

The Development and Testing of a Novel Face-Controlled Experimental Tool for Toddlers and Young Children

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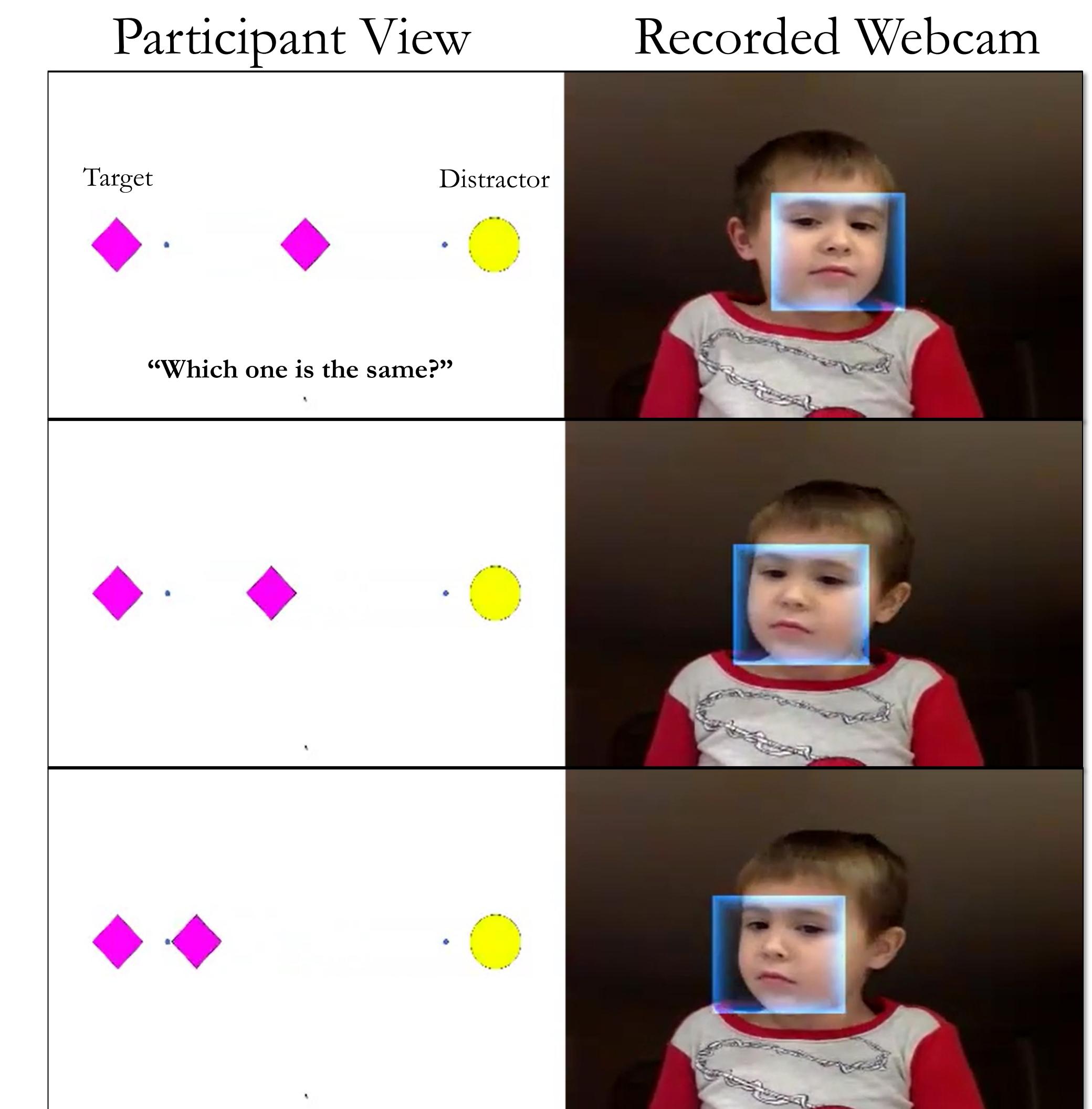
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OVERVIEW

- Remote testing methods for use with young children are limited in their contingency.
- Instead, remote stimulus presentation and experimental procedures are often non-contingent pre-recorded displays.
- This project was an initial attempt to connect participant's facial movements to stimulus presentation in a remote experimental design.
- Some participants enjoyed the game, but most did not turn their face in response to stimuli or encountered technical challenges.
- We suggest that future efforts use simple gestures, develop iteratively, and consider the technical limitations of home devices.

METHOD

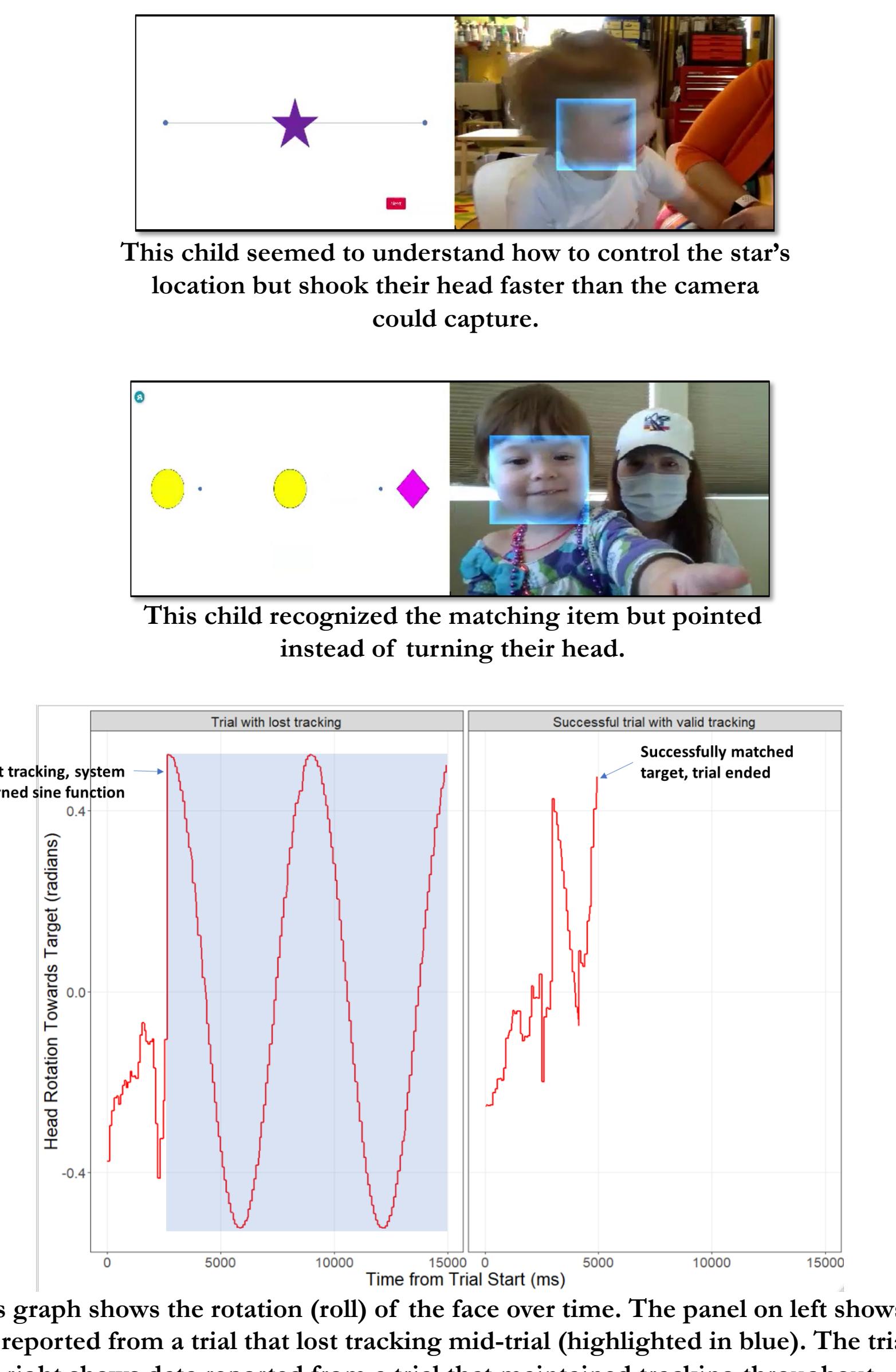
- We used the HandsFree.js (Ramos, 2021) face tracking package to link the location of an on-screen image to the angle of a participant's face.
- By turning their face, participants could control the location of an image.
- We asked participants to use this ability to match a series of colored shapes.
- We delivered our task on the Gorilla platform (Anwyl-Irvine, Massonié, Flitton, Kirkham, & Evershed, 2020).
- Half of participants received live instruction over Zoom, and half received a fully automated version of the task.
- **Participants:** 34 children (23 F, 11 M) ages 1-4 years (1.0-4.8, $M_{age} = 2.95$ years).



As this child turns their face to their left, the center object moves to the left. The left side of these images displays the user's screen, and the right side displays the webcam footage we recorded during testing. The blue box overlaid on the webcam footage indicates the face tracked by the HandsFree.js implementation.

CHALLENGES IN DEVELOPMENT

1. Many children did not turn their face in response to stimuli, despite training trials and demonstrations.
2. Other children moved their face with enthusiasm – faster than we could track.
3. Some children used other methods to indicate the matching item (pointing, speaking).
4. Technical limitations:
 - Slower computers tracked less consistently than higher-end computers.
 - In a few instances, stimuli display was delayed by slow internet speeds.
 - When no face was detected, the face tracking model returned a sinusoidal function. This must be removed from the data to accurately track performance.



This graph shows the rotation (roll) of the face over time. The panel on left shows data reported from a trial that lost tracking mid-trial (highlighted in blue). The trial at right shows data reported from a trial that maintained tracking throughout.

RECOMMENDATIONS

In future efforts we recommend that researchers:

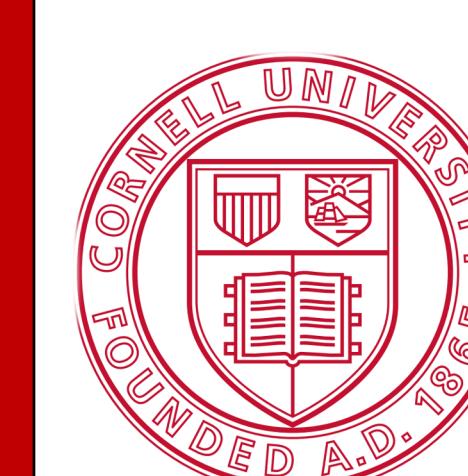
1. **Test designs on high- and low-end devices.** Computer capabilities varied dramatically across participants and affected performance.
2. **Test with participants throughout development.** This may accelerate the process of identifying challenges and opportunities.
3. **Test across the intended age range.** Interactions that appear intuitive or obvious to older children or adults may not appear so to young children.

REFERENCES

- Ramos, O. (2021.). Handsfree.js. Retrieved 2021, from <https://handsfree.js.org/>
Anwyl-Irvine, A.L., Massonié J., Flitton, A., Kirkham, N.Z., Evershed, J.K. (2019). Gorilla in our midst: an online behavioural experiment builder. Behavior Research Methods. doi: <https://doi.org/10.3758/s13428-019-01237-x>

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