Understanding How Children Use Touchscreens

Quincy Brown
Assistant Professor, Bowie State University

Lisa Anthony
Post-Doctoral Research Associate, UMBC
Touchscreens are Everywhere

- Touchscreen shipments to reach 833 million by 2013
- 5 million iPhone 5 sales Sept 21-Sept 23, 2012
- Children are using mobile devices (own / parents’)

Kids as Users of Touchscreens

- Smaller fingers
- Less manual dexterity
- Devices not designed for children
Motivation

- Kids already have trouble with touch interaction:\n  - Touch: target sizes, target locations
  - Gestures: single stroke vs. multiple strokes
  - Dragging: difficulty maintaining contact

Approach

• Understand differences between kids and adults in touch / gesture input
  • e.g., can we reliably identify kids?
• Design interaction to help kids have more successful interaction
  • e.g., target sizes and active spaces
• Develop technology to offer tailored interaction for kids
  • e.g., recognizers and widgets
Research Progress

- 3 studies with kids and adults
- Two touchscreen tasks
- Laboratory setting

Study 2
Research Progress

- **Participants**
  - S1: 14 (8 kids, 6 adults)^
    - *Kids were 7-11 yrs old*
  - S2: 30 (16 kids, 14 adults)^*
    - *Kids were 7-16 yrs old*
  - S3: ongoing (25 kids, 16 adults so far)
    - *Kids are 10-17 yrs old*
    - *Plan to look at 5-10 yrs old this fall*

Research Progress

- **Android platform**
  - Open source and free to develop
  - Java-based development environment
  - S1: Google Nexus One (320 x 480 interface)
  - S2&3: Google Nexus S (480 x 800 interface)
Research Progress

- **Task 1: Touch Interaction**
  - Touch target with finger (4 sizes)
  - Measure touch time, touch location \((x, y)\), touch pressure, # of attempts, etc.
  - S1: 43 total targets,
    S2&3: 104 targets
Research Progress

- **Task 2: Gesture Interaction**
  - Draw gesture with finger
  - Measure touch properties grouped by strokes and gestures
  - S1: 9 gestures (x1 sample per user), S2&3: 20 gestures (x6 samples per user)
Research Progress

- Task 2: Gesture Interaction

<table>
<thead>
<tr>
<th>Study 1</th>
<th>Study 2 &amp; 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A E K</td>
<td>A E K Q X</td>
</tr>
<tr>
<td>Q +</td>
<td>2 4 5 7 8</td>
</tr>
<tr>
<td>O □ △</td>
<td>O □ △ V</td>
</tr>
</tbody>
</table>
Cross-Study Findings: Touch Task

- **Children miss more targets than adults**
  - S1: 46% kids vs. 32% adults (of all targets)
  - S2: 23% kids vs. 17% adults (of all targets)

- **Smallest targets most challenging**
Cross-Study Findings: Touch Task

- **Edge-padded targets more challenging**
  - S2: miss rate doubles on edge-padded targets
  - S2: 99% of misses in “gutter”

Study 2
Cross-Study Findings: Touch Task

- Discovered new phenomenon: **holdovers**
  - S2: touches in location of previous target
  - S2: 96% of holdovers were kids
  - S2: 81% of holdovers were smallest targets

Study 2
Cross-Study Findings: Gesture Task

- Kids make gestures differently than adults
  - S1: kids make bigger gestures**
  - S1: kids make gestures with more strokes**

**significant at the p<0.01 level
Cross-Study Findings: Gesture Task

- Kids gestures are recognized less accurately than adults
  - S1: 34% kids vs. 64% adults**
  - S2: 81% kids vs. 90% adults**, correlated to age**

**significant at the p<0.01 level

Design Implications

• **Touch interactions:**
  • Misses around outside of target – *increase area to activate desired target*
  • Misses in edge gutter – *align targets with edge of screen*
  • Holdovers – *ignore touches in same location as previously accepted target*

• **Gesture interactions:**
  • Stroke differences and recognition accuracy – *train on kids’ gestures or specialized recognizers*
Next Steps

- Looking at younger kids
- In-context apps
- Co-design exercises with kids
Approach

☆ Understand differences between kids and adults in touch / gesture input
  • e.g., can we reliably identify kids?
  • Design interaction to help kids have more successful interaction
    • e.g., target sizes and active spaces
  • Develop technology to offer tailored interaction for kids
    • e.g., recognizers and widgets
Question and Answer!

• Quincy Brown
  Bowie State
  qbrown@bowiestate.edu

• Lisa Anthony
  UMBC
  lanthony@umbc.edu

Funding:
• NSF CISE IIS #IIS-1218395/IIS-1218664
• Dept of Ed HBGI Grant Award #P031B090207-11