Interaction and Recognition Challenges in Interpreting Children’s Touch and Gesture Input on Mobile Devices

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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’)

Interaction Challenges for Kids

- **Manual dexterity** / fine motor control develop with age of child
- **Shapes** children are expected to generate vary by age
- Little hands activate interactors unexpectedly*
- Children have difficulty tapping and with drag and drop

Interpreting Kids’ Intent

LETTERS (ADULT / CHILD)

A

E

Q

SHAPES (ADULT / CHILD)

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The MTAGIC Project

“Mobile Touch and Gesture Interaction for Children”

https://mtagic.wordpress.com/

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PIs:

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Students:

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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: Studies

3 studies with kids and adults (S1^, S2*, S3-ongoing)

- 49 kids (ages 7-17), 36 adults (ages 18+)

Two touchscreen tasks, laboratory setting

Study 2 setting


Research Progress: Tasks

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: Tasks

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 2 interfaces

Study 2 & 3 gestures

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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)
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**

**significant at the p<0.05 level**

Study 1
(one attempt per target)

Study 2
(must get target correctly)
Cross-Study Findings: Touch Task

**Understand:**
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**

**Design:**
- increase area to activate desired target
- or use probabilities to identify most likely target
- follow recommendations for target size in paper

**significant at the \( p<0.05 \) level

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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

** significant at the p<0.05 level
Cross-Study Findings: Touch Task

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

Design:
align targets with edge of screen (Fitts’ Law holds!)

**significant at the p<0.05 level
Cross-Study Findings: Holdovers

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

**Study 2**
Cross-Study Findings: Holdovers

Understand:
Discovered new phenomenon: **holdovers**
- touches in location of previous target
- 96% of holdovers were by children
- 81% of holdovers were smallest targets

Study 2

Design:
ignore touches in area of previously active target based on timing

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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 make gestures differently than adults

- S1: kids make bigger gestures**
- S1: kids make gestures with more strokes**

Kids gestures are recognized\(^\land\) less accurately than adults

- S1: 34% kids vs. 64% adults**
- S2: 81% kids vs. 90% adults**, correlated to age**

Study 1


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

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

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

Design:
- train on kids’ gestures by age group
- or develop specialized recognizers for kids

Study 1


\(\text{** significant at the } p<0.01 \text{ level}\)
MTAGIC 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
MTAGIC Next Steps

**Short-term:**
- Looking at younger kids
- In-context apps

**Mid-term:**
- Interaction co-design with kids

**Long-term:**
- Tailored recognition for kids

Hokey Pokey Penguin prototype
Question and Answer!

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