Experimenter Naivete and Imagery Practice

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The effects of imagery practice on motor skill acquisition have been examined for over 50 years (Sackett, 1935) under many labels. Mental practice (Corbin, 1967), mental rehearsal (Yamamoto & Inomata, 1982), mental training (Ulich, 1967), and visuo-motor behavior rehearsal (Noel, 1980) have all been employed to describe basically the same process. Equally varied have been the motor tasks utilized in research. Familiar motor tasks such as the basketball free throw (Eideness, 1965), volleyball serve (Shick, 1970) and tennis forehand (Surburg, 1968), as well as novel tasks such as target tracking (Kohl & Roenker, 1983), have been incorporated into imagery research.

Intons-Peterson (1983) conducted a series of studies involving imaginal or perceived judgments to determine if imagery paradigms are influenced by experimenter expectation. The results of these studies, as well as those of earlier work (Intons-Peterson & White, 1981), substantiated the hypothesis that an experimenter knowledgeable of the paradigm could introduce unconscious bias into an imagery study. Tacit cues such as voice inflections, meaningful pauses, and certain verbal and nonverbal feedback (i.e., demand characteristics) can be given by the experimenter.

The results of these studies raise questions regarding the findings of imagery research involving motor tasks. First, has imagery/motor skill research been conducted in such a manner that bias of this type may have been introduced? Second, are imagery/motor skill studies as sensitive to these biases as were the perceived judgments of Intons-Peterson’s (1983) research?

A perusal of imagery/motor skill research revealed the utilization of various instructional conditions and practice sessions. For example, taped instructions were provided by Harris and Robinson (1986), task information and demonstrations were provided by Ryan and Simons (1982), and written instructions were used by Epstein (1980). Some of these procedures were apparently done with experienced researchers and with a protocol that could have introduced an unconscious bias. Intons-Peterson (1983) concluded that naive experimenters were required when conducting experiments involving imaginal or perceived judgments (i.e., single-blind protocols). Rosenthal (1966) identified a similar effect pertaining to experimenter expectancy. Martens (1970), however, concluded that experi-

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Menter expectancy may not influence psychomotor performance to the extent that it does cognitive and affective variables. The question arises as to the need for naive experimenters in imagery/motor skill studies.

The first stage of learning has been described by Fitts and Posner (1967) as the cognitive stage. This phase may be more sensitive to experimenter bias, for subjects are integrating into their thought processes different information and cues. Fleishman and Hempel (1954) demonstrated the changing role of different perceptual motor components during motor skill acquisition. For example, visualization was shown to have a greater role during the early stage of skill acquisition. Based on this conclusion, it is possible that experimenter bias may influence both the imagery component and the early physical practice phases. An alternative hypothesis is that this bias effect is cumulative and emerges during later stages of skill acquisition. The primary purpose of this study was to determine the effect of experienced and naive experimenters on the outcome of an imagery/motor skill acquisition experiment. If applicable, a second purpose was to determine the stage or stages during skill acquisition in which bias effects are most salient.

Method

Subjects

Subjects were 80 college-age students ($M = 20.1$ years) at Indiana University. Forty-two females and 38 males were randomly assigned to one of four conditions.

Apparatus

A photoelectric pursuit rotor (Lafayette Model No. 30014) with a circular template was used for the criterion task. Target velocity was set at 45 RPM, and an electronic chronoscope recorded the subject’s time on target for each trial. Between each testing session, the velocity of the pursuit rotor was calibrated. A multitask reaction-time apparatus (Lafayette Model No. 6314) involving key pressing was used for the placebo group.

Procedures

All testing was done with only the subject and an experimenter present and with time on target serving as the dependent variable. Table 1 provides a summary of the procedures followed in all conditions. A 30-second rest period with an oral recitation of a list of colors was interpolated between the 15 trials of practice.

The only difference between the two experimental groups was the experience of the experimenter and knowledge of the experimental hypothesis. The experimenter in the naive-experimenter group was not aware of the study’s hypothesis and had never taken part in an imagery study. This individual was trained in data recording, timing, performance task execution, and the extent to which questions about the study could be answered without being assessed as a knowledgeable experimenter. A script based on the protocol of Kohl and Roenker (1983) was used in both conditions. An experimenter who had conducted several imagery studies was used to provide instructions to the experienced-researcher group. In lieu of imagery practice, subjects in the placebo and control groups
Table 1
Research Design and Protocol

<table>
<thead>
<tr>
<th>Group</th>
<th>Protocols</th>
<th>7 blocks of 3 x 30 s trials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 s demo.</td>
<td>RT</td>
</tr>
<tr>
<td>C</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>E</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

RT = reaction time task; IP = imagery practice; PP = physical practice (criterion task); C = control group; P = placebo group; N = naive experimenter; E = experienced experimenter.

executed a reaction-time task and began the criterion task immediately following a demonstration, respectively. Following the testing phase, subjects in the imagery groups were debriefed by the experienced experimenter to determine the way subjects imaged the task. This constituted a manipulation check of their cognitive processing.

Results

Means and standard deviations for the four groups are presented in Table 2. The 21 trials were grouped into seven blocks with 3 trials per block. A 4 x 7 (Groups x Blocks) analysis of variance was conducted to compare the influence of experienced and naive experimenters on imagery practice of a motor skill.

Table 2
Mean Time on Target and Standard Deviations for Four Groups and Seven Blocks

<table>
<thead>
<tr>
<th>Block</th>
<th>Naive M</th>
<th>SD</th>
<th>Experienced M</th>
<th>SD</th>
<th>Placebo M</th>
<th>SD</th>
<th>Control M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.71</td>
<td>3.06</td>
<td>8.84</td>
<td>3.19</td>
<td>5.79</td>
<td>2.44</td>
<td>5.41</td>
<td>2.14</td>
</tr>
<tr>
<td>2</td>
<td>9.09</td>
<td>3.38</td>
<td>10.51</td>
<td>4.09</td>
<td>7.47</td>
<td>3.06</td>
<td>6.08</td>
<td>2.83</td>
</tr>
<tr>
<td>3</td>
<td>9.63</td>
<td>3.51</td>
<td>10.94</td>
<td>3.91</td>
<td>8.24</td>
<td>2.77</td>
<td>6.15</td>
<td>3.35</td>
</tr>
<tr>
<td>4</td>
<td>10.60</td>
<td>3.84</td>
<td>11.01</td>
<td>4.42</td>
<td>8.52</td>
<td>2.65</td>
<td>6.62</td>
<td>3.25</td>
</tr>
<tr>
<td>5</td>
<td>10.65</td>
<td>3.67</td>
<td>10.95</td>
<td>4.49</td>
<td>8.95</td>
<td>2.94</td>
<td>6.67</td>
<td>3.70</td>
</tr>
<tr>
<td>6</td>
<td>11.09</td>
<td>4.05</td>
<td>11.60</td>
<td>4.43</td>
<td>9.39</td>
<td>2.30</td>
<td>7.55</td>
<td>3.74</td>
</tr>
<tr>
<td>7</td>
<td>11.43</td>
<td>4.37</td>
<td>11.92</td>
<td>5.26</td>
<td>9.45</td>
<td>2.62</td>
<td>7.53</td>
<td>3.91</td>
</tr>
</tbody>
</table>
Significant main effects for groups, $F(3,76)=6.42$, $p<.05$, and blocks, $F(6,456)=53.74$, $p<.05$, were found. Tukey tests provided the following results for groups: The naive-researcher group was statistically superior in performance to the control group, and the experienced-researcher group was statistically superior to both control and placebo groups. The findings of the post hoc analysis for blocks are as follows: All blocks were greater than Block 1, all subsequent blocks were greater than Block 2, all subsequent blocks were greater than Block 3, and Blocks 6 and 7 were greater than Blocks 4 and 5.

In order to examine the possible effects of experimenter bias upon early and late stages of skill acquisition, two separate $4 \times 3$ (Group $\times$ Blocks) analyses of variance were conducted on the first three and last three blocks of trials. For Blocks 1 through 3, significant main effects occurred for groups, $F(3,76)=7.28$, $p<.05$, and blocks, $F(2,152)=57.4$, $p<.05$. A significant group by trial interaction effect, $F(6,152)=2.33$, $p<.05$ was also evident. Significant simple effects were found between the experienced-researcher group and the three other groups. Additional significant differences are as follows: naive and placebo, naive and control, placebo and control. An identical analysis was conducted upon Blocks 5 through 7. Results were significant main effects for groups, $F(3,76)=5.16$, $p<.05$, and blocks, $F(2,152)=12.97$, $p<.05$. Tukey HSD tests revealed that experienced- and naive-researcher groups were superior to both placebo and control groups. No difference was found between the two imagery groups, but a significant difference was found between placebo and control groups.

**Discussion**

The significant differences found in the present study between imagery groups and the control group are similar to the findings of Clark (1960), Shick (1970), and Kohl and Roenker (1983). Although differences were noted between imagery groups and the placebo group for all stages of skill acquisition, a significant difference was also found between placebo and control groups, indicating a possible Hawthorne effect. This finding indicates that the common protocol of having subjects in a control group only take the motor tests (Wichman & Lizotte, 1983) or read magazines during control situations (Kohl & Roenker, 1983) does not seem appropriate. An unrelated motor activity such as the reaction-time task in this study or the beanbag toss in Zecker's (1982) should be considered for the protocol of a control group. This is an important procedure in an imagery study involving skill acquisition in order to regulate the possible occurrence of a Hawthorne effect.

During the early stage of skill acquisition (i.e., the first three blocks) the performance of the group with the experienced researcher was superior to that of the group with the naive experimenter. This finding is in agreement with the work of Intons-Peterson (1983) where experimenter bias occurred with perceived and imagined patterns. Intons-Peterson proposed that an experienced experimenter may influence subjects by tacit cues provided in the verbal instructions or through various nonverbal clues such as facial expressions or other types of body language. These factors may also interact with the experimental setting, per se. An experimental setting may foster certain expectations and strategies on the part of subjects (Orne, 1962). Subjects may develop a particular hypothesis about the experiment that may be confirmed in some manner by an experienced experi-
menter. Volunteer subjects are already amenable to this experimental situation and may respond in a supportive manner.

There are several possible explanations for the significant difference found between the experienced- and naive-experimenter groups during the early stage of skill acquisition. Subject compliance in response to demand characteristics may occur with motor skill acquisition as well as perceptual imagery. This possibility is potentiated because the early stage of motor skill acquisition has been described as a cognition (Fitts & Posner, 1967) and verbal–motor stage (Adams, 1971). Motor tasks with high cognitive demands are facilitated more readily through imagery practice in skill acquisition than more motor-oriented tasks (Feltz & Landers, 1983). Although the pursuit rotor is a motor-oriented task, the early stage of skill acquisition does have more cognitive demands (Fitts & Posner, 1967). This phase may not only be more receptive to imagery practice but may also be more sensitive to experimenter bias. As the stages of skill acquisition progress and the task becomes more motor oriented with the formation of a schema from cognitive elements, experimenter bias may not impact upon skill acquisition.

The temporal factor of experimenter bias may also be related to a possible ceiling effect in this study. During the last nine trials (designated as Blocks 5–7, the late stage) the experienced-researcher group’s performance appreciably leveled off; the performance of the naive-experimenter group still improved. It is possible that the difference between these two groups was obfuscated by a ceiling effect, which may be viewed as a limitation of the study. Within the context of this study, experimenter expectations did affect the earlier stages of skill acquisition. Imagery groups were superior in motor performance to placebo and control groups. Control groups in studies dealing with imagery practice and motor skill development should be subjected to an unrelated motor activity. From a practical perspective, this procedure seems to be an appropriate alternative to a control group that engages only in the testing phase of the study. From a methodological perspective, both types of groups (i.e., control and placebo groups) may be needed to ascertain if the nonrelated activity is fulfilling its intended purpose. Based upon the work of Intons-Peterson (1983) and the present findings, strategies should be implemented to attenuate the possible effect of experimenter expectations when conducting imagery studies with motor skills.

References


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