Characterizing How Interface Complexity Affects Children's Touchscreen Interactions

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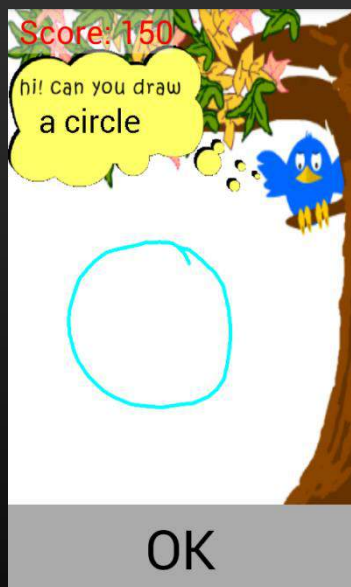[3]User Testing, Inc., Mountain View, CA USA
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[6]Bowie State University, Bowie, MD USA

† Work conducted while these authors were summer interns at the University of Florida.
‡ Work conducted while this author was a student at the University of Florida.
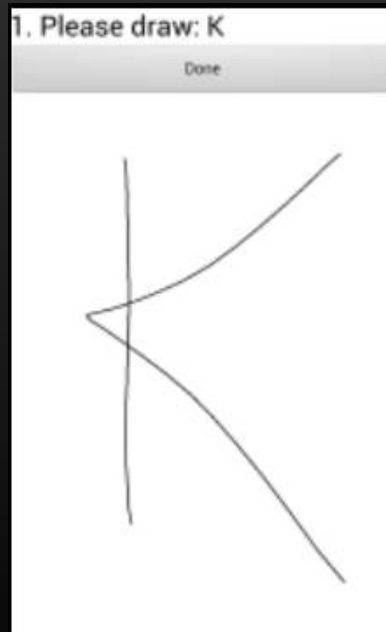
Motivation and Impact

"M7190060" by sheldon0531 under CC 2.0

Motivation and Impact

- Anthony et al. (ITS 2012)
  - Study of children's touch and gesture interaction on simple interfaces.

Please draw the specified gesture

Please touch the blue square

Motivation and Impact

- Most interfaces are visually complex.
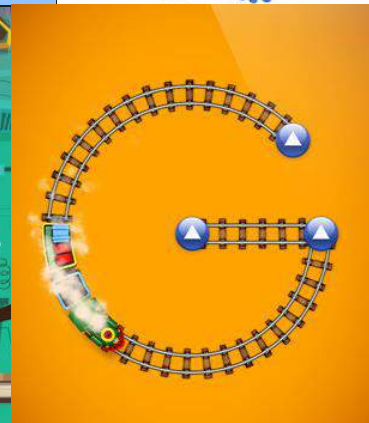
Motion Math: Hungry Guppy

Racing Penguin, Flying Free
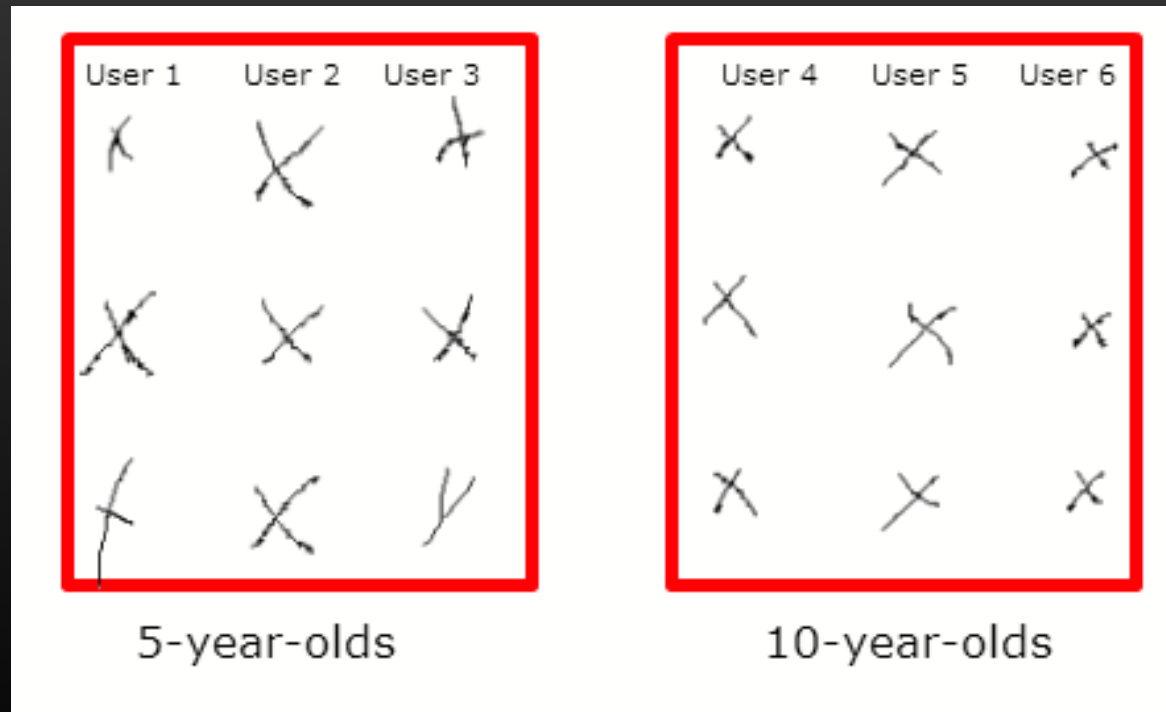
Trace It, Try It

Fruity Fractions

Build a Truck

Letter School

Motivation and Impact

- Little work on examining children's gestures across ages.
  - Most prior work groups many ages together (Anthony et al. JPUC '14, Anthony et al. IDC '13, Arif & Sylla IDC '13)
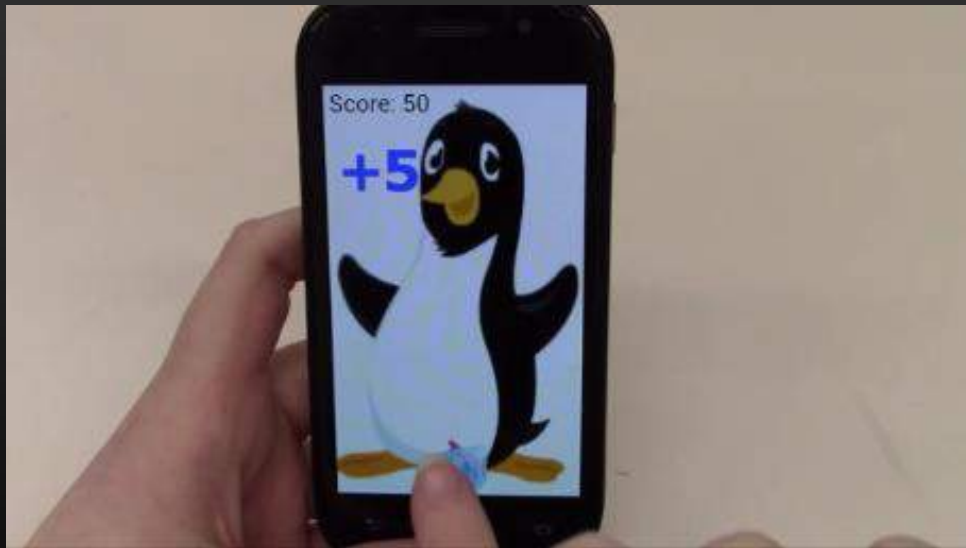

"X" gestures from our study

Interface Complexity

- We examined if interface complexity had any impact on children's touchscreen interactions.

"Toca Tailor" by Toca Boca under CC 2.0

Touch & Gesture Interaction

- We analyzed touch and gesture interactions from children and adults in order to see the difference between them.
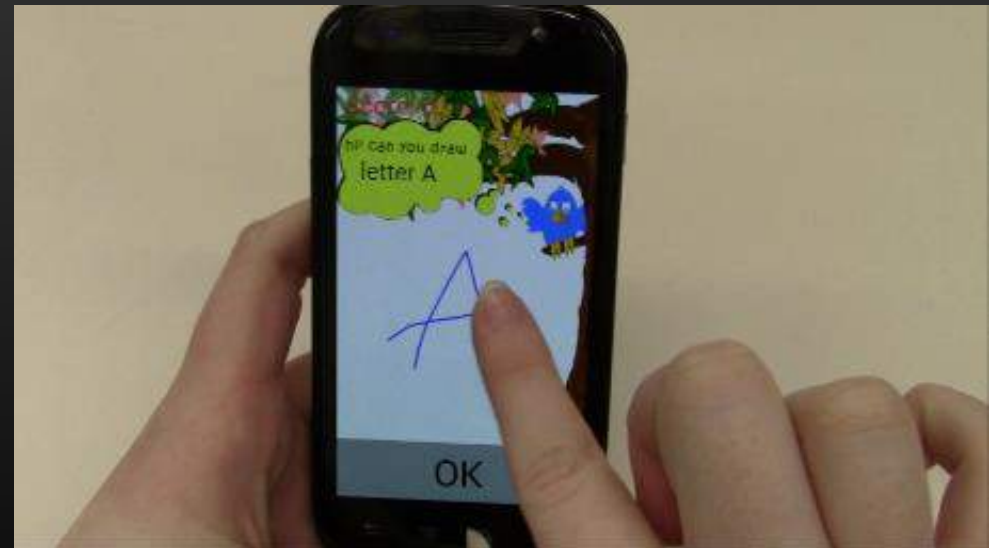
Effect of Interface Complexity

- Affected some touch interactions, primarily related to visual salience.

- Did not affect gesture recognition.

"ipad app" by Clive Darra under CC 2.0

Session Setup

Gesture Sheet

Abstract Target

Complex Target
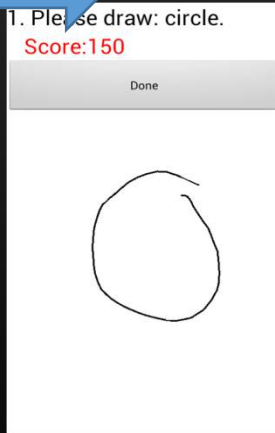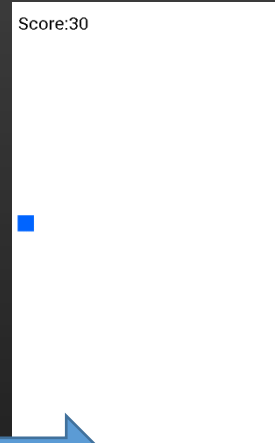
Abstract Gesture

Complex Gesture

Interfaces

Complete Tasks

Prizes

Related Work

- Brewer et al. (IDC 2013)
  - Described gamification method used in our study.
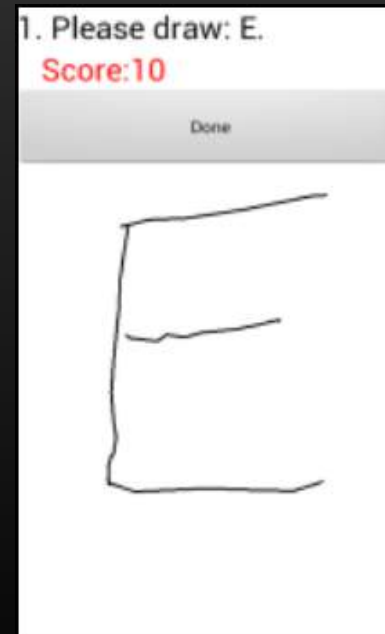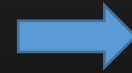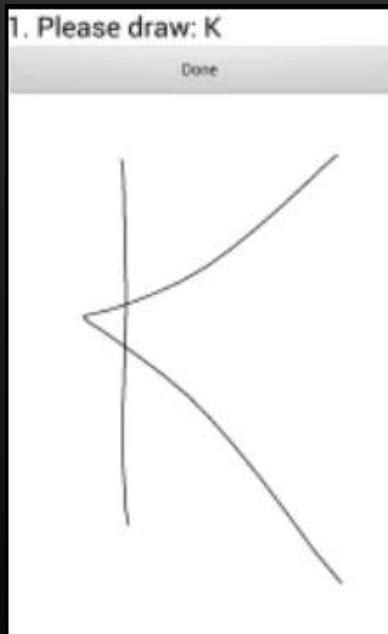
Participants

Participant Type	Number of Participants	Male	Female	Age Range	Age Mean
Adult	30	15	15	17 to 33 years	23 years
Child	30	14	16	5 to 10 years	7.7 years

- 78% right handed, 12% left handed, 5% ambidextrous (5% did not answer).

Target Applications
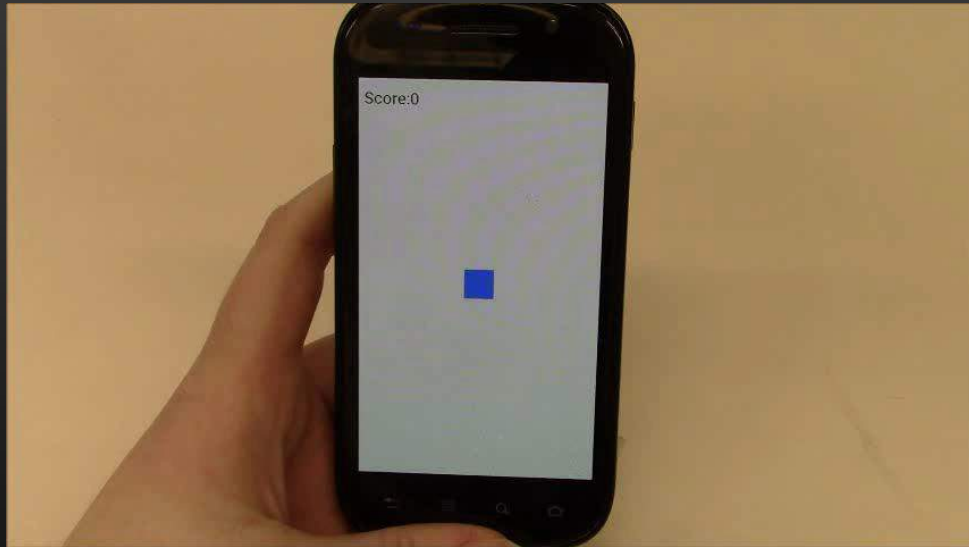
Abstract Target Activity
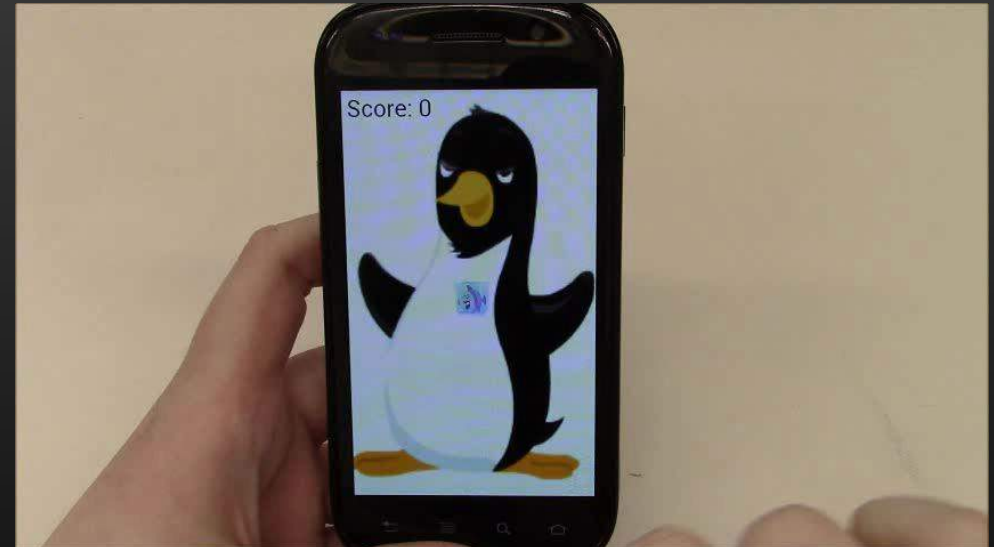
Complex Target Game

Gesture Applications
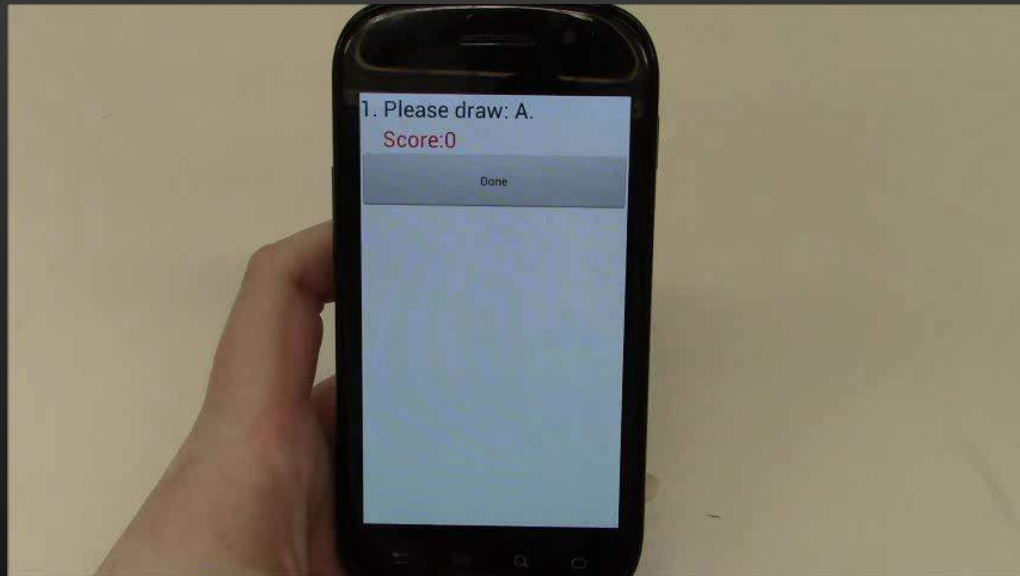
Abstract Gesture Activity
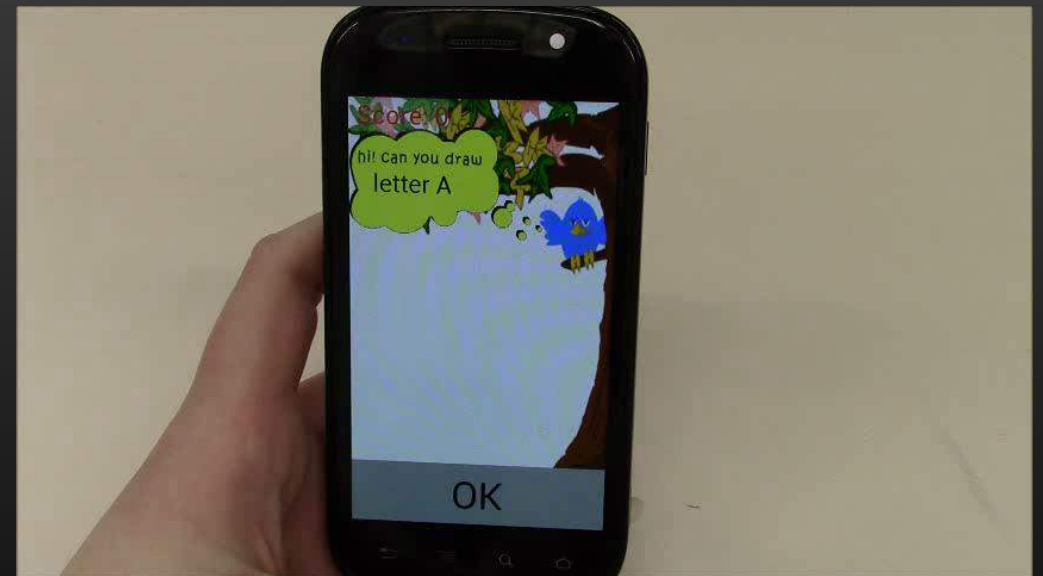
Complex Gesture Game

Target Interaction
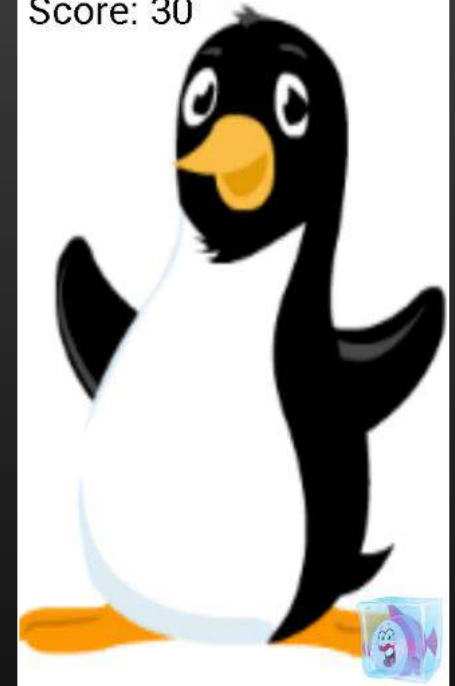
Holdovers (Effect of Complexity)
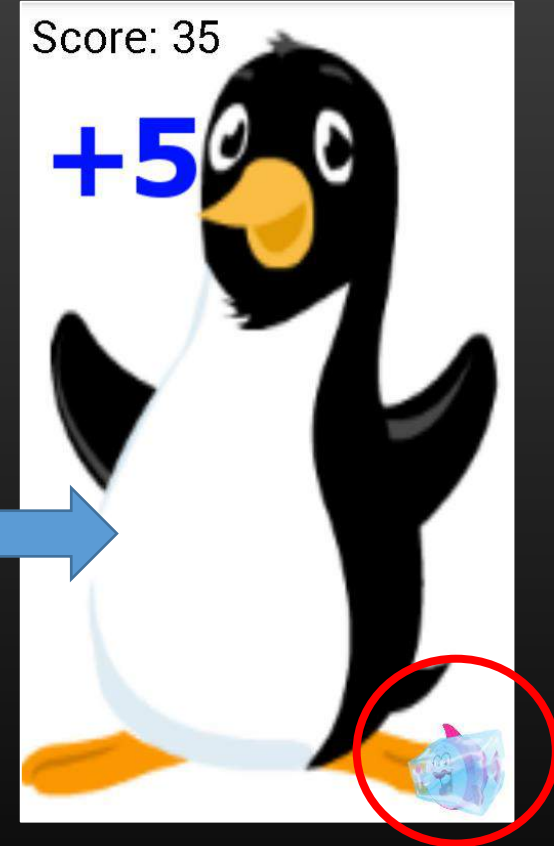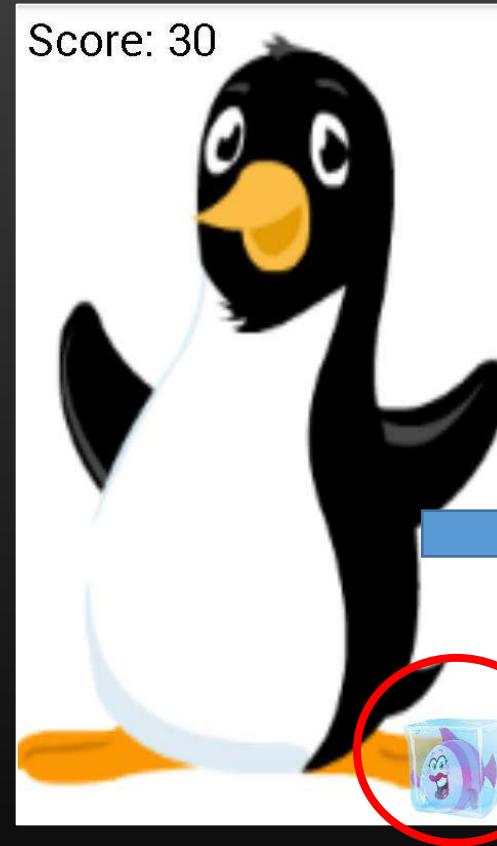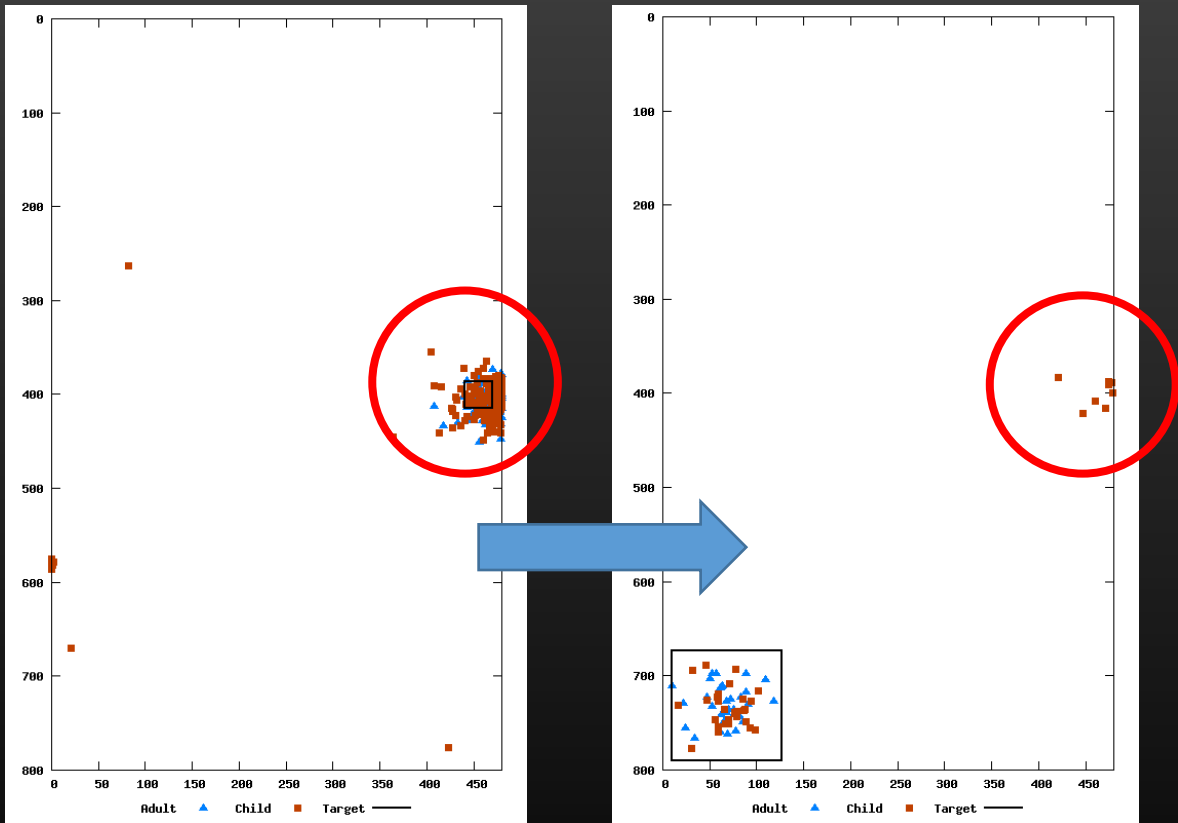
- Decrease in Holdovers for complex applications.

Target Misses (No Effect of Complexity)

1. Overall Misses

Proportion of Misses	Abstract Interface	Complex Interface
Children	23%	24%
Adults	17%	15%

2. Misses by Target Size

Proportion of Misses by Target Size

Target Size
p<.0001
Participant Type
p<.0001

Legend:
- Adult Abstract
- Adult Complex
- Child Abstract
- Child Complex
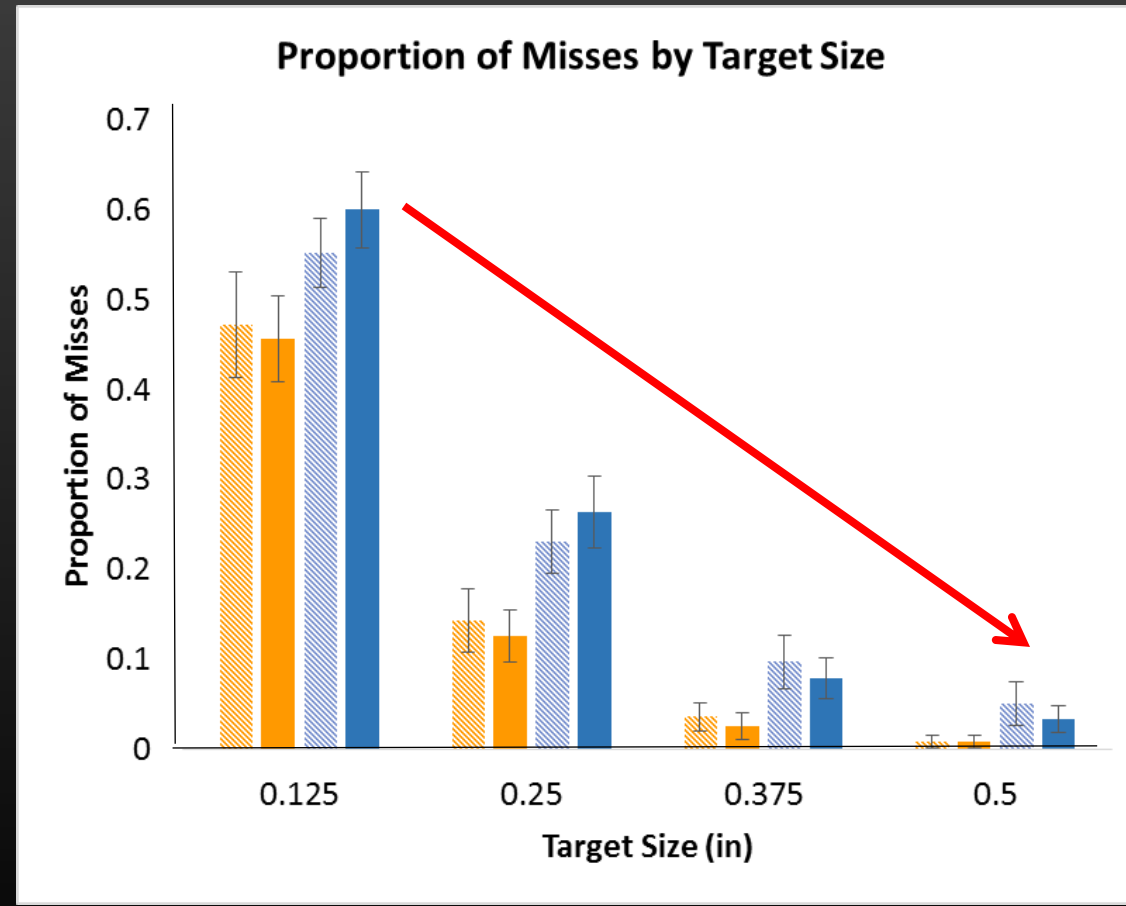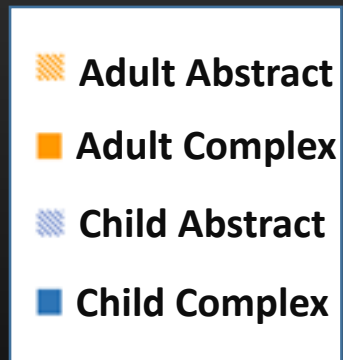
Target Misses (No Effect of Complexity)

3. Edge Padding

Score:25

Score:125

Score:20

Score:125
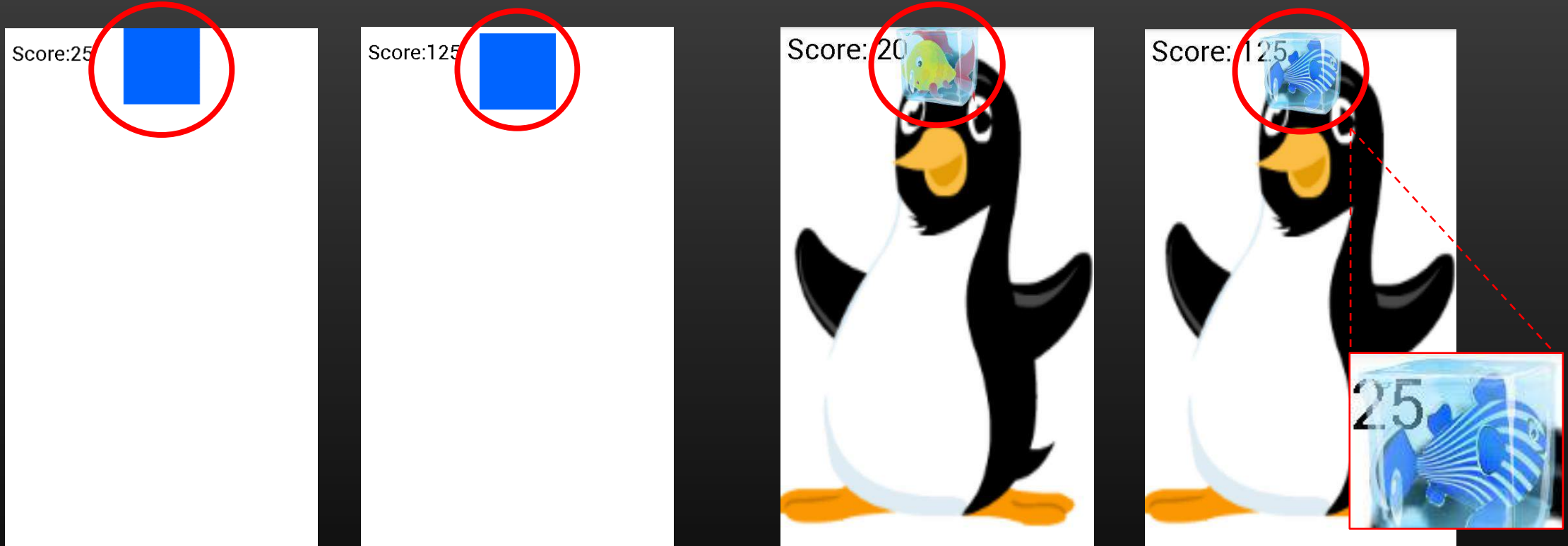
- Higher proportion of misses for targets with edge padding.

Touch Pressure and Size (Effect of Complexity)

- Lower touch pressure and size for complex applications.

"Pointing Finger Vector Clip Art" by www.toublanc.info under CC 2.0

Location (No Effect of Complexity)
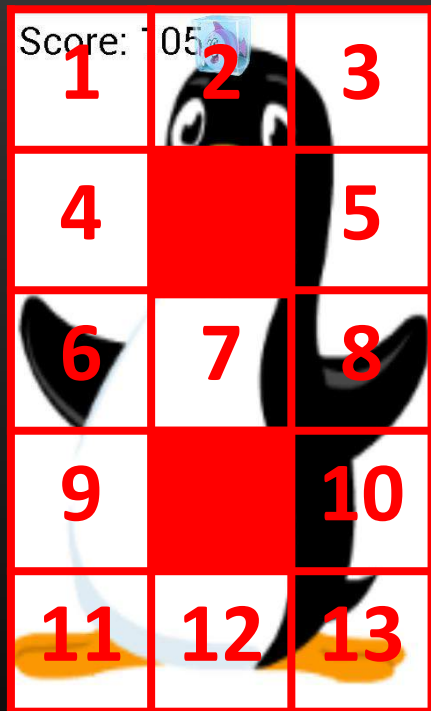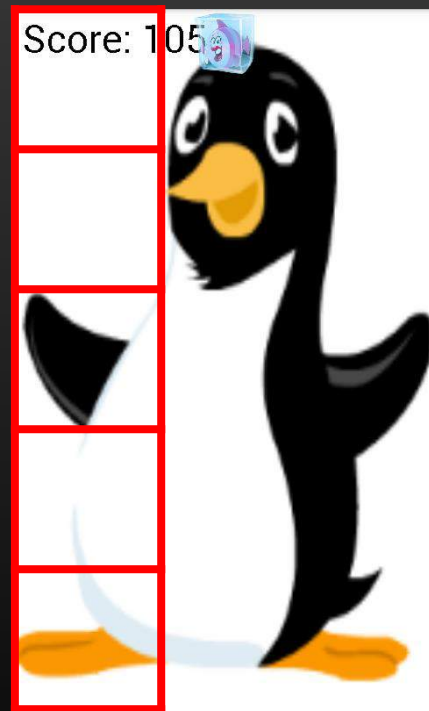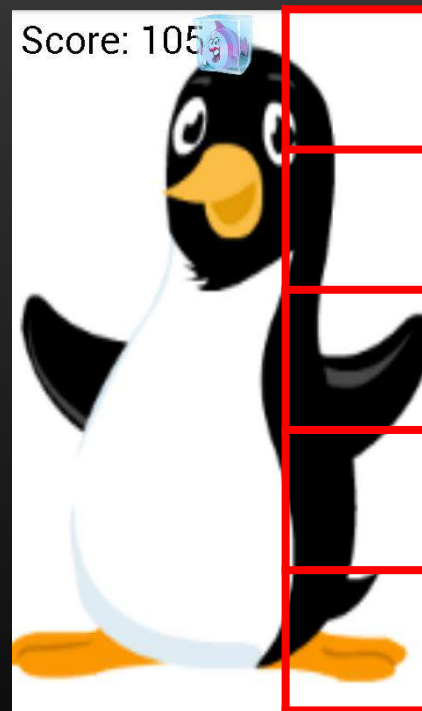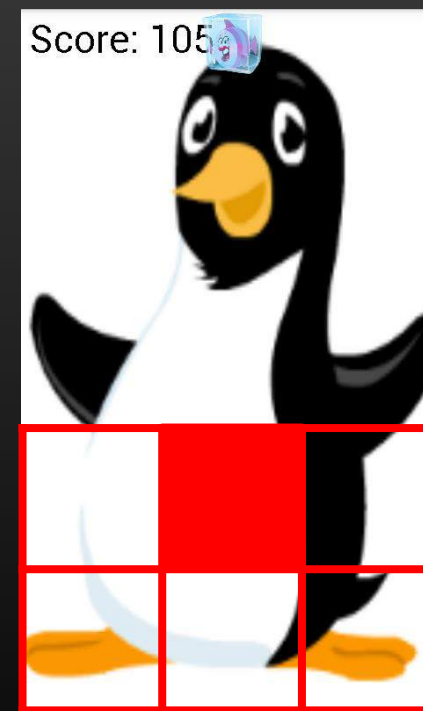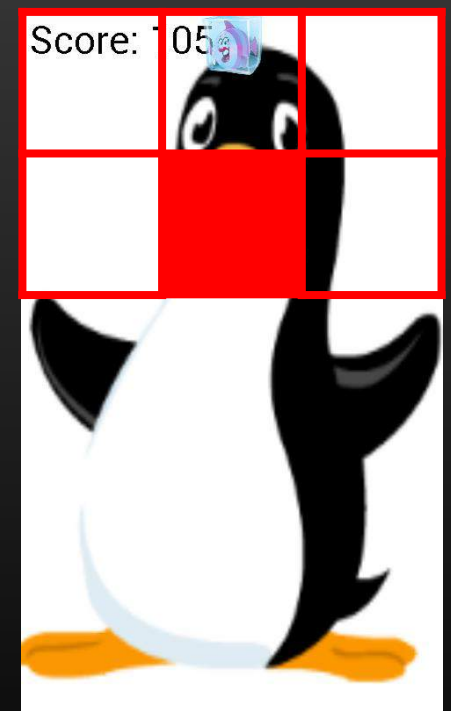
• Higher proportion of misses on the right side and the top.

Response Time (Effect of Complexity)
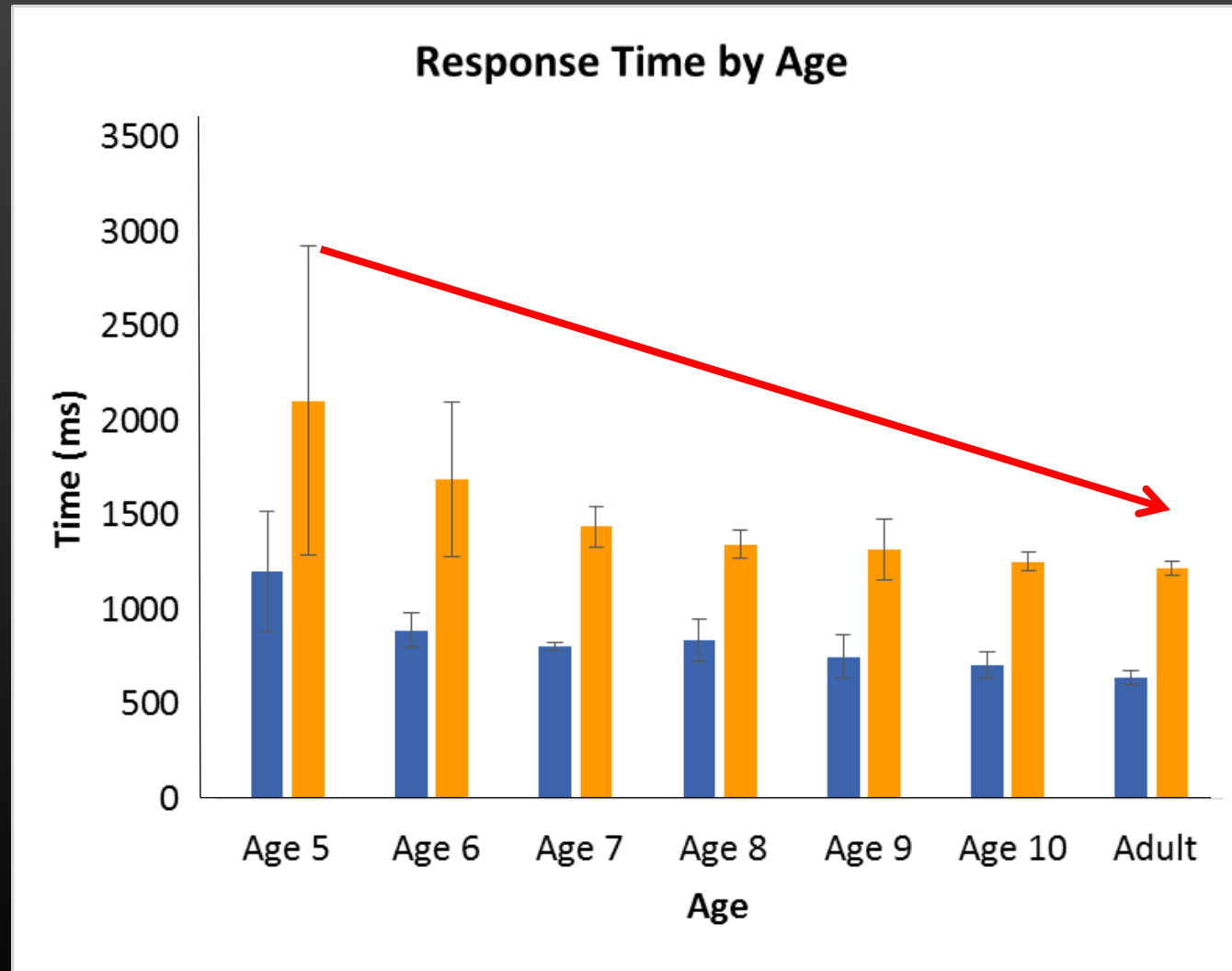
Complexity p<.0001
Target Size   p<.0001
Participant Type   p<.0001
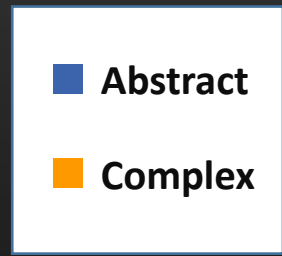
Abstract
Complex

- Children more distracted by visual stimulus.
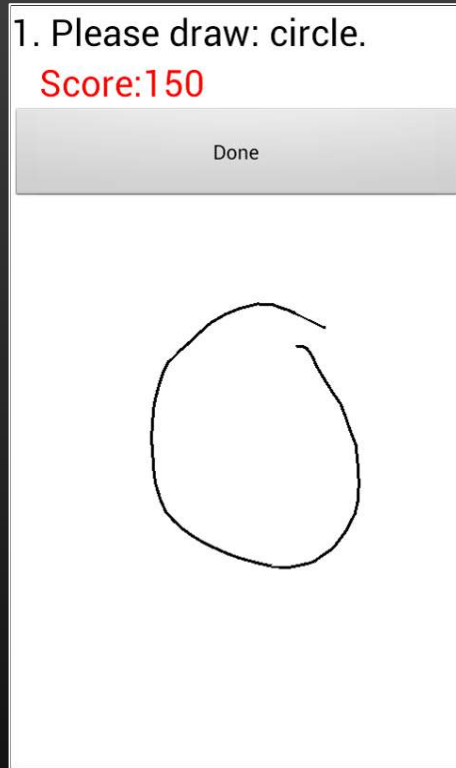
Gesture Interaction
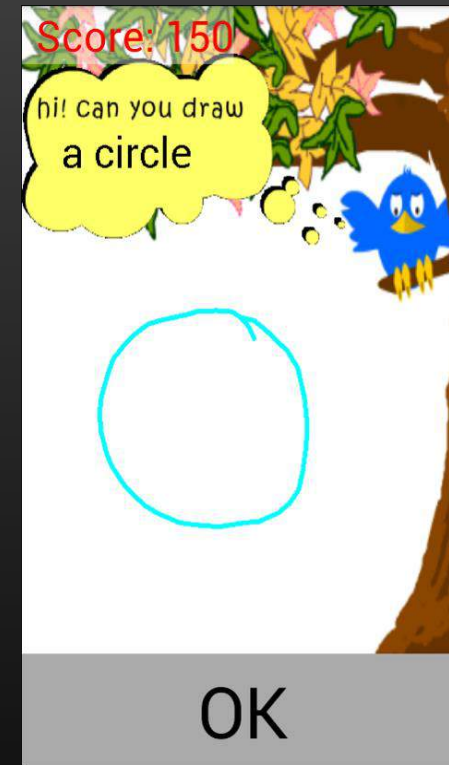
Gesture set

- 2 apps * 6 reps * 20 gestures = **240 gestures per participant**

- 240 * 60 participants = **14,400 total gestures**
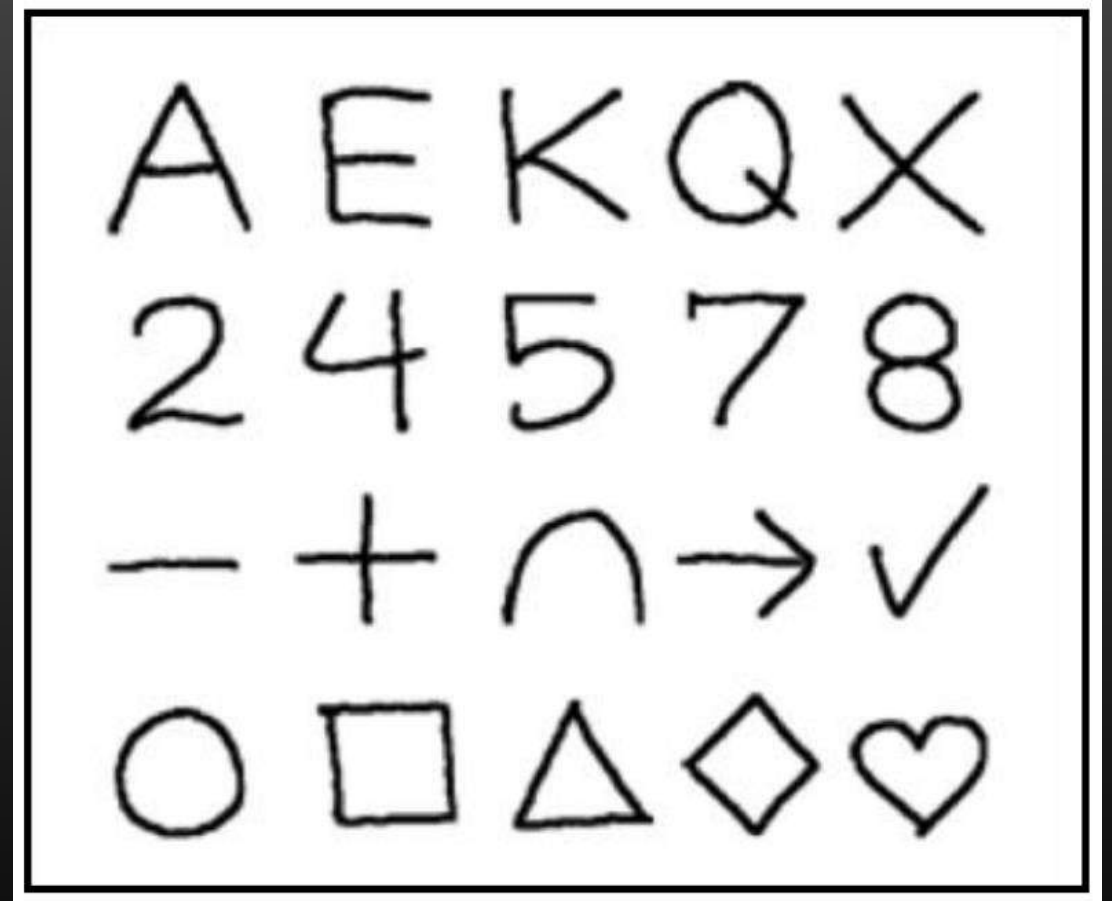
Anthony et al (ITS 2012)

Gesture Recognition Experiments

- User Dependent
  - *within* user
- User Independent
  - *between* users

- $P Recognizer (Vatavu et al, ICMI 2012)

User Dependent
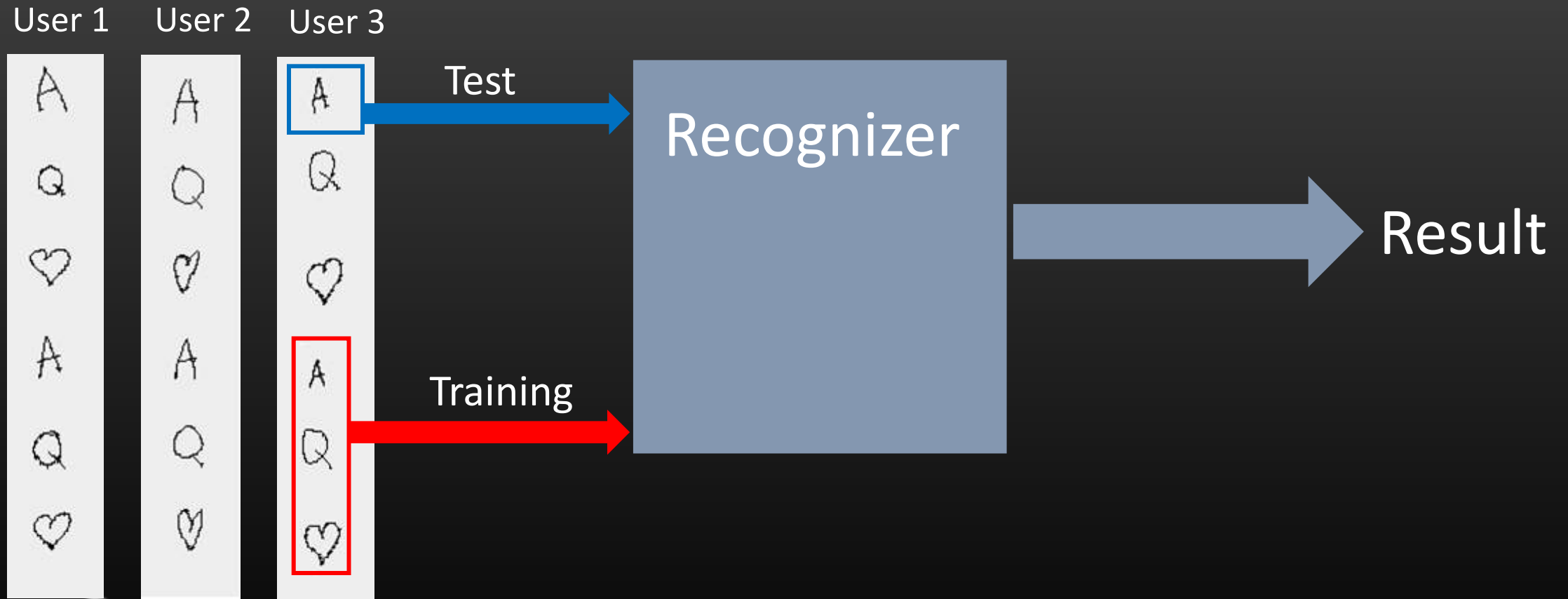
Repeat for each user

User Independent

User 1   User 2   User 3

Test

Recognizer

Training

Result
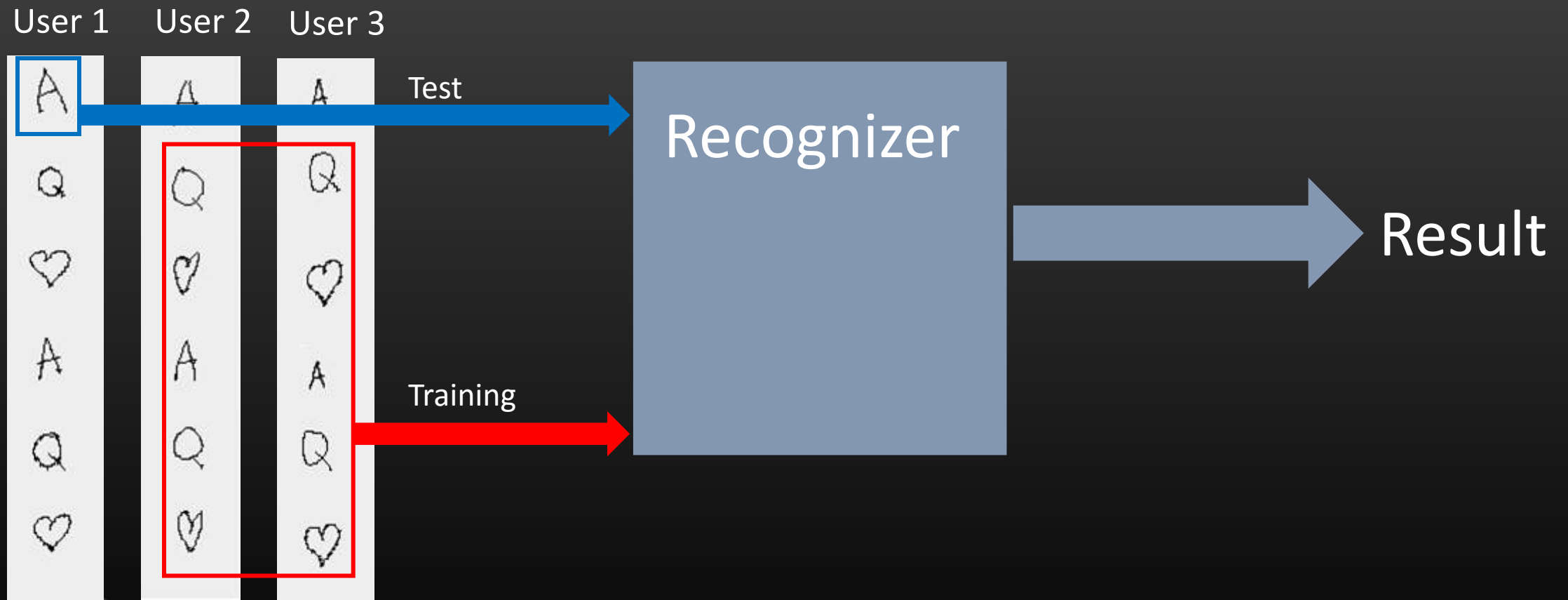
Repeat for each user

User Dependent (No Effect of Complexity)

User-Dependent Accuracy by Age

Age
p<.0001

Legend: Abstract (blue), Complex (orange)

init( )

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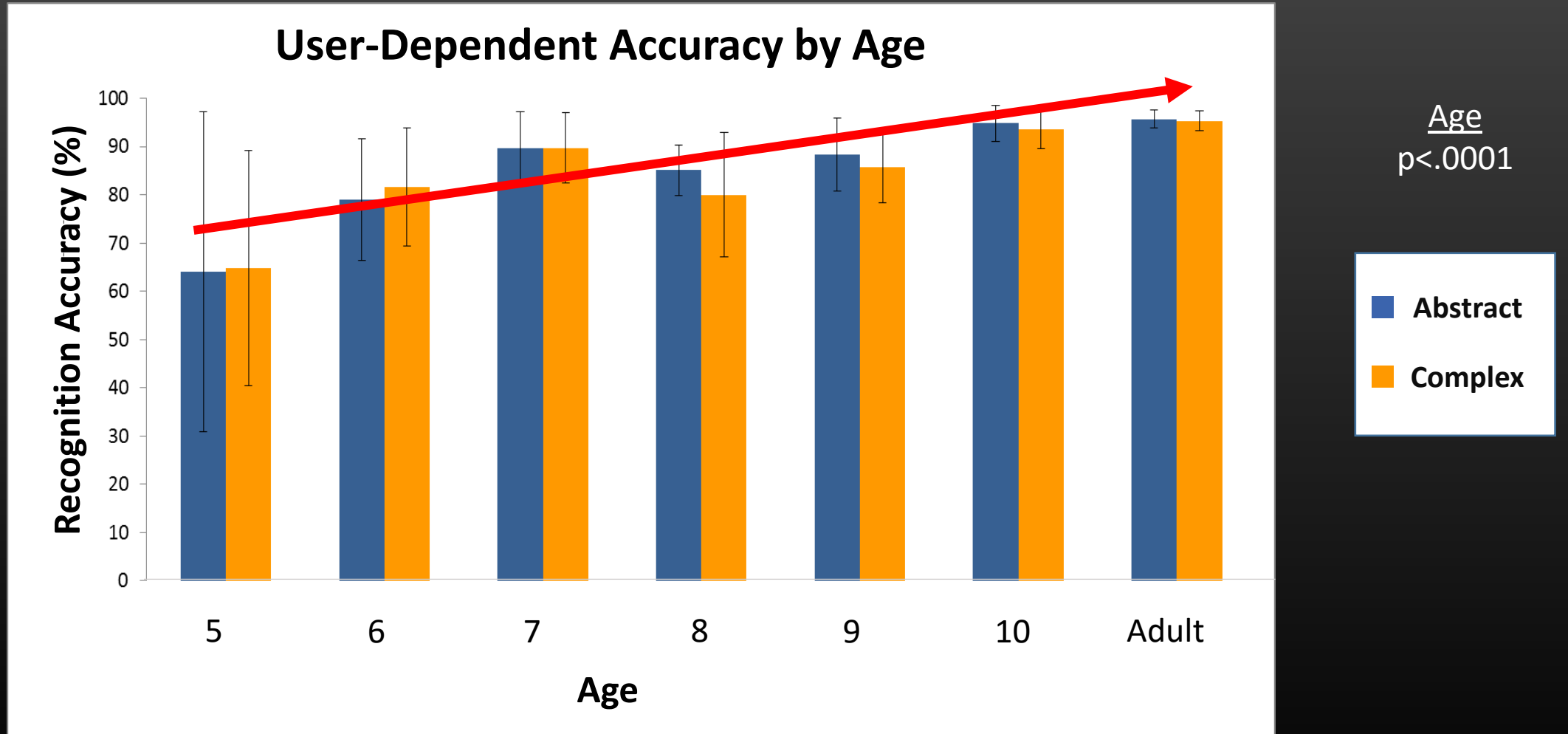
User Independent (No Effect of Complexity)
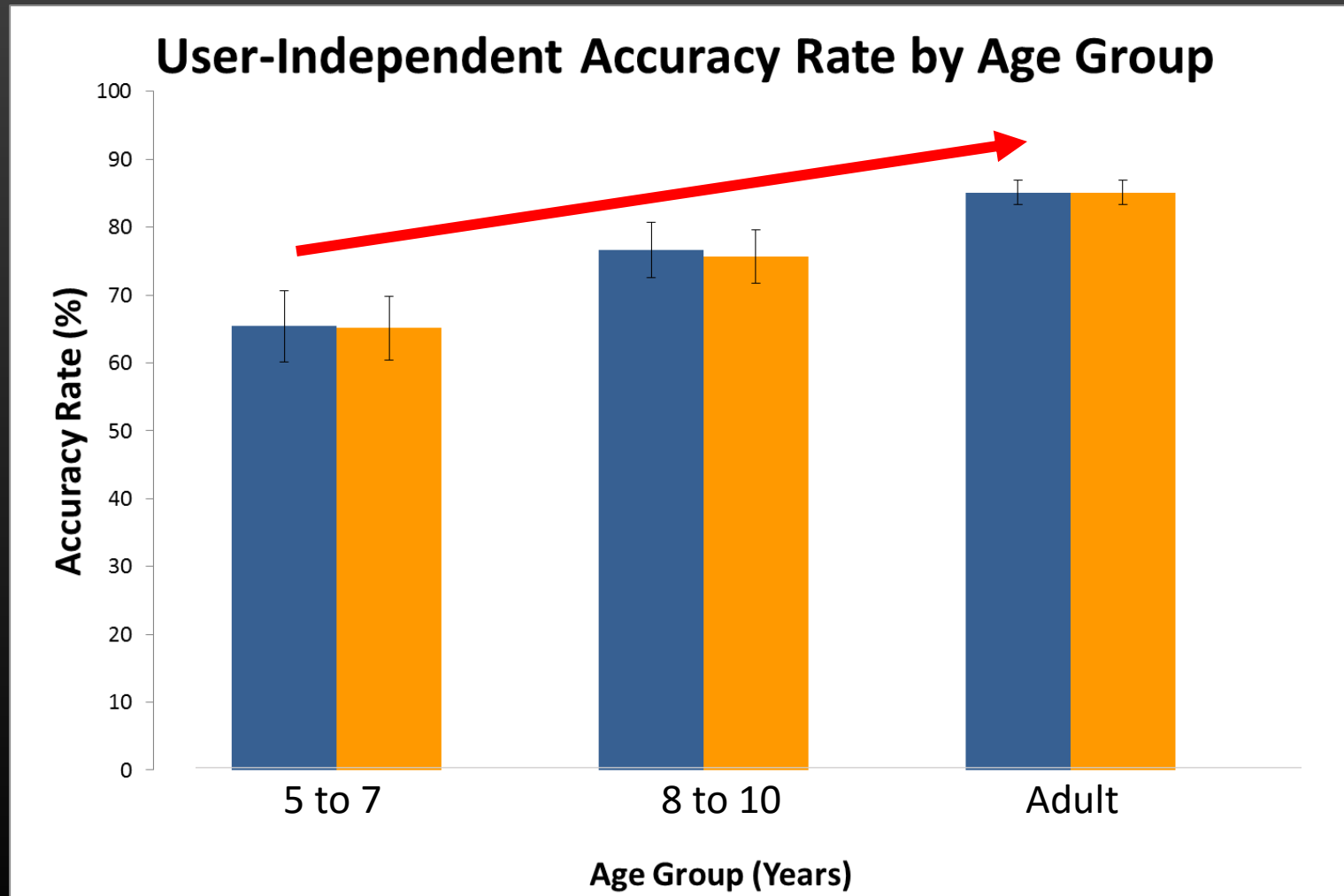
Training Examples & Age

- Significant effect of number of training examples and age on accuracy
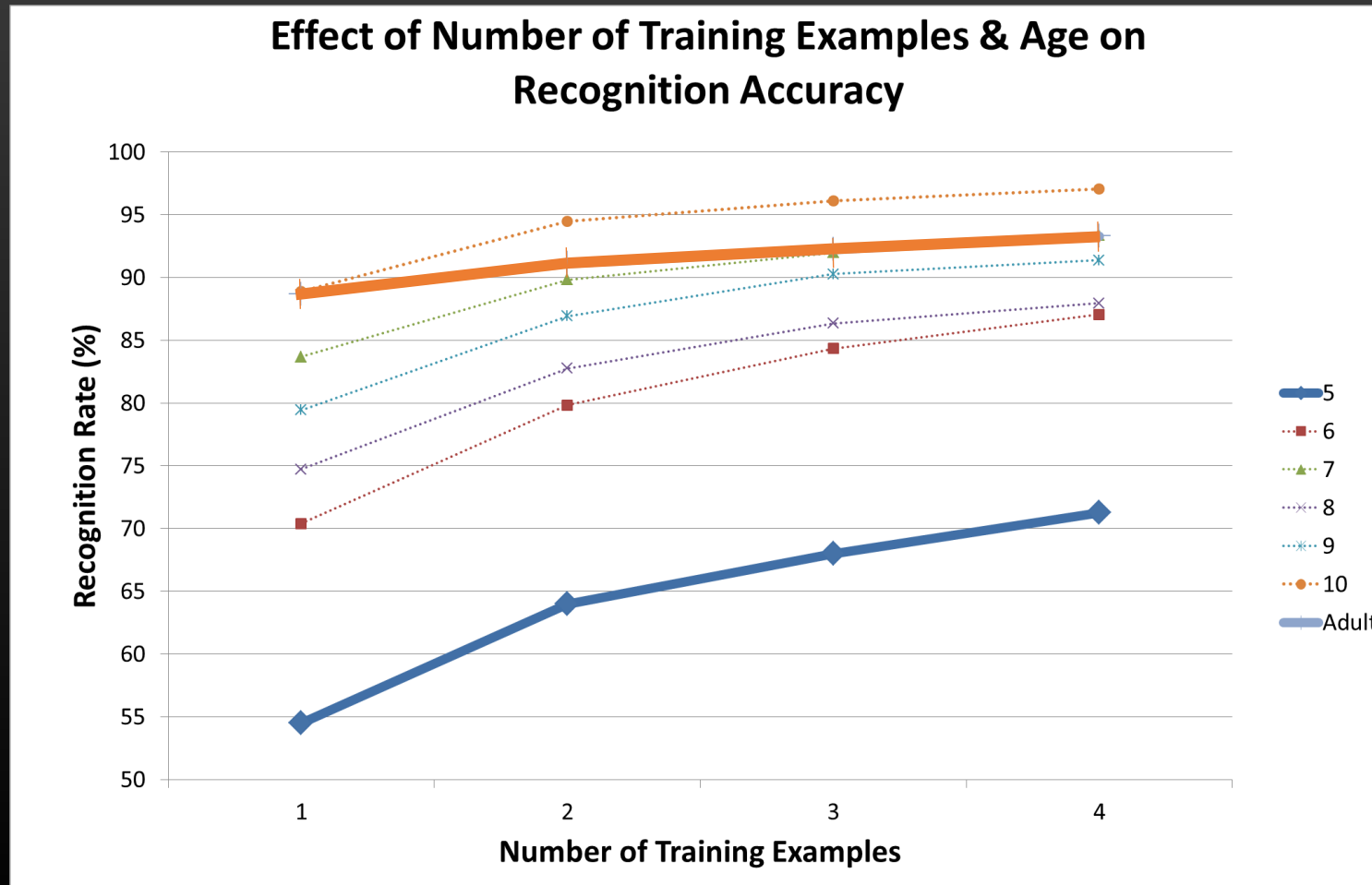
p<.0001

Design Implications
and
Conclusion
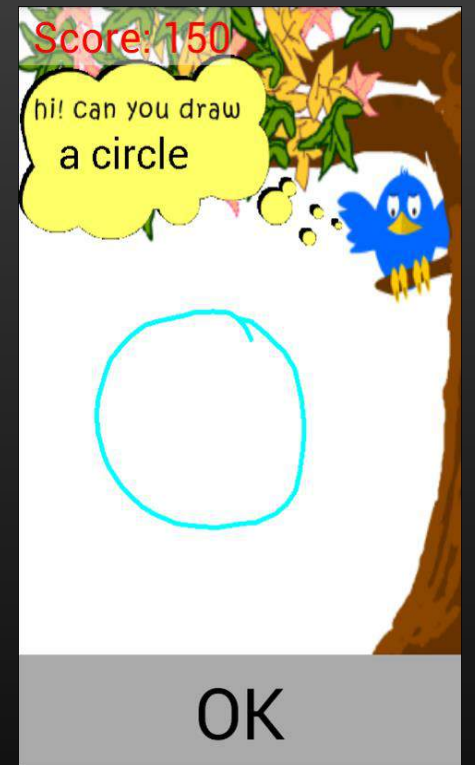
Design Implications

- Provide salient visual feedback of accepted input to prevent holdovers.
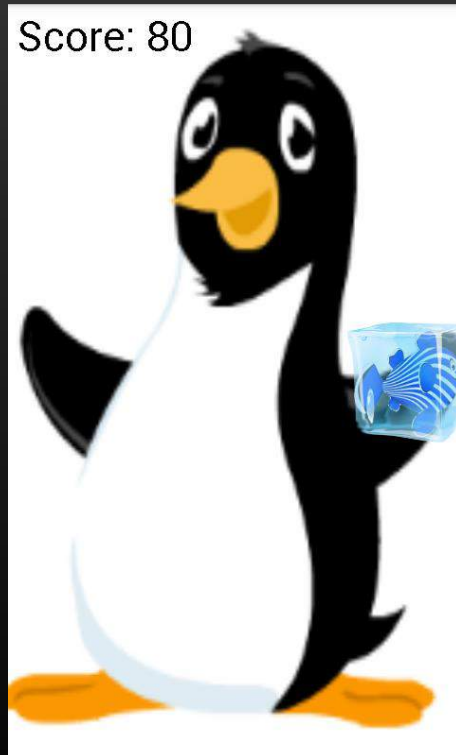
Design Implications

- Avoid small targets at screen edge, especially for complex interfaces.
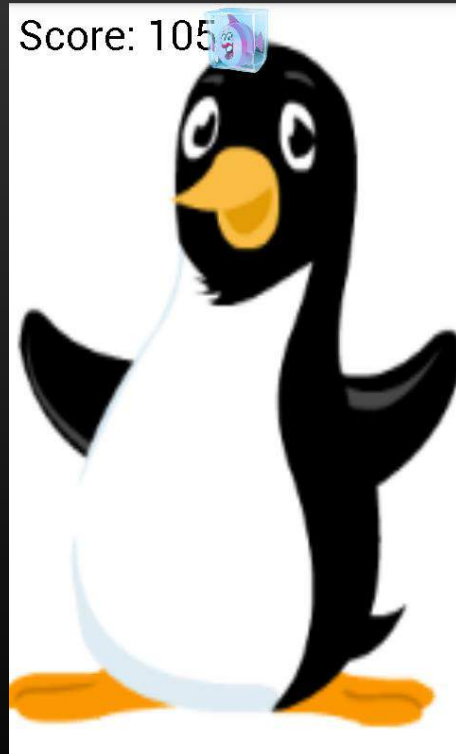
Design Implications

- Consider trade-off between visual saliency and response time.
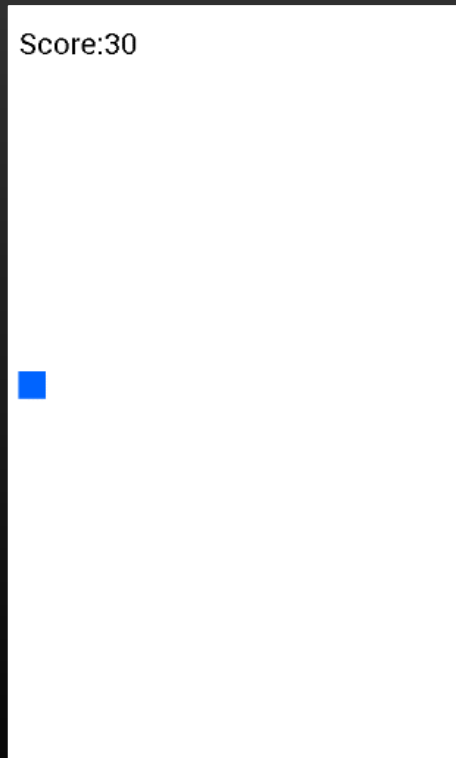
Design Implications

• Train gesture recognizers for younger children with more examples.

"heart" gestures from our study
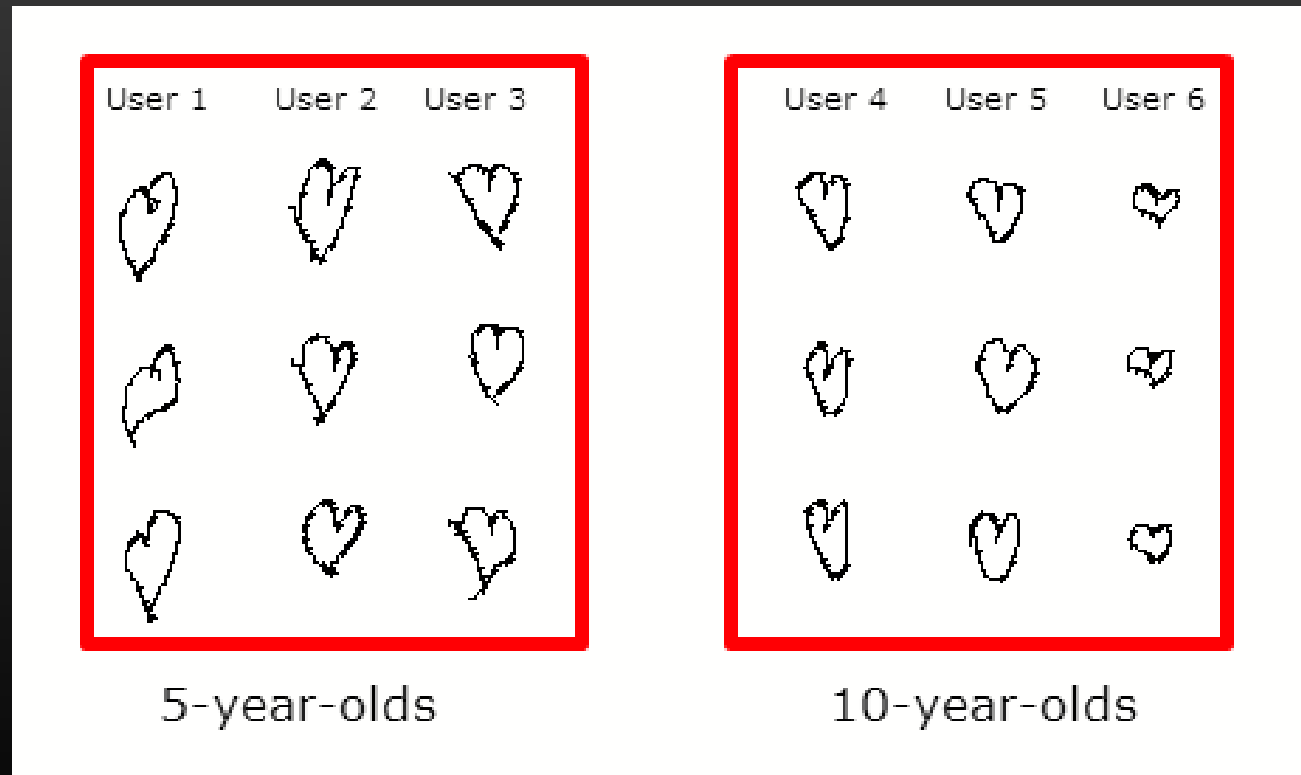
Conclusion

- Interface complexity
  - Affected some touch interactions, primarily regarding visual saliency.
  - Did not affect gesture recognition.

Future Work

- Larger touchscreen display.
- Characterizing children's gestures to improve recognition.*
- Get direct input from children in designing intelligent interfaces.

"Microsoft Surface" by Vanguard Visions under CC 2.0

"student_ipad_school-129" by Brad Flickinger under CC 2.0

Thank you!

Julia Woodward

Alex Shaw
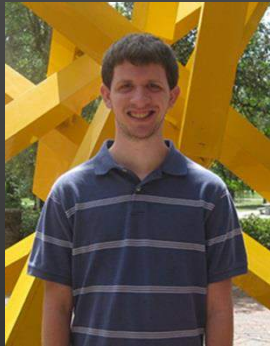
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Dr. Quincy Brown

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Annie Luc
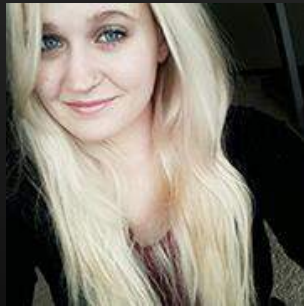
Brittany Craig

Juthika Das

Phillip Hall Jr.

Akshay Holla

Germaine Irwin

Danielle Sikich

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