Let the Games Begin: Attention Training Following Brain Injury
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Abstract
Attention Process Training-3 (APT-3) and Lumosity™ brain games are computer-based treatments for attention problems. The researchers performed a single subject, ABACA alternating treatment design across 4 adults with severe acquired brain injury (ABI) to determine whether improved performance on attention intervention programs generalized to comparable, untrained tasks and to ecologically-plausible attention tasks included as part of a standardized assessment. Individual growth curve analyses showed participants made significant improvements in progressing through both interventions. However, visual inspection of graphic displays, computation of trend lines, and comparison of trend line slopes with a slope of 0 using data from weekly probe measures and post-test evaluations revealed that generalization to untrained attention tasks was minimal.

Purpose
To determine whether improved performance on computer-based, attention intervention programs by adults with severe ABI generalized to comparable untrained tasks.

Method
Participants
4 adult, male survivors of severe ABI: ND, MF, JW, & JR
- Persistent and severe attention deficits
- Between 3 and 35 years post-injury
- WAB-R scores indicated no aphasia

Procedures
Pre-testing
- Probe measure
- Test of Everyday Attention (TEA)
Intervention phases used APT-3 and Lumosity
- 5 sessions per week for 4 weeks
- Sessions lasted ~30 minutes
- Treatment order systematically alternated across participants
- Weekly probe measure
Post-testing occurred at end of each treatment phase
- Probe measure
- TEA

APT-3 progression
Results
All trend line slopes for all participants differed significantly from a line with a slope of 0.00. Thus, participants progressed to more challenging levels throughout the course of Intervention.

Lumosity progression
Trend line slopes for all participants differed significantly from a line with a slope of 0.00 for 4/5 game activities. For Rotation Matrix, only ND’s trend line corresponded with a significant improvement.

Probe measures
Weekly measurement of accuracy and speed for 4 tasks:
1. Cancelling X’s in rows
2. Counting number of X’s in rows
3. Summing digits in rows
4. Simultaneous cancelling X’s and summing digits in rows
No participants had significant performance speed differences on any probe tasks across administrations
Minimal performance accuracy changes occurred on probe tasks across administrations (See Table)

No significant change
Trend approaching significant improvement
Significant improvement

TEA scaled and adjusted scaled scores

<table>
<thead>
<tr>
<th>Participant</th>
<th>1 minute</th>
<th>2 minutes</th>
<th>Auditory distraction</th>
<th>Auditory reversal</th>
<th>Auditory distortion</th>
<th>White counting</th>
<th>Colour counting</th>
<th>Lottery</th>
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<tr>
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<td>3</td>
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1 scaled score: M = 10 (SD = 3); 2 adjusted scaled score M = 10 (SD = 3)
*increase from baseline performance ; • decrease from baseline performance

Discussion
One of four study participants appeared to generalize improved attention performance following computer-based interventions to similar, yet novel, attention tasks; no such generalization was evident for the remaining three participants. Hence, computer-based remediation activities provided in programs such as APT-3 and Lumosity brain games may improve the skills of adults with chronic and severe attention deficits within the context of the intervention programs themselves; however, the likelihood of improvements generalizing to other attention tasks is variable. More positive outcomes may occur for individuals who receive longer or more intense treatment or who have more recent injuries than those of the participants targeted in this research.