

An early childhood vigilance test of attention in preschool-age Ugandan children perinatally exposed to HIV

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BACKGROUND

- Over 1.2 million Ugandan children are uninfected but at risk from compromised caregiving due to HIV disease burden.
- HIV infection in mothers can disrupt neurocognitive and behavioral development through pro-inflammatory effects gestationally, ARV effects pre- and post-natally during critical periods of brain development, and disruptions to caregiving from maternal illness.
- We have previously demonstrated that attention and impulsivity are related to memory and learning measures in school-age Ugandan children perinatally exposed to HIV.

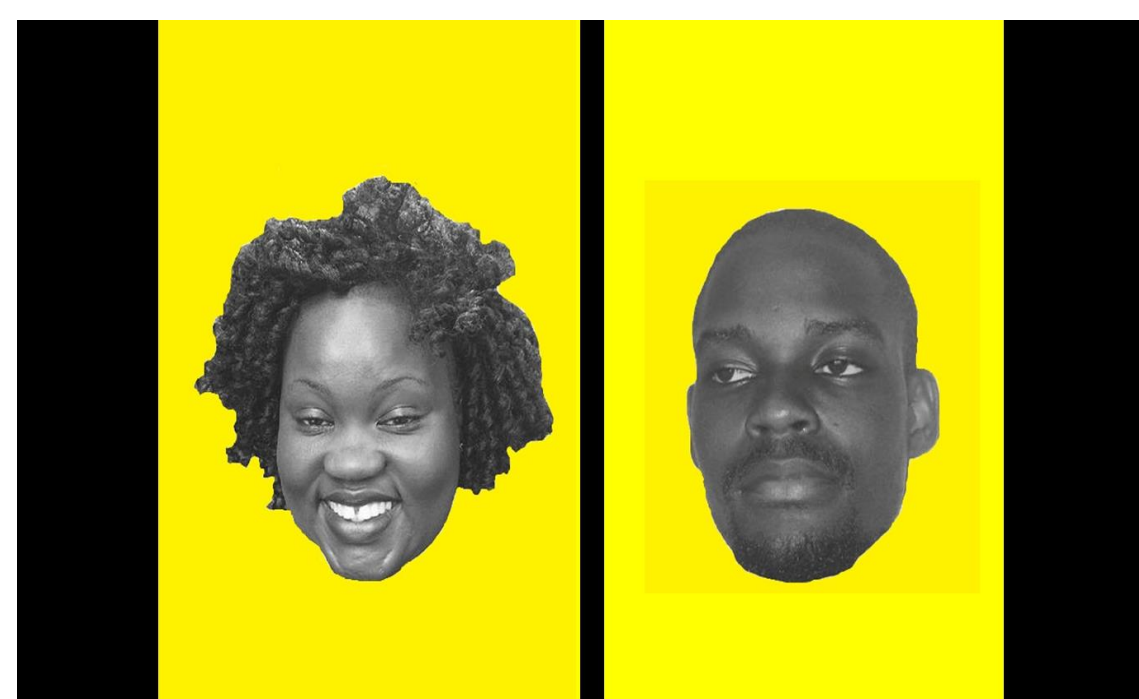
Figure 1: Map of Uganda, Study Site: Tororo, Uganda



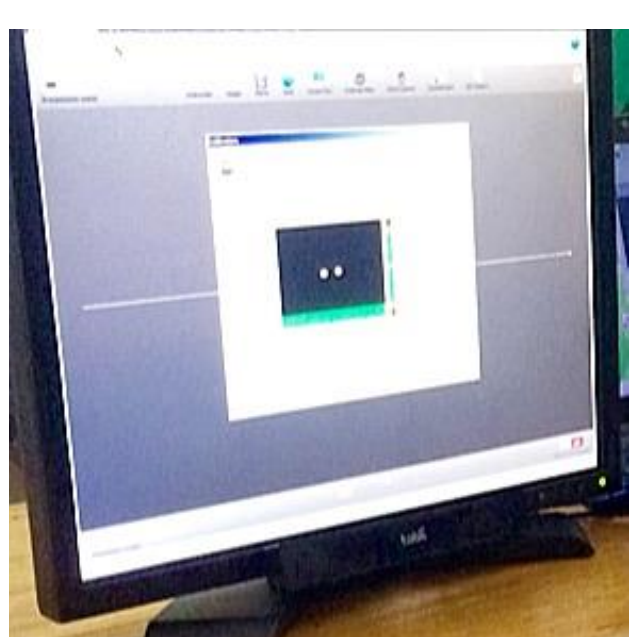
PURPOSE

- The Fagan Test of Infant Intelligence (FTII) uses gaze length to familiar and unfamiliar human faces to gauge working memory in infants.
- Our modified FTII uses an automated eye-tracking instrument to measure infant gaze length.
- This pilot study was conducted to validate the use of new eye-tracking technology in this field of research.

Two faces are shown to the infant to measure **Novelty Preference**: preference for the unfamiliar

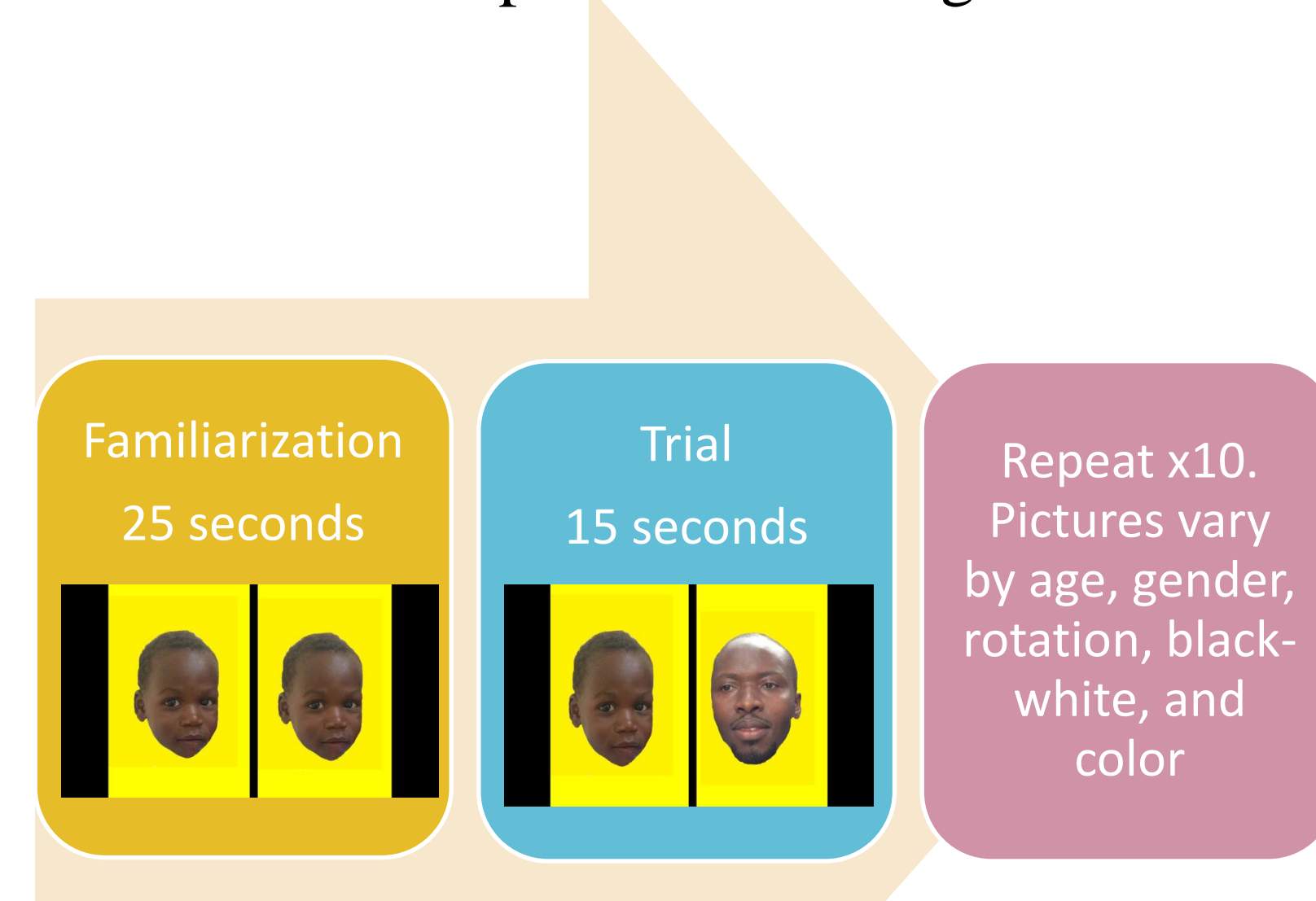


Accurate pupil detection using eye-tracking technology



METHODS

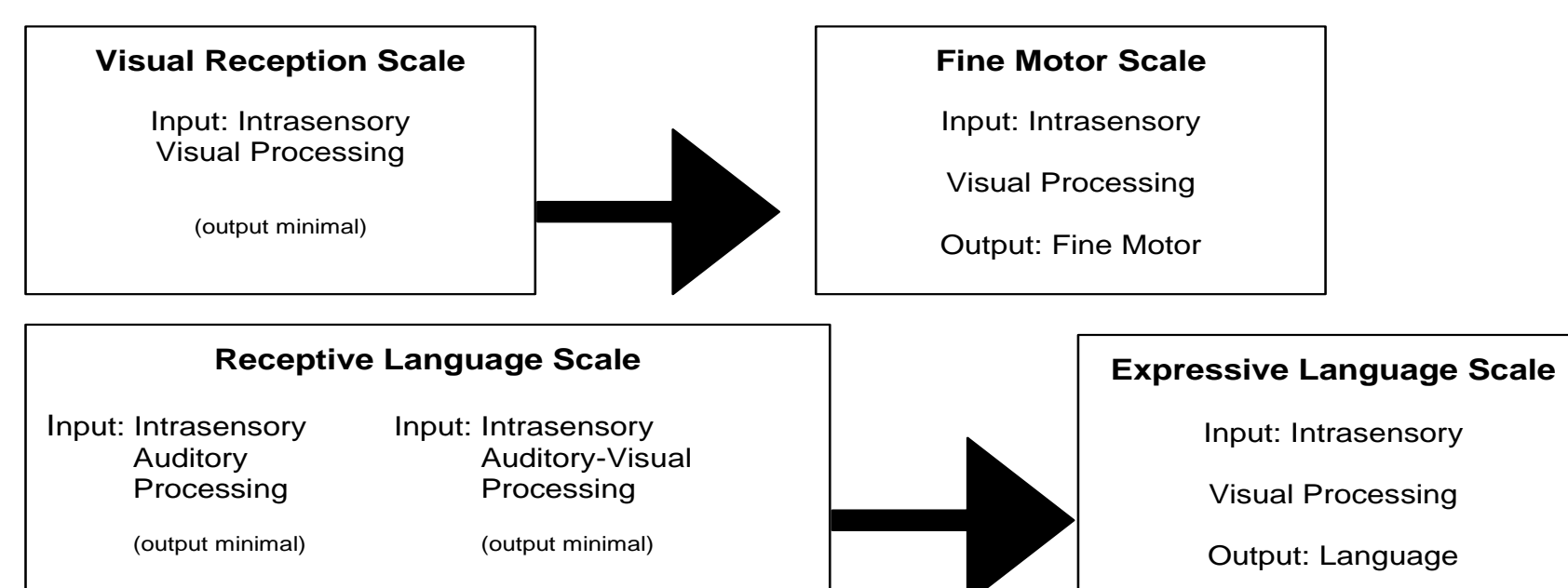
- The modified FTII was administered to 31 non-infected Ugandan infants perinatally exposed to HIV, 6-12 months of age (11 boys; $M=0.69$ yrs, $SD=0.14$; 20 girls; $M=0.79$, $SD=0.15$).
- 10 series of faces are presented in a repeated pattern for a fixed presentation length.



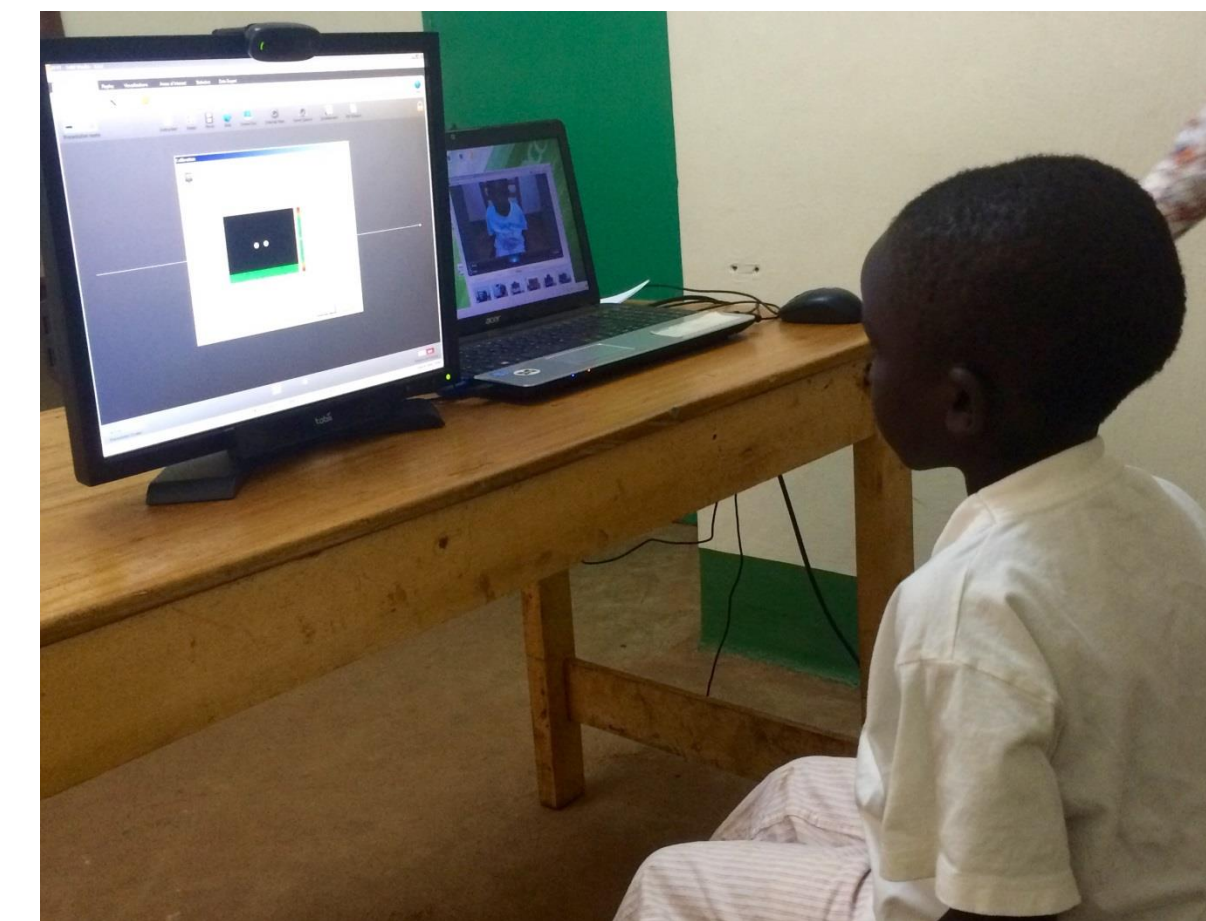
- Tobii X2-30 infrared camera programmed for pupil detection of gaze direction and duration.



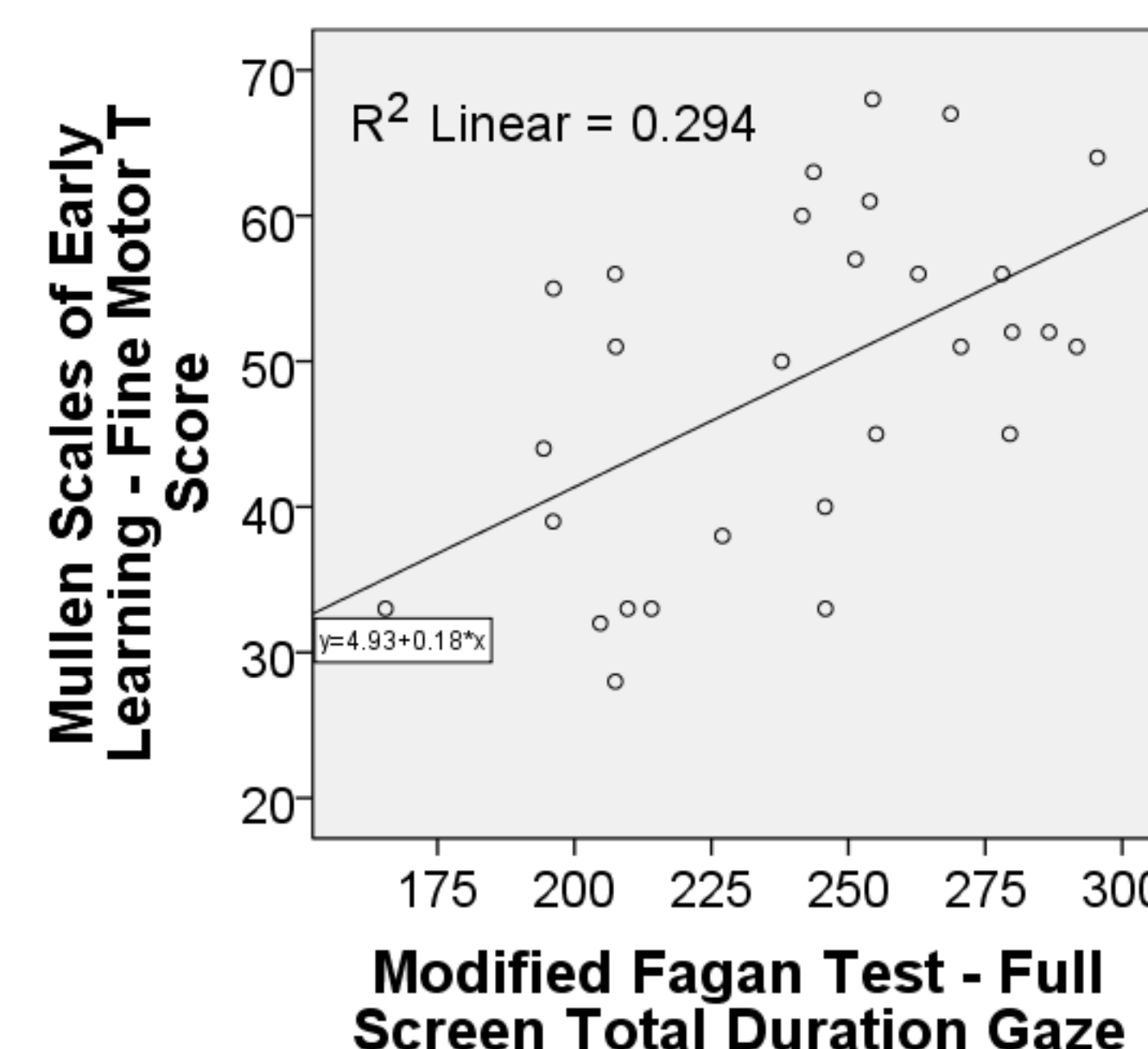
- Modified Fagan results were correlated with performance on the Mullen Scales of Early Learning (MSEL) time, which provides a composite measure of fluid intelligence.



RESULTS



- Infants spent significantly more time gazing at the novel picture than familiar over 10 novelty preference trials ($t=9.17$, $P<0.001$).
- Boys tended to look at the faces longer than girls ($t=1.98$, $P=0.06$). The MSEL was correlated with overall time spent looking at the video ($r=0.52$, $P=0.004$).
- The MSEL Fine Motor scale, which measures visuospatial working memory requiring a motor response, was correlated with
 - gaze length at novel faces ($r=0.40$, $P=0.03$),
 - gaze length at familiar faces ($r=0.38$, $P=0.04$), and
 - overall gaze length during the video ($r=0.54$, $P=0.002$).



CONCLUSIONS

- Our modified Fagan test for Uganda resulted in a sensitive working memory measure predictive of overall child development.
- Use of eye scanning technology in infants can provide an accurate neurocognitive outcomes for evaluating risk and resilience in low-resource settings for at-risk children.

IMPLICATIONS

These findings suggest that eye tracking technology can improve the sensitivity, validity and reliability of neurocognitive measures in infants in low-resource settings (novelty preference and gaze length measured by eye tracking).

Special thanks to:

- The MSU Global Innovation Scholars Program
- MISC Research Team in Tororo, Uganda.
- Michigan State University College of Human Medicine Global Outreach Program

This research was funded by: NIH RO1 HD070723 (PIs: Boivin, Bass)
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