THE GRACE HOPPER CELEBRATION OF WOMEN IN COMPUTING

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Understanding How Children Use Touchscreens

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GAMES MOBILE Play Learn Live Lab

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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')○**

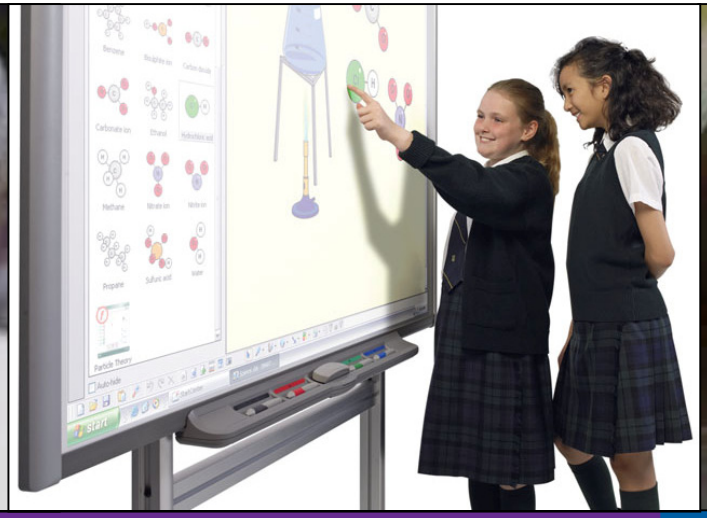
^ ISuppli. *Touch-Screen Shipments Expected to Reach 833 Million by 2013*. 2008.

* http://online.wsj.com/article/BT-CO-20120924-707595.html?mod=WSJ_ComputerHardware_middleHeadlines

○ Chiong, C. and Shuler, C. *Learning: Is there an app for that? Investigations of young children's usage and learning with mobile devices and apps. The Joan Ganz* Cooney Center at Sesame Workshop, New York, 2010.

Kids as Users of Touchscreens

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



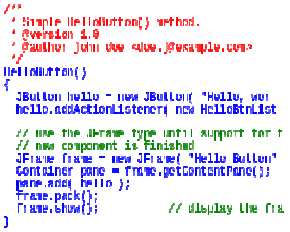
Motivation

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

^ Brown, Q., Bonsignore, E., Hatley, L., Druin, A., Walsh,G., Foss, E., Brewer, R., Hammer, J. and Golub, E. Clear Panels: A Technique to Design Mobile Application Interactivity. In Proc. *Design of Interactive Systems* (2010)

Approach

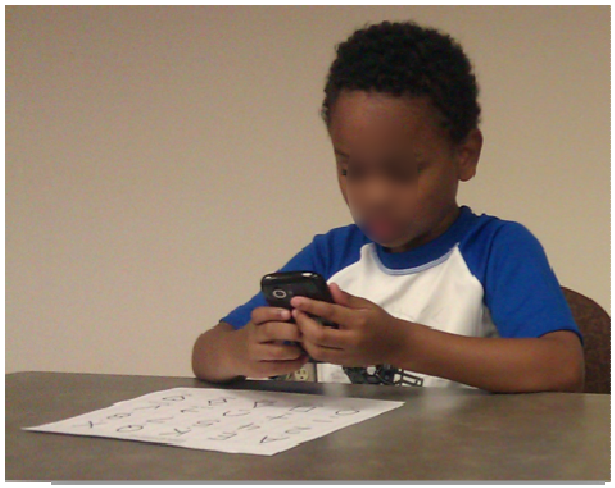
- **Understand differences between kids and adults in touch / gesture input**
  - e.g., can we reliably identify kids?
- **Design interaction to help kids have more successful interaction**
  - e.g., target sizes and active spaces
- **Develop technology to offer tailored interaction for kids**
  - e.g.,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

^ Brown, Q. and Anthony, L. 2012. Toward Comparing the Touchscreen Interaction Patterns of Kids and Adults. *Proc. ACM SIGCHI Workshop on Educational Software, Interfaces and Technology (EIST'2012)*, Austin, TX, 05-06 May 2012.
* Anthony, L., Brown, Q., Nias, J., Tate, B., and Mohan, S. 2012. Interaction and Recognition Challenges in Interpreting Children's Touch and Gesture Input on Mobile Devices. *Proc. ACM Conf. on Interactive Tabletops and Surfaces (ITS'2012)*, Cambridge, MA.

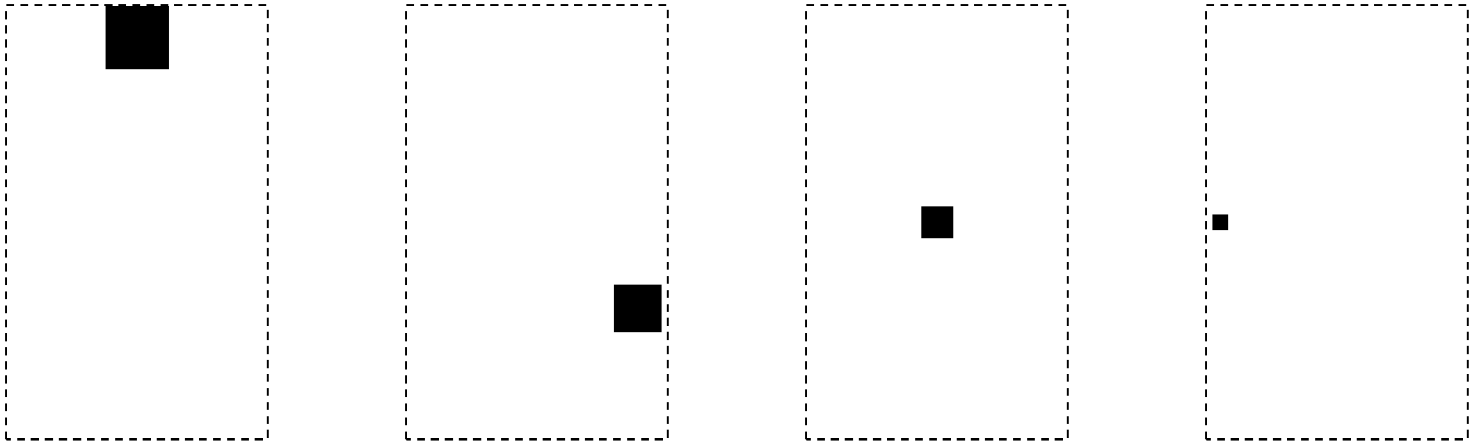
Research Progress

- **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

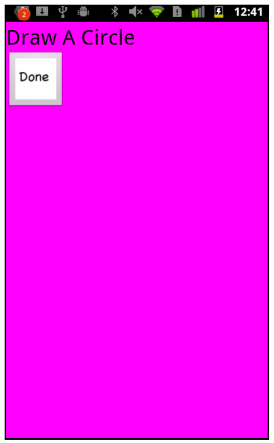
Study 2

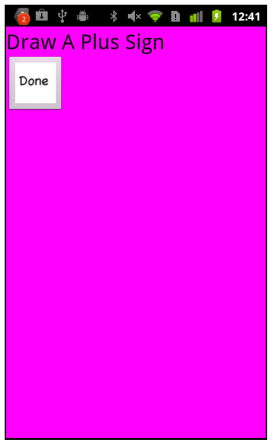


Research Progress

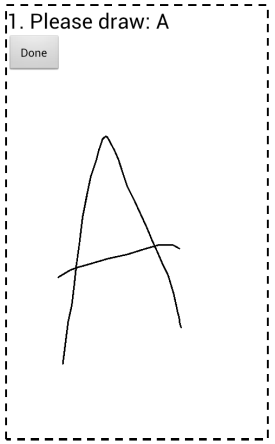
- **Task 2: Gesture Interaction**
  - Draw gesture with finger
  - Measure touch properties grouped by strokes and gestures
  - S1: 9 gestures (x1 sample per user), S2&3: 20 gestures (x6 samples per user)

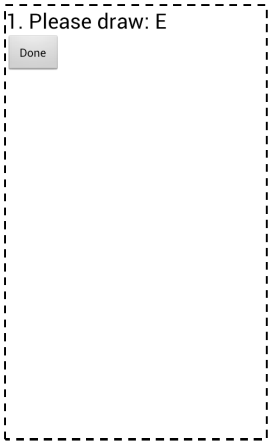
Study 1





Study 2

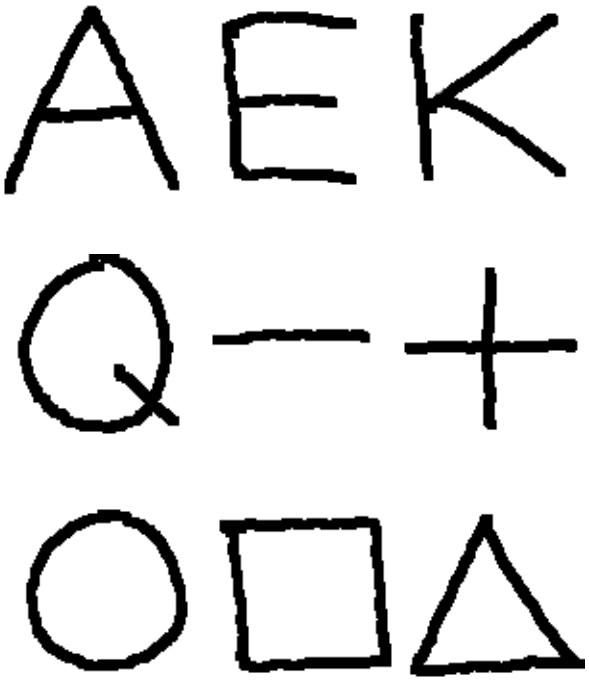




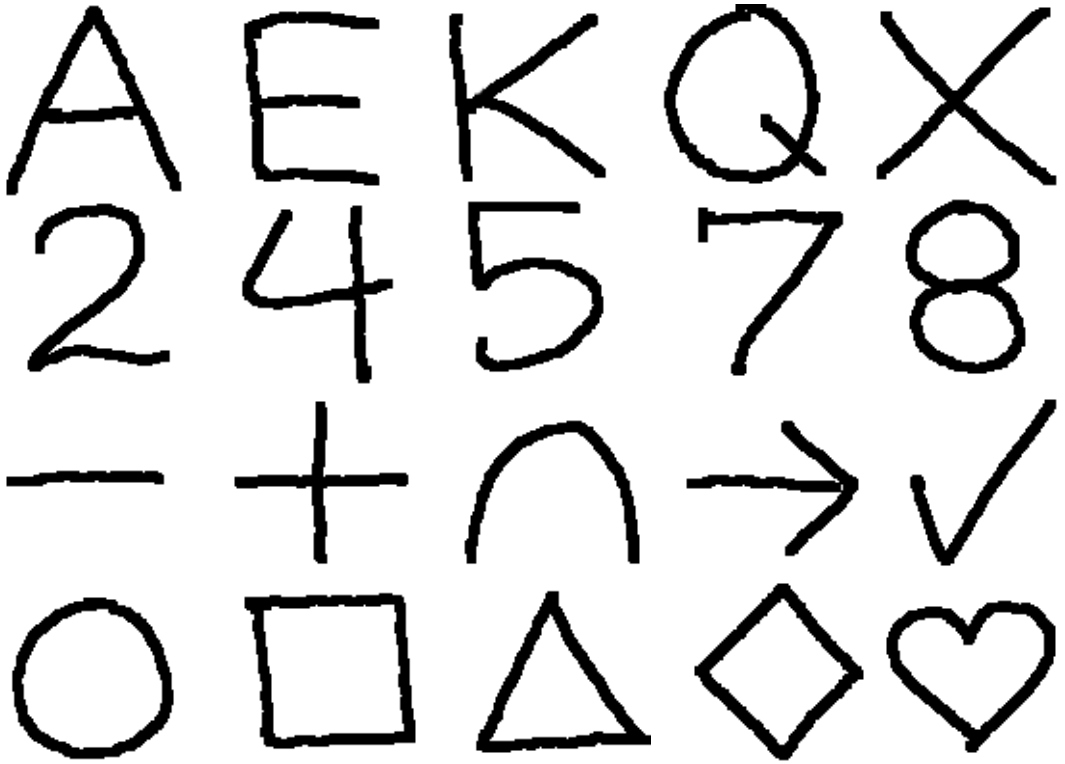
Research Progress

- **Task 2: Gesture Interaction**

Study 1



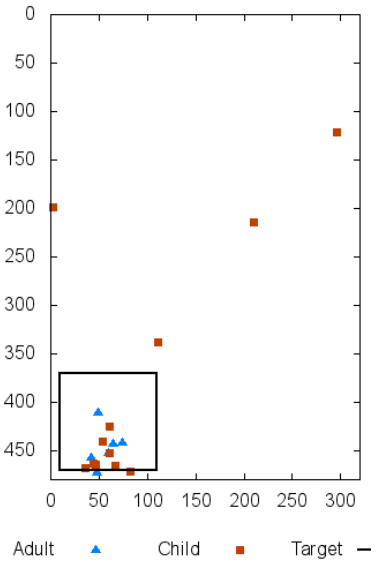
Study 2 & 3



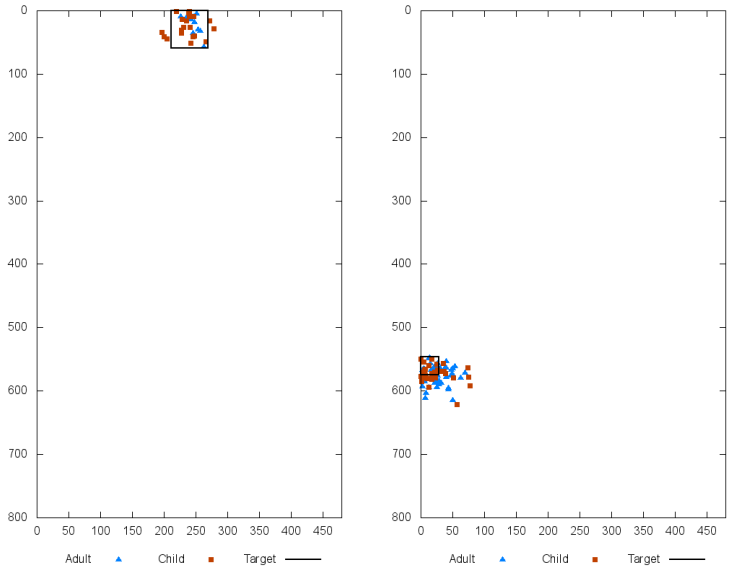
Cross-Study Findings: Touch Task

- **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**

Study 1



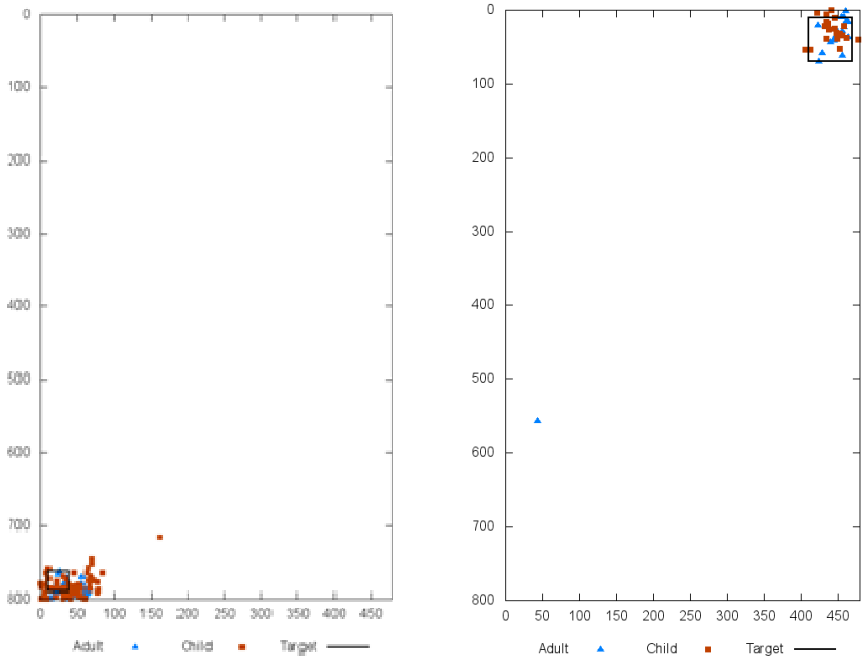
Study 2



Cross-Study Findings: Touch Task

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

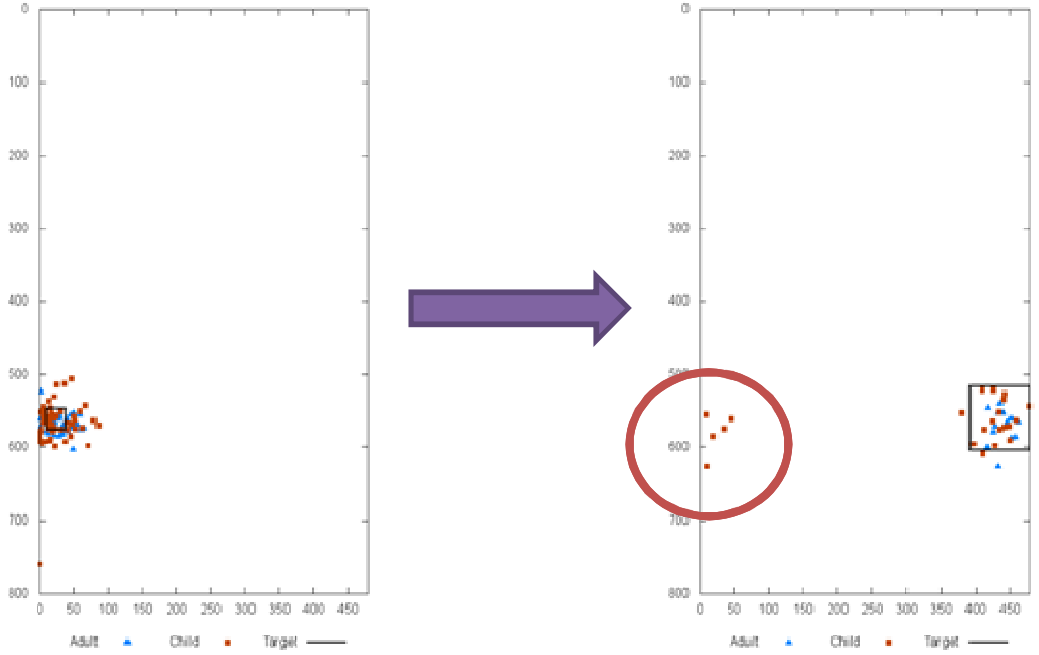
Study 2



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

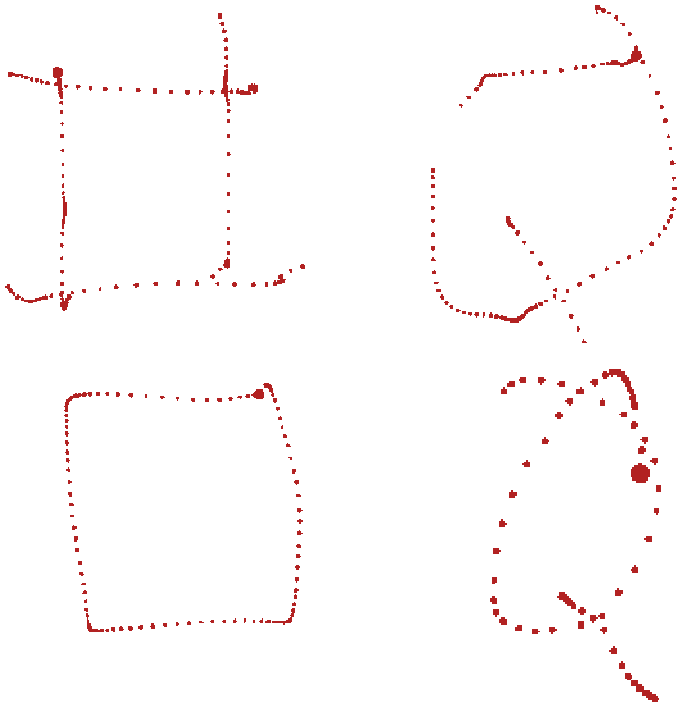
Study 2



Cross-Study Findings: Gesture Task

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

Study 1



Children

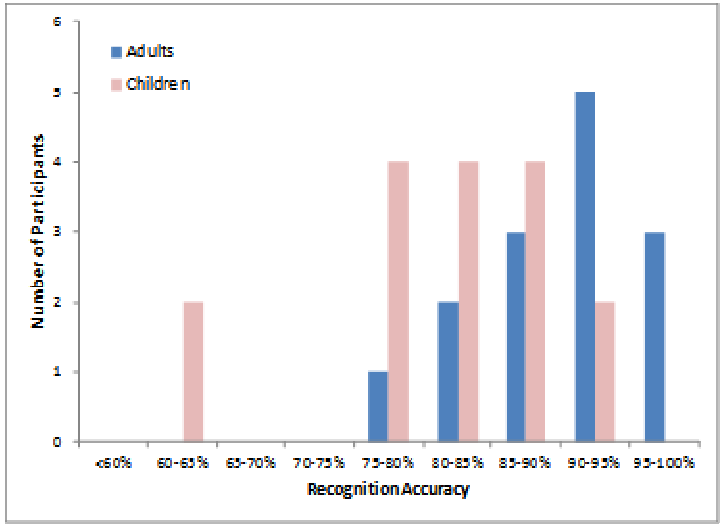
Adults

** *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**

Study 2

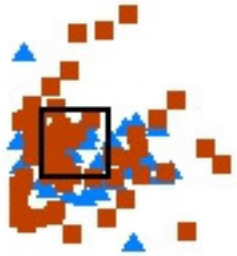


** *significant at the p<0.01 level*

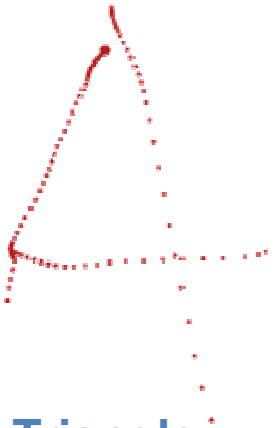
^ Anthony, L. and Wobbrock, J.O. 2010. A Lightweight Multistroke Recognizer for User Interface Prototypes. *Proc. Graphics Interface (GI'2010)*, Ottawa, Canada, 02 Jun 2010, p.245-252.

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*



Touch cloud



Triangle

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**
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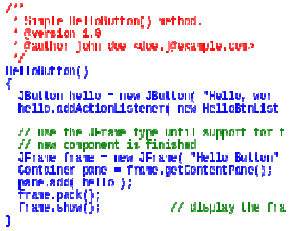

Question and Answer!

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