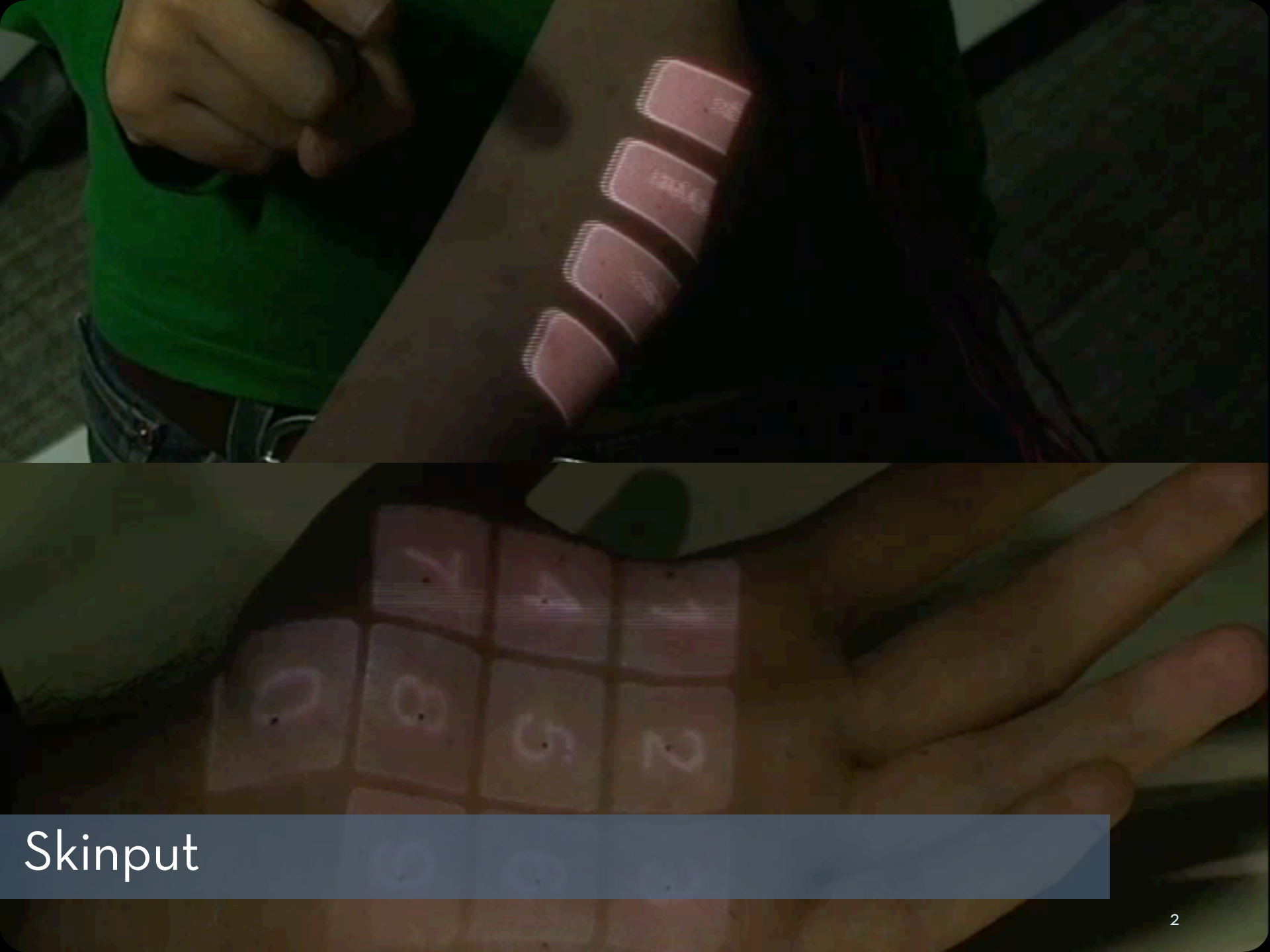


Input and Interaction

MICHAEL BERNSTEIN

CS 376



Skinput

Recall: Omnitouch

Recall: SenseCam

Input and interaction research

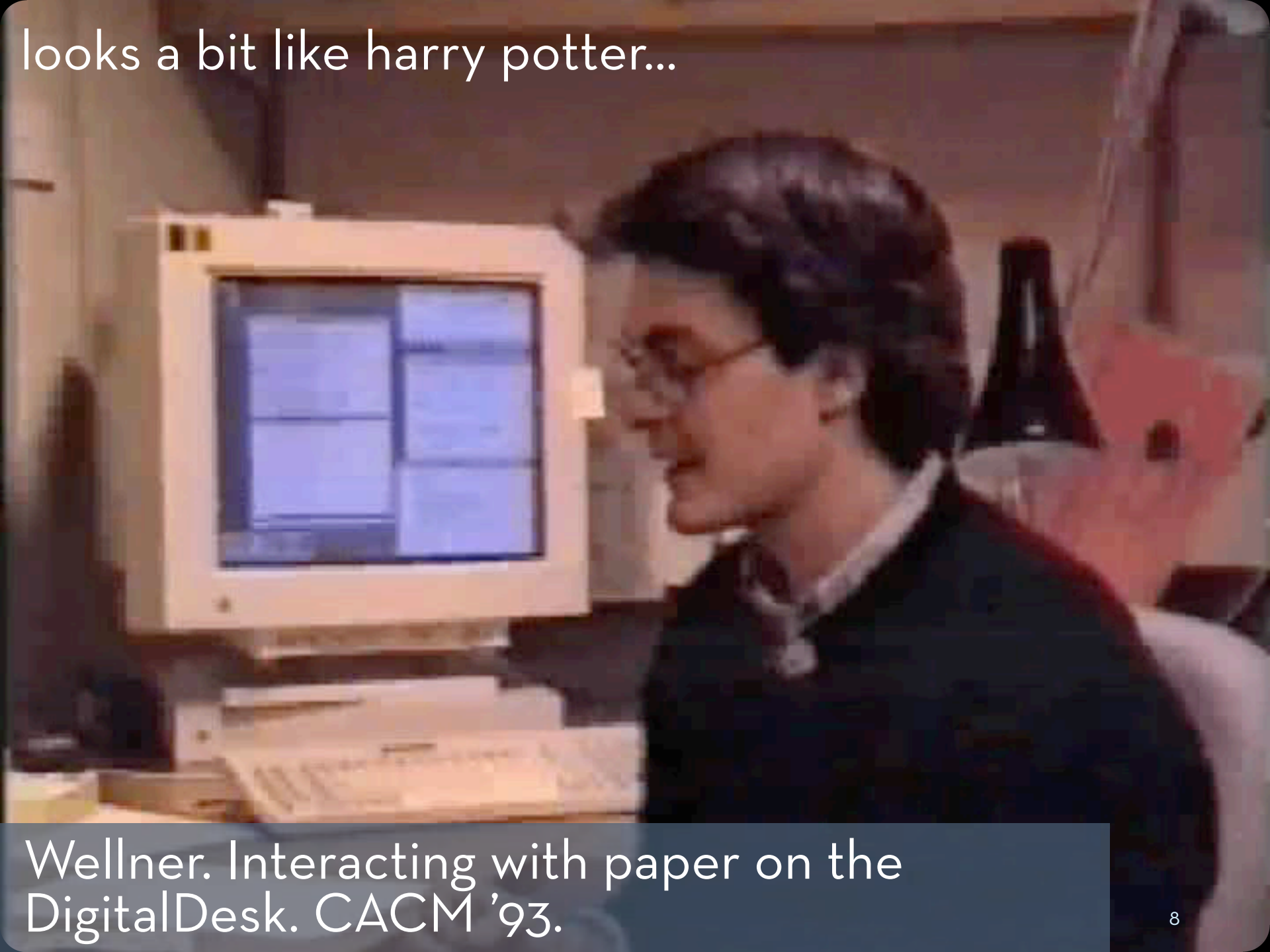
- How can the user interact fluidly with the world around them?
  - New input modalities: e.g., depth cameras
  - New output modalities: e.g., pico projectors
  - New user vocabulary: e.g., gestures
- This research is often driven by, or involves the creation of, new hardware

Bolt. “Put-that-there”: Voice and gesture at the graphics interface. SIGGRAPH ’80.

Put That There

- Contribution: combined gesture and voice input
  - In a closed world
  - With a toy goal
  - Using simple manipulation operations
  - Using a laser attached to the wrist
- In many ways, our goal since 1980 has been to relax those assumptions

looks a bit like harry potter...



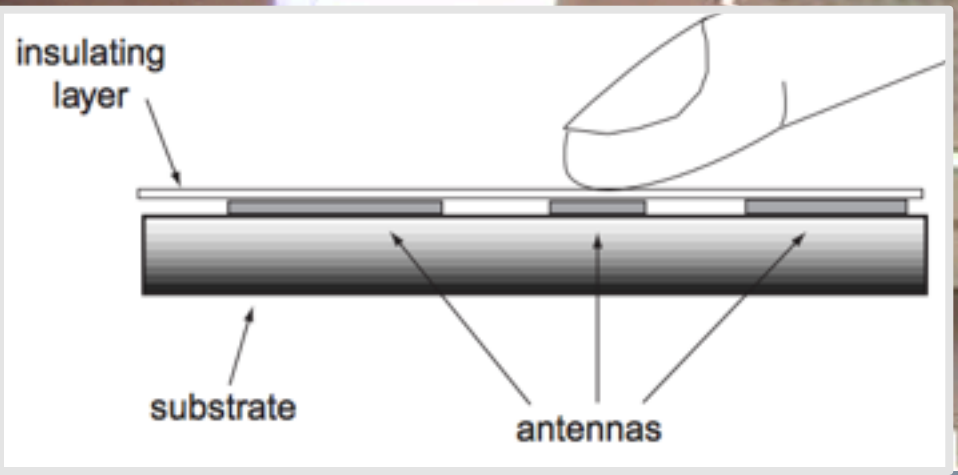
Wellner. Interacting with paper on the DigitalDesk. CACM '93.

DigitalDesk

- Contribution: fluid boundaries between digital and physical objects
  - In a constrained space
  - On a small set of tasks
  - With predefined behaviors
- Again, we work to relax these assumptions

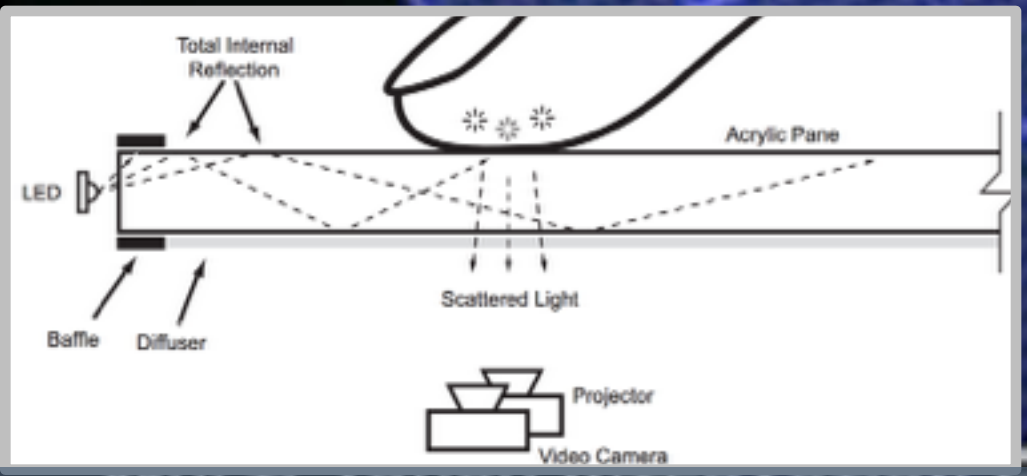
Input technologies

Tabletop



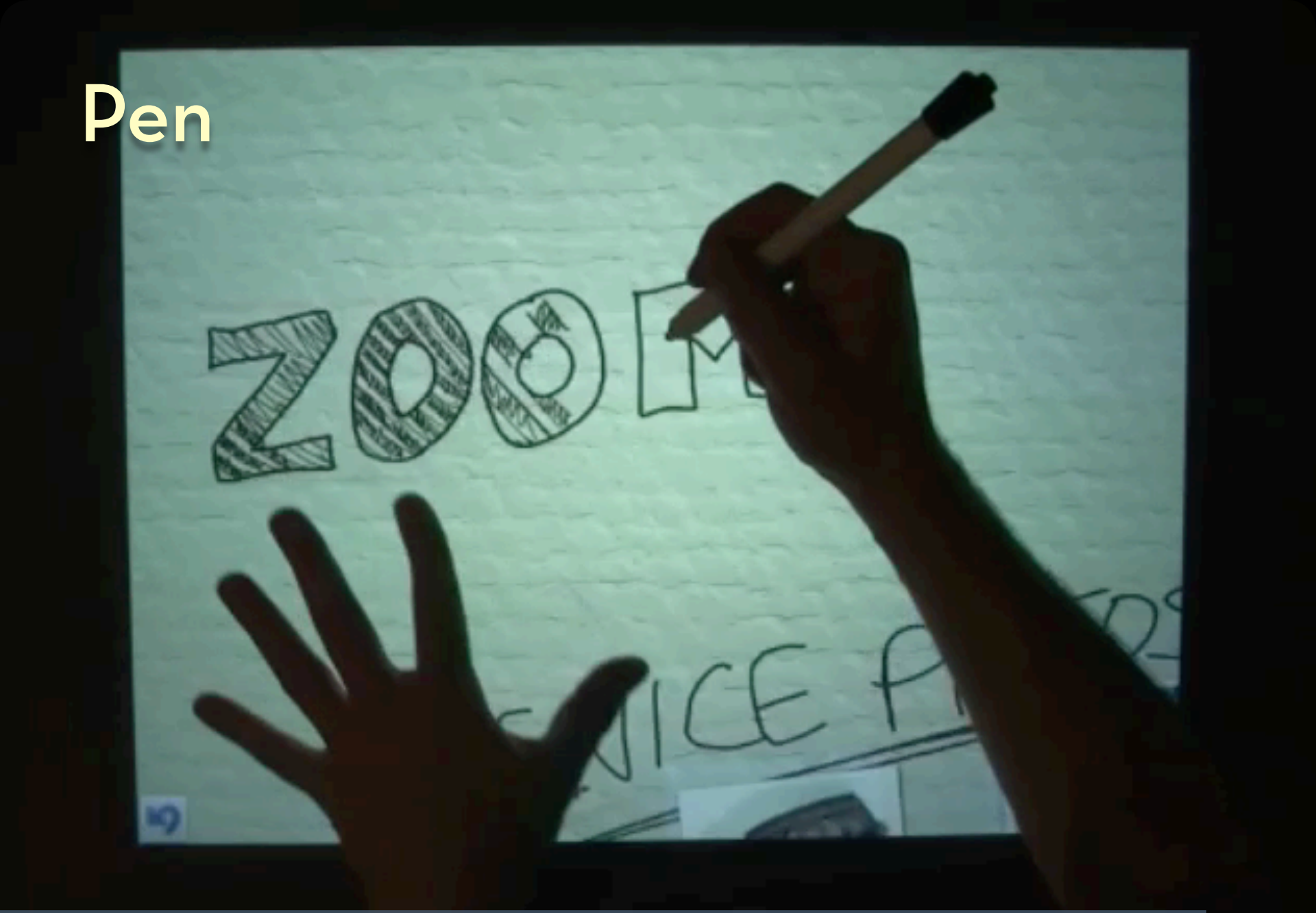
Dietz and Leigh. DiamondTouch: a multi-user touch technology. UIST '01.

Tabletop



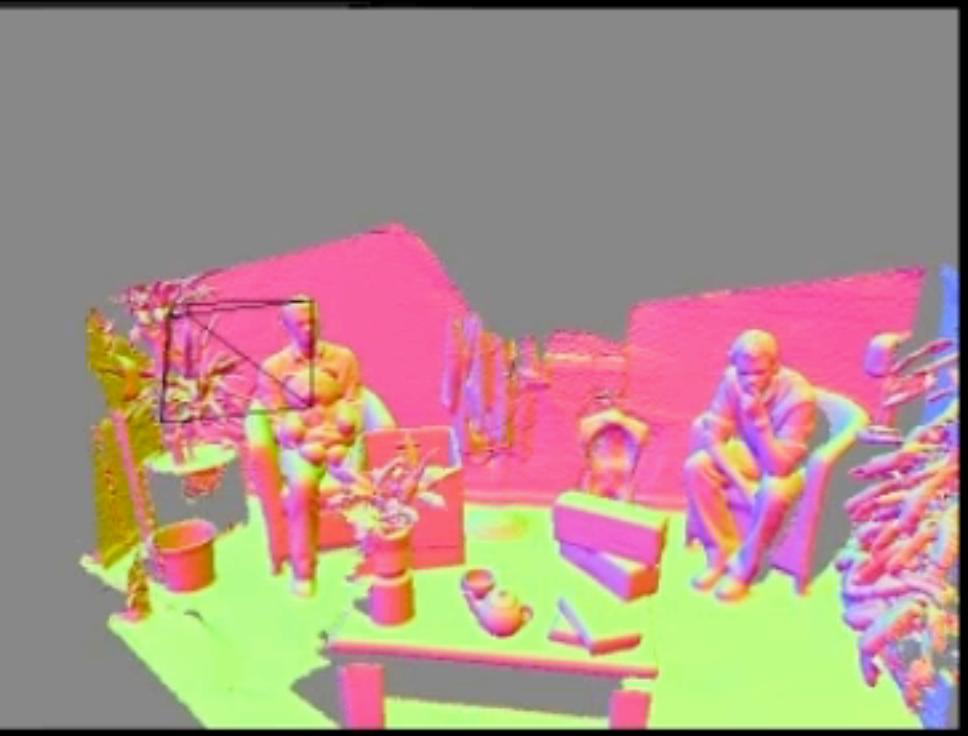
Han. Low-cost multi-touch sensing through frustrated total internal reflection. UIST '05.

Pen

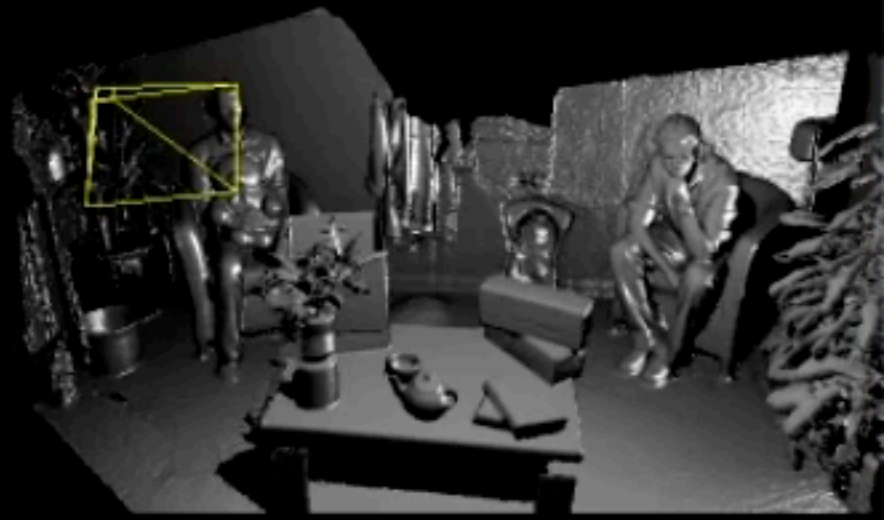


Hinckley et al. Pen + touch = new tools. UIST '10.

Depth sensing



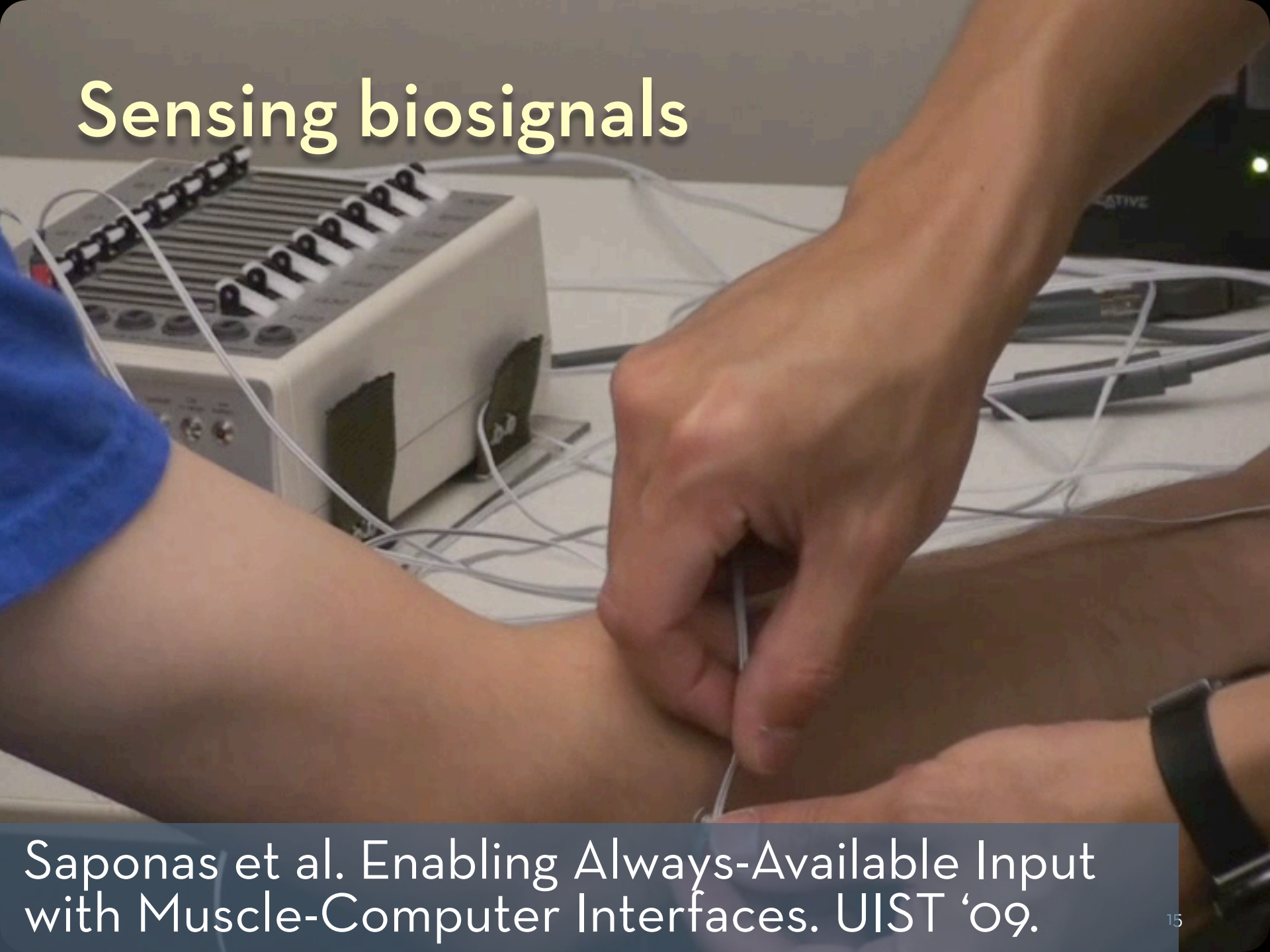
Model normal map



Phong shaded model

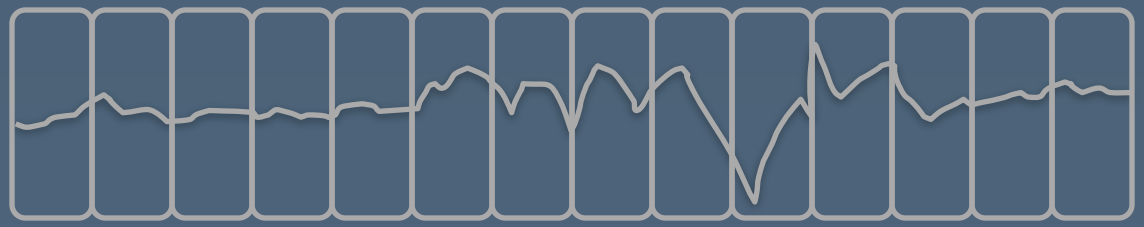
Izadi et al. KinectFusion. SIGGRAPH '11.

Sensing biosignals



Saponas et al. Enabling Always-Available Input with Muscle-Computer Interfaces. UIST '09.

Machine learning model for muscle interfaces et al.



x6 Sensors

30 millisecond sample

Features

Root Mean Square (RMS)
ratios between channels

Frequency Energy
10 Hz bands

Phase Coherence
ratios between channels

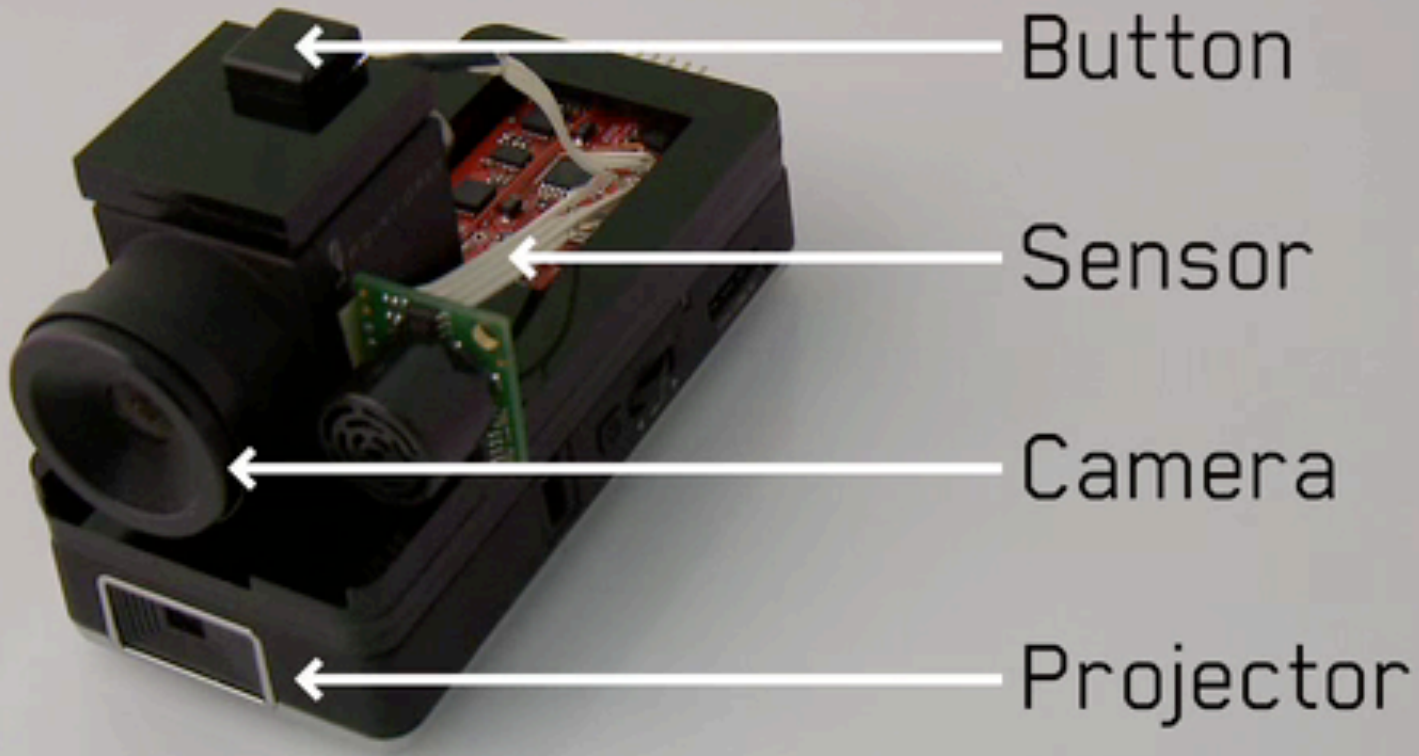
user specific model

Support Vector Machine

gesture classification

Output technologies

Handheld projectors

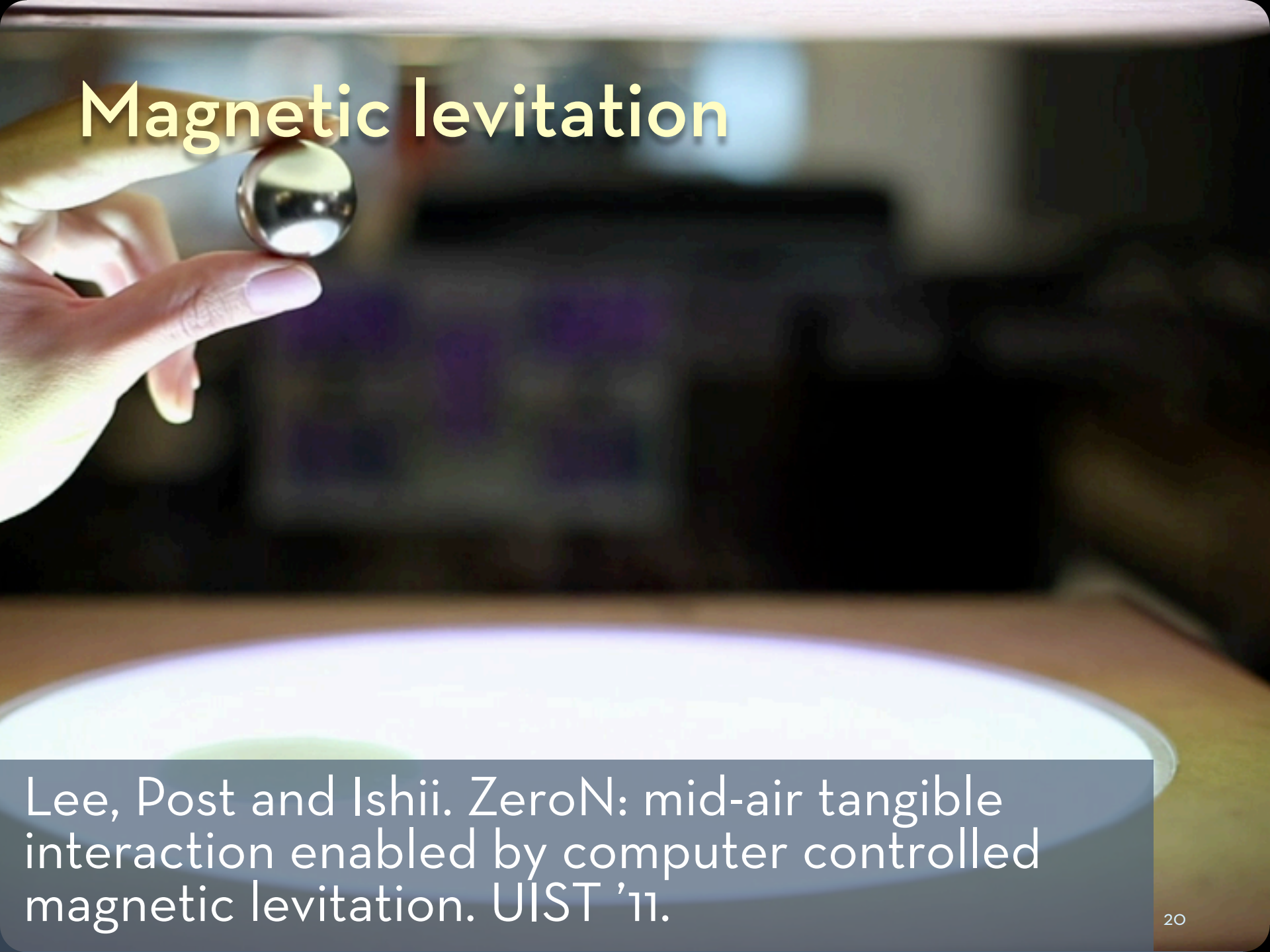


Willis et al. SideBySide: ad-hoc multi-user interaction with handheld projectors. UIST '11.

Physically actuated material

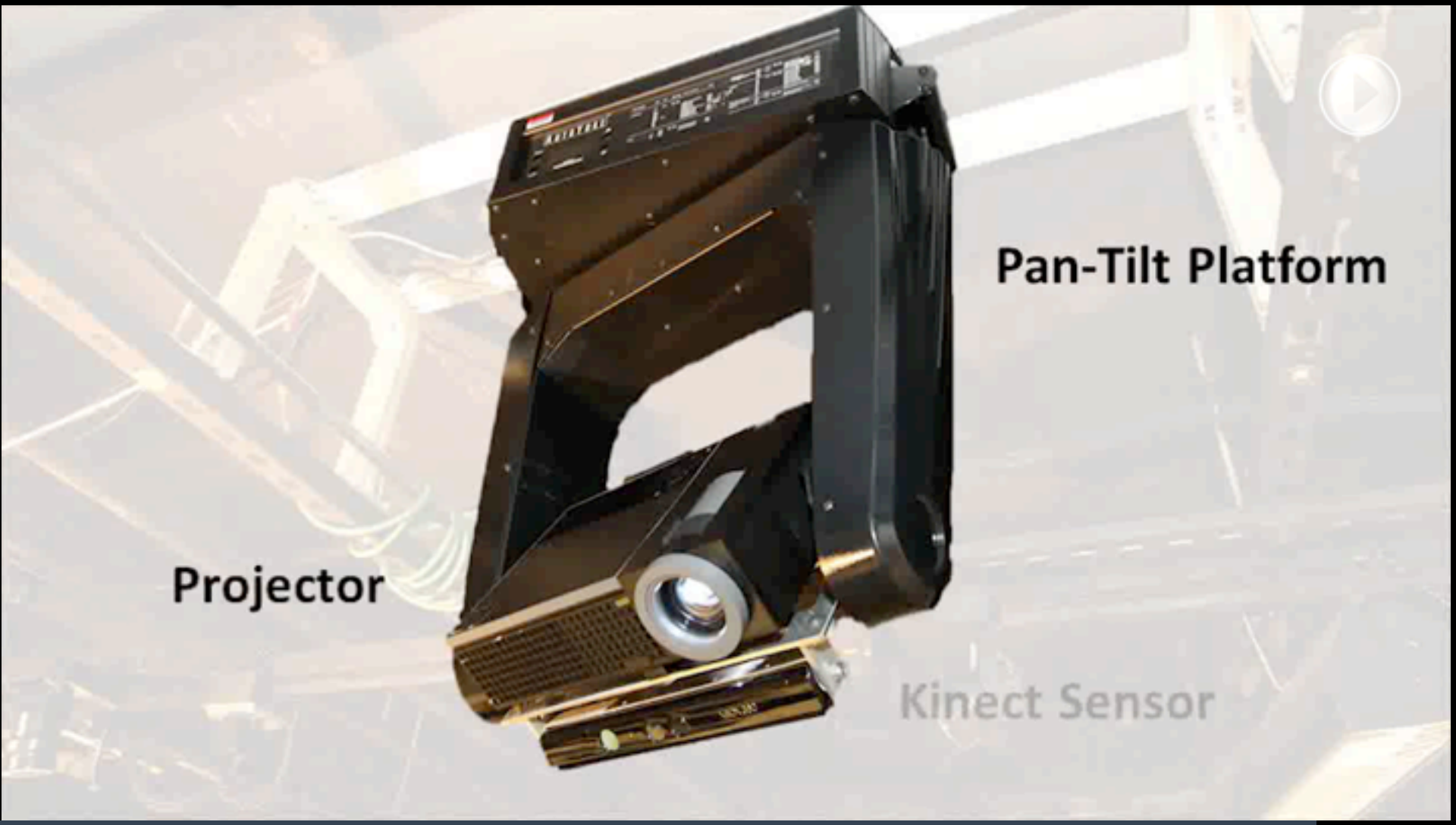
Follmer et al. Jamming user interfaces: programmable particle stiffness and sensing for malleable and shape-changing devices. UIST '12.

Magnetic levitation



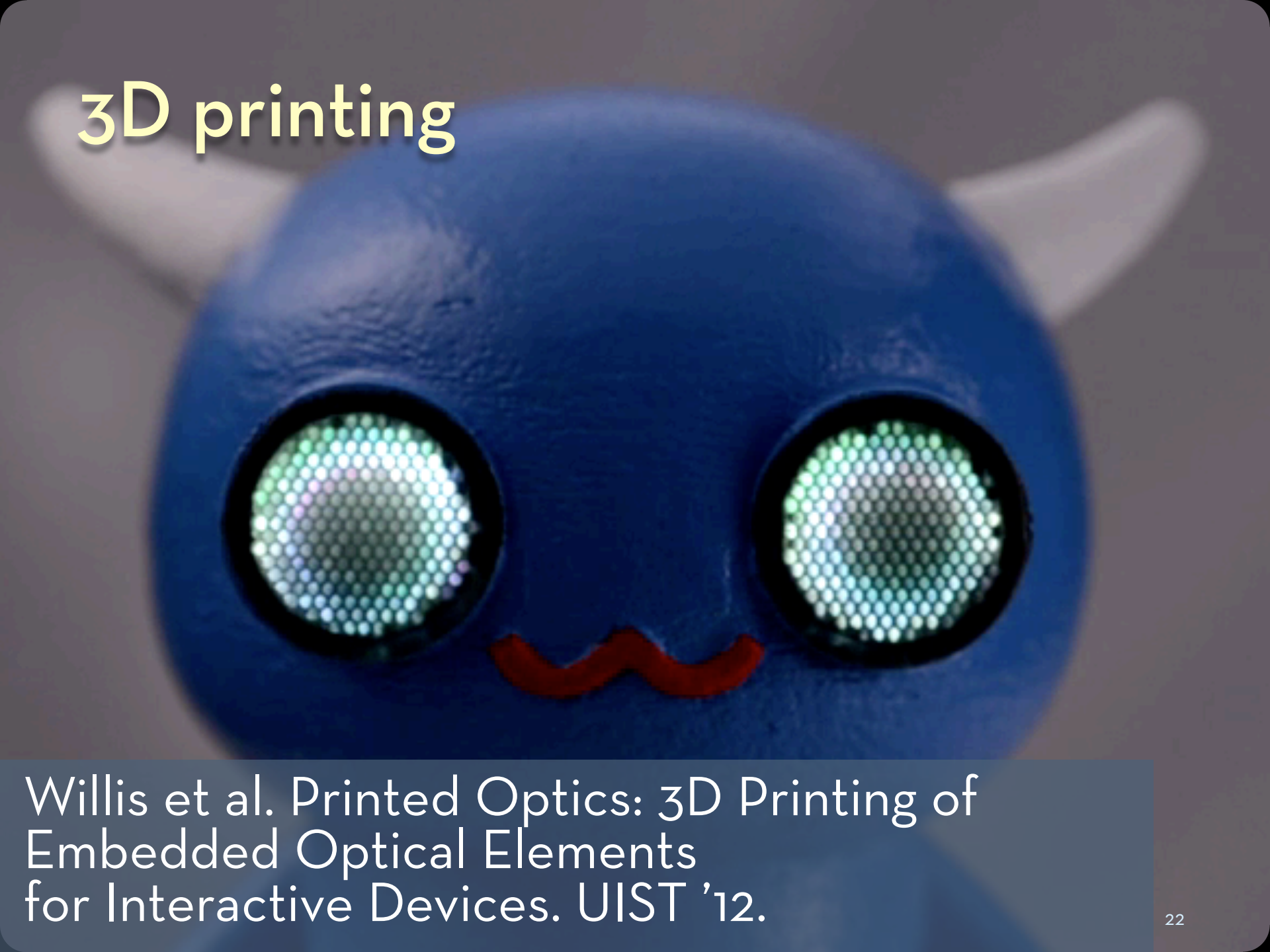
Lee, Post and Ishii. ZeroN: mid-air tangible interaction enabled by computer controlled magnetic levitation. UIST ’11.

Projectors



Wilson et al. Steerable augmented reality with the Beamatron. UIST '12.

3D printing



Willis et al. Printed Optics: 3D Printing of Embedded Optical Elements for Interactive Devices. UIST '12.

Skill sets for input research

- Learn “enough to get by” in...
  - Electrical engineering
  - Mechanical engineering
  - Computer graphics
- Known techniques for research in these domains often have direct mappings onto open questions in input