Conscious Processing and Cortico-cortical Functional Connectivity in Golf Putting

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Introduction

The Theory of Reinvestment[1,2]
Automated motor processes are disrupted when task-relevant declarative knowledge is used to consciously control movements.

<table>
<thead>
<tr>
<th>Group</th>
<th>Expert</th>
<th>Novice</th>
<th>F(1, 18)</th>
<th>p</th>
<th>η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>T7-Fz ISPC</td>
<td>M (SD)</td>
<td>0.39 (0.04)</td>
<td>0.48 (0.04)</td>
<td>3.89</td>
<td>.06</td>
</tr>
<tr>
<td>T8-Fz ISPC</td>
<td>0.48 (0.05)</td>
<td>0.51 (0.05)</td>
<td>0.15</td>
<td>.70</td>
<td>.01</td>
</tr>
</tbody>
</table>

Consc. Proc. 2.80 (0.93) 3.50 (0.77) 3.55 0.07 .165

Table 1. Mean (standard deviation) of the left temporal (T7) / right temporal (T8) to frontal (Fz) high alpha (10-12 Hz) Inter Site Phase Clustering (ISPC) and Conscious Processing in experts and novices. Results of repeated-measure ANOVAs are reported.

Methods

Participants:
- Handicap Experience yrs. M M
- Experts (N = 10) 1.50 11.25
- Novices (N = 10) no formal handicap 1.85

Design:
- Between subjects
- Within subjects

Task: Golf putting

120 puts

Measures:
- Conscious Processing
  - Putting Reinvestment scale
  - Functional Connectivity
    Inter Site Phase Clustering ISPC(f) = ∑ e^{i2πf(t)}
    - no functional connectivity
    - perfect functional connectivity

Results

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Holed</th>
<th>Missed</th>
<th>F(1, 18)</th>
<th>p</th>
<th>η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>T7-Fz ISPC</td>
<td>0.40 (0.04)</td>
<td>0.46 (0.05)</td>
<td>5.71</td>
<td>.03</td>
<td>.241</td>
</tr>
<tr>
<td>T8-Fz ISPC</td>
<td>0.48 (0.05)</td>
<td>0.51 (0.06)</td>
<td>2.07</td>
<td>.17</td>
<td>.103</td>
</tr>
</tbody>
</table>

Table 2. Mean (standard deviation) of the left temporal (T7) / right temporal (T8) to frontal (Fz) high alpha (10-12 Hz) Inter Site Phase Clustering (ISPC) in holed and missed puts. Results of repeated-measure ANOVAs are reported.

Discussion

Future directions:
- Implicit motor learning
  A motor skill can be learned implicitly (i.e., with reduced movement-relevant declarative knowledge being generated).[1,2]
  Implicit learners display lower communication between left temporal and frontal areas and perform better compared to explicit learners.[3]
- Neurofeedback
  Individuals can be trained to alter selective features of their cortical activity during the acquisition of a motor skill.[4]
  Training individuals to reduce the communication between their left temporal and frontal cortical areas during motor learning could prevent the formation of movement-related declarative knowledge, promote implicit motor learning, and expedite the novice-expert transition.

References