Worksite Stress Reduction Through the 
Transcendental Meditation Program

J. Richard N. Broome
CIDA City Campus, Johannesburg

David W. Orme-Johnson
Center for Natural Medicine and Prevention

Jane Schmidt-Wilk
Maharishi University of Management

An experiment on stress reduction using the Transcendental Meditation (TM) technique and Progressive Muscle Relaxation (PMR) was conducted at a South African firm with 80 employees. Psychological stress decreased significantly over 5.5 months for the TM group (p < .0002) with 67% of the decrease in the first two weeks; for the PMR group (p < .03); and near significantly for on-site controls (p < .09). Six weeks of TM practice produced greater reductions in psychological stress than six weeks of PMR (p < .03). Off-site active controls who received business-skills training showed nonsignificant decreases. Posttest stress levels were higher than for on-site groups (p < .04). Blood pressure decreased at 5.5 months for systolic (p < .05) and diastolic (p < .04) for the TM groups but not significantly in PMR or on-site controls. Subjective reports and changes in company climate generally supported the results, which are discussed in terms of the theory of collective consciousness from Maharishi Vedic Science.

Stress in organizations has been documented to produce wide ranging psychological, physical and behavioral ill effects. The costs of stress are variously estimated at hundreds of billions of dollars annually, or 12% of U.S. GNP (Siu, Lu, & Cooper, 1999). The visible portion of these costs

Author’s Info:  J. Richard N. Broome, Box 87395, Houghton, 2041, Republic of South Africa; +27 11 483 0685; fax +27 11 728 1280; email think@icon.co.za.

Authors’ Notes: This paper summarizes the principal findings of a South African doctoral dissertation in Business Administration from the University of Cape Town (Broome, 1995).

The authors wish to thank Kai Druhl for assistance with the discussion of phase transitions in physical systems.

stems from compensation claims (Kottage, 1992), reduced productivity and increased absenteeism (Manuso, 1979), added health insurance costs (Mulcahy, 1991), and direct medical expenses for related diseases such as ulcers, high blood pressure and heart attacks (Newman & Beehr, 1979).

In the physiology and management literature, job stress is usually defined as a characteristic of the individual, i.e., the psychophysiological changes experienced as a consequence of job-related demands on the individual. In this context, stressors are environmental or internal demands leading to adaptive (or maladaptive) responses on the part of the individual. Stress management refers to the adaptive behavior of changing any aspect of the environment or person in such a way as to decrease stress response (sometimes referred to as “strain”) and promote organizational and/or individual health.

Prevention-oriented programs emphasizing individual training in stress management have been offered in over half of large U.S. organizations (Kuri, 1996). However, until recently, few worksite programs had been evaluated with any scientific rigor (Murphy, 1984, 1986; Newman & Beehr, 1979). Ivancevich, Matteson, Freedman, and Phillips (1990) observed that this situation persists for many practical reasons, including lack of control over nuisance variables, difficulties with sampling and with adequate controls—and the ongoing lack of a clear definition of stress (Söderfeldt, Söderfeldt, Ohlson, Theorell, & Jones, 2000). Furthermore, “rarely does an SMI (stress management intervention) proceed from an identified theoretical position” (Ivancevich et al., 1990).

**Worksite Stress Management Interventions**

Although many hundreds of laboratory/clinical studies have been conducted on personal strategies for behavioral stress reduction, the number of worksite stress management interventions is much smaller. A search conducted in 1985 spanning two countries at eight major libraries, including the Library of Congress in Washington, D.C. and including the MEDLARS, PSYCHINFO, and psycLIT databases located many hundreds of clinical studies but only 22 worksite stress management intervention studies. Murphy (1996) reports 31 worksite stress studies.

Clinical studies reveal a wide variety of stress management techniques including various forms of relaxation, cognitive/behavioral skills training, meditation and biofeedback. Clinical research also indicates that different techniques produce different effects (Davidson & Schwartz, 1976; Lehrer, Carr, Sargunaraj, & Woolfolk, 1994; Orme-Johnson & Walton, 1998). Among worksite applications, relaxation and meditation approaches predominate, with Progressive Muscle Relaxation (PMR) as the most frequently mentioned specific relaxation technique and the
Transcendental Meditation (TM) technique as the most frequently mentioned specific meditation technique.

**Progressive Muscle Relaxation.** PMR, as developed and described by Jacobson (1957), involves focusing one’s attention on muscle activity levels in order to release muscular tension. Worksite applications for PMR interventions report reduced blood pressure and reduced breath and heart rates (Throll, 1982). These findings are, however, obscured by different researchers using different adaptations or variations of classical PMR.

**The Transcendental Meditation technique.** Instruction in the Transcendental Meditation technique is given worldwide in a standardized manner by qualified instructors, using traditional training formats. The instruction is simple, straightforward and easily assimilated by staff of diverse cultural backgrounds. This standardization has allowed generation of a voluminous body of literature (Orme-Johnson & Farrow, 1977; Chalmers, Clements et al., 1989; Wallace, Orme-Johnson et al., 1990), the largest on any meditation or relaxation technique (Murphy & Donovan, 1996). Clinical research reports a wide range of stress reduction findings, including reduced blood pressure (Barnes, Schneider, Alexander & Staggers, 1997; Alexander et al., 1996; Schneider et al., 1995) and reduced breath and heart rates (Dillbeck & Orme-Johnson, 1987; Jevning, Wallace, & Beidebach, 1992).

Meta-analyses comparing the effect sizes of the TM technique with other forms of meditation and relaxation found that the TM technique produces (a) a psychophysiological unique state of restful alertness that is not achieved during ordinary eyes-closed rest (Dillbeck & Orme-Johnson, 1987), (b) greater reduction in trait anxiety (Eppley, Abrams, & Shear, 1989) and (c) greater improvement in psychological health (Alexander, Rainforth, & Gelderloos, 1991) than any other meditation or relaxation technique studied to date, plus (d) a significantly larger decrease in substance abuse (cigarettes, alcohol, and drugs) than produced by relaxation, prevention or other treatment programs (Alexander, Robinson, & Rainforth, 1994).

Findings on the TM technique relevant to organizational performance include improved cognitive performance (see Orme-Johnson, Alexander, & Hawkins, 2005, for a recent summary of studies), increased self-esteem (Orme-Johnson & Dillbeck, 1987) and higher levels of self-actualization and development (Alexander et al., 1991; Alexander, Heaton, & Chandler, 1994) associated with more effective managerial performance (Torbert, 1987).

Studies on the TM technique as a worksite stress management intervention span three decades (Schmidt-Wilk, Alexander, & Swanson, 1996). Although the early retrospective research was criticized for
methodological weaknesses (Pelletier & Lutz, 1989), later studies—performed more-or-less simultaneously and independently of this study and reported after its completion—were more rigorous. For example, a study of 768 industrial workers (N = 447, 321 controls) conducted by the Japanese National Institute of Industrial Health found significant decreases on measures of psychological distress, health complaints, insomnia and smoking following instruction in the TM program compared to controls (Haratani & Henmi, 1990a, 1990b).

Two subsequent studies supplemented self-reported psychological data with objective physiological measurements and extended their investigations to performance and productivity concerns of the business community. These controlled worksite studies indicate that the psychophysiological changes brought about through practice of the TM technique result in (a) significantly decreased trait anxiety, job tension, insomnia, fatigue, cigarette and hard liquor use, and health complaints, and enhanced employee effectiveness, job satisfaction, and work and personal relationships (Alexander et al., 1993); and (b) reduced perceived stress, somatic symptoms of stress, and blood cholesterol levels; and improved mental health, vitality, energy, health habits, and peer-rated assessments of organizational contribution (DeArmond, 1996).

The TM program has a well-developed theory base, articulated in the Vedic Science of Maharishi Mahesh Yogi (Alexander et al., 1990; Dillbeck, 1983a,b; Dillbeck & Alexander, 1989; Maharishi Mahesh Yogi, 1969; Orme-Johnson, Zimmerman, & Hawkins, 1997).

Previous case studies suggest that large proportions of organization members practicing the Transcendental Meditation technique contribute to improvements in organizational performance (Schmidt-Wilk et al., 1996). Questions arise regarding what proportion of an organization practicing the TM technique would be needed to create an influence of harmony in the organization as a whole (Herriot, 1989). In the present study, 61% of the company (49 out of 80 employees) eventually learned and practiced the TM technique, leading to the hypothesis that the company as a whole—even non-meditating employees—would show stress reduction (see below).²

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¹ The Alexander et al. 1993 study called for future research with direct measurement of productivity, as well as random assignment of participants to treatment and control groups to control for the confounding effects of self-selection and relaxation. Although the Alexander study was reported only after the conclusion of the experimental phase of the present study, the present study had already been designed to control for these nuisance variables.

² Several (non-TM) stress management studies have noted improvements in controls (Thomas, 1982; Murphy, 1984; and see Discussion).
Rationale for the Study and Development of Hypotheses

The present study investigated the effects of a stress management intervention in a South African firm. The mix of psychological, physiological, and other dependent variables reported in this article proceeded from the theoretical position adopted by Broome (1995). Variables included psychological stress symptoms, i.e., participants’ self-reported incidence of nervousness, irritability, headaches, etc., using a standardized inventory (the Stress Symptoms Check List questionnaire, SCL-90-R, described in Measures below). It also measured blood pressure and heart rate, as objective physiological stress parameters.

In addition, the study aimed to investigate behavioral stress consequences, measurable aspects of organizational behavior, such as staff turnover rates, and perceptions of company climate. Since at the outset of the study it appeared that productivity data would be difficult to obtain, company climate was studied as well—as a possible intervening variable from which productivity could be inferred (Marcoulides & Heck, 1993). According to Siu et al. (1999), organizational climate may be an important predictor of health and strain effects. It would seem to be common sense that stress reduction in staff would be accompanied by broader perspectives, more positive affect, and more objectivity of judgment. Perceptions should become more positive and attitudes should reflect greater willingness to give “the benefit of the doubt” in judging climate dimensions, such as the extent to which working rewards are perceived to be in line with the work sacrifices involved. Therefore, stress reduction should correlate with more positive climate. This should also translate into improved productivity and organizational effectiveness.

The TM technique was chosen as the primary treatment and PMR was chosen as the alternative treatment. Since research indicates that controls often show improvements in the vicinity of stress management interventions, control and comparison groups outside the host firm were also studied.

The general research question was formulated as: would the Transcendental Meditation technique and PMR be effective in reducing stress at the worksite?

H1 The stress management interventions will be effective in producing improvements within 6 weeks on measures of physiological stress parameters, psychological stress symptoms, productivity, and company climate.

H2 The TM technique will be more effective than PMR in producing improvements in the psychophysiological measures mentioned.
H3 Because a large proportion of the company learned the Transcendental Meditation program, on-site controls will also show improvement 5.5 months after the stress reduction intervention as measured by the psychophysiological measures in contrast to off-site controls, who would not improve significantly over the study period.

Appropriate null hypotheses were then formulated in order to subject the above research hypotheses to experimental scrutiny.

METHOD

On-Site Participants

Table 1 summarizes the demographic data for all participants at the start of the study.

At pretest, the firm employed about 80 people full-time and several hundred part-time. Two of the three most senior executives and about 90% of the staff were women. The atmosphere in the offices and corridors of the head office building was one of frenetic activity attendant on frequent deadlines and the need to coordinate hundreds of part-time field workers.

Recruitment, selection, and screening procedures. Study participants were recruited by an invitation to attend a company-sponsored presentation on stress. Management encouraged but did not require attendance. All but about 10–15 of the full-time staff attended and were briefed on stress, its consequences, and the benefits of individual participation in stress reduction programs. Attendees were told that management wished to evaluate two approaches to stress reduction—Progressive Muscle Relaxation, and the Transcendental Meditation technique. They were advised that participation in the project could be expected to secure the individual benefits described in the presentation, and that participation in the project would be voluntary, on company time, and at no cost to the individual. Furthermore, they were told that strict confidentiality would be observed: no individual information would be divulged to the company.

Three conditions for participation were also announced; the first two conditions are standard prerequisites for training in the TM technique. Participants were to (1) abstain from use of nonprescription medication or recreational chemicals for two weeks prior to instruction; (2) attend all training sessions in order to receive adequate instruction; and (3) participate in whichever treatment they were randomly assigned to. In return, participants might, if they desired, receive instruction in the treatment of their choice at the conclusion of the project. At the conclusion of the talk, opinion survey forms were circulated to collect data on
### TABLE 1  Demographic Data for Participants at Start of Study

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| N                    |                      |                      |                      |                      |                        |                    |
| 41                   | 18                   | 11                    | 16                   | 15                   | 22                      | 250                     | 374                 |
the credibility and expectancy of benefits—and also participants’ choice of techniques.

On-site participant demographics (Groups 1–6). A majority (64) of the full-time staff volunteered to participate in the program, while a small number declined. Of these 64 volunteers, 59 received training. The participating group had a mean age of 38 with a range of 19–65. Eight were male, four represented top management, 9 senior management, 18 supervisory staff and the remainder clerical. Groups 1–4 (41 participants) were TM participants in a Solomon-four group design (see Procedure and Table 2 below). Groups 5 and 6 (18 participants) were PMR participants (also see Procedure section). Although there were initially 41 TM participants, 6 PMR participants and 2 on-site controls crossed over to TM instruction, making a total of 49 of the 80 of the employees in the company eventually practicing the TM program.

Validity of the on-site sample. Those attending were not representative of the general population of staff of South African companies because over 80% were female. Anecdotal evidence suggested that those who did not attend held negatively prejudicial attitudes towards self development in general and towards the TM program and relaxation in particular. However, correlation analysis later found no significant correlation between expectancy scores and SCL scores at the 6 weeks posttest.

On-site controls (Group 7). To control for a possible placebo effect, self-selection effect, or desire to make the program successful, the on-site non-volunteers were asked to participate in the data-gathering process as no-treatment controls. A majority agreed, and in due course, 11 on-site controls completed the same psychological, physiological and climate measurements as the on-site treatment groups. The mean age of the no-treatment controls was 37, with a range of 25–58. All were female; ten were at clerical grades, with one at supervisory level. This group was thus weighted towards clerical grades compared to the test groups.

Off-Site Controls

Off-site controls (Group 8). Off-site controls consisted of two groups who participated in the three-day business productivity workshops given by the first author on the days when pretests were being administered at the host company. The business productivity workshops included instruction in a number of useful skills, including nonlinear noting, strategic planning, presentation, brainstorming, and information handling and retention skills. In addition, background information was provided on stress and suggestions made on ways to ameliorate the negative consequences of job stress. This 90-minute stress presentation
and discussion included a 10-minute briefing on the benefits of the TM technique.

The 16 people in this combined group were subsequently posttested concurrently with the host company posttesting, 5.5 months later. Mean age of the group was 35, with a range of 27–44. The group had four top and middle managers, four supervisors, and the rest were clerical staff. 44% were male. This group thus had more males than the on-site groups.

In addition, three comparison groups completed only the SCL-90-R, for purposes of comparison with the experimental responses.

*Long-term TM practitioners (Group 9).* A group of 15 long-term (1–25 years) TM practitioners completed posttests concurrently with the on-site posttests. Mean age was 38 with the range of 18–60. Nine were female, and 58% represented clerical occupations—close to the proportion represented by the on-site groups.

*Replication group (Group 10).* A replication group of 22 people who learned the TM technique in the Linksfield Ridge TM Center completed the pretest and were posttested at 2 weeks. They were self-selected, i.e., coming in response to advertisements or word-of-mouth. All were in white collar occupations comparable with those at the host company. Mean age was 39 with a range of 21–61. Four were male. Five were top or middle management, 15 were supervisory, and the rest clerical. This group thus differed from the on-site groups only in the ratio of supervisory to clerical staff (Table 1).

*Normative group (Group 11).* Average scores for the SCL-90-R for South Africa were obtained by testing 250 participants who participated in three-day business productivity workshops over the course of the study period. The composition of these workshop groups was very similar from event to event: primarily senior-to-middle-managers or “knowledge workers,” such as systems analysts or programmers. The proportion of self-selected participants is not known, because some were nominated by their managers for the training. Mean age was 35 (standard deviation 8.2) with a range of 22–56. 220 were male, 30 female. They completed the test during the course of the workshop, prior to the discussion on stress.

**Experimental Design**

The study was designed as a field experiment, had a strongly quantitative orientation, and used an experimental design. The core of the study took place March to August 1991. It consisted of accessing a South African host company, selecting a representative sample of staff, conducting pretests, assigning volunteers randomly to experimental and control conditions, administering widely used stress reduction treat-
ments, and posttesting participants. The experimental core was supplemented with qualitative interviews conducted three years after the intervention. In addition, two studies were conducted outside the host company—a replication study and a normative study. The research also tested an off-site active control group that received a management skills training course and a long-term TM comparison group.

Methodological refinements incorporated into the study included longitudinal assessment and the use of demographically similar comparison groups and controls. The problem of lack of an adequate definition of stress was addressed by the use of a multi-method, multivariate design that measured “stress levels” by simultaneous measurements of self-reported stress symptoms on a standardized measure of felt stress, and objective measurements of physiological stress correlates. Use of a Solomon-four group design controlled for nuisance variables, such as pretest sensitization and history effects. Collateral effects of changes in stress levels were investigated using data on company productivity and subjective perceptions of company climate.

The Intervention Site

The host company was a well-known, 20-year-old, medium-sized South African marketing research consultancy that conducted market surveys for a cross-section of South African and international clients. The company had been founded and run by one owner up to the year prior to the study when the owner sold his shares to the existing management. Real (inflation-adjusted) sales growth rate averaged 6.3% per annum for the seven years up to the financial year-end immediately prior to the intervention. Company fortunes appear to have fluctuated widely, with substantial growth in some years of the previous seven years and declines in real turnover in others. Sales turnover was in a declining trend in an unfavorable business climate in the months immediately prior to the intervention.

Measures

Measures used in this study included self-reported stress symptoms, objective measurements of physiological stress correlates, subjective perceptions of company climate and some limited data on company productivity. In addition, data was collected in order to control for expectancy of benefits, credibility of treatment, self-selection and motivation to obtain relief from stress, intention to relax, type of instructions, health habits, regularity of practice, subjective perception of benefits, medication usage, and quality of relationship with course leader, using questionnaires specially designed for this study.
Psychological stress symptoms. Stress symptoms were self-reported using the revised Stress Symptoms Check List (SCL-90-R), a questionnaire developed by Derogatis (1977) and used in previous stress research, (e.g., Nelson & Sutton, 1990). The instrument contains 90 items, each of which is rated on a five-point scale of distress, according to how much discomfort each problem has caused “during the past week, including today.”

Physiological stress parameters. An experienced nurse who was blind to group assignments measured systolic blood pressure (SBP), diastolic blood pressure (DBP), breath rate (BR), and heart rate (HR) with participants seated using a standard upright Acoma (Japan) mercury sphygmomanometer and cuff. The nurse also recorded information on current medication, transient stress responses, and exercise patterns.

Blood pressures were averaged over three readings taken at least 5 minutes apart. The measurements were separated by the light activity of filling out questionnaires, such as the SCL-90-R. Appearance and disappearance (phase V) of Korotkoff sounds were used as the criteria for establishing systolic and diastolic pressures. Measurements were taken as nearly as possible at the same time of day, usually between 10 AM and 3 PM.

Reliability was addressed by taking three blood pressure readings at similar times of day and then averaging the results. In addition, blood pressures were always taken in the same room, by the same nurse in as nearly as possible the same circumstances with the participant filling out SCL-90-R questionnaires and chatting with other participants between the blood pressure measurements.

Participants were deleted from physiological measures if they were on medication (antihypertensive medication, estrogen, contraceptives, antibiotics, asthma spray, antidepressants, antihistamines) or were under transient stress conditions, such as just had a fight. This eliminated about 25% of the participants (see Ns in Table 4).

Productivity and other documented changes. Productivity data was requested from the host company’s management, but the only data made available were figures for monthly sales turnover and staff complement for the six-month period of the intervention. Management did not give permission for the publication of the sales data, so the figures were indexed and a productivity index constructed as productivity index = sales/head count. In addition, three years after the study, information was gathered on the growth of the company in terms of number of employees, facilities and equipment, new management, market share, new markets, and real growth rate of sales.
Company climate. The Industrial Barometer, an instrument developed by Litwin & Stringer and adapted for South African conditions by Gelfand as reported by Nasser & Schmikl (1986) was used to measure company climate. Participants completed the entire questionnaire, consisting of 40 questions. The dimensions of interest were Warmth and Support, which were defined by Litwin & Stringer in 1968 as follows:

Warmth: ...the feeling of general good fellowship that prevails in the work group atmosphere; the emphasis on being well-liked; the prevalence of friendly and informal social groups (Nasser & Schmikl, 1986).

Support: ...the perceived helpfulness of managers and other employees in the group; emphasis on mutual support from above and below (Nasser & Schmikl, 1986).

The organizational climate measurements were not originally the major thrust of this study. They served to supplement the limited productivity measures and objective changes documented gleaned from interviews.

Subjective perception of benefits. Subjective perceptions often provide a more holistic account of results than objective measures. Although objective measures are less prone to subjective bias, their narrow focus may reflect only a limited range of what happened. For example, decreased blood pressure may be only a small part of a constellation of changes that occur. Subjective perceptions were obtained from interviews with employees in the host company. The interviewer asked specific questions about changes noticed in the work climate, stress levels, productivity, interpersonal interactions, and in an open-ended format, invited the employees to mention any other changes they noticed during the intervention and in the ensuing two-and-a-half years.

Procedures

The 64 volunteers for training were randomly assigned to one of six treatment conditions: four TM groups to execute the Solomon four-group design (Groups 1–4) and two PMR groups (Groups 5–6), with about 10 volunteers per group. Groups were stratified by management level and sex, so that management, supervisory and clerical levels were all evenly represented in each group. Treatment conditions for the subgroups were as follows.

TM 1: Members of this group were pretested, taught the TM technique and posttested (O - X - O).

TM 2: Members of this TM subgroup were not pretested (— - X - O) in order to control for pretest sensitization by comparing scores of Groups 1 and 2 at posttest.
TM 3: Members of this TM group were pretested twice (O - O - X - O) to control for pretest sensitization by comparing this group score at second pretest with TM Group 4 scores at first pretest.

TM 4: This group was made up of short waitlist controls; they waited for two weeks before being pretested (...O - X - O) in order to control for nonspecific history effects by comparing their pretest scores with those of Groups 1 and 3.

PMR 5: This alternative treatment group was initially due for instruction in PMR at the start of the experiment. However, instruction was delayed for five weeks due to non-availability of a PMR instructor. The group was re-pretested six weeks after commencement, but before PMR instruction (O - O - X - O). This confounded the original purpose of the experiment to compare the TM technique and PMR (Hypothesis 2) but provided a serendipitous opportunity to control for history and field effects as discussed below.

PMR 6: This alternative treatment group waited a further week before the PMR instructor became available (...O - O - X - O).

In addition, the on-site non-volunteers (Group 7) agreed to act as on-site controls. They were pretested on all measures at commencement and then only again after 5.5 months. Table 2 summarizes the treatment and timings of all groups and shows the execution of the logic of the Solomon-four group design.

A series of pre-course briefings for each treatment intervention were held to explain the specific training program. Forms were circulated at the conclusion of the talks to collect demographic and health data. The forms were screened to eliminate any applicants undergoing medication deemed to interfere with the program; applicants with previous experience with relaxation or meditation programs; or those undergoing psychiatric or psychotherapeutic treatment. None were eliminated at this point.

A week before instruction, a trained nurse collected the physiological data while the participants completed the Health Habits, SCL-90-R, and Company Climate questionnaires.

4 TM teachers are trained to require a 2-week drug-free period before providing TM instruction to an applicant who has been using non-prescription (i.e., recreational) drugs. Users of other drugs (e.g., anti-hypertensive medication) were admitted to the study but posttest measurements were not used if dosages had changed. This approach was also used by Alexander et al. (1993).
### TABLE 2 Timetable for the Research

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</tr>
<tr>
<td>Off-site 8</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>LongTM 9</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

*O represents an observation or measurement of the stress questionnaire (SCL-90-R) and blood pressure, *X* represents training in TM or PMR.

*Retrenchments announced at the end of this week (Friday, 24 May, 1991).*
The training in the TM technique was performed live during weeks 2–4 by a qualified TM instructor in 1.5–2 hour sessions over four consecutive days at a quiet residence about five minutes drive from the host company’s offices. Training in PMR during weeks 7 and 8 followed the same format in the same training rooms. Participants in both treatment groups were told to practice as instructed for 20 minutes in the morning on company time and 20 minutes at the end of the day on their own time. Group practice sessions were convened in offices especially set aside for the purpose.

Follow-up meetings for PMR and the TM technique treatments were conducted after 2 weeks, 6 weeks, 3 months, and 5.5 months. Total contact time was 16 hours. This was greater than the median contact time of 8–10 hours for workshop stress management programs surveyed earlier. The top end of the range of contact times was 16 hours. Posttesting involved three further sessions of 20 minutes each at 2 weeks, 6 weeks and 5.5 months, as shown in Table 2.

Training for the off-site controls was provided live at a commercial conference venue in the same city, using an overhead projector and room set up in an open U-shape. The workshop provided 21 hours of contact with the instructor over three days, with a one-hour homework assignment, including skills practice, on two evenings. Off-site controls completed SCL-90-R pretests during the three-day workshop and were mailed posttests to complete and return 5.5 months later. There was no other contact or follow-up.

Three years after the experiment ended, structured interviews were conducted with host company members to elaborate and extend the findings of the quantitative investigation.

Confounding Events

Three potentially confounding events took place during the study period. Firstly, a delay was experienced in obtaining a PMR instructor. This prompted a decision to retest the PMR groups (Groups 5–6) before instruction at week 7 of the study (see Table 2). This observation was not called for in the original design but was done to test for the presence of history or other nuisance variables. Secondly, a stressful event in the form of announcements of the retrenchment of 10 staff took place in May (during week 12) just after the PMR groups’ 6-week posttest. Thirdly, shortly after learning PMR, six of the PMR participants insisted on learning the TM technique. These six were instructed in the

---

5 These were the only retrenchments in the ten years prior to the intervention and up to the present.
TM technique two weeks later in week 14 of the study. This double instruction invalidated any attempt to use these participants to compare outcomes with the TM technique, so they were dropped from the PMR group at the final 5.5 month analyses.

**Statistical Analysis**

There were no significant differences at pretest between any of the experimental core groups on any of the measures or demographic variables, using one-way ANOVA with “group” as the main effect. The off-site controls, long-term TM practitioners, and normative groups were composed of a lower percentage of female participants, and the normative group had a much higher percentage of managers. According to Huysamen (1981, p. 154), “failure to satisfy the assumption of homogeneity of variance between any pair of scores within the same, or across the (J) groups may result in serious errors in the inferences reached by an ANOVA.” The groups tested were independent and the core groups were randomized, thus at least partially satisfying this assumption.

SCL-90-R change scores were analyzed using Students t test (Fisher & Yates, 1974) as described by Huysamen (1981, p. 51), because it was assumed that SCL scores were normally distributed. Calculations were checked by hand using Wilcoxon’s (1964) nonparametric procedures as set out by Huysamen (1981, p. 142) to cover for the possibility that the standard assumptions (regarding normality and variance) were violated. The Wilcoxon test returned very similar results in all cases. Unmatched group procedures were used as a check in many cases, because of attrition (32% in Groups 1–4 due to retrenchments and other factors, such as unavailability for tests due to work pressure) so as to utilize all available data. These results are generally conservative. One-tailed tests were used because change directions were predicted in advance. Where applicable, analysis of covariance of posttest scores with pretest covariates was used.

**RESULTS**

**Psychological Stress Symptoms**

TM Groups 1, 3 and 4 were collapsed into one combined group of 31 to increase the power of the analysis. This step was permissible because they had similar composition and ANOVA had showed that differences in group means were not significant. Results from the Solomon design suggested that sensitization and history effect were not a concern. TM Group 2 was omitted because no pretest had been conducted. Table 3 shows the mean SCL-90 scores for all test groups: rows for other groups were added into the table for comparison purposes. For clarity, only integer values are shown.
These results are graphically illustrated in Figure 1.

It can be seen in Figure 1 and Table 3 that the pretest scores for the TM participants (SCL = 64; N = 31) were very similar to the South African Norms taken by the first author (SCL = 62; N = 250). The pretest means for all the groups ranged from 62 to 83, and these differences were not statistically significant.

**TM results.** The TM groups showed highly significant decreases at the 2 week, 6 week, and 5.5 month posttests (p values ranged from < .0001 to .0003). The decrease was 52% on the SCL scale by month.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Initial N</th>
<th>pretest</th>
<th>pretest 2</th>
<th>2-wk post</th>
<th>6-wk post</th>
<th>5.5-mo post</th>
</tr>
</thead>
<tbody>
<tr>
<td>TM (1,3,4)</td>
<td>31</td>
<td>64 (49)</td>
<td>—</td>
<td>42 (27)</td>
<td>33 (25)</td>
<td>31 (17)</td>
</tr>
<tr>
<td>PMR (5, 6)</td>
<td>18</td>
<td>73 (38)</td>
<td>55 (42)</td>
<td>—</td>
<td>43 (40)</td>
<td>31 (25)</td>
</tr>
<tr>
<td>On-site controls (7)</td>
<td>11</td>
<td>70 (63)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>32 (27)</td>
</tr>
<tr>
<td>Off-site controls (8)</td>
<td>16</td>
<td>79 (46)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>61 ns (42)</td>
</tr>
<tr>
<td>Long-term TM (9)</td>
<td>15</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>41 (31)</td>
</tr>
<tr>
<td>Replication study (10)</td>
<td>20</td>
<td>83 (56)</td>
<td>—</td>
<td>49 (41)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>South Africa normative (11)</td>
<td>250</td>
<td>62 (40)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

*Except as noted below, all tests are one-tailed paired t comparisons with pretest.*

*a TM p < .0003, n = 26. Wilcoxon p better than p < .005.*

*b TM p < .0001, n = 27. Wilcoxon as above.*

*c TM p < .0002, n = 21.*

*d Two-tailed PMR p < .005, n = 15.*

*e PMR comparison with pretest 2 was near significant. p < .058, n = 11.*

*f PMR first pretest to 5.5-mo. post p< .03, n=6.*

*g On-site controls near significant, p < .05, n = 5. Wilcoxon not significant.*

*h Replication study, p < .0005, n = 13.*
The majority of the decrease (67%) occurred in the first two weeks after instruction. The TM Replication group, composed of individuals who were part of the TM Center’s usual fare of students, showed a similar rapid decline in psychological stress in the first two weeks (p < .0005, n = 13). This finding supports Hypothesis 1 that this stress management technique would be effective within the first 6 weeks of implementation.

Repeated-measures ANOVA on the TM and PMR groups together showed that time was a significant main effect (p < .002). Analysis of covariance on the TM and PMR participants together indicated that management level, age, gender, marital status, and regularity of practice were not significant factors in SCL change at 5.5 months. There was a trend for younger participants to change more. Expectation levels at pretest were not correlated with improvements at week 6 or 5.5 months.

**PMR results.** Please recall that the PMR group was delayed from starting on schedule because of a lack of a teacher, and therefore was pretested a second time at week 7 (pretest 2, see Table 2). Even though the PMR group had not yet learned the PMR technique, at pretest 2, the group decreased significantly on the SCL (p < .005, n = 15, two-tailed).
PMR continued to show significant stress reductions 6 and 8 weeks after they learned the PMR technique \((p < .058, \text{and } .03, \text{respectively})\).

Comparison of the TM technique and PMR results. The rate of decrease after 6 weeks of PMR practice was slower than for 6 weeks of TM practice (see Figure 1). Whereas the mean SCL scores for the PMR group decreased from 55 at Pretest 2 to 43 after 6 weeks \((-22\%)\), the TM mean decreased from 64 to 33 in six weeks \((-48\%)\). Analysis of covariance on the 6-week posttest scores using pretest scores as a covariate was \(p < .034\) (1-tailed), supporting Hypothesis 2 that TM practice would produce greater reductions in stress than PMR. Even though the magnitude of decrease in psychological stress for the TM group was 2.2 times greater than for the PMR group, the TM and PMR groups did not differ significantly on “satisfaction with the course so far” at the 6-week post treatment. There was, however, a trend for TM participants subjectively to report greater improved productivity, and such subjectively reported improvements from the TM participants generally exceeded those of the PMR participants.

This 6-week comparison of the TM technique and PMR was unfortunately invalidated by circumstances. The groups were not tested at the same time, and by the time of pretest 2 (7 weeks after the TM group learned the TM technique), PMR already had decreased significantly on the SCL. Hence the groups were starting from a lower initial value (55 for PMR, 64 for TM). PMR’s decrease from pretest 1 to 2 may be best explained by working in an environment in which over half of the employees were experiencing marked reductions in stress from practicing the TM technique (see Discussion). This interpretation is supported by the results for the on-site controls who did not learn to meditate but also decreased near significantly in stress after 5.5 months \((p < .09)\).

On-site controls. By month 5.5, all of the on-site groups had decreased to approximately the same low level of stress. The reductions in the on-site controls were predicted by theory and support Hypothesis 3: that non-meditating co-workers would experience stress reduction due to the collective dynamics of consciousness in which a majority in the worksite (61% by the end of this study) practice the TM program.

Off-site controls. Off-site controls’ SCL scores did not decrease significantly over the same period from pretest to 5.5 months (Figure 1 and Table 3). An analysis of covariance on posttest scores with a pretest covariate showed that the groups differed at posttest \((\text{partial } F(4,42) = 2.81, p < .04)\). Sheffe’s post-hoc procedure indicated a significant difference between the off-site controls and the combined TM groups \((p < .05)\).
Long-term TM practitioners: Finally, Table 3 shows that long-term TM participants, who were not at the study worksite, also had low stress levels, which were not significantly different from the on-site TM group.

Physiological Stress Parameters

Table 4 summarizes the objective findings for the physiological stress parameters: blood pressure, heart rate, and breath rate at pretest, 6 weeks, and 5.5 months for the on-site participants in the TM treatment, alternative PMR treatment, and control groups.

Blood pressure (BP). The blood pressure decreases for the TM group were significant, supporting Hypothesis 1 that there would be improvements in stress related parameters over time. At pretest, the means for all groups were in the normotensive range. The TM group’s systolic blood pressure decreased by 3 mm Hg, from 112.5 at pretest to 109.5 at 5.5 months (p < .05). The TM group’s diastolic BP also

<table>
<thead>
<tr>
<th>TABLE 4</th>
<th>Physiological Stress Parameters over the Course of the Study: Blood Pressure, Heart Rate, and Breath Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest</td>
</tr>
<tr>
<td>Systolic Blood Pressure</td>
<td></td>
</tr>
<tr>
<td>TM N = 24</td>
<td>112.5</td>
</tr>
<tr>
<td>PMR N = 12.7</td>
<td>108.9</td>
</tr>
<tr>
<td>Control N = 7</td>
<td>105.0</td>
</tr>
<tr>
<td>Diastolic Blood Pressure</td>
<td></td>
</tr>
<tr>
<td>TM</td>
<td>75.8</td>
</tr>
<tr>
<td>PMR</td>
<td>76.1</td>
</tr>
<tr>
<td>Control</td>
<td>75.2</td>
</tr>
<tr>
<td>Heart Rate</td>
<td></td>
</tr>
<tr>
<td>TM</td>
<td>75.0</td>
</tr>
<tr>
<td>PMR</td>
<td>74.4</td>
</tr>
<tr>
<td>Control</td>
<td>70.4</td>
</tr>
<tr>
<td>Breath Rate</td>
<td></td>
</tr>
<tr>
<td>TM</td>
<td>20.3</td>
</tr>
<tr>
<td>PMR</td>
<td>20.1</td>
</tr>
<tr>
<td>Control</td>
<td>19.1</td>
</tr>
</tbody>
</table>

Note: All tests in this table: Student’s t, matched-pairs one-tailed.

<sup>a</sup> TM SBP, p < .05.

<sup>b</sup> TM DBP, p < .04.

<sup>c</sup> PMR at 6 weeks, p < .04, n = 12.

<sup>d</sup> PMR at 5.5 months, p < .25 ns, n = 7.

<sup>e</sup> PMR at 6 weeks, p < .02, n = 12.
decreased by 3 mm Hg, from 75.8 to 72.8 (p < .04). The three TM participants with the highest DBP at pretest showed a decrease in blood pressure from the hypertensive range to the normotensive range: SBP changed from 153.3 to 134.5 (p < .003); DBP changed from 95.6 to 87.8 (p < .03). Interestingly, the three participants with the lowest blood pressure at pretest actually tended to increase in blood pressure: SBP increased from 99.4 to 100.6 (n.s.); DBP increased from 62.8 to 67.2 (p < .07) (see Table 5). PMR showed a significant blood pressure reduction at 6 weeks posttest (p < .04, n = 12, matched pairs, one-tailed).

Over the full test period, neither the PMR participants nor the controls changed significantly on blood pressure, although their means at 5.5 months were similar to the TM mean. The statistical significance of the TM results could be because of greater statistical power since the TM group N was larger. But statistical significance also indicates that the change in the TM group was fairly consistent across participants, and that the reduction could not be attributed to chance. Also, the TM data suggest a “dose effect”: there was no appreciable change at 6 weeks but a significant change was noted at 5.5 months. Similar dose effects have been found in other studies (see Table 5 for comparisons with present study).

Heart rate (HR). Only the TM group showed small but nonsignificant reductions in HR at 6 weeks and 5.5 months (2 bpm). The PMR group increased by 2.7 bpm (p < .02) at their 6-week posttest, which took place four days prior to the stressful announcement of retrenchments in week 12 of the study. Oddly, diastolic blood pressure decreased at this time by 4.7 mm Hg (p < .04). It appears that increased arousal and vigilance (higher heart rate) coexisted with some relaxation (lower blood pressure) in these participants.

Breath rate (BR). There were no significant changes in breath rate for any of the groups.

Correlations between physiological parameters ranged from .29 to .83, the higher one being between systolic and diastolic blood pressure. Heart rate and breath rate were correlated at .6. Intercorrelations among the physiological and psychological variables were generally low and nonsignificant. Diastolic blood pressure and the SCL were correlated at .26, p < .01, but other physiological correlations with the SCL or company climate variables were not significant.

Productivity and Other Documented Changes

Productivity indices are charted in Figure 2. The chart indicates that overall company productivity decreased for two months and then rose following the retrenchment of 10 staff in May 1991. The net gain was
### TABLE 5  Comparison of Blood Pressure Findings in the Present Study with Previous Studies

<table>
<thead>
<tr>
<th>Authors</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Participants</th>
<th>Significance</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SBP/DBP</td>
<td>SBP/DBP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lovell-Smith et al. (1976)</td>
<td>118/95</td>
<td>112/74</td>
<td>18 normals; 5 hypertensives</td>
<td>.005, .001</td>
<td>10-week intervention. Measurement followed a 10-min TM practice</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(DBP &gt; 90)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooper &amp; Aygen (1978)</td>
<td>126.4/82.7</td>
<td>119.2/78.1</td>
<td>23 normals; age 44; 15 males, 8 females</td>
<td>.001, .001</td>
<td>38-week intervention</td>
</tr>
<tr>
<td>Agarwal &amp; Kharbanda (1979)</td>
<td>156.8/101.8</td>
<td>140.0/91.9</td>
<td>16 mild-moderate hypertensives (DBP &gt; 90)</td>
<td>.001, .001</td>
<td>24-week intervention</td>
</tr>
<tr>
<td>Wallace et al. (1983)</td>
<td>135.62</td>
<td>117.1</td>
<td>112; age 50; 56 m, 56 f</td>
<td>.001</td>
<td>cross-sectional comparison of long-term TM practitioners with U.S. normative data for white adults with 13+ yrs. education</td>
</tr>
<tr>
<td></td>
<td>U.S. norms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>of same age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(not pretest)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-19.52, difference from norms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Authors</th>
<th>Pretest BP/DBP</th>
<th>Posttest BP/DBP</th>
<th>Participants</th>
<th>Significance</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schneider, Alexander et al.</td>
<td>145.4/93.7</td>
<td>135.0/88</td>
<td>36 TM</td>
<td>TM vs C</td>
<td>Well-controlled 12-week, randomized study. TM decreased BP twice as much as PMR.</td>
</tr>
<tr>
<td>(1995)</td>
<td>93.7/88</td>
<td>88</td>
<td>46 PMR</td>
<td>.0005</td>
<td>TM effective for both genders and across risk groups (psychosocial stress, obesity, alcohol use, physical inactivity, dietary sodium/potassium, multiple risks)</td>
</tr>
<tr>
<td>Schneider et al.</td>
<td>144.3/89.7</td>
<td>140.3/87.6</td>
<td>mild hypertensives</td>
<td>TM vs PMR .025</td>
<td></td>
</tr>
<tr>
<td>(1996)</td>
<td></td>
<td></td>
<td></td>
<td>.05</td>
<td></td>
</tr>
<tr>
<td>This study</td>
<td>112.5/75.8</td>
<td>109.5/72.8</td>
<td>21 normals + 3 hypertensives (DBP&gt;90)</td>
<td>.05</td>
<td>22-week intervention. Independent of medication.</td>
</tr>
<tr>
<td>This study</td>
<td>153.3/95.6</td>
<td>134.5/87.8</td>
<td>3 hypertensives (DBP&gt;90)</td>
<td>.03</td>
<td>These were the 3 highest DBP at pretest in the above group.</td>
</tr>
<tr>
<td>This study</td>
<td>99.4/62.8</td>
<td>100.6/67.2</td>
<td>3 “hypotensives” (DBP &lt; 65)</td>
<td>.346 ns</td>
<td>These were the 3 lowest DBP at pretest in the above group.</td>
</tr>
</tbody>
</table>
from 15.3 to 16.7, a gain of 9.2%. Sales growth rate doubled from 6% before the intervention to 12% after.

Other changes in the company during and in the 2.5 years following the intervention were:

1. Staff numbers increased from 80 at the time of the intervention to 115, representing growth of 44%.
2. The company moved from its 1450 sq. meter premises to 2100 sq. meter premises in a new building.
3. Personal desktop computers were acquired for most staff.
4. Two new directors were appointed.
5. The company gained in market share by 1–2%.
6. A major new business opportunity was developed, in the form of a franchised customer satisfaction measurement service contributing about 15% of sales. The franchiser presented service awards to the company for two successive years.
7. The company was about to relaunch itself with a new corporate identity.
8. Sales had grown at a compound rate of “20–25%” per annum in years where inflation was 13.9% and 9.7%. This represents real growth of about 12% per annum, after adjusting for inflation. This is about double the average real growth rate for the seven years prior to the intervention (6.3%).
Company Climate

Initially results were analyzed at the 5.5-month posttest for all on-site participants. When it became apparent that retrenchments may have adversely affected results, a second analysis was conducted using data from only the TM groups. The TM 6-week posttests had been conducted before the retrenchments and provided a serendipitous opportunity to assess the impact of the retrenchments.

Although the two dimensions of principal interest were Support and Warmth, all dimensions were calculated to identify interesting trends. A single-factor ANOVA indicated that TM groups, PMR groups, and on-site controls were not significantly different from one another on any of the nine climate dimensions at pretest.

Support. As expected, positive shifts were seen in the test groups but not in the no-treatment controls. At the 6-week posttest, the TM groups (1–4) increased significantly on Support (p < .005).

At 5.5 months, the company score moved from 72.6 to 75.3 (n.s.), comparable with Banking at 78, as recorded by Nasser & Schmikl (1986) for this dimension. Other Nasser scores for this dimension were Beverages = 80, Retailing = 79, Mining = 73, and Services = 68.

Warmth. Compared with other company results reported by Nasser & Schmikl, the host company scores on Warmth were very high at pretest. Perhaps a ceiling effect was operating, as the company pretest score of 81.3 was higher than for Beverages and Hotels, the highest Nasser & Schmikl report for this dimension and highest for any company dimension. Although the TM groups increased somewhat at 6 weeks, and decreased at 5.5 months, neither change was statistically significant. Hypothesis 1 was supported only for Support at 6 weeks. The only other measure that changed was Identity, which decreased significantly (p < .005) at 5.5 months, possibly due to the fallout from retrenchments.

Subjective Perception of Benefits

Asking respondents whether they had noticed any change in productivity or output elicited positive responses in four out of the nine respondents. The other five did not offer any positive or negative comments; they were just neutral. Positive comments included: “different atmosphere and better productivity,” “we find we are more accurate the first time around,” “definitely improved,” “we were concerned [before learning TM, about a colleague’s creative output] and now we are not,” “my wife tells me I am more patient,” “TM helped us to deal with the more pressurized working environment,” and “individual people, definitely yes.”
Extending this question to whether the respondents had noticed any changes in productivity of the company as a whole since learning the TM technique, responses were also positive from four out of nine respondents. Comments were:

The company has had much more exposure and vision. We are much more in the public eye. We seem to have grown, and I think that has been over the past three years.

Yes. A lot more willingness amongst the staff to help instead of leaving people sitting here until ten at night to sort out their problems. ... in our department, problems were put on the table and sorted out there and then ... we were sticking together ... the staff were more united.

I would say three years ago [i.e., the year the TM program was implemented], yes there was probably a change ... I think it had a very good effect ... What has happened here is the company has grown to such an extent.

Respondents were then asked whether they had noticed any other changes in the organization since so many had learned the TM technique. Responses indicated many substantial changes in the company over the three years since learning the TM program. In the words of one respondent:

1992 (the year after TM instruction) was much better. And this year (1993) was a fantastic year. But there were a number of factors coming together here, and I would be most hesitant to ascribe it to TM. We hired new people and we were lucky in getting good people because our opposition went down. We got some of their big accounts and some of their people. So both ways we scored. I am convinced it’s the good people we had. It really made us successful because all our strength is people. The company has grown hugely. Our market share has picked up one or two percent.

When asked the direct question, “How would you rate the overall health of the company since January 1991?” the Marketing Director replied, “Could say it’s healthier. It’s gone up and down. In between, turnover has gone up about 20% compounded.”

**DISCUSSION**

This was a study of two stress reduction practices, the Transcendental Meditation technique and Progressive Muscle Relaxation, on psychological and physiological stress in a business in South Africa with 80 employees. On-site participants who volunteered to be in the study were randomly assigned either the TM technique or to PMR. There was also an on-site non-volunteer control group. In addition, there was an off-site
active control group of workshop attendees who were taught a number of business productivity skills, including suggestions on how to reduce stress.

At pretest, all groups had equivalent stress levels measured by the SCL-90 and they were not significantly different from normative data taken by the first author on 250 businesspeople in South Africa, which were somewhat higher than U.S. norms. During the course of the 5.5-month study, after over 61% of the 80 employees learned the TM technique, stress levels decreased in all on-site groups—the TM groups, the PMR participants, and non-volunteer controls, whereas it did not decrease significantly in off-site controls. The host company had more females than the off-site control group, and the off-site controls took the posttest by mail. But neither of these factors appears to explain why the on-site controls would decrease more on stress over time than off-site controls, given that the groups started at equivalent levels.

Both TM and PMR groups decreased in stress within 6 weeks, supporting hypothesis 1. However, the reduction in psychological stress was significantly greater after six weeks of TM practice than after six weeks of PMR practice, supporting hypothesis 2.

Off-site controls who received the business productivity skills training showed a nonsignificant mean reduction in stress level. The decrease may have been due either to benefits from the business skills workshop, or to regression towards the mean. Given the practical nature of the skills imparted at these workshops, there is anecdotal evidence of sustained behavioral change and there have been a large number of informal observations and qualitative reports of skill retention over decades, particularly in the case of nonlinear noting techniques. The workshop included specific practical recommendations for review of the workshop material. Therefore it is possible that some of the stress reduction recommendations were implemented by the off-site controls in the months following the workshop, although there were no formal follow-up sessions as in the case of instruction in PMR and the TM technique. These recommendations included the taking of adequate rest, exercise, dietary guidelines and lifestyle recommendations, though no actual meditation or relaxation technique was instructed.

Sixty-seven percent of the decrease in psychological stress in the TM group occurred in the first two weeks, and a similar marked reduc-

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6 It was interesting that the tabulated group means were all above Derogatis’ (1977) USA norms. He reported group mean scores on the SCL-90-R of 28 for 974 non-patient normals (480 female and 494 male), and 113 for 1002 psychiatric outpatients (577 female and 425 male).
tion in two weeks was observed in the replication study. Blood pressure decreased significantly only for the TM group: (p < .05 SBP; p < .04 DBP), decreasing 3 mm Hg for both systolic and diastolic after 5.5 months. Heart rate and breath rate did not change significantly.

The measures of company climate showed a significant increase in Support at 6 weeks for the TM group. According to the four test items that make up this scale, increased Support reflects increased sympathy from higher ups in the organization, management making an effort to talk to the person about her career and aspirations, management philosophy emphasizing the human factor and how people feel, and assistance from one’s boss and co-workers when on a difficult assignment. However, Support decreased (though nonsignificantly) at the 5.5-month posttest, apparently reflecting the retrenchments.

The decrease on the Identity scale appears to contradict the Support findings. Decreased Identity appears to reflect a feeling that one is not a member of a well-functioning organization, and that there is not much personal loyalty in the company. It could reflect a feeling of betrayal following the retrenchments. On the other hand, subjective reports from the interview at three-year follow-up indicated positive changes similar to the Support scale. Four of the nine interviewed expressed that there was a better atmosphere, improved attitudes, more patience, less pressure, more helpfulness, greater accuracy, and greater productivity, which was generally attributed to the TM program. However, one respondent suggested that the changes could be attributed to “a number of factors coming together” and “luck” due to attracting more good employees from a competitor after it went under. We shall return to this point below when we present our interpretation of all the measures and events in terms of Maharishi’s phase transition model of collective consciousness.

Documented changes in the study site at the three-year follow-up included company expansion to more employees, new bigger facilities, upgraded equipment, new directors, slightly greater market share, new markets, and faster growth.

At this time around half of the 49 people who had learned the TM technique were still meditating, still a substantial fraction of the company. During the three years following the intervention, the head count grew rapidly to 115, up at a rate of about 18% p.a. Real sales growth rate was about 12% (after inflation), double that of the previous seven years.

Unfortunately, over the subsequent seven years, attrition in the TM program continued, until only “about 5” people were still meditating 10 years after the intervention. Correspondingly, it would seem that the growth of the company slowed once more. In the past seven years up to
the present the staff has increased from 115 to only “120–130”, representing very slow growth of around 1% per year. The company has declined to make sales figures available.

Overall, the study was successful in its goal of replicating at the workplace previous clinical findings from clinical settings. Reductions in psychological stress symptoms were corroborated by improvements in physiological stress parameters. The blood pressure findings of this study are consistent with blood pressure findings previously reported in well-controlled randomized clinical trials (e.g., Alexander et al., 1996; Schneider et al., 1995). This study appears to extend previous clinical work by suggesting normalization in blood pressure through TM practice, not just reduction. Participants with high blood pressure decreased whereas participants with low initial blood pressure tended to increase to a more normal range. This suggests that the TM technique produces balance rather than merely somatic arousal reduction (Dillbeck & Orme-Johnson, 1987). Increased balance also has been noted in previous research showing that TM practice decreases cortisol in participants in which it is too high, and increases it in participants in which it is too low (Subrahmanyam & Porkodi, 1980).

These findings replicate and extend research by other authors on the TM technique as a worksite stress intervention. Studies conducted concurrently with the present study found clear and significant distinctions between TM practitioners and controls on a variety of psychophysiological measures of stress (Alexander et al., 1993; DeArmond, 1996; Haratani & Henmi, 1990a, 1990b). In these worksite studies, the intervention was limited to small proportions, from less than 1% to less than 10% of the total on-site workforce. The present study, however, had a substantially larger percentage of the company (61%) learning the TM program, leading to the prediction that even nonparticipants in the study would be affected.

Impact on the Whole Company—Collective Effects
The concept that the benefits of a stress management intervention would extend even beyond those participating in a new program is not new to management research. A number of studies in the stress management literature have also reported improvements in controls as well as experimental participants (Thomas, 1982). Murphy (1984) reported that six out of nine studies reported significant benefits in both experimental and control groups on some measures; the size of observed effects was usually but not invariably larger in the experimental groups. This phenomenon usually seems to be de-emphasized in the discussion of find-
ings or is explained as due to the operation of some environmental nuisance variable. Candidate explanations include Hawthorne Effects, social interaction effects, self-initiated treatments, expectation, placebo effects, regression toward the mean, pretest sensitization, or perhaps just doing the test is a powerful stress-reduction technique in itself. For example, Murphy (1984) suggested the following explanation:

It has been the author’s experience that workers have a great deal of interest in stress management programs and positive attitudes are generated whenever an organization allows employees to participate in such programs. Workers feel that the organization is concerned about them, and this results in a desire among participants to make the program successful. Such a state of affairs would explain in part the positive effects seen in controls on self-report measures. Significant decreases in physiological measures observed in control groups may be a function of taking the time out of the workday and sitting in a comfortable chair for 40 minutes or more (Murphy, 1984, p. 8).

In the present study, the on-site controls were initially generally negative towards the programs. Yet two of them eventually insisted on learning the technique. As a group the remaining non-volunteers decreased in stress whereas off-site controls did not. A possible argument against attention effects or the Hawthorne effect in this experiment is that off-site controls also received attention—a management skills course—but they did not change significantly on stress. Moreover, the stress-reducing effects of the TM program are triangulated by a wide variety of empirical data, including the significant reductions in blood pressure in the present and other studies (see Table 5), reductions in the major stress hormone plasma cortisol (e.g. Jevning, Wilson, & Davidson, 1978; Jevning, Wilson, & Smith, 1978) and increased autonomic stability (Orme-Johnson, 1973). There are many other examples.

Regarding Murphy’s (1984) suggestion that any kind of resting might have the same effect, a meta-analysis of 32 studies has found that the physiological effects of the TM technique are significantly greater than ordinary eyes-closed resting for the same period of time (Dillbeck

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7 So much so, that in an extraordinary paragraph, Murphy (1984) asserts that the improvement in controls may be statistically significant because of the small size of the control groups. He writes: “It is significant that studies which found significant effects in both control and trained groups utilized small comparison group sizes (n = 12 or less). The results could be explained by the low statistical power for detecting group differences and/or the high participant variability across outcome measures.” All authorities consulted by the present author seem to agree that small sample size makes it difficult to demonstrate statistical significance where differences in group means are not great and where individual scores are not homogeneous. Therefore it would surely be more accurate to say that differences in controls were noted despite small sizes of the control groups.
Moreover, an overview of meta-analyses and randomized studies has found that all stress reduction programs do not have the same effects (Orme-Johnson & Walton, 1998). Thus it is plausible that the calming effects on the TM group extended to their social interactions and helped reduce work stressors, thus lowering the stress of nonparticipants.

It is interesting to note that the stress level in the company after 5.5 months was not significantly different from that of long-term TM practitioners. In fact, the mean for the company was lower than that for the long-term meditators, though not significantly so. This suggests that working and meditating together with other meditators has greater stress reducing potential than meditating alone and working with non-meditators. The relatively high level of stress reflected by the South African and American (psychiatric outpatient) norms, as well as in the high pretest scores for all groups in the present study indicate that most work environments may be very stressful places, and perhaps much more so than they need to be. The finding that stress and blood pressure decreased, and productivity and success increased at the host company indicates that it is not necessary to have a high stress work environment to succeed. Indeed, the converse may be true.

In closing, we offer an interpretation of the results in terms of the field theoretic view presented in Maharishi Vedic Science. Briefly to recap the theory, Maharishi Vedic Science holds that each level of social organization has a corresponding collective consciousness that arises from individual members of the population and reciprocally influences every individual. The theory holds that individuals are always influencing each other via collective consciousness, even at a distance where there are no direct perceptual/behavioral interactions. Empirical research has found that when the number of TM participants in a city or nation exceeds 1% of the population, there will be a transition to a more coherent state of functioning for the group as a whole (Borland & Landrith, 1977). We do not know what percentage of meditators would be needed to create a phase transition for a population the size of a company, but the general principle is that for smaller groups, the larger the percentage that would be needed. Certainly the 61% in the present study should be enough.

One feature of collective systems that may provide some insight into the present study is the phenomenon of phase transitions, which is a topic central to the complexity sciences, the study of behavior and self-organizing phenomena in physical, chemical and biological systems (Haken, 1983; Nicolis & Prigogine, 1989). Phase transitions are found in many systems in nature when the temperature or other measures of
random activity are decreased. For example, when the motion of water molecules is decreased by lowering the temperature, at some point subtle ordering forces inherent in the molecules that are not seen under conditions of high temperature take over, and the molecules spontaneously organize themselves into a crystalline structure—ice. Moreover, as the temperature is reduced, the entropy or amount of disorder in a system is also reduced, and thereby impurities of any kind are eliminated.

Similarly, when the temperature of liquid helium is reduced below a specific critical value, a phase transition occurs and underlying quantum mechanical coherence manifests on the macroscopic scale—the liquid helium becomes superfluid, with unusual new properties. For example, superfluid helium flows without resistance; it does not evaporate when hot objects are placed into it; instead, it transmits the heat as sound waves.

The emission of coherent light by a laser is a third example of a phase transition to greater order in a complex system. This transition to greater coherence also occurs spontaneously as either the number of light-emitting atoms is increased (pumping), or the losses from the laser resonator are reduced.

In each of these cases, the intervention is concerned only with establishing the conditions under which the phase transition to coherent activity will occur. Right before the phase transition occurs, there is an upheaval, a bubbling up, as the system begins to reorganize itself. The amount of random fluctuations in the system increases dramatically. For example, the fluctuations in the density of water increase just before it crystallizes as ice; the liquid helium begins to bubble up before it finally settles down into its superfluid state; in the laser, the fluctuations of the intensity of the emitted light increase. Finally, these examples all involve the influence of a field effect which leads to the long-range ordering of the constituents of the water, helium or laser matrix material, as discussed by Druhl, Langstaff, & Monson (2001).

Applying these scientific principles to human society, Maharishi Vedic Science holds that there is a powerful source of order intrinsic to human consciousness, which is usually obscured by the agitation of stress (disorder) in the mind and body. At the basis of the active mind is a silent level of transcendental consciousness that is identical with the unified field of natural law, the ultimate source of order for the universe (Hagelin, 1987). The Transcendental Meditation technique is a means of allowing the mind to spontaneously reduce its agitation until a phase transition occurs, when the person transcends thought to directly experience transcendental consciousness, the state of perfect order of mind and body. This mechanism is held to be the basis of all of the effects of TM
practice. Because the individual always has an effect on others via collective consciousness, when she transcends, an influence of order is propagated through the system. This is a holistic, life-supporting effect on all levels of life: physiological, psychological, and sociological.

Consider the company in this study as an organic system with its own collective consciousness: When a large fraction of the company began to experience greater order through TM practice, the company as a whole began to be more coherent. Within the first two weeks after instruction in the TM technique, stress decreased markedly in the TM group, as verified by the replication study, in which anxiety also decreased in the first two weeks. This influence spread to other members of the company, as was apparent at week 6 in the reduction of stress in the PMR group before they learned PMR. At some point, week 12, the system as a whole reached the phase transition point—retrenchment! There were upheavals and changes (in the words of one employee “it was very, very, very traumatic”), but the ultimate effect of all this was that the system reorganized itself into a state of greater order and effectiveness, as indicated by increased productivity, a doubling of real growth rate of sales, new directors, a greater market share, new markets and “a new corporate identity,” in the words of one of the managers.

Returning to the laser analogy, at low pumping rate a laser emits random or normal light. This is analogous to the behavior of the company before the TM intervention. At the critical pumping rate, the previous field configuration becomes unstable, which is analogous to the retrenchment event. At this transition point, fluctuations are amplified, and a new, higher-level order is established, wherein individual atoms are entrained by the field to behave coherently. In terms of the suggested phase transition in the host company, this corresponds to the fact that even nonparticipating control participants become less stressed.

Individual members of management, and in fact all employees, no doubt played crucial roles in bringing about these changes. On the behavioral level, their efforts brought about the changes. But on the deeper level of the abstract intelligence underlying behavior, we argue that increased coherence in collective consciousness was the cause. Although this experiment did not tease out field effects from behavioral effects, the field theory provides a holistic perspective of the events that took place in this experiment. Some of these changes are not predicted by behavioral models; they suggest rich new avenues for future research. We contend that to really understand the dynamics of what happened in this study in particular and how businesses function in general, it is necessary to understand the functioning of the holistic level of collective consciousness. With knowledge of the dynamics of collective con-
sciousness, management may find it easier to improve the company as a whole or to handle trends and tendencies in the economic environment.

This deeper, broader knowledge provides alternative or nontradi-
tional interpretations of business phenomena and may thus enable man-
agement better to prepare for change. Such preparation could include
educating the management in the principles of collective consciousness,
so that they recognize and understand the changes that are taking place.
A practical step to actualize this broader understanding could be to learn
the TM technique themselves, which the literature suggests would make
them less stressed and more creative and flexible—ready to take advan-
tage of opportunities and change in the workplace.

**CONCLUSION**

This study indicates that the Transcendental Meditation technique
merits consideration as a program for occupational stress reduction; it
also suggests that a large proportion of organization members practicing
the Transcendental Meditation technique may improve organizational
performance. Company-wide implementation appears to serve both goals
simultaneously: benefiting both the organization and the individuals within
it. In this context it is interesting to note that instruction in a large
percentage of the staff in the TM technique appears to secure benefits even
for nonparticipants, therefore no one need be coerced into participating.

Future research may investigate not only the specific effects but also
the processes through which organizational systems begin to reorganize
themselves. Analysis of multiple studies may help identify the critical
thresholds at which organizational phase transitions take place. Whether
or not future research bears out the field theoretic perspective in busi-
ness, the empirical data alone from this and many other studies warrants
the implementation of this program for worksite stress reduction.
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