THE RELATIONSHIP BETWEEN N-BACK MEASURES OF WORKING MEMORY AND NEUROPSYCHOLOGICAL TESTS OF COGNITIVE FUNCTIONING

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INTRODUCTION

Working memory refers to the type of memory involved in temporary maintenance as well as manipulation of information required for an ongoing cognitive task. Recognized tests used to measure the capacity for working memory include the Digit and Spatial Span Backward, Subtests of the Weschler Memory Test; the Paced Auditory Serial Addition Task; and Symbol Digit Modalities Test. However, a disadvantage of many of these tests is their inability to be used in conjunction with physiological procedures such as Event-Related Brain Potentials or fMRI. The N-back task, a sequential memory task that is thought to measure working memory, has been used with physiological measures of brain function. An advantage of the N-back task is that it allows for the parsing of simple and complex forms of processing speed and working memory performance. A recent study (Miller et al., 2009) questioned the utility of the N-back as a measure of working memory. In the present study, we compared several N-back behavioral measures (accuracy, reaction time, and standard deviation of reaction time) with data obtained from a battery of classical neuropsychological tests thought to measure processing speed and memory. We hypothesized that these neuropsychological tests would be related to specific behavioral N-back measures.

RESULTS

N-back

Accuracy & Standard Deviation of Reaction Time

<table>
<thead>
<tr>
<th>N-back</th>
<th>Accuracy</th>
<th>Standard Deviation of Reaction Time</th>
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</thead>
<tbody>
<tr>
<td>1-back</td>
<td>0.345</td>
<td>0.06</td>
</tr>
<tr>
<td>2-back</td>
<td>0.475</td>
<td>0.09</td>
</tr>
<tr>
<td>3-back</td>
<td>0.652</td>
<td>0.14</td>
</tr>
</tbody>
</table>

Participants:

44 healthy volunteers (39 females, 5 males) participated. Mean age of 44±10.4 and 15.3±1.8 years of formal education. Volunteers were screened prior to testing and were excluded if they had head trauma, hearing problems, learning disorders, psychiatric conditions, neurological conditions, or any other major medical conditions.

SUMMARY & CONCLUSIONS

- Measures of the N-back task were predicted by neuropsychological measures of attention and working memory, including the PASAT, SDMT, Trail Making Test, Spatial Span Backward, and Stroop Test.
  - These findings are in contrast to the Miller et al. paper in which the measures of working memory and processing speed used (Stroop, Trail Making Test A, and Digit Span) were not found to be associated with N-back measures.
  - The PASAT, a measure often used to assess working memory and processing speed in clinical populations, was predictive of N-back performance, reaction time, and standard deviation of reaction time across most conditions. In particular, it was strongly associated with standard deviation of reaction time across all N-back conditions.
  - The SDMT, which is also a test used in clinical populations, was predictive only during the 2-back condition (highest working memory load) for reaction time and standard deviation of reaction time.
  - We conclude that the N-back task is a useful test of information processing speed and working memory with both experimental and potential clinical utility.

ACKNOWLEDGEMENTS

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REFERENCES