Ugandan infant eye-tracking test of human-face memory predicts pre-school neurocognition

0412

Michael J. Boivin[1], Itziar Familiar-Lopez[1], Alla Sikorskii[1], Jonathan Weiss[2], Ronak Chhaya[2], Victoria Seffrens[3], Kwabena Nkansah-Amankra[2], Aatirah Holmes[2], Ethan Godwills Arima[4], Ojuka Julius Caesar[4], Noeline Nakasujja[5]

[1]Global Neuropsychiatry Program, Michigan State University; [2]College of Human Medicine, Michigan State University; [3]School of Public Health, University of Michigan; [4]Global Health Uganda, Kampala, Uganda; [5]Department of Psychiatry, Makerere University, Uganda

BACKGROUND

- Neurodevelopmental assessments in early childhood followed by neurocognitive assessments during the preschool-age years are sometimes used to monitor HIV-affected children in resource-constrained settings.
- Using an automated neurocognitive performance test at one-year of age, we evaluated its predictive validity with neuropsychological performance on validated preschool measures several years later.

METHODS

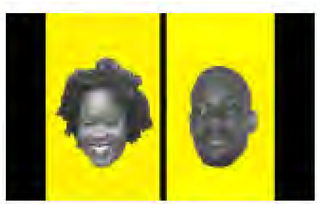
- 58 uninfected children (25 boys, 33 girls) of mothers with HIV were evaluated at one year of age with the Mullen Scales of Early Learning (MSEL) and the Fagan Test of Infant Intelligence (FTII), modified for use of local faces.
- FTII tests recognition for pictures of local adult and children faces.
- Tobii eye tracking instrumentation was used to automatically measure gaze direction and duration during successive trials where familiar (previously presented) and novel faces were presented together, with longer gaze to novel faces expected.
- Total screen viewing duration (either novel or familiar face) was used as a measure of attention.
- Most of these children were tested several years later with the Kaufman Assessment Battery for Children, 2nd Edition (KABC-2) and the visual computerized Tests of Variables of Attention (TOVA).
- Evaluation took place at the Tororo District Hospital in eastern Uganda, an impoverished area.

An eye-tracking based measure of infant attention and working memory (for human faces) can predict aspects of neurocognitive performance several years later in HIV-affected children.

RESULTS

- FTII proportion of time viewing novel (vs. familiar) faces was significantly related to overall KABC-2 performance (eta^2=0.07),
- FTII was especially related to KABC auditory working memory (KABC Number Recall; p<0.05).
- FTII proportional preference for novel faces was significantly related to TOVA percent omission errors (vigilance attention).
- FTII overall attention was related to KABC-2 Hand Movements (eta^2=0.11), Rebus (symbol coding learning eta^2=0.13) and TOVA D prime (signal detection; eta^2=0.06).
- MSEL and FTII performance were not significantly related to one another, suggesting they measure different things.
- MSEL cognitive ability did predict several TOVA performance measures for signal detection and attention.

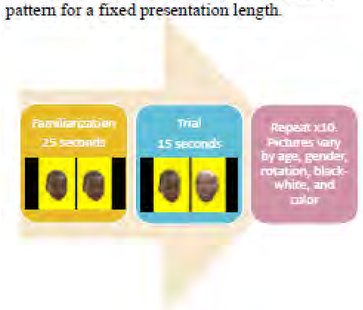
Two faces are shown to the infant to measure **Novelty Preference**: preference for the unfamiliar





Accurate pupil detection using eye-tracking technology

- 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.





Kaufman Assessment Battery for Children (KABC-II)



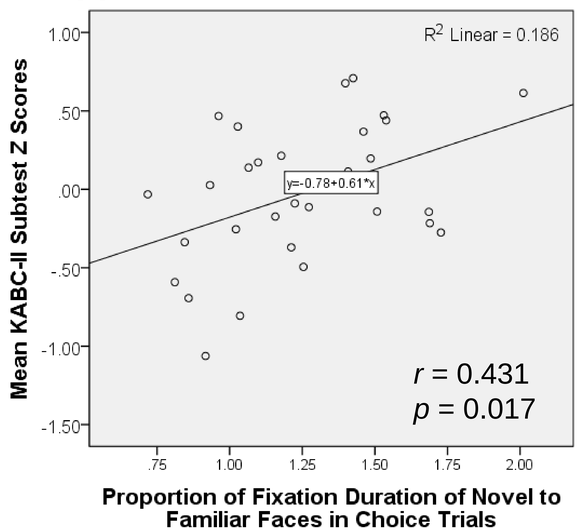
Test of Variables of Attention (TOVA)
Target NonTarget

CONCLUSIONS

- An eye-tracking based measure of infant measure of attention and working memory (human faces) can predict aspects of neurocognitive performance several years later.

IMPLICATIONS

- ***Gathering test results automatically, eye-tracking based cognitive assessments in infants can be beneficial in evaluating neurocognitive risk in HIV-infected and affected children; gauging benefits from early treatment and supportive care.***



Funding Source: This research was supported by NIH grant RO1 HD070723 and HD070723S1 (PIs: Boivin, Bass). Michigan State University Departments of Psychiatry and Neurology and Ophthalmology funding support for Drs. Michael Boivin and Itziar Familiar-Lopez

Email: boivin@msu.edu http://globalneuropsychiatry.msu.edu/