Abstract

The goal was to investigate whether there are age related differences in early and late learning in the process control task. Participants (24 young and 24 old adults) undertook the role of a manager of a sugar production factory, and were told that they could control sugar output by manipulating the number of workers employed. Unbeknownst to them, output was related to the input by a mathematical equation. People show implicit learning on this task by achieving the target output more frequently across time, despite being unable to answer questions about the system they learned to control. Squire & Frampach (1990) interpreted data from amnesic patients as showing that early in the process control task, learning is implicit, while later on it becomes explicit. In the present study, healthy aging, with its known explicit learning deficits, is used as a test case to investigate this two-stage theory.

In a previous study we had found no age related deficits early in training, suggesting that implicit skill learning of this type, which does not involve perceptual/motor learning and does not rely on the medial-temporal lobe system, is spared in healthy aging. In the present study, as predicted by two-stage theory, we again found age constancy early in training, and in addition we found age-related deficits later in training.

Goals

- To test two-stage theory:
  - To determine whether there are age related differences in late, but not early learning in the process control task
  - To determine whether learning correlates with implicit memory
  - To determine whether learning occurs in the absence of explicit, verbalizable knowledge

Participants

<table>
<thead>
<tr>
<th>Gender</th>
<th>Old</th>
<th>Young</th>
</tr>
</thead>
<tbody>
<tr>
<td>16F, 10M</td>
<td>16F, 8M</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>72.6 (6.37)</td>
<td>29.8 (1.38)</td>
</tr>
<tr>
<td>Education</td>
<td>17.13 (3.15)</td>
<td>14.79 (1.02)</td>
</tr>
<tr>
<td>Self-rated health</td>
<td>4.38 (0.71)</td>
<td>4.71 (0.55)</td>
</tr>
</tbody>
</table>

Note: Standard deviations in parentheses

Process Control (PC): Sugar Production Task

Task:
- Goal to reach 9,000 T of sugar
- Vary the workforce size
- 12 possible inputs (100 – 1,200 workers)
- 12 possible outputs (1,000-12,000 T of sugar)

Procedure: 2 X 40 trials

Equation:

\[ P = 2 \times W - P_1 + r \]

- \( W \): workforce
- \( P_1 \): previous sugar output
- \( P \): current sugar output
- \( r \): random element, either 1, 0 or –1 (in thousands)

Implicit Memory: Specific Situations Task

Age differences?

- No age differences

Correlations with late learning?

Old: \( r = .541, p = .005 \)
Young: \( r = .156, p > .05 \)

Conclusions

- Age constancy in implicit, but not explicit learning of process control
- Support for two-stage theory:
  - Age differences late, but not early
  - Late in training, process control performance based on implicit memory for old, but not young

References


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