

Validation of a Novel Computerized Test Battery for Automated Testing

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BACKGROUND

- Although standard neuropsychological tests have a strong clinical and research foundation, they are resource-intensive and use outdated paper-and-pencil methods.
- Computerized tasks offer an avenue for automated testing and enhanced sensitivity to neurocognitive changes, provided they assess the same constructs as standard neuropsychological tests.
- The present study assessed the validity of a battery of novel computerized tasks, which measured speeded information processing, attention, executive functioning, and memory, against a "gold standard" neuropsychological battery in a healthy aging sample.

MATERIALS AND METHODS

- Administered the computerized and neuropsychological batteries to 134 healthy adults (57 males; mean age: 47 [SD: 25; range 18-90]; mean education: 15.8 years [SD: 2.9]) in counterbalanced fashion.

Computer Tasks

Task Name	Variables of Interest	Type
<i>CogState (Maruff et al., 2009) - Detection</i>	reaction time (ms); accuracy	speeded processing
<i>CogState - Identification</i>	reaction time (ms); accuracy	speeded processing
<i>CogState - One Card Learning</i>	reaction time (ms); accuracy	memory
<i>CogState - One Back</i>	reaction time (ms); accuracy	working memory
<i>Cambridge Brain Sciences (CBS; Hampshire et al., 2012) - Spatial Rotation</i>	overall score; reaction time (ms)	fluid reasoning
<i>CBS - Odd One Out</i>	overall score; reaction time (ms)	fluid reasoning
<i>CBS - Hampshire Tree Task</i>	overall score; reaction time (ms)	visuospatial planning
<i>CBS - Switching Stroop</i>	reaction time; accuracy for 3 congruency conditions (congruent, incongruent, double incongruent); cost of switching reaction time and accuracy	speeded processing; inhibition
<i>CBS - Self-Ordered Search</i>	max correct; reaction time (ms)	visuospatial working memory
<i>Face Name test (Troyer et al., 2012)</i>	item memory; associative memory	memory

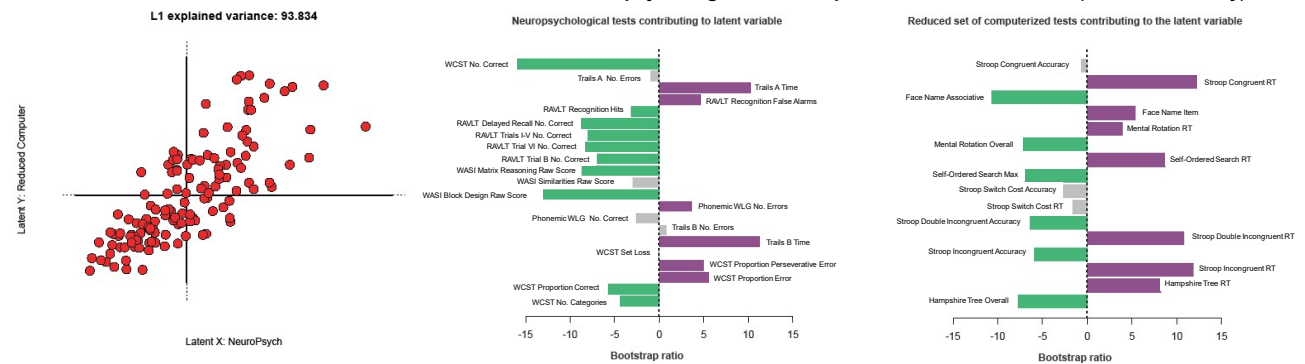
Neuropsychological Tasks – 2-3 hr

- Standard neuropsychological battery included: Wechsler Abbreviated Scale of Intelligence (WASI), Rey Auditory Verbal Learning Test (RAVLT), Wisconsin Card Sorting Test (WCST), Trail Making Test, A and B (TMT A and B), Symbol Digit Modalities Test (SDMT), Phonemic Word List Generation (WLG), and Semantic WLG

RESULTS

- Partial Least Squares – Correlation and Regression (PLS-C and PLS-R; Krishnan et al., 2011) is a multivariate technique that was used to assess the co-variance between standard neuropsychological and computerized batteries.

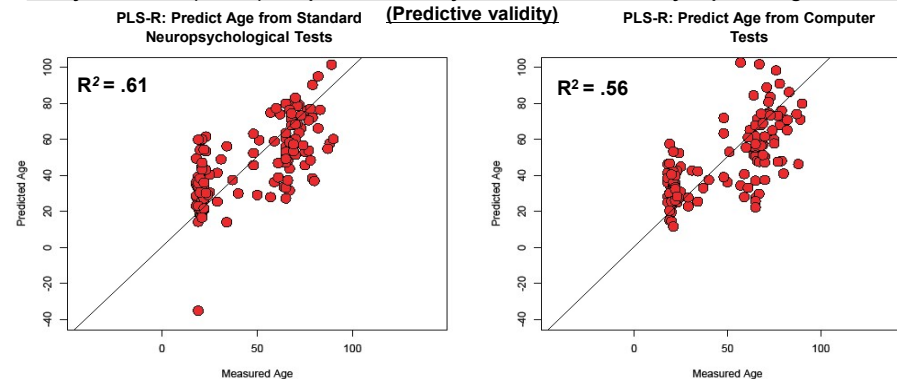
Identification of shared variance between standard neuropsychological and computerized tests with PLS-C (construct validity)



- One significant latent variable accounted for 94% ($p < 0.001$) of cross-block co-variance.
- A similar latent variable emerged after accounting for variance due to age.

- The computerized battery could not account for significant variance in verbal tests (WASI Vocab, Similarities; WLG).
- Based on time of administration and theoretical usefulness, a reduced (30 min) battery of computerized tests was selected; these tests accounted for 61% of the variance in the neuropsychological battery.

Ability of reduced (30 min) computerized battery vs. standardized battery to predict age with PLS-R



SUMMARY AND DISCUSSION

- A 30-min battery of computerized measures of attention, memory, and executive functioning was comparable to the standard 2-3 hour neuropsychological battery (with the exception of verbal capacities that were not assessed in a computerized format).
- The reduced computerized battery was able to predict age to a similar degree to the neuropsychological battery.
- The computerized battery may be useful in large-scale testing (cohort or epidemiological studies) or as a screening tool.
- We are currently using the battery in patients with brain disease to determine any diagnostic ability.

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