

A Militarily Relevant Virtual Reality Assessment Captures Individual Differences in Attention and Executive Function

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Background

- Over 533,000 mild traumatic brain injuries (mTBI) occurred among U.S. Armed Forces personnel between 2000-2025.
- Current neurocognitive assessments are difficult to administer in operational environments.
- Virtual reality may provide an objective, portable alternative for cognitive assessment.
- **Objective:** Determine whether performance during a VR Shoot/No Shoot (SNS) task reflected established measures of attention and executive function

Methods

Participants

- 100 participants (ages 18-60)

Virtual Reality Military Operational Neuropsychological Assessment (VRMONA)

- Participants completed four immersive VR tasks designed to assess operationally relevant cognitive performance
- SNS Metrics included:
 - Overall Accuracy
 - Hit rate
 - Commission error rate
 - Mean reaction time
 - Post-reversal accuracy



Neurocognitive Measures

- Standardized cognitive battery included:
 - Psychomotor Vigilance Task (PVT): sustained attention
 - Wisconsin Card Sorting Test (WCST): executive function

Data Analysis

- Spearman correlations assessed relationship between VR performance metrics and neuropsychological outcomes.
- False discovery rate (FDR) correction applied for multiple comparisons

Results

Figure 1

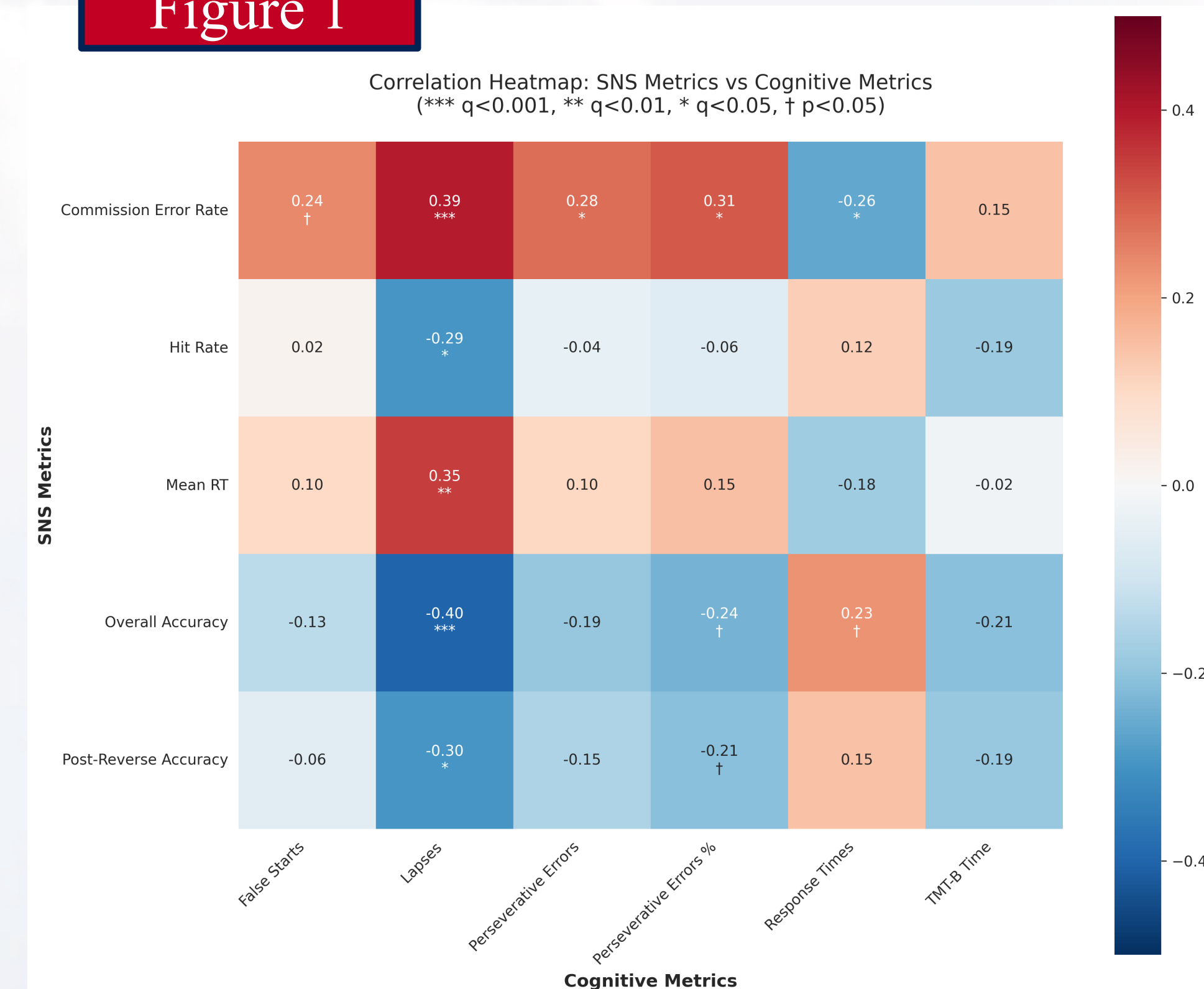


Figure 1 shows a correlation heatmap of VRMONA Shoot/No Shoot Metrics and Neuropsychological Outcomes. Color intensity represents correlation strength (blue = negative correlation, red = positive correlation).

Figure 2

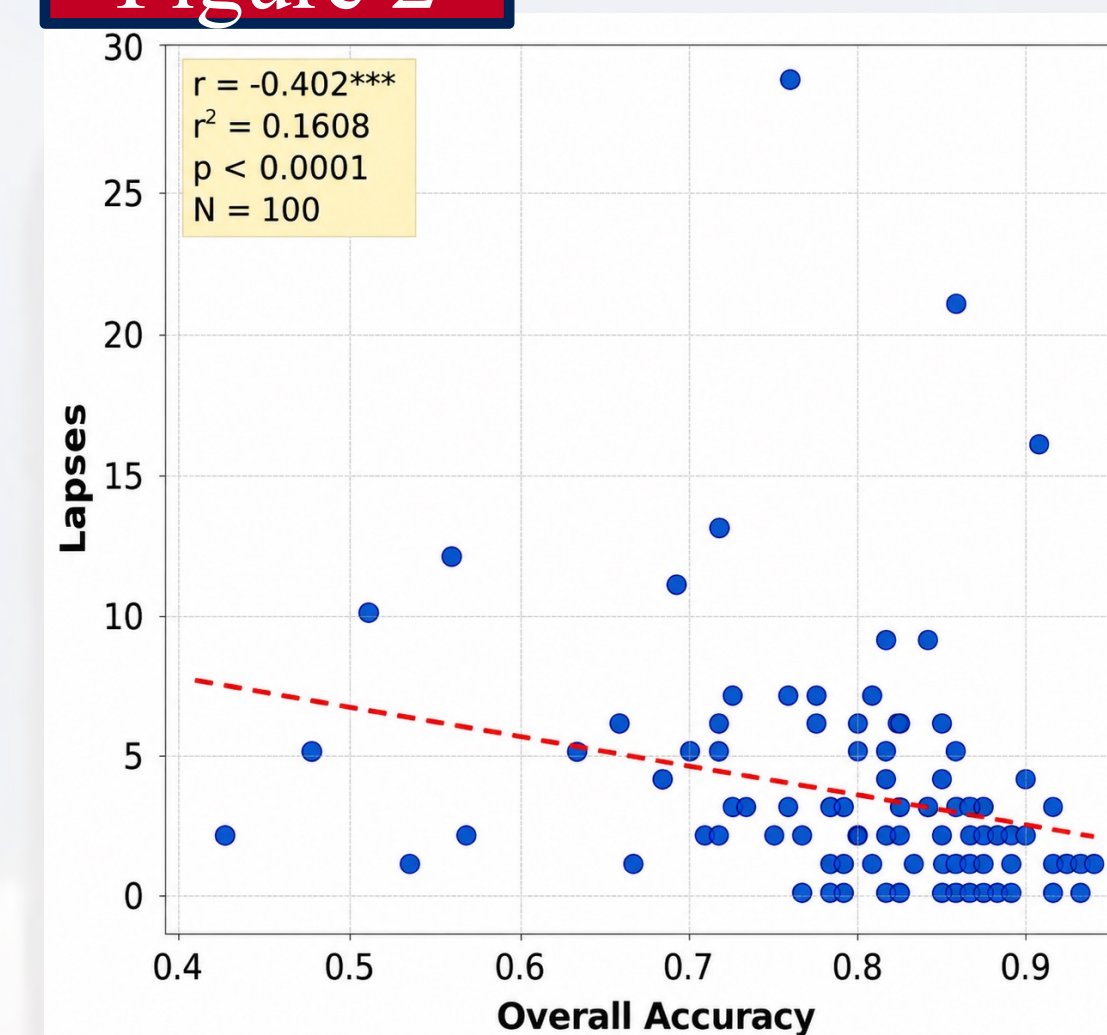
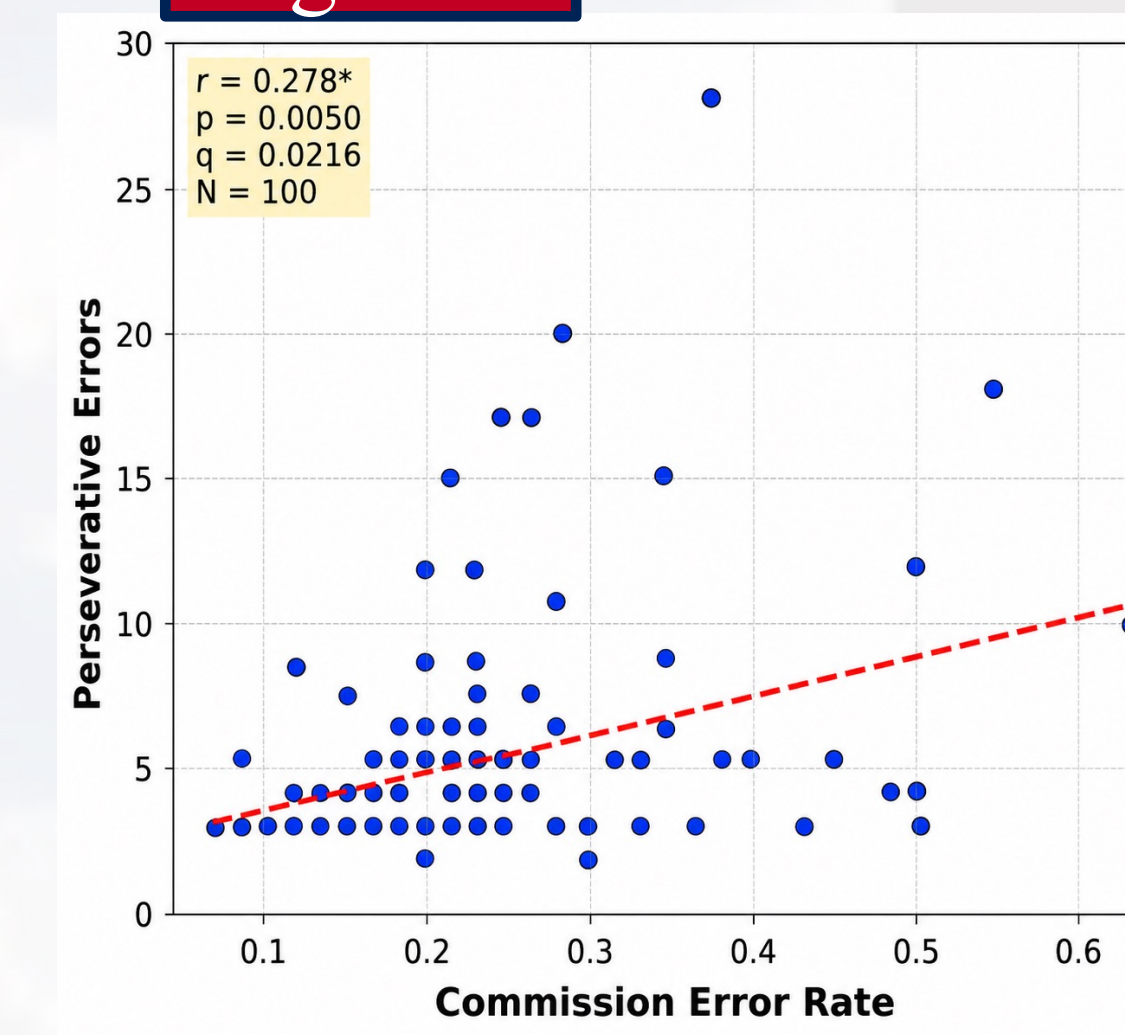


Figure 3



- Figure 2 shows a negative association between overall accuracy on the SNS task and the PVT lapses (Spearman $\rho = -.40$, $q < 0.001$).
- Figure 3 shows a positive association between the SNS commission error rate and the WCST perseverative errors (Spearman $\rho = 0.28$, $q = 0.022$).

Conclusions

- VR-derived SNS performance demonstrated significant associations with validated measures of sustained attention and executive function.
- Overall accuracy and commission error rate demonstrated the strongest associations with established measures of attention and executive function, indicating that these behavioral metrics may be particularly sensitive to individual differences in neurocognitive performance.
- The observed relationships suggest task accuracy and response inhibition within a militarily relevant VR environment reflect cognitive processes measured by conventional neuropsychological assessments.
- These findings provide preliminary evidence that VRMONA can capture individual differences in cognitive performance using objective, continuous behavioral measures.