Input and interaction

MICHAEL BERNSTEIN
CS 376
Recall: Skinput
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...

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

Izadi et al. KinectFusion. UIST ’11.
Sensing biosignals

Machine learning model

30 millisecond sample

- Root Mean Square (RMS) ratios between channels
- Frequency Energy
  - 10 Hz bands
- Phase Coherence
  - ratios between channels

x6 Sensors

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.
Wilson et al. Steerable augmented reality with the Beamatron. UIST ’12.
3D printing

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
## Discussion rooms

<table>
<thead>
<tr>
<th>Rotation</th>
<th>Littlefield 107</th>
<th>Littlefield 103</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>12</td>
<td>34</td>
</tr>
<tr>
<td>b</td>
<td>24</td>
<td>13</td>
</tr>
<tr>
<td>c</td>
<td>14</td>
<td>23</td>
</tr>
<tr>
<td>d</td>
<td>34</td>
<td>12</td>
</tr>
<tr>
<td>e</td>
<td>13</td>
<td>24</td>
</tr>
<tr>
<td>f</td>
<td>23</td>
<td>14</td>
</tr>
</tbody>
</table>