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Visual Memory Improvement in Recognition

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Rationale

• In 2008 Jaeggi and her colleagues demonstrated that fluid intelligence could be improved by training on a visual working memory \( n \)-back task.

• While improvement on a simple working memory test was noted, no improvement in working memory capacity was found.

• Preece (2011) and Palmer (2011) found that \( n \)-back training did not improve fluid intelligence. Furthermore Palmer (2011) found that training on a general knowledge/vocabulary task did improve fluid intelligence.

Purpose of this study
• To investigate whether \( n \)-back training can increase visual recognition memory.

Hypothesis
• After training using the single \( n \)-back task, participants’ scores on a test of visual recognition memory will be significantly higher in comparison to participants who undergo general knowledge/vocabulary training.
Method

• Mixed factorial design

• Between-subjects factor - 2 levels (single $n$-back task and combined general knowledge/vocabulary task)

• Within-subjects factor - 2 levels (pre-training and post-training)

• Dependent variable - raw test scores of Test 13, Picture Recognition (WJ III)

• Initial testing

• 20 days of training over a 30 day period

• Final testing phase
Participants

- 47 participants in total completed the training task
- 21 participants in the active control group
- 26 participants in the experimental group
- Participants’ ages ranged from 18 to 68 ($M = 35.91$) in the $n$-back group, and ($M = 40.44$) in the active control group.

Materials

- Test 13, Picture Recognition of the Woodcock-Johnson III Test of Cognitive Abilities (2001) (Fig 1)
- Experimental group - $n$-back training task software obtained from Brainworkshop (n.d) and modified to replicate the software used by Jaeggi et al. (2008) (Fig 2)
- Active control group - Definetime, vocabulary task accessed via the East of the Web (n.d.) website and Who Wants to be a Millionaire accessed via the Real Player Games (n.d.) website (Fig 3)
• Interaction between the training group and pre-post Test 13 scores was non-significant indicating that type of training did not have an influence over improvement in visual recognition memory scores, SPANOVA $F(1,42) = .016$, $p = .899$, partial $\eta^2 < .001$.

• Overall participants significantly improved in their Test 13 scores from pre- to post-test SPANOVA $F(1, 42) = 15.515$, $p = < .001$, partial $\eta^2 = .270$. 
Follow-up Interviews

• Participants spoke about how motivating they found the Definetime task.
• Participants spontaneously described how they used shape recognition strategies to obtain high scores (Fig 1).

Figure 1. Example of shapes used by participants for recognition.
Active control groups

- **Definetime** - those who were higher scorers in Definetime had a **significantly higher** gain in Test 13 scores than those in the lower gain group, one-way between groups ANOVA $F(1,19) = 6.864, p = .017, \eta^2 = .265$. This suggests that high Definetime scorers increased their visual recognition memory in comparison to low Definetime scorers.

- **Who wants to be a Millionaire** - there was **no significant difference** in gain in Test 13 scores between the low and high Who Wants to be a Millionaire scoring groups, one-way between groups ANOVA $F(1,19) = .811, p = .379, \eta^2 = .041$. This suggests that there was no difference in visual recognition memory improvement between the low and high Who Wants to be a Millionaire scorers.

Experimental group

- **$N$-back** – there was **no significant difference** in gain in Test 13 scores between the low and high $n$-back scoring groups, one-way between groups ANOVA $F(1,23) = .879, p = .358, \eta^2 = .037$ (Fig 6). This suggests that there was no difference in visual recognition memory improvement between the low scoring $n$-back group and the high scoring $n$-back group.
Table 1. Means and standard deviations of Test 13 gain in low and high performing groups.

<table>
<thead>
<tr>
<th>Training Group</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Definetime</td>
<td>0.40</td>
<td>1.71</td>
</tr>
<tr>
<td>Millionaire</td>
<td>1.70</td>
<td>2.11</td>
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<tr>
<td>N-back</td>
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<td>2.47</td>
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</table>
Conclusion

• Training using the single n-back task does not significantly increase visual recognition memory scores when compared with general knowledge/vocabulary training.

• Participants who obtain high scores in Definetime improve their visual recognition scores significantly more than participants who have low scores in Definetime.

• Participants who have high scores in Definetime use shape recognition strategies.
Questions for further research

• Is visual recognition memory improved through training?

• Is Definetime a better visual recognition training task than $n$-back training?

• Is the $n$-back task in the single $n$-back form a visual recognition training task?

• Is Definetime a visual recognition training task?

• Was Jaeggi (2008) incorrect to conclude that $n$-back training can improve fluid intelligence?

• Do motivational factors affect performance on cognitive training tasks?

• Is visual recognition the driving influence behind the fluid intelligence gains demonstrated by Jaeggi (2008), Preece (2011) and Palmer (2011)?
References


