Factors Contributing to Word Forming and Tiles Moved in Normal and Traumatic Brain Injury Subjects
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Introduction
• People with Traumatic Brain Injury (TBI) often suffer motor and/or cognitive loss.
• Small force-feedback technology (haptics) can be used for simulations to measure motor and cognitive skills.
• We used previously collected data of normal and subjects with TBI that have completed the training module and a word-forming task.
• We hypothesized that there is a positive correlation between training rank (average time spent per phase) and performance in word-forming in normal and TBI patients.

Methods
1. Multiple sets of data previously collected with an IRB approved protocol were analyzed for the purpose of this project.
2. We oriented subjects to the device which moved the cursor in a 3-D virtual environment and provided them with a training module consisting of 6 phases (Figure 2).
3. The haptic cursor tracks the trajectories of each subject’s movement and grabbing or releasing of objects in that space (Figure 2).
4. Training performance was determined by rank based on average time spent per phase in training and compared to their performance on word-forming task (Figure 3).
5. When no significant correlation was found through analysis for either TBI or controls (Figure 4, 5), a Spearman correlation was done for controls who completed five training modules.
6. Normals were ranked based on word forming low (0-3 words) or high (4-13 words) performance and correlated with tiles moved and tiles/word (Table 1).

Results

<table>
<thead>
<tr>
<th>Words Formed</th>
<th>0-3 (Low Performers)</th>
<th>4-13 (High Performers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tiles Moved</td>
<td>p value 0.6597 r value 0.0995</td>
<td>p value 2.67e-08 r value 0.7624</td>
</tr>
<tr>
<td>Tiles/Word</td>
<td>2.29e-05 -0.7749</td>
<td>0.023 -0.368</td>
</tr>
</tbody>
</table>

Discussion
• No significant correlation was found between training rank and word-forming performance in subjects with TBI or normals.
• Subjects’ performance on the training does not correlate with word forming. May be due to the 3-D motor manipulation not needed to perform at the cognitively driven word-forming task.
• For low performers (Table 1), a negative correlation between words formed and tiles/word could mean that there are issues of cognition, but motor difficulty may be attributed to fewer words formed and a higher ratio of tiles/word.
• For high performers (Table 1), a positive correlation between words formed and tiles moved means that as subjects formed more word, they used more tiles. However, the ratio of tiles/word did not change.

Conclusion
The null hypothesis was proven since no significant correlation was found between the average time spent per phase in training and number of words formed or number of tiles moved (p >0.8, r <0.1). Normal subjects who were low performers demonstrated a significant correlation between performance and tiles/word (p <0.005, r = -0.77) and high performers demonstrated a significant correlation between performance and tiles moved (p <0.005, r = 0.76).

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References