Leaping into Augmented Reality

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Dr. Mooi Chuah
Roadmap

• PC gaming background and controls

• Overview and purpose of our game

• Human-Computer Interaction (HCI) findings
Some Gaming Background: Traditional Mouse and Keyboard


http://www.amazon.com/Microsoft-Wireless-Mobile-Mouse-3500/dp/B0035ERKYW
The Leap Motion Controller

• 2013 hardware + software
• 2 cameras, 3 infrared LEDs
• Hand tracker: place hands above it
• Interact with computer without touching

Resources

• Game engine: Unity 5
• Language: C#
• Leap Motion Controller/SDK (software development kit)
• Game assets: Unity Asset Store/TurboSquid
“A Handy House Builder”

Click here for demo video
Explored HCI Questions

• Leap Motion vs Mouse and Keyboard (M&K)
  – What aspects of the game does each excel at?
    • Compare completion times

  – Enjoyability, naturalness, ease of use
    • User survey: rank gestures, which control scheme did you prefer, etc
Hypotheses

• Players will take longer to complete the game with the Leap Motion than with the traditional mouse and keyboard

<table>
<thead>
<tr>
<th>Gestures</th>
<th>Leap Motion</th>
<th>No Preference</th>
<th>M&amp;K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pick up</td>
<td>(x)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Move around</td>
<td></td>
<td>(x)</td>
<td></td>
</tr>
<tr>
<td>Look L&amp;R</td>
<td></td>
<td></td>
<td>(x)</td>
</tr>
<tr>
<td>Look U&amp;D</td>
<td></td>
<td></td>
<td>(x)</td>
</tr>
<tr>
<td>Jump</td>
<td>(x)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pause</td>
<td></td>
<td>(x)</td>
<td></td>
</tr>
<tr>
<td>Chop</td>
<td>(x)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Testing Process

• Participants all from Mountaintop
• Both versions of the game were played
• Players alternated playing order

• Additional help instructions given for Leap Motion

• Survey on thoughts & experiences given after
Results

31 Mountaintop participants; one bad datum was thrown out
Completion Times Comparison

- Leap Motion always took longer
- One-sample z-test gave $p < 0.00001$ at 95% confidence
Real-Time Observations on Participants’ Problems

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Number of Participants Who Mentioned Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-traditional M&amp;K</td>
<td></td>
</tr>
<tr>
<td>Misunderstood Gestures</td>
<td></td>
</tr>
<tr>
<td>Problems Moving</td>
<td></td>
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<tr>
<td>Problems Looking L/R</td>
<td></td>
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<tr>
<td>Problems Looking U/D</td>
<td></td>
</tr>
<tr>
<td>Problems Picking Up</td>
<td></td>
</tr>
<tr>
<td>Problems Jumping</td>
<td></td>
</tr>
<tr>
<td>Problems Chopping</td>
<td></td>
</tr>
<tr>
<td>Problems w/Menu</td>
<td></td>
</tr>
<tr>
<td>Required Little Help</td>
<td></td>
</tr>
</tbody>
</table>
Challenges

- Very little Leap Motion documentation
- USB speeds (low data rates warning)
- No beta testing period
- External factors:
  - Gaming experience
  - Hand size
  - Ability to follow directions
  - Steep learning curve
  - Playing order
  - ....
Conclusions

- Leap Motion: a novel way to interact with computers
- Has significant limitations in sensitivity, depth perception, and intuitiveness for these users
- In particular: "steep learning curve" for the Leap Motion interface
- Traditional mouse and keyboard is still faster regardless of PC gaming background
- Leap Motion: some advantages compared to M&K
  - A step in the right direction for interactivity
  - but it’s not quite there yet
Thanks

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• Special thanks to advisors Dr. Mooi Chuah and Dr. Xiaolei Huang of Lehigh University
Follow Up Links

- https://leapmotion.com/
- https://developer.leapmotion.com/
- https://community.leapmotion.com/
- https://unity3d.com/learn/tutorials