# Display Enhanced Testing for Concussion and mTBI (DETECT)

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The DETECT system is a portable, efficient diagnostic tool that creates an immersive environment for neuropsychological testing to determine the presence and severity of concussions. Possible applications include:

- Sideline assessment of sports-related injury
- Emergency room diagnostics
- Battlefield evaluation
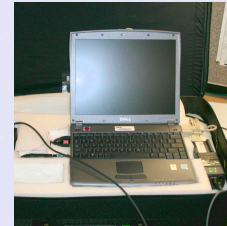
DETECT Hardware

Computer
A Dell Latitude X200 is used to run the software.

Head-mounted Display
I-O Display Systems i-glasses SVGA is used to display the software. A visor is positioned around the HMD frame to block out external light.

Earmuffs
Bose® Aviation Headset X active noise reduction (ANR) earmuffs are used to play the audio instructions while blocking out external noise.

Input Device
Two Jelly Bean® switches were connected to an X-keys USB Switch Interface and programmed to respond as a yes or no button.

Neuropsychological Tests

**Simple & Complex Choice Reaction Time.**

Users respond to a stimulus with 1 to 3 characteristics: shape, color, and internal line orientation. Correctness and mean reaction time are recorded.

Selective Reminding Memory Test

bear
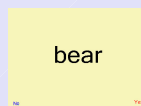
Users are asked to remember a group of 12 words. They are then shown 24 words and asked to respond when one from the original list is recognized.

N-Back Working Memory Test
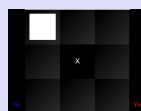
Users respond to a flashing white square on a 3x3 grid. On the 1-Back test, users respond when the square flashes in the same position it did one flash earlier. On the 2-Back test, users respond when the square flashes in the position it did two flashes earlier.

Usability Study

Hypothesis

The virtual display and noise reduction technology used in the DETECT system will create a non-distracting, immersive environment for neuropsychological test administration.

Method

42 uninjured Georgia Tech undergraduates participated in the study. They completed the test twice, once in a lab without additional noise and once in the lab with simulated noise. Two sets of data were used, and the study was counterbalanced to avoid ordering effects. Responses and reaction time were recorded. After the tests, participants completed a post-task questionnaire to assess the effectiveness and comfort of the hardware components.

Results

The findings show the environments did not contribute to significant differences in test scores or reaction times.

Comparison of test performance (% correct)

Comparison of response times (milliseconds)
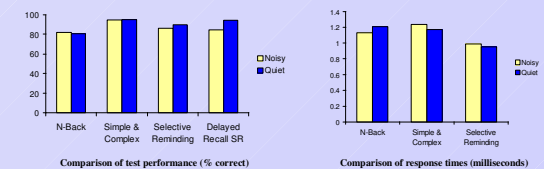
The post-task questionnaire showed the system blocked out audio and visual distractions, the HMD and earmuffs were comfortable to wear, and the input buttons were easy to use.