THE EFFECTS OF THE TRANSCENDENTAL MEDITATION TECHNIQUE UPON AUDITORY DISCRIMINATION

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The Transcendental Meditation technique was found to increase perceptual acuity. — EDITORS

The effects of the Transcendental Meditation (TM) program upon auditory discrimination were assessed. The task involved the discrimination of 40 pairs of 1,000 Hz, 30 db tones; in each pair one tone was 2,000 milliseconds and the other was 2,225 milliseconds in duration. Thirty-two people who practiced Transcendental Meditation volunteered to serve as their own controls. The results demonstrated that the postmeditation group performance was superior to that of the postrelaxation group performance. Closed eyes in nonmeditation control groups was discussed as a factor that may have spuriously benefited eyes-closed meditation groups in several studies in this area and was consequently controlled for in the present study.

INTRODUCTION

It has been suggested that the practice of the Transcendental Meditation (TM) technique makes the meditator more perceptually acute (5, 8), but with few exceptions there has been little experimental work investigating this hypothesis. A pilot study by Graham (6) demonstrated that in a postmeditation test period subjects had lower frequency and amplitude discrimination thresholds in response to an auditory stimulus than after an equivalent period of reading a book. Because there were only eight subjects in this study and some data were lost due to a power failure, the conclusions were tentative.

Perceptual-motor performance may be improved with Transcendental Meditation. In their pilot study Shaw and Kolb (10) found that an eyes-closed postmeditation group had lower reaction times than a nonmeditation control group matched for age and sex that had rested with eyes closed for an equivalent period. No statistical analysis was reported, and conclusions were based upon inspection of means. Within the meditator group, postmeditation performance was superior to that of premeditation performance; within the nonmeditator control group, postrest performance was inferior to prerest performance. The authors suggested that the nonmeditator control subjects appeared drowsy after their rest and speculated that this may have impeded performance.

Blasdell's (2) results may have been similarly confounded by an eyes-closed factor in the nonmeditator control group subjects, whose performance was inferior to that of an eyes-closed meditation group. Psychophysiological evidence that the eye factor may be important has been suggested by Wada (11), who found by electroencephalographic measurement that an eyes-closed meditation group remained awake more readily than an eyes-closed nonmeditation control group. He demonstrated that five experienced meditators fell asleep during 20 out of 40 sessions, while five eyes-closed subjects who did not practice TM fell asleep during 36 or 37 out of 40 sessions.

Boese and Berger (3) have suggested another problem related to the question of open eyes or closed eyes, as people who practice TM tend to meditate spontaneously in an eyes-closed relaxation or rest period even if instructed not to meditate. This factor may cause underestimation of performance differences between groups when TM subjects are used as their own controls.

The present experiment controlled for these eyes-open or eyes-closed problems by instructing meditators to keep their eyes open during the relaxation period and to close them during the meditation period. The experiment tested the hypothesis that the performance of the postmeditation group would be superior to that of the postrelaxation group who had relaxed with eyes open for an equivalent period.

METHOD

DESIGN—Thirty-two subjects were randomly assigned to one of four groups, with eight subjects in each group. One group was instructed to meditate in the first phase of the experiment and relax in the second phase (MR), one group
to relax in the first phase and meditate in the second phase (RM), one group to meditate in both phases (MM), and one group to relax in both phases (RR). The latter two groups were used as controls to assess the effects of the practice of the Transcendental Meditation technique and the passage of time upon performance.

STIMULI—The stimuli were 40 pairs of 1,000 Hz, 30 db sine-wave tones (as measured at the sound source) generated by an Eico model 377 tone generator and recorded onto a stimulus tape. One tone in each pair was 2,000 milliseconds in duration and the other was 2,225 milliseconds in duration. Each pair constituted one trial. The intertone interval was 2,000 milliseconds between each pair. Duration was controlled by an Iconix digital event determiner. The order of the two-tone durations was randomly determined and constrained so that there were no more than four successive trials with the same order of presentation of tones and an equal number of both orders of presentation of tones. The stimulus tape was ten minutes in total duration.

SUBJECTS—The subjects in this experiment were 32 people who practiced TM who had volunteered from the community. Sixteen subjects were male and 16 female; the age range was from 17 to 61 years of age with a mean age of 26.03 years. The range of experience with TM was from three months to ten years with the average length of practice 28.16 months. Sex, age, and range of practice were not counterbalanced across groups. Two of the original subjects were dropped from the experiment because they did not follow instructions; they were replaced.

PROCEDURE—Each subject was individually tested in a sound-shielded room while seated comfortably in an easy chair. All subjects were given written and verbal information pertaining to operation of the response device and were given instructions appropriate to their group for both phases of the experiment. All subjects serving in the meditation condition were told to meditate with eyes closed for 20 minutes, and all subjects serving in the relaxation condition were told to relax with eyes open. The subjects were given a cue after the 20-minute period had elapsed to indicate that the tones were to begin. Subjects who had served in a relaxation condition had been instructed to close their eyes for the duration of the tone presentations only; meditation subjects already had their eyes closed. This was done to control for any effect open eyes or closed eyes may have had on the task itself.

The tones were presented through Sony DR-7 headphones. After each pair of tones was presented, the subjects responded by pushing a single-pole double-throw switch that returned to center after each throw; it was thrown to the left or to the right to indicate whether the longest tone came first or second. Responses were recorded on an event channel of a Grass model 7 polygraph.

After the first 40 pairs of tones were presented the subjects either meditated or relaxed for another 20 minutes depending upon their Phase II group assignment. They were then retested on the auditory discrimination task. Subjects who served in a relaxation condition in Phase II had been instructed to open their eyes after the first task and keep them open for the duration of the Phase II condition.

At no point were subjects given knowledge of results of their task performance. The same stimulus tape was used for both phases even though subjects had been told a different tape would be used in Phase II. Upon questioning subjects at the conclusion of the experiment, no subject indicated awareness that the tape used in Phase II was the same as that used in Phase I. Thirty db white noise as measured at the sound source was introduced into the chamber over a speaker to mask extraneous stimuli.

RESULTS

All scores were computed in terms of the mean number of errors over 40 trials (table 1 and fig. 1). The primary analysis was of the order of the MR and RM conditions, in which a repeated measures analysis of variance was performed. The within-group condition (meditation or relaxation) effect was found to be significant, $F(1, 14) = 7.98, p = .013$, with fewer errors for the meditation condition. The between-group condition order effect was found not to be significant, $F(1, 14) = .39, p = .54$, with superior performance in the meditation condition compared to that of the relaxation condition regardless of the order in which subjects meditated or relaxed. The order × condition interaction was not significant, $F(1, 14) = .12, p = .73$.

In view of the hazards of a repeated measures design (cf. 7), a between-groups analysis of the meditation and relaxation effect was performed by pooling the first phases of orders MM and MR (meditation) and contrasting these with the first phases of orders RM and RR (relaxation). With this analysis the effect of the condition was significant, $F(1, 30) = 4.22, p = .048$, indicating better performance on the part of subjects in the meditation condition than in the relaxation condition.

Subordinate analyses were performed on the data. A repeated measures analysis of variance was performed on the mean number of errors of both phases of order MM and was found not to be significant, $F(1, 7) = 1.22, p = .31$, indicating that the second meditation did not significantly improve performance. In order to assess the effect of sex upon performance, a $t$-test was performed on the pooled first phases of orders MM and MR for the male subjects and compared to the pooled first phases of the same orders for
the female subjects and found not to be significant, \( t (14) = .95, p < .25 \). A \( t \)-test was also performed on the pooled first phases of orders RR and RM for the male subjects and compared to the pooled first phases of the same orders for the female subjects and was found not to be significant, \( t (14) = .71, p < .25 \). Apparently sex was not a factor predicting performance. The factor of age was inspected but not statistically assessed and was found not to be important.

Campbell and Stanley (4) have noted that the mere passage of time may affect performance in pre- and posttest designs and may consequently offer a rival explanation of the experimental results. As this study had two phases each consisting of a 20-minute condition followed by a ten-minute test period, the effect of the passage of time was assessed. An orthogonal change score analysis was performed on the MM and RR groups (computed by subtracting Phase II scores from Phase I scores).

### Table 1
RESULTS OF AUDITORY DISCRIMINATION TEST

<table>
<thead>
<tr>
<th>GROUP (ORDER OF CONDITIONS)</th>
<th>MEAN NUMBER OF ERRORS OVER 40 TRIALS</th>
<th>DIFFERENCE BETWEEN PHASES I AND II SCORES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Phase I</td>
</tr>
<tr>
<td>Meditation-Relaxation (MR)</td>
<td>8</td>
<td>6.38</td>
</tr>
<tr>
<td>Relaxation-Meditation (RM)</td>
<td>8</td>
<td>. . . 8.25</td>
</tr>
<tr>
<td>Meditation-Meditation (MM)</td>
<td>8</td>
<td>7.38</td>
</tr>
<tr>
<td>Relaxation-Relaxation (RR)</td>
<td>8</td>
<td>. . . 10.13</td>
</tr>
</tbody>
</table>

**FIG. 1. SUPERIOR AUDITORY DISCRIMINATION AFTER TM.** Mean number of errors in auditory discrimination performance over 40 trials after TM and after relaxation. Four different orders of meditation and relaxation were employed: meditation, then relaxation (MR); relaxation, then meditation (RM); meditation, then meditation (MM); and relaxation, then relaxation (RR). A low number of errors indicates superior auditory discrimination.
and was found not to be significant, $F(1, 14) = .18$, $p < .68$, indicating that the mere passage of time did not affect performance.+

**DISCUSSION**

The hypothesis that the performance of the postmeditation group would be superior to that of the postrelaxation group that had relaxed for an equivalent period was confirmed. Order of condition was not significant, as meditators performed better than controls who relaxed in both orders, MR and RM. In order to eliminate any possible confounding effect of order, a between-groups analysis was performed on the Phase I scores only, and again the performance of the meditation group was superior to that of the nonmeditation group.

Analysis of the order MM demonstrated that a second meditation did not significantly improve performance. The change-score analysis eliminated the rival hypothesis that the mere passage of time favored the meditation group over the relaxation group in performance.

Previous studies have provided tentative evidence that TM improves performance. Graham's pilot study (6) suffered data loss due to a power failure, making conclusions tentative. Shaw and Kolb (10) reported means but no statistical analysis. Both Shaw and Kolb (10) and Blasdell (2) utilized eyes-closed nonmeditator control groups in which drowsiness may have been induced, consequently spuriously favoring the meditator groups. Shaw and Kolb suggested that this might have been the case in their experiment, as they observed overt behavioral signs of drowsiness in their nonmeditator control group.

The present study controlled for the eyes-closed control group problem by instructing the relaxation group subjects to keep their eyes open for the duration of the condition. This control also disallowed the members of the relaxation group from falling into a meditation state, which may have occurred had their eyes been closed. This study therefore provides the best experimental evidence to date that the TM technique makes the meditator more perceptually acute, but additional replicative support is necessary for this conclusion to remain firm.

**ACKNOWLEDGMENTS**

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