Examining the Need for Visual Feedback during Gesture Interaction on Mobile Touchscreen Devices for Kids

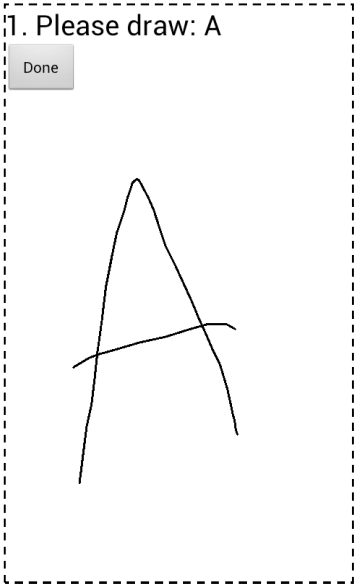
Lisa Anthony†, Quincy Brown‡,
Jaye Nias‡, Berthel Tate‡

† UMBC*, ‡Bowie State University

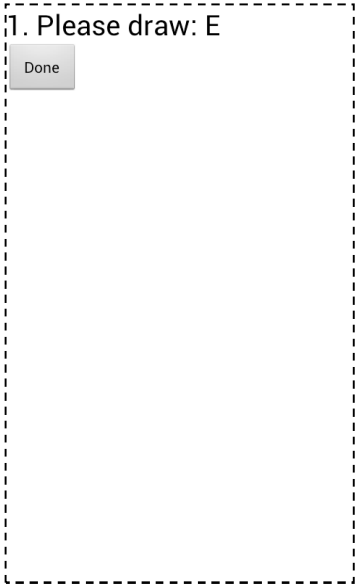
* to join faculty at University of Florida this fall

What do we mean by Visual Feedback?

Feedback



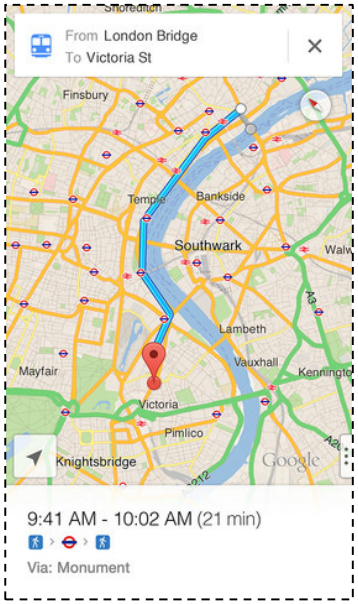
No Feedback



Why explore Visual Feedback?

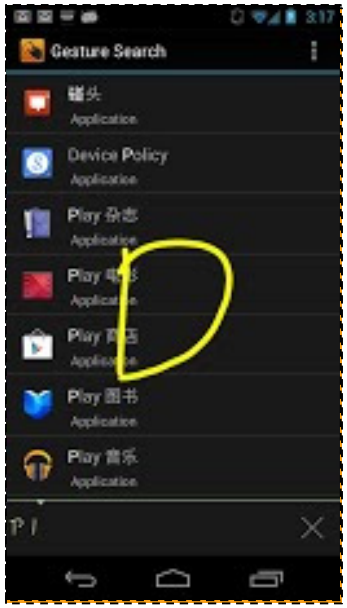
Feedback:
I Write Words
(gdiplus)

No Feedback:
Google Maps
(Google, Inc.)

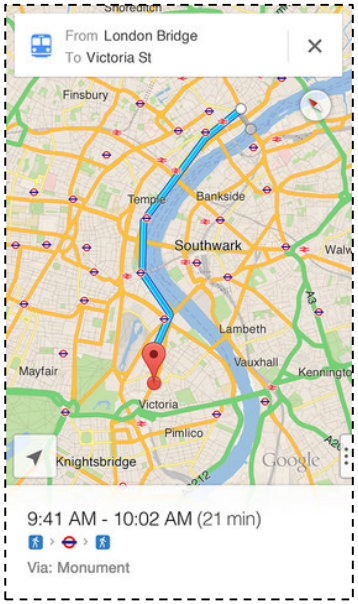


Why explore Visual Feedback?

Feedback: Gesture Search (Google, Inc.)



No Feedback: Google Maps (Google, Inc.)



Key Take-Aways

- Gestures made by kids and adults with visual feedback differ from those made without it:

Feedback

No Feedback

- Some differences make it hard to interpret the gestures.
- Kids prefer to enter gestures with visual feedback.
- **Recommendation**: provide visual feedback during surface gesture interaction.

The MTAGIC Project

- "Mobile Touch and Gesture Interaction for Children"
- Students (current and former):
  - UMBC:
    - Robin Brewer (PhD), Felix Bui (UG), Germaine Irwin (PhD), Shreya Mohan (UG), Luis Queral (UG), Femi Williams (UG)
  - Bowie State:
    - Thaddeus Brown (UG), Jaye Nias (PhD), Monique Ogburn (UG), Chiamaka Okorohoa (UG), Berthel Tate (PhD)

Funding:

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

Touch and Gesture Interaction Challenges for Kids

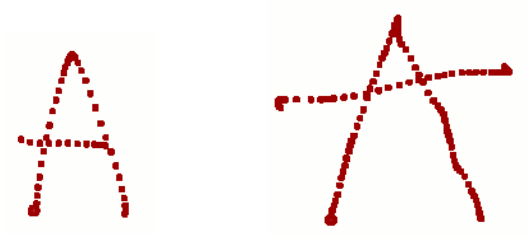
- Manual dexterity / fine motor control develop with age of child
- Shapes children are expected to generate vary by age^
- Little hands activate interactors unexpectedly*
- Children have difficulty tapping and drag and drop○

^ Beery, K., Buktenica, N., and Beery, N.A. The Beery Buktenica Developmental Test of Visual-Motor Integration, 5th Edition. 2004.
* McKnight, L. & Cassidy, B. (2010) Children's Interaction with Mobile Touch-Screen Devices: Experiences and Guidelines for Design. *International Journal of Mobile Human Computer Interaction* 2 (2), 18 pp.
○ 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. *Proc. DIS 2010*, 360–363.

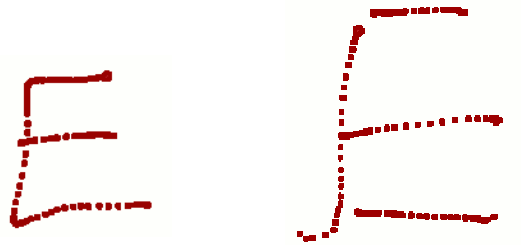
Interpreting Kids' Intent

Letters (Adult / Child)

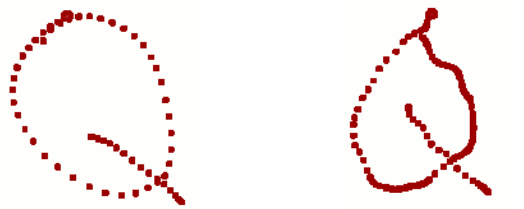
A



E

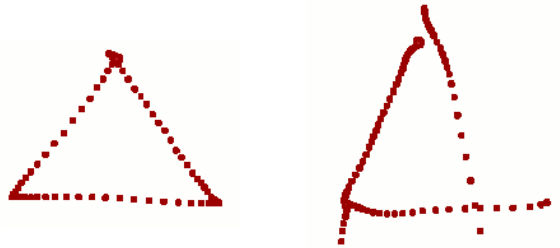


Q



Shapes (Adult / Child)

Δ



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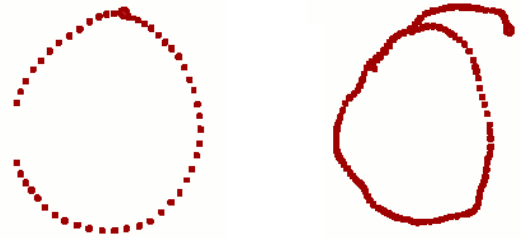
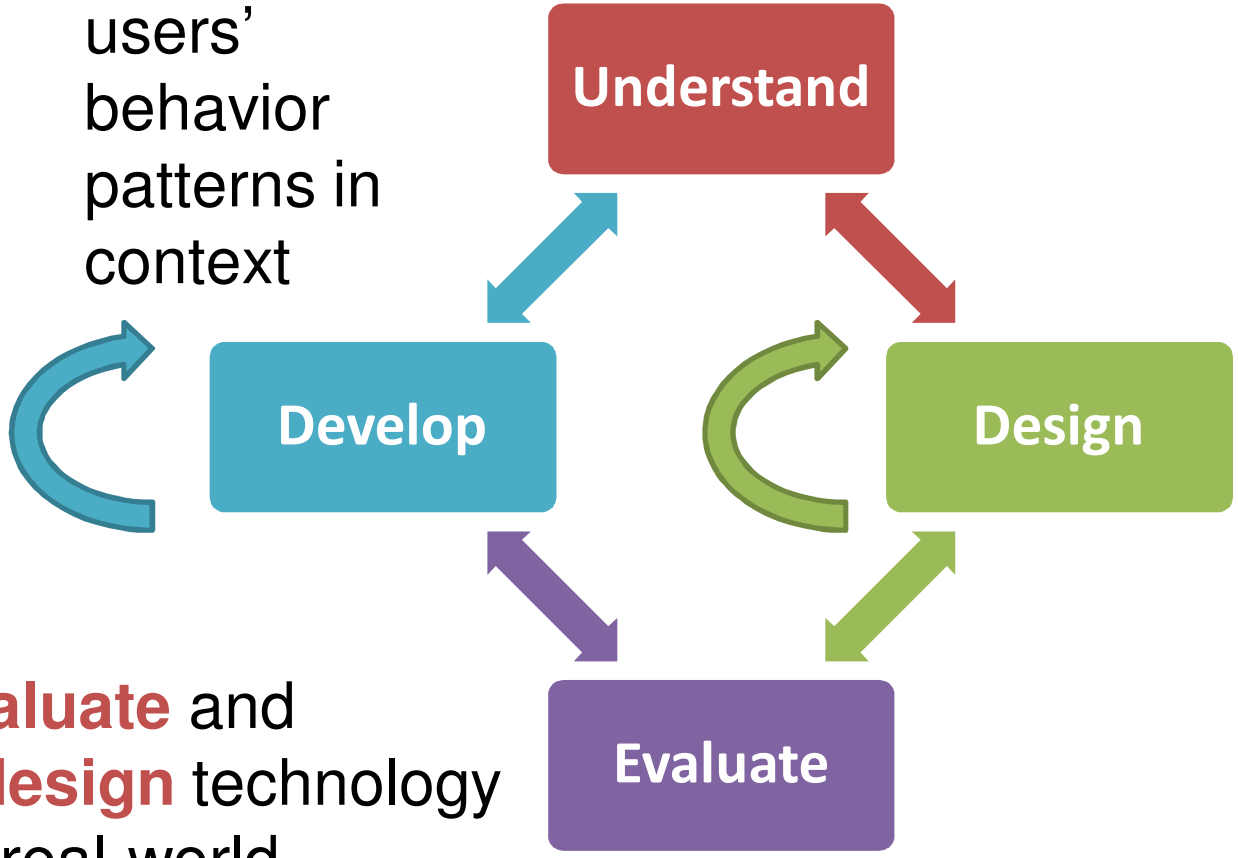


+

drawn to scale

Research Approach

Study users' behavior patterns in context

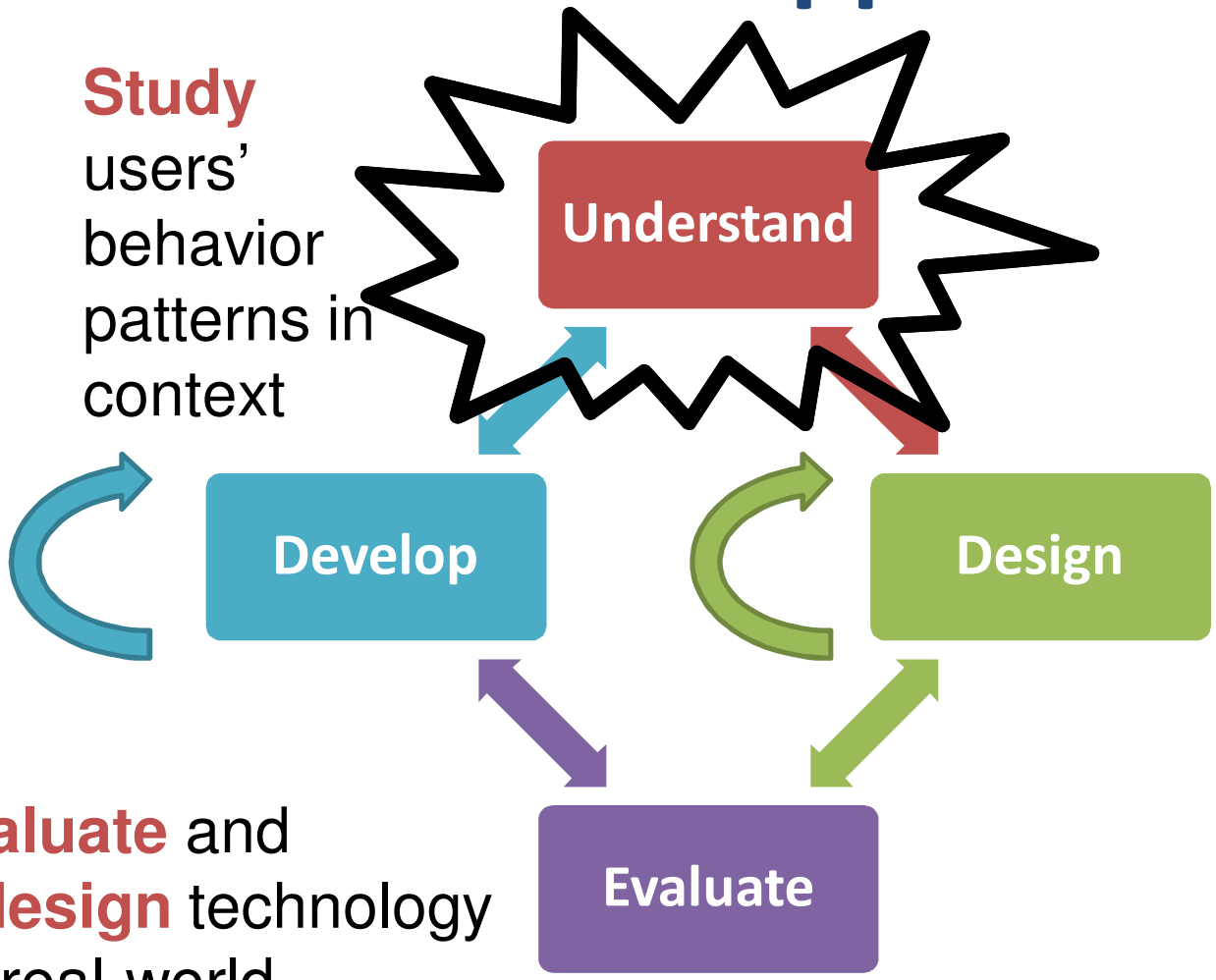


Design and **develop** interactive systems based on user needs

Evaluate and **redesign** technology for real-world benefits

Research Approach

Study users' behavior patterns in context



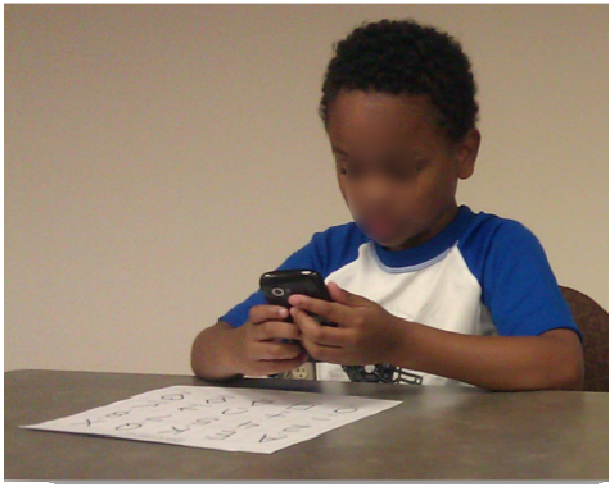
Design and **develop** interactive systems based on user needs

Evaluate and **redesign** technology for real-world benefits

MTAGIC Findings to Date for Gesture Interaction

- Kids make gestures differently than adults
  - Kids make bigger gestures**
  - Kids make gestures with more strokes**
- Kids' gestures are recognized^ less accurately than adults'**
  - Correlated to age**

– We have also looked at target tapping tasks



** *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.

Research Questions for Today

1. How does the presence or absence of visual feedback affect how children (and adults) input touch gestures on mobile devices?

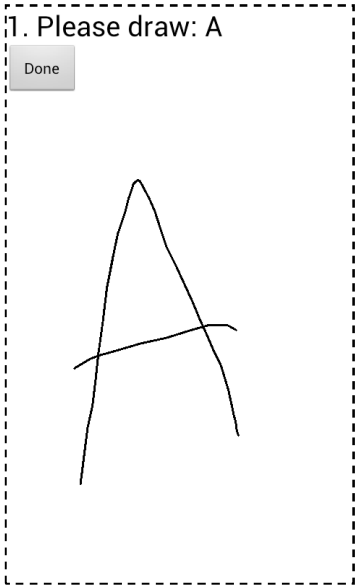
2. If differences exist, do they affect software recognition of gestures?

Empirical Study

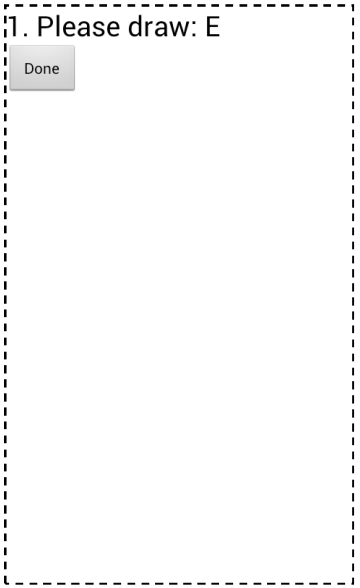
- Laboratory study
- Mobile devices with tasks we designed
- 41 total participants:
  - 25 kids (ages 10-17), 16 adults (ages 18+)
  - Group kids into age groups: 10 yrs, 11 to 13 yrs, 14 to 17 yrs

Gesture Task

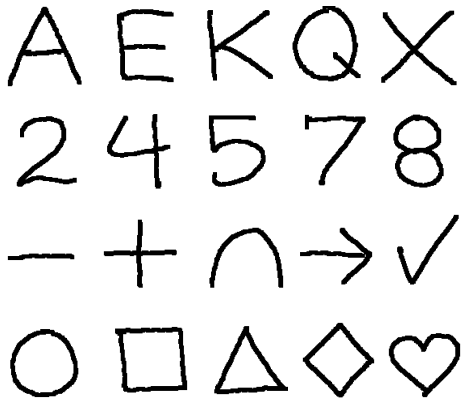
Feedback



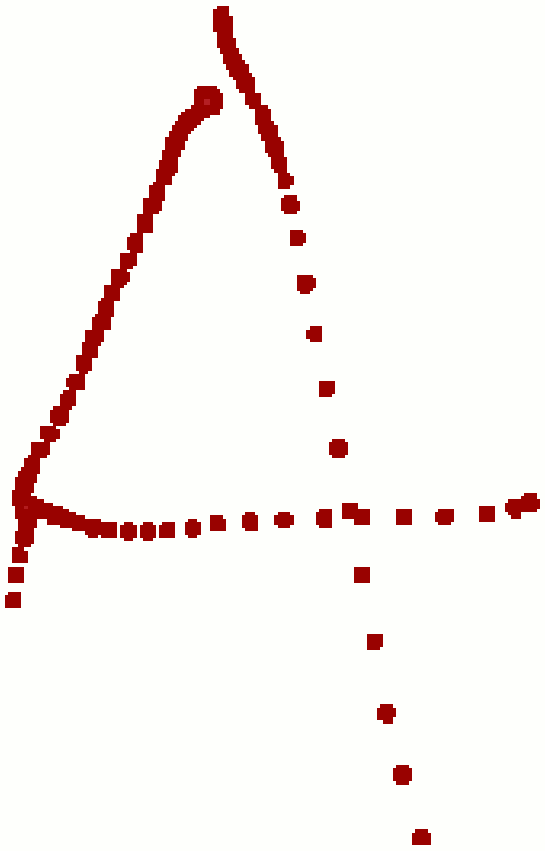
No Feedback



20 gestures:

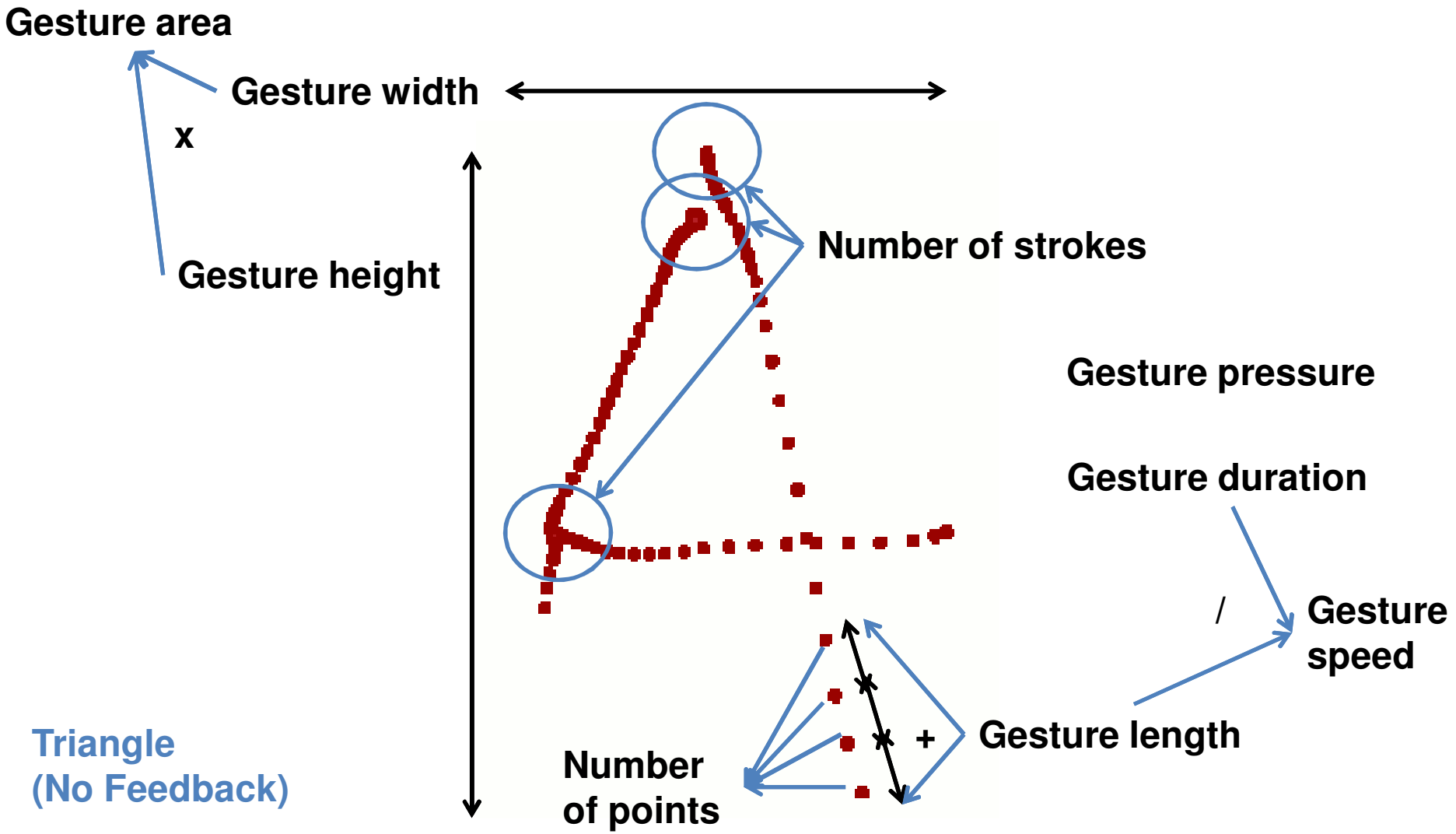


Gesture Features

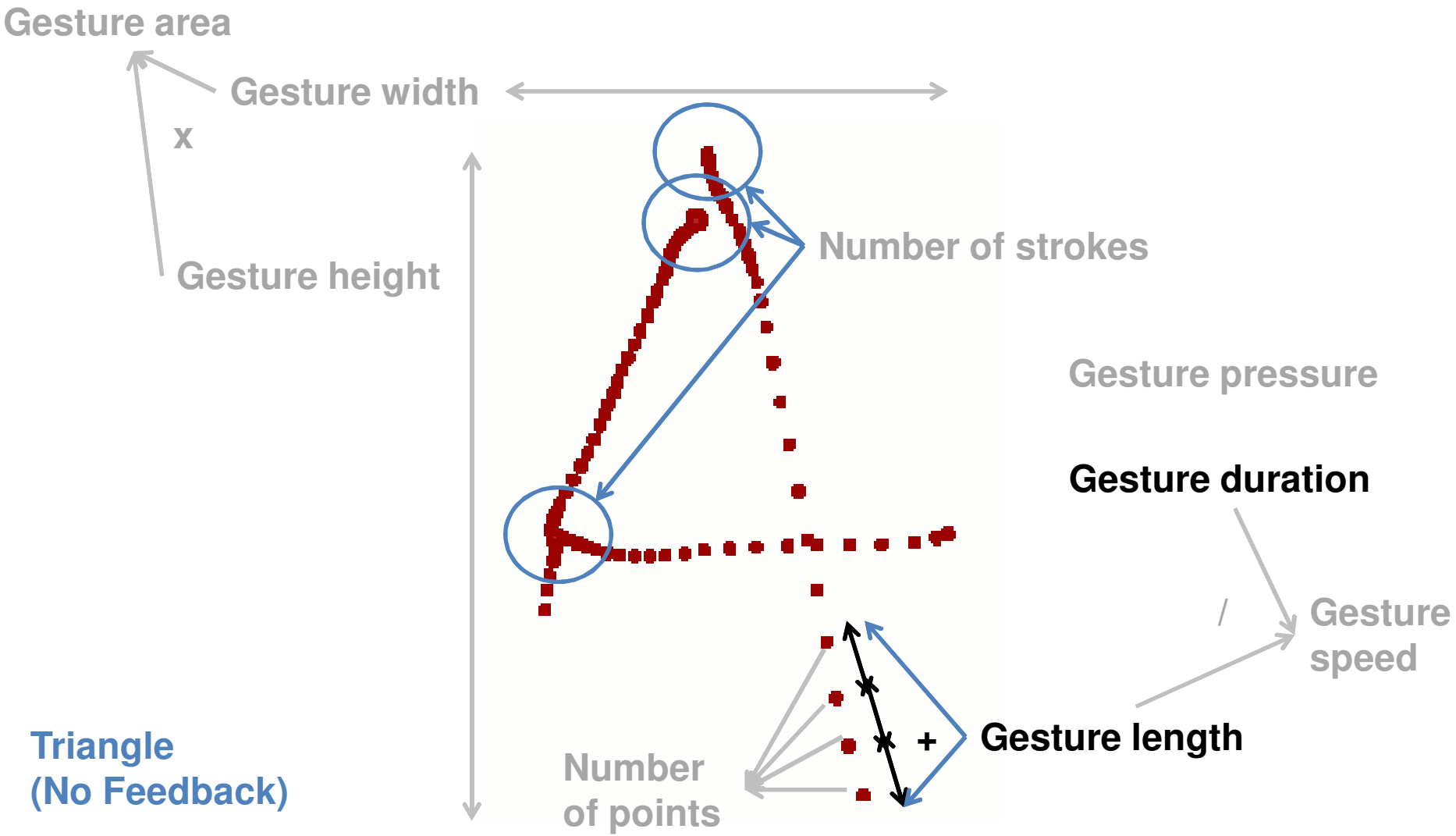


Triangle
(No Feedback)

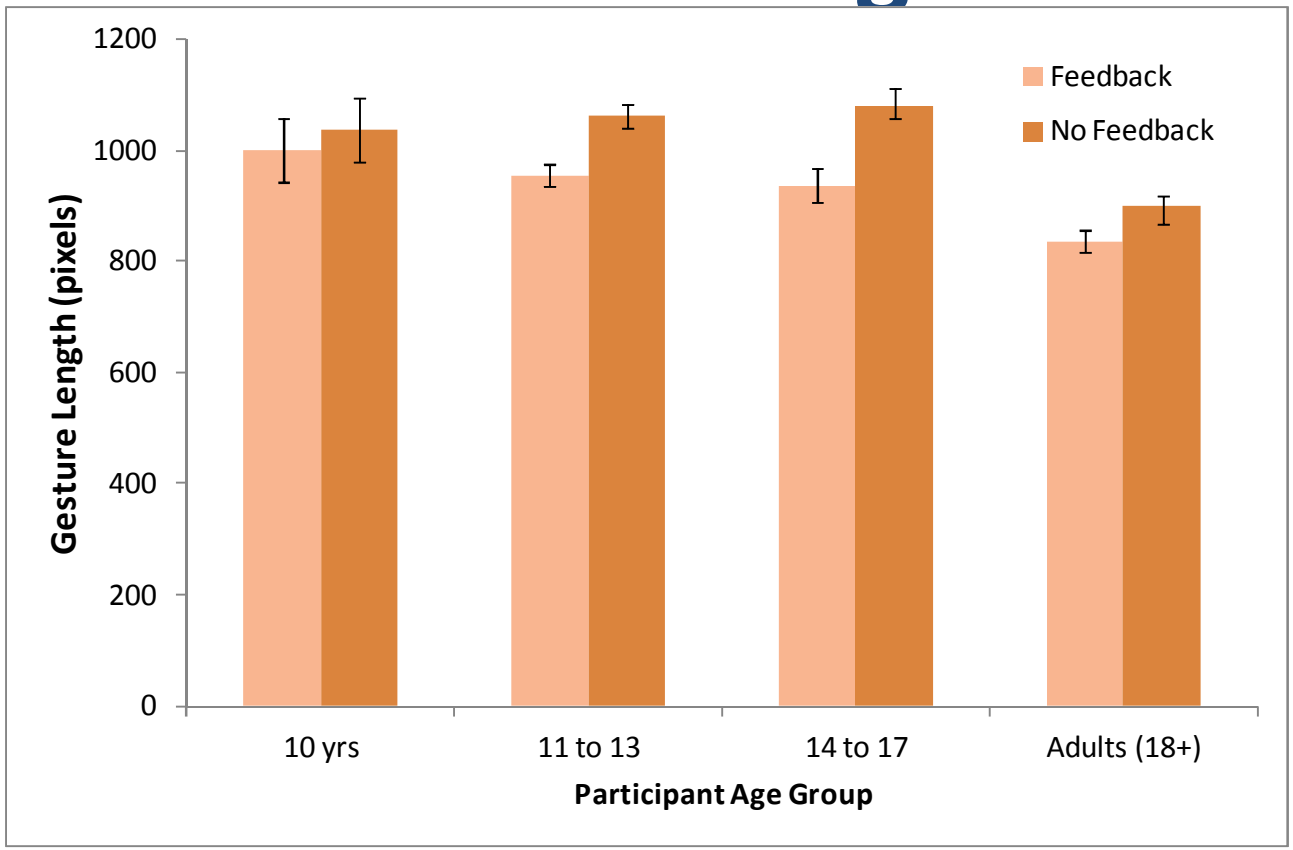
Gesture Features



Gesture Features

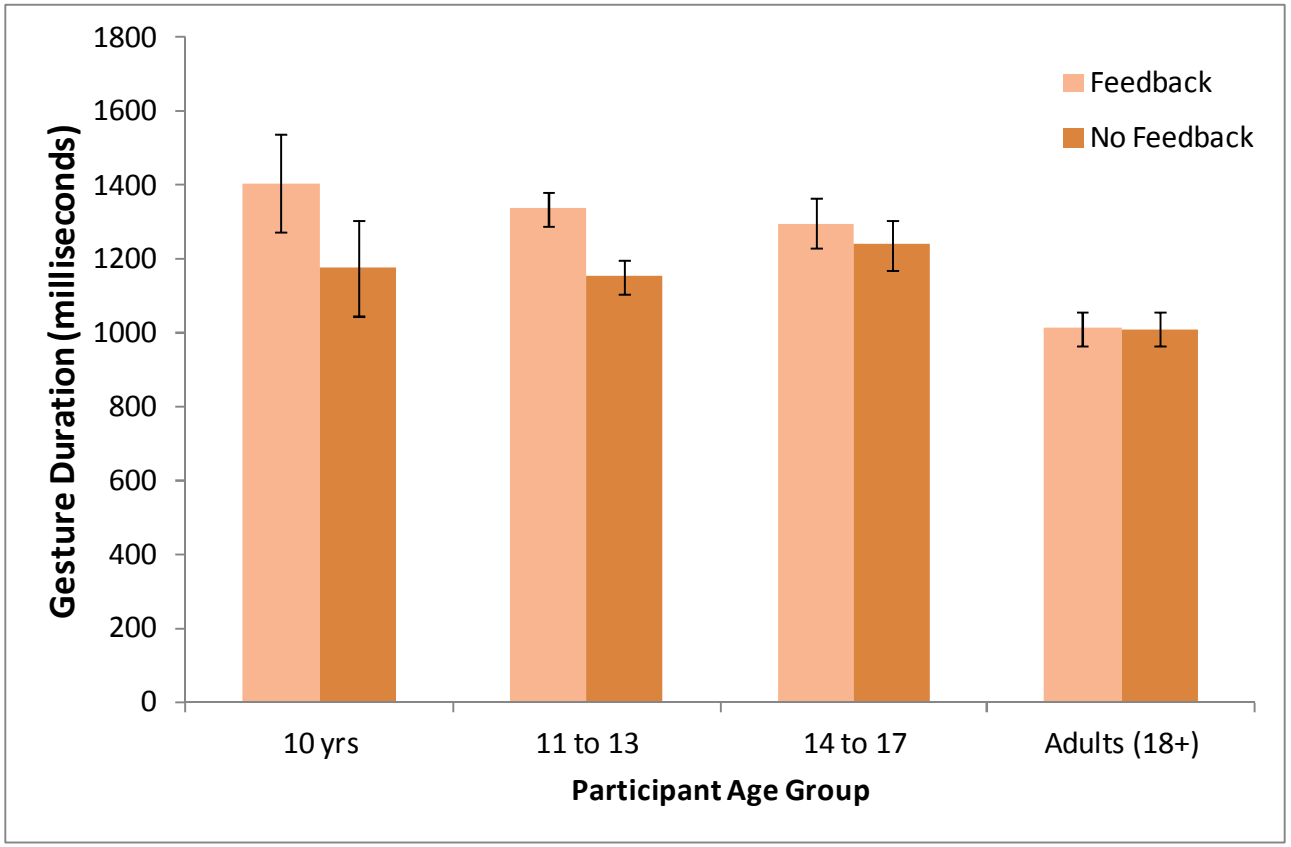


Gesture Features Case Study 1: Gesture Length



Significant interaction between participant age group and visual feedback for gesture length ($F_{3,8154} = 4.03$, $p < .01$).

Gesture Features Case Study 2: Gesture Duration



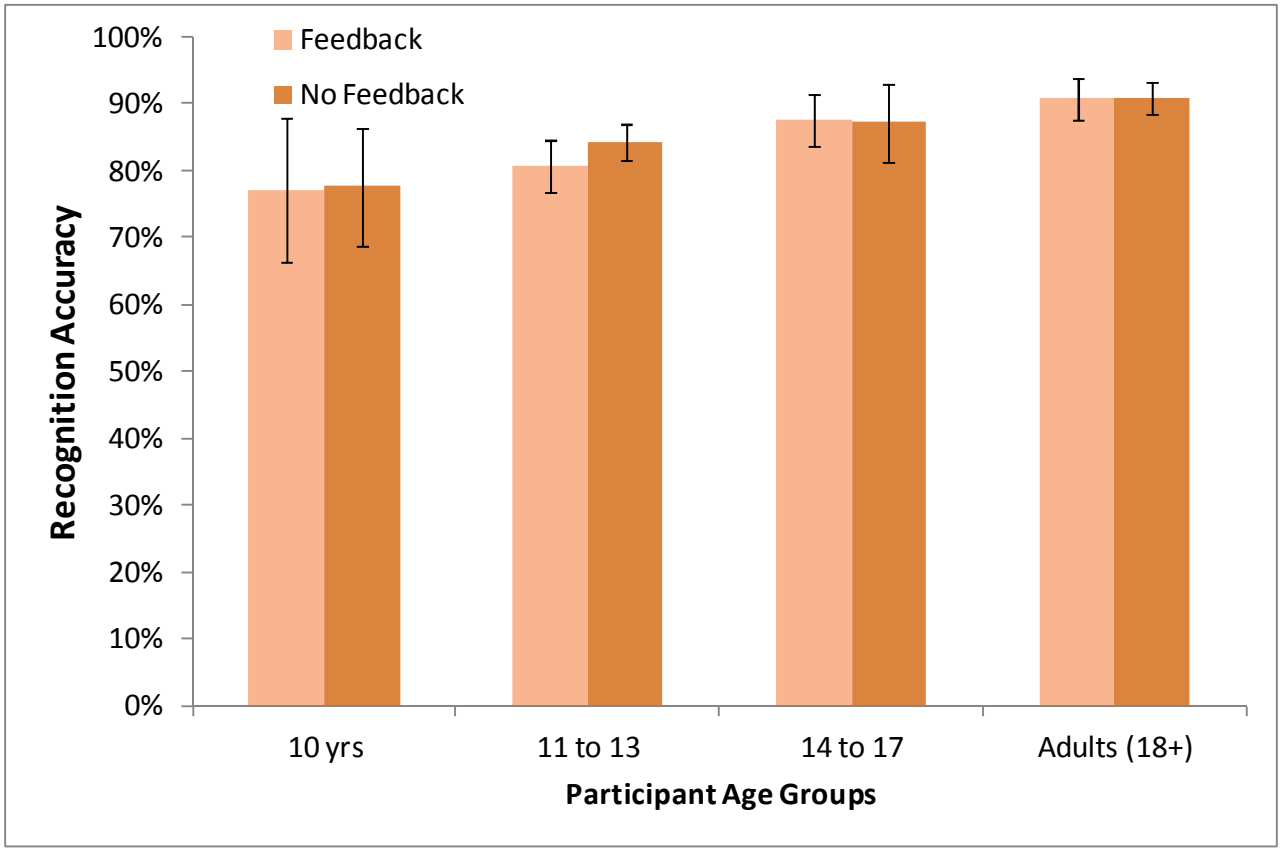
Significant interaction between participant age group and visual feedback for gesture duration ($F_{3,8154} = 5.80$, $p < .01$).

Gesture Features Overall Findings

- Users of all ages are more careful during gesture interaction **with** visual feedback.
  - Fluency?
- The **younger the children** (to age 10), the more absence of visual feedback impacted their gestures.

- **Recommendation**: provide visual feedback during surface gesture interaction.

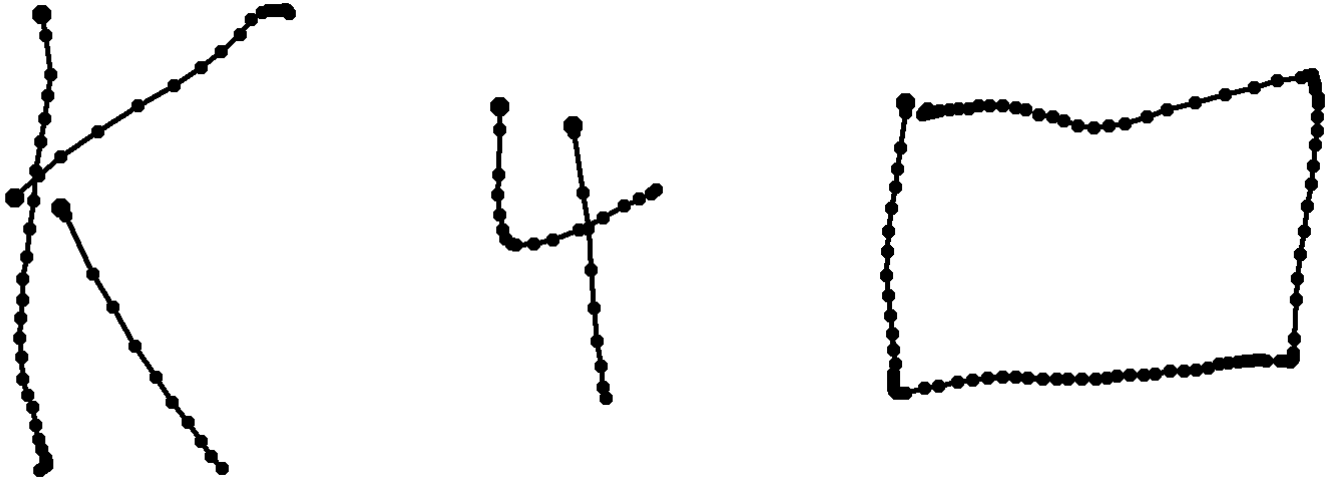
Gesture Recognition Accuracy



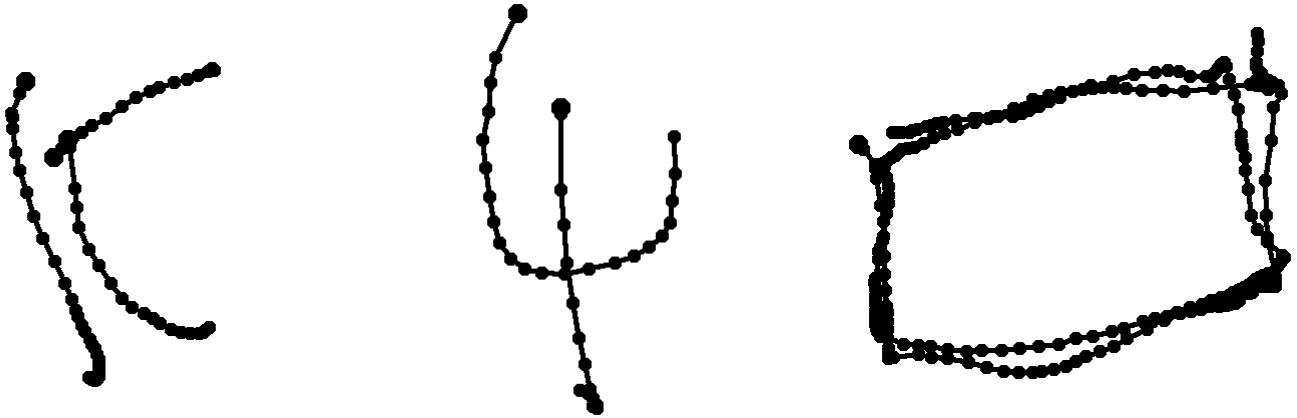
No difference in recognition accuracy based on visual feedback ($F_{1,37} = 0.56$, *n.s.*).
[Significant main effect of participant age group alone ($F_{3,37} = 7.38$, $p < .01$).]

Qualitative Observations

Feedback



No Feedback



Gesture Interaction Design Recommendations

Strategy	Design Implication
Tailor gesture recognition for children (improve recognition accuracy)	1. Test new gesture sets with the target recognizer in advance.
Support children's conceptual models of gesture input (improve design)	2. Avoid gestures unfamiliar to children.
	3. Provide visual feedback for surface gesture interaction on mobile devices.

Thank You!

- Contact:
  - Lisa Anthony, lanthony@umbc.edu
  - Quincy Brown, qbrown@bowiestate.edu