

# Suggestions from Sean

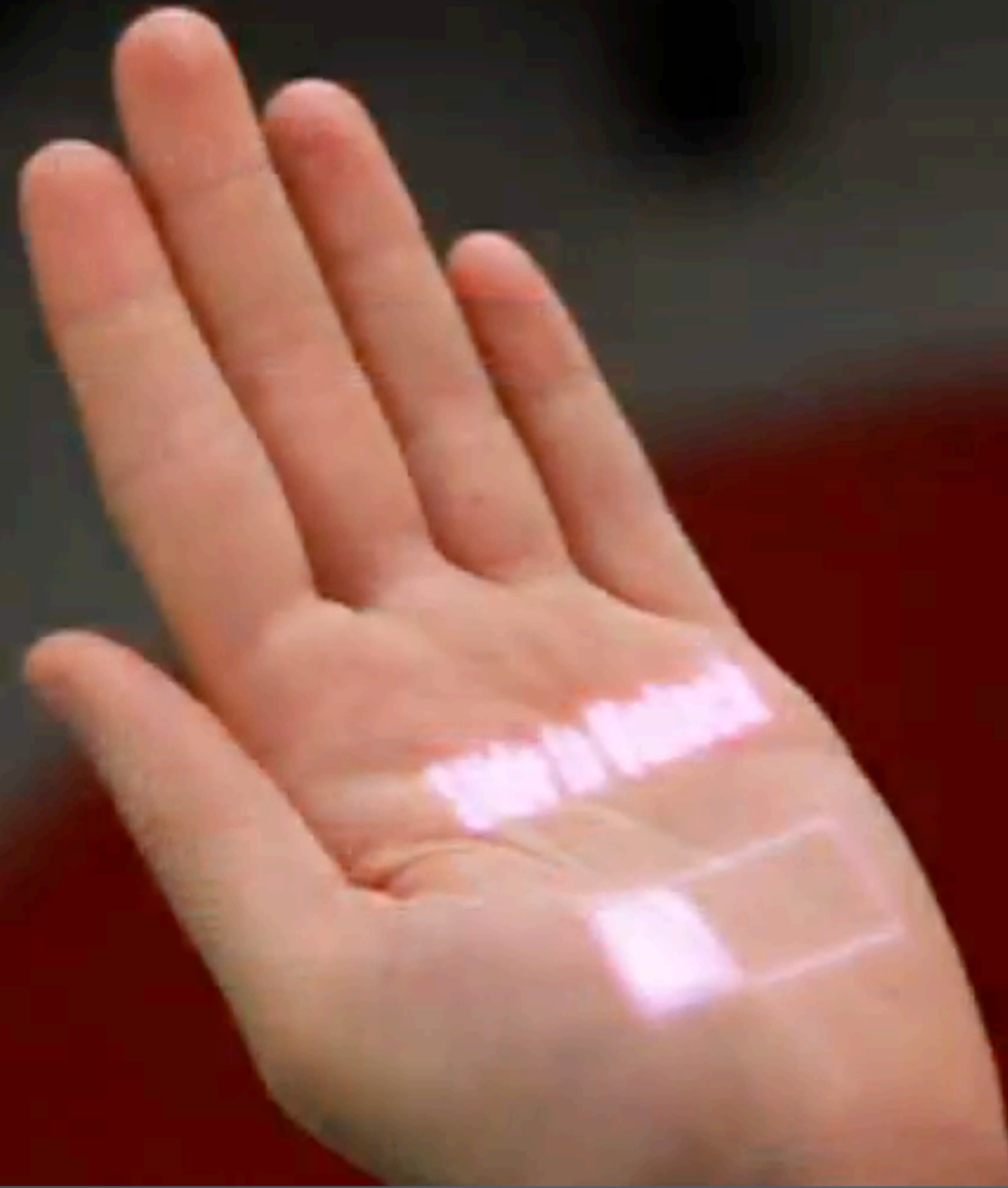
- Tablet+Stylus
  - <https://www.youtube.com/watch?v=9dgHgHQSuuY>
  - <http://research.microsoft.com/en-us/um/people/kenh/All-Published-Papers/Pre-Touch-CHI-2016.pdf>
- Soli: <https://atap.google.com/soli/>

# Input and interaction

MICHAEL BERNSTEIN  
CS 376



Recall: Skinput



Recall: Omnitouch

A man with glasses and a blue and white striped shirt is shown in an office environment. He is holding a black, handheld device in his hands and looking upwards and to the right. The background features a desk with a computer monitor, a chair, and a window with blinds. A semi-transparent dark blue bar is at the bottom of the image, containing the text 'Recall: SenseCam'.

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 and fabrication
  - New user vocabulary: e.g., gestures
- This research is often driven by, or involves the creation of, new hardware

# Foundations



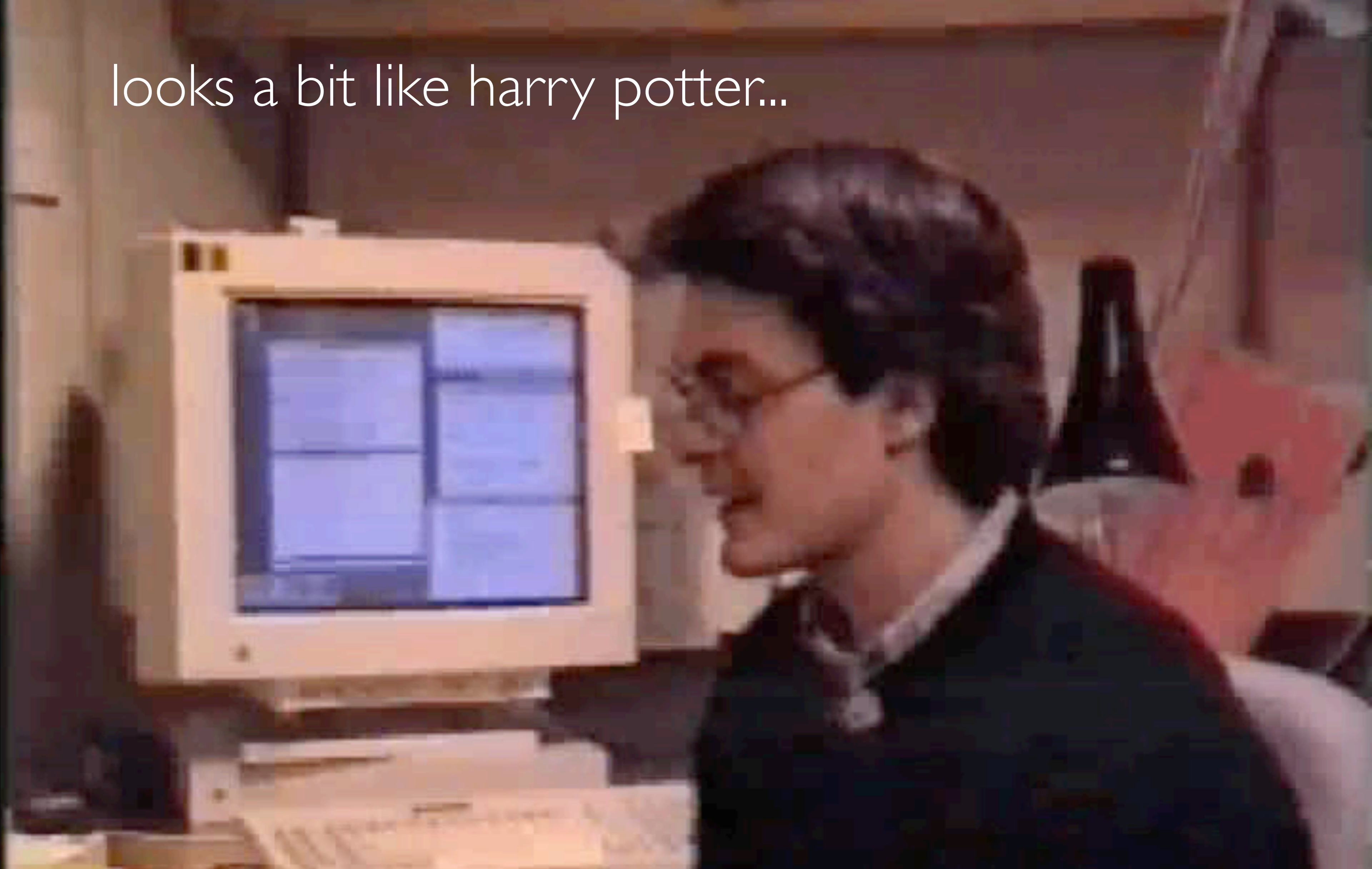
Bolt. "Put-that-there": voice and gesture at the graphics interface. SIGGRAPH '80.



# 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...



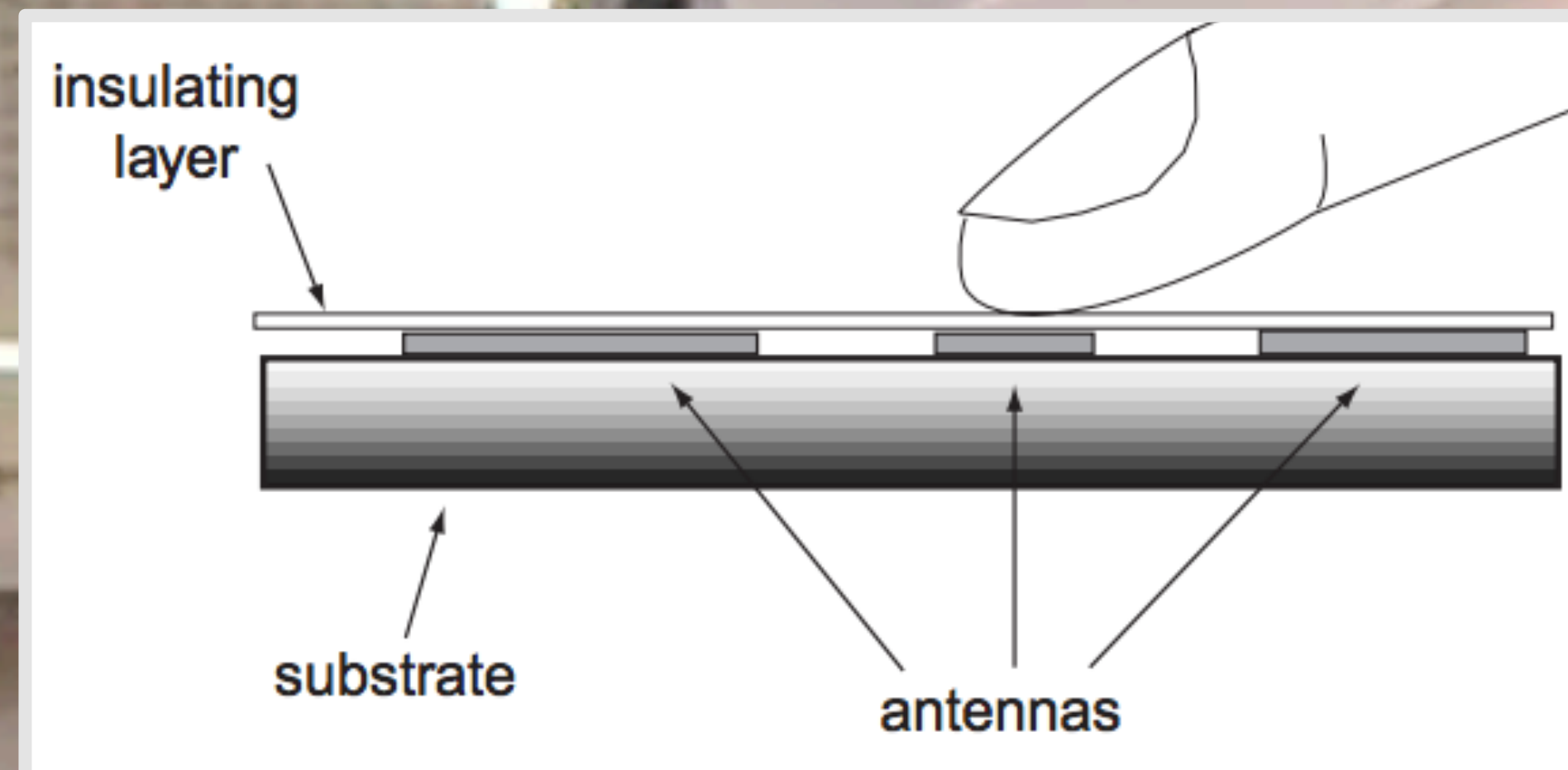
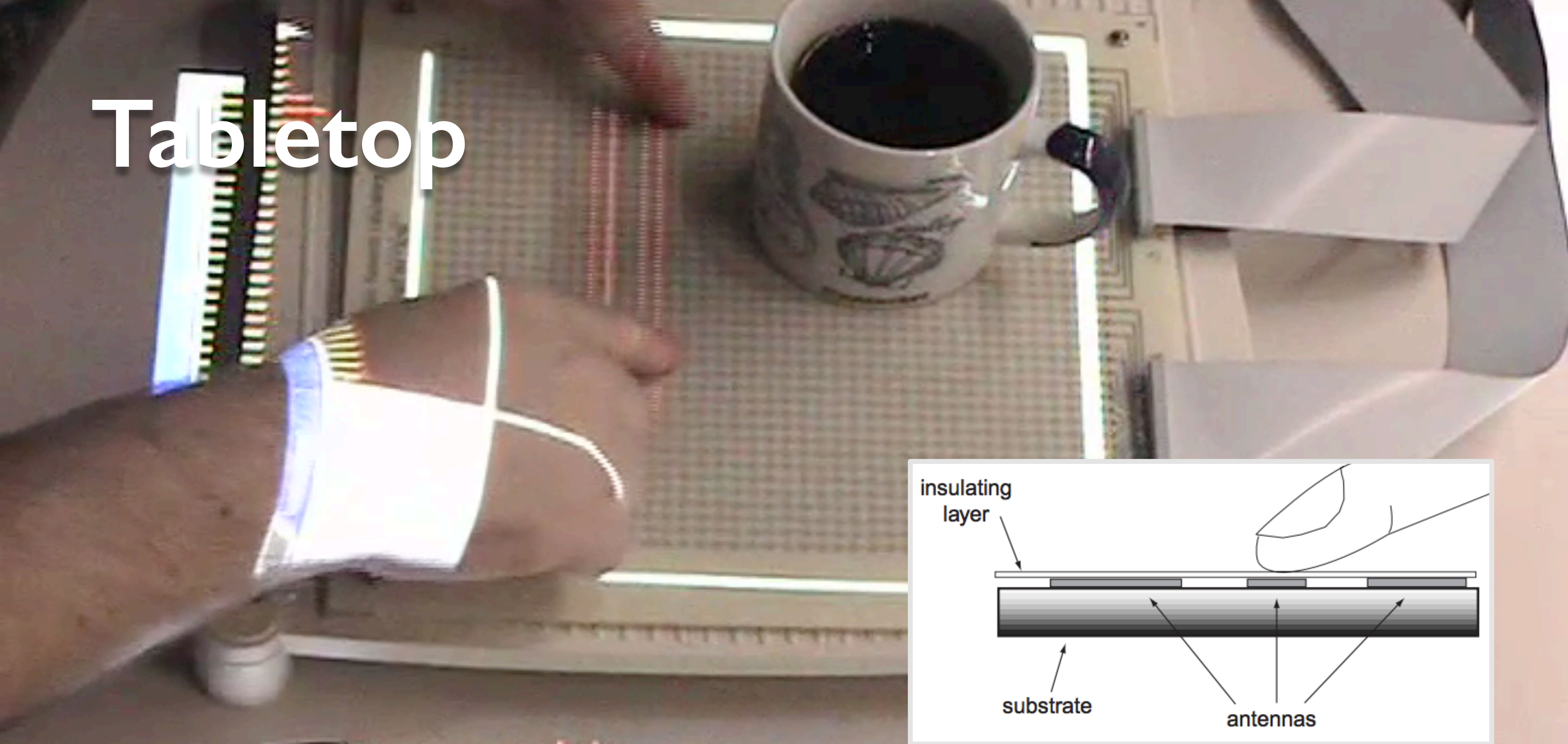
Wellner. Interacting with paper on the DigitalDesk. CACM '93.

# 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

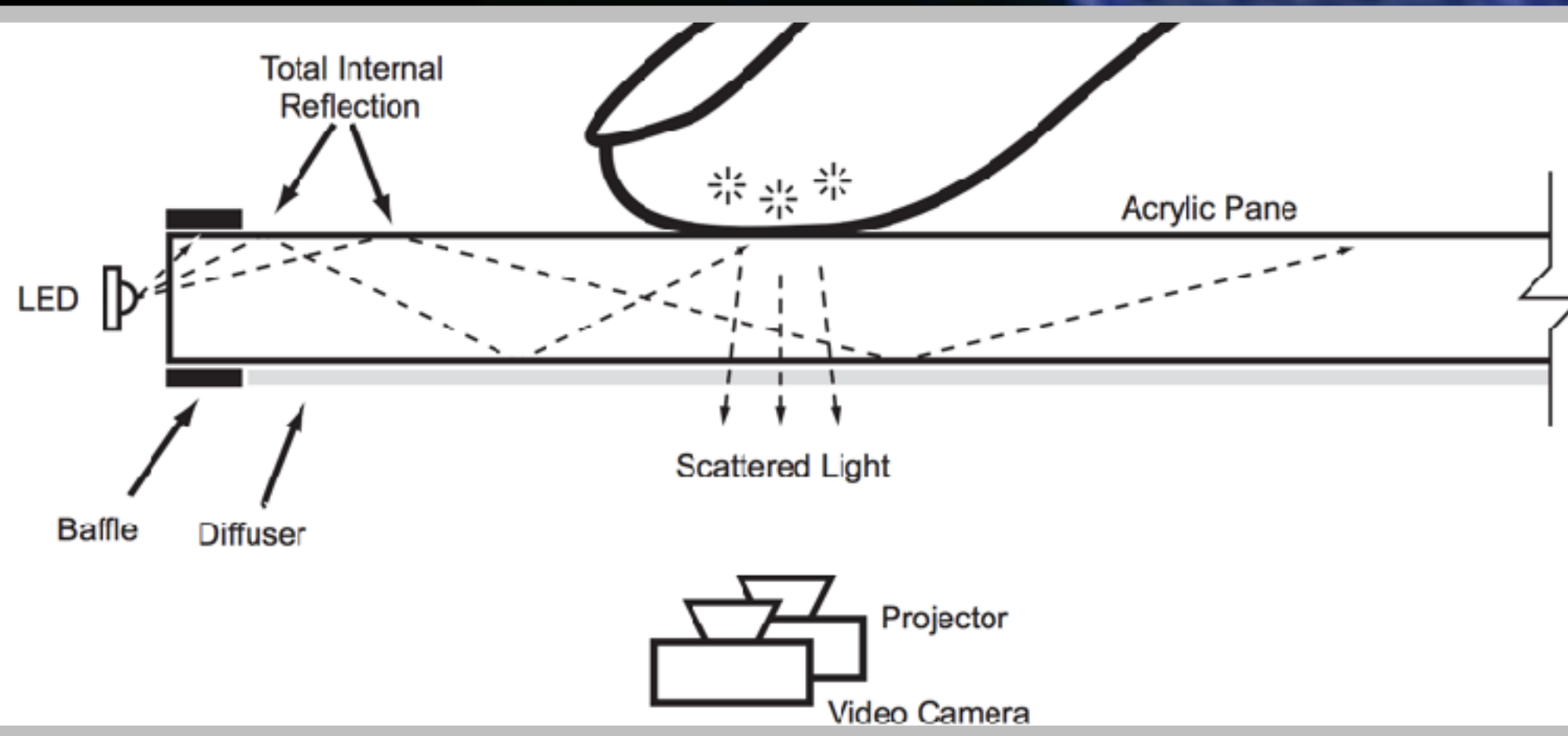
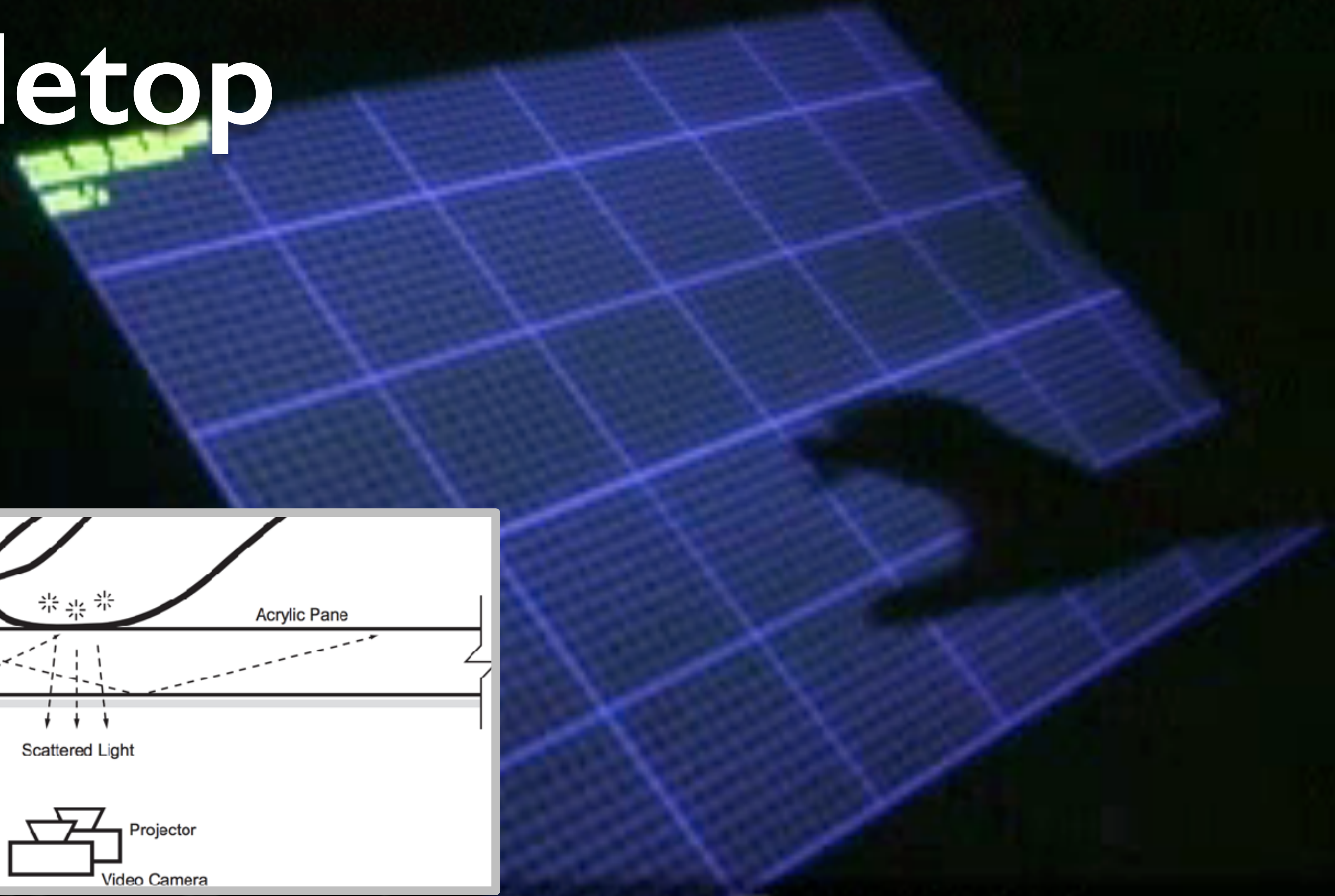
# Input technologies

# Tabletop



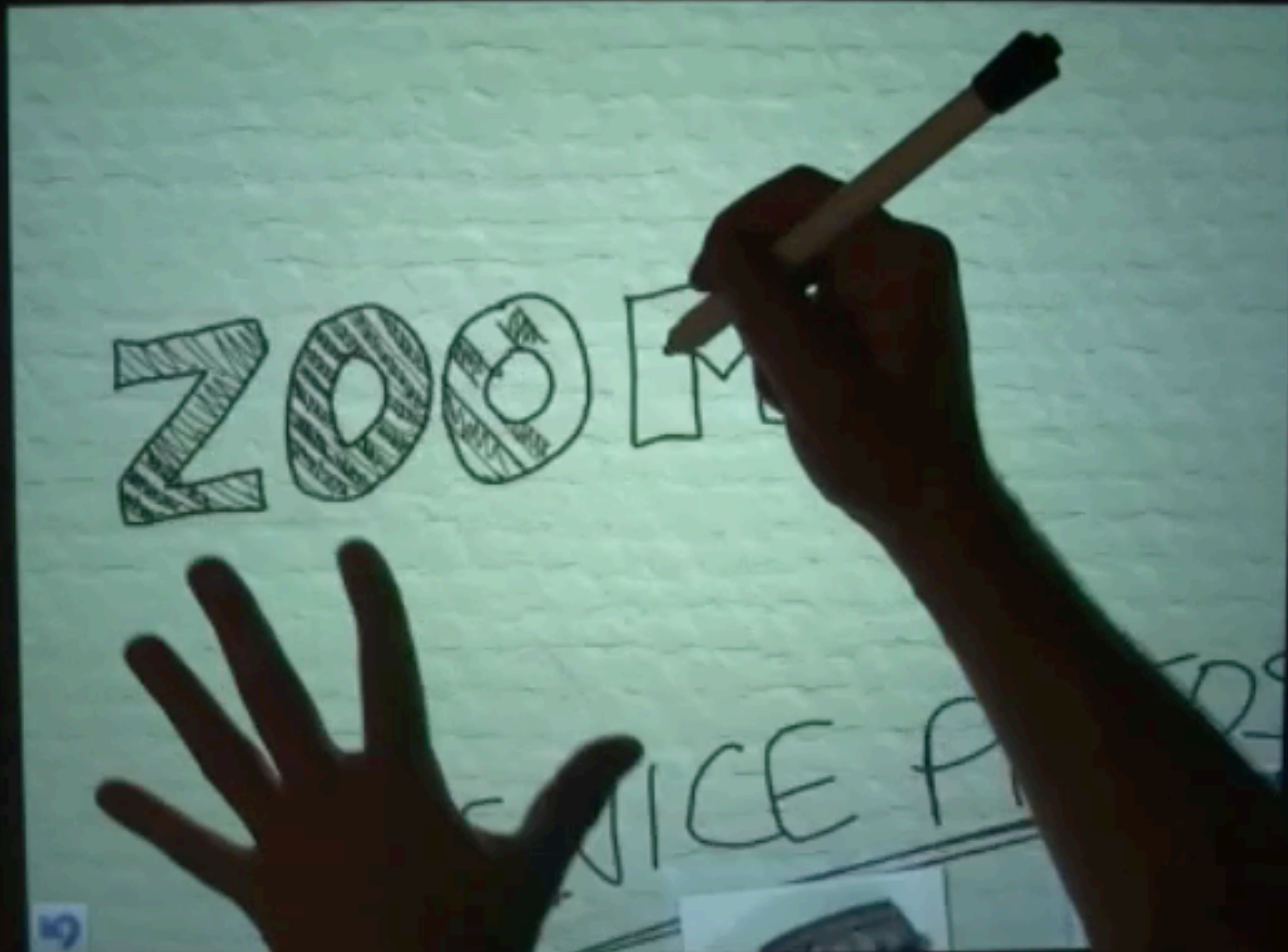
Dietz and Leigh. DiamondTouch: a multi-user touch technology. UIST'01.

# Tabletop



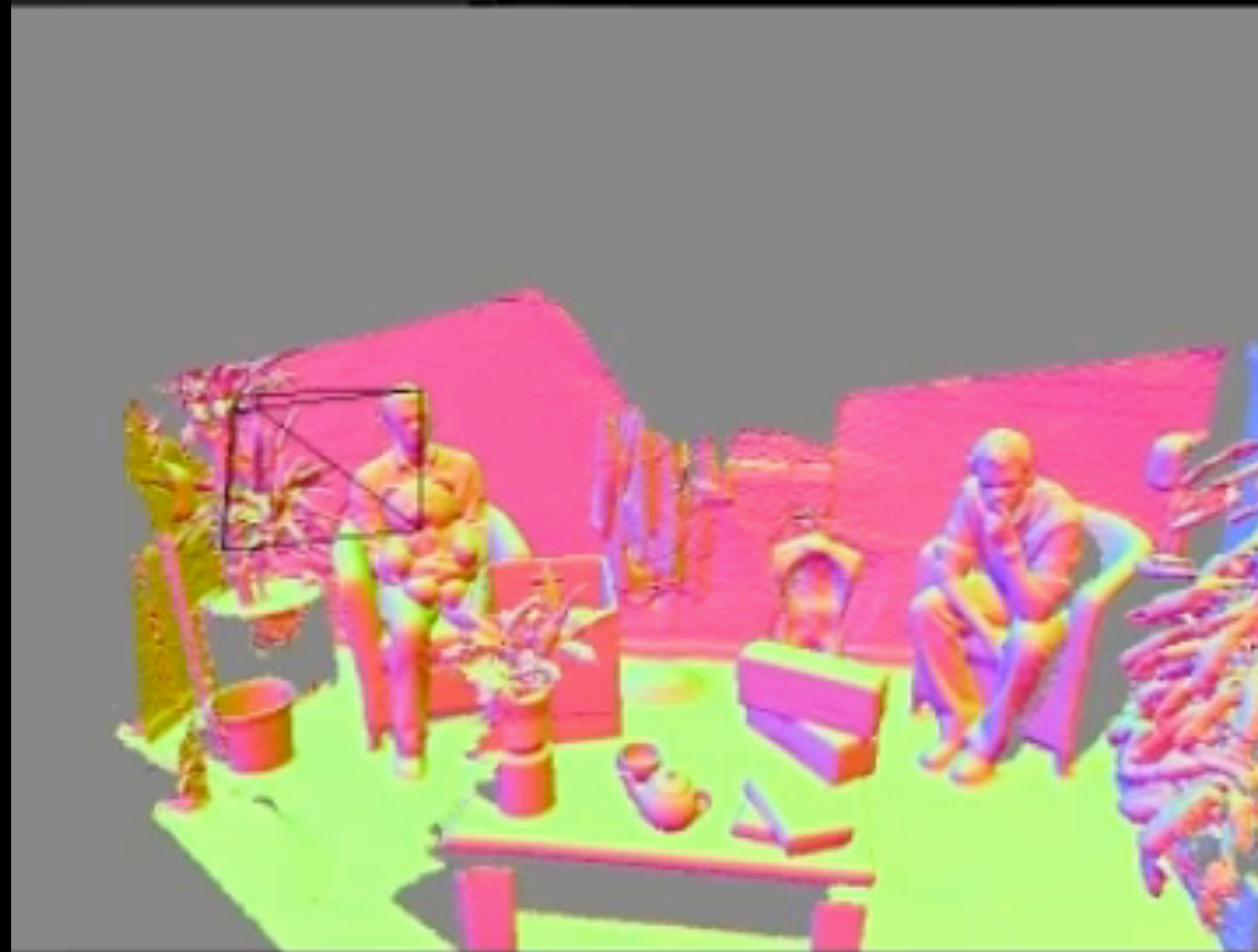
Han. Low-cost multi-touch sensing through frustrated total internal reflection. UIST '05.

# Pen

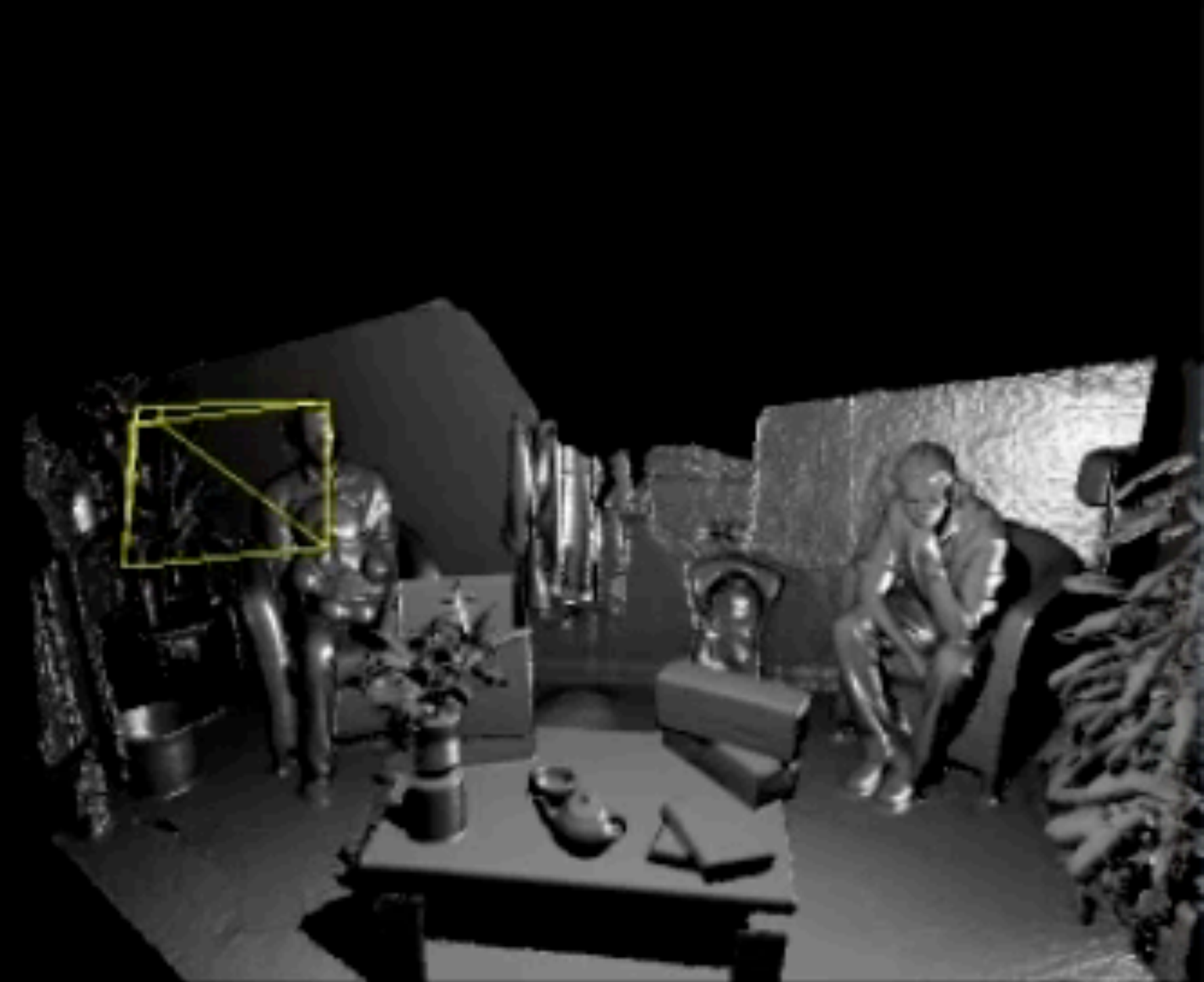


Hinckley et al. Pen + touch = new tools. UIST '10.

# Depth sensing



Model normal map



Phong shaded model

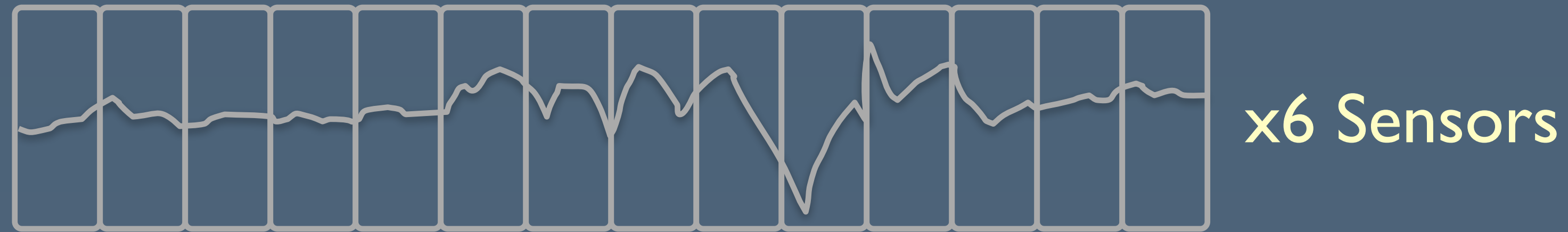


# Sensing biosignals

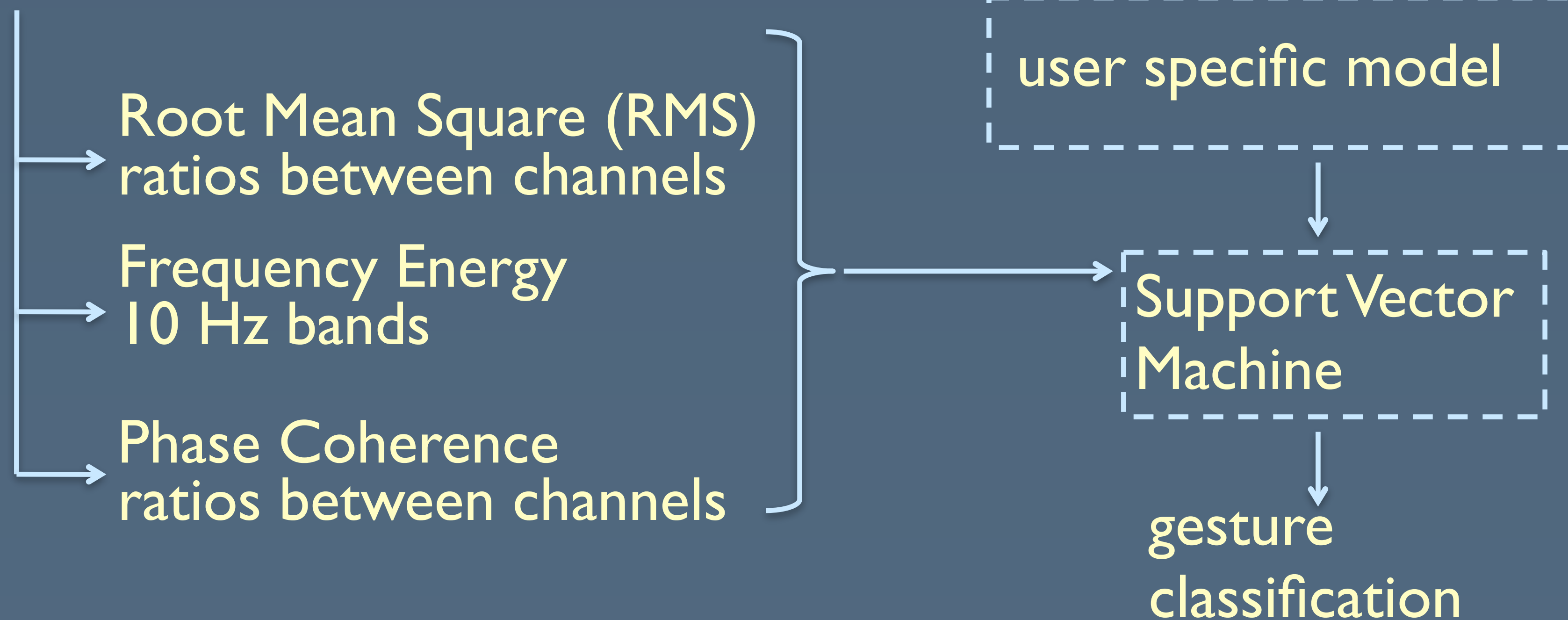


Saponas et al. Enabling Always-Available Input with Muscle-Computer Interfaces. UIST '09.

# Machine learning model

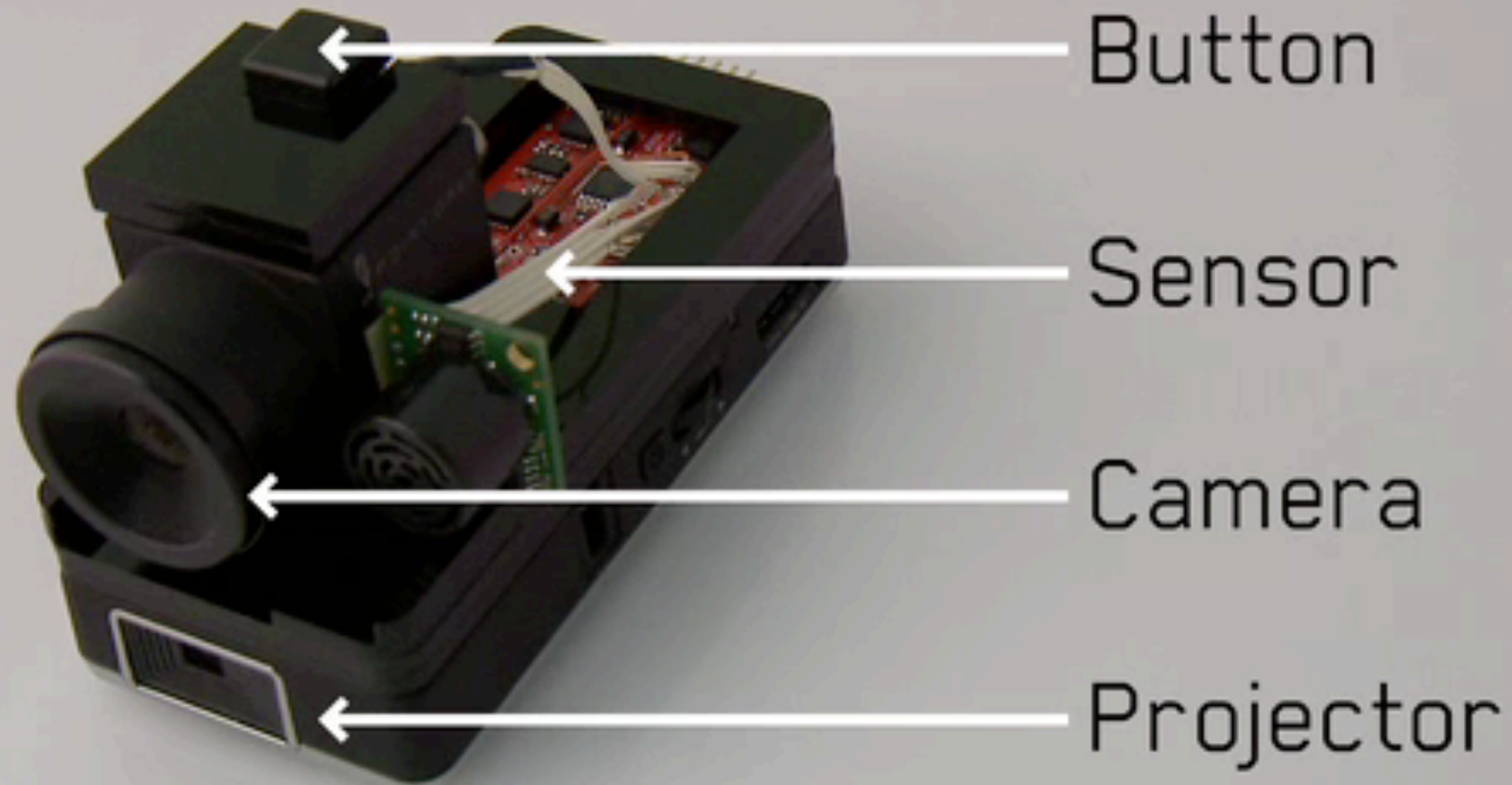


30 millisecond sample



# 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

A hand is shown holding a small, dark, reflective sphere. Below the hand, a circular area on a table is illuminated with a bright, glowing light, suggesting a magnetic levitation setup. The background is dark and out of focus.

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

# Projectors



**Pan-Tilt Platform**

**Projector**

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

Today's papers

# Tangible Bits

- What?
  - An extremely influential vision of making computing something physically perceivable and manipulable
- Why?
  - Ishii's Tangible Bits projects laid the foundations

# Touché

- What?
  - Swept-frequency capacitive sensing to identify user interactions with the environment
- Why?
  - A great example of a creative use of sensing: using “new parts of the spectrum” for HCI

# Discussion rooms

<b>Rotation</b>	<b>Littlefield 107</b>	<b>Littlefield 104</b>
a	12	34
b	24	13
c	14	23
d	34	12
e	13	24
f	23	14