**Implicit learning a sequence of body movements**

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**Introduction**

Typically, implicit sequence learning is tested with a visuo-motor serial reaction time task. Recently, implicit learning was also demonstrated for sequences of tasks, at least when they were correlated with an additional stream of information (Meier & Cock, 2010). Here, we investigated whether sequences of motions can also be learned.

**Method**

A total of 100 young adults participated in this study (Exp 1: N=22, Exp 2: N=40, Exp 3: N=19, Exp 4: N=19). They were seated and blindfolded in a chair that was mounted on a MOOG motion platform. They were instructed to discriminate up-down, left-right and front-back platform motions by pressing one of two response buttons with their left or right thumb according to a specific response mapping (i.e., left key for up, left, and front; right key for down, right, and back). Each motion lasted 500ms and displaced the participant by 2 cm. The motions were pre-tested in order to be clearly distinguishable. A fixed response to stimulus interval of 900 ms was used. Each Experiment was composed of 8 Blocks with 96 motions. To assess sequence learning a 12-element sequence was embedded in the motion axis, the required responses, or both.

**Experiment Structure**

<table>
<thead>
<tr>
<th>Block 1</th>
<th>Block 2</th>
<th>Block 3</th>
<th>Block 4</th>
<th>Block 5</th>
<th>Block 6</th>
<th>Block 7</th>
<th>Block 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice</td>
<td>Practice</td>
<td>Random</td>
<td>Random</td>
<td>Random</td>
<td>Random</td>
<td>Random</td>
<td>Random</td>
</tr>
</tbody>
</table>

Sequence learning assessed the difference between Block 7 and the surrounding Blocks 6 and 8.

**Experiment Overview**

- **Experiment 1:** Motion sequenced and motor response sequenced (correlated streams)
  - Motor Response | Trajectory
  - Up & down | Y & X
  - Right & left | Y & X
  - Front & back | Y & Z

- **Experiment 2:** Only motor response sequenced
  - Up & down | Y & X
  - Right & left | Y & X
  - Front & back | Y & Z

- **Experiment 3:** Only motion sequenced
  - Up & down | Y & X
  - Right & left | Y & X
  - Front & back | Y & Z

- **Experiment 4:** Correlated sequences - transfer to random motion
  - Up & down | Y & X
  - Right & left | Y & X
  - Front & back | Y & Z

**Results**

Accuracy was high (94.8%; SE=.005) and did not differ across blocks and experiments. Median RTs for each motion axis were averaged individually for each participant. Trajectories across blocks and learning scores are presented. Significant learning scores are highlighted by an asterisk (alpha was set at .05). Error bars indicate standard errors.

- **Evidence for learning a correlated motion and response sequence**
- **No response sequence learning alone**
- **No motion sequence learning alone**
- **Evidence for sequence integration**

**Conclusions**

The results indicate that sequence learning occurred specifically when correlated sequences were present. Thus, 3D body motion information can be integrated into a comprehensive sequence representation.

**References**


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