THE TRANSCENDENTAL MEDITATION TECHNIQUE AND ITS EFFECTS ON SENSORY-MOTOR PERFORMANCE

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The Transcendental Meditation program was found to produce both short-term and long-term improvement in complex sensory-motor performance. —EDITORS

This study was designed to measure the long-term and short-term effects of the Transcendental Meditation technique on sensory-motor performance. The subjects were 36 college-age males—21 experimental subjects, who had been practicing the Transcendental Meditation technique at least five months, and 15 control subjects. All subjects were tested twice on a sensory-motor task ("Labyrinth Game"), with ten trials in each test. Twelve of the meditators meditated for 20 minutes between the two tests. The remaining nine meditators and all the control subjects rested for 20 minutes between tests. The mean performance of all the meditators on the first test was significantly better than that of the control subjects ($p = .041$). All groups improved after the interval of rest/meditation between tests, but the group that meditated displayed a greater improvement than the resting meditators ($p = .018$) or the resting controls ($p < .001$). The difference in improvement between the resting meditators and the resting controls was not significant. These results indicate that the Transcendental Meditation technique produces both short-term and long-term improvement of sensory-motor performance. One possible explanation for this effect is that the Transcendental Meditation technique reduces anxiety in subjects, thereby improving mind-body coordination. Another possibility is that the Transcendental Meditation technique improves concentration, which would also lead to enhanced sensory-motor performance.

INTRODUCTION

This report is concerned with the influence of the Transcendental Meditation (TM) technique on sensory-motor performance. There are a number of studies that suggest that anxious subjects perform less well than nonanxious subjects on a variety of sensory-motor tasks (3, 4, 5). It is reasonable to assume, therefore, that behavior that lowers anxiety will cause an improvement in performance.

There is evidence that the practice of the Transcendental Meditation technique reduces anxiety levels; in particular, subjects practicing TM show a marked increase in skin resistance (8) and a decrease in the concentration of blood lactate (8, 9). Both of these physiological responses have been correlated with a decrease in tension and stress. Tests designed to measure anxiety levels, administered to subjects before and after they began the TM technique, indicate that anxiety levels do decrease significantly (1, 6, 7).

Blasdell (2) has reported that subjects who practice TM perform significantly better than nonmeditators on a sensory-motor task. The present study was designed to extend the generality of her finding to another sensory-motor task and to assess the long-term effects of the TM technique on sensory-motor performance. In Blasdell's study the experimental subjects meditated just prior to performing the task (Mirror Star-Tracing Test). It is possible that meditation has both a long-term and a short-term effect on sensory-motor performance and that a history of practicing the TM technique would be a sufficient condition to produce the effect without the subject's meditating just prior to performing the task. The present experiment was designed to provide evidence on these possibilities and, specifically, to test the following two hypotheses: the performance of meditators on a sensory-motor task would be superior to that of nonmeditating controls, and the performance of meditators would improve more after a 20-minute period of meditation than would the performance of either meditators or nonmeditating controls after a 20-minute period of rest.

METHODS

SUBJECTS—The subjects were 36 college-student males between the ages of 18 and 24. The age and sex of the subjects was restricted in order to eliminate unnecessary

sources of variance from the experiment. Twenty-one of the subjects had been practicing TM for at least five months, and the remaining 15 had never practiced TM. None of the subjects had ever performed the sensory-motor task.

APPARATUS AND MATERIALS—The sensory-motor task used was the "Labyrinth Game," manufactured by Brio of Sweden. It consists of a movable board in a box with two controlling hand-dials on the sides of the box. One dial tilts the board to the left or right, and the other tilts it towards or away from the subject. The board has a path with obstacles and 60 numbered holes placed throughout the path. The goal of the game is to move a metal ball from the start (hole one) to the finish (hole 60), which entails avoiding the first 59 holes. The game requires accurate perception and quick and accurate motor responses. Any small error will result in the ball's falling through one of the holes. Tape was placed over hole nine for the purpose of eliminating a difficult impasse so that higher scores and a wider range of scores would be obtained.

Meditators often spontaneously start meditating when sitting in a chair with eyes closed. However, it is uncommon to meditate while lying down because new meditators are specifically instructed by their teachers to meditate only while sitting up and not while lying down. Therefore, a bed with a pillow was available for all subjects instructed to rest rather than meditate.

Every subject was given a questionnaire regarding his socioeconomic background. The meditators were given an additional questionnaire that requested information about experience with meditation, regularity of meditation, and whether or not these subjects had practiced any other forms of meditation. There were also a few questions pertaining to the quality of their most recent meditation and their mood that day.

EXPERIMENTAL DESIGN—The basic design of the experiment is presented in table 1. The two main groups of subjects were meditators and controls. In Phase I the purpose was to evaluate the long-term effects of TM on this sensory-motor task. The two groups of meditators were thus compared with the controls on their initial performance of the task.

The purpose of Phases II and III of the experiment was to evaluate the immediate effects of TM on the sensory-motor task. Thus, the meditators were divided into two groups following their initial test. The subjects in one of these groups were instructed to meditate for 20 minutes, whereas the other meditators and the nonmeditating controls were simply instructed to lie down and rest for 20 minutes. After this meditation/rest period all subjects were again tested on the game.

PROCEDURE—Subjects were tested individually. They were brought into a small experimental room and were instructed to sit at a table on which the game had been placed. They were given the short socioeconomic questionnaire, which took approximately two and one-half minutes to answer. Immediately after they completed the questionnaire they were given a five-minute practice session in order to become familiar with the game. At the end of five minutes the game instructions were read, and the ten subsequent trials were scored. The scores were calculated by recording the number of the hole at the point where the ball fell through. Thus, a score of 15 would be superior to a score of six.

At the end of the first ten trials, members of one group of meditators (N = 12) were told to meditate for 20 minutes; members of the other group of meditators (N = 9) and the nonmeditating controls (N = 15) were individually instructed to lie down on the bed and rest for 20 minutes.

Following the meditation/rest period all subjects were given another five-minute practice period. After the practice period another set of instructions was given. Following this the second ten trials were given, and the experiment was concluded.

RESULTS

The first hypothesis, that the performance of meditators on a sensory-motor task would be superior to that of nonmeditating controls, concerns the long-term effects of TM on sensory-motor performance. The Phase I data in tables 2, 3, and 4 and fig. 2, summarized in table 5 and fig. 1, are relevant to this question. The mean per-

TABLE 1

EXPERIMENTAL DESIGN

GROUP	N	PHASE OF EXPERIMENT		
		Phase I Game Trials	Phase II 20-Minute Condition	Phase III Game Trials
Meditators	12	Practice (5 min); Test	Meditation	Practice (5 min); Test
Meditators	9	Practice (5 min); Test	Rest	Practice (5 min); Test
Controls	15	Practice (5 min); Test	Rest	Practice (5 min); Test

TABLE 2

INDIVIDUAL MEAN SCORES FOR MEDITATORS BEFORE AND AFTER MEDITATION
(N = 12)

SUBJECT	PHASE I Before Meditation (mean of ten trials)	PHASE III After Meditation (mean of ten trials)
1	12.1	18.9
2	8.2	11.3
3	6.2	9.7
4	6.5	12.9
5	16.1	25.4
6	25.5	26.4
7	15.1	19.6
8	7.3	14.6
9	4.5	7.9
10	3.8	6.5
11	3.8	9.5
12	7.5	10.6
Group mean	9.72	14.44
S.D.	6.45	6.67

TABLE 3

INDIVIDUAL MEAN SCORES FOR MEDITATORS BEFORE AND AFTER REST
(N = 9)

SUBJECT	PHASE I Before Rest (mean of ten trials)	PHASE III After Rest (mean of ten trials)
1	6.2	8.4
2	11.0	12.0
3	6.5	11.5
4	4.5	7.0
5	11.2	9.7
6	15.4	18.1
7	8.1	11.8
8	13.1	15.5
9	4.0	6.3
Group mean	8.89	11.14
S.D.	3.98	3.86

TABLE 4

INDIVIDUAL MEAN SCORES FOR CONTROLS BEFORE AND AFTER REST
(N = 15)

SUBJECT	PHASE I Before Rest (mean of ten trials)	PHASE III After Rest (mean of ten trials)
1	7.3	9.0
2	5.8	7.9
3	5.5	6.5
4	4.0	4.5
5	4.9	5.8
6	8.3	8.9
7	4.4	5.0
8	6.2	7.3
9	9.4	11.7
10	7.9	13.0
11	8.3	10.8
12	6.4	9.8
13	12.2	12.7
14	6.2	7.7
15	3.6	4.2
Group mean	6.69	8.32
S.D.	2.28	2.87

TABLE 5

ANALYSIS OF LONG-TERM EFFECT OF TRANSCENDENTAL MEDITATION ON PERFORMANCE SCORES

GROUP	N	PHASE I Mean Score	PHASE I S.D.	t	df	p*
Meditators	21	9.36	5.42	1.79	34	0.041
Controls	15	6.69	2.28			

*One-tailed t-test for independent samples.

formance score on the first set of ten trials for all the meditators taken together (9.36) was higher than the score for the nonmeditating controls (6.69). This superior performance by the meditators was statistically significant ($t = 1.79$, $df = 34$, $p = .041$; one-tailed t-test for independent samples). Therefore, the first hypothesis was supported by the data.

The second hypothesis, that the performance of meditators would improve more after a 20-minute period of meditation than would the performance of either meditators or nonmeditating controls after a 20-minute period of rest, concerns the short-term effects of TM on performance. The Phase III data in tables 2, 3, and 4, summarized in figs. 2 and 3, show that all groups improved in performance after the 20-minute interval of rest/meditation and that the meditators who meditated improved more than subjects in the other two groups.

To determine whether the meditators who meditated improved significantly more than the meditators and controls who rested, the results were analyzed by analysis of covariance (table 6). In this way the initial differences between groups at the first test (Phase I) were taken into account. The one group of meditators improved their performance significantly more after meditating than did the other group of meditators after resting ($p = .018$) or the controls after resting ($p < .001$). There was no significant difference in improvement of performance between the meditators and controls who rested. Therefore, the second hypothesis, that the TM technique would have an immediate positive effect on sensory-motor performance, also received support.

TABLE 6

ANALYSIS OF COVARIANCE OF THE SHORT-TERM EFFECT OF TRANSCENDENTAL MEDITATION ON PHASE III PERFORMANCE SCORES

GROUP COMPARISON	SOURCE	SUM OF SQUARES	*df*	MEAN SQUARE	*F*	*p*
Meditators after meditating vs. Meditators after resting						
	Between	32.34	1	32.34	6.71	0.018
	Within	86.75	18	4.82	. . .	. . . .
	Total	119.09	. . .	. . . .	. . .	. . . .
Meditators after meditating vs. Controls after resting						
	Between	58.66	1	58.66	16.29	<0.001
	Within	86.45	24	3.60	. . .	. . . .
	Total	145.11	. . .	. . . .	. . .	. . . .
Meditators after resting vs. Controls after resting						
	Between	2.47	1	2.47	1.06	NS*
	Within	48.90	21	2.33	. . .	. . . .
	Total	51.37	. . .	. . . .	. . .	. . . .

*NS = not significant.

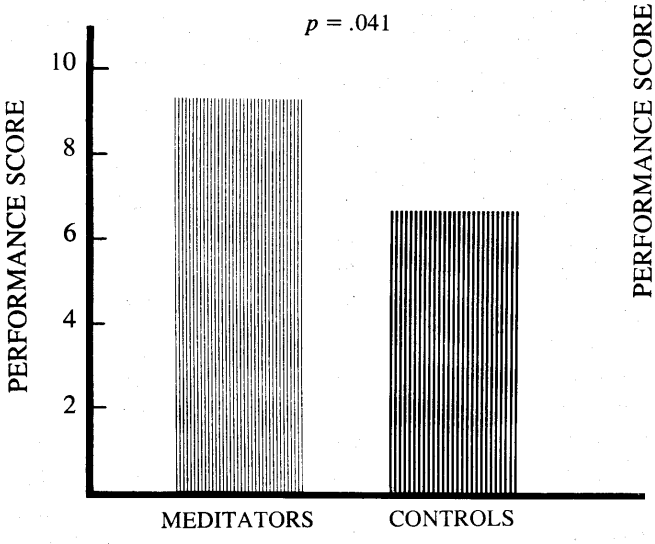

FIG. 1. MEAN PERFORMANCE SCORES FOR MEDITATORS (N = 21) AND CONTROLS (N = 15) ON FIRST SET OF TEN TRIALS. Both groups were given ten performance trials in the first phase of the experiment to determine the long-term effects of the Transcendental Meditation technique. The performance score is the number of the hole on which the error occurred. A high score indicates superior performance.

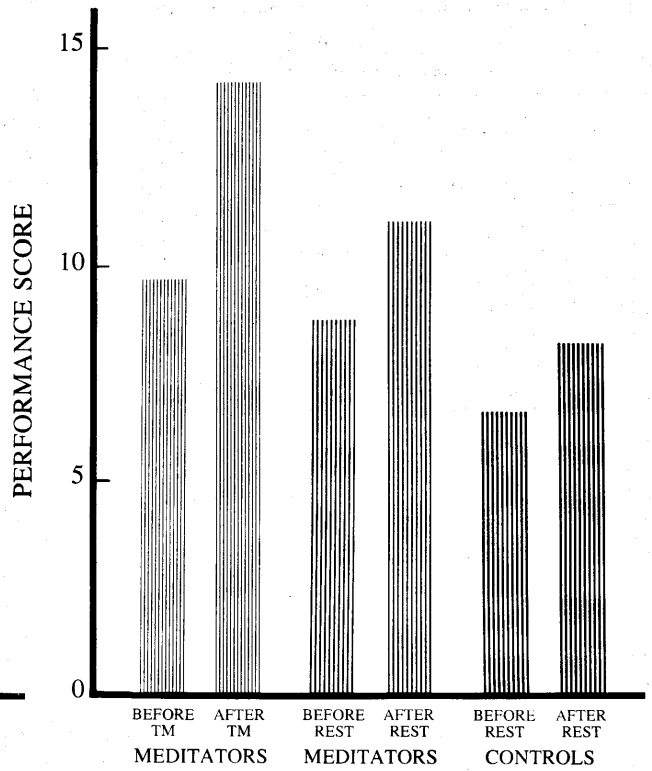

FIG. 2. MEAN PERFORMANCE SCORES FOR CONTROLS AND BOTH GROUPS OF MEDITATORS BEFORE AND AFTER REST OR MEDITATION. Each group was given ten performance trials both before and after a 20-minute period of rest or meditation. The performance score is the number of the hole on which an error occurred. A high score indicates superior performance.

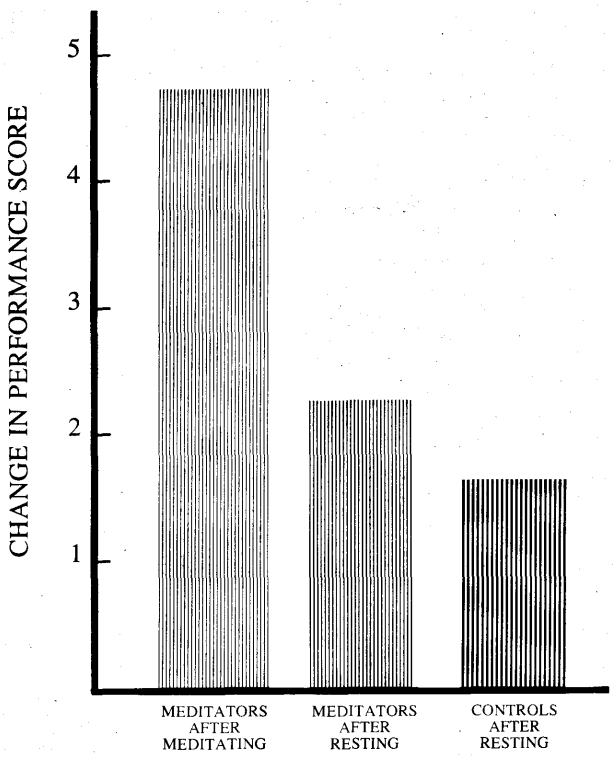

FIG. 3. CHANGE IN MEAN PERFORMANCE SCORE AFTER MEDITATION OR REST. The figure shows the change in score from the first set of ten trials (Phase I) to the second set of ten trials (Phase III). Between the two test sessions the subjects either meditated or rested (Phase II).

DISCUSSION

The results of this experiment are clearly consistent with the prediction that the Transcendental Meditation technique facilitates performance on a sensory-motor coordination task. Two effects of meditation were observed. First, subjects who had practiced the technique for five months or more performed initially at a higher level than subjects who had never meditated. Second, meditators who were instructed to meditate prior to the second testing showed a more substantial improvement than either meditators who rested or nonmeditators who rested prior to the testing. These findings confirm, clarify, and extend those of Blasdell.

Two points are relevant when applying these data to other situations. First, the subject population for this study was restricted to males of college age (18–24). Whether or not these results would be obtained with other subject populations needs to be determined. Second, only one kind of sensory-motor task was employed, and the results might therefore be specific to this task. It is encouraging, however, to note that Blasdell obtained a similar outcome using a different task.

As noted above, evidence indicates that anxiety inhibits learning and motor performance and that TM reduces anxiety. TM might therefore influence sensory-motor performance by reducing the anxiety level of the subject. Because there was no independent measure of anxiety in the present experiment, this conclusion remains tentative.

Another possible explanation for the results is that the TM technique facilitates the ability to focus attention on the situation at hand. Such an improvement in concentration would permit subjects to learn and perform better.

New research should examine questions regarding the quantitative, functional relationships between the TM technique and sensory-motor task performance. For example, how long must a person practice TM before its influence will be seen? How long does the immediate influence of TM last? Can a naive subject enjoy immediate benefits from TM? These intriguing questions clearly call for more research to fully explore the effects of the Transcendental Meditation technique on sensory-motor performance.

REFERENCES

1. BALLOU, D. 1973. The Transcendental Meditation program at Stillwater Prison. (Published in this volume.)

2. BLASDELL, K. 1971. The effects of the Transcendental Meditation technique upon a complex perceptual-motor task. (Published in this volume.)

3. CLARKE, D. H. 1968. Effect of preliminary muscular tension on reaction latency. *Research Quarterly* 39: 60–66.

4. FARBER, I. E., and SPENCE, K. W. 1953. Complex learning and conditioning as a function of anxiety. *Journal of Experimental Psychology* 45: 120–125.

5. FARBER, I. E., and SPENCE, K. W. 1956. Effects of anxiety, stress, and task variables on reaction time. *Journal of Personality* 25: 1–18.

6. FERGUSON, P. C., and GOWAN, J. C. In press. Psychological findings on Transcendental Meditation. *Journal of Humanistic Psychology.*

7. LAZAR, Z.; FARWELL, L.; and FARROW, J. T. 1972. The effects of the Transcendental Meditation program on anxiety, drug abuse, cigarette smoking, and alcohol consumption. (Published in this volume.)

8. WALLACE, R. K. 1970. The physiological effects of Transcendental Meditation: A proposed fourth major state of consciousness. Ph.D. Thesis, Dept. of Physiology, University of California, Los Angeles.

9. WALLACE, R. K.; BENSON, H.; and WILSON, A. F. 1971. A wakeful hypometabolic physiologic state. *American Journal of Physiology* 221: 795–799.