THE EFFECTS OF THE TRANSCENDENTAL MEDITATION TECHNIQUE UPON A COMPLEX PERCEPTUAL-MOTOR TASK

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Speed and accuracy of complex perceptual-motor performance involving adaptive flexibility were greater in subjects practicing the Transcendental Meditation technique than in control subjects.—EDITORS

Individuals practicing the Transcendental Meditation technique performed significantly better after meditation than nonmeditators did after rest on a complex perceptual-motor task, the Mirror Star-Tracing Test. The meditators (n = 8) completed the task in a mean of 67.05 seconds with a mean of 21.13 errors. The corresponding means for the nonmeditators (n = 10) were 104.30 seconds and 39.28 errors. The meditators were significantly faster (p = .036) and made significantly fewer errors (p = .034) than nonmeditators (one-tailed t-test). Many factors are known to account for efficient perceptual-motor performance. Among them are smooth or integrated behavior, speed and accuracy, good coordination between the mind and body, flexibility in adapting to a novel situation, low anxiety, fine coordination and discrimination, improved kinesthetic as well as visual perception, fast reactions, and omission of extraneous movements or wasteful tensions that interfere with performance and often result in fatigue and strain. Research has demonstrated many improvements in physiology and psychology resulting from the practice of the Transcendental Meditation technique that could account for the observed superiority of meditators on this measure of efficient action.

INTRODUCTION

Proponents of the Transcendental Meditation (TM) technique state that this simple mental process brings about increased efficiency in action after meditation. Efficiency is an index of skill developed through learning, characterized by smoother and more integrated behavior. Extraneous movements are omitted, and the performance is executed with fewer errors and increased speed and accuracy (2, p.10). Efficiency requires good coordination between mind and body; lack of coordination results in unskilled or poor movement, which is dominated by cortical control that supersedes reflex and integrative mechanisms (16, p. 166). The term "perceptual-motor" was coined to indicate the important influence of meanings formed from sensory experience (a process of perception) on motor activity (2, p. 12). A perceptual-motor task such as the Mirror Star-Tracing Test is indicative of this mind-body coordination and hence efficiency of action. If TM increases efficiency in action, subjects practicing this technique should perform more quickly and more accurately on the Mirror Star-Tracing Test than those who do not practice TM.

There has been little research investigating the role of relaxation in efficient human movement. However, there have been numerous studies concerning the effects of anxiety, stress, and muscle tension on motor performance. For example, it has been shown that increased anxiety causes subjects to display excess motions that are often meaningless. These wasteful tensions interfere with the primary purpose of the activity and often result in fatigue and strain (6, p. xiv). Although anxiety, stress, and muscle tension can facilitate the efficiency of performance of a simple mental or motor task, they produce less efficient performance on a more complex task (2, p. 10).

Transcendental Meditation (TM), as taught by Maharishi Mahesh Yogi, is a mental technique that has been shown to reduce anxiety, stress, and muscle tension. These improvements should lead to superior motor performance. One study relating TM to motor performance supports the claim that TM aids efficiency in action. Subjects practicing this technique had faster reaction time on a simple motor task than those who did not (12). It is worthwhile, therefore, to investigate the effects of TM on a complex perceptual-motor task to establish a better measure of efficient action.

PROCEDURE

College-age subjects were recruited at the Students International Meditation Society center in Los Angeles to
TABLE 1

<table>
<thead>
<tr>
<th>GROUP</th>
<th>N</th>
<th>MEAN TIME (sec)</th>
<th>S.D.</th>
<th>t</th>
<th>df</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meditators</td>
<td>8</td>
<td>67.05</td>
<td>32.3</td>
<td>1.926</td>
<td>16</td>
<td>0.036</td>
</tr>
<tr>
<td>Nonmeditators</td>
<td>10</td>
<td>104.30</td>
<td>44.9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*One-tailed t-test.

TABLE 2

<table>
<thead>
<tr>
<th>GROUP</th>
<th>N</th>
<th>MEAN ERRORS</th>
<th>S.D.</th>
<th>t</th>
<th>df</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meditators</td>
<td>8</td>
<td>21.13</td>
<td>10.9</td>
<td>1.960</td>
<td>16</td>
<td>0.034</td>
</tr>
<tr>
<td>Nonmeditators</td>
<td>10</td>
<td>39.28</td>
<td>24.8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*One-tailed t-test.

comprise two groups: Group I, eight subjects practicing TM; and Group II, ten subjects who had not yet received instruction in TM. Group I subjects were found by asking people who came to the center to meditate if they would have time after meditation to take a hand-eye coordination test. Group II consisted of volunteers from a public introductory lecture given for people intending to begin the TM program.

Both groups were told that the test was to determine if TM aided hand-eye coordination. They were also told that they would be retested after nine months to see if their performance improved after regularly practicing TM. This information was given so that both groups would do their best, on the observation that people who begin TM are highly skeptical of claims that TM improves efficiency in action, and that those practicing the technique want proof of growth.

The subjects sat in a dimly lit room for 20 minutes. Group I meditated; Group II was told, “Just sit comfortably and relax with your eyes closed, and I’ll return for you in about 20 minutes.” Each subject was then brought to a desk where the Mirror Star-Tracing Test (MSTT) was set up. The pattern of two concentric 6-pointed stars separated by a % inch space was taped to a flat board on the desk top. An arrow outside the stars indicated the clockwise direction. A metal shield on the desk prevented the subject from viewing the star as he sat down. He could see the star only by looking in a mirror placed vertically behind the star. The MSTT reverses the forward and backward or “up” and “down” directions, but has no effect on the right-left orientation, thereby creating a visual motor conflict that the subject has to resolve. Each subject was told:

Please sit down. This is a hand-eye coordination test for speed and accuracy [alternately reversed to avoid emphasis on either speed or accuracy]. I want you to look in the mirror and trace around the star. You must stay within the lines. You are to do this as quickly, but as accurately [or vice versa], as possible. You will follow the direction of the arrow. Here is your pen. You may put it down inside the lines near the dot, but don’t begin until I say “Go.” [Subjects had to look at the paper to start.] Please tell me “Stop” when you are done. Ready? Get set. Go!

Whatever happened, the experimenter’s reply was, “You’re doing just fine.” The subject was timed from the word “Go” until he returned to the starting point. Subjects were told their time scores and then were given the instruction, “Now, I want you to do it again. Remember this is a test for speed and accuracy. Ready? Get set. Go!” The five trials were one minute apart, allowing time for the experimenter to remove the completed star and tape down a new one. Performance was measured by speed in seconds and by the number of times a subject crossed outside of the % inch gap between stars. Two people independently counted errors for each trial.

RESULTS AND DISCUSSION

The results are summarized in tables 1 and 2 and figs. 1 and 2. Means of time and error scores for Group I (TM) were 67.05 seconds and 21.13 errors, respectively. The corresponding means for Group II were 104.30 seconds and 39.28 errors. Thus, Group I performed faster and made fewer errors than Group II. One-tailed t-tests showed that the difference in speed was significant at \( p = 0.036 \) and that the difference in accuracy was significant at \( p = 0.034 \). The results indicate that individuals practicing the Transcendental Meditation technique perform better than nonmeditators on this measure of efficiency in action.

Superior perceptual-motor performance in meditators should be viewed in the context of the many physiological
and psychological changes brought about by TM. Wallace, Benson, and Wilson have shown that TM produces a state of "restful alertness" characterized by a greater reduction in metabolic rate than that found during deep sleep (15). Relative to rest, meditation produces a mean decrease of 17 percent in oxygen consumption; a 25 percent decrease in cardiac output; a decrease of one liter per minute and three breaths per minute in ventilation; a three beat-per-minute decrease in heart rate; and a mean increase in skin resistance of 160 percent. Arterial pH decreases slightly, and blood lactate decreases markedly (14, 15). According to Pitts's theory (9) the decrease in arterial lactate concentration could be related to a reduction of anxiety symptoms (14).

Orme-Johnson found that subjects practicing TM had a more rapid rate of evoked skin resistance response habituation to a stressful stimulus than nonmeditators, indicating that meditators recover from stress more quickly than nonmeditators. Meditators were also found to have fewer spontaneous skin resistance responses (responses occurring independently of apparent external stimuli or movements by the subject). Low levels of spontaneous skin resistance responses are often found to be correlated with rapid habituation, and both are correlated with physiological and behavioral characteristics associated with good mental health, behavioral and autonomic stability, extroversion, field independence, a stronger ego, less susceptibility to a variety of stresses, less susceptibility to acquiring conditioned stress, and less motor impulsivity (8). Several studies demonstrate a marked reduction in anxiety as a result of TM (1, 4, 5, 7, 8).

These findings are of considerable significance when accounting for the observed superiority of meditators in perceptual-motor performance. Literature on motor performance shows that while anxiety facilitates some simple motor tasks, it produces less efficient performance in more complex tasks, and as anxiety reaches a certain level a "breakdown of psychological and physiological integrative mechanisms is often seen to occur" (2, p. 163).

Wechsler and Hartogs found that increasing levels of anxiety impeded the fine coordination and fine discrimination needed for complex tasks and that individuals with high anxiety levels took significantly longer to learn a mirror drawing task. These subjects continually made "graphomotor blocks"—small tense strokes made in a small area—which were taken as an indication that the neuromuscular integration had broken down (17). Brieson and others found that continued anxiety leads to physiological breakdown, measurable by nerve cell deterioration (2, p. 164). Wassenaar discovered that "general anxiety" was present during the performance of many motor tasks and that it was detrimental to many psychomotor performances. Heightened anxiety results in rigid behavior and a breakdown of the integrative mech-
anisms that permit efficient perceptual-motor control and promote the individual's ability to adapt to new situations (2, p. 164). The well-studied reduction of anxiety through the TM program could therefore be expected to lead to increased adaptability and the observed improvement in perceptual-motor performance.

The ability to adapt to a new situation is obviously crucial in the mirror star-tracing task. This adaptability is a sign of a strong nervous system, characterized by greater stability, according to Neblyissen (3). Roberts states that adaptability is a function of extroversion (10), which in turn has been correlated \( r = .75 \) with rapid habituation (10). Therefore, Orme-Johnson's finding of rapid habituation in meditators (8) indicates increased adaptability and helps explain the superior perceptual-motor performance of meditators.

Visual motor conflicts like the Mirror Star-Tracing Test create a conflicting sensory experience that must be integrated to achieve a single perceptual judgment. Witkin et al. (18) found in the Tilting Room-Tilting Chair, the Rod-and-Frame, and the Rotating Room tests that field-dependent subjects estimated the true vertical by confusing visual cues. Improvements in measures of field independence as a result of the TM program imply that meditators should perform better than nonmeditators on the MSTT, as was observed.

Research shows that the TM technique provides the body with a deep state of rest, which reduces impediments to motor performance such as anxiety and susceptibility to stress and muscle tension. It also leads to the development of positive psychological characteristics that have been associated with efficient motor performance, such as field independence, extroversion, and adaptability. The practical benefits of improved efficiency in action warrant a thorough, well-controlled examination of the full effects of this technique.

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