Specific practice conditions enhance perceptual-cognitive-motor skill acquisition

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Introduction

Practice leads to skill acquisition

(Li & Wright, 2000; Lin et al., 2009; Schmidt & Lee, 2011)
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Specificity of Learning Hypothesis

(Proteau, 2005; Proteau & Cournoyer, 1990; Proteau et al., 1987; 1992; Soucy & Proteau, 2001)
Vision of the Stylus
in a Manual Aiming Task:
The Effects of Practice

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**Diagram Description:**
- **Y-axis:** Root Mean Square Error (mm)
- **X-axis:** Experimental Phases (Acquisition, Transfer)
- **Legend:**
  - Full vision
  - Target + Stylus vision
  - Target vision only

**Graph Elements:**
- Starting position
- Shoulder
- Elbow
- Wrist
- Stylus
- Target
Rationale

Previous research has focused on motor tasks or perceptual-motor tasks.
In sports, most tasks require perceptual, cognitive, and motor skills

(Williams et al., 2011)
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In sports, most tasks require perceptual, cognitive, and motor skills.

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Little systematic research has examined whether the principles of specificity apply to perceptual-cognitive-motor skill acquisition.
Aim

To examine practice conditions required to influence the acquisition of perceptual-cognitive-motor skill
Aim & Hypotheses

To examine practice conditions required to influence the acquisition of perceptual-cognitive-motor skill

1) Perceptual-cognitive-motor practice would lead to improved perceptual-cognitive-motor performance

2) Modulating perceptual and/or cognitive processes would result in skill attenuation of perceptual-cognitive-motor performance
Methods

Groups

- Perceptual-cognitive-motor practice (PCM) group
- Perceptual-motor practice (PM) group
- Motor practice (M) group
Methods

Groups

– Perceptual-cognitive-motor practice (PCM) group
– Perceptual-motor practice (PM) group
– Motor practice (M) group

Table 1. The characteristics of the participants in all PCM, PM, and M groups

<table>
<thead>
<tr>
<th></th>
<th>Number of subjects</th>
<th>Age (years)</th>
<th>Computer-game playing experience (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCM group</td>
<td>13 (Male = 11 &amp; Female = 2)</td>
<td>21.0 ± 2.3</td>
<td>3616.7 ± 1946.4</td>
</tr>
<tr>
<td>PM group</td>
<td>13 (Male = 11 &amp; Female = 2)</td>
<td>21.6 ± 1.1</td>
<td>4006.1 ± 2775.1</td>
</tr>
<tr>
<td>M group</td>
<td>13 (Male = 11 &amp; Female = 2)</td>
<td>22.1 ± 2.1</td>
<td>3570.3 ± 1731.2</td>
</tr>
</tbody>
</table>
## Methods

- **Pre-test**
  - **PCM group** (n=13)
  - **PM group** (n=13)
  - **M group** (n=13)

- **PCM task (8 trials)**
## Methods

<table>
<thead>
<tr>
<th></th>
<th>Pre-test</th>
<th>Practice phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCM group (n=13)</td>
<td>PCM task (8 trials)</td>
<td>PCM task (96 trials)</td>
</tr>
<tr>
<td>PM group (n=13)</td>
<td></td>
<td>PM task (96 trials)</td>
</tr>
<tr>
<td>M group (n=13)</td>
<td></td>
<td>M task (96 trials)</td>
</tr>
</tbody>
</table>
PCM task

PM task

M task

VIDEO
PM task

PCM task

M task
## Methods

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<tr>
<th>Group</th>
<th>Pre-test</th>
<th>Practice phase</th>
<th>Post-test</th>
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Data analysis

Motor performance

Frequency of successful trials
Data analysis

Motor performance
Frequency of successful trials

Visual search
Frequency of Saccades
(Bennett & Barnes, 2006; Xivry et al., 2006)
Data analysis

Motor performance
Frequency of successful trials

Visual search
Frequency of Saccades
(Bennett & Barnes, 2006; Xivry et al., 2006)

Cognitive processing
Frequency of if-then statements
(Raab, 2003; Raab et al., 2009)
Figure 1. Mean ($SD$) of frequency of successful trials for PCM, M, and PM group in pre-test and post-test (* $p < .05$)
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Figure 2. Mean (SD) of frequency of successful trials for PCM group in practice phases (* p < .05)
Figure 3. Mean (SD) of successful time duration within yellow circle for PM and M group in practice phases.
Figure 4. Mean (SD) of change in frequency of horizontal and vertical saccades from pre-test to post-test for PCM, M, and PM group (* $p < .05$)
Figure 5. Mean (SD) of frequency of if-then statements for PCM, M, and PM group in pre-test and post-test (* $p < .05$)
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Findings support Specificity of Learning Hypothesis

(Proteau, 2005; Proteau & Cournoyer, 1990; Proteau et al., 1987; 1992; Soucy & Proteau, 2001)
Discussion

Findings support Specificity of Learning Hypothesis

(Proteau, 2005; Proteau & Cournoyer, 1990; Proteau et al., 1987; 1992; Soucy & Proteau, 2001)

1) Perceptual-cognitive-motor practice led to improved perceptual-cognitive-motor performance
Discussion

Findings support Specificity of Learning Hypothesis

(Poteau, 2005; Poteau & Cournoyer, 1990; Poteau et al., 1987; 1992; Soucy & Poteau, 2001)

1) Perceptual-cognitive-motor practice led to improved perceptual-cognitive-motor performance

2) Modulating perceptual and/or cognitive processes resulted in skill attenuation of perceptual-cognitive-motor performance
Discussion

Findings support Specificity of Learning Hypothesis

(Proteau, 2005; Proteau & Cournoyer, 1990; Proteau et al., 1987; 1992; Soucy & Proteau, 2001)

Limiting perceptual information resulted in less efficient visual search behaviour

Limiting cognitive process resulted in less skill acquisition
Implications

Optimal practice in sport should contain the same processes required in the competition version of the sport.
Thank you
Any questions?

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References


Figure. Means (SD) of frequency of successful trials for practice and control group in pre-test and post-test
Appendix

**Figure.** Means (*SD*) of change in frequency of horizontal and vertical saccades from pre-test to post-test for practice and control group.
Figure. Means (SD) of change in characteristics of horizontal and vertical saccades from pre-test to post-test for practice and control group.
Figure. Means (SD) of change in frequency of if-then statements from pre-test to post-test for practice and control group.