Persistent modification of cognitive control through implicit attention training

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INTRODUCTION
An important aspect of cognitive control is to direct attention towards relevant information and away from distracting information. This attentional modulation is at the core of several influential frameworks, but its trainability and generalizability remain unclear. The goals of the present study were therefore to train subjects in attention modulation in the context of a conflict task and to test the trainability and cross-task generalizability of cognitive control. Subjects were trained to either direct attention towards a potentially distracting prime (prime-attended group) or divert attention away from this prime (prime-diverted group). Pre-tests were administered the day before training and generalization was measured directly after training (direct transfer task) and one day later (direct transfer task, close and far transfer tasks).

METHOD

Design

<table>
<thead>
<tr>
<th>Task type</th>
<th>Task</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training</td>
<td>Arrow priming with attentional manipulation: Prime-attended Prime-diverted</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct Transfer</td>
<td>Arrow priming</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Close Transfer</td>
<td>Number priming</td>
<td>x</td>
<td>x</td>
<td></td>
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<tr>
<td>Far Transfer</td>
<td>AX-CPT</td>
<td>x</td>
<td>x</td>
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</tbody>
</table>

Tasks

- Inducing trial (20%): • respond to prime (prime-attended group, N=20)
- * no go (prime-diverted group, N=23)

RESULTS

![Training task](image)

![Direct transfer task](image)

DISCUSSION
First, results showed that the attentional modulation induced during training was effective. A larger congruency effect (CE) on RTs was obtained for the prime-attended group than for the prime-diverted group. This indicates that the prime had a larger effect in the group that had to focus attention on the prime. Second, the training effect on RTs generalized to the direct transfer task. No between-group difference in CE was found on day 1 before training, but a larger CE was found for the prime-attended group than for the prime-diverted group, directly after training (day 2) and one day later (day 3). Importantly, this between-group difference emerged even though the direct transfer task was completely identical for both groups, demonstrating training effectiveness. Third, the training effect did not transfer to tasks that were more distantly related to the trained task. No between-group difference in CE was observed on the close transfer task, even though only the stimuli from this task differed from the trained task. No transfer effects were found on the far transfer task either. Together, this suggests that the acquired strategy to focus more versus less on the prime was restricted to the specific features used during the training phase and only transferred to tasks with these same features (i.e., stimuli and task goal; Abrahams et al., 2016; Egner, 2014).

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