

**STRESS MANAGEMENT AND ORGANISATION DEVELOPMENT:
EFFECTS OF TRANSCENDENTAL MEDITATION ON
PSYCHOLOGICAL, PHYSIOLOGICAL, AND ORGANISATIONAL
VARIABLES AT THE WORKSITE**

by

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ONE PAGE ABSTRACT

This study evaluated the effectiveness of a stress reduction intervention (SRI) offered to employees at one worksite where 80 were employed. 41 Volunteers (aged 21-65) participated in Transcendental Meditation (TM), and 18 (aged 19-46) in Progressive Muscle Relaxation (PMR). Two groups did not attend the SRI. These were 11 non-volunteers for the SRI (aged 25-58) who served as on-site controls, while 16 outside attendees (aged 27-44) of a personal productivity workshop served as off-site controls. All subjects completed a standardised stress symptoms questionnaire (SCL-90-R) before and after the SRI. On-site subjects also had blood pressure, heart and breath rates measured by a trained nurse and completed a company climate questionnaire—before and after the SRI. Structured interviews were conducted at three year followup.

An hypothesis that test groups would show significant reductions in psychological stress symptoms was supported at 6-week (TM $p < 0,0001$, PMR $p < 0,001$) and 5,5 month followup ($p < 0,0002$, paired-t). TM groups showed significant reductions in blood pressure at 5,5 month followup ($p < 0,05$). Overall company climate showed improvement at 6 weeks which tended to reverse at 5,5 months, following retrenchment of 10 staff. Psychological and physiological variables were found to be positively correlated. Non-volunteer *on-site* controls appeared to benefit almost as much as those who received training, whereas *off-site* controls did not. Company effectiveness improved over three years following the intervention though causality was not addressed.

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CHAPTER I

BACKGROUND ON STRESS AND THE RESEARCH PROBLEM

INTRODUCTION

Stress in organisations has been blamed for wide ranging psychological, physical, behavioural and organisational ill effects including lost productivity. It is variously estimated to cost American business \$100 billion (Ivancevich & Matteson, 1990) to \$200 billion (United Nations International Labour Organization, 1993) annually. Furthermore, stress-related claims have climbed from 5% in 1980 to 15% of all USA occupational disability claims in 1990 (ILO, 1993). It has therefore attracted increasing research attention recently.

Despite a very large number of clinical and laboratory studies on techniques purporting to reduce stress, reviews of the stress literature (Newman & Beehr, 1979; Murphy, 1984, 1986) have pointed out a dearth of good evaluative experimental research on stress management, particularly at the worksite itself. Furthermore, in an earlier review, Beehr & Newman (1978) asserted that nearly all the studies of consequences of job stress were methodologically flawed—using self report data in correlational rather than experimental designs—"thus disallowing strong inference regarding the direction of causation."

One of the reasons why this state of affairs has persisted to the present is that daunting problems confront the stress researcher. The construct of stress itself is a complex phenomenon yet to be "exhaustively defined" (Van Staden, 1992). Indeed so complex that it may *never* be defined. As Pelletier noted:

Early in 1987 a major conference of psychologists and immunologists met for the sole purpose of defining a common ground in terminology, research procedures, and measurement in the PNI (psycho-neuro-immunology) area. Ironically, the first stumbling block was an attempt to define stress, leading to the unanimous conclusion that absolute definition was impossible (Pelletier, 1992: xxxi).

In addition, company managements are not easy to persuade of the need for stress reduction, because neither stress, nor the payoff for stress reduction is well understood. Payoff for reduced stress may be reduced costs (Kottage, 1992; Mulcahy, 1991; Allen, 1990; O'Donnell & Krumreich, 1989; Manuso, 1979), improved climate (Heaney, Israel, Schurman & Baker, et al, 1993), increased productivity (Parasuraman & Alutto, 1986), or broader change leading to increased organisational effectiveness (McHugh & Brennan, 1992). The linkage between organisational functioning and stress has been discussed by several writers (McHugh & Brennan, 1992; Altorfer, 1989; Byers, 1987), as has that between worksite features and burnout (Golembiewski & Roundtree, 1988), but does not appear to be well researched yet.

Furthermore, many practical difficulties hinder the execution of valid, replicable, quantitative research at the worksite (Pelletier & Lutz,

1989). Lack of authority, staff availability, disposition and compliance, and other factors circumscribe good experimental research in the real world, away from the laboratory.

Nevertheless, this case study attempted to throw more light on job stress management in South Africa. The research problem was to evaluate a stress reduction intervention *at the worksite*. This study of a medium-sized South African company wished to investigate the longitudinal impact of training in stress reduction—on self reported stress symptoms, certain physiological parameters, and productivity. However, at the outset of the study it appeared that productivity data would be difficult to find, so company climate was studied as well—as a possible intervening variable from which productivity could be inferred,

The study was designed to overcome shortcomings in previous research (such as lack of adequate controls) and to extend clinical findings to the practical world of organisational life. Measurements made in the field may have more value for prognostication of stress consequences than those made in the doctor's office (Dimsdale, 1984). The study was therefore designed as a field experiment, had a strongly quantitative orientation and used a prospective experimental design.

As the study unfolded, it became apparent that stress reduction in a large proportion of the staff of the organisation was associated with positive trends in organisation climate and the company grew substantially. Stress management may therefore have broader

implications for the management of organisational change, and thus begs to be considered within a larger organisation development (OD) framework (Altorfer, 1989). Adams (1980: 180) admonished organisation development professionals to approach stress management as an OD intervention to increase the effectiveness of both personal habits (such as exercise, relaxation and diet) and organisational habits (such as counselling services, vacations and annual medical checkups).

As mentioned, there are many limitations to the usefulness of a strictly quantitative, experimental approach in the real world where volunteer companies are hard to find. For example, the use of a sample consisting of staff at only one organisation may limit the generalisability of the findings to other organisations or groups. In addition, the study of a single organisation (as happened here) may impose a practical limitation on sample sizes.

For these reasons, the quantitative investigation was extended to representative comparison groups *outside* the participating company (as called for by Murphy, 1986). In addition, some of the limitations of the quantitative analysis were addressed by a *qualitative* analysis of the intervention three years later. This qualitative survey also embraced a second smaller organisation. Finally, the question of sample sizes was addressed by the rigorous application of appropriate statistical techniques designed to handle modest sample sizes where relevant.

PREVIEW

This dissertation first examines the historical development of the stress concept and demonstrates that there is no easy answer to the question "what is stress?" However, stress must be defined or it cannot be measured.

Therefore operational definitions are proposed before motivating the study of stress in organisations and reviewing the available worksite stress management literature in chapter II. Having thus developed a framework for the study of stress management, chapter II presents a rationale for the choice of stress management techniques (or treatments). It goes on to operationalise the key research question "does the treatment work *at the worksite?*" by developing specific, testable research hypotheses.

Chapter III motivates and elaborates the methods and procedures used to collect and treat data for the study.

Chapter IV presents the detailed statistical treatment of these data.

These results are discussed in Chapter V and an "hierarchic model of stress and coping" is proposed as a response to the stress literature in the light of the findings of the study. Finally, chapter VI summarises the entire dissertation along with the key findings that:

1. Transcendental Meditation (TM) was effective in reducing stress levels as measured by psychological stress symptoms and physiological stress parameters.

Physiological changes were in line with previous clinical research on TM. Psychological changes were in line with previous work site research on other techniques.

In addition, some evidence was found of normalisation of blood pressure (i.e., blood pressure tended to *increase* in those with initially low levels) following training in TM.

2. Non-volunteer *on-site* controls appeared to benefit almost as much as those who received training, whereas *off-site* controls did not.

The sizes of the improvements seemed greater than can be accounted for by traditional explanations such as the Hawthorne effect and may be due to the operation of field effects as reported elsewhere.

3. Reductions in stress levels were correlated across psychological and physiological stress parameters. Beneficial changes in overall company climate accompanied the psycho-physiological improvements. However the climate dimensions of principal interest, WARMTH and SUPPORT, were negatively correlated with physiological variables, but showed a slight tendency to correlate positively with psychological variables. Consideration of these

findings, together with those below, lent some support for the commonsense proposition that there may be an OD payoff for stress reduction, measurable in terms of improved company climate.

4. Productivity appeared to improved slightly over six months following the intervention and overall company effectiveness appeared to improve over the following three years. This finding was not unexpected,¹ and appears to be in line with anecdotal reports from elsewhere. If this finding can be replicated and anecdotal reports corroborated, it suggests a possible useful role for Transcendental Meditation in the processes of change management and organisation development.
5. Just as stress management may impact on organisational effectiveness, organisational changes seem to impact stress levels, as seen by increases in physiological stress parameters for subjects posttested after an organisational stressor in the form of retrenchments.

For the reader's convenience these findings are repeated in increasingly greater detail in chapter VI, in the recap at the beginning of chapter V, in the introduction to chapter IV—and are of course presented fully in the body of chapter IV.

¹ Although commonsense suggests that productivity may improve if employees are "less stressed," productivity improvement was not the subject of a formal null hypothesis, because at the commencement of the study it appeared that productivity data would be unavailable.

STRESS

The purpose of this section is to provide a brief review of the stress literature in order to be able to define stress operationally and to develop empirically testable hypotheses later.

The stress concept is not new. As Selye put it:

It must have occurred even to prehistoric man that the loss of vigour and the feeling of exhaustion that overcame him after hard labour, prolonged exposure to heat or cold, loss of blood, agonising fear or any kind of disease had something in common ... When the feeling came ... he must have realised instinctively that he had exceeded the limits of what he could reasonably handle - that, in other words he had 'had it!' (Selye, 1974: 18)

Stress and disease - psychosomatic illness

Mind and body have been intimately linked in the causation of disease since the beginnings of medical history. Caraka (approx 200 BC) reported Agnivesa's comment on the causes of disease:

Perverted, negative and excessive use of time, intelligence and sense objects is the threefold cause of both psychic and somatic disorders (Sharma, 1981: 7).

Agnivesa lived around 1000 BC.

Compare this with Friedman & Rosenman's modern (1974) definition of "coronary prone" or Type A behaviour: They have asserted that the Type A personality is engaged in:

an excessive and chronic struggle to obtain an unlimited number of often poorly defined things from his environment, often in the shortest possible time (Strümpfer, 1978: 48).

This definition clearly links psyche and soma, i.e., personality and behaviour with physical disease. The term "psychosomatic" has been used for some time even in the modern medical literature. The German psychiatrist Heinroth wrote in 1818 that "as a general rule the origin of insomnia is psycho-somatic" (Lipowski, 1984: 155).

According to Pelletier (1979: 1), psychosomatic or stress-related disorders include cardiovascular disease, cancer, arthritis and respiratory disorders, such as emphysema and bronchitis, and in addition, widespread depression. Since the turn of the century these "afflictions of civilisation" have taken over from cholera, tuberculosis, dysentery and typhoid as the leading causes of death.

Thus stress has been implicated in a very large number of deaths. Medical literature is however, divided on the role of stress in the aetiology of disease. As Pelletier put it :

Throughout the history of medicine there has been controversy concerning the internal versus the external determinants of health and disease, and today the debate is more evident than ever... (1979: 96)

The view that environmental factors (i.e., stressors) have a major role in the causation of disease seems to be gaining ground. On the other hand...

when contemporary researchers assert that an infectious disorder involves psychosocial and environmental dimensions, their data are suspect since the prevailing model is based primarily on micro-organisms (Pelletier, 1979: 96).

It is interesting to note how the focus of blame for disease has shifted over the past hundred years from social factors to microbes. Now the pendulum seems to be swinging back again.

Microbiologists like Louis Pasteur identified microbes such as those found in diphtheria and tuberculosis sufferers nearly a century ago. It is ironic that when they blamed these "germs" for the disease, they were criticised because medical opinion then was that these disorders were the product of social and environmental factors.

Shortly thereafter, at the turn of the century, Claude Bernard said in flat contrast to Pasteur's views that our body's internal environment (*milieu interieure*) maintained an equilibrium that resisted disease - that the "seeds" of disease surrounded us but did not affect us unless the body was in a state to receive them, i.e., unless the equilibrium was upset (Adams 1980: 13).

In the 1930's Walter Cannon suggested the term "homeostasis" for the physiological processes which maintain the body equilibrium. Cannon described "the wisdom of the body" which made physiological adjustments in response to change and disruption. He has been credited with the origin of the term "fight-or-flight" to describe the body's

physiological response to a perceived threat in the environment (Selye 1974: 19).

The complex interconnections between psychological, physiological and sociological phenomena in the processes of health and disease were demonstrated over ninety years ago by the life charts of Adolf Meyer (Adams, 1980: 13).

These phenomena were extended by Holmes & Rahe (1967) who examined the relationships between life settings, emotional states and specific diseases. They noted that stressful life events played an important causative role in the natural history of many diseases by evoking psychophysiological reactions (Holmes & Rahe, 1967: 215). These stressful life events had a common theme—each required significant change for the individual and required coping or adaptation. Holmes & Rahe (1967) devised a "Social Readjustment Rating Scale" which scored and ranked stressful events such as from "death of a spouse" (100 points) to "minor violations of the law" (11 points). This scale has become very well-known. According to Holmes & Rahe (1967), higher total points correlated with both greater severity of illness and greater chances of getting sick.

These ideas have been supported more recently by studies in which for example the onset of influenza was found to be uncorrelated with the amount of Asian flu virus present in the bloodstream. Bad emotional

experiences seemed to be the precipitating factor, not the presence of the virus, according to Adams (1980: 15).

Thus according to Pelletier:

Medical science is coming to understand that the human mind is not walled off from the supposedly involuntary activities of the autonomic nervous system (Pelletier, 1979: xiii).

As elaborated later in detail, stress seems to damage every major body system. Examples are the cardiovascular system (heart attack, hypertension, angina pectoris, arrhythmia, migraine); the digestive system (ulcers, colitis, constipation, diarrhoea, diabetes) and the immune system (influenza, arthritis).

These problems have an obvious impact on occupational productivity variables such as absenteeism, illness rates, time lost through visits to the health centre and health care costs (Manuso, 1979).

In order to understand the interaction of stress with these variables it was necessary to examine the nature of stress, starting with a glimpse of the mechanics of the stress response, and then trying to answer the question—what is stress?

The physiology of stress

What happens inside people as real or perceived threats (i.e. stressors) come and go? Pelletier (1992) has provided a succinct overview of the physiology of the stress response in the following terms. He began by

describing the overall orchestration of the body by two major subdivisions of the nervous system:

Two distinct but interdependent parts of the autonomic (or involuntary) nervous system are responsible for the regulation of (stress related) changes. One is the *sympathetic* nervous system and the other is the *parasympathetic* nervous system (italics mine). Generally the sympathetic system tenses and constricts involuntary muscles, such as those of the blood vessels by means of the tiny muscles in their walls, and activates the endocrine system, although it does control dilation in some systems. In contrast, the parasympathetic system generally initiates the dilation of the body's smooth muscles and induces a state of relaxation (Pelletier, 1992: 56).

He then proceeded to elaborate the mechanics of the stress response:

...during stress blood tends to shift away from the periphery of the body, such as the hands and feet, and the gastro intestinal tract, towards the head and trunk. ...subjectively the overall characteristics of excessive sympathetic-nervous system activity (i.e. stress) are: dilated pupils; tight throat; a tense neck and upper back with the shoulders raised up; shallow respiration; accelerated heart and pulse rate; cool, perspiring hands; a locked diaphragm; a rigid pelvis with the genitals numb and the anus tight; flexor muscles in the legs contracted and extensors inhibited. ...each of these systems or signals is a clue to the individual that he or she is under stress (Pelletier, 1992: 56).

Clearly the stress response, mediated by the parasympathetic nervous system, does not feel pleasant. Recovery from stress presumably involves the reversal of the above changes.

According to Pelletier (1992), relaxation or recovery from stress, mediated by the parasympathetic branch of the nervous system, feels subjectively more pleasurable. English contains many expressions

reminiscent of parasympathetic activity, such as: "warm-hearted", "my heart goes out to you", "swollen with pride", "flushed with excitement."

Because stress and stress reversal are so central to this study,

Pelletier's next comment is important:

...there is one vital distinction between the two systems which is central to an understanding of stress responses. Parasympathetic nervous activity is relatively specific in its influences and selective in its activation of the organs it controls. The sympathetic system ...usually acts through a general excitation effect ... termed mass discharge. This phenomenon is sometimes referred to as the 'fight-or-flight' response and constitutes the body's most comprehensive reaction to extreme stress. All the stress responses can be considered as an ergotropic response (Greek ergos: work) to initiate fight-or-flight activity. On the other hand, the movement towards relaxation is termed a trophotropic response (Greek trophos: nutrition), in which the person receives the nutrition of relaxation. At this point, suffice it to say that when the fight-or-flight response is prolonged, and when an individual cannot take action by fighting or fleeing to release his body from this response, the consequences can be deleterious to health (Pelletier, 1992: 56).

Pelletier (1992) also pointed out differences in the body's reaction to transient versus long term stress. The hormone adrenalin appears to be implicated in the immediate fight-or-flight response (see also de Wied, 1980: 252)—raising metabolic rate, including heart rate and breath rate². Another hormone implicated in the short term stress response is noradrenaline which is responsible for raising blood pressure with much less influence on heart rate. It appears that different proportions of adrenalin and noradrenaline are released from one stress response to

² This point is necessary background to interpreting some of the physiological data flowing from this study.

another. Pelletier (1992) has asserted that many researchers tend to regard adrenalin as the "fear hormone" and noradrenaline the "anger hormone."

The foregoing has presented a biological insight into some of the essential mechanics of the stress response and concludes that:

...generalised, prolonged and unabated stress places a person in a state of disequilibrium, which increases his susceptibility to a wide range of diseases and disorders" (Pelletier, 1992: 56).

Now for the question: what is stress?

Stress models - attempts to define stress

The stress concept is defined differently in different conceptual models, which hampers the integration of knowledge about stress (Scott & Howard, 1970: 265). This problem has persisted, as illustrated by the following comment by Beehr & Newman in the course of their review:

...the present authors have carefully avoided defining the term 'stress', primarily because there is no universally agreed upon meaning among behavioural scientists let alone scientists in general (Beehr & Newman, 1978: 667).

A wide range of definitions, proposed causes and assumed effects has been associated with stress (Shirom, 1982: 21), burnout (Meier, 1984: 211) and psychosomatic disease (Lipowski, 1984: 153).

In fact over 300 definitions have been proposed for stress according to Allmann (1985: 11). For instance, Selye's (1974: 13) definition of stress as

the non specific response of the body to any demand placed upon it, is one well-known early definition.

Stress as a response

This definition is representative of the response-based approach wherein stress, the *dependent variable* is viewed as a pattern of responses to an agent or stressor.

Stress as a stimulus

Stress is alternatively seen as a property of the environment, i.e., as an *independent variable*. This stimulus-based approach views stress as the stimulus which provokes a response termed "strain." In a limited way this is analogous to the behaviour of materials under the influence of a deforming force.³

For example, researchers at the University of Michigan (Caplan, Cobb, French, van Harrison & Pinneau, 1975), defined strain as *any deviation from normal responses in the person*. They differentiated between psychological strains (such as job dissatisfaction, anxiety and low self-esteem), physiological strains (such as elevated blood pressure and serum cholesterol levels), and behavioural strains (such as smoking and dispensary visits).

The idea of deviation from normal is also found in the work of Maharishi Mahesh Yogi (1972) and others who describe stress more

³ Engineers refer to the deformation of a mechanical structure as "strain" and the system of deforming forces as the "stress."

broadly as resulting from any "overload" on the functioning of the nervous system, and which remains in the organism in the form of a biochemical or structural abnormality. For example, "a single photo flash may create a stress in the mechanisms of visual perception" (Alexander, Davies, Dixon, Dillbeck, Druker, Oetzel, Muehlman & Orme-Johnson, 1990: 299). This school of thought is also represented by Wallace, Fagan & Pascoe (1988) who regard stress as a disruption of homeostasis or balance in the physiology and psychology "caused by a violation of natural law."

As will be seen later, this study develops this idea of deviation of psychological and physiological responses from normal.⁴ However, this study chose to use the term *stress* rather than strain to describe the deviation, if for no other reason than that the primary outcome measure was called the "*Stress Symptoms Checklist*," of which more later.

Scott & Howard (1970: 259) presented a useful review of conceptual models of stress in the literature. They presented the following eight models:

1. The *social psychology of adaptation model* was formulated by Mechanic (1962) to interpret a study of graduate students under the stress of doctoral exams. Mechanic defined stress as:

- ...the discomfoting responses of persons in particular situations.
- ... Factors promoting discomfoting responses are :
- ability and capacity of a person,

⁴ A suggestion of normalisation of blood pressure was found after training in stress reduction in this study.

- skills and limitations produced by group practices and traditions,
- the means provided to individuals by the social environment, and
- the norms that defined where and how an individual may utilise these means (Mechanic, 1962: 7)

According to Scott & Howard, this model "...applies most appropriately to the social and social-psychological level of functioning in the organism (1970: 260)."

2. The *combat model* was formulated by Basowitz, Persky, Korchin & Grinker (1955) based on a study of men in combat. Central concepts of the model were "anxiety," "stress," and "stress situations" (1955: 54). Stress referred to the class of stimuli that were more likely than others to produce anxiety, defined as conscious and reportable feelings of intense dread and foreboding. Stress situations were those that contained stimuli that were so intense and threatening to vital functions that they were likely to overload the capacity of most organisms. It was recognised that these situations may provoke differing responses. According to Scott & Howard (1970), the model has been used to interpret the responses of groups of persons simultaneously under great pressure.

3. The *psychosomatic model* of stress was developed in separate studies conducted by Alexander (1950), Dunbar (1947) and Grinker and Spiegel (1945). These writers suggested that alterations in basic physiological processes as well as subjective feelings of intense dread and discomfort were both expressions of anxiety or fear generated by serious

conflicts. If such conflicts were not confronted directly, the predicted result was that the tension would be internally dissipated, flowing from one body system to another, thereby producing organic changes.

4. The *protective reactions model*, developed by Wolff (1950, 1953) was related to the psychosomatic model. The principal concept here was the "protective reaction pattern" according to which the body attempted to seal off and then rid itself of a threat to its integrity. Feelings, behaviour and physiological changes were considered to occur *simultaneously*. As will be seen later, this study develops this idea of simultaneous changes by investigating correlations between psychological, physiological and climate variables.

5. The *biochemical model* developed by Selye (1956) was also related to the previous two models. He described stress as the non specifically induced changes in a biologic system as a result of a demand placed on the system. The model embraced a three-stage "General Adaptation Syndrome" which progressed from an alarm reaction, leading to a resistance phase, followed by exhaustion if the stressor persisted despite these responses (Selye, 1974: 22). Detailed mechanics of this and the following model were discussed under *the physiology of stress* earlier.

6. Scott & Howard also discuss "a kind of *mechanical model of stress*" (1970: 262). This was in fact a set of assumptions implicit in the work of a large number of researchers who have isolated specific physiological changes associated with stressful stimuli. In this model stress is viewed as

"the internal response of the organism to an external load placed upon it by some pathogenic agent, stressor or life crisis" (Scott & Howard, 1970: 262). These authors cited research showing effects of stress on physiological processes such as changes in cardiac function, mucous membrane secretion and gastric functioning. In addition, stress was linked to the onset of specific disease syndromes such as cardiovascular disorder, ulcerative colitis, dermatitis and glaucoma. Thus stress, the internal response of the organism, led to pathological changes and certain typical disorders of adaptation. These consequences may be called "strain" as indicated in the diagram to follow (figure 1a).

7. The *mental disorders model* evolved by Dohrenwend (1961), modified Selye's (1956) physiological stress model and applied it to the incidence of mental disorders. Dohrenwend isolated five factors in stress reactions: external stressors; mediating factors; the perceived experience (interaction of stress and mediating factors); the adaptive syndrome (attempts to cope); and the organism's response (which may be adaptive or maladaptive). Stress was regarded by Dohrenwend as the product of any behaviour in response to pressures, regardless of whether the response was adaptive or maladaptive.

8. The *disaster model* was evolved by Janis (1954) to interpret the responses of disaster victims. The model embraced psychological responses to traumatic events such as air raids, surgery and natural disasters and the intra psychic and situational determinants of these

responses. Janis identified three major phases of danger associated with all large-scale disasters, and five types of responses associated with these phases (Scott & Howard, 1970: 264).

Subsequent to this early review, several *appraisal models* have been developed, including those by McGrath (1976) and Lazarus (1980). While acknowledging the physiological component of stress, these models argue that the individual's emotional state and appraisal of the situation mediate the experience of stress, according to van Staden (1987).

The review presented above highlights the first limitation of stress models—the word "stress" means different things in different models. A second limitation of these early stress models, according to Scott & Howard (1970), was that they tended to be field-specific, thus precluding ready generalisation of research finding to other areas of life. A third limitation was that they tended to deal exclusively with extreme situations such as disasters and crises, or acute reactions such as heart attacks or ulcers.

A fourth limitation was that most earlier models were incomplete. By this Scott & Howard (1970) meant that they did not take into account all of the relevant variables that produce stress. Personal experience may for example be an important resource which would mediate the response to a problem situation. According to these writers, "it is important ... that these factors be explicitly recognised in the conceptual models on which empirical studies are based" (Scott & Howard, 1970: 268). However, this

injunction inevitably leads to great complexity, such as may be seen in the model proposed by Shirom (1982) and discussed below in the section: *occupational or job stress*.

Fifthly, most models contained what Scott & Howard termed "unjustified assumptions" (1970: 268)—such as the assumption that what is perceived and experienced as stressful for one individual is necessarily so for another. The sixth limitation proposed by Scott & Howard was that a number of models did not entirely explain all observed phenomena, such as the variability between individual response patterns to the same threats.

At this point it is useful to turn to the specific field of occupational stress and more recent research which has addressed some of the above limitations.

Occupational or job stress.

McGrath (1976) defined job stress as:

...a set of preconditions which, once satisfied, warrant describing a certain situation as having stress in it *from the viewpoint of an employee*. These preconditions are:

- the employee must perceive an organisational demand,
- the demand should be perceived as being out of balance with the employee's capabilities, and
- failure to meet the demand should be perceived by the employee as likely to result in sanctions (McGrath, 1976).

This model made explicit reference to the role of perception in the stress process, thereby addressing one of the limitations of earlier models.

Another major stress conceptualisation, the person-environment fit or P-E fit theory developed by French, Rogers and Cobb (1974), defined job stress as a mismatch between the characteristics of the person and of the environment. This was associated with psychological (e.g. job dissatisfaction) or physiological strain (e.g. high blood pressure).

Margolis & Kroes (1974) defined job stress as a condition at work which interacted with worker characteristics to disrupt psychological or physiological homeostasis. The situational causes were job stressors and the disrupted homeostasis was job-related strain. They suggested that there were at least five dimensions to job-related strain which they labelled: short-term subjective states, long-term and more chronic psychological responses, transient physiological changes, physical health and work performance decrement (Beehr & Newman, 1978: 669). For purposes of this study these changes may be conveniently reclassified as:

- Psychological:

- transient anxiety, tension and anger,
- chronic depression, malaise and alienation;

Physiological:

- biochemical: blood pressure, catecholamine changes,
- health: gastro intestinal complaints, coronary heart disease and asthmatic attacks; and

Work Performance Decrement.

Building on French et al's (1974) and McGrath's (1976) models, Shirom (1982) made a facet-analysis of stress. (According to Shirom, a facet was a conceptual dimension underlying a set of variables.) Shirom's extraordinarily complex definition of organisational stress is as follows. It is quoted here only to illustrate the lengths to which stress researchers have been forced to go in order to try to account for all the relevant variables impinging on the stress construct (as called for earlier by Scott & Howard (1970: 268). Shirom's "mapping sentence" follows:

An item belongs to the universe of organisational stress if, and only if, its domain asks for an employee's perception of:

<u>Description</u>	<u>(Facet)</u>
an ongoing condition or an episodic appearance of	(Duration of demand)
an ambiguous or conflicting or quantitatively overloading or varied or complex demand which originates from	(Type of demand)
roles played by the employee or significant others or procedures in reference to	(Source of demand)
individual work process or individual output or group work process or group work output which is perceived as	(Interaction context)
quantitatively or qualitatively taxing his or her	(Aspect of resource)
individual or organisational resources to a	(Type of resource)
very little or very large extent, or any combination of the elements in the facet (Shirom, 1982: 27).	(Range)

According to Beehr & Newman (1978: 669), many other variables are also thought to be important in the job stress process. These include biochemical individuality, early lack of experiences, psychological set, cultural factors, conscious and unconscious defence mechanisms and social support systems.

Writing four years before Shirom, Beehr & Newman proposed a general definition of job stress as:

a situation wherein job-related factors interact with the worker to change (i.e., disrupt or enhance) his or her psychological and/or physiological condition such that the person (i.e., mind - body) is forced to deviate from normal functioning (1978: 669).

Although it begged the question of what was meant by "normal functioning," this definition is useful because:

- it also embraced the field of employee health, i.e., his or her mental and physical functioning as a continuum from perfection to death,
- it did not exclude the possibility of beneficial effects of stress on performance,
- it embraced those views of stress as an environmental demand, an individual response or the interaction between the environment and individual,
- it embraced Selye's (1974, 1956) physiological concept of stress as a non-specific response to *any* demand or stressor, i.e., it did not require stress to be a response to an *excessive* demand, and

- it opened the way to the following facet design:

Beehr & Newman's facets were as follows:

1. Environmental facet: - job and role demands, organisation climate, etc.
2. Personal facet: - psychology, physiology, health, sociology, etc.
3. Process facet: - perceptions, evaluations, neurological processes etc.
4. Human Consequences facet: - psychological, physiological and health etc.
5. Organisational Consequences facet: - productivity variables
6. Adaptive Responses facet: - meditation, relaxation, social support, etc.
7. Time facet (Beehr & Newman, 1978: 671).

This facet analysis was important to the present study because it provided an explicit framework for interpreting the results of the stress reduction interventions used here. In addition, it was broader than Shirom's later (1982) analysis. For example, Shirom chose to exclude objective measures of stress such as physiological variables. Yet self-reported stress may be distorted by perceptual biases as he himself points out (Shirom 1982: 33).⁵

⁵ This idea is supported by the work of Coles (1984) who found differences in stress perception between practitioners of stress reduction programmes and controls.

Beehr & Newman (1978) concluded that the organisational consequences facet of job stress had been the subject of very little inquiry within the context of job stress research, and "both *human and organisational consequences* need to be studied in relationship to the same job stressors in the same study" (italics mine). The present study wished to do this. Therefore these facets are now examined in more detail below.

Human consequences of stress in organisations

Psychological consequences

Beehr & Newman's review (1978: 665-699) presented evidence showing a job stress link with job dissatisfaction and with poor mental health, i.e., neuroticism, tension, depression, irritation and anxiety. Other psychological consequences included low self-esteem, boredom, psychological fatigue, and resentment.

Physical (physiological) consequences

Much of the literature on the consequences of stress in organisations has focussed on the cardiovascular system. Beehr & Newman's (1978) survey presented evidence of a job stress link with cardiovascular abnormalities such as elevated blood pressure, elevated cholesterol levels, elevated pulse rate, and electrocardiogram abnormalities.

Their review further implicated job stress with decrements in general health, such as higher incidence of sick reports and medication required, elevated uric acid, peptic ulcer, elevated blood sugar, and with self reports of physical illness.

Behavioural Consequences

The same review found evidence that smoking and escapist drinking were further potential consequences of job stress.

Thus stress experienced in organisations has been blamed for wide ranging psychological, physical and behavioural ill effects which some writers have labelled *strain* (e.g., Margolis & Kroes, 1974).

Organisational consequences—stress and productivity

What is the relationship between stress and productivity?

The idea that stress impairs performance is not new, but the evidence from field studies appears to be inadequate. Brief & Aldag (1976) and others have reported job stressors and felt stress to be linked to staff turnover (Parasuraman & Alutto, 1984: 332). According to Parasuraman & Alutto, performance was posited by several researchers to be influenced most immediately by felt stress (1984:332). However Davies (1968) found the effects of stressors to vary from enhanced performance to logarithmically reduced performance, with a wide spectrum in between.

Furthermore, according to Allmann, "the reliability of performance degradation effects has fallen very much into question" (1985: 15).

An hypothetical relationship was proposed by Hebb (1949). In this classic theory, arousal and performance were held to have an inverted - U relationship wherein sub-optimal performance arose from excessive *or* insufficient arousal. This view has intuitive appeal and is supported by a wide variety of evidence (Groves & Schlesinger, 1979: 479).

One laboratory study by Sales (1970) found that job overload (on an anagram task) was related to task performance. Overloaded subjects decoded more anagrams but made more errors and decoded a smaller percentage of the anagrams given them. "Thus depending on the definition of job performance, job overload led to either better or worse performance" (Beehr & Newman, 1978: 690).

Sales' study was important in the present context because it measured both productivity (anagrams solved) and physiological variables (heart rate) while manipulating the stressor (overload). Few other researchers appear to have measured productivity and physiological variables simultaneously. One exception was a study by Kohn (1981) who, according to Murphy (1984), found that individuals trained in progressive muscle relaxation showed lower heart rates and made fewer errors under conditions of high noise.

According to Beehr & Newman, (1978: 691), Lyons (1971) showed that perceived role ambiguity (correlated with job-related tension) was related to voluntary staff turnover among registered nurses.

This overview of the stress literature has concluded with what Beehr & Newman described as the human and organisational consequences facet. The adaptive responses facet will be discussed later, in chapter II: *the management of stress and development of hypotheses*. The time facet is addressed by the experimental design, as discussed in chapter III: *methods and procedures*.

Toward an operational definition of stress

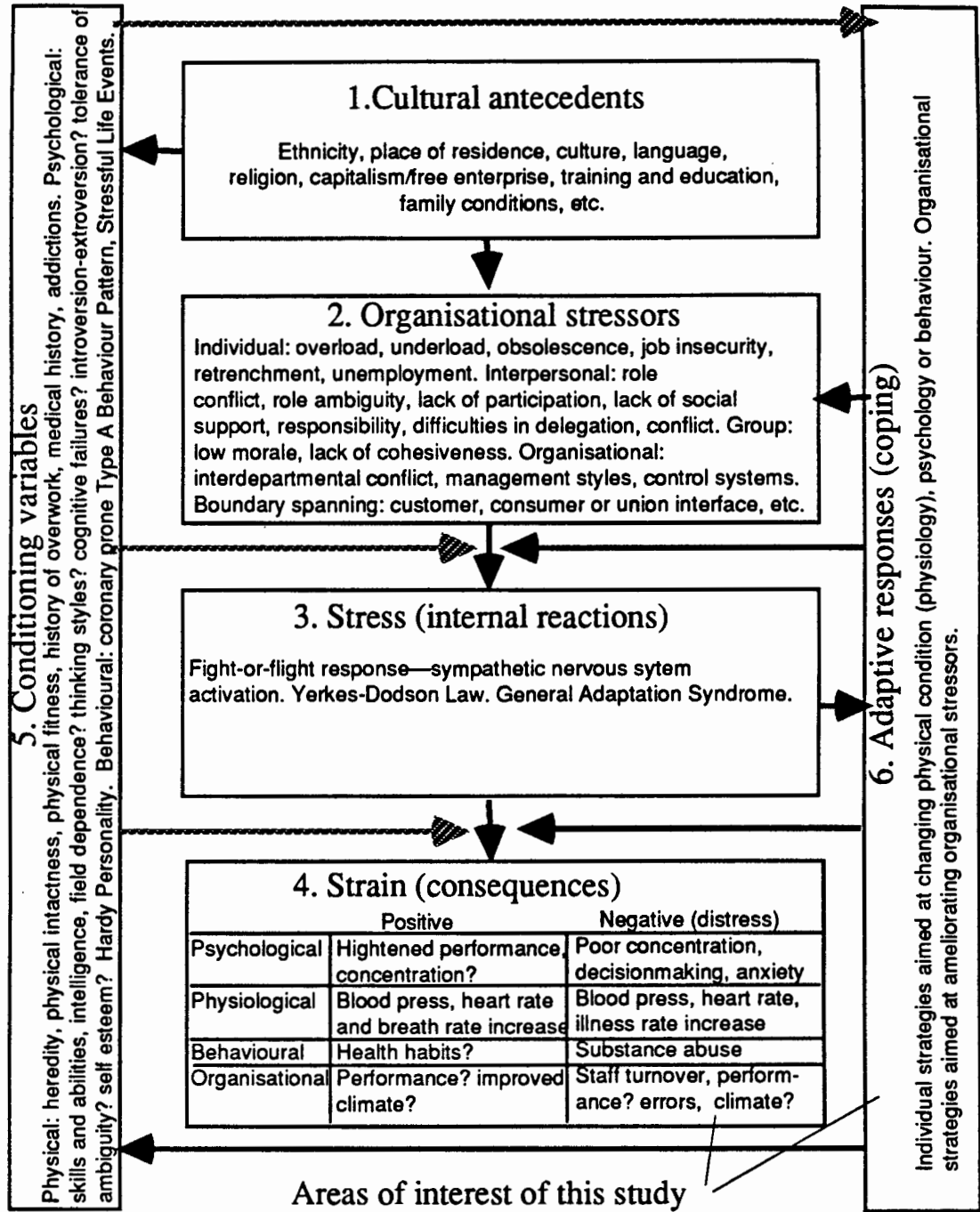
The foregoing review may conveniently be summed up by the following model which will be used as the basis for an operational definition of stress for this study.

Figure 1a

MODEL OF JOB STRESS VARIABLES

(See overleaf)

MODEL OF JOB STRESS VARIABLES



From Strümpfer (1987: 537). Box 4 contents from Ivancevich & Matteson(1990: 222). Box 6 contents from Sethi, Caro & Schuler, (1987), c.f. figure 1b, chapter II.

Strümpfer elaborates each class of components of reaction to a stressor (i.e., each box), and the complex interactions (i.e., arrows) between them. Solid arrows indicate direct influences, while striped arrows indicate "processes that condition (strengthen or weaken) other components or the interaction between them" (1987: 538). His discussion on each component is summarised in the relevant box in figure 1a above. In essence, according to Strümpfer, this model may be represented: stressor -> experience of stress -> strain. However, it is not the stimulus (stressor) itself that causes the altered behaviour or strain. Instead cognitive structures are viewed as intervening between stimulus and response, so that internal stimuli shape behaviour (Strümpfer, 1987: 537). Strümpfer's discussion of some of the complexities of the model are paraphrased below with reference to figure 1a:

1. Cultural antecedents

Cultural antecedents such as ethnicity provide a backdrop against which to interpret observations of stress variables. Solid arrows indicate direct influences on organisational stressors and conditioning variables.

2. Organisational stressors

A large number of organisational stressors have been described in the literature. In terms of the model, these stressors, such as overload, remain essentially neutral until perceived and appraised as stressful by a person. For example, McGrath's (1976) views were mentioned earlier.

3. Stress (internal reactions)

A person's internal reactions are described as "stress" in this model. The characteristics of the transient fight-or-flight reaction have been discussed earlier. The longer term pattern of responses to stressors has been described as the Yerkes Dodson Law. Yerkes & Dodson (1908) demonstrated in learning experiments on mice that efficiency and performance increased as stress increased. If stress continued to increase, however, efficiency and performance eventually declined. (Business-people can relate to this study.) Later Selye (1974) described a similar pattern of responses to stressors which he termed the General Adaptation Syndrome. According to Selye, this is a triphasic response consisting of an alarm, a resistance, and eventually, an exhaustion phase if the stressor persists long enough (1974: 22).

4. Strain (consequences of stress)

The negative psychological, physiological (health) and behavioural consequences of stress have also been discussed. However some researchers have suggested that not all stress damages health (Dienstbier, 1989; Selye, 1974).

Selye distinguished between positive stress (eustress) and negative stress which he called distress (1974: 16). According to Dienstbier (1989), there are two different types of arousal. One, mediated by the hormone cortisol, is mediated by the pituitary-adrenal-cortical system. The other involves adrenal responses stimulated by the hormones adrenaline and

noradrenaline. The former cortisol-related response seems to take place in situations of unavoidable stress, while the adrenaline-related response occurs where the individual regards a stressor as a challenge. Dienstbier claims this adrenaline-related response (to toughening practice such as swimming) can have beneficial effects.

Figure 1a indicates some of the differences between positive and negative consequences of stress identified earlier in this chapter and by Ivancevich & Matteson (1990: 222). The negative consequences of job stress represented in box 4 are discussed by Ivancevich & Matteson (1990) and are further elaborated later in chapter II.

5. Conditioning variables

Conditioning variables are viewed as being intervening variables within the person which mediate or condition the response to a stressor. Feedback between conditioning variables and coping behaviours further mediates the extent to which the person will react to a stressor and what the consequences of that reaction may be. There is thus a dynamic interplay between all the components of the model.

6. Adaptive or coping responses

The model views adaptive or coping responses as being triggered by the subjective experience of stress and acting to ameliorate organisational stressors, conditioning variables, and/or their impact on the individual. The subject of adaptive responses by the individual is elaborated in the

next chapter: *the management of stress and development of hypotheses*. The subject of organisational responses was considered to be beyond the scope of this study.

The principal strength of the model set out above is its comprehensive view of the broad range of stress variables and their antecedents as identified in the stress literature. A weakness of the model is its failure to address the issue of normal/abnormal responses as mentioned in the work of Caplan et al (1997), Maharishi (1972), Alexander et al (1990), and Wallace et al (1988). Another weakness is that it does not address the issue of possible positive consequences of stress. The strengths and weaknesses of the model are discussed in the following section and are addressed in chapter V in the section: *hierarchical model of job stress and coping*

The purpose of the foregoing review was to develop the terminology used below for an operational definition of stress.

OPERATIONAL DEFINITIONS FOR THIS STUDY

This study wished to evaluate a stress reduction intervention. Therefore it was necessary to operationalise the stress concept in order to be able to measure "stress." The work of Scott & Howard (1970) and subsequent researchers was therefore re-examined in the light of the job stress model presented above in figure 1a.

Recall that Scott & Howard reviewed conceptual models of stress in the literature up to 1970. Their discussion of the various models may be paraphrased essentially as follows: Mechanic defined stress as the discomforting *responses* of persons in particular situations. This corresponds with *strain* in figure 1a. Basowitz and Janis defined stress as a *quality* of a situation, i.e., as a *stressor*, corresponding with box 2 of figure 1a. Selye, Dohrenwend and the mechanical modellers defined stress as the *internal reaction* to stressors, i.e., box 3 of the figure, leading to pathological changes as represented by box 4. Dunbar defined stress as an *attribute* of the stressors. This seems to correspond with the arrow linking boxes 2 and 3 in the figure. Alexander and Wolff defined stress as both an *attribute of the stressors* and the *individuals responses* to them. This extends the previous definition into the domain of box 3.

It seemed to the author of the present study that the traditional approach to the study of stress has been for each researcher to define his or her own terms of reference by operationalising stress in a way which suited the thrust of that particular investigation, based on the literature available up to that time.

Therefore in the absence of any universally accepted definition of stress, for the purposes of this study, stress was defined in terms of the approaches of Mechanic (1962), Selye (1974, 1956), Dohrenwend (1961), the mechanical modellers mentioned by Scott & Howard (1970), and the

appraisal models of McGrath (1976) and Lazarus, (1980). These views seemed to converge into the model shown as figure 1a.

Thus this study was designed around a view of stress as *the individual's psychological, physiological and behavioural responses to the total of internally and externally driven demands on that individual.*⁶

The main strength of this definition is that it is simple. It represents the integration of an enormous literature. Further it enabled the researcher to attempt to evaluate the impact, at the worksite, across a number of variables—of an intervention, which on the basis of a well developed clinical literature,⁷ purported to "reduce stress."

Another strength was that it allowed for the simultaneous operation of cultural antecedents (box 1), and conditioning variables (box 5), as well as organisational stressors (box 2).

However the definition has several weaknesses:

1. For purposes of measurement it ignored internal reactions to stressors (box 3), and focussed rather on consequences (box 4). This was because the study was interested in human and organisational consequences, and the links between them—rather than in what the model chose to categorise as internal reactions.

⁶ This operational definition represents a response to the stress literature reviewed to this point. The task of improving on the literature is left until after evaluating the (sometimes surprising) results of the intervention.

⁷ This literature is discussed later, in chapter II.

2. It did not distinguish between positive and negative consequences of stress (box 4). However prevailing research opinion appears to overlook or ignore the positive consequences, so that the term "strain" is taken to mean negative consequences. Strümpfer, for example makes no mention of positive consequences in his discussion of the area corresponding with box 4 here (1987). The legitimacy of lumping positive and negative consequences together is defended in the light of recent work by Frankenhaeuser, Lundberg, Fredrikson, Melin, Bodil & Wallin (1989). These researchers measured healthy Swedish white-collar employees over two 12-hour periods. One period was at work and afterward; the other was during work-free conditions at home. All groups showed a moderate increase in cardiovascular and neuroendocrine activity during the day at work. According to the figure 1a model, they suffered strain. But was this eustress or distress? Avoiding this distinction in the present study allowed the researcher to concentrate on the relationships between the stress-reduction intervention and the responses, and also on the relationships between the different responses.

3. The term "stress" is used here, whereas "strain" (box 4) is a more precise term and has been used in very recent literature (e.g. Goodspeed & DeLucia, 1990). However, most researchers seem to persist in using the term "stress." Furthermore the primary outcome measure, the SCL-90-R questionnaire is called a "stress" symptoms checklist (with 90 questions, revised) by its developer (Derogatis, 1977). Perhaps a better name would have been a *strain* checklist.

4. A more serious weakness is that the definition fails to deal with the issue of normality, i.e., the concept of stress as a deviation from normal responses, as referred to by Caplan et al (1975), Maharishi, (1972), Alexander et al (1990) and Wallace et al (1988). Had the concept been part of the definition, normality would then have needed to be defined. Presumably this could have been done by taking measurements over a pre-intervention baseline period, as has been done by others (e.g., blood pressure measured by Peters et al, 1977 II). However it is possible that *average* values of stress-related variables are not in fact *normal* in working populations. What constitutes normality is debatable without having a benchmark to measure normality against.⁸ This study avoided having to deal with issue of normality by comparing pretest-posttest levels of the variables of interest in an experimental design as discussed in chapter III: *methods and procedures*.

5. A final weakness is that the definition may be construed to equate strain (box 4) with somatic arousal. Some writers investigating meditation, (Holmes, Solomon, Cappo & Greenberg, 1983; Cooper, Lamprey, Botha, Shires, Baker & Seftel, 1985) appear to have been motivated by a "somatic arousal reduction hypothesis." This hypothesis

⁸ Such a benchmark may now exist in the form of large populations of individuals practicing techniques thought to enhance health. For instance, Wallace, Silver, Mills, Dillbeck & Wagoner (1983) found that blood pressure norms for long-term practitioners of Transcendental Meditation were significantly lower than for the general population. They noted: "It is interesting to note that when short-term meditators (<5 years) were compared to long-term meditators (>5 years), the mean systolic of the long-term group when covaried for age was significantly lower for both men and women, suggesting an active effect of the meditation" (Wallace, et al, 1983).

may be stated as: "subjects who meditate show less somatic response to threat." As pointed out by Orme-Johnson & Dillbeck (1986), reduced stress (through the practice of Transcendental Meditation) may be understood in terms of "greater adaptive efficiency, which may include more rapid mobilisation of adaptive resources (i.e., greater sympathetic arousal) in response to threat and more rapid recovery to baseline once the threat is removed, not less somatic response to threat." Therefore strain is recognised as being a more complex phenomenon than simply psycho-physiological arousal. Furthermore, *under arousal* may be a consequence of the operation of an extreme stressor such as physical injury (Martin, 1990).

The terms of reference for this study are now defined below, again with reference to figure 1a.

Terms of reference for this study

Stress here refers to the individual's psychological, physiological, or behavioural responses (i.e., box 4) to environmental or internal stressors (i.e., boxes 1 and 2 acting under the influence of conditioning variables in box 5), as measured by the methods mentioned below.

Job stress (or worksite stress) here refers to stress experienced at the worksite or at home as a consequence of job-related demands on the individual.

Stressors are environmental or internal demands⁹ (i.e., box 2 under the conditioning influence of box 6) leading to adaptive (or maladaptive) responses (i.e., stress, box 4) on the part of the individual.

Psychological Stress symptoms refers to subjects' self-reported incidence of nervousness, irritability, headaches, etc. (i.e., box 4), using a standardised inventory.

Physiological Stress parameters refers to the degree of stress response (i.e., box 4) as measured by levels of physiological parameters such as blood pressure and heart rate.

Behavioural stress consequences refers to measurable aspects of organisational behaviour (i.e., box 4) such as staff turnover rates, error rates, absenteeism, conflict, and possibly perceptions of company climate.

Stress management refers to the adaptive behaviour (i.e., box 6) of changing any aspect of the environment or person in such a way as to decrease stress response and promote organisational and/or individual health.

Chapter II now turns to the organisational consequences of stress and the management of stress.

⁹ These environmental demands were not measured in this study, but a retrenchment programme was observed to impact physiological stress parameters.

CHAPTER II

THE MANAGEMENT OF STRESS AND DEVELOPMENT OF HYPOTHESES

THE ORGANISATIONAL CONSEQUENCES OF STRESS

However stress is defined, the cost of stress has been said to be so enormous as to be incalculable. Time Magazine suggested in 1983 (6 June) that stress cost the USA \$50 - 75 billion annually, or more than \$750 per worker per annum. More recent American estimates have placed the figure at \$150 billion (Manuso, 1984; Schwimer, 1991). The United Nations International Labour Organisation currently estimates that occupational stress costs American business up to \$200 billion per annum (1993). The cost stems from compensation claims, reduced productivity, absenteeism, added health insurance costs and direct medical expenses for related diseases such as ulcers, high blood pressure and heart attacks.

According to Kottage (1992), stress claims have become the fastest growing category of workers' compensation cases in the USA, and stress in the workplace could become a matter of a company's survival. Some writers have recently suggested that workplace stress has become epidemic (Allen, 1990), and Northwestern National Life Insurance Company has concluded this has caused some 70% of employees to experience stress illnesses often (Mulcahy, 1991). Mulcahy pointed out that between 1985-90, the incidence of disabling

stress more than doubled, and insurer and employer reserves for stress-related disability payments now average more than \$73 000 per case. Responses to this disturbing situation include recommendations for employers to monitor workloads, discuss performance monitoring, avoid harassment and recognise and deal with stress (O'Donnel & Krumreich, 1989).

In South Africa the problem may even be more serious. South African workers have among the highest Coronary Heart Disease (CHD) mortality rates in the world. Job stress linked to a high level manpower shortage has been suggested as a possible contributory factor (Strümpfer, 1980). Strümpfer also presented evidence that there may be a preponderance of Type A behaviour (as a conditioning variable) among White South African males, with scores on the Jenkins Activity survey mostly well above those for comparable American, Dutch, English and New Zealand male samples (1987: 554).¹

In addition the South African skills shortage places a great premium on maximising productivity. It has been said that nothing is more important for the long-run economic welfare of a country than improving productivity. Yet since 1975 labour productivity in SA has increased at a lower rate than that of its trading partners (du Plooy, 1987).

¹ This interesting observation is echoed in this study by the observation that psychological stress symptoms of South African employees appear to be higher than American norms (see also footnote to figure 7 in chapter IV, *Results*.)

Stress has often been linked to lower productivity, both in the sense of decreased performance and increased costs of health care. For instance, Manuso (1979) has estimated the incremental costs of employing one person with stress-related symptoms such as generalised anxiety or headache as US\$ 3394 per annum—or one-fifth of annual salary. He ascribed this cost primarily to lost productivity through time off work to visit the health centre, interference with output, effects on colleagues and costs of treatment.

The Financial Mail (15 July 1984) estimated that stress-induced absenteeism cost South Africa R300 million per annum in 1984. This was over R1 million per working day then. At today's Rand value this translates into over R3,7 million per working day now.

With stakes as high as this, it is not surprising that stress management programmes have started to enter the market. But which of these programmes and approaches are effective?

INITIAL RESEARCH QUESTIONS

The following initial research questions were then formulated:

1. Besides obvious environmental measures (such as reducing overload), what stress management approaches are available to managers seeking to reduce stress levels of their staff?
2. Which of these approaches have been proven successful in clinical studies?

3. Which approaches have been used *at the worksite*? Who were the subjects? How were programmes oriented—what training formats were used? Which were most frequently reported?
4. Which approaches have worked in practice at the worksite?
5. Which are most effective?

A survey of the stress management literature provided ready answers to the first three questions—but not to the last two. All approaches surveyed (see appendix T) were claimed by their researchers to be effective, but it proved very difficult to draw firm conclusions as to relative effectiveness. Comparison between approaches was obscured by lack of worksite data, lack of standardisation of techniques, and flawed research designs.

This study wished to evaluate Transcendental Meditation using Progressive Muscle Relaxation as a control treatment.² The general research question for this study was then formulated as: *Is the selected technique effective in reducing stress at the worksite?* Later, when it became apparent the treatment *was* effective, the question was added: *what might be the consequences for organisational development?*

² These techniques are described later in chapter III: *stress management treatments*.

MANAGING STRESS: THE LITERATURE

Stress management approaches embrace personal strategies (such as relaxation) and organisational strategies (such as organisational restructuring). This study confined itself to personal strategies.

A search was therefore first conducted for laboratory or clinical studies on personal strategies for behavioural stress reduction. The search then turned to applications of these techniques at the worksite. Hand searches were conducted at the Johannesburg Public Library, the Library of Congress in Washington, DC., the Wartenweiler, Cullen, Educom, Graduate School of Business and Medical School libraries at the University of the Witwatersrand, and the Graduate School of Business library at UCT. In addition computer searches were made of the MEDLARS database via a terminal at Harvard University in Boston, and the PSYCHINFO database via a terminal at the University of the Witwatersrand. A concluding search was conducted of the psycLIT database on CD ROM at UNISA.

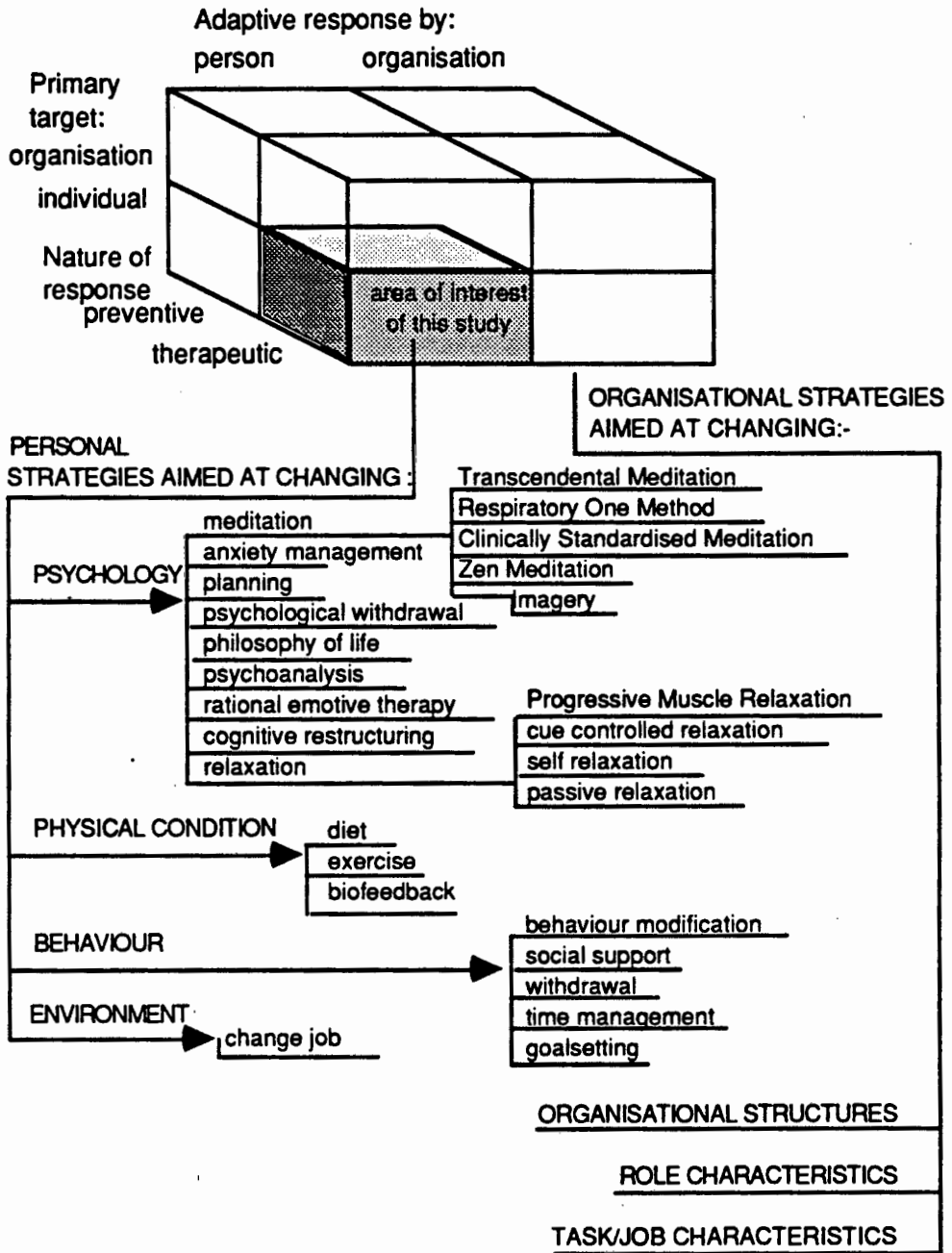
Strategies for handling job stress have been classified into several useful categories by Newman & Beehr (1979). These categories are conveniently depicted by the following diagram which answers the question—what approaches are available? The diagram represents an elaboration of box 6 in figure 1a.

Figure 1b

STRATEGIES FOR MANAGING JOB STRESS

(see overleaf)

STRATEGIES FOR MANAGING JOB STRESS



The cube is after Newman & Beehr, 1979:2. Strategies are as proposed by Sethi, Caro & Schuler, 1987: 23-25, 229-338.

Clinical and laboratory studies

The next question was—what stress management approaches have been successful?

Clinical and laboratory studies have found that the apparent negative consequences of stress were ameliorated by a wide variety of techniques including various forms of relaxation, various forms of cognitive/behavioural skills training, and various forms of meditation and biofeedback.

Most frequently mentioned specific relaxation technique was Progressive Muscle Relaxation (PMR), and most frequently mentioned specific meditation technique was Transcendental Meditation (TM). TM and PMR are described later in chapter III.

Other techniques such as the "Respiratory One Method" (Peters, Benson & Porter, 1977) and "Clinically Standardised Meditation" (Carrington, Collings, Benson, Robinson, Wood, Lehrer, Woolfolk & Cole, 1980) were mentioned in single studies or small groups of related studies. These recently-developed techniques may be based³ on TM which was introduced in 1958 (Domash, 1977) and to which references

³ See letter to the Chairman, Harvard Medical School, dated 16 Dec 1975, from the Vice Chancellor, Maharishi European Research University. The purport of the letter is that TM is a traditional technique of great antiquity and produces well documented beneficial effects (which appear to be greater than those produced by Benson's technique). The letter is critical of specific instances of Benson's having quoted the results of TM research as if it is research on his own technique. Benson co-authored some early writing on TM (Benson & Wallace, 1972) so may be expected to be familiar with TM. In addition Carrington et al (1980) refer to their CSM technique as being a "non-cultic" meditation technique. Taken in context the description may be inferred to mean that other meditation techniques are "cultic" (and therefore tainted?). Presumably the "cultic" technique is TM because the meditation research cited is research on TM.

appear several years earlier in the literature (for example in Wallace, 1970).

The literature on biofeedback techniques was not surveyed for purposes of the present study because application to large groups at the worksite was perceived to be difficult and to require special equipment.

The cognitive/behavioural skills training literature was not pursued because of the lack of uniformity of training between those studies which came to light early in the survey.

Relaxation/meditation behavioural approaches were in fact represented by a majority of studies. A relaxation/meditation orientation was therefore suitable for this study.

TM and PMR were then studied further, TM because the present study wished to use it as the primary intervention and PMR because it has often been used as a control condition in clinical studies using TM. The researcher is thoroughly familiar with TM, having practiced it for 16 years and taught it in organisational settings for 12 years prior to commencement of the experiment. Other reasons for highlighting TM and PMR were that they are relatively inexpensive to administer using traditional training formats. As described later, TM training requires a trained instructor (Domash, 1977) and PMR either an instructor or tape-recorded instructions (as used by Carrington et al, 1980). Both techniques are simple and quick to learn by employees with different demographic backgrounds.

The Transcendental Meditation literature

Transcendental Meditation (TM) in particular has generated a voluminous (non-worksite) literature, the findings of which extend well beyond the present field into cognitive and developmental psychology, physiology and preventive medicine, sociology and rehabilitation. This review located some hundreds of studies on the effects of TM, of which a large number were directly relevant to this study. A wide range of findings having a bearing on stress reduction have been reported including:

- reduced blood pressure (Schneider and Ferguson, 1991; Agarwal and Kharbanda, 1979; Cooper and Aygen, 1978; Lovell-Smith, Dickie and Robinson, 1976; Benson and Wallace, 1972)
- reduced serum cholesterol (Subramanyam & Porkodi, 1980; Cooper & Aygen 1979, 1978)
- decreased skin conductance (Wallace, 1970)
- increased alpha and theta EEG (Banquet, 1973)
- reduced breath and heart rate (Dillbeck & Orme-Johnson, 1987; Wallace, Silver, Mills, Dillbeck & Wagoner, 1983; Throll, 1982; Cooper & Aygen, 1978; Blackwell, Hanenson, Bloomfield, Magenheim, Nidich & Gartside, 1975; Benson & Wallace, 1972; Wallace, 1970)
- reduced plasma cortisol (Bevan, 1980; Jevning, Pirkle & Wilson, 1977; Bevan, Young, Wellby, Nenadovic &

Dickins, 1976; Jevning, Wilson, Van der Laan & Levine, 1975)

In addition, significant reductions in catecholamines during TM practice were found by Subramanyam & Porkodi (1980) and Bujatti & Riederer (1976). However many other researchers have failed to find reductions (Cooper et al, 1985; Jevning et al, 1977; Michaels, Huber & McCann, 1976; Bevan et al, 1976) so this finding seems inconclusive.

The above general pattern of responses appears opposite to the fight-or-flight syndrome of increased sympathetic arousal in response to stressors discussed earlier. Goleman & Schwartz (1976) noted that in contrast to the stress reactivity pattern of chronically anxious individuals, TM meditators displayed rapid stress recovery and lower state and trait anxiety levels.

Anxiety appears to have been studied more thoroughly than any other stress-related psychological variable, and many researchers have reported improvements after TM treatment.

Ferguson (1981) performed a meta-analysis on 50 experimental studies which used psychological measures to evaluate meditation techniques. In meta-analysis a quantity known as the effect size is calculated by dividing the difference between experimental and control scores by the standard deviation. Ferguson found that TM produced an effect size of about twice as large as other meditation techniques. The principal weakness of this study was a shortage of non-TM studies for review.

Extending Ferguson's work, Eppley, Abrams & Shear (1984) performed a meta-analysis wherein they compared the effect sizes on trait anxiety of 50 TM outcomes, 54 outcomes for other forms of meditation, 46 for PMR and 53 for other relaxation techniques. They found the TM outcomes had a significantly larger effect size ($p < 0.005$), whether studies were matched for possible confounding variables or not. They found

TM was significantly superior to all the other techniques. Progressive Relaxation (i.e. PMR) was similar to all other (non-TM) treatments except for concentration meditation, which had a significantly smaller effect size, and meditation using Sanskrit mantras, which had borderline smaller effect size (Eppley et al, 1984).

A thorough survey and meta-analysis by Orme-Johnson and Dillbeck (1986) demonstrated that the effect size for TM is significantly larger than for simple eyes-closed rest for findings of increased basal skin resistance, decreased respiration rate, decreased oxygen consumption, and decreased plasma lactate. No significant differences were found between TM and eyes-closed rest for heart rate or spontaneous skin resistance responses—although TM practitioners were found to exhibit significantly lower levels of these variables as well as respiration rate and plasma lactate outside of actual TM practice. These findings all bear directly on the stress levels as defined here.

Findings relevant to the question of improved productivity were:

- improved job satisfaction, job performance and relationships with co-workers and supervisors (Frew, 1974; Friend, 1978)
- reduced anxiety (Eppley et al, 1983; Dillbeck, 1977; Goleman & Schwartz, 1976)
- increased self-esteem (Orme-Johnson & Dillbeck, 1986; Nystul & Garde, 1977; Ferguson & Gowan, 1976)
- reduction in smoking and drug abuse (Shafii, Lavelly & Jaffe, 1974; Benson & Wallace, 1972)
- improved creativity (Orme-Johnson & Haynes, 1981; Travis, 1979)

Although neutral results have been reported by some researchers (Zuroff & Schwartz, 1980; Yuille & Sereda, 1980; Smith, 1976; Holmes, 1984), considered as a whole, the clinical literature suggests that TM has an important role in the amelioration of the undesirable consequences of stress. So TM has been shown to be effective in clinical settings, but would it work at the worksite?

Turning from clinical settings to the workplace, Alexander et al, (1992) recently found two groups of regular TM practitioners (N=27 and 18 at two different sites) scored significantly more than controls on multiple measures of stress-reduction and development including decreased skin conductance levels, decreased fatigue, cigarette and hard liquor use, and improved employee effectiveness, job satisfaction and relationships. This is only the third TM worksite study that was located in the literature. In future research this study called for direct

measurement of productivity, as well as random assignment 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. In addition to investigating the impact of stress reduction on company climate and productivity—this study was designed to replicate, under practical conditions and constraints, worksite stress-reduction findings reported previously only in clinical studies on TM. The practical administration of such a stress reduction programme poses many challenges to control procedures and statistical power, such as difficulty in recruiting large enough groups of participants, and in truly random allocation to test and control conditions of the experiment. This may be why the literature is so thin and why well-controlled studies are rare. This study therefore emphasised control.

Progressive Muscle Relaxation

Given the breadth and depth of the TM literature surveyed, and the suggestion of greater effect size for TM outcomes, it seemed justifiable to favour TM for further study as the primary treatment and PMR as the control treatment. The PMR literature was therefore not pursued as vigorously as that for TM.

Findings reported for PMR included:

- reduced blood pressure (Engel & Gaarder, 1983; Throll, 1982; Agras, Horne & Taylor, 1982; Glasgow, Gaarder & Engel, 1982; Peters, Benson & Porter, 1977),
- Reduced breath and heart rate (Throll, 1982)

These findings appear to be superficially similar to those reported for TM. However, the PMR picture is obscured by different researchers using different adaptations or variations of classical PMR as developed and described by Jacobson (1957). TM, by contrast, is taught in a way which has been described as: "remarkably systematic, precise and uniform" (Domash, 1977).

Having reviewed clinical studies, the next question was which stress management approaches have been used *at the worksite*? Who were the subjects? What training orientations and formats were used? Which were most frequently reported?

Worksite stress management studies

Murphy (1984) reviewed a number of worksite stress management studies. A further 12 published and unpublished studies were located in the course of the present search, giving a total of 21 studies for review. Two of these studies were not actually run at the worksite (Roskies, 1979; Rose & Veiga, 1984) but their subjects and reported results were directly comparable to the other studies, so they were included. These studies are tabulated with citations in appendix T

The following review of the principal findings provided answers to some of the initial research questions mentioned earlier..

Worksite stress management programme subjects

Most researchers studied white collar workers. Specific occupations included clerks, police officers, managers, psychologists, nurses, highway maintenance workers and public agency workers. All working groups were successful in learning stress management skills. Blue collar workers appeared to be as successful as white collar workers in learning relaxation skills.

Worksite stress management programme orientation

Twice as many studies in the literature survey had a preventive rather than therapeutic orientation. Studies with a therapeutic orientation selected candidates for training on the basis of Type A Behaviour Patterns (Roskies, 1980), high scores on a stress symptoms quiz (Carrington et al, 1980), chronic headaches or anxiety problems (Manuso, 1979), self referral for tension or nervousness (Puate & Beiman, 1980) or hypertension (Schleifer, 1981; Drazen, Nevid, Pace & O'Brien, 1982 as cited in Murphy, 1984).

Studies usually presented stress management techniques to workers as health-promotion measures rather than stress-reduction.

Worksite stress management programme formats

Contact time with subjects ranged from one to 16 hours. Median contact time was 9 hours. Studies with longer contact times reported

greater reductions in physiological measures and self-reported stress symptoms.

Worksite stress management methods

Stress management methods used, in order of frequency of mention were:

- Relaxation (Progressive Muscle Relaxation, passive relaxation, muscle relaxation, self relaxation, cue controlled relaxation): 19 studies
- Cognitive/Behavioural skills (cognitive restructuring, anxiety management, cognitive modification, rational emotive therapy, coping skills training): 10 studies
- Meditation: 5 studies (Transcendental Meditation: 2 studies, other forms of meditation: 3 studies)
- Biofeedback: 5 studies
- Imagery: 1 study
- Breathing Exercise: 1 study
- Psychotherapy: 1 study
- Exercise: 1 study
- "Stress Awareness Workshop:" 1 study
- "Workshop:" 1 study
- "Multimodal Workshop:" 1 study

Worksite stress management programme findings

Relaxation was a treatment in all but two studies. Most studies combined relaxation training with other strategies. Of those studies which did not combine techniques, most measured forehead muscle

tension (Electro myogram or EMG) and found significant decreases within or between sessions compared to controls.

According to Murphy (1984) hand temperature (another physiological stress correlate) showed a significant increase after relaxation training in one study by Peterson in 1981 and no change in another by Murphy in 1983.

Many studies showed muscle relaxation training was also associated with significant reductions in systolic and diastolic blood pressure, subjective anxiety and reported ability to cope with stress (Carrington et al, 1980; Roskies, 1979; Peters, Benson & Porter, 1977; Peters, Benson & Meters, 1977)

However, many of these studies also noted comparable improvements in the controls! (Murphy, 1984; Thomas, 1982; Carrington et al, 1980; Peters, Benson & Porter, 1977; Peters, Benson & Meters, 1977).

Cognitive/Behavioural Skills Training was represented by a number of techniques as shown above. All studies using this approach also included relaxation exercises, for which findings are mentioned above.

Meditation was represented in five studies, two of which used TM (Puente & Beiman, 1980; Friend, 1977) and three the Respiratory One Method (ROM), or Clinically Standardised Meditation (CSM) (Payne-Gair, 1982; Carrington et al, 1980; Peters, Benson & Porter, 1977)

Friend (1977) found TM had a net positive effect on mood, aspects of job-satisfaction related to supervisory relations, and work behaviour. This can only be regarded as a very tentative conclusion, however as the study lacked adequate controls.

Peters et al (1977) found ROM superior to "self-relaxation" on measures of systolic and diastolic blood pressure, self-reported stress symptoms, mood state, job satisfaction, and self-reported performance.

Carrington et al (1980) found significant reductions in reported stress symptoms after training either in ROM or CSM. Reviewing these last two findings, Murphy concluded:

These results need to be replicated but meditation methods appear to be effective strategies for helping workers lower arousal levels and reduce psychological and somatic symptoms of stress (1984).

Puente & Beiman (1980:294) found "self-relaxation" and a combination of cognitive restructuring and PMR to be "apparently more effective" than TM in reducing cardiovascular stress response to viewing threatening slides. They held therapeutic suggestion and positive reinforcement of progress to be responsible for these results. However an alternative interpretation of the TM-related findings of this study is suggested by Orme-Johnson & Dillbeck's assertion that the goal of the TM technique is:

greater adaptive efficiency, which may include more rapid mobilisation of adaptive resources (i.e. greater sympathetic arousal) in response to threat... and not less somatic response to threat (Orme-Johnson & Dillbeck, 1986: 31)

This view yields the alternative interpretation, supported by Goleman & Schwartz' earlier (1976) work, that the TM groups' physiological responses may represent greater adaptive value in the face of stress.

In conclusion, relaxation and meditation appear to be effective behavioural approaches to the management of job stress, although insufficient studies have as yet tested their practical application in well-controlled experimental designs at the worksite.

Therefore the question of relative effectiveness of different approaches to stress management at the worksite did not appear to have a ready answer and further work seemed justified.

RESEARCH PROBLEMS

In their review of the stress literature Beehr & Newman (1978) concluded that the organisational consequences facet of job stress had been the subject of very little inquiry and that consequences need to be studied together.

A year later Newman & Beehr wrote:

We are amazed at the lack of research on the effectiveness of diet (nutrition), exercise, biological feedback, etc., in preventing or ameliorating job stress and its consequences (Newman & Beehr, 1979).

The present literature search revealed an ongoing paucity of data in the area of stress management *at the worksite* itself. This was the first problem.

Another difficulty was that relatively few of those interventions used at the worksite have been the subject of systematic empirical evaluation, even in clinical studies. In this regard, Newman & Beehr, stated that :

...the majority of the papers concerning personal strategies for handling stress were written by former stress victims, medical doctors, psychiatrists and clinicians and tended to be of the quasi science, philosophy of life, or personal experience variety (Newman & Beehr, 1979).

Neither have these studies investigated any linkage between stress-reduction outcomes (at the individual level of analysis) with productivity or climate outcomes (at the organisational level of analysis). In addition, Beehr & Newman (1978) assert that nearly all studies of the consequences of job stress have been methodologically flawed—using self-report data in correlational rather than experimental designs—"thus disallowing strong inference regarding direction of causation."⁴ Methodological weaknesses and flawed design was thus the second problem.

In addition there is a problem with lack of standardisation. It was found that in those few worksite stress management programmes that have been reported, relaxation appeared to be a key component. The searches of others (Rose & Veiga, 1984 and Newman & Beehr, 1978) support this impression. Further confirmation came from Murphy (1984) who found relaxation was a treatment or control condition in 12 of the 13 studies reviewed.

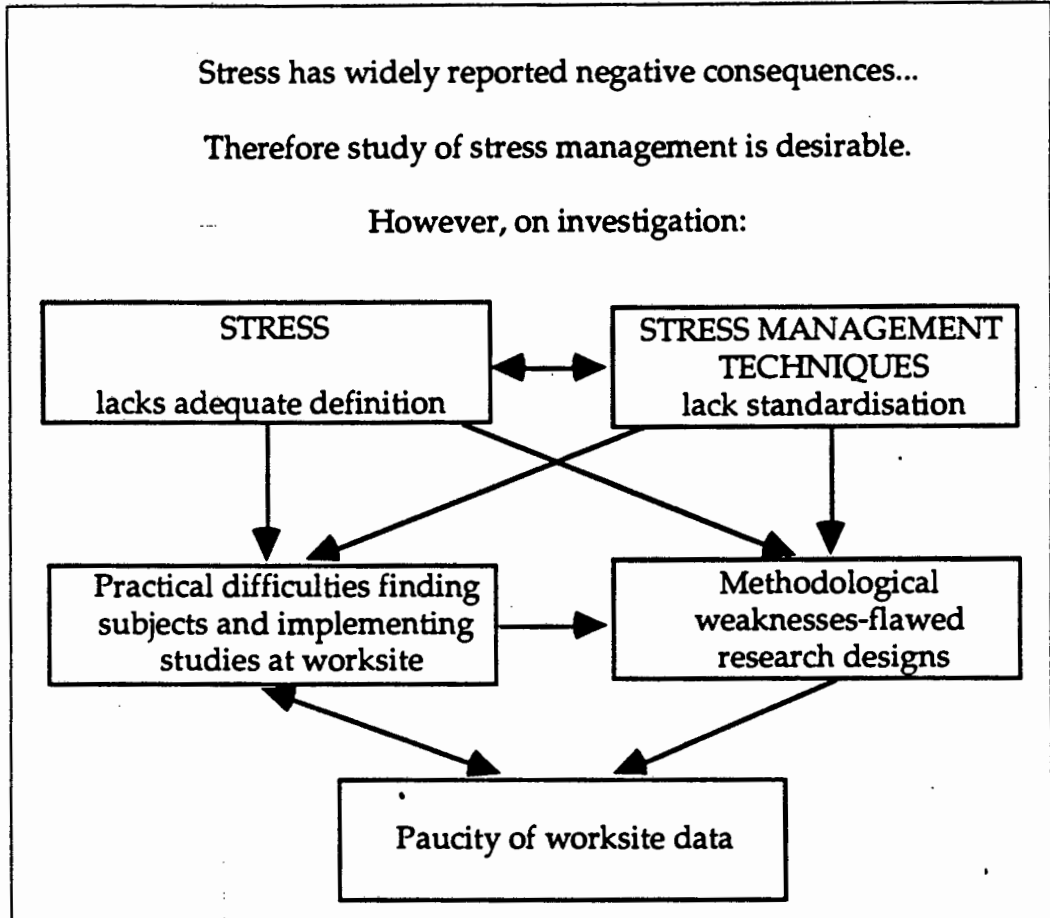
⁴ This study used a multi method multivariate approach in an attempt to establish causation.

However, while "relaxation" may superficially appear to be a common treatment in these studies, it actually seems that each researcher designs his own programme or adapts the approach of others. For instance Carrington et al (1980) at the New York Telephone Co. used two meditation techniques and a muscle relaxation technique for stress reduction. Both meditation techniques appear to be variations on Transcendental Meditation (as described by Orme-Johnson & Farrow, 1977) and the relaxation technique was explicitly "Budzynski's modified version of Edmund Jacobson's classical relaxation technique" (i.e. PMR). Thus the task of comparing techniques for the purpose of selecting those for further study was regrettably complicated. This lack of standardisation of stress management treatments compounds the problem of lack of adequate definition of stress discussed in chapter I.

These three problems of lack of standardisation, flawed designs and the shortage of data together with academic problems with stress definition and practical difficulties finding companies willing to participate in stress management research may be represented as follows. Figure 2a below summarises the logic of this report so far:

Figure 2a

WORKSITE STRESS MANAGEMENT RESEARCH PROBLEMS



Given, therefore, that the stress concept is presently beyond adequate definition; further that there have been relatively few stress management studies; and that those studies have tended to report on non-standard stress management techniques in flawed designs—it is reasonable to assert that much has yet to be learned about stress at the worksite.

BACKGROUND TO THE RESEARCH PROJECT

Further work on stress management at the worksite thus seemed necessary in view of this lack of knowledge and desirable in view of the negative consequences of stress elaborated earlier.

Furthermore it seemed appropriate to evaluate solutions rather than to study the problem further—and to make this evaluation within the real-life context of a South African company, despite all the constraints this imposes on experimental rigour and purity. As Lazlo has asserted:

We witness today another shift in ways of thinking: the shift towards rigorous but holistic theories. This means thinking in terms of facts and events in the context of wholes, forming integrated sets with their own properties and relationships (Lazlo, 1972).

The present study was conducted in an attempt to address the paucity of worksite data and the problems mentioned above by replicating and extending clinical findings to the real workplace. This was done in a case-history format by providing training in standardised and widely used stress reduction techniques to staff of a company — and then attempting to establish causation by measuring the results of the intervention over an extended period using a rigorous experimental design complemented by a qualitative followup investigation.

Rationale for using a multi-method multivariate experimental design

Referring back to figure 2a, the problem of lack of an adequate definition of stress was addressed by the use of a multi-method,

multivariate experimental design which measured "stress levels" by simultaneous measurements of self-reported stress symptoms, and objective measurements of physiological stress correlates. In addition, data was collected on company productivity and subjective perceptions of company climate.

Previous research, such as that of Peters et al, (1977) and Carrington et al (1980) has invariably (and not surprisingly) reported physiological and psychological results of stress reduction interventions as the subjects of separate statistical analyses, and sometimes even of separate journal articles (Peters et al, 1977, I and II). What does seem surprising, however, is that this study was unable to find in the literature any attempt to *correlate* movement of dependent variables following treatment in stress reduction. The focus on only physiological or only psychological stress correlates is surprising because even Carrington refers to: "the *cluster* of physiological changes observed during the practice of...meditation or muscle relaxation methods, as an *integrated* reaction" (italics mine). Despite the implicit view that the changes following stress reduction treatment reflect changes in some underlying quality ("stress") no attempt appears to have been made to correlate physiological changes with other changes—for example with psychological changes.

There is an eastern fable which describes a king's first visit to the village of the blind. As he entered the gates, three blind villagers rushed out to investigate the elephant bearing the king. The first villager grabbed a leg, another the trunk and the third the tail.

Running back to their families, each described the elephant very differently. Yet each limb was an expression of the same animal.

This study therefore used a multi-method multivariate approach in order to be able to say—since all these variables moved the same way—and because stress is *defined* as the integrated total of these variables—therefore stress levels have changed as a result of the stress reduction intervention. A further practical reason for using a multivariate approach embracing physiological measurements was to obviate faking which is a possibility with self-reports.

Rationale for using TM and PMR as treatments

Again referring to figure 2a, lack of standardisation of techniques has been discussed here as a problem which hinders scientific comparison of techniques and therefore the growth of knowledge about stress management. This study therefore regarded it to be important to use a standardised stress management treatment.

According to Alexander and his co-workers:

Although few studies have been done on the effects of meditation in the work place, extensive research has been conducted on meditation in other settings. The most widely practiced and investigated of these procedures is the Transcendental Meditation (TM) technique (Alexander et al, 1993).

As mentioned earlier, TM instruction is given in a standardised manner by qualified instructors, using traditional training formats (personal instruction followed by group discussion). Furthermore TM instruction is simple, straightforward and easily assimilated by staff of

diverse cultural backgrounds. Trained TM teachers are readily available in Johannesburg, as in most countries.

As described by Orme-Johnson and Dillbeck (1986), and others (Chalmers et al 1989: 745-752) TM has a well-developed theory base drawing on physical and quantum-mechanical models to interpret the wide range of physiological, psychological and sociological findings reported on regular practice of TM.

The choice of TM as the primary treatment and PMR as the control therefore seemed justified, because of the breadth of clinical knowledge about these techniques, and because of the frequency of mention of PMR for worksite studies (and of TM outside the workplace).

Rationale for measuring company climate

Because of the negative organisational consequences of stress,⁵ this study was originally conceived to evaluate a stress reduction intervention in terms of its impact on productivity as well as physiological stress parameters and psychological stress symptoms. However at the commencement of the experimental phase, because of limited information on sales turnover and staff numbers, and unavailability of other productivity data at the company participating in this study, it was decided to look for other organisational variables as a possible indirect measure of productivity.

⁵ According to Towler (1988): "...research has proven the cause and effect relationship between stress and illness, interpersonal difficulties, absenteeism and productivity problems."

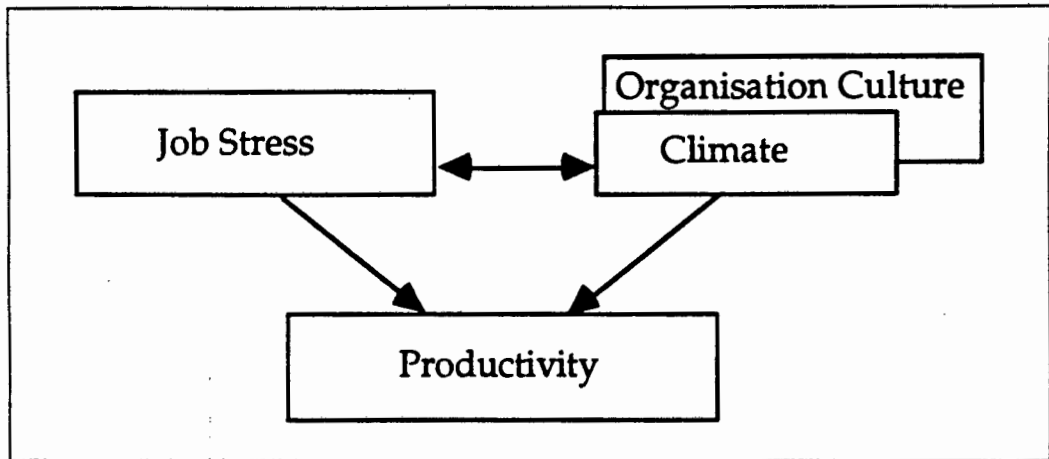
Therefore attention was turned to an assessment of company climate as a possible correlate of job stress (as called for by Roth & Preston, 1989). Others such as Saffold (1988) have also argued that it is reasonable to expect that organisational culture (of which climate is a subset⁶) affects organisational performance. It was reasoned that climate might therefore also be an antecedent of productivity, in a model which may be represented: stress -> climate/culture -> productivity.

In support of the direction of the relationships indicated above, Sutherland & Davidson recently (1993) found "stress of the organisation culture and climate" to be the strongest predictor of job dissatisfaction. In addition, Cooke & Szumal (1993) hypothesised cultural norms to influence motivation, performance, job satisfaction, thinking and behaviour—as well as stress, implying a reverse direction. Also subsequent to the present study, Marcoulides & Heck (1993) have proposed and successfully tested a model wherein climate (and other latent variables) were hypothesised to affect organisational performance.

The above linkages may be illustrated as follows:

⁶ Wiener & Vardi (1990) defined culture as a system of shared values that produces normative pressures. Schneider & Gunnarson (1994) distinguished between *climate*, the perceived atmosphere, and *culture*, describing culture as a "broader pattern of mores, beliefs and values" in an organisation.

Figure 2b
 POSSIBLE LINKAGES BETWEEN JOB STRESS, CLIMATE AND
 PRODUCTIVITY



This study was interested in the impact of TM on job stress and productivity—and therefore the other linkages as well.

Frew (1974) reported improved performance and relations with peers and supervisors following the implementation of TM in a business setting. Friend (1978) has also reported improvements in relationships with co-workers and supervisors following TM training. While both these studies suggest positive outcomes for in-company TM, their findings were self-report-based and neither psychological nor physiological job stress variables were measured. Furthermore the studies were not longitudinal and controls from the same occupational group were absent.

As mentioned earlier, other findings of improvements following TM practice include increased self-esteem and creativity, and reduced anxiety, smoking and drug abuse. It was therefore hypothesised that

training in TM at the worksite may have an impact on organisational climate as well as productivity.

Nasser and Schmickl (1986) have researched organisational climate in South African companies. They used an instrument developed by Litwin and Stringer in 1968, which was adapted for South African conditions by Gelfand in 1972 and further refined by themselves. They quote Litwin and Stringer's definition of climate as:

...a set of measurable properties of the work environment, perceived directly or indirectly by the people who live and work in this environment, and which is assumed to influence their motivation and behaviour (Nasser and Schmickl, 1986).

Nasser and Schmickl measured organisational climate in terms of nine dimensions: SUPPORT, REWARD, STRUCTURE, RESPONSIBILITY, RISK, CONFLICT, WARMTH, STANDARDS, AND IDENTITY. (These dimensions are defined in the discussion of results in chapter IV.) Measurement of these dimensions is made by self-report so is based on perceptions of the subjects. Perceptions appear to change after TM practice (Ahlström, 1991; Coles, 1984) and TM may thus alter organisational climate.

In summary, the study was originally conceived to evaluate the impact of a stress reduction intervention on psychological, physiological and productivity variables. In practice, departmental productivity data proved to be unavailable—and management appeared unwilling to provide sufficient turnover data to enable a balanced assessment of overall company productivity. A climate instrument that had been used in South African companies was

available to the researcher. A commonsense way around the anticipated productivity data problem seemed to be to broaden the scope of the study and to use climate⁷ as an intervening variable. The validity of this approach seems to have been supported by literature subsequent to the actual implementation of the study.

Rationale for choice of survey company

In the ideal world of experimental research, the sample company or companies would have been selected at random from the universe of South African companies and the intervention performed therein. This was not possible because of practical difficulties in persuading company managements to sanction the research protocol. Therefore implementation of the experiment was delayed until the following opportunity presented itself.

As a result of a previous training contract for the company, the researcher was invited to suggest a staff development exercise for a medium-sized Johannesburg-based market research company. He suggested training in TM to reduce stress and promote creativity.

A meeting was held where the researcher explained the idea to the unit heads. Also present were three (of five) of the directors, including Managing Director, Deputy Managing Director, and Executive Director. The outcome of the meeting was a positive response to the

⁷ Measurements were eventually made of all nine dimensions of the climate instrument. However, as discussed presently under rationale for hypothesis 1, principal attention was paid to the climate dimensions of WARMTH and SUPPORT. This was because in terms of the WARMTH and SUPPORT question wordings it was hypothesised that training in TM would have greatest impact on those dimensions. In practice, climate is also impacted by exogenous change factors, such as management style—as well as endogenous change factors such as TM (as discussed by Gustavsson, 1992: 35-318).

researcher's proposal to make available a "Corporate Development Programme" aimed at improving creativity as well as reducing stress levels. TM would be the prime intervention, but relaxation would be offered to those not wishing to learn TM. The project would be researched.

Management had bought the company from its founder the previous year and was seeking ways to consolidate their position. The Deputy Managing Director was already familiar with TM. Asked subsequently why she had agreed to the project she said:

Deputy MD: Because I had done TM myself and was convinced of the beneficial effects it had. And also at that time we needed something that would bring the company together. All sorts of cracks started appearing, partly because of the bad economic situation. It needed some glue. We thought TM might be it.

Researcher: So you were looking for some kind of glue to patch up the cracks, like team-building?

Deputy MD: Team-building, yes and to get some purpose back into the company.⁸

This company had a staff of about 80 at the time the experiment commenced. Later the need arose to extend the investigation into the qualitative arena after completion of the experiment. For this purpose a small Johannesburg advertising agency employing a staff of about 10 was chosen. This company had 8 of its staff learn TM through a TM centre in the city about a year before the interviews were conducted.

⁸ Personal communication, 6 Dec 1993

DEVELOPMENT OF HYPOTHESES

The general research question

Having considered the initial research questions relating to what had been tried at the worksite, and the research problems leading to a paucity of worksite data, the general research question was formulated as:—*would Transcendental Meditation be effective in reducing stress at the worksite?*

Global aims of the study

The global aims of the study may now be summarised as having been:

1. To develop improved methods for stress management by performing a well-controlled stress-reduction intervention at the worksite and measuring its impact on psychological stress symptoms, physiological stress parameters and organisational variables.
2. To determine whether the results of previous studies performed in clinical settings can be replicated at the worksite under conditions of stringent experimental/scientific control.

Specific empirical objectives—research hypotheses

In order to operationalise these global aims it was then necessary to develop specific, testable research hypotheses. These are presented below, together with a brief rationale for each.

Research hypothesis 1

The interventions (TM, and PMR as control treatment) will be effective in reducing stress (as defined here in chapter I) within 6 weeks, with regard to the following dependent variables:

1. Psychological Stress Symptoms measured by the revised Stress Symptoms Checklist (SCL-90-R of Derogatis, 1977, as discussed in chapter III).
2. Physiological Stress Parameters measured by
 - 2.1. Systolic Blood Pressure (SBP)
 - 2.2. Diastolic Blood Pressure (DBP)
 - 2.3. Heart Rate (HR)
 - 2.4. Breath Rate (BR)
3. Company Climate, as measured by the
 - 3.1. WARMTH and SUPPORT dimensions of the Industrial Barometer climate instrument of Nasser et al (1986).

Rationale for research hypothesis 1

Transcendental Meditation is a simple mental technique practised twice daily with the eyes closed for 20 minutes either individually or in a group. While few studies have been done on the effects of

meditation at the workplace, TM has been thoroughly researched in clinical settings, (Orme-Johnson & Farrow, 1977; Chalmers et al, 1989) and as mentioned, many clinical studies have suggested stress-reduction outcomes including reduced blood pressure, reduced serum cholesterol, decreased skin conductance, reduced breath and heart rate, and reduced plasma cortisol.

PMR is also a relatively simple technique designed, according to its developer to "quiet the nerve-muscle system" (Jacobson, 1957: 87). Various researchers have also reported on the impact of PMR on blood pressure, heart and breath rates, sometimes in the same study as that reporting on TM (e.g. Throll, 1982).

It was therefore hypothesised that blood pressure, breath and heart rate reductions could be replicated with TM and PMR at the worksite despite practical problems such as compliance discussed earlier. Of the many possible stress measures, these physiological stress parameters were selected as being non-invasive, and inexpensively and easily measured by a trained nurse. They were therefore a practical choice for a real worksite.

Pelletier (1992) has used the following diagnostic parameters to define what he terms a "neurophysiological stress profile." He used an electroencephalograph (EEG) for brain-wave activity; electromyograph (EMG) for muscle activity; detection of peripheral temperature in the hands and feet; galvanic skin response (GSR) for noting emotional lability; blood pressure; electrocardiogram (ECG) for

heart rate and regularity; and respiration rate as well as respiration pattern (Pelletier, 1992: 79).

Although this work was reviewed only after the completion of the experimental phase of this study, it was interesting to see parameters used here represented on his list.

Regarding climate, improvements were expected in the SUPPORT dimension after treatment with TM because if people are "less stressed" they could be expected to be more sympathetic towards the problems of co-workers or subordinates and to place more emphasis on psychological or human factors such as emotions and feelings. Improvements on the WARMTH dimension were also expected, because relaxation may reasonably be expected to be accompanied by increased openness and warmth towards others.

Regarding the timing of the hypothesised improvements, other research has suggested that the improvements take place within a few weeks of the intervention. For example Carrington et al (1990) asserted that over 80% of the eventual improvement in SCL-90-R scores at 5,5 months had already taken place by the 6-week posttest.

Research hypothesis 2

TM will be more effective than PMR in reducing stress with respect to the following dependent variables:

1. Psychological Stress Symptoms measured by the SCL-90-R.
2. Physiological Stress Parameters measured by
 - 2.1. Systolic Blood Pressure (SBP)

2.2. Diastolic Blood Pressure (DBP)

2.3. Heart Rate (HR)

2.4. Breath Rate (BR)

Rationale for research hypothesis 2

As mentioned earlier, meta-analyses such as those by Eppley, et al (1984), and Orme Johnson & Dillbeck (1986) found anxiety reduction effect sizes to be significantly greater for TM than for other techniques.

Other meta-analyses have also suggested significantly larger effects for TM than for other meditation techniques on psychological health (Ferguson, 1981), and blood pressure (Kuchera, 1986).

It was therefore hypothesised that TM would be more effective than Progressive Muscle Relaxation in promoting beneficial changes.

Research hypothesis 3

Changes would be correlated across the dependent variables:

1. Psychological Stress Symptoms (SCL-90-R scores)
2. Physiological Stress Parameters:
 - 2.1. Systolic Blood Pressure (SBP)
 - 2.2. Diastolic Blood Pressure (DBP)
 - 2.3. Heart Rate (HR)
 - 2.4. Breath Rate (BR)
3. Company Climate, as measured by:
 - 3.1. WARMTH and SUPPORT dimensions of the Industrial Barometer climate instrument of Nasser et al (1986).

Had it been possible at the commencement of the study to be sure productivity data would be available, the following dependent variables could also have been added:

- 4.1. An overall productivity index calculated as sales turnover/Full-time staff wage and salary bill or head count (provided data is available).
- 4.2. Any other indications of overall company effectiveness improvement, such as turnover growth.

Rationale for research hypothesis 3

Difficulties with definition of the stress concept have been discussed earlier. Yet it is clear that stress itself cannot be isolated or observed. It is an integrated underlying phenomenon which therefore has to be inferred by observation of statistics such as blood pressure. Because researchers such as Carrington (1980) have referred to clusters of physiological changes in response to meditation/relaxation, it seemed logical to hypothesise that physiological stress parameters would correlate with each other.

As mentioned earlier, there is an abundant literature on the fundamental interconnectedness of mind and body (Sharma, 1981; Lipowski, 1984; Pelletier, 1979, 1991). According to Pelletier, basic physiological processes, such as heartbeat, respiration rate and blood vessel diameter are controlled by centres within the same major brain structure (the medulla oblongata). Therefore it would seem reasonable to predict that breath rate, heart rate and blood pressure would move in concert.

In addition there is evidence that practice of TM influences perceptual processes. (Ahlström, 1991; Coles, 1984; Pelletier, 1974) Therefore self-reported psychological stress symptoms and company climate could also reasonably be expected to shift in concert with changes in physiological stress parameters following training in stress reduction.

Therefore, however ambitious the undertaking, the study aimed to establish whether any of these physiological stress parameters were correlated with one another and/or with psychological stress symptoms and/or climate.

After the experiment it became apparent that some limited productivity data was available. A discussion and rationale for the observed organisational outcomes following training in TM is presented in chapter V.

Research hypothesis 4

In-house controls will also show improvement 5,5 months after the stress reduction intervention as measured by the dependent variables:

1. Psychological Stress Symptoms measured by the SCL-90-R.
2. Physiological Stress Parameters measured by:
 - 2.1. Systolic Blood Pressure (SBP)
 - 2.2. Diastolic Blood Pressure (DBP)
 - 2.3. Heart Rate (HR)
 - 2.4. Breath Rate (BR)

Rationale for research hypothesis 4

In his literature survey Murphy (1984) mentioned that six out of nine studies reviewed reported significant benefits in both experimental *and control groups* on some measures. This phenomenon has also been reported by others (Thomas, 1982; Carrington et al, 1980; Peters, Benson & Porter, 1977; Peters, Benson & Meters, 1977). The experimental design of this study therefore included control groups both on-site and outside of the organisation under study.

Null hypotheses

The following null hypotheses were then formulated in order to subject the above research hypotheses to experimental scrutiny:

- H0 1. After treatment (in TM or PMR), posttest levels of the dependent variables (SCL-90-R,⁹ SBP, DBP, HR, BR, WARMTH and SUPPORT) are no different from those found at pretest. This hypothesis is expected to be *rejected*, i.e., there are significant differences within subjects after treatment, in the direction of lower physiological and higher climate scores. (Specifying direction of change allowed the use of more powerful one-tailed tests of significance.)
- H0 2. After treatment with TM, posttest levels of the dependent variables (SCL-90-R, SBP, DBP, HR, BR) are no different from those for PMR at posttest. This hypothesis is expected to be

⁹ For convenience, the abbreviations used here are: SCL-90-R = Stress Symptoms Checklist; SBP = systolic blood pressure; DBP = diastolic blood pressure; HR = heart rate; BR = breath rate.

rejected, i.e. there are significant differences between subjects after treatment. TM variables are expected to be lower than PMR variables after treatment.

H0 3. This hypothesis will be accepted if no significant coefficients of correlation¹⁰ are found between the dependent variables (SCL-90-R, SBP, DBP, HR, BR, WARMTH and SUPPORT) at posttest. This hypothesis is expected to be *rejected*. Significant correlations are expected.

H0 4a. After treatment (with TM and PMR), posttest levels of the dependent variables (SCL-90-R, SBP, DBP, HR, BR, WARMTH and SUPPORT) for the on-site controls are no different from those of the test groups (who learned TM or PMR). This hypothesis is expected to be *accepted*, i.e., there are no significant differences between subjects after treatment.

H0 4b. After treatment (with TM and PMR), posttest levels of the dependent variable (SCL-90-R) for the on-site controls are no different from those of the off-site control group (who did not learn TM or PMR). This hypothesis is expected to be *rejected*, i.e. there are significant differences between subjects in- and off-site after treatment of the test groups on-site. On-site SCL-90-R scores are expected to be lower than for those off-site.

In addition to the above hypotheses that bear directly on the research hypotheses enumerated earlier, several other hypotheses

¹⁰ Sample correlation coefficient (Snedecor & Cochran, 1980: 175).

needed to be tested in order to provide appropriate statistical controls.
and to answer questions that surfaced during analysis of the data.
These are presented in the *preview* section of chapter IV.

CHAPTER III

METHODS AND PROCEDURES

INTRODUCTION

This chapter begins with an overview of what was done. It then presents a rationale for the methods used before going into detail on treatments and variables, experimental design, subjects and procedures.

Overview of the general approach

The study consisted of a prospective (i.e., results were predicted in advance) experiment (i.e., using pre- and posttests, experimental and control groups) at a real worksite. In addition, for comparison and control purposes, measurements were made of a pilot group who learned TM in a TM centre; a normative group; an off-site control group; and a group of long-term TM practitioners.

The results were analysed statistically to determine both significant shifts and trends of borderline significance. The results were then interpreted in the light of qualitative questionnaires. Interpretation was a learning process (as described by Eisenhardt, 1989) and generated new questions. Answers to these were sought by further analyses of the data and also by conducting structured interviews with senior staff

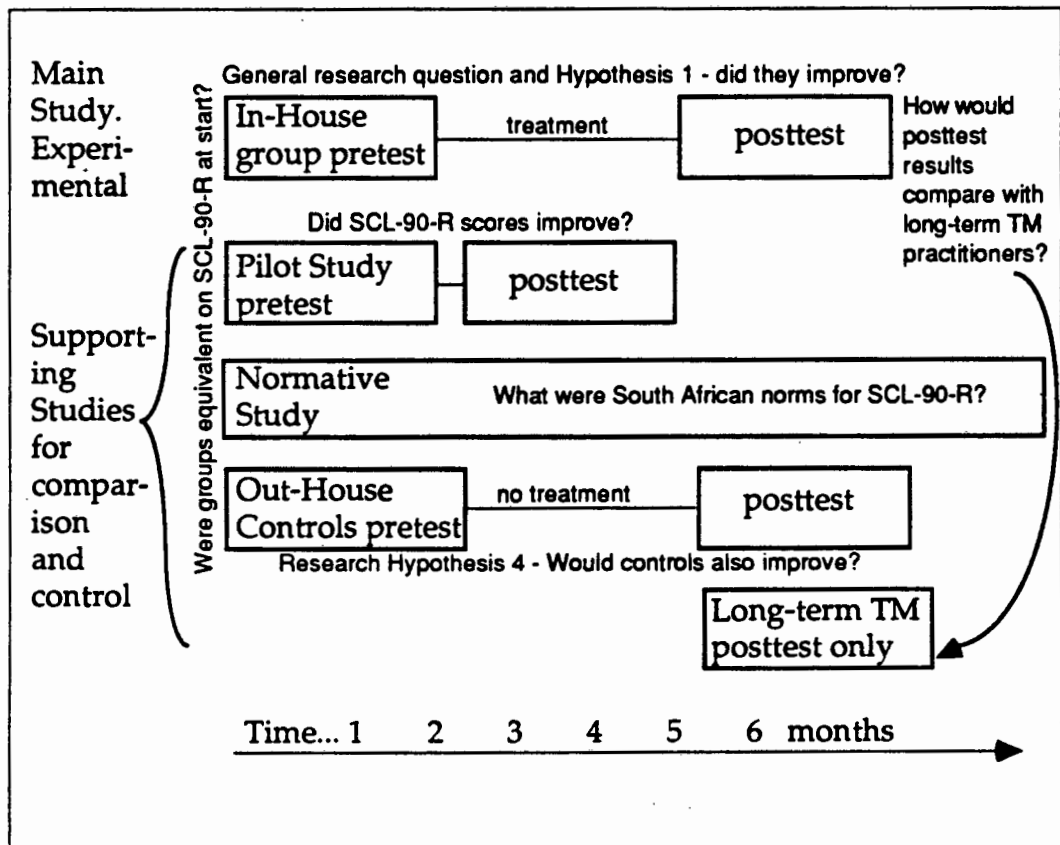
of the survey company and another smaller company three years later.

The sketch below may clarify the broad methodological framework of the study.

Figure 3

METHODOLOGICAL FRAMEWORK

Showing how research questions were answered using main and supporting studies.



Details of the main study, such as the test and control group comparisons are not shown above. They are discussed later under

experimental design (see table 1), and further elaborated in *procedures*.

RATIONALE FOR METHODS USED

General methodological considerations

As set out earlier, the global aim of this study was to evaluate the impact of Transcendental Meditation in reducing stress levels at the worksite. Typical worksite stress management studies, such as that by Carrington et al (1980), have measured baseline stress levels, then conducted the stress reduction intervention, followed by post-intervention measurements. The principal strength of this approach is also its principal weakness—in that the intervention takes place in the real world, and it is therefore difficult to control for the effects of external variables such as changes in business climate.

This case study wished to replicate clinical findings on TM and extend them to the worksite. In order to replicate clinical findings, the general approach adopted here was to work within a strongly quantitative framework and then to address the inevitable limitations (such as attrition and limitations on generalisability of findings) by qualitative methods. Further reasons for the use of qualitative methods was in order to explore issues such as productivity and in order to validate¹ the quantitative work. The primary outcome

¹ See further discussion on validity of measures in this chapter and in chapter V: *Methodological weaknesses—external validity*.

measure was raw score on the stress symptoms checklist (SCL-90-R) as described later.

The experimental study

The experimental core of the study therefore consisted of finding a South African target company, then selecting a representative sample of staff, pretesting them, assigning them randomly to experimental and control conditions, administering the experimental treatment, and posttesting them. Then the results were analysed using appropriate statistical procedures.

However straightforward this procedure may appear to be, many layers of elaboration and control were necessary in order to ensure results were scientifically meaningful.

In addition, many preliminary questions had to be answered, a few of which were:

1. Was the SCL-90-R suitable for use in South Africa? No local references to its use were found in the literature. Were the question wordings understandable? What were South African norms for questionnaire scores?

2. How long would the SCL-90-R questionnaire take to complete? How would the questionnaire be scored economically, considering that it would be administered over 400 times? What database software and what clerical and error-checking routines would be appropriate?

3. Would SCL-90-R scores reflect improvements in stress levels after training in TM for subjects who referred themselves for training

through the Linksfield Ridge TM centre? This was one of six Johannesburg non-profit training centres which, according to the host organisation, were providing training to about 500 members of the public annually (SAAAE, 1992).

4. How would the blood pressure and other physiological measurements be taken, without interfering unduly with work routines?

To answer these questions, two other studies were conducted outside the target or survey company. These are referred to below as the pilot study, and the normative study. In addition, two further groups were studied for purposes of control and comparison with the groups on-site at the survey company. These are later referred to as the off-site controls and the long-term TM practitioners.

The pilot study

A pilot study was first performed on a group of business-people who referred themselves for training through the Linksfield Ridge TM centre. The chosen stress-measurement instrument, the SCL-90-R, was administered, scored and analysed to get a feel for the size of score shifts from pretest to two weeks after training in TM. This exercise also demonstrated how long the SCL-90-R questionnaire took to complete and to score. The exercise also facilitated the development of a comprehensive personal computer database to store the substantial volumes of data to result from the study. There were eventually 374 respondents, providing some 1800 blood pressure readings, 600 heart rate readings, 600 breath rate readings, 4800 climate data points and

36000 SCL-90-0 R data points. (This large number of SCL data points was needed to provide redundant data to facilitate greater depth of analysis later, if required).

Eventually, the pilot study SCL-90-R results were used for comparison with those from the carefully controlled experimental study conducted on-site.

The normative study

The SCL-90-R was concurrently administered to a group of 231 South African staff in batches of 6-25. The subjects were participants in a series of three-day business productivity workshops conducted over a period of about 18 months. The questionnaires were administered as a step of the workshop leading up to a discussion on stress. The purpose of this fairly substantial undertaking was to establish South African stress norms for comparison both with Derogatis' (1977) USA norms and in-company pretest scores. This survey was undertaken because during the pilot study it became apparent that scores on the SCL-90-R were much higher than Derogatis' norms.² The results of this survey and the demographic characteristics of this normative group are presented later in this chapter, under *Subjects* (table 2: Demographic data).

² For some discussion on the differences between SA and USA norms as highlighted by this survey, see the section later in this chapter: *Dependent variables—the assessment of stress via psychological stress symptoms.*

The out-house controls

Another of these workshop groups, whose measurement date coincided with that of the first in-company measurements, was used as the off-site control group referred to later. They attended a productivity workshop, but did not learn to practise any specific stress-reduction technique. Having been pretested, they were later posttested at the time of the on-site posttests for purposes of comparison with the on-site results.

The on-site or experimental phase of the study was then conducted using as subjects the bulk of the staff of the survey company. This is described in detail later, under the heading: *Experimental Design*.

The long-term TM practitioners

After conclusion of the on-site measurements, six months after the start of the experimental phase, a group of long-term (1-20 years) TM practitioners were measured on the SCL-90-R. These subjects were attendees at a TM conference held at the Linksfield Ridge TM centre one weekend. The measurement was made for purposes of comparison with the posttest results flowing from the on-site study.

Addressing weaknesses of previous research

Some of the weaknesses in previous research were identified in chapter II, which discussed problems such as lack of standardisation, flawed design, shortage of data and difficulty operationalising stress. Previous reviews of the stress literature have elaborated many

methodological weaknesses and have pointed out the need for the following elements in future research on stress management. These elements were included in the experimental design of this study. The research:

1. Should be at the worksite—rather than be a laboratory or clinical study (Beehr & Newman, 1978).
2. Must include a measure of the dependent variable (i.e., physical and mental health and job performance and satisfaction) preferably based on pre- and post-treatment measures (Newman & Beehr, 1979).
3. Must reflect multiple causation and multiple effects—and must therefore be multivariate in nature (Newman & Beehr, 1979).
4. Should provide direct comparisons between methods (Murphy, 1984).
5. Should have control groups (Schwartz, 1980).
6. Should control for non-specific effects (e.g. sitting in a chair with eyes closed,³ and workers' desire for programme to be successful) (Murphy, 1984).
7. Should report on the durability of the effects and compliance rates after termination of the programme (Beehr & Newman, 1978).

³ Eyes-closed-rest is a condition commonly used in studies of meditation to control for simple relaxation effects which are not specific to the meditation technique itself.

8. Should investigate the impact of practice rates, i.e., how often the technique is practiced by the trainee (Murphy, 1984).
9. Should use larger (than 12) group sizes to gain statistical power (Murphy, 1984).

Newman & Beehr (1979) and Murphy (1984) also called for the following elements which were considered to be beyond the scope of the present research: It should report on cost-benefit; it should compare successful/unsuccessful participants on socio-demographic, attitudinal, job stress and personality variables; and it should evaluate combinations of personal and organisational stress management strategies.

Nuisance variables

Inadequate control for nuisance variables has also been cited as a problem in previous research. Murphy (1984) pointed to the need to control for the following confounding effects which are not specific to the particular intervention being tested. These non-specific effects were

- Expectancy of benefit and credibility of treatment.
- Self-selection and motivation to obtain relief from stress.
- Intention to relax.
- Type of instructions.
- Quality of relationship with course leader.

In addition to the above nuisance variables, most introductory research design treatises (such as those by Leedy, 1985, and Huysamen, 1981) point out the need to control for sensitisation of the experimental subjects by the very act of pretesting. Procedures to control for these non-specific effects were built into this study as described below under control *procedures*.

Social interaction and field effects

Another phenomenon mentioned in the literature (Murphy, 1984) is improvement in controls. A large part of the company participated in the programme with 59 out of 80 actually receiving instruction in TM or PMR during the experimental period. The entire company staff were therefore well aware of the intervention and could be expected to manifest the improvements first described by Homans at the Hawthorne plant of the Western Electric Company between 1927-1932. There a series of experiments found:

A continuous increase in productivity had taken place irrespective of changing physical conditions of work (Lawrence & Seiler, 1965: 173).

Interventions by researchers were not intended to be perceived as attention from management, yet operators appeared to appreciate the attention of management and responded by improvements in attitude and output.

The kind of intervention used here also appears to be appreciated by staff and, as mentioned earlier, they are often keen for the

intervention to succeed. This has been mentioned in the literature as a possible reason why improvements in controls are commonplace according to Murphy (1984).

All such behaviour takes place in the context of social interactions at work. Such work group behaviour has been described by Homans and others (in Lawrence & Seiler 1965) as flowing from emergent sentiments and values. The desire to see a stress-reduction programme succeed would be an example of an emergent norm in such a conceptual scheme. Such emergent norms could then be regarded as a *non-intervention-specific effect* leading to the manifestation of confounding improvements. This phenomenon has been termed the Hawthorne effect.

As discussed in detail later, a Solomon four group design as described by Leedy (1985: 218) was used to control for the Hawthorne effect. Comparison of results of pretests made before and after the intervention with other groups provided one level of control. Comparison of posttest results between groups pretested and those not pretested provided another. The measurement of *non-volunteers* on-site provided a further measure of control, although random assignment was not made to this group. These non-volunteers would presumably have no interest in the success of the intervention. In fact many actually proved hostile towards the intervention.⁴ Any improvement in this group is therefore unlikely to be due to the

⁴. One of the non-volunteers said to the researcher a fortnight after the start of the intervention "... you've ruined the company. Everything is terrible." Hostility was also mentioned in the structured interviews conducted later with some of the managers.

operation of a Hawthorne effect, and is more likely to be due to faking, as discussed later. However, social interactions with colleagues who are "less stressed" could reasonably be expected to be more relaxed. As a result, the non-participating controls might also become more relaxed.

As a further possible confound, Dillbeck (1990) and a number of other researchers have noted "field effects" in the vicinity of groups practicing Transcendental Meditation (Dillbeck, Banus, Polanzi & Landrith, 1988; Dillbeck, Landrith & Orme-Johnson, 1981; Orme-Johnson, Alexander, Davies, Chandler & Larimore, 1988; Dillbeck, Cavanaugh, Glenn, Orme-Johnson and Mittlefehldt, 1987).

These field effects have been hypothesised to account for the reductions of crime and violence which have been frequently⁵ reported in populations in the vicinity of which Transcendental Meditation and its extension the TM-Sidhi programme is practiced in a group—the size of which exceeds a certain threshold. As discussed later in chapter V, these reports have sparked vigorous scientific debate (Schrodt, 1990; Orme-Johnson, Alexander & Davies, 1990).

According to Hagelin (1989), the operation of these field effects is not confined to individuals in direct social contact with the meditators so the effect is distinctly different from the social interaction effects described above. The effect could be termed action-at-a-distance since the social variables are found to improve at locations remote from the invention reported to produce the

⁵ This study located 42 published and unpublished references to this specific phenomenon.

improvement. For example, Orme-Johnson et al (1988) reported that in a prospective social experiment the practice of TM and its advanced programmes together in a group during August and September 1983 in Jerusalem was predicted to reduce stress in the collective consciousness of Israel and Lebanon. Box-Jenkins ARIMA impact assessment, cross-correlation, and transfer function analyses were used to study the effects of changes in the size of the TM group on several variables and composite indices reflecting quality of life in Jerusalem, the quality of life in Israel, and war deaths in Lebanon. They reported that:

Increases in the size of the group had a statistically significant effect in the predicted direction on the individual variables and on all composite quality-of-life indices. The effects of holidays, temperature, weekends and other forms of seasonality were explicitly controlled and could not account for these results. Cross-correlations and transfer functions indicated that the group had a leading relationship to change on the quality-of-life indicators, supporting a causal interpretation (Orme-Johnson et al, 1988).

A subsequent methodological critique of this study by Schrodt (1990) asserted several methodological problems with the Orme-Johnson study and suggested that validation of this theory would "contradict virtually the whole of contemporary understanding of causality and social behaviour."

Replying to the critique, Orme-Johnson and his co-workers asserted that re-analysis showed that the results were robust across 14 alternative transfer function models and concluded:

We have shown that our original study not only exceeded the standards for field research in

international conflict but that re-analyses actually strengthen our original findings. Even if there were not already 40 replications, the striking results of this study alone would warrant serious consideration (Orme-Johnson, Alexander & Davies, 1990).

It is to be expected that scientific discussion of this nature arouses intense scepticism and calls for investigation of the credibility and professional standing of researchers publishing such results. As Orme-Johnson et al (1990) themselves state:

It is still commonly held by social scientists that social influence is necessarily restricted to observable behavioural interactions. Instead, our research suggests that the phenomenon of field effects occurs not only in the domain of particle physics but also on the scale of human interaction (Orme-Johnson et al 1990).

They go on to point out that it is interesting that several founders of contemporary psychology and sociology - including William James, Gustav Fechner, and Emile Durkheim - proposed theories embracing possible effects on human behaviour of collective consciousness⁶ almost a century ago. They point out that such theories did not have a lasting influence because they could not be empirically tested (Orme-Johnson et al, 1990).

The reason this researcher felt it important to mention these issues in such depth is because, as described in chapter V: *Discussion*, these controversial findings may provide possible explanations for the surprising size of the improvements in controls eventually seen in this study. Field effects may provide explanations alternative to those traditionally advanced by researchers attempting to explain away

⁶ Jung spoke of the collective *unconscious*. See e.g. Mischel, 1981: 52.

improvements in controls. In addition, they may provide possible hypotheses for future research, as suggested in chapter V:

Discussion—improvements in controls.

Whatever the merits of the arguments presented for the existence of field effects or action-at-a-distance, rigorous control for these effects would involve random assignment to treatment and control groups across separate companies both neighbouring and remote. This would clearly be difficult to do in practice and was outside the scope of this study. However the study examined a group of outside workshop attendees who served as off-site controls at a location remote from the company under test. They were outside the influence of any possible local field effect flowing from the meditating group, as well as social interaction effects and were thus not expected to show improvements.

The balance of this chapter discusses experimental treatments and control procedures in depth and then elaborates the selection and demographic characteristics of subjects. First, the treatments:

STRESS MANAGEMENT TREATMENTS-THE INDEPENDENT VARIABLES

The experimental intervention was Transcendental Meditation (TM) of Maharishi Mahesh Yogi (1977); Progressive Muscle Relaxation (PMR) of Jacobson (1929) was the control treatment.

Both techniques are frequently mentioned in the stress literature and have spawned what appear to be imitations, for example Carrington's "clinically standardised meditation" and Budzynski's "modified version" of PMR (Carrington et al, 1980). TM in particular has been widely studied in clinical settings and is taught in a highly systematic manner making it an ideal candidate for scientific investigation.

Transcendental Meditation

TM is an effortless procedure which involves the use of a mantra—a Sanskrit term meaning "instrument of thought" (Chambers Dictionary, 1990). In TM practice, the mantra is held to be a specific sound used purely for its sound value without reference to any meaning. According to Alexander and his co-workers (1990)

TM ...frees attention from the control of language and the semantically conditioned thinking process. During the practice, mental activity is said gradually to subside as increasingly refined levels of thought and feeling are experienced. This gives rise to the state of pure consciousness in which awareness is maintained, but all specific objects of attention (percepts, concepts,

feelings) are systematically transcended, with the result that awareness becomes self-referral, or directly aware of itself (Alexander et al, 1990: 299).

The founder of Transcendental Meditation, Maharishi Mahesh Yogi, has described TM as "the process of bringing the attention to the level of transcendental Being (Maharishi, 1966: 52). He describes Being as "the state of eternal and absolute existence." He has described this state as the source of thought and asserts that:

...through the experience of a thought we can experience the subtle states of thinking and, transcending them, are certain to arrive at the transcendental state of Being (Maharishi, 1966: 52).

The value of regular daily practise of this process is described by Maharishi in the following terms:

When the mind proceeds to experience subtler states of thought and transcendental Being, its full potentiality unfolds and automatically becomes available for use in daily activities. By this process one begins to make use of one's full potential in the fields of senses, body and surroundings and one lives life in completeness. (Maharishi, 1966: 94).

This conclusion is supported by a substantial clinical literature suggesting not only stress amelioration with regular TM practice, but culturing of a more ideal style of neurophysiological functioning leading to "improvements in all aspects of the individual's physical, mental and emotional capacities" (Wallace 1986). Wallace cites the research of others (including Ferguson & Gowan in 1976; Hjelle in 1974; Nidich et al in 1973; Seeman et al in 1972; and Shapiro in 1974) on the TM programme that show improvements in self actualisation,

as measured by tests based on the research and theories of Abraham Maslow.

These considerations weighted the choice of a primary intervention in favour of TM. Other reasons for choosing TM as the primary intervention included the standardisation of the teaching, the simplicity of instruction and the ready availability of TM teachers.

In addition to his experience with practice and teaching of TM, the researcher fulfilled the criterion of familiarity with the theoretical framework of the technique as called for by Orme Johnson & Dillbeck (1986). The teaching of TM is well described by Gustavsson (1992) as follows:

The Transcendental Meditation technique of Maharishi Mahesh Yogi is taught in a standardised way all over the world by authorised⁷ TM-teachers. The general course consists of seven steps:

1. General information about the technique and its effects presented at a lecture for about 1,5 hours.
2. More specific information about the technique in about 1 hour for those who have attended the first information lecture. Those interested in learning the technique apply to the teacher at the end of the lecture. Steps 1 and 2 are usually held on separate occasions but can, as an exception, be given in consecutive steps at the same time.
3. Those who have applied to learn the technique meet the teacher for a 5-10 minute individual interview in order for the teacher to get acquainted with the applicant and to give practical information as a preparation for the actual teaching of the technique.
4. Individual teaching of the technique is held on a separate day and takes 1-1,5 hours. Here the person

⁷ As discussed later.

learns the technique and has his first experiences of the technique. The teaching follows the custom of the tradition it comes from with a short ceremony. The main purpose of this step is experiential: to let the person experience the effects of the technique, usually experienced as deep rest. The person is asked to meditate twice a day for 15-20 minutes.

5-7 The following steps consist of group meetings on three consecutive days where those who learned the technique at the same occasion meet for about 2 hours and discuss experiences of their meditations. The teacher explains the practice of the technique in more detail on the basis of the persons' experiences, corrects wrong notions of the practice, and explains experiences in terms of practical arrangements (when to do it, etc), release of stress and fatigue, and visions of the development through the technique. The persons are asked to meditate regularly twice a day, at home, at work, or wherever suitable, alone or together with others.

Usually there are two or three more meetings with two to six weeks intervals where accumulated and long-run experiences are discussed. In addition, the technique is usually "checked" individually by the teacher in order to ensure correct practice. The purpose of the follow-up meetings is to facilitate an integration of TM with the daily activity and to inspire the course participants to regular practice of the technique.

The core of this general course scheme is also used by those teaching the technique in organisational settings. Usually there are more follow-up meetings in these courses and the technique and its philosophy is often discussed in terms of principles of management, business, etc. (Gustavsson, 1992: 285).

These procedures were applied in this study as discussed presently.

It is recognised that the practice of TM is frequently misunderstood by business-people unfamiliar with the more introspective side of human nature. In this regard, it is necessary to emphasise that

experience during TM practice is familiar, comfortable and not mystical or removed from everyday life. Alexander and his co-workers cite the typical report of a TM practitioner:

She states that often during TM practice, 'I experience a state of complete silence devoid of any motion, a state of unboundedness and total ease in deep relaxation. There are no thoughts, no feelings or any other sensations like weight or temperature. I just know I am. There is no notion of time and space, but my mind is fully awake and perfectly clear. It is a very natural and simple state.' (Alexander et al 1990: 311).

Progressive Muscle Relaxation

This was described by Carrington as:

Edmund Jacobson's classical relaxation technique in which selected muscle groups are alternately tensed and then relaxed with the aim of eventually learning to release muscle tension without any preliminary tensing (Carrington, 1980).

Jacobson himself (1957: 87) described the aim of his technique as being to "quiet the nerve-muscle system." The essential feature of the technique is to do away with "residual tension." Like Maharishi, he emphasised the importance of daily practice.

Jacobson elaborated the aims of his practice in the following terms:

To learn to pass from the state of tension that usually characterises modern living into one of complete relaxation within a few minutes or less; to repeat this again and again until relaxation becomes habitual - such, from the present stand point, are the aims of nervous re-education" (Jacobson, 1957).

He described the practice as "progressive" in three respects:

1. The subject relaxes a group, for instance the muscles that bend the right arm, further and further each minute. 2. He learns one after the other to relax the principle muscle groups of his body. With each new group he simultaneously relaxes such parts as have received practice previously. 3. As he practices from day to day, according to my experience, he progresses towards a habit of repose - tends towards a state in which quiet is automatically maintained" (Jacobson, 1957: 94)

In Jacobson's terms this relaxation is the opposite of "tenseness" which he described as the sensation felt where a muscle is contracted and which may be found to be habitual. In this sense tenseness could be said to be stress and PMR could thus be said to be a stress-reduction technique.

The procedures used by the trainer to impart progressive muscle relaxation are set out in detail in Appendix R. The procedures were basically as described by Jacobson (1957). However, he recommended two or more hours of instruction per week plus practice alone of one or two hours per day. The solo requirements were judged to be unrealistic for the particular target audience of this study. For this reason and for purposes of making the training as nearly as possible comparable with that of TM, Jacobson's procedure was modified by giving a total of 7 hours instruction in the first week (more than the recommended hours), and a further two group meetings over the next 6 weeks (which was less than recommended). Practice time was set at 2 sessions of 15-20 minutes per day, slightly less than recommended, but exactly the same as the TM requirement.

DEPENDENT VARIABLES

In general terms, stress level was the dependent variable. Recall the definition of stress used in this study was: *the individual's psychological, physiological and behavioural responses to the total of internally and externally driven demands on that individual.*

Validity of the Stress Construct

Job stress is a highly complex phenomenon which, as a construct, cannot be directly observed or isolated. Stress researchers have apparently therefore resorted to increasingly complex stress models (as, for example the "facet analytic model" of Shirom, 1982) in order to be able to develop and test hypotheses. There is general agreement on the multiple causation and open-ended nature of job stress and reviewers such as Newman and Beehr (1979) have therefore drawn attention to the need for the study of multiple causes and effects. This study therefore used a multivariate approach involving the simultaneous measurement of a range of variables in an attempt to solve the problem of construct validity.

There were thus three categories of quantitative dependent variables: physiological, psychological and organisational (company climate and productivity). In addition, questionnaires and structured interviews were used to extend the quantitative data.

The assessment of stress via psychological stress symptoms

The SCL-90-R

Stress symptoms were self-reported using the Stress Symptoms Check List SCL-90-R, a questionnaire developed by Derogatis (1977). As shown in Appendix H, it 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." Scoring ranges from 0 = "not at all" to 4 = "extremely." It has been widely used in stress research, for example by Nelson and Sutton (1990), Carrington et al (1980), and Peters, Benson and Porter (1977).

According to Derogatis (1977: 20) the assessment and treatment of stress syndromes has come to occupy a significant place in current clinical research and the SCL-90-R has been shown to be highly sensitive to stress related conditions. He mentioned the work of Carrington et al (1980) as reviewed in this study and asserted the SCL-90-R has been demonstrated to be highly sensitive to differences between meditation and control groups in the treatment of stress. Further that the SCL-90-R "reveals significant differences between various types of meditation." He then detailed the work of Horowitz with post-traumatic stress disorders; Bohachick with cardiac rehabilitation interventions; Baum dealing with stress at Three Mile Island, and Green with residual levels of stress among survivors of the Beverley Hills Supper Club fire. In each study the SCL-90-R appeared to have proved to be "quite sensitive," according to Derogatis (1977).

The SCL-90-R is scored and interpreted in terms of nine primary symptom dimensions. These are labelled: SOMATIZATION, OBSESSIVE-COMPULSIVE, INTER-PERSONAL SENSITIVITY, DEPRESSION, ANXIETY, HOSTILITY, PHOBIC ANXIETY, PARANOID IDEATION, AND PSYCHOTICISM. In addition there are three global indices of distress. These are the GLOBAL SEVERITY INDEX (GSI), POSITIVE SYMPTOM DISTRESS INDEX (PSDI) and POSITIVE SYMPTOM TOTAL (PST).

The inventory is "designed primarily to reflect the psychological symptom patterns of psychiatric and medical patients." (Derogatis, 1977). The questionnaire is therefore usually used to assess the individual patient's clinical status. For this reason raw scores are usually converted to standard T-scores using tables provided in the manual and based on normative groups' scores observed in the USA (Derogatis, 1977, Appendix 2).

For purposes of this study, however, it was judged undesirable to convert raw scores to T-scores because the study was not interested in individual clinical profiles. Furthermore, the raw score means reported by Derogatis (1977: table 18) for U.S.A. normative groups (GSI mean 0,31, standard deviation 0,31) appear to be very different from those of the South African normative group measured for purposes of this study (GSI mean 0,73, s.d. 0,45). A detailed investigation into this discrepancy, and thus into the appropriateness of utilising U.S.A. norms for the conversion of SA results, was judged to be beyond the scope of this study.

According to Derogatis "the GSI ⁸ represents the best single indicator of the current level or depth of the disorder, and should be utilised in most instances where a single summary measure is required." The GSI is calculated as the grand total of distress scores across all items of the inventory, divided by the number of items (90). Division of each subject's scores by 90 adds an extra calculation step and does not affect statistical manipulation of the data. This step was therefore omitted and like Carrington et al (1980), the study worked with SCL-90-R raw scores.

According to Derogatis (1977) the self-report method of psychological measurement is useful because it is a window directly into the subject's experience, because scoring is economical, and because it is readily amenable to statistical interpretation. It has therefore become one of the most frequent means of operationally defining normality versus abnormality.

Reliability of the SCL-90-R

Two types of reliability reported for the SCL-90-R were internal consistency and test-retest reliability.

Internal consistency served to measure the "homogeneity or consistency with which the item selected to represent each symptom construct actually reflects the underlying factor." Derogatis reported internal consistency reliability coefficients of 0.77 to 0.90 across the various symptom dimensions.

⁸ Global Severity Index (grand total distress score)

Test-retest reliability is concerned with stability over time and typically decreases with time between tests. Test-retest reliability coefficients of 0.8 to 0.9 were reported by Derogatis as "...an appropriate level for symptom constructs." He further asserted:

Test-retest reliabilities are very good for the 90, and we have been unable to detect any significant 'practice' effects which might bias the profile on repeated demonstration (Derogatis, 1977).

This last point is interesting in the light of observations made in this study that retest scores on the instrument were almost invariably somewhat lower than initial test, regardless of the intervening treatment.

Validity of the SCL-90-R

According to Derogatis the inventory was designed to reflect psychological symptom status in a broad spectrum of individuals ranging from non-patient 'normal' respondents through medical patients of various types, to individuals with psychiatric disorders. It may be used either for single assessments of a patient's clinical status or it may be utilised repeatedly, either to document trends over time or in pre-post evaluations.

The inventory may also be utilised with adolescents down to age 13. These considerations make it clear that the inventory was suited for use with a population of normal business-people.

Regarding the validity of the SCL-90-R, according to Derogatis:

Validity takes on practical meaning only in regard to a specific purpose or criterion. While theoretical formulations concerning validity can be complex at

times, at the operational level validation usually consists of a set of correlations with more or less inclusive indicators of the construct the scale purports to represent. By demonstrating positive correlations between scale values and external criteria felt to be good reflections of the construct, validation is initiated. Validation is not accomplished through a single definitive experiment, however; rather it is achieved through a series of rational operations and empirical procedures that converge to extend and redefine the limits of generalisability of the measured construct. Viewed in this matter, validation is programmatic; it is a process that is dynamic and ongoing rather than a static status to be attained and displayed (Derogatis, 1977).

Regarding the correlations between the SCL-90-R with other established inventories, the SCL-90-R has been contrasted with the widely used Minnesota Multiphasic Personality Inventory (MMPI). Derogatis reported that this study reflected a high degree of convergent validity for the SCL-90-R. In another investigation the SCL-90-R was correlated with dimensions of the Middlesex Hospital symptom questionnaire (MHQ).

Significantly, in this latter study, the GSI yielded a correlation coefficient with the MHQ global score of 0,92, a highly significant correlation. The above study was important here because it validates the use of the raw score (i.e., GSI x 90) as the primary outcome measure in the present study.

These considerations satisfied the present study on the validity of using the SCL-90-R to measure stress levels of normal business people.

Regarding normality, Derogatis measured a sample of 974 non-patient normals. This non-patient normal cohort was comprised of 494 males and 480 females. It represented a stratified random sample from a diversely comprised county in a large Eastern state in the USA. The sample was 87% White and 12% Black. 85% were single, mean age was 46 years, and the standard deviation was 14,7 years. Mean GSI report for the group was 0.31. Multiplying this by 90 gives a mean raw score of 28 on the SCL-90-R for this normative group. This is much lower than the South African norms of 65. However Carrington et al (1980) reported pre-intervention scores at about the same level as the SA norms for staff "self-selected for stress" at the New York Telephone Company.

The assessment of stress via physiological stress parameters

Blood pressure, heart rate and breath rate

Systolic and diastolic blood pressure, heart rate and breath rate measurements were taken by an experienced nursing sister with subjects seated, using a standard upright Acoma (Japan) mercury sphygmomanometer and cuff. 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 (the same procedure as used by Peters et al, 1977). Measurements were

taken as nearly as possible at the same time of day, usually between 10.00 h and 15.00 h.

The nurse was blind to group assignments.

The nurse was instructed to ask subjects whether they were taking any medication and whether there had been any current upsets (such as bad news, arguments with colleagues, etc). This was in order to be able to screen out readings affected by medication (e.g. anti-hypertensive medication dosage changes) or transient stress responses.⁹ In addition she was briefed to ask whether the subject had changed her exercise patterns recently, because fitness is known to influence resting heart rate. These comments were recorded on special record sheets (see Appendix N) together with blood pressure, breath rate and heart rate readings. The data on these record sheets was later entered into a personal computer data base. Later results were displayed in a way which facilitated visual inspection in order to pick up possible reasons for any unusual results. This information was later cross-referenced to the medical information acquired via the TM programme course application form (Appendix K) and later proved very useful, as for example in the case where one woman had been having injections for appetite suppression before one of her blood pressure posttest readings. Her blood pressure was noticed to be unusually elevated and that reading was accordingly rejected.

⁹ Transient stress is known to elevate blood pressure. For example, according to Civin, a patient about to undergo surgery in theatre may have a DBP of well over 100 mmHg, compared to <90 mmHg measured in the ward earlier that day. (Personal communication, 1994. Civin is Course Coordinator, Medical and Dental Student Training in Anaesthetics at Baragwanath Hospital, Soweto.)

Validity of blood pressure as a measure of stress level

The validity of using blood pressure as an assessment of stress level flows out of literature reviewed earlier which discussed research suggesting a job-stress link with elevated blood pressure. In addition, as Pelletier (1977) has pointed out, blood pressure is regulated by the stress-related hormone vasopressin which is released from the posterior lobe of the pituitary gland of the brain. This same gland's anterior lobe controls the release of other secretions which generally "prepare the body to cope with a stressful event by temporarily increasing circulation, heart action, basal-metabolism rate, and other processes"(Pelletier, 1977). He elaborates that during stress:

...metabolism in the tissues is intensely stimulated...
When this happens, a person sweats easily and feels nervous and shaky; his heart beats too fast, breathing becomes rapid and unusually deep and he tires quickly (Pelletier, 1977).

The foregoing discussion serves to suggest that blood pressure, heart rate, and breath rate are valid ways of assessing stress. The same argument holds for heart and breath rates.

Reliability of blood pressure measurements

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 nursing sister in as nearly as possible the same circumstances with the subject filling out SCL-90-R questionnaires and chatting with other subjects between the blood pressure measurements.

Taken outside of these systematic procedures, blood pressure as measured by generally overworked medical doctors in general practice may not necessarily be reliable. Several subjects in fact complained that the blood pressures produced by the nursing sister were not the same as their GP had reported to them in previous weeks. This is not surprising, considering the lack of control over the circumstances in which their blood pressures were taken outside of the study.

The assessment of company climate

This study regarded climate as a variable possibly intervening between job stress and productivity, as indicated in figure 2b in chapter II. As discussed earlier, an instrument developed by Litwin & Stringer as reported by Nasser & Schmickl (1986) was used to measure climate. The dimensions of interest were WARMTH and SUPPORT. Other dimensions were STRUCTURE, RESPONSIBILITY, REWARD, RISK, STANDARDS, CONFLICT and IDENTITY. Subjects completed the entire questionnaire, consisting of 40 questions (see Appendix I).

According to Nasser the WARMTH dimension was defined by Litwin & Stringer in 1968 as follows:

...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, 1986).

Specific questions on the WARMTH dimension were:

4 - A friendly atmosphere prevails among the people of this organisation,

21 - Its very hard to get to know people in this organisation,

28 - People in this organisation tend to be cool and aloof towards each other,

35 - There is a lot of warmth in the relationship between management and workers in this organisation (Nasser, 1986).

Respondents had to rate their agreement with these statements across a 4 point scale ranging from Definitely agree /Inclined to Agree /Inclined to Disagree /Definitely Disagree.

The SUPPORT dimension was defined by Litwin & Stringer as:

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

Specific questions on the SUPPORT dimension were:

5 - you don't get much sympathy from higher ups in this organisation if you make a mistake,

13 - management makes an effort to talk with you about your career aspirations within the organisation,

29 - the philosophy of our management emphasises the human factor, how people feel, etc, and

36 - when I am on a difficult assignment I can usually count on getting assistance from my boss and co-workers (Nasser, 1986).

Validity of climate as a link between stress reduction and productivity

As discussed earlier in chapter II: *Rationale for measuring company climate*, the organisational climate measurements were not originally the major thrust of this study, being rather a stop-gap in the absence of any other suitable productivity measures. It is perhaps just as well this was so because the following commentary on validity of

this measurement is made by Nasser & Schmickl in the introduction to their working paper wherein they state:

The concept of organisational climate is currently enjoying a great deal of limelight, but it also appears to be one of the haziest¹⁰ concepts to have come along in some time (Nasser & Schmickl, 1986).

However they point out that the concept of organisational climate as a product of the individual's perception seems to have taken root. They mention that a company's climate is affected by innumerable factors, many of which are dynamic and interactive and are responsible for a variable 'weather' within the organisation. Other factors remain relatively constant and may be modelled as the characteristic climate for the organisation. In terms of the definition of organisational climate put forward by Litwin & Stringer (cited by Nasser & Schmickl, 1986) climate is a set of measurable properties of the work environment. These properties are measured by responses to questions such as those set forth earlier.

Could climate influence productivity? Nasser & Schmickl (1986) cited a 1971 study by Karasick in which it was established that climate related strongly to managerial satisfaction, but the relationship between climate and performance was not strong. This would seem to undermine the present study's proposition that climate may be a device from which productivity may be inferred.

¹⁰ The term hazy presumably means abstract. The discussion around figures 4 and 27 develops the idea that consideration of different levels of abstraction may be useful when attempting to deal with concepts such as company climate.

Now what could influence company climate? Specifically, could stress levels have a bearing on climate? Stress was not discussed by Nasser & Schmickl. However they did discuss management, organisation structure and individual needs.

Management was asserted by Nasser & Schmickl to be a primary influencer of organisational climate. Organisation structure appeared to be an important second influence. However evidence for this assertion was mixed. Results of a study reported by Nasser & Schmickl suggested that structure did not in fact play a noticeable role in determining an organisation's climate.

The third possible organisational variable impacting on or being impacted by organisational climate was individual needs, according to Nasser & Schmickl (1986). They cited a 1968 study by Litwin & Stringer wherein a simulation technique was used to examine the effects of organisational climate and managerial style on the achievement, power and affiliation needs of employees within three organisations. One way analyses of variance of the motive changes all failed to reach statistical significance but the direction of the tendencies indicated: "a relationship between climate and needs" (Nasser & Schmickl, 1986).

In a further 1968 study, Litwin & Stringer examined the organisational climate and the consequent development and motivation needs of MBA students and business managers. They found relationships between organisational climate (as measured by the same instrument used in this study) and motivation needs. (Nasser & Schmickl did not mention what instrument was used to

measure motivation needs.) Their study also found relationships between climate and personality variables as measured by the California Psychological Inventory.

How do these findings clarify the relationships between stress reduction, organisational climate, and productivity?

Nasser & Schmickl made the reasonable assertion that the larger the overlap between individual needs and organisational climate the more likely employees will be productive, deliver quality work and progress rapidly within the organisation. However, if there is a poor fit, it is: "more than likely that he will become frustrated, disgruntled and add another index to the labour turnover of the organisation" (Nasser & Schmickl, 1986).

They asserted that where little or no overlap exists between individual needs and organisation climate either the employee exerts the minimum amount of effort required to sustain organisational membership, or if the goals of individual and organisation are very far removed: "the consequences for effective organisational function and profitability are disastrous." It would seem reasonable to postulate therefore, that a poor match between individual needs and organisational climate would be reflected by higher stress levels within the organisation. However, the present study did not pursue this particular line of thought any further.

Would the climate questionnaire used here represent a valid measure of stress levels and productivity? It seemed reasonable to postulate a link between climate, stress levels and productivity,

however speculative this may have been at the commencement of the study. As mentioned earlier in chapter II, literature published subsequent to the intervention seems to have supported this view (Sutherland & Davidson, 1993; Marcoulides & Heck, 1994).

In this context, a doctoral dissertation completed subsequent to the execution of the present study provided a useful link between meditation and company climate.

Gustavsson (1992) has developed a concept he calls the "transcendent organisation." He describes the organisation in terms of levels of organisational abstraction, from very abstract at its fundamental basis, to very concrete at the level of its expression in terms of organisational charts. He argues that "that-thing-we-call-organisation does not have an ontological ¹¹ status of its own - it exists as an objectification in the minds of people" (Gustavsson, 1992: 223).

He asserts that therefore the different levels of organisational reality are the levels of abstraction in people's minds from the grossest materialisation (e.g. organisation charts) to the ultimate source of these objectifications in pure consciousness ¹²: As Gustavsson puts it:

"Conceived in this way, pure consciousness is the most fundamental level of organisational reality"
(Gustavsson, 1992: 223).

¹¹ i.e. relating to the science that "treats of the principles of pure being"—the nature and essence of things (Chambers, 1990).

¹² The term pure consciousness is used here in the sense of consciousness as a process i.e., without any specific thought content. The term consciousness is in turn used in a somewhat broader sense than is common everyday experience (i.e., "the waking state of the mind" Chambers, 1990). e.g. Hagelin (1989: 60) asserts "in a state of pure consciousness, consciousness experiences itself as the unified source and fountainhead of all the laws of nature: all forms and phenomena in the universe are experienced to emerge from there."

According to Gustavsson, this way of conceiving the organisation is similar to the systems approach in which reality is organised in a hierarchy of levels of systems, where the higher level systems are made up of systems of lower level systems. As represented below, Gustavsson's model describes the organisation as starting at the level of pure consciousness, the basis of all individual's consciousnesses and according to Gustavsson "thus at the basis of all potential objectifications of organisations." He mentions that this level may itself be conceived of in levels, examples of which would be Jung's Archetypes and Sheldrake's Morphogenetic Fields.

Moving up a level, Gustavsson asserts that this pure consciousness is expressed through individuals as collective consciousness when we consider groups of people.

Moving one level higher Gustavsson proposes that the tangible and expressed aspects of group consciousness be called "interactive consciousness." He asserts that it is on this level of interactive consciousness that "we find the intersubjective objectifications of reality and organisations in language, symbols, etc." He suggests that the collective consciousness sets the frame for the interactive consciousness and that paradigms are transmitted on the interactive level. Gustavsson proposes that the collective consciousness and interactive consciousness levels can be referred to jointly as the organisation's group consciousness.

What is most interesting about Gustavsson's analysis in the present context is that the top level of his model of the transcendent

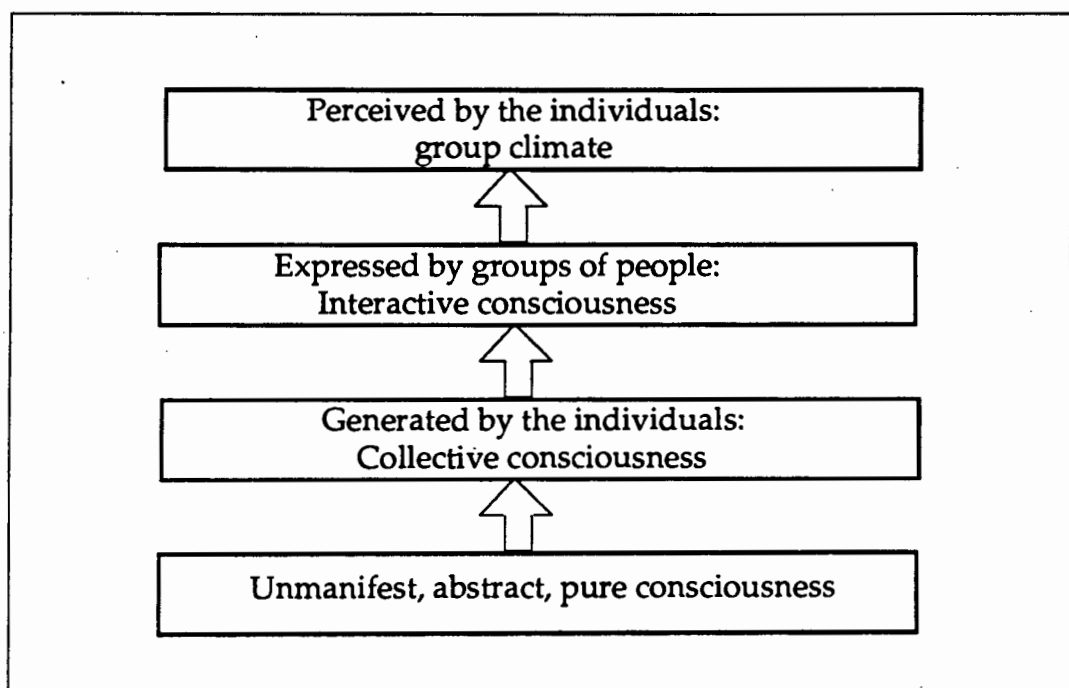
organisation he terms the *group climate*, which consists of how the culture of the organisation is *experienced*. The climate would therefore represent an expression of the things on the surface of all organisational and psychological processes. According to Gustavsson,

...the climate also easily reacts to outer changes and is partly determined by the culture. Every individual organisation member perceives the climate and can describe it on the basis of his own perceptions. The climate of an organisation can therefore be studied by way of these perceptions. ... the group climate is the most tangible and concrete aspect of the group consciousness in an organisation and it is therefore also the most local (Gustavsson, 1992: 227-8).

Gustavsson represented his model as follows:

Figure 4

THE TRANSCENDENT ORGANISATION



From Gustavsson (1992: 227). The order of presentation is done in a hierarchical manner, so that the bottom of the figure represents the innermost, most abstract aspects.

The point of this discussion has been to draw a link between stress reduction via the practice of TM, and possible shifts in group climate and productivity. TM is held to provide access to the unmanifest, abstract field of pure consciousness. Regular TM practice should, according to Maharishi (1966, 94) therefore unfold whatever potentialities reside in that field of pure consciousness. It seems logical that this would ultimately influence the group climate and productivity. As Gustavsson put it:

A rise of the level ¹³ of collective consciousness in the organisation would therefore expand the organisation's potential in terms of greater ability to comprehend wholeness, less reifying ¹⁴ understanding of organisational objectifications, and in enhancing the transcendent evolutionary order of pure consciousness. This would entail a rise in the organisation's members' reflection of pure consciousness and could be achieved by meditation methods ..." Gustavsson 1992: 234).

Could "greater ability to comprehend wholeness" and "less reifying understanding of organisational objectifications" be symptomatic of stress reduction? If the answer is in the affirmative, the above arguments suggest that climate measures may be a valid way of measuring stress levels.

Would these cognitive improvements and a "rise in the organisation's members' reflection of pure consciousness" lead to

¹³ Meaning an increase in the degree to which pure consciousness is expressed outwards into concrete or tangible aspects of the organisation, such as group climate.

¹⁴ i.e. to think of as a material thing, to materialise, to turn into an object, to depersonalise (Chambers, 1990). Gustavsson (1992) attributes negative connotations to the word, as opposed to the word "objectify" (to make objective) which in Gustavsson's work carries neutral to positive connotations.

improved productivity? Another affirmative answer would suggest that stress reduction could lead to improved productivity.

An argument could also be presented here for the face validity of this climate instrument. It would seem to be commonsense that stress reduction in staff would be accompanied by broader perspectives, more positive affect and more objectivity of judgement. 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 organisational effectiveness, as argued in chapter V: *Discussion—organisational outcomes following training in TM.*

Other questionnaires

Additional information was collected on credibility of treatment, health habits, regularity of practice, subjective perception of benefits and medication usage using questionnaires specially designed for this study. These questionnaires are tabulated as:

Appendix J—Opinion Survey (credibility and expectancy)

Appendix K—Transcendental Meditation Application Form

Appendix L—Six Week Evaluation Questionnaire (benefits)

Appendix M—Structured Interview

Appendix N—Nurses Record Sheet

EXPERIMENTAL DESIGN

Having discussed the broad framework of the study earlier, this section discusses the design of the experimental core of this study.

TM was administered to 41 volunteers and PMR to 18 volunteers in-company in a prospective experimental design using both volunteer (waitlist) and 11 non-volunteer controls as described below. The study was multivariate and used repeated measures so subjects acted as their own controls. Pretests were administered one week prior to treatment, and posttests were conducted after six weeks and 5,5 months. These posttest intervals were set in order to be able to compare the results with those of Carrington et al (1980) who used these periods. It was judged important to be able to do so in order to replicate and extend her findings. Two weeks after instruction, a further posttest was done of psychological and physiological measures only. This was done because Carrington et al reported that:

within the first six weeks of the study, a rapid reduction in symptoms occurred which accounted for 86,4% of the total symptom reduction seen over the entire course of the study (Carrington et al, 1980).

The present study wished to broaden the understanding of how quickly symptoms reduce after training in stress reduction. An additional consideration was the availability of subjects for measurements at the followup meeting held two weeks after instruction.

As already discussed, four sets of additional measurements were also taken for purposes of comparison with the experimental results.

Each measured psychological stress symptoms of a group of subjects whose ages and occupations were comparable to those in the main study. A pilot study (using a pre- and two-week posttest) was first conducted on volunteers who learned TM in a TM centre. In addition, a normative group was measured in order to establish South African norms for stress levels. Then concurrently with the main study, pretest and 5,5 month posttest measurements were made on controls *outside* the company who attended a three-day workshop on self-development but did not learn any stress reduction technique. Finally a group of long-term TM meditators were posttested only at the same time as the in-company subjects had their 5,5 month posttest.

The study used a Solomon four-group design to control for nuisance variables, such as pretest sensitisation, and history effects. According to Leedy, the Solomon four-group design "removes a kind of Hawthorne effect from the experiment." (Leedy, 1980: 218). Leedy further asserts:

In terms of experimental designs, the Solomon four-group design is probably our most powerful experimental approach. The data are analysed by doing an analysis of variance of the posttest scores. The rigorous bivariate structure does require, however, considerably larger samples, and demands much more energy on the part of the researcher to pursue it. Its principle value is in eliminating pretest influence, as we have previously pointed out, and where such is desirable the design is unsurpassed (Leedy, 1980: 218).

The Solomon four-group design may be represented as follows (after Leedy, 1980: 214) where R-- indicates random assignment to each of the groups:

Table 1

EXPERIMENTAL DESIGN

R--	[O ₁ - X - O ₂	(pretest-treatment-posttest)
		X - O ₃	(no pretest, control for pretest sensitisation)
		O ₄ - O ₅	(two pretests, control for pretest sensitisation)
		- - O ₆	(testing delayed 2 weeks to control for effects not specific to the intervention, as discussed below)

(O represents an observation, X an intervention)

The quantitative focus of the study was broadened by a qualitative component which used subjective evaluation and structured interviews on order to evaluate the overall success of the intervention and its impact on the organisation as a whole.

Control procedures

As mentioned, several writers have highlighted the methodological weaknesses in previous stress research (Murphy, 1984; Schwartz, 1980; Newman & Beehr, 1979). For this reason, particular attention was paid to controlling for the following nuisance variables.

Expectancy of benefit and credibility of treatment

All experimental subjects (i.e., volunteers) were given the same expectation of benefit at initial presentation. A prepared standardised presentation was used with visual material.

Regarding the original intention to test the differential effectiveness of TM against PMR, this comparison was handicapped from the start as it was common cause that the Deputy Managing Director was a TM practitioner. Nevertheless, during the presentation benefits were ascribed to factors common to both PMR and TM such as "relaxation", "enjoyment", "normalisation of physiology", "mental rest - get mind off the job", etc.

At the end of the presentation, an opinion survey was conducted. Despite the attempt made to level the playing field, 48 responded they wished to learn TM, 4 PMR and 12 neither technique. This result would largely invalidate any formal attempt to compare the differential effectiveness of the two techniques. As mentioned later, the comparison was further obstructed by unavailability of a PMR instructor on time, and finally confounded by the announcement of retrenchments during the 6-week PMR posttests.

Regarding the question of expectancy of benefit (from whatever technique), subjects had completed the opinion survey which also collected credibility and expectancy data (see Appendix J: *opinion survey*) before receiving instruction. The question was then addressed using multiple regression analysis as discussed in chapter IV: *results*.

Self selection and motivation to obtain relief from stress

All subjects were recruited by responding to an invitation to a talk on stress. Management made it known in advance that while all staff were expected to attend, this was not mandatory. Further it was emphasised that participation in the stress-management programme

itself was entirely voluntary and without cost to the participants. Analysis of Variance (ANOVA) found no significant differences (at the $\alpha=0,05$ level) between groups in the pretest scores on the SCL-90-R. Non-volunteers, TM pilot study subjects and off-site controls did not have significantly different stress levels from volunteers at the start of the experiment.

Intention to relax

Did all subjects have the same degree of intention to relax? They were all exposed to the same briefing procedure and they could possibly be expected to have the same demand characteristics. Furthermore, they had filled out an opinion survey, the scores on which were later summed to provide an overall credibility and expectancy score. Variance in these scores could possibly be interpreted as variance in degree of intention to relax.

The use of eyes-closed-rest groups has sometimes been used to control for non-specific relaxation effects but here was considered to be unnecessary and impractical.

The use of volunteers as six month waitlist controls was considered to be unnecessary given the availability of non-volunteers and inexpedient given the small sizes of the experimental subgroups. However due to the delay in PMR instruction the PMR group effectively served as four week waitlist controls. The non-volunteer and off-site groups served as extra-experimental controls who could reasonably be expected to have neither the motivation to relax nor to

engage in self-administered treatments as suggested by other researchers and discussed below.

Type of instructions

TM training is constrained to a 'live' format using an instructor, personal (one-on-one) instruction and followup seminars. Therefore this format was used for both TM and PMR treatments. All participating subjects were trained in the same room in a quiet private home a few minutes drive away from the company's offices. Great care was exercised to maintain as nearly as possible an identical set and setting for both TM and PMR training.

Quality of relationship with course leader

All groups received instruction from either of two experienced management trainers qualified¹⁵ to teach TM. The majority of TM instruction was provided by an Educational Psychologist with 20 years experience teaching TM in organisational and TM centre settings. Both trainers have had international training experience and both have been conducting in-company workshops for over fourteen years. Both have usually received high ratings from participants on other programmes. However one trainer was male and the other female. The groups were predominantly female. This could have biased the results, as most TM was trained by the female trainer and the PMR by the male. He devised and delivered the training in PMR according to

¹⁵ The South African Association of the Age of Enlightenment (SAAAE) accredits TM teachers according to strict guidelines laid down by its parent body, Maharishi European Research University (MERU) of Seelisburg, Switzerland. These requirements before accreditation include sound physical and mental health, good character and at least a year's practice of Transcendental Meditation and its advanced programmes.

the procedures laid down by Jacobson (1957) and within a course framework as similar as possible to that used for training TM as mentioned earlier. No evidence emerged during the course of the study—subjective, anecdotal or otherwise—to suggest that trainees preferred to receive instruction from one or other of the two instructors.

Practical experience and observation of many trainers over the years has led this writer to believe that the perceived credibility of the course leader is a crucial determinant in the success of any training programme, stress-related or otherwise. As already mentioned, an attempt was made to control for credibility using data collected during the registration phase of the training.

Pretest sensitisation

A Solomon four group design was used to control for pretest sensitisation. (Results suggestive of some sensitisation did not reach statistical significance when eventually subjected to an analysis of variance.)

Social interaction and field effects

Out-house controls who had no training in stress-reduction and who had no contact with the survey company were tested for comparison with the non-volunteer in-company controls—who also had no training but were in immediate proximity to those who had. These groups were matched on age and occupation variables but not

on sex. (There were more males in the outside group). Analysis of variance found no significant difference between on-site and off-site groups on SCL-90-R scores at pretest. Subjects were not randomly assigned to either group, and no physiological or climate variables were measured on the off-site group, so this investigation technically falls outside the experimental core of the study.

SUBJECTS

The balance of this chapter is devoted to the actual composition of samples and a discussion of the procedures used in practice.

In-house subjects

The survey company

A well-known medium-sized South African marketing research consultancy agreed to participate in the study. The company had about 80 full-time employees at the time the experiment commenced. In addition it had several hundred part-time researchers. An unusual feature of the company was that two of the three most senior executives and about 90% of the total staff were women.

The company was about 20 years old and had been founded and run by one individual up to the year prior to the study when he sold his shares to the existing management.

The business of the company was that of undertaking market surveys for a cross-section of South African and international clients ranging from consumer-goods manufacturers to government departments and political parties.

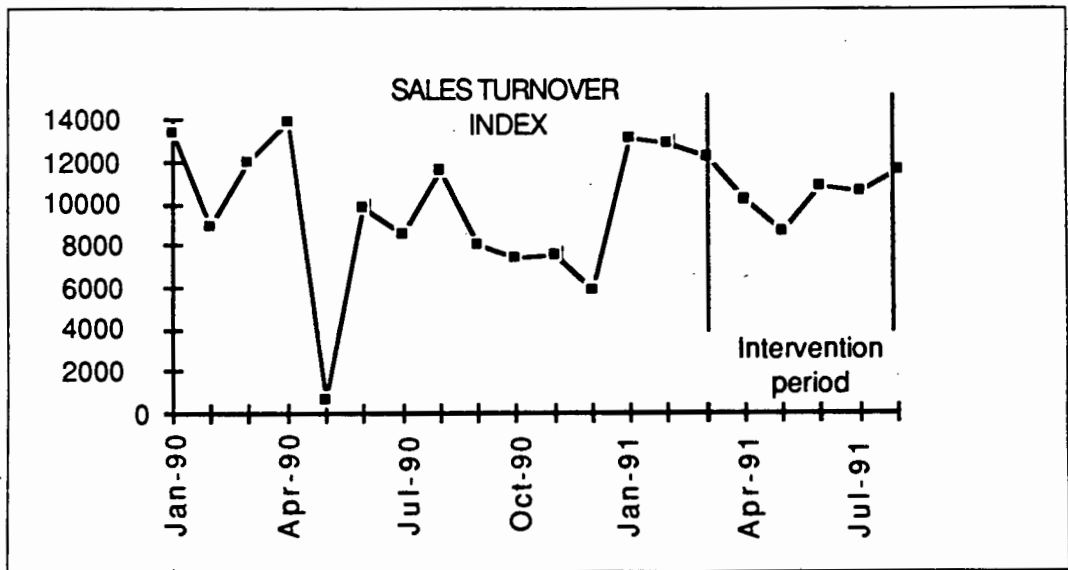
The company declined to provide sales turnover information except for the period spanning 20 months up to the end of the intervention. However, real (i.e., inflation-adjusted) growth rate

appears to have averaged 6,3% per annum for the 7 years¹⁶ 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 mid-1980s and declines in real turnover in others. Sales turnover was in a declining trend in an unfavourable business climate in the months immediately prior to the intervention. This trend continued for two months after the study commenced, as shown by the figure below.

Figure 5a

SURVEY COMPANY MONTHLY INVOICED SALES TURNOVER

Figures are indexed for protection of privacy



Interviewed three years later, the Managing Director offered a possible explanation for the fluctuations in the chart above:

¹⁶ Disclosing the source of the turnover figures on which this estimate is based makes it easy to identify the company, so this is not done here. Inflation figures were provided by Central Statistical Services.

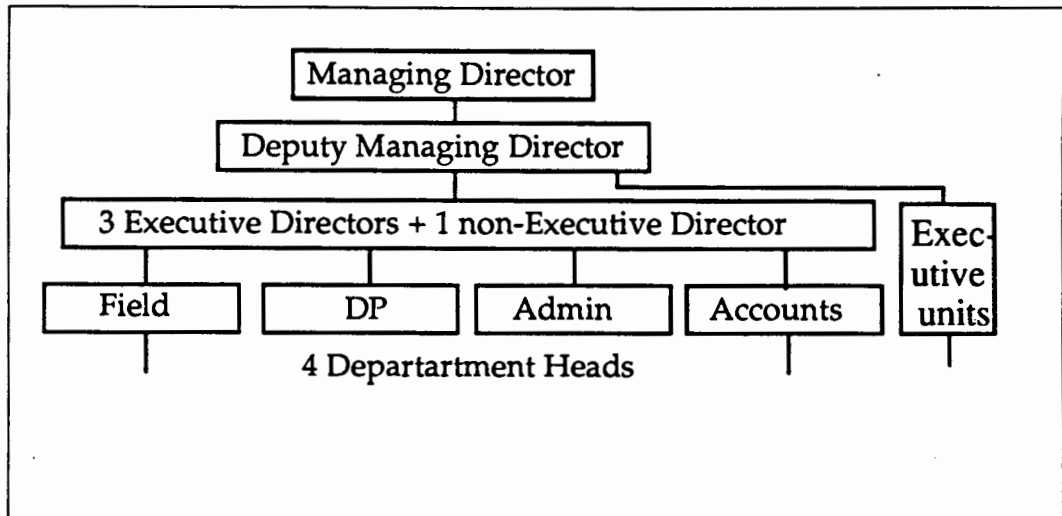
During those five months we were doing heavy negotiations in terms of the buy-out. So it was a very difficult situation for the company (Interview, 1994).

A feature of the organisation at the time of the intervention was that the Managing Director had only been in office since the management buy-out the previous year. The previous owner and Managing Director was still on-site several days a week. This made for some difficulties, as explained later by the Managing Director:

That first year after the buy-out was quite frenetic and difficult for people sorting out their new roles, particularly with ex MD and myself, and people also felt that they had old loyalties—but also new loyalties. That was also incumbent in the whole company. ... Whilst the first year was difficult because of the take-over... we actually turned the corner in the third year... and this year I've truly become MD, whereas before it was a sort of transition phase. So you couldn't have done the TM at a worse time. Maybe it was the best time to do it (Interview, 1994).

The most senior levels of the company management structure are reflected in the following organogram.

Figure 5b
MANAGEMENT STRUCTURE



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 co-ordinate hundreds of part-time field workers.

Recruitment of subjects

Participants in the study were recruited by an invitation to a talk on stress. Management encouraged attendance, but it was not mandatory. All but about 10-15 staff were briefed on stress, its consequences, and the benefits of individual participation in stress programmes.

Validity of the on-site sample

Were those attending representative of the general population of staff of South African companies? The answer was "no" only in the sense that the staff were over 80% female.

Were those who did not attend the talks different in any way from those who did? The answer is possibly yes, in the sense that there was anecdotal evidence at the time that many of those who did not attend, did not for reasons of negatively prejudicial attitudes towards self development in general and TM and relaxation in particular. The evidence for this is anecdotal and frequently hearsay and possibly needs to be tested. Detailed treatment of the question of attitudes towards TM was considered to be beyond the scope of the study but it seems likely that a small percentage (probably less than 5%) of the working population in South Africa has negative attitudes towards TM. In the opinion of this researcher these attitudes appear to be rooted in misunderstanding and lack of knowledge about TM leading to apprehension that practice of TM could in some way be prejudicial to their religious development. One of the non-participating staff members said to this researcher about a month after the initial TM training, "... you've ruined the company." This was accompanied by negative affect conveyed by defensive body language and facial expression. She did not articulate the perceived damage to the company other than to say "...everything is terrible."

Personal communication with the data processing manager of a substantial Sydney merchant bank that implemented a TM programme the year before the present study, suggested a somewhat similar phenomenon. In this instance a substantial proportion of the members of the data processing staff, including the data processing manager, had learned TM. Subsequently the data processing manager indicated that the non-TM participants "took strain." One of the

managers interviewed in this study at the three year followup indicated that at the time of starting the project, the non-volunteers did not take strain and seemed to take great comfort in their religion; but there was conflict between the TM volunteers and non-volunteers which "could have been quite disastrous before we started."

Those subjects eventually taking part in the present study therefore could reasonably be characterised as having an absence of negative attitudes towards relaxation and TM. The question of whether these attitudes could skew the results has already been handled in the section on *control procedures*.

Selection and screening procedures

Points covered in the talk on benefits of stress-reduction included increased clarity of thinking, greater alertness, better concentration, greater creativity, increased energy, reduced fatigue, lower blood pressure, reduced cholesterol levels, improved sleeping patterns, reduced substance abuse, improved general health and improved family relations.

Two possible approaches to stress reduction were explained as being Progressive Muscle Relaxation, and Transcendental Meditation. It was explained that the company wished to evaluate each of these approaches and that participation in the project could be expected to secure the individual benefits described earlier. Participation in the project would be voluntary, in company time, and at no cost to the individual and furthermore strict confidentiality would be observed. No individual information would be divulged to the company.

However, three conditions for participation had to be met: no non-prescription medication or recreational chemicals to be used for two weeks prior to instruction¹⁷; participant agrees to attend all the necessary training sessions in order to receive adequate instruction¹⁸; and participant agrees to participate in whichever of the treatments she is assigned to. In return she can, if she wishes, receive instruction in the treatment of her choice at the conclusion of the project. At the conclusion of the talk, opinion survey forms were circulated in order to collect data on credibility and expectancy of benefits—and also subject's choice of technique.

A majority (64) of the staff volunteered to participate in the programme, while a small number declined to participate. The participating group had a mean age of 38 with a range of 19-65. Eight were male, four represented top management (level 1), 9 senior management (level 2), 18 supervisory staff (level 3) and the balance clerical (level 4).

As mentioned earlier, improvements in on-site controls have often been noted in worksite studies. It was therefore necessary to control for a possible placebo effect, self selection effect or desire to make the programme successful as mentioned by various researchers (Murphy, 1984; Thomas, 1982; Carrington, 1980; Peters, Benson & Porter, 1977; Peters, Benson & Meters, 1977). For this reason the non-volunteers for training in stress-reduction were asked to participate in the process of data-gathering as non-participating controls. Again a

¹⁷ This is a standard prerequisite before training in TM.

¹⁸ This is also a standard prerequisite.

majority agreed and in due course 11 on-site controls completed the same psychological, physiological and climate measurements. The mean age of the non-participating controls was 37, with a range of 25-58. All were female and all but one were clerical grades, with one at supervisory level.

Out-house subjects

In addition four groups of extra-experimental controls completed only the SCL-90-R questionnaire for purposes of comparison with the experimental responses.

The pilot group

The pilot study group of 22 learned TM in the Linksfield Ridge TM centre. They were self-selected, i.e., had responded to advertisements or word-of-mouth. All were in white collar occupations comparable with those at the target 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 therefore differed from the on-site groups only in the ratio of supervisory to clerical staff, as may be seen in table 2 below.

The normative group

These 250 subjects were selected on the basis that they were participants in a series of three-day business productivity workshops. This means that they were largely senior-to-middle-managers or "knowledge workers," such as systems analysts or programmers. The

proportion who had self-referred themselves for the workshops is not known, some having been 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 were measured during the course of the workshop, prior to a discussion on stress.

The off-site controls

Two of the workshop groups mentioned above were selected as the off-site controls on the basis of the workshop taking place concurrently with pretests at the survey company. There were 16 in this combined group. They were subsequently posttested concurrently with the survey 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 means this group had more males than the on-site groups.

The long-term TM practitioners

A group of 15 long-term (1-25 years) TM meditators was also measured concurrently with the on-site posttests to compare results. 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. The table below summarises the demographic data for all subjects.

Table 2
 DEMOGRAPHIC DATA
 Subjects at start of study

GROUPS	TM	PMR	On-site controls	Off-site controls	Long-term TM	Pilot study	Normative group	All subjects combined
Group no.	1-4	5-6	7	8	9	10	11	
Mean Age	39	36	37	35	38	39	35	36
range	21-65	19-46	25-58	27-44	18-60	21-61	22-56	19-65
Fem %	85	89	100	56	40	82	17	75
Male %	15	11	-	44	60	18	83	25
Management%	24	25	-	25	25	23	80	31
Supervisory%	22	15	17	25	17	67	20	28
Clerical %	54	60	83	50	58	10	0	41
%	100	100	100	100	100	100	100	100
N=	41	18	11	16	15	22	250	374

PROCEDURES

Description of the on-site study itself

A series of pre-course briefings were held to explain the programme. Forms were circulated at the conclusion of the talks in order to collect demographic and health data (see Appendix A). The forms were then screened in order to be able to eliminate any applicants: undergoing medication deemed to interfere with the programme¹⁹; applicants with previous experience with relaxation or meditation programmes; or those undergoing psychiatric or psychotherapeutic treatment. None were eliminated at this point.

At this point there were 64 volunteers for training. (Eventually 59 actually received training). Six groups were then created because 10 is a convenient size for a group in training.

Volunteers were randomly assigned to one of six treatment conditions by pulling named pieces of paper out of a shoe box. Each group thus numbered about 10 volunteers. Groups were stratified by management level and sex, so that management, supervisory and clerical levels were all evenly represented in each group.

¹⁹ 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 (1992).

Four groups were required to execute the Solomon four-group design (see table 1). For this reason and because TM was the primary stress reduction intervention, four groups were randomly assigned to the TM treatment condition and the remaining two to PMR.

Treatment conditions were TM for group one (comprising subgroups 1-4 below) and PMR for group two (comprising subgroups 5-6 below). The subgroups were as follows. (Compare this with table 1: *experimental design* earlier.)

TM 1—were pretested, taught TM and posttested (O - X - O)

TM 2—a TM subgroup who were not pretested (— - X - O). This was in order to control for pretest sensitisation by comparing scores of groups one and two at posttest,

TM 3—a TM subgroup who were pretested twice (O - O) in order to control for pretest sensitisation by comparing this group score at second pretest with TM 4 scores at first pretest.

TM 4—short waitlist controls who waited for two weeks before being pretested (— - O - X) in order to control for non-specific history effects by comparing their pretest scores with those of groups one and three,

PMR 5—the relaxation control group were 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 then re-pretested five weeks after commencement, but before

PMR instruction (O - O - X). This confounded the original purpose of the experiment to compare TM and PMR (hypothesis two) but provided a serendipitous opportunity to control for history and field effects as discussed below.

PMR 6—who waited a further week before the PMR instructor became available (... O - O - X).

In addition, the 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.

The table below summarises the treatment and timings of all groups discussed so far. Notice that this table shows the execution of the logic of the Solomon 4 group design discussed earlier. This table will be useful for reference later when considering chapter IV: *Results*.

Table 3
TIMETABLE

test	Week Number													...5,5 months post
	1 pre	2	3	4 2w post	5	6	7	8 6w post	9	10	11	12 *	13	
Group														
TM 1	O	X		O				O						O
TM 2		X		O				O						O
TM 3	O	O	X		O				O					O
TM 4			O	X		O				O				O
PMR 5	O						OX						O	O
PMR 6		O						OX					O	O
Non-V 7	O													O
Out-H 8	O													O
LongTM 9														O
Pilot 10	O		O											
Norm 11	O...													

O represents an observation or measurement, X represents training in TM or PMR

* Retrenchments announced this week (25 May, 1991)

Note groups 10 and 11 did not have their test concurrent with the other groups, as suggested by this layout. They are only included to provide a complete overview.

A week before instruction a trained nurse performed the physiological observations while the subjects completed the Health Habits, SCL-90-R and Company Climate questionnaires.

The training in TM was then performed live by a qualified TM instructor in 1¹/₂ - 2 hour sessions over four consecutive days. The training venue was a quiet residential house about five minutes drive from the survey company's offices. The training in PMR followed exactly the same format in the same training rooms. Follow-ups 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 programmes surveyed earlier (see *worksite stress management programme formats*). 16 hours was in fact equal to the top end of the range of contact times.

Posttesting involved three further sessions of 20 minutes each at 2 weeks, 6 weeks and 5,5 months, as shown by the table above. The six-week evaluation questionnaire (Appendix L) was administered at 6 weeks post-instruction.

Out-house controls did their SCL-90-R pretests during a three-day workshop and were mailed posttests to complete and return 5.5 months later

Subjects were instructed to practice 20 minutes in the morning in company time and twenty minutes at the end of the day in their own time. Group practice sessions were convened in offices especially set aside for the purpose.

Three years after the end of the experiment, structured interviews were conducted with the survey company in order to elaborate and extend the findings of the quantitative investigation. In addition, interviews were conducted at a second company. This second survey company was a small advertising agency employing about 10 staff of whom 8 had learnt TM a year previous to the structured interviews.

The findings now follow in chapter IV.

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CHAPTER IV

RESULTS

INTRODUCTION

The results were analysed by category of dependent variable: psychological stress symptoms, physiological stress parameters and company climate. Because of the rarity of good (i.e., collected under controlled conditions) worksite TM data, the analysis was performed in some depth. This was in order to answer not only the general research question (would TM be effective?) by testing the research hypotheses presented in chapter II, but also to answer other questions that suggested themselves in the course of the analysis.

Having analysed the data and written up the results, the overall impression gained was of a positive outcome to the experiment. The commonsense question to ask next was: what happened to the company as a whole in the three years following the intervention? This question was addressed by structured interviews conducted at the survey company (and also at a second company) three years after the experiment.

The analysis is described in detailed narrative format after the summary and preview below.

SUMMARY

Hypothesis 1

Hypothesis 1 was supported—that TM would be effective in reducing stress levels as measured by SCL-90-R¹ raw scores ($p < 0,0002$ at 5,5 mo posttest, paired-t, $N = 21$; or $p < 0,0005$, unrelated groups, $n = 31, 26$). Additional support was suggested by the finding that at 5,5 months posttest, TM groups' SCL-90-R scores were significantly lower ($p < 0,05$, Scheffe's post-hoc) than those of off-site controls (matched on age and occupation variables but not on sex).

Hypothesis 1 was also supported on the blood pressure dimension (SBP $p < 0.05$ and DBP $p < 0,04$ at 5,5 mo posttest, Students t, matched pairs). Heart and breath rates showed a decreasing trend as predicted, though these changes failed to reach statistical significance.

Considering TM groups only, the SUPPORT and WARMTH company climate dimensions of interest improved at 6 weeks, lending support to hypothesis 1. The SUPPORT improvement reached significance at $p < 0,005$ (Wilcoxon, $N = 23$).

Hypothesis 2

Hypothesis 2, that TM would be more effective than PMR, was tentatively supported in the lower levels of statistical significance² for the PMR reductions in SCL-90-R scores at six week posttest.

¹ Recall SCL = stress symptoms check list, SBP, DBP = systolic and diastolic blood pressure.

² TM: $p < 0,0001$, $N = 27$. PMR: $p < 0,001$, $N = 11$. (paired-t comparisons with first pretest)

On the physiological measures, results were mixed, with PMR showing better than TM in the case of DBP at six weeks. PMR groups showed a significant decrease in DBP ($p < 0,04$, paired-t), but a significant *increase* in heart rate ($p < 0,02$ paired-t) at six weeks. These comparisons (i.e., of TM versus PMR), while interesting, were rendered invalid by practical difficulties with executing the original experimental design.

Hypothesis 3

Hypothesis 3, that stress measures would be positively correlated, found mixed support. Some support was from a correlation analysis which found significant positive correlations between SBP/DBP and WARMTH/SUPPORT ($p < 0,01$, 53 df). Further positive correlations of borderline significance were noted between SCL/DBP and SBP/BR ($p < 0,1$). However negative correlations were noted between the climate and physiological variables WARMTH/BR ($p < 0,05$) and SUPPORT/ BR (borderline— $p < 0,1$).

Hypothesis 3 was also supported by a multiple regression analysis (reported separately as Appendix U) which found that DBP and log SBP each contributed significantly to the predictable variance in transformed (log) SCL-90-R scores (DBP partial-F=9,417; DF=1, 48; $p < 0,0035$ and log SBP partial-F=6,208; DF=1, 48; $p < 0,0162$).

Limited turnover and staff complement data available suggested a small overall company productivity gain over the intervention. Structured interviews three years after the intervention suggested increased company effectiveness and growth.

Hypothesis 4

Hypothesis 4, that on-site controls would *also* show improvements, was supported at 5,5 month posttest, despite small sample size ($p < 0,034$, paired-t, one tailed, $n = 7$), with reductions in SCL scores of the same order of magnitude (51%) as for the TM groups (52%), suggesting the operation of social interaction, Hawthorne or field effects. Although smaller than control scores, these 5,5 month posttest scores failed to differ significantly when compared with off-site controls (matched on age and occupation variables but not on sex).

Analysis of subjective comments from questionnaires and structured interviews was broadly supportive of hypothesis one, with the majority of comments covering positive perceived physiological/health benefits such as "relaxation", "calm", "reduced tiredness", "increased energy" and "more alertness." Regarding hypothesis 2, observed frequencies of positive comments did not differ significantly between TM and PMR groups. However the same trend for TM improvements to exceed those for PMR was also seen in comments made, both in terms of deeper inner experience and greater productivity improvements.

PREVIEW OF RESULTS

The following preview is presented in tabular form in order to show how research questions were asked and answered using statistical procedures.

Table 4
PREVIEW OF RESULTS

RESEARCH QUESTION AND HYPOTHESIS	STATISTICAL TEST : RESULT AND INTERPRETATION
<p>1. Regarding SCL scores: were Groups 1, 3-8, and 10 significantly different from one another at pretest? Null hypothesis was that, in statistical terms, all groups were effectively samples drawn from the same parent population and therefore means would not differ.</p>	<p>One way ANOVA using "group" as main effect failed to reject the null hypothesis ($F=0.34$, $df=7$, $p<0,9$). See table 5.</p> <p>Group means were comparable at pretest</p>
<p>2. Did pilot (group 10) mean improve (reduce) after TM? Null hypothesis was that group means of SCL would be equal.</p>	<p>Failed to reject null hypothesis ($p<0,0005$, 1-tailed Student's-t test for matched groups). Improvement was significant. See table 6.</p>
<p>3. What was the trend of SCL scores over the course of the experiment? (See also question 36.)</p>	<p>SCL results for all groups showed a decreasing trend over the 5,5 months of the study. See figure 7.</p>
<p>4. How did pretest SCL scores compare with those of other researchers?</p>	<p>Group means were found to lie midway between Derogatis' (1977) 'normals' and 'psychiatric outpatients' and were directly comparable with scores reported by Carrington et al (1980).</p>
<p>5. Did TM groups improve on the SCL after TM? Hypothesis (H_0) was that there would be an improvement (i.e., reduction) from pre to posttest, and that this reduction would increase over time.</p>	<p>Group means improved significantly at 2 weeks ($p<0,014$), 6 weeks ($p<0,002$), and 5,5 months ($p<0,0005$) using Student's unpaired-t because of attrition at posttest. Paired-t comparison at 5,5 months was significant at $p<0,0002$. See table 8.</p>

<p>6. Was pretest sensitisation a problem? See Appendix Q tests 1-4.</p>	<p>Student's t and Wilcoxon's tests found no significant difference, suggesting pretest sensitisation was not a nuisance variable.</p>
<p>7. Did PMR groups improve after PMR?</p>	<p>Paired-t comparison with 2nd pretest at 6 weeks post-instruction was near significant ($p < 0,058$). However group means had already improved significantly when posttested for a second time 5 weeks after the initial pretest ($p < 0,005$, paired-t). This suggested the operation of history, Hawthorne, social interaction or field effects.</p>
<p>8. Did TM groups improve more than PMR groups? Hypothesis (H_{02}) was that they would.</p>	<p>This comparison was rendered invalid by departures from the original experimental design. However greater statistical significance of the TM improvements suggested some support for this hypothesis.</p>
<p>9. Was there any improvement in TM group 3's means at second pretest 2 weeks after the first? Null hypothesis was that there would be no difference. (Appendix Q, test 4)</p>	<p>There was a small improvement which failed to reach significance (Student's t). The trend suggested the operation of the nuisance variables noted earlier.</p>
<p>10. Did on-site controls improve at 5,5 months posttest? Null hypothesis (H_{04a}) was that they would.</p>	<p>They improved as much as the TM groups and PMR groups although the statistical significance was lower at $p < 0,034$ (1-tailed paired-t). These results suggested the operation of Hawthorne, social interaction or field effects as nuisance variables.</p>

<p>11. Did off-site controls improve at 5,5 months posttest? Null hypothesis (H_{04b}) was that pre and posttest group means would be equivalent.</p>	<p>Group mean was lower at posttest, suggesting the operation of a possible practice effect but the reduction failed to reach statistical significance.</p>
<p>12. How did 5,5 months posttest results for the test groups (1-4 and 5-6) compare with long-term TM group (9)?</p>	<p>Group means were comparable but ANOVA found no significant difference at 5,5 months.</p>
<p>13. Did TM SBP improve at 5,5 months? Null hypothesis (H_{01}) was that group means would be equivalent.</p>	<p>A small reduction was found (significant at $p < 0,05$, paired-t). Null hypothesis was rejected, supporting hypothesis 1. SBP improved following TM training.</p>
<p>14. Did PMR SBP improve at 6 weeks? Null hypothesis (H_{01}) was that there would be no significant difference between group means.</p>	<p>SBP <i>increased</i> non significantly at 6 weeks possibly due to staff cuts. SBP recovered later. Results were n.s. suggesting very tentative support for hypothesis 2.</p>
<p>15. Would non-participating on-site controls improve SBP at 5,5 months? Null hypothesis (H_{01}) was that there would be no difference.</p>	<p>Null hypothesis failed to be rejected. However there was a non significant reducing trend at 5,5 months. This suggests very tentative support for hypothesis 4.</p>
<p>16. Would there be any evidence for normalisation of SBP? i.e., would SBP increase in subjects with low initial SBP, while decreasing in those with high initial SBP?</p>	<p>Division of test groups into hypertensive and hypotensive categories yielded results suggestive of normalisation. SBP of TM hypertensives was the only measure to improve significantly (at 6 weeks, $p < 0.05$, paired-t). Re-analysis using ANOVA across high, normal and low tensive categories yielded further support for normalisation.</p>

<p>17. Would TM group DBP improve? Null hypothesis (H_{01}) was that there would be no difference.</p>	<p>Null hypothesis was rejected with a significant improvement at 5,5 months ($p < 0,04$, paired-t). This suggested support for hypothesis 1.</p>
<p>18. Would PMR groups DBP improve (decrease) at 6 weeks?</p>	<p>DBP showed a significant decrease at 6 weeks ($p < 0,04$, paired-t). This result supports hypothesis 1 but appeared to contradict hypothesis 2 because the PMR effect size was larger than TM. However this improvement was not sustained at 5,5 months after 6 of the group learned TM.</p>
<p>19. Would the DBP of on-site controls improve?</p>	<p>Hypothesis 4 was tentatively supported by a small but non significant improvement in DBP.</p>
<p>20. Would TM heart rate improve?</p>	<p>Small and insignificant reductions were found at 6 weeks and 5,5 months, indicating very tentative support for hypothesis 1.</p>
<p>21. Would PMR heart rates decrease at 6 weeks?</p>	<p>A significant <i>increase</i> was noted at 6 weeks ($p < 0,02$, paired-t). Posttest was done after announcement of retrenchments, confounding this result.</p>
<p>22. Would on-site controls improve heart rate?</p>	<p>A small and non significant increase in heart rate was noticed at 5,5 months. This was not supportive of hypothesis 4.</p>
<p>23. Would breath rate improve for TM, PMR and on-site controls?</p>	<p>Results were similar to heart rate findings (i.e., small increases at 6 weeks, followed by decreases at 5,5 months) except that no changes reached significance.</p>

<p>24. Would company climate improve on the WARMTH and SUPPORT dimensions at 5,5 months?</p>	<p>Non significant improvement in SUPPORT was noted in the test groups. Improvement in SUPPORT reached significance ($p < 0,025$) for the PMR group, 6 of whom had in fact had both PMR and TM training. These results were supportive of hypothesis 1. Both SUPPORT ($p < 0,005$) and WARMTH (n.s.) improved at 6 weeks, but this tendency seemed to reverse later after retrenchments.</p>
<p>25. Were the physiological parameters (SBP/DBP/HR/BR) correlated? Hypothesis (H₀₃) was that there would be positive correlations.</p>	<p>Sample correlation coefficients were found to be significantly positive with r between 0,294-0,833 (table 18). Multiple regression analysis found the only statistically significant relationship was between SBP and DBP (partial $F=62,3$; $df=1,34$; $p < 0,0001$) while that between SBP and BR approached significance. These results indicated strong support for hypothesis 3.</p>
<p>26. Were physiological and climate parameters correlated with SCL results? (H₀₃).</p>	<p>Psychological (SCL) and physiological variables were positively correlated (table 23). However, WARMTH and SUPPORT were not correlated with SCL and were negatively correlated with physiological variables.</p>
<p>27. Would subjective evaluation at 6 weeks correlate with improvement in SCL score?</p>	<p>Correlation analysis suggested very low correlation ($r=0,19$, n.s.) underscoring the importance of objective measures to assess the intervention</p>
<p>28. Would expectation at pretest correlate with improvement in SCL score at 6 weeks?</p>	<p>Correlation analysis found $r=0,36$ at 6 weeks and $r=0,32$ at 5,5 months. (Both n.s.)</p>

<p>29. Would improvement at 6 weeks predict improvement at 5,5 months on SCL?</p>	<p>Correlation analysis found $r=0,95$ at 5,5 months ($p<0,01$) suggesting improvement at 6 weeks was the best predictor of improvement at 5,5 months.</p>
<p>30. What was the impact on 5,5 month SCL score improvements of the nuisance variables: management level, sex, marital status, expectation at pretest, initial SCL score, regularity at 5,5 months and age group?</p>	<p>Five-factor analysis of covariance (factors: management level, age group, sex, marital status and regularity of practice at 5,5 months —covariates: expectation and SCL at pretest) suggested pretest SCL was the only significant effect (partial-F 34.1: $df=1,10$; $p<0,0002$). The only other effect to approach significance was age group. Examination of trends suggested SCL improvement at 5,5 months was greater for the lower management levels, greater for lower age groups, and greater for increased regularity of practice (but only at 2 weeks).</p>
<p>31. Was faking a problem with the SCL results?</p>	<p>Analysis of low-scoring subjects' results gave some support for the suggestion of faking on the part of the on-site controls. There was also some evidence the faking rate may have increased as the study progressed.</p>
<p>32. Did TM and PMR groups differ on 'satisfaction with the course so far' at 6-weeks post treatment.</p>	<p>One-factor ANOVA using TM/PMR as the grouping factor suggested no significant difference between the groups. This result suggested the TM and PMR groups did not differ in their satisfaction with the training at the 6 week posttest point.</p>

<p>33. Was there any difference across TM and PMR groups in the percentage of subjects reporting positively on the dimensions relationships, productivity, satisfaction with the course and benefits?</p>	<p>A contingency plot and Chi-square tests suggested the only near-significant difference between TM and PMR was on the percentage of positive responses to a question on improved productivity following the course. Analysis of subjective evaluations was broadly supportive of hypothesis 2. There was the suggestion of a tendency for the TM improvements to exceed those for PMR, as seen earlier, suggesting support for hypothesis 2.</p>
<p>34. Did experimental groups differ significantly from controls at the end of the experimental period? Null hypothesis (H_{01}) was that there would be no significant difference.</p>	<p>One-factor analysis of covariance performed for the effect of type of training on SCL posttest scores, including SCL score at pretest as the covariate, suggested that type of training was a significant effect (partial-F = 2,81; df=4,42; $p < 0,04$). Scheffe's post-hoc procedure, evaluating the results on a pairwise basis, indicated a significant difference between the off-site control group mean and the mean of the combined TM group ($p < 0,05$). Taken with the answer to question 5, this suggests strong support for hypothesis 1, using the principle of triangulation.</p>
<p>35. Were there any significant interaction effects between the type of training (TM and PMR) and initial SCL main effects? i.e., did SCL at pretest influence SCL posttest scores differently depending on the treatment group?</p>	<p>Analysis of covariance which included an interaction factor in the analysis, gave an insignificant p value in association with the partial-F for the interaction factor, suggesting no significant interaction effect.</p>

<p>36. Would the experimental effect increase over time and was the pattern of change over time the same for different treatments?</p>	<p>A repeated-measures ANOVA suggested time was a significant main effect ($p < 0,002$). On this basis the null hypothesis that there was no training effect over time was confidently rejected. This supports the second part of hypothesis 1. This analysis was repeated with the physiological measures and found no significant main effects.</p>
<p>37. Did self-selection make any difference? Was the pilot TM group mean different from the on-site TM group mean at the 2 week posttest?</p>	<p>One-factor analysis of variance of the 2 week SCL scores, using initial test scores as the covariate, suggested group as a non significant effect. Accordingly the null hypothesis that the groups were equivalent at the 2 week posttest failed to be rejected. Self-selection did not make a difference.</p>
<p>38. Was there any significant difference between the on-site TM group and long-term TM group means at the 5,5 months posttest?</p>	<p>One-factor ANOVA on the 5,5 months SCL scores (without using initial SCL as covariate) found no significant main effect. The analysis failed to reject the null hypothesis. In-house and long-term TM group means did not differ significantly at the 5,5 month posttest on SCL-90-R scores.</p>

The statistical analyses supporting the above summary and preview are presented below. The narrative follows essentially the same sequence as the research questions above.

Before proceeding to this narrative, it is important to note that despite the fact that the analyses have been presented here in somewhat clinical detail, great caution has been used in interpreting the results of individual analyses. This is because the conclusions to

be drawn from each analysis are limited by the assumptions underlying the use of the statistical tests. For example, violations of the assumptions of normality, homogeneity of variance and independent and random samples underlying the use of analysis of variance (ANOVA) may affect the validity of the conclusions drawn from the ANOVAs presented later.³

Therefore, the overall approach has been to perform the analyses in detail, but to use the results to guide thinking in conjunction with the results of other analyses and qualitative findings, i.e., using the principle of triangulation in order to reach firm conclusions material to the study.

³ However, the robustness of the tests used here has been fairly well established by many studies, according to Bendixon (personal communication, February 1995. Bendixon lectures in quantitative methods at the University of the Witwatersrand Graduate School of Business.

PSYCHOLOGICAL STRESS SYMPTOMS

Pilot study

As mentioned earlier, the pilot study measured 22 white collar workers of age, sex and occupational categories similar to those in the main study. All had elected to learn TM voluntarily for a variety of reasons, including seeking relief from stress, and were instructed in TM in a TM centre. The SCL-90-R test instrument was administered immediately before instruction, and again two weeks later. All analyses following used raw scores on the SCL-90-R (i.e., grand total score across all 90 items on the questionnaire.) An ANOVA was performed using SuperAnova software (Abacus Concepts, 1989) to establish whether group means differed significantly from one another at pretest.

At this point, it is necessary to stipulate the assumptions underlying the use of ANOVA. These are that test scores are normally distributed, variance of the groups are homogeneous (i.e., similar), and paired scores are independent (both within and between groups). Accordingly, samples should be random and independent (Huysamen, 1981: 157).

The ANOVA below compares group means at pretest in order to establish the equivalence, or otherwise, of all groups at the start of the experiment.

Table 5
ANOVA TABLE—MEAN SCL-90-R SCORES AT PRETEST
Groups 1, 3-8, 10

Source	df	Sum of Squares	Mean Square	F-Value	P-Value
GRP	7	6143,224	877,603	,339	,9338
Residual	89	230282,260	2587,441		

Dependent: SCL-PRE

Means Table
Effect: GRP
Dependent: SCL-PRE

	Count	Mean	Std. Dev.	Std. Error	
1	11	62,000	56,498	17,035	TM
3	10	58,800	26,436	8,360	TM
4	10	70,300	59,481	18,810	TM
5	10	73,600	41,404	13,093	PMR
6	7	71,286	36,909	13,950	PMR
7	11	69,727	63,148	19,040	ON-SITE CONTROL
8	18	79,000	46,232	10,897	OFF-SITE CONTROL
10	20	82,850	56,390	12,609	PILOT

The top right cell of the table indicates a large and non-significant probability associated with the calculated value of the F statistic. How was this result to be interpreted?

According to Huysamen (1981: 157), when using ANOVA, violation of the assumption of normally distributed test scores only negligibly affects the conclusions to be reached, especially when each of the populations of test scores has the same (non-normal) shape.

Violation of the assumption of homogeneity of variance can have more serious consequences—however the impact of this problem is minimised where each sample contains the same number of cases according to Huysamen (1981). The test above compared samples of differing sizes, but the p value was so large that any possible violation of this assumption would have been inconsequential.

According to Huysamen "failure to satisfy the assumption of independence between any pair of scores within the same or across the (J) groups may result in serious errors in the inferences reached by an analysis of variance" (Huysamen, 1981: 154). Accordingly the researcher should attempt to satisfy this requirement by establishing independent and random samples. The groups tested above were independent and groups 1-6 were randomised, so it is argued this assumption was partially satisfied.

Returning to the large p value in the table above, it was concluded that group mean SCL score was not significantly different between the pilot group and any of the on-site or off-site groups at the start of the experiment. Accordingly the analysis failed to reject the null hypothesis (that any group mean differs from the others).

the analysis then proceeded to test the hypothesis that group mean SCL score would improve after TM instruction.

Student's t test (Fisher & Yates, 1974) as described by Huysamen (1981: 51) was used to test the SCL-90-R data because it was assumed that SCL scores are normally distributed. The usual assumptions (regarding normality and variance) of SCL population properties are

necessary conditions for the use of a parametric procedure such as that of Student (Huysamen, 1981: 36, 52). Carrington et al (1980) also used Student's procedure. To cover for the possibility that the standard assumptions may have been violated, calculations were checked by hand using Wilcoxon's (1964) non-parametric procedure as set out Huysamen (1981: 142). Wilcoxon results were very similar, as may be seen in Appendix Q (e.g. comparison 5).

The table below⁴ shows the matched groups comparison, calculated using Microsoft Excel (1992). A one-tailed test was appropriate, as the direction of change was predicted in advance.

Table 6
PILOT GROUP t TEST

Group 10 pretest mean SCL-90-R scores cf with 2 weeks post-TM

t-Test: Paired Two-Sample for Means		
	<i>Pretest</i>	<i>2 wk post</i>
Mean	85,7	49,5
Variance	3428,2	1939,0
Observations	13	13
df	12	
t	4,33	
P(T<=t) one-tail	0,0005	
t Critical one-tail	1,78	

After instruction in TM, pilot group mean improved significantly against pretest when posttested 2 weeks ($p < 0,0005$, paired-t).

⁴ This table is shown simply to illustrate the format of calculations used in this report. Basic statistical calculations like the one below are not set out in future because of the large number of calculations performed and their repetitive nature. In the analysis following, calculations were done using the procedures for both matched (paired-t) and unmatched (two-sample) groups.

Unmatched groups procedure was used as a check because of attrition at posttest, yielding a lower significance ($p < 0.023$). Data attrition rates were eventually 32% for groups 1-4, 56% for groups 6-7, and 36% for on-site controls due to retrenchments and other factors mentioned in *discussion*. The unmatched groups procedure utilised all available data and yielded conservative results. i.e., the p-value using unmatched pairs was usually larger or statistically less significant. This means results reported for unmatched groups are generally conservative.

Main study

Subsequent to the initial briefing, some volunteers withdrew from participation. Reasons were not given, but possibly related to negative attitudes as discussed earlier. Several more missed the training for unspecified reasons (leave, etc). This left a total of 59 participants who were measured before and after training in TM or PMR.

Group mean SCL scores are shown in the following tables. Integer values are shown for clarity, although all analyses were performed to eighteen decimal places. Variability within SCL scores was another reason for showing only integer values. Standard deviations were often of almost the same magnitude as the group means. Therefore to report SCL results to one decimal place seemed to risk conveying an inappropriate impression of precision. These large standard deviations proved to be a reason why relatively large shifts in group mean were required in order to reach statistical significance.

The table below summarises group mean SCL scores for on-site groups only. Groups 5 and 6 were combined because they differed only in having received training a week apart. The table was constructed as a *preliminary* view of trends on-site, so other groups were omitted at this point.

Table 7

MEAN SCL-90-R SCORES—IN-HOUSE GROUPS ONLY

Showing trends only— see table 8 for significance

	PRETEST*	2ND PRETEST	2 WEEKS	6 WEEKS	5,5 MO
TM 1 (n=11)	62 ¹	-	35 ²	36	29
TM 2 (n=10)	-	-	47 ²	34	33
TM 3 (n=10)	59 ³	57 ³	43	25	28
TM 4 (n=10)	70 ¹	-	41	50	32
PMR (n=18)	73	55	-	43	29
In-h non-vol contr. (n=11)	70	-	-		35 ⁴

- 1-1. Differences were n.s. (see preview question 1 and Appendix Q). TM 4 was pretested 2 weeks after TM 1 in order to control for history, social interaction or field effects.
 2-2. Differences were n.s. (see preview question 6 and Appendix Q). TM 2 was not pretested in order to control for pretest sensitisation.
 3-3. Differences were n.s. (see preview question 9 and Appendix Q). TM 3 was pretested twice in order to control for pretest sensitisation.
 4 Proposed reasons for this large improvement are discussed in chapter V, *discussion*.
 * Recall the timetable of testing (table 3) when interpreting these results.

At this point the analysis was ready to perform the comparisons called for by the Solomon 4 group design (see table 1, *chapter III*). Appendix Q sets out details of six Student's-t and Wilcoxon comparisons, results of which are summarised below:

1. Comparison of groups 1 and 2 at first posttest found a suggestion of pretest sensitisation which failed to reach statistical significance.

2. Comparison of group 3 at second pretest with group 4 first pretest also found evidence of pretest sensitisation which again failed to reach significance.

3. Comparison of the above groups combined also found a non-significant suggestion of pretest sensitisation.

4. Comparison of group 3 first with second posttest found similar results.

5. Comparison of group 1 pretest with first posttest found a significant reduction in the posttest group mean using both Student's-t ($p < 0,03$, one-tailed, paired, $N=9$), and Wilcoxon ($p < 0,01$, $N=9$). The unmatched group comparison failed to reach significance ($p < 0,08$, unpaired, $n=11, 9$).

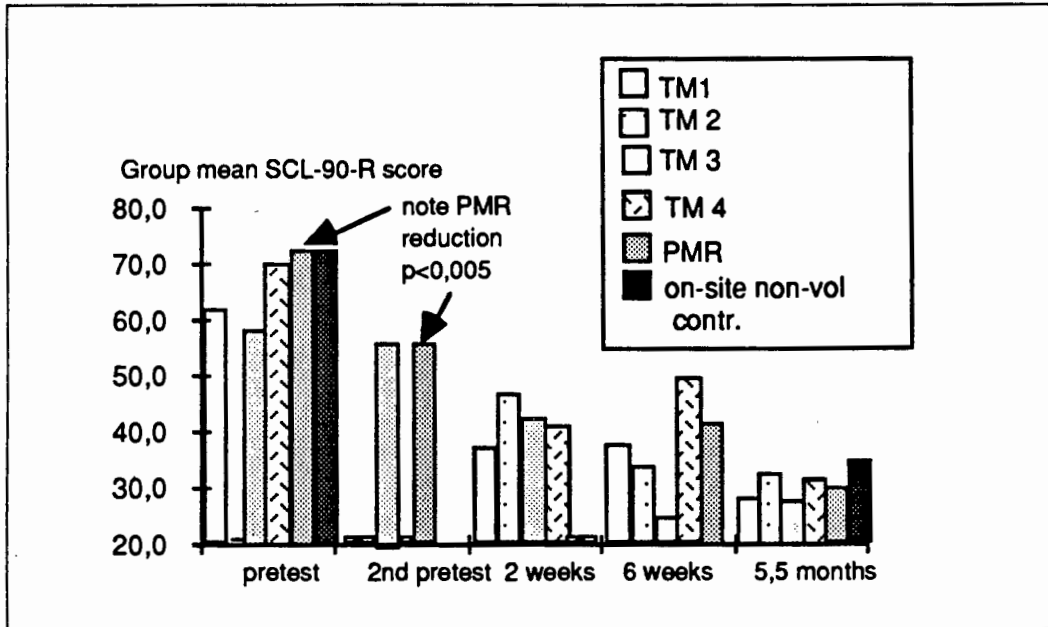
6. Comparison at first posttest of groups 1-2 combined with 3-4 combined was also found to be significant ($p < 0,04$, unpaired-t, $n=19,18$).

Taken together, these six comparisons suggest the operation of a significant treatment effect due to training in TM, which was supportive of hypothesis 1.

Before proceeding to further tests of hypothesis 1—that SCL scores would improve (decrease) after the intervention—it was useful to view table 7 in chart form, as shown below.

Figure 6

MEAN SCL-90-R SCORES—ON-SITE GROUPS ONLY



Three features of this chart were immediately apparent.

1. Initial test levels were comparable. ANOVA (table 5) had found no significant differences between group means at pretest.
2. All test results showed an improving trend over the course of the experiment. *Non-participating controls appeared to have improved as much as experimental groups.* The significance of this is a central issue of this study and is discussed later.
3. The combined PMR group (groups 5 and 6) appeared to have improved at second pretest (after six weeks), whereas TM group 3 had not (after one week). The reasons for this are discussed later in chapter V:discussion .

For detailed statistical analysis, TM Groups 1, 3 and 4 were then 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. TM Group 2 was omitted because no pretest was done. Again for clarity, only integer values are shown. Rows for other groups were added into the table for comparison purposes. The table is shown below.

(see overleaf)

Table 8
MEAN SCL-90-SCORES—ALL GROUPS

Groups	Initial n	pretest	pretest 2	2 wk post	6 wk post	5.5mo post
TM (1,3,4)	31	\bar{x} 64 s 49	-	42 $p<0,014$ 27 ¹	33 $p<0,002$ 25 ²	31 $p<0,0005$ 17 ³
PMR (5, 6)	18	\bar{x} 73 s 38	55 ⁴ 42	-	43 ⁵ 40	29 ⁶ 24
On-site non-vol controls.(7)	11	\bar{x} 70 s 63	-	-	-	35 ⁷ 29
off-site controls.(8)	16	\bar{x} 79 s 46	-	-	-	61 ^{ns} 42
Long-term TM (9)	15	\bar{x} s	-	-	-	41 31
Pilot study (10)	22	\bar{x} 83 s 56	-	49 $p<0,023$ 41	-	-
SA normative (11)	250	\bar{x} 62 s 40	-	-	-	-

\bar{x} = mean, s = standard deviation.

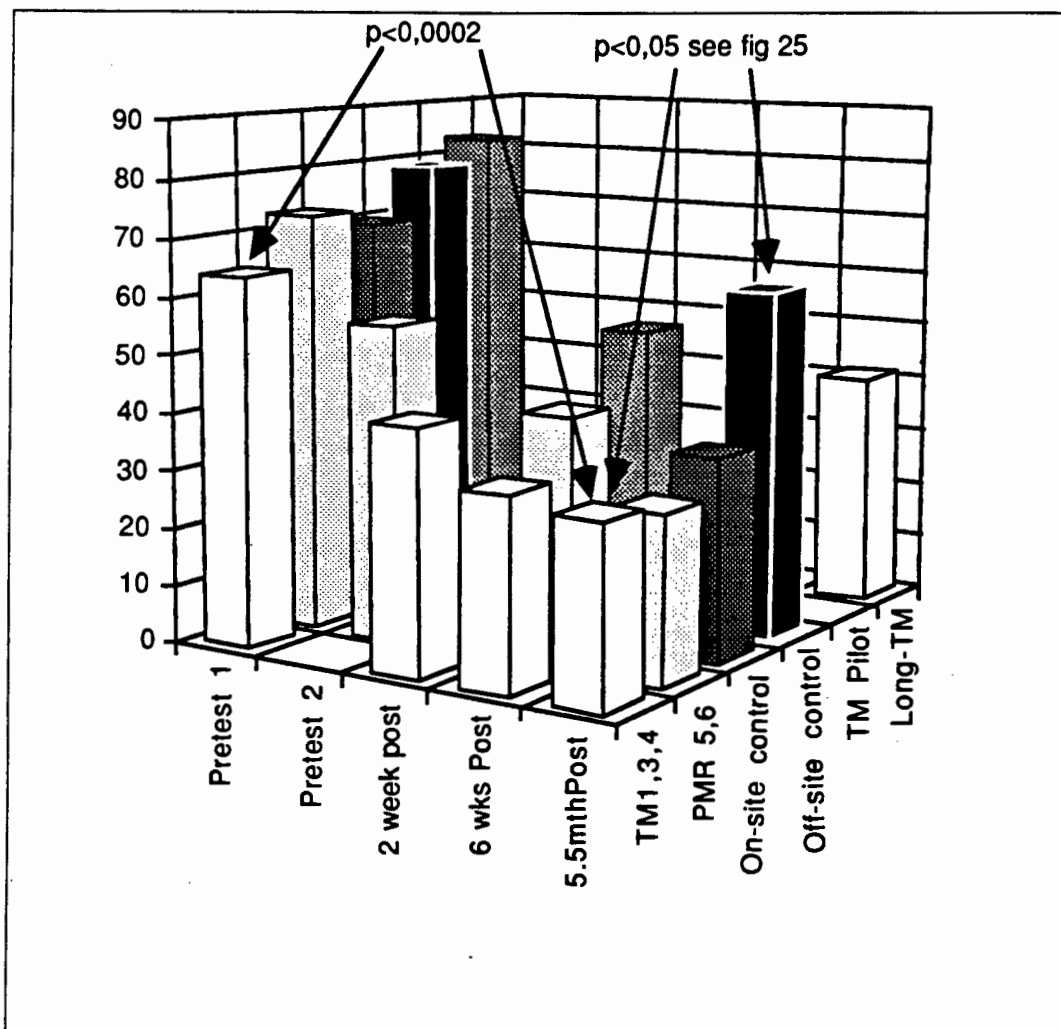
Except as noted below, all comparisons were against pretest using one-tailed Student's t test for two unrelated groups, because of attrition at posttest. (Checked using paired- t and Wilcoxon's matched-pairs signed-rank test).

1. Paired-t $p<0,0003$, N = 26. Wilcoxon p better than $p<0,005$. Range of tables was limited (Huysamen, 1981: 243).
2. Paired-t $p<0,0001$, N = 27. Wilcoxon as above.
3. Paired-t $p<0,0002$, N = 21.
4. This was significant when using two-tailed paired-t comparison with pretest ($p<0,005$, N = 15).
5. Paired-t comparison with pretest 2 was near significant. ($p<0,058$, N = 11). Unrelated groups comparison with pretest 1 was significant ($p<0,028$, n = 17, 11).
6. Six of this combined group had learned TM three months prior to 5,5 months posttest. Significant differences were noted against both pretest 1 ($p<0,001$, n = 17, 8) and pretest 2 ($p<0,036$, n = 16, 8)
7. This comparison against pretest was not significant using unrelated groups but reached significance when using paired-t ($p<0,034$, N = 7) and Wilcoxon ($p<0,03$, N = 7).

These results are graphically illustrated below, omitting SA and USA norms⁵ for clarity. This chart may be regarded as the centrepiece of this study, as it presents so many comparisons simultaneously.

Figure 7

GROUP MEANS—SCL-90-R RAW SCORES



⁵ 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). However, Carrington et al (1980) reported comparable mean scores of 66-72 at pretest for New York Telephone Company employees "self selected for stress."

Looking at figure 7, The TM group appeared to have enjoyed significant beneficial changes after treatment, with effect apparently increasing over time. Group mean improved significantly at 2 weeks (groups 1,3,4; N = 26; $p < 0,0003$, paired-t), 6 weeks ($p < 0,0001$, N = 27) and at 5,5 months after pretest ($p < 0,0002$, N = 26).

A sub-group (TM group 2, n = 10) was not pretested—in order to control for pretest sensitisation. However, two week posttest results were not significantly different from those of TM 1. This result supported Derogatis' (1977) view that test/re-test reliability is high for the SCL-90-R. This point should be borne in mind when considering the evidence presented later for the operation of field effects.

For PMR the improvements were of lower statistical significance. Matched pairs comparison of 6 weeks post instruction with pretest 2 was near significant ($p < 0,058$, one-tailed, t) and with pretest 1 was significant at $p < 0,001$. As a check on the validity of the assumption of normally distributed test results, posttest scores were analysed using both parametric (Student's t) and non-parametric procedures (Wilcoxon's Matched Pairs Signed Rank Test). Both procedures yielded similar results.

The PMR comparison with TM was confounded after the 6-week posttest because of pressure from the group to learn TM. Part (i.e., 6) of the group was then instructed in TM. This mixed group then also demonstrated significant improvement against first pretest ($p < 0,001$) and pretest 2 ($p < 0,036$). The significance of this finding is not discussed

further except to note that the group mean at 5,5 months posttest was the lowest seen during the course of the study.

The PMR group only received instruction 5 weeks after the initial groups had been instructed in TM. Prior to instruction this group was re-prettested. Test results demonstrated a surprising (25%) improvement in scores which reached significance ($p < 0,005$, two tail) when compared using Student's t test for matched pairs. A two tail test was appropriate because no improvement was expected. As discussed later in *Discussion*, these results suggest either the possible operation of a Hawthorne or Field Effect or a challenge to Derogatis' (1977) assertion that test-retest reliability is high. TM group 3 was also re-prettested two weeks after initial pretest with no significant difference in means—although a small improvement was noted, as shown by table 7.

The on-site non-volunteer controls were pretested before commencement of training and posttested after 5,5 months. Post test scores at 5,5 months *also* improved by the same order of magnitude (51%) as did the TM groups (52%) and PMR/TM groups (59%). The pre-posttest difference reached significance at $p < 0,034$ using a one-tailed t test for paired groups. A one-tailed test was appropriate because the improvement in controls was predicted before the experiment. (The difference failed to reach statistical significance when using two-tailed t^6 tests or unmatched tests). These results were also suggestive of Hawthorne or Field Effects as discussed later.

⁶ A one-tailed t test is more powerful because the rejection region all falls to one side of the mean of the sampling distribution — see e.g. Huysamen, 1981: 40.

The off-site non-participating controls also showed some reduction in scores, suggestive of a practice effect at posttest, as shown clearly by figure 7. This improvement failed to reach significance ($p < 0,3$, two tailed, paired-t).

Finally, 15 long-term (1-25 years) TM practitioners were measured in order to contrast these results. Reference to the results tabulated above suggested the long term TM (group 9) mean may be comparable with the 5,5 month posttest results for the participating groups. In order to evaluate this possibility, an analysis of variance was performed across all groups, collapsing groups 1-4 into a combined TM group, and 5-6 into a combined PMR group. The results are shown in the ANOVA table below:

Table 9
ANOVA TABLE—MEAN SCL-90-R SCORES AT 5,5 MONTH
POSTTEST

All on-site groups (1-7) plus long-term TM (9)

Source	df	Sum of Squares	Mean Square	F-Value	P-Value
TM/PM/IN...	3	1175,477	391,826	,700	,5562
Residual	52	29098,737	559,591		

Dependent: SCL-5,5M

Means Table
Effect: TM/PM/IN...
Dependent: SCL-5,5M

	Count	Mean	Std. Dev.	Std. Error
TM	26	30,500	16,707	3,277
PMR	8	29,375	23,802	8,415
IN	7	35,286	28,640	10,825
LTM	15	40,733	30,744	7,938

The table showed a high and insignificant probability associated with the calculated F statistic. Accordingly it was concluded that the mean SCL-90-R score for the sample of long-term TM practitioners was not significantly different from those of the on-site groups after implementation of TM on-site.

Consideration of the above results yielded the impression that there was support for hypothesis one that experimental groups would show improvements against off-site controls. However the final and most important question in the evaluation of psychological stress symptom results was whether posttest means across the groups were significantly different from one another—i.e., had experimental

groups shown improvements *against off-site controls*? This analysis was deferred until later, pending investigation of the impact of nuisance variables. (See *Correlations between variables* and figure 25)

PHYSIOLOGICAL STRESS PARAMETERS

Results for TM and non-participating controls were broadly supportive of hypothesis one (that there would be improvements, increasing over time) and hypothesis 4 (that controls would also show improvements). The drawing of conclusions regarding the PMR groups and hypothesis two (that TM effect size would be greater) was confounded by the unexpected announcement of retrenchments just before the PMR 6-week posttests.

These results are summarised below. In interpreting these results, it is useful to bear in mind that according to Oxford reference (1990),

A young adult would be expected to have a systolic pressure (SBP) of around 120 mm and a diastolic pressure (DBP) of 80 mm (Martin, 1990: 81).

Normal range is held to vary with age so that the formula for "normal" SBP is said to be 100 plus the age. According to Civin,⁷ male and female blood pressures do not differ. Normal SBP for adults would lie in the range 120-140 mmHg, and DBP 60-90. DBP is regarded as "most significant from a clinical point-of-view" because it is less responsive than SBP to transient stressors, and is therefore a more reliable indicator of long-term stress.

⁷ Personal communication, November 1994. As mentioned in a footnote earlier, Civin is an anaesthetist.

Table 10
PHYSIOLOGICAL STRESS PARAMETERS

		PRE	6 WEEKS	5.5 MONTHS
SBP	TM n = 27	112,3	112,0	109,5 p<0,05*
	PMR n = 12	108,9	110,3	(109,1)**
	Control n = 9	107,6	-	104,5
DBP	TM	75,8	75,2	72,8 p<0,04
	PMR	77,6	73,2 p<0,04	(74,5)**
	Control	77,4	-	70,9
HR	TM	75,0	74,4	73,1
	PMR	74,4	77,1 p<0,02	(72,3)**
	Control	71,2		73,8
BR	TM	20,3	20,8	19,8
	PMR	20,1	20,9	(19,8)**
	Control	18,9	-	19,3

SBP = Systolic Blood Pressure, DBP = Diastolic Blood pressure, HR = Heart Rate, BR = Breath Rate.

* All tests in this table: Student's t, matched-pairs one-tailed

** After 6 of the combined group had learned TM

At pretest, group means were seen to be low in terms of the broad definition of normality given earlier. This is probably due to the low mean age of the group (39) according to Civin. Individual SBPs ranged from 157-90 with a standard deviation of 14 at pretest across all groups.

For discussion purposes, each of the physiological parameters tabulated above are charted below.

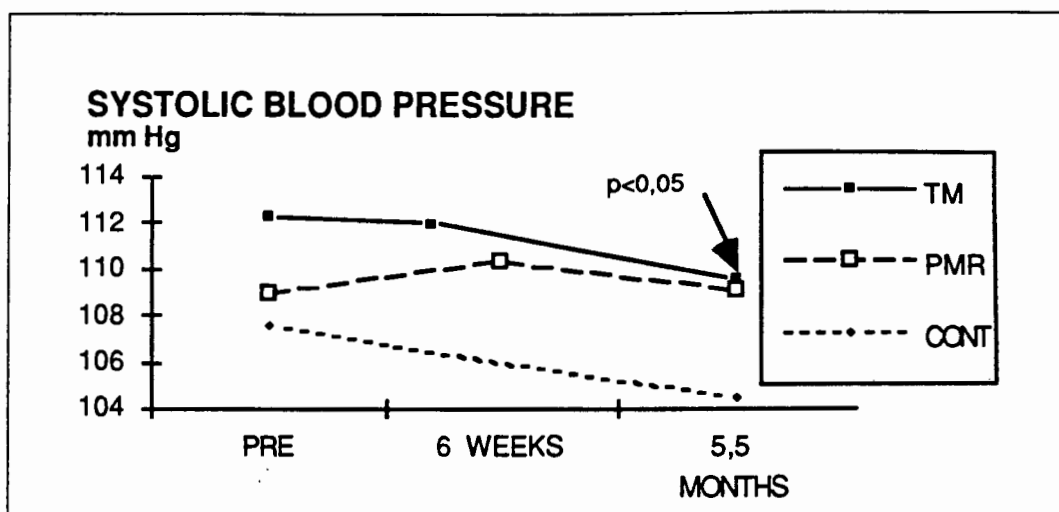
Systolic Blood Pressure (SBP)

This showed a reducing trend over the course of the experiment.

Figure 8

IMPROVEMENT IN SYSTOLIC BLOOD PRESSURE

All test groups: TM (1-4), PMR (5-6), on-site controls (7)



Note that PMR 6-week posttests were conducted 6 weeks later than for TM. Retrenchments may have raised PMR 6-week posttest SBP levels.

TM

A small but significant reduction was found in TM SBP at 5,5 months ($p < 0,05$, paired-t, $n=27$). This change was in the predicted direction, suggesting support for hypothesis one.

PMR

SBP of the PMR group increased non-significantly at the 6-weeks posttest. This may have been a reaction to a transient stressor in the

form of staff cuts made just over 3 weeks before this measurement, in which case the result could be disregarded.⁸

Three months after training in TM, the PMR group mean SBP recovered to insignificantly higher than at pretest. Recall that the PMR group were taught TM three months prior to the 5,5 month posttest.

Controls

Non-participating controls showed a non-significant decrease in SBP at 5,5 months after pretest (they were not posttested at 6 weeks).

⁸Chance presented an opportunity to test this hypothesis. While checking the dates of the TM 6-week posttests, it was noticed that a number of posttests had been delayed and were then conducted in the week that the retrenchments had been announced. It was reasoned that in the absence of any specific environmental stressor (such as uncertainty flowing out of staff cuts), physiological stress parameters should improve in the TM group with the passage of time. (This was hypothesis one which is largely supported in the discussion below.) Therefore the improvement against pretest should *increase* for those posttest measurements made late. TM Group 1 had five late posttests - so posttesting straddled the announcement of the retrenchments. A dummy variable was therefore assigned to the TM Group 1 data series to indicate whether the posttest was on time or late. 0 was assigned for on time, 1 for late, i.e. made during retrenchment week. A correlation matrix was then calculated using StatView Student (Abacus Concepts, 1991) for the improvement in the physiological measures at the 6-week posttest. Thus % improvement in SBP between pretest and six week posttest (as % of pretest SBP) was correlated with % improvement in DBP, HR and BR and with date of posttest. Date of posttest was expressed as = 0 if before retrenchments and = 1 if after.

CORRELATION MATRIX-TM GROUP 1-PHYSIOLOGICAL IMPROVEMENTS AT 6-WEEK POSTTEST-CORRELATED WITH DATE OF POSTTEST

	DATE	IMP SBP	IMP DBP	IMP HR	IMP BR
DATE	1				
IMP SBP	-,333	1			
IMP DBP	-,211	,483	1		
IMP HR	,025	,237	-,402	1	
IMP BR	,13	,307	-,376	,76	1

IMP SBP = improvement of SBP at 6-week posttest as % of pretest SBP

As suspected, improvements in SBP and DBP correlated *negatively* with date of test - suggesting that those tested late may have responded to the retrenchments with an *increase* in blood pressure. However heart rate and breath rate yielded small positive correlations.

Interpreting these results, in the case of the TM group these results suggest very tentative support for hypothesis 1. The comparison between TM and PMR effect size (hypothesis 2) was confounded at 6-week posttest by the unexpected retrenchments and was further confounded at 5,5 months by the insistence of the PMR group on learning TM.

The reduction in the SBP of the non-participating controls gives very tentative support for hypothesis 4 (that controls would also show improvement - this phenomenon is discussed in some detail later under *discussion*)

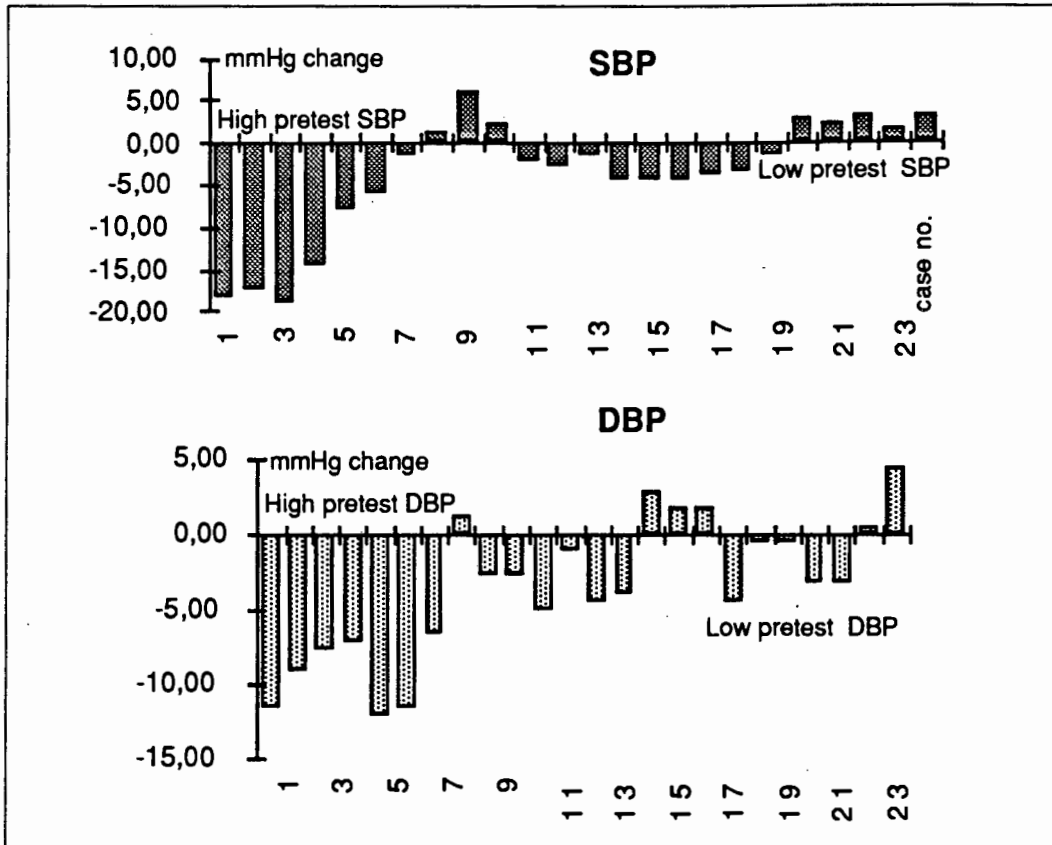
Normalisation of SBP

Several other studies (Schneider in Ferguson, 1991; Wallace, Silver, Mills, Dillbeck and Wagoner, 1983; Throll, 1982; Cooper and Aygen, 1978; Wallace, 1970) have noted reductions in SBP and DBP of borderline hypertensive populations. Accordingly, the blood pressure results for the TM groups were ranked in decreasing order of initial SBP⁹. Then a data column was constructed. Variation in individual cases was smoothed by taking the moving average SBP over three successive cases. Therefore for the first case shown below, the SBP was as shown. The second case was the average of the first two. The third the average of the first three. For the rest the SBP shown is the moving average over three cases. The chart is shown below (together with a chart for DBP using the same procedure).

⁹ SBP was chosen arbitrarily as the variable of interest. However, DBP would have been a better choice if the focus had been clinical. According to Lovell-Smith, Dickie & Robinson (1976), "...diastolic pressure is more stable than systolic and is believed more important in determining the severity of hypertension." However this was not a clinical study.

Figure 9
MOVING AVERAGE IMPROVEMENT IN TM BLOOD PRESSURE

Groups 1-4, change at 5,5 months



The top chart shows decreasing reduction in SBP moving from left to right i.e., from high to low initial SBP. Visual inspection of the chart suggests most of the improvement was found over the first seven cases—those with initial SBP of over 120 mm Hg. In the lower chart most of the improvement is seen over the first 14 cases¹⁰.

Accordingly the TM subjects were divided somewhat arbitrarily into two subgroups having SBP higher and SBP lower than 115 mm

¹⁰ Only the first three cases would clinically have been regarded as hypertensive, i.e., had initial DBP over 90 mm Hg.

Hg. These borderline "hypertensive" and "hypotensive" groups were then re-analysed.

The mean SBP of TM "hypertensive" subjects was found to decrease significantly at 6 weeks ($p < 0,05$, paired-t, $n = 9$), but just failed to reach significance at 5,5 months, perhaps due to attrition. The only other physiological parameter to decrease significantly in the "hypertensive" group was heart rate ($p < 0,02$, paired-t, $n = 9$).

The mean of the TM hypotensive group actually increased non-significantly at 6 weeks suggesting a normalisation of blood pressure with TM practice. However this increase was not maintained at 5,5 months.

Repeating this procedure for the PMR and non-participating Control groups, they were divided into hyper- and hypotensive groups using group means as the point of separation.

The mean SBP of all hypertensive groups tended to decrease progressively over 5,5 months, whereas for the hypotensives it tended to increase. As discussed above and set out in the table below, the only change which reached statistical significance was the TM SBP reduction at 6 weeks.

Table 11

SBP FOR HYPER VERSUS HYPOTENSIVES

All test groups: TM (1-4), PMR (5-6), on-site controls (7)

	PRE	6 WEEK	5,5 MONTHS
Hyper TM	135,7	128,7 $p<0,05$	126,3
PMR	123,3	118,8	122,8*
Control	120,8	-	110,2
Hypo TM	101,4	104,1	101,1
PMR	100,2	106,5	104,0*
Control	97,0	-	100,0

* After 6 of the combined group had learned TM

Subsequently the study re-analysed these results by performing a one-factor ANOVA on improvement in SBP at 5,5 months for the TM groups only (1-4). Subjects were divided into three tensive categories: high (initial SBP ≥ 113 mm Hg), normal and low (initial SBP ≥ 98 mm Hg). The results are set out below:

(see overleaf)

Table 12
ONE-FACTOR ANOVA ON IMPROVEMENT IN SBP

Groups 1-4, improvement (reduction) in SBP at 5,5 mo posttest

ANOVA Table

Source	df	Sum of Squares	Mean Square	F-Value	P-Value
TENSIVE CATEGORY	2	282,720	141,360	2,071	,1511
Residual	21	1433,465	68,260		

Dependent: IMP SBP

Means Table

Effect: TENSIVE CATEGORY

Dependent: IMP SBP

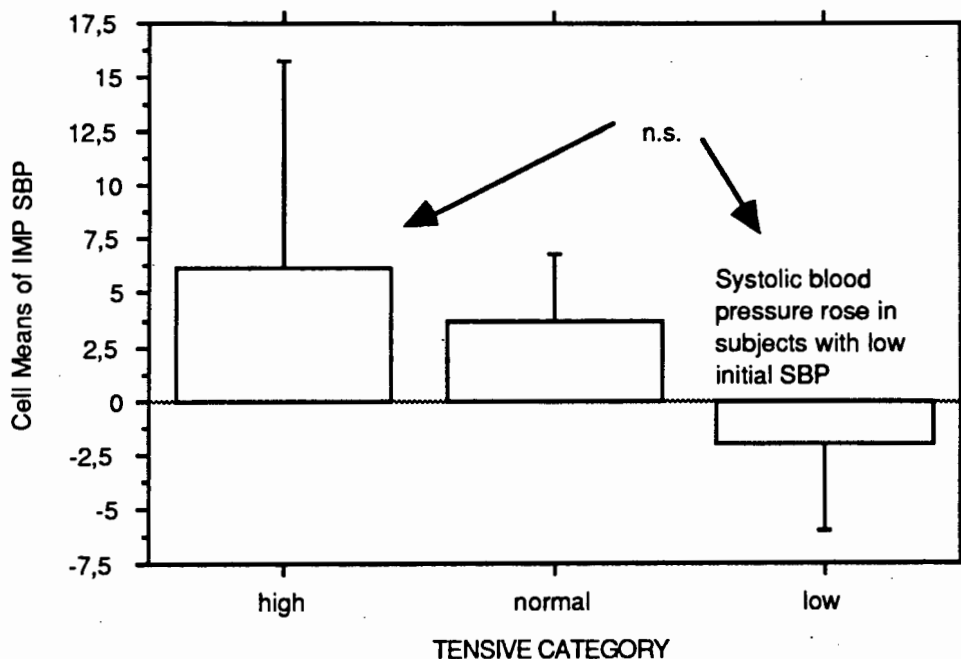
	Count	Mean	Std. Dev.	Std. Error
high	9	6,222	12,424	4,141
normal	8	3,708	3,677	1,300
low	7	-2,146	4,163	1,573

Interaction Bar Chart

Effect: TENSIVE CATEGORY

Dependent: IMP SBP

With 95% Confidence error bars.



A large p-value associated with the calculated F statistic suggested that the tensive category effect was of only borderline significance.

Extending the sample to include the PMR and on-site control groups—i.e., all subjects for whom blood pressure data was available in order to gain statistical power—brought the differences between the high and low tensive groups to the edge of significance. This is shown by the repeated ANOVA table below.

(overleaf)

Table 13

ONE-FACTOR ANOVA ON IMPROVEMENT IN SBP—ALL

Groups 1-7, improvement (reduction) in SBP at 5,5 month posttest

ANOVA Table

Source	df	Sum of Squares	Mean Square	F-Value	P-Value
TENSIVE CATEG...	2	474,585	237,292	2,951	,0638
Residual	40	3216,425	80,411		

Dependent: IMP SBP

Means Table

Effect: TENSIVE CATEG...

Dependent: IMP SBP

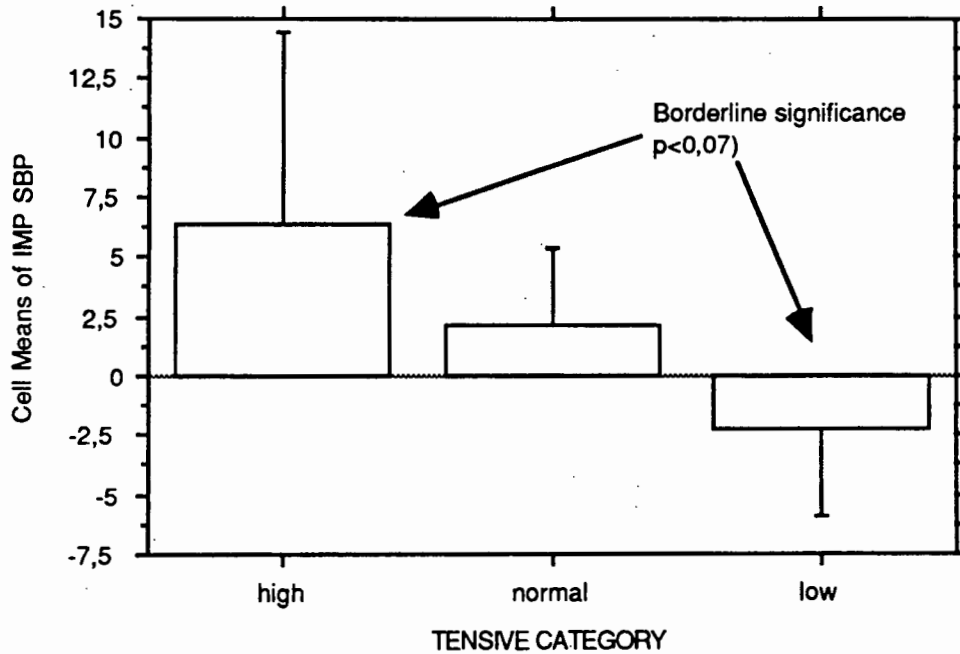
	Count	Mean	Std. Dev.	Std. Error
high	13	6,358	13,374	3,709
normal	18	2,165	6,496	1,531
low	12	-2,362	5,662	1,634

Interaction Bar Chart

Effect: TENSIVE CATEG...

Dependent: IMP SBP

With 95% Confidence error bars.



Using SuperAnova software to execute Scheffe's post-hoc procedure (Abacus Concepts, 1989: 211) to check the significance of the difference between group means yielded the following table:

Table 14
SCHEFFE'S S POST-HOC TEST

Groups 1-7, improvement (reduction) in SBP at 5,5 month posttest

Scheffe's S				
Effect: TENSIVE CATEG...				
Dependent: IMP SBP				
Significance level: ,05				
	Vs.	Diff.	Crit. diff.	P-Value
low	normal	4,528	8,496	,4077
	high	8,721	9,126	,0638
normal	high	4,193	8,298	,4454

None were significantly different at this level.

Although no group means were significantly different, low versus high approached significance.

These results are suggestive of *normalisation* of blood pressure, supporting a model for stress reduction which is more complex than the simple "somatic arousal hypothesis" discussed earlier in chapter 1: *Operational definitions for this study.*

For instance, it is known that severe shock (i.e., stress) may lead to an abnormally low blood pressure (Martin, 1990: 81). Accordingly it seems reasonable to expect that stress reduction may actually increase

blood pressure in subjects whose blood pressure is abnormally low due to stress.

If SBP appears to decrease for hypertensives and increase for hypotensives following stress reduction, how would SCL scores behave? The above relationship between SBP improvement and initial level was then contrasted by making the same comparison for SCL-90-R scores.

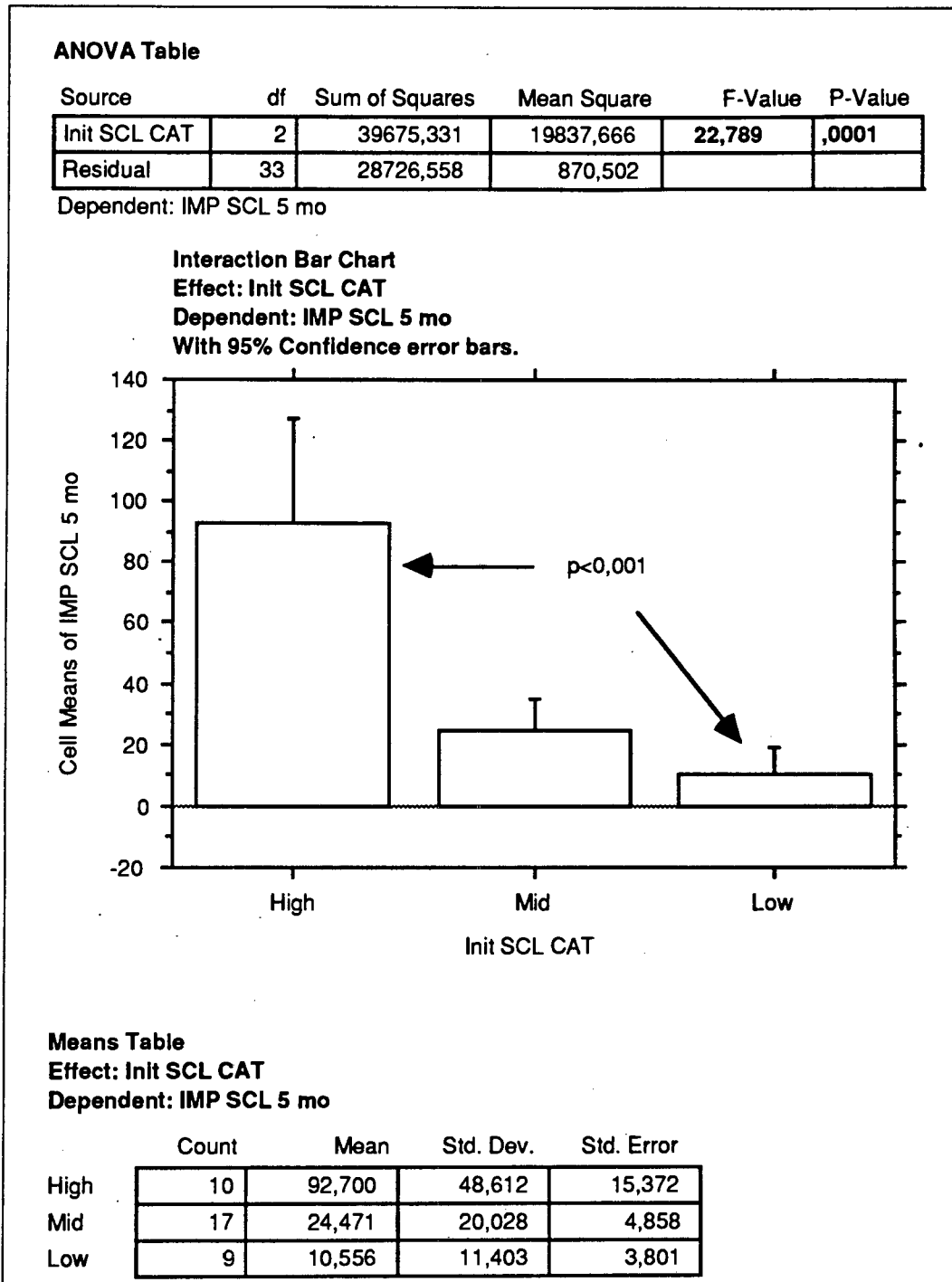
The study performed a one-factor ANOVA on improvement in SCL for the on-site groups (1-7). Subjects were divided into three arbitrary SCL categories: high (initial SCL ≥ 80), normal and low (initial SBP ≤ 40). The results are set out below:

(see overleaf)

Table 15

ONE-FACTOR ANOVA ON IMPROVEMENT IN SCL

Groups 1-7, improvement in SCL score at 5,5 month posttest



The low initial SCL category subjects did not increase their SCL scores at 5,5 month posttest. However, it was noted that the improvement in SCL score at 5,5 months was very significantly greater for the high initial SCL category. This suggested that initial SCL score may operate as a nuisance variable. Subsequent analyses of SCL results therefore removed the effect of initial SCL score by using the analysis of covariance procedure (see *concluding analysis*).

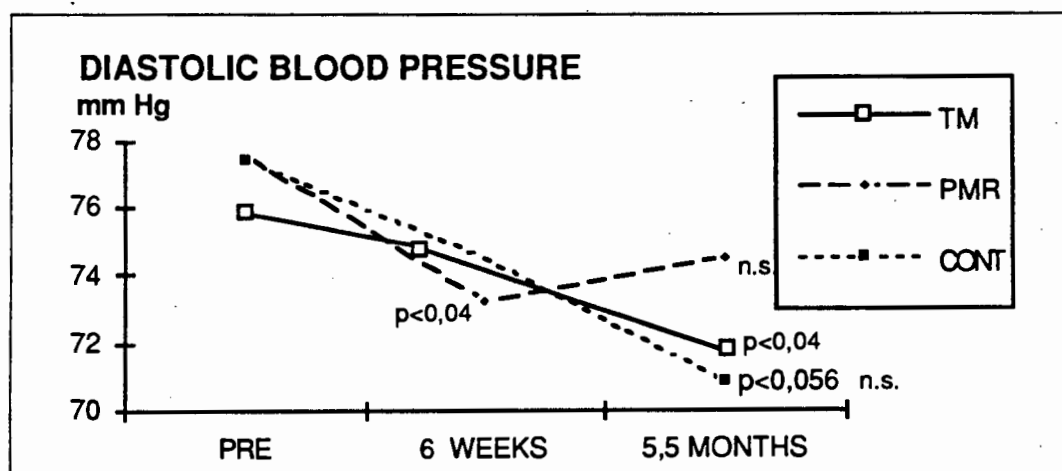
Diastolic Blood Pressure (DBP)

Results are charted below.

Figure 10

IMPROVEMENT IN DIASTOLIC BLOOD PRESSURE

All test groups: TM (1-4), PMR (5-6), on-site controls (7)



TM

DBP results supported hypothesis 1 with a small improvement, i.e., a decrease at 6 weeks, which reached significance at 5,5 months

(paired t, $n = 27$, $p < 0,04$). Hypothesis 1 was also supported by the PMR results.

PMR

DBP showed a significant decrease at 6 weeks, despite the timing of the posttest as discussed above (paired t, $n = 12$, $p < 0,04$) This result appears to contradict hypothesis 2 because the PMR effect size was larger than TM. This improvement at 6 weeks was not sustained at the 5,5 month posttest, after learning TM.

Controls

Hypothesis 4 once more received support from a borderline-significant improvement in DBP of non-participating controls at 5,5 months posttest. ($p < 0,056$). The small size of the group ($n=9$) curtailed the statistical power of this comparison with pretest. However, it was noticed that the case with lowest initial DBP demonstrated a large increase at 5,5 month posttest (61,7-78,3). Re-analysing the data to exclude this case saw the significance improve to $p < 0,004$ ($n = 8$, paired-t, one-tail).

Heart Rate (HR)

Average heart rates do not differ for males and females, according to Civin.¹¹ Increased physical fitness is known to reduce resting heart rate. Exercise habits data was acquired as part of the nurses record sheet. Examination of this data suggested that no significant changes

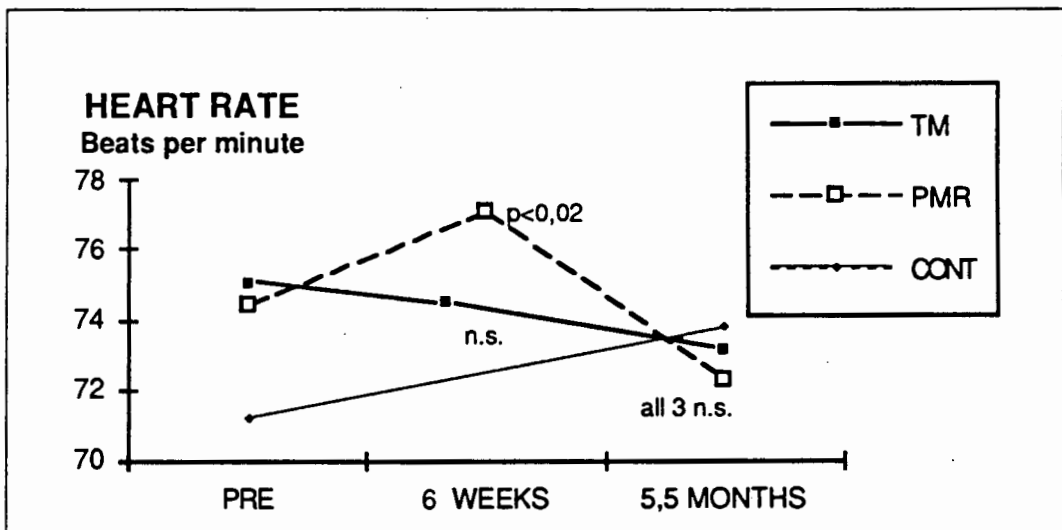
¹¹ Personal communication, 1994, as mentioned earlier.

had taken place in exercise patterns over the course of the experiment. Results are charted below.

Figure 11

IMPROVEMENT IN HEART RATE

All test groups: TM (1-4), PMR (5-6), on-site controls (7)



Note: the PMR increase at 6 weeks is not a result of muscle activity. PMR did not involve muscle activity during the nurses reading.

TM

Only the TM group showed improvement with small and non-significant reductions at 6 weeks and 5,5 months. This finding indicates tentative support for hypotheses 1 and 2

PMR

However the PMR results contradict hypothesis 1 with a significant *increase* at 6 week (paired t, n=12, p<0,02). The timing of the posttest after the announcement of the retrenchments could have confounded this result and frustrated any attempt to draw conclusions about support or otherwise for hypothesis 1 and 2. After 6 of the PMR

group had received training in TM, heart rate for the group recovered to a level just below initial pretest.

Controls

Non-participating controls also showed a small and non-significant increase in heart rate at 5,5 months. This finding is not supportive of hypothesis 4.

Breath Rate (BR)

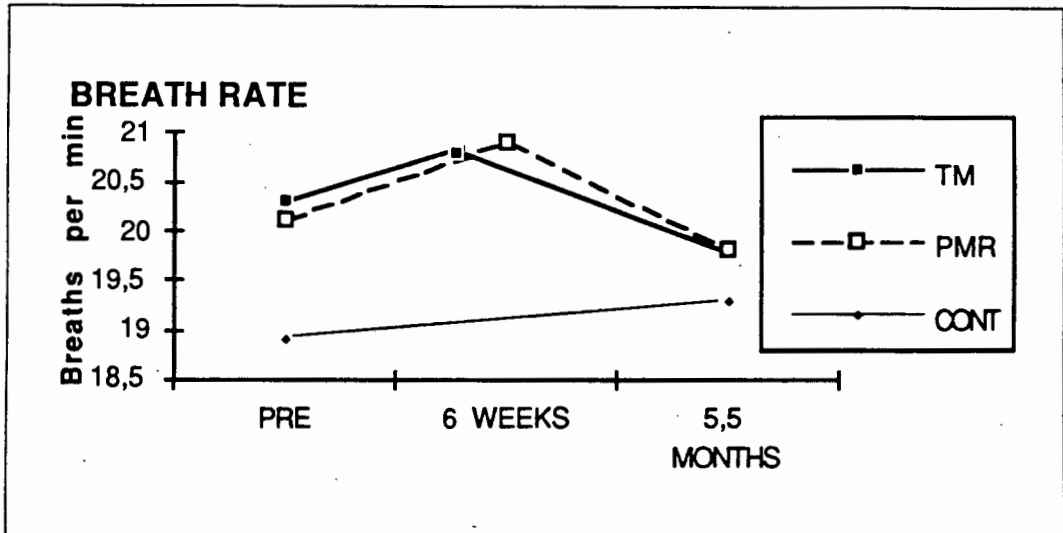
Normal breath rate for adults is 12-14 according to Civin.¹² In the obese it is higher, and lower in athletic subjects. Results charted below are "borderline tachypnoeic" according to Civin. This may possibly be accounted for by the atmosphere of frenetic activity at the offices of the survey company, as referred to earlier i.e., the subjects were "stressed." Results are charted below.

¹² Personal communication, 1994.

Figure 12

IMPROVEMENT IN BREATH RATE

All test groups: TM (1-4), PMR (5-6), on-site controls (7)



Results were similar to the heart rate findings except that no changes reached significance. Once again, the six week results suggested the operation of a transient stressor, the retrenchments.

This concluded the examination of physiological variables. The analysis then turned to the question of climate changes.

COMPANY CLIMATE

The following analysis is also presented in narrative format. Initially results were analysed for all on-site subjects. This initial analysis attempted to assess the impact of the overall intervention and thus compared pretest with 5,5 month posttest (see fig. 13 a). Later it became apparent that retrenchments may have adversely affected results. Therefore a second analysis was conducted using data from TM groups only (see fig. 13 b). This was done because the TM 6 week posttests had been conducted before the retrenchments, thus providing a serendipitous opportunity to assess the impact of the retrenchments.

The two dimensions of principal interest were SUPPORT and WARMTH. However all dimensions were calculated in order to look for interesting trends. A single-factor ANOVA was performed on the pretest results for each of the nine climate dimensions. This was done to establish whether the test groups were equivalent (i.e., in statistical terms, were drawn from the same parent population). Calculated values for the test statistic F were well within critical values of F at the 95% significance level on each dimension. TM, PMR and on-site controls were therefore not significantly different from one another on any of the nine climate dimensions at pretest.

All three groups were posttested after 5,5 months and the results tabulated below. The table sets out pre-and posttest scores on all nine

dimensions, analysed across TM, PMR and on-site controls. For simplicity, variances are not reported in the table. (Pretest variances typically ranged from 8,0 - 16,0.) Scores below represent percentages. Answering "4" on all questions comprising a dimension would result in a score of 100. Higher scores are "better."

Table 16 a
CLIMATE SCORES—SHIFTS OVER SIX MONTHS

Groups 1-7, group mean dimension score

	GROUP	PRETEST	5,5 MO. POSTTEST
SUPPORT	TM n=28	72,1	73,8
	PMR n=13	70,3	79,9 ¹
	CTL n=7	78,6	75,9
	ALL	72,6	75,3
REWARD	TM	72,5	73,0
	PMR	71,3	77,8
	CTL	72,1	75,7
	ALL	72,1	74,3
STRUCTURE	TM	74,9	74,5
	PMR	69,4	75,5
	CTL	70,2	72,6
	ALL	72,8	74,4
RESPONSIBILITY	TM	65,2	66,6
	PMR	66,1	70,1
	CTL	62,5	59,8
	ALL	65,0	66,3
RISK	TM	67,4	66,9
	PMR	66,1	70,8
	CTL	69,6	73,2
	ALL	67,4	68,6
CONFLICT	TM	61,2	61,5
	PMR	60,4	58,3
	CTL	67,0	64,3

	ALL	61,8	61,3
WARMTH	TM	82,6	80,3
	PMR	80,2	79,9
	CTL	77,7	77,7
	ALL	81,3	79,8
STANDARDS	TM	78,6	76,6
	PMR	82,1	83,3
	CTL	78,6	75,0
	ALL	79,5	77,6
IDENTITY	TM	78,1	73,8
	PMR	79,2	77,1
	CTL	77,7	72,3
	ALL	78,3	74,2 ²

CTL = on-site controls, ALL = whole company

1. $p < 0,025$, Wilcoxon's matched pairs signed rank, $N=8$ pairs. By hand (Huysamen, 1981: 142)

2. $p < 0,005$, Wilcoxon's matched pairs signed rank, $N=27$ pairs. By hand

The results above have been presented in decreasing order of positive shift (i.e., increase) at 5,5 months.

Only two pre- posttest comparisons were found to be statistically significant. These were PMR on SUPPORT which improved significantly ($P < 0,025$, Wilcoxon, $N=8$ pairs), and all groups combined (i.e., total company score) on the IDENTITY dimension, which worsened significantly ($p < 0,005$, Wilcoxon's matched pairs signed rank test, $N=27$ pairs after deletion of ties) None of the other shifts reached significance. These results are discussed in more detail below.

Wilcoxon's non-parametric procedure (Huysamen, 1981: 38, 142) was used because it was not clear whether the assumption of normality required for use of parametric procedures such as Student's

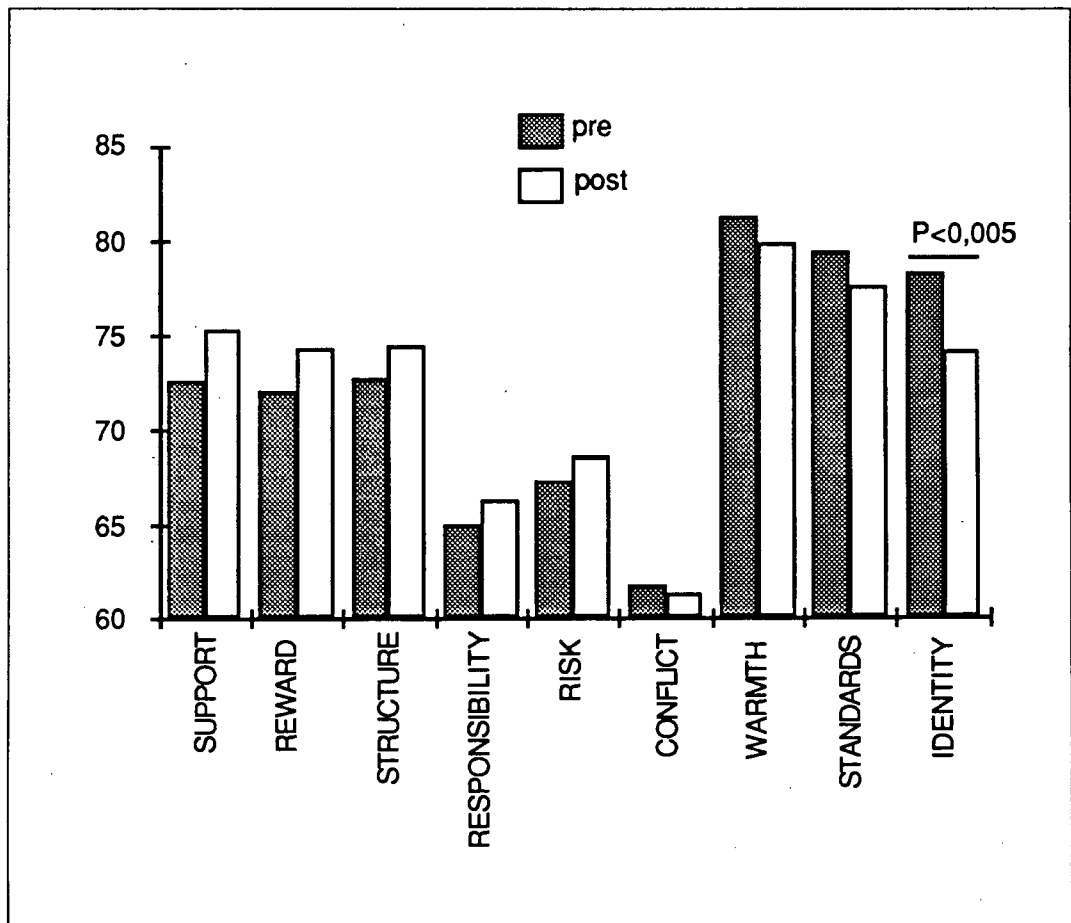
would hold for the distribution of climate scores. Accordingly the analysis used the Wilcoxon procedure.¹³

Plotting the results for all 59 subjects (representing over 80% of the full-time staff) yielded the following bar chart:

Figure 13 a

CLIMATE—TOTAL COMPANY SHIFTS OVER SIX MONTHS

Groups 1-7 pretest versus 5,5 months posttest (after retrenchments)



Examining these total company scores, five scores improved slightly at post test (i.e., scores increased), while four worsened.

¹³ After discussion with Schmickl, who provided the climate instrument, and Pretorius who lectures in quantitative methods at UNISA SBL.

The question now arose—how were these shifts to be interpreted? Why had SUPPORT improved (as predicted) while WARMTH had not? What was the significance of the other dimension changes, and how did the survey company dimension scores compare with other companies? Some discussion of these issues is presented below, and further discussion is presented in chapter V: *Climate—desirable climate dimension movements*.¹⁴ According to Gustavsson who commented on the discussion following "it can be hard to interpret findings on TM and climate change."¹⁵

Support

This dimension purports to measure "the perceived helpfulness of the managers and other employees in the group; the emphasis on mutual support from above and below" (Nasser & Schmickl, 1986).

As expected, positive shifts were seen in the test groups but not in the non-participating controls, who perhaps felt excluded. Largest positive shift ($p < 0,025$) was seen in the PMR group, some of whom had in fact learned both PMR and TM. Company score moved from 72,6 to 75,3 (n.s.), comparable with Banking at 78, as recorded by Nasser (1986) for this dimension. Other Nasser scores for this dimension were: Beverages - 80, Retailing - 79, Mining - 73, and Services - 68.

Subjective reports gathered during the training suggest that the programme was appreciated by the participants—so a positive shift in

¹⁴ Before reading these results, it may be useful to examine Appendix I: *Climate questionnaire*, which presents the questions for each dimension.

¹⁵ Personal communication, January 1995.

support score is not surprising after training. This is especially so for the PMR group, having two training courses rather than just one.

However the most likely reason for the observed results emerged during the structured interviews with some managers at the 3 year followup. Apparently, at the time of the retrenchments, management took great pains to explain their feelings to the retrenchees, i.e., they felt bad but the step had to be taken due to the financial situation at the time. Management's concern seems to have communicated itself to the survivors.

Looking at these results later, with the hindsight of the structured interviews, yielded the impression that the retrenchments severely impacted the final climate measurement (made about 3 months after the retrenchments). In the words of one manager: "...the retrenchment process was very traumatic for me personally—*very, very, very* traumatic."

Reward

This dimension purports to measure "the feeling of being rewarded for a job well done; emphasising positive rewards rather than punishments; the perceived fairness of the pay and promotion policies" (Nasser & Schmickl, 1986).

Company pretest score was 72,1 and no changes were expected. However positive but non-significant increases were seen in all groups. Company posttest score (all groups combined) was the same as Nasser & Schmickl report for General Services companies. By

comparison, Nasser & Schmickl report 67 on this dimension for Mining.

Structure

This dimension attempts to assess "the feeling that employees have about the constraints in the group; how many rules, regulations and procedures there are; is there an emphasis on 'red tape' and going through channels, or is there a loose and informal atmosphere " (Nasser & Schmickl, 1986).

No changes were expected. However, non-significant shifts were seen in the PMR and non-participating control groups. Company pretest score of 72,8 was in line with Nasser & Schmickl's report for mining companies at 73 and ahead of Services at 68. This was interesting because employees must therefore have perceived the company as being relatively highly structured—more like a mine than a service company.

Responsibility

This dimension assesses "the feeling of being your own boss; not having to double-check all your decisions; when you have a job to do, knowing that it is your job" (Nasser & Schmickl, 1986).

No changes were expected. However, perceptions of TM and PMR groups improved, while non-participating controls worsened. These changes failed to reach significance. A pretest company score of 65,0 compares unfavourably with Nasser & Schmickl's reported score of 73 for general services, but is ahead of Mining at 61.

Interviews conducted three years later suggested that the reason for low scores on this dimension lay in the management style of the managing director, who checks staff work in some detail.

Risk

This dimension looks at "the sense of riskiness and challenge in the job and in the organisation; is there an emphasis on taking calculated risks, or is playing it safe the best way to operate" (Nasser & Schmickl, 1986).

No changes were expected. Scores of PMR and non-participating controls increased, while TM worsened slightly, though not significantly. Posttest company score of 68,6 was the same as Nasser & Schmickl's report for Mining companies. Because of the nature of the company's business as a marketing research consultancy, it was not surprising that the company's score was ahead of general services companies at 64.

Conflict

This dimension examines "the feeling that managers and other workers want to hear different opinions; the emphasis placed on getting problems out in the open rather than smoothing them over or ignoring them" (Nasser & Schmickl, 1986).

No change was expected. It is interesting that TM group perceptions of tolerance of conflict improved, however slightly, while those of the other groups worsened. These changes were however not statistically significant. Company pretest of 61 was surprisingly slightly

lower than for Nasser & Schmickl's General Services companies at 65, but ahead of Mines at 58.

Warmth

This dimension examines "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 & Schmickl, 1986).

Improvements had originally been expected, but it was not surprising to find that test groups' perceptions worsened slightly at final posttest (after the retrenchments). However, non-participants were unchanged. The changes were not significant. Compared with other company results reported by Nasser & Schmickl, the survey 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 & Schmickl report for this dimension and highest for any company dimension. Other scores reported by the same authors were: Mining - 73 and Services - 68.

Standards

This dimension measured "the perceived importance of implicit and explicit goals and performance standards; the emphasis on doing a good job; the challenge represented in personal and group goals" (Nasser & Schmickl, 1986).

No changes were expected. Company score worsened slightly at posttest, with the PMR group showing small improvement. No changes reached significance. Company pretest score of 79,5 was higher than for any industry groupings reported by Nasser & Schmickl, as for example Beverages - 78, Mining - 74, Services - 70.

Identity

This final dimension measures "the feeling that you belong to a company and you are a valuable member of a working team; the importance placed on this kind of spirit" (Nasser & Schmickl, 1986).

No changes were expected. However company score decreased significantly from 78,3 to 74,2 at posttest ($p < 0,005$, $N = 27$ pairs, Wilcoxon). All three groups moved in the same negative direction. It seems likely that the negative shifts seen here reflect perceptions of events surrounding the retrenchment of about 10% of the staff only three months before posttesting.

For comparison, Nasser & Schmickl reported the following scores on this dimension: Beverages - 83, Services - 71, Mining - 61.

The reduction in identity scores was surprising, so the individual component question scores were then checked. The four questions comprising the identity dimension are: (Nasser and Schmickl 1986)

- Q8 "People are proud of belonging to this organisation"
- Q16 "I feel that I am a member of a well-functioning team"
- Q24 "As far as I can see there is a great deal of personal loyalty to the company."
- Q31 "In this organisation people don't only look after their own interests."

(Questions 24 and 31 are here rephrased slightly to maintain the direction of the first two questions)

When the data was examined, the first three questions showed large negative shifts, while the fourth showed a small positive shift. Questions 8 and 16 in fact had the largest (negative) shifts at posttest of any of the 40 questions used in the instrument. None of which was surprising, considering the "trauma" of the retrenchments.

Having examined the whole company shifts at 5,5 month posttest, and seen that there was a suggestion of a confound in the form of the retrenchments, the spotlight was turned on the results for the TM groups (1-4). These groups had been posttested at 6 weeks in addition to 5,5 months. When examining results for the TM groups only, the table and plot below suggested a somewhat different outcome—an initially favourable climate trend before retrenchments, which reversed later, after retrenchments.

Table 16 b

CLIMATE SCORES—TM ONLY

Groups 1 - 4, N = 41

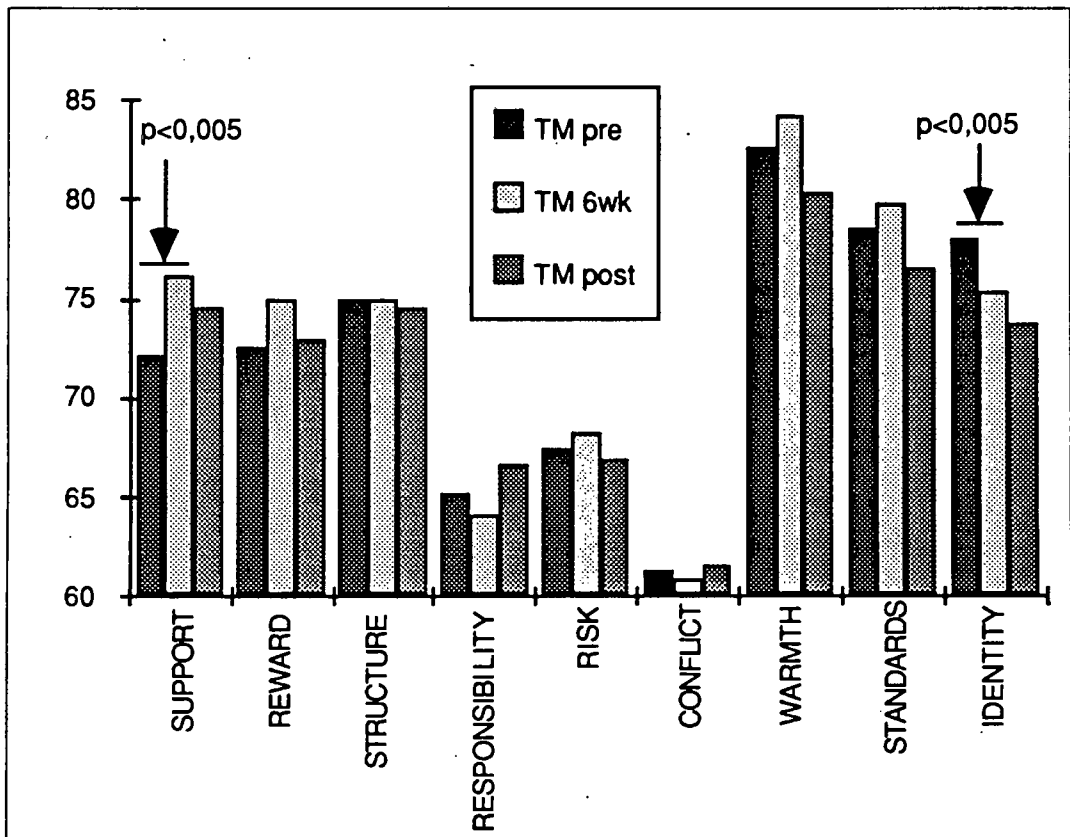
	TM pre	TM 6wk, before retr.	TM 5,5 mo, after retr.
SUPPORT	72,1	76,2*	74,5
REWARD	72,5	74,9	73,0
STRUCTURE	74,9	74,9	74,5
RESPONSIBILITY	65,2	64,1	66,6
RISK	67,4	68,2	66,9
CONFLICT	61,2	60,9	61,5

WARMTH	82,6	84,2	80,3
STANDARDS	78,6	79,8	76,6
IDENTITY	78,1	75,3*	73,8

* p < 0,005, Wilcoxon, N = 23 pairs.

Charting these results showed a trend for TM results in a positive direction(i.e., increase) at 6 weeks which then tended to reverse at final posttest, after the retrenchments.

Figure 13 b
CLIMATE SCORES
TM groups 1-4 only



Note that only support and identity changes reached statistical significance.

What was most noticeable about this chart was that hypothesis 1 now appeared to be supported across both SUPPORT ($p < 0,005$, $N = 23$) and WARMTH (n.s.), but only at 6 week posttest.

These results were later shown to management and staff and are discussed in chapter V: *Discussion.—climate.*

PRODUCTIVITY

The only productivity data made available by management were figures for monthly sales turnover and staff complement. Management did not give permission for the publication of turnover data, so the figures below have been indexed by dividing the sales turnover figure by a constant.

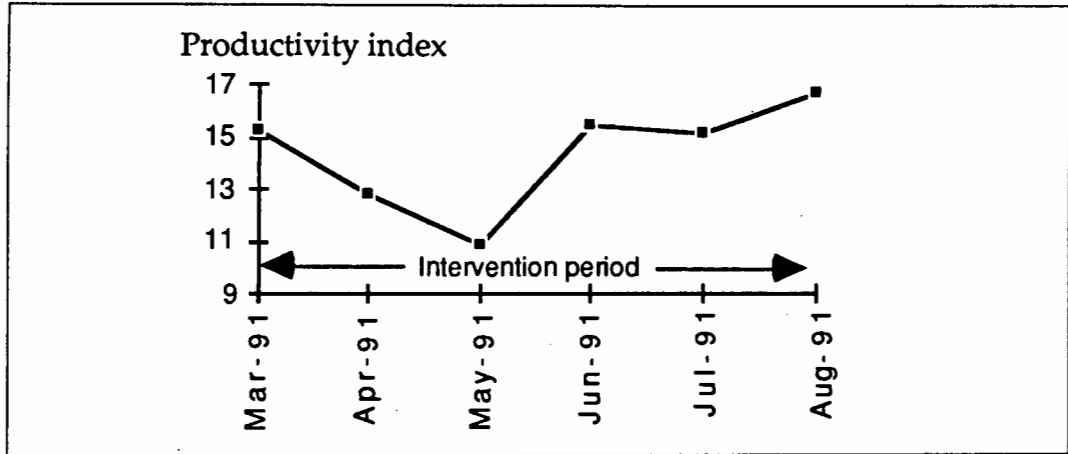
Table 17

PRODUCTIVITY INDEX

	Mar-91	Apr-91	May-91	Jun-91	Jul-91	Aug-91
Indexed monthly sales turnover	12210	10280	8720	10840	10630	11680
Head count	80	80	80	70	70	70
PRODUCTIVITY INDEX (sales/heads)	15,3	12,9	10,9	15,5	15,2	16,7

These productivity index figures are charted below.

Figure 14
PRODUCTIVITY INDEX



As may be seen from the chart, overall company productivity decreased for two months following the intervention, and then rose following the retrenchment of 10 staff. The net gain was from 15,3 to 16,7, a gain of 9,2%. This finding is discussed further in chapter V: *discussion*.

CORRELATIONS BETWEEN VARIABLES

Having established tentative support for hypotheses one, two and four, the data was examined to test hypothesis three (that stress symptoms, physiological parameters and climate variables would be correlated).

Physiological Variables

A correlation matrix was accordingly calculated¹, firstly for the physiological parameters at pretest: systolic blood pressure (SBP), diastolic blood pressure (DBP), breath rate (BR) and heart rate (HR). Experimental groups 1-6 were analysed—see Appendices C, D and E for the raw data. Only cases with a complete data series were used. Where data was missing the row was deleted, (which happened in 21 out of 59 cases). Using StatView Student (Abacus Concepts, 1991: 165), pairwise correlations were calculated (to 18 decimal places and displayed to 3).

The correlation matrix follows for 38 cases:

¹ The matrix displays values of the sample correlation coefficient, r as computed by the relation $r = \frac{\sum x_1 x_2}{\sqrt{(\sum x_1^2)(\sum x_2^2)}}$ (Snedecor & Cochran, 1980: 175)

Table 18
CORRELATION MATRIX PHYSIOLOGICAL PARAMETERS

Groups 1-6 at pretest, N = 38 pairs

	SBP-PRE	DBP-PRE	HR-PRE	BR-PRE
SBP -PRE	1			
DBP -PRE	,833 *	1		
HR -PRE	,311 †	,328 *	1	
BR -PRE	,367 *	,294 *	,648 *	1

Note: 21 cases deleted with missing values.

*p<0,05 or better, † p<0,01

As expected, SBP correlated very closely with DBP. According to Snedecor & Cochran (1980: 191): "It is well known that a person's systolic and diastolic blood pressures are highly correlated..."

What was more interesting is that there appeared to be significant correlations between the other physiological variables as well.² How significant were these correlations? According to Snedecor & Cochran, the presence of a linear relationship between two variables (such as SBP and DBP) may be tested by calculating the t statistic (as used earlier in this report) or directly by using tables for r—calculated using the relationship: $t = r\sqrt{(n-2)/\sqrt{(1-r^2)}}$, where n is the number of pairs of data, r is the sample correlation coefficient, and t the statistic of Student (Snedecor & Cochran, 1980: 185). According to these authors,

² Particularly between heart and breath rate. According to Civin, it is known that breath rate is slower to respond to transient stressors than heart rate. This may account for a correlation coefficient smaller than that for SBP and DBP.

this t test requires that at least one variable is normally distributed (a reasonable assumption in the case of human physiological data).

Interpolating from tables presented by Snedecor & Cochran (1980: 477), for 38 pairs (i.e., 36 df), the critical levels of r for 1%, 5% and 10% significance are respectively 0,413, 0,321 and 0,271.

Examination of the table above therefore suggests that positive correlations exist between all physiological parameters measured here. These correlations were significant at $p < 0,05$ or better in all cases except SBP and HR and DBP and BR, which were of borderline significance at $p < 0,01$.

However only pretest data for groups 1-6 were used for this preliminary analysis which thus spanned only 38 data series. The analysis was then extended to every case available—i.e., also using second pretest, 2-week posttest, 6 week posttest and 5,5 month posttest including groups 1-7. This gave potentially 350 cases for analysis, but after deletion of rows for missing data 185 remained³. A further correlation matrix was then calculated to compare with the table above.

³ In order for a data series to be included in the analysis all data had to be present, i.e., pretest, 2 week posttest, 6 week posttest and 5,5 month posttest. One of the practical difficulties experienced with this study was getting busy subjects to attend testing sessions. Management of the project and follow up of missing data proved to be a shortcoming of the project. Therefore a missing data point in a data series was not uncommon.

Table 19

CORRELATION MATRIX—PHYSIOLOGICAL PARAMETERS

Groups 1-7 - all tests: 350-165=185 cases

	SBP	DBP	HR	BR
SBP	1			
DBP	,811	1		
HR	,109	,126	1	
BR	,139	,071	,601	1

Note: 165 cases deleted with missing values.

All others Correlation coefficients for the larger analysis were seen to be broadly similar to (though smaller than) those displayed in table 18.

Interpolating from tables presented by Snedecor & Cochran (1980: 477), for 185 pairs (i.e., 183 df), the critical levels of r for 1%, 5% and 10% significance are respectively 0,189, 0,145 and 0,121.

Examination of the table above therefore suggests a similar conclusion to that before, i.e., these correlations were significant at $p < 0,05$ or better in all cases except SBP/HR, and DBP/BR, which were in this case not statistically significant.

Psychological Variables

It was now appropriate to add psychological stress data to the analysis. This was done by adding the column of raw scores from the SCL-90-R instrument. A correlation matrix was first calculated for groups 1-7 and all cases, i.e., using data from both pre- and posttests in

order to maximise the number of cases and therefore the statistical sensitivity of the tests.

Table 20

CORRELATION MATRIX: PSYCHOLOGICAL AND PHYSIOLOGICAL PARAMETERS

Groups 1-7 - all tests: 350-187=163 cases.

	SCL	SBP	DBP	HR	BR
SCL	1				
SBP	-,1	1			
DBP	,079	,819	1		
HR	,17	,116	,134	1	
BR	,132	,151	,071	,581	1

Note: 187 cases deleted with missing values.

Coefficients of correlation were seen to be insignificantly small for the main relationships of interest: SCL⁴ and blood pressure, so the matrix was recalculated using log SBP⁵ with almost identical results:

⁴ Recall SCL = score on SCL-90-R instrument. Lower scores are "better," i.e., "less stressed."

⁵ The logic of transforming variables is presented in Appendix U.

Table 21

CORRELATION MATRIX: PSYCHOLOGICAL AND PHYSIOLOGICAL
PARAMETERS

Groups 1-7 - all tests: 350-187=163 cases, SBP transformed

	SCL	log SBP	DBP	HR	BR
SCL	1				
log SBP	-,099	1			
DBP	,079	,816	1		
HR	,17	,123	,134	1	
BR	,132	,159	,071	,581	1

Correlations between variables of interest were still small.

Cases with low initial SBP had previously been noted to show anomalous behaviour after stress-reduction, i.e., blood pressure appeared to increase after TM. Accordingly all cases presenting $SBP \leq 98$ were then eliminated from the correlation analysis with the following result:

Table 22
CORRELATION MATRIX: PSYCHOLOGICAL AND PHYSIOLOGICAL
PARAMETERS

Groups 1-7 - all tests, SBP over 98: 311-179=132 cases

	SCL	SBP	DBP	HR	BR
SCL	1				
SBP	-,138	1			
DBP	,054	,785	1		
HR	,165	,058	,083	1	
BR	,139	,092	,002	,573	1

The coefficients of interest were still low, but the SCL/SBP coefficient had increased in size to approach borderline significance. From tables (Snedecor & Cochran, 1980: 477) r_{crit} for $p < 0,01 = 0,146$ for 130 df. The direction of the correlation was, however not supportive of hypothesis 3, that physiological and psychological variables would be positively correlated.

Before drawing final conclusions from the analysis so far, climate variables were added.

Climate Variables

Data for climate variables (i.e., WARMTH and SUPPORT scores) were now added and a final correlation matrix calculated for all variables:

Table 23

CORRELATION MATRIX: PSYCHOLOGICAL, PHYSIOLOGICAL
AND CLIMATE PARAMETERS

Groups 1-7 - all tests: SBP>98, 311-256=55 cases

	SCL	SBP	DBP	HR	BR	WARMTH	SUPPORT
SCL	1						
SBP	,004	1					
DBP	,259 \wedge	,778 \bullet	1				
HR	,108	,134	,088	1			
BR	,094	,231 \wedge	,157	,71	1		
WARMTH	-,092	,015	,051	,188	,279 \ast	1	
SUPPORT	-,072	,038	,111	,145	,238 \wedge	,424 \bullet	1

Note: 256 cases deleted with missing values.

 \bullet p<0,01 \ast p<0,05 \wedge p<0,1

Adding the climate variables had the effect of reducing the number of cases for analysis because of incomplete data series. This severely restricted the usefulness of this analysis.

However it was noted that the first column correlation coefficients all had plus signs except SCL/WARMTH and SCL/SUPPORT. With the climate variables an increase in score represented an improvement, so the negative correlation with SCL (which *decreased* with improvement) was expected. Thus climate improvement appears to be positively correlated with improvement in SCL. However the sizes of r were insignificantly small.

The direction of the correlations with the principal outcome measure, the SCL-90-R, was therefore now weakly supportive of hypothesis three, that climate and psychological variables would be

positively correlated. However, the positive signs of the climate correlations with the physiological variables indicated a *negative* correlation between climate improvement and *physiological* improvement.

Interpolating from tables presented by Snedecor & Cochran (1980: 477), for 55 pairs (i.e., 53 df), the critical levels of r for 1%, 5% and 10% significance are respectively 0,341, 0,265 and 0,222. Accordingly, examination of the table above suggests significant positive correlations between SBP/DBP and WARMTH/SUPPORT (better than $p < 0.01$, 53 df). This was not surprising.

A significant negative correlation was noted between WARMTH/BR ($p < 0,05$). This was not supportive of hypothesis three.

Positive correlations of borderline significance were noted between SCL/DBP and SBP/BR ($p < 0,1$). These were supportive of hypothesis three.

Finally a negative correlation of borderline significance was noted between SUPPORT/ BR ($p < 0,1$), again not supporting hypothesis three.

This analysis is extended in Appendix U: *Correlations between variables: a multiple regression analysis*. This analysis examined the regression of the above variables on SCL. The analysis concluded that hypothesis three was supported in terms of significant relationships between SCL and physiological variables but not climate variables (though SUPPORT approached significance).

Nuisance Variables

Attention then turned to the impact of nuisance variables, such as expectation, on improvement in SCL scores for the experimental groups (groups 1-6).

A correlation matrix was first calculated (using StatView Student) for the variables expectation at start and improvement in SCL raw score at six weeks and 5,5 months after pretest. Subjective evaluation of the usefulness of the training was included for interest to assess the extent to which subjective perceptions and objective improvement scores correlated. The correlation matrix is shown below:

Table 24

CORRELATION MATRIX - EXPECTATION AND IMPROVEMENT

Groups 1-6, 59-41=18 cases

	EXP	EVAL	IMP SCL...	IMP SCL...
EXP	1			
EVAL	,384	1		
IMP SCL 6WK	,361	,191	1	
IMP SCL 5 mo	,32	,054	,952 *	1

Note: 41 cases deleted with missing values.

* Better than $p < 0,01$. All others n.s.

The first interesting relationship was the relatively low correlation between improvement in SCL score at 6 weeks and subjective evaluation at that time ($r = 0,191$ n.s.).

Consideration of the other correlations in this table suggested that expectation may have been a predictor of subjective evaluation of the course at six weeks ($r = 0,384$, just missed borderline significance), and improvement in SCL score at 6 weeks ($r = 0,361$) and 5,5 months ($r = 0,32$, n.s.).

Improvement at 6 weeks was almost certainly a predictor of improvement at 5,5 months ($r = 0,952$). The significance of this correlation was better than $p < 0,01$, since r_{crit} for $p < 0,01 = 0,590$. This correlation would seem to be of great practical value to the trainer in the design of followup training and reinforcement.

A multiple regression analysis was therefore performed, treating improvement in SCL raw score at 5,5 months as the dependent variable. As shown by the tables below, the only significant regressor was improvement at six weeks (partial- $F=149,512$; $DF=1, 14$; $p < 0,0001$). In fact over 90% of the improvement at 5,5 months was predicted by this model (adjusted $R^2=0,907$):

Table 25
 MULTIPLE REGRESSION ANALYSIS - EXPECTATION AND
 IMPROVEMENT

Groups 1-6, 18 cases

ANOVA Table Partial-F values					
Source	df	Sum of Squares	Mean Square	F-Value	P-Value
EXP	1	9,999	9,999	,085	,7752
EVAL	1	360,490	360,490	3,057	,1023
IMP SCL 6WK	1	17630,333	17630,333	149,512	,0001
Residual	14	1650,870	117,919		

Dependent: IMP SCL 5 mo

Model Summary					
Dependent: IMP SCL 5 mo					
Count	18				
R	,961				
R-Squared	,924				
Adj. R-Squared	,907				
RMS Residual	10,859				
	df	Sum of Squares	Mean Square	F-Value	P-Value
Model	3	19970,074	6656,691	56,451	,0001
Error	14	1650,870	117,919		
Total	17	21620,944			

The next question of interest was whether or not management level, age group, sex and marital status had any effect on improvement in SCL at 5,5 months for those who had learned TM. At the same time the effect of regularity of practice and of initial SCL score were included as further possible confounding variables. Several of these nuisance variables were nominal variables (i.e., the factors level, age group, sex, marital status and regularity). Accordingly an

analysis of covariance was performed with five factors and two regressors, with the following results:

Table 26

FIVE FACTOR ANALYSIS OF COVARIANCE

Groups 1-5, 52-36=16 cases. Improvement in SCL at 5,5 months.

Factors: management level, age group, sex, marital status, and

regularity of practice at 5,5 months. Covariates (regressors):

expectation and SCL score at pretest.

ANOVA Table of Partial-F values					
Source	df	Sum of Squares	Mean Square	F-Value	P-Value
LEV	3	1196,016	398,672	1,999	,1781
SEX	1	111,915	111,915	,561	,4710
MAR	2	16,918	8,459	,042	,9586
EXP	1	37,037	37,037	,186	,6756
SCL-PRE	1	6803,435	6803,435	34,117	,0002
REG 5,5 M	3	548,307	182,769	,917	,4675
AGE GROUP	2	1292,626	646,313	3,241	,0822
Residual	10	1994,144	199,414		

Dependent: IMP SCL 5 mo

Model Summary		Residual Summary	
Dependent: IMP SCL 5 mo		Dependent: IMP SCL 5 mo	
Count	24	SS[e(i)-e(i-1)]	4243,379
R	,971	number >= 0	12
R-Squared	,943	number < 0	12
Adj. R-Squared	,868		
RMS Residual	14,121		

	df	Sum of Squares	Mean Square	F-Value	P-Value
Model	13	32805,481	2523,499	12,655	,0002
Error	10	1994,144	199,414		
Total	23	34799,625			

Consideration of the overall model summary suggested this model was a good predictor of SCL improvement at 5,5 months (adj $R^2=0,868$; $F=12,655$, $DF=13, 10$; $p<0,0002$).

SCL at pretest proved to be a significant effect. (Partial- $F=34,117$; $DF=1, 10$; $p<0,0002$). The only other effect to approach significance was age group.

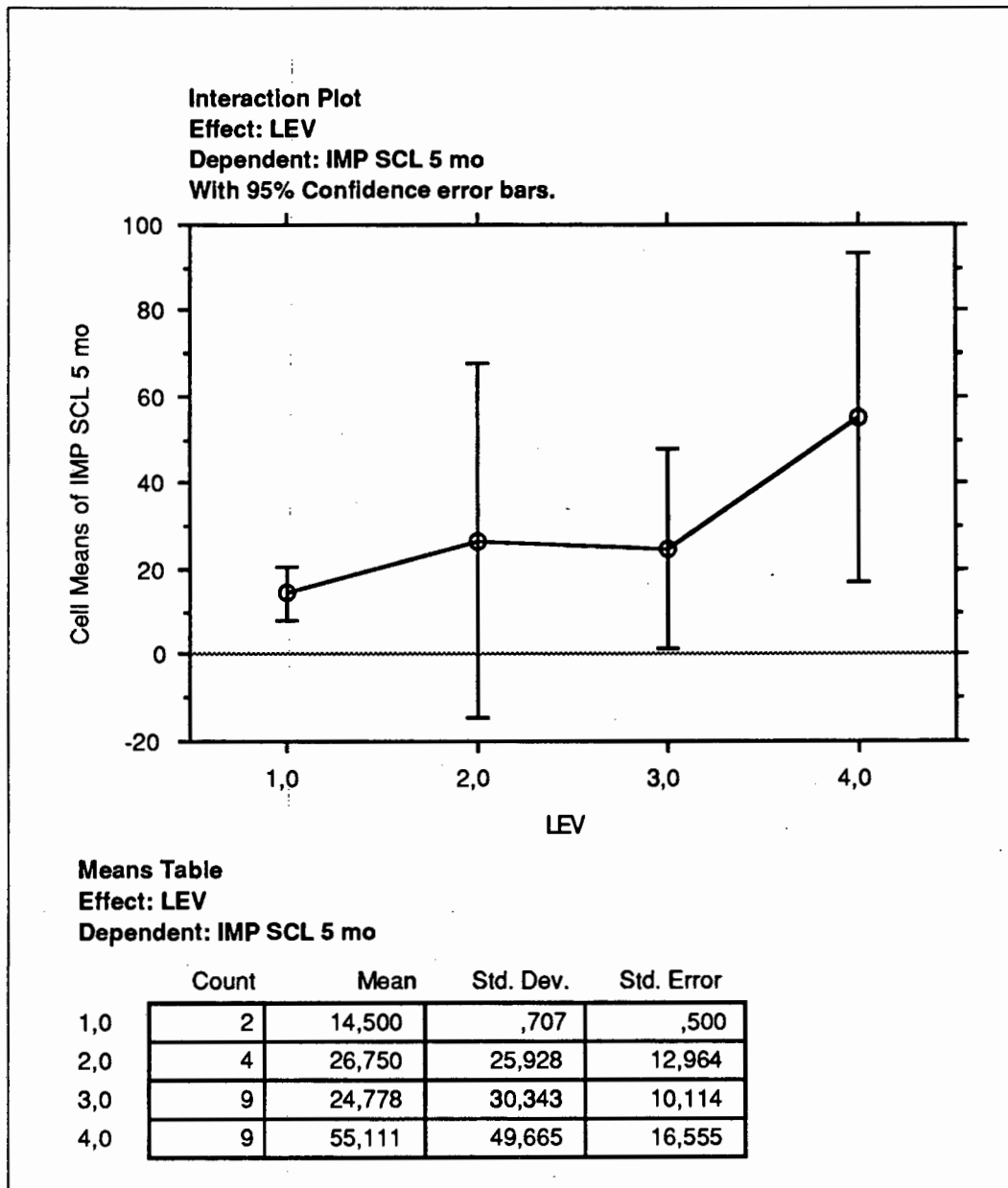
Despite lack of statistical significance of the factors of interest, interaction plots were then made for management level, age group and regularity of practice at 5,5 months posttest:

(see overleaf)

Figure 15

INTERACTION PLOT -MANAGEMENT LEVEL

Improvement in SCL at 5,5 months versus Management Level

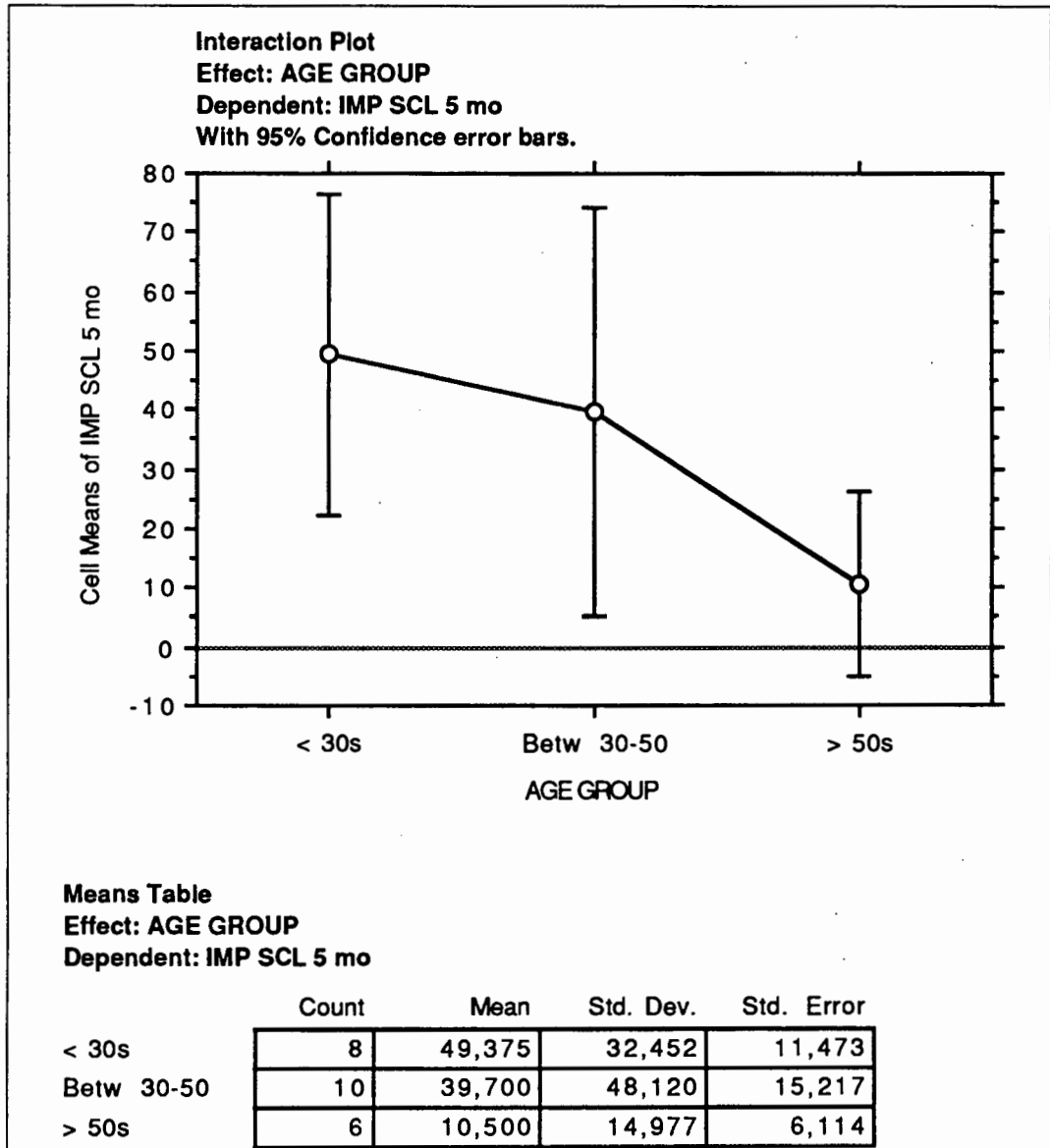


There appeared to be a tendency for greater improvement in SCL score at 5.5 month posttest for lower management levels. (level 1 was senior management, 2 - professional, 3 - supervisory, 4 - clerical).

Figure 16

INTERACTION PLOT - AGE

Improvement in SCL at 5,5 months versus Age group

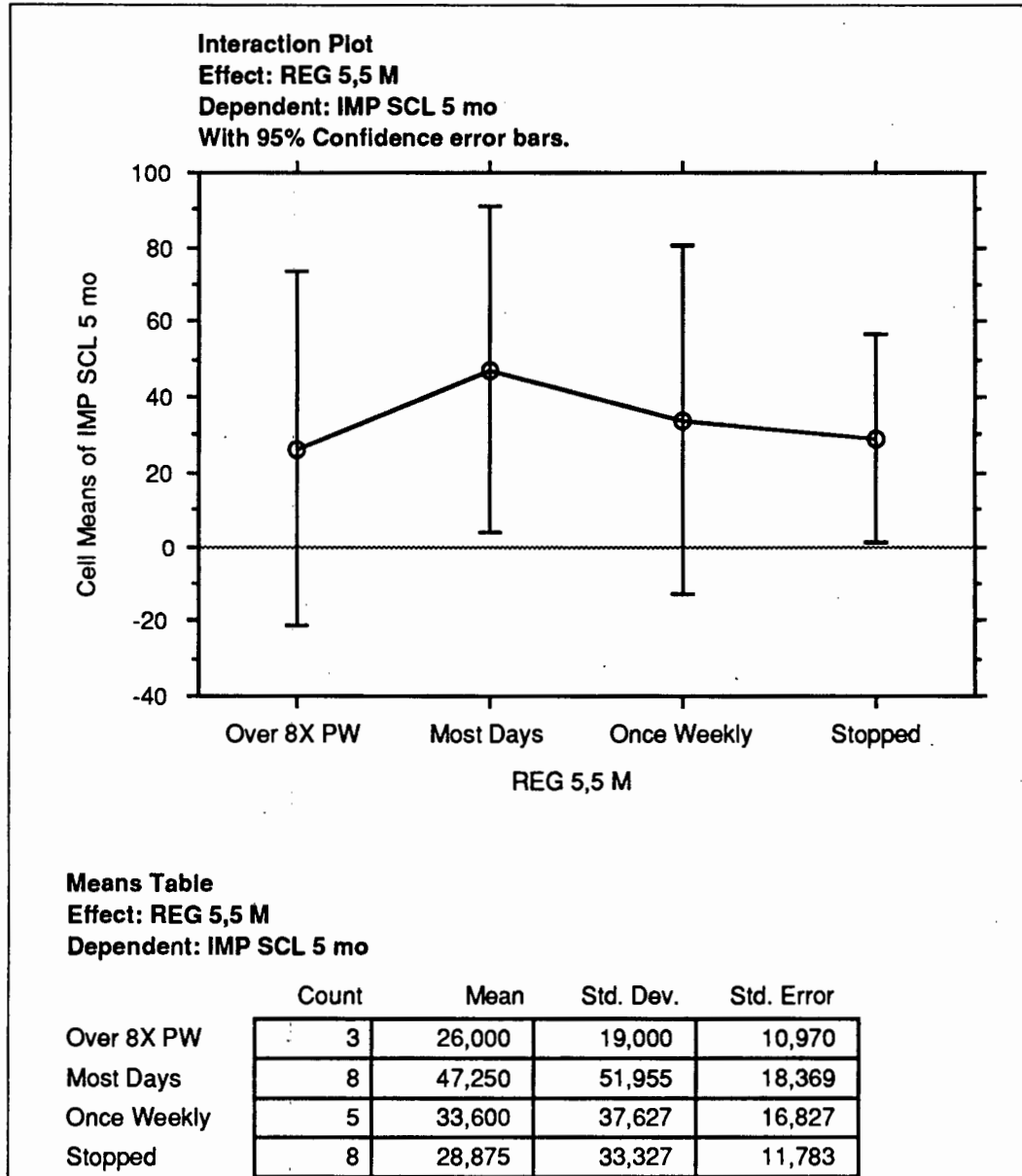


Greater improvement appeared to have taken place in the lower age groups.

Figure 17

INTERACTION PLOT - REGULARITY 5,5 MONTHS

Improvement in SCL at 5,5 months versus Regularity of Practice



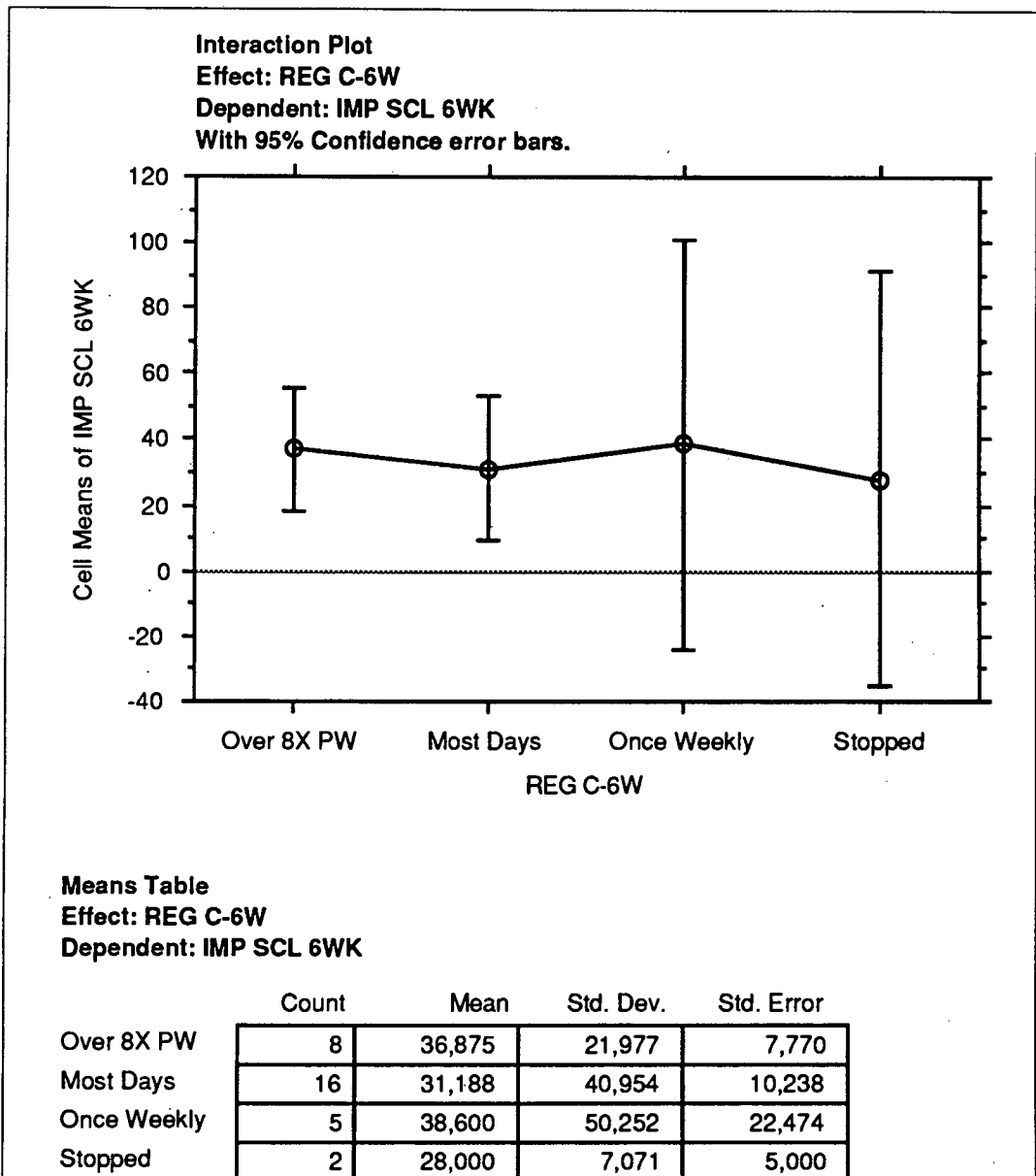
Previous research suggested that there should have been greater gains with greater regularity. Here the practiced-over-8 times-per week group showed less improvements than the stopped-practice group.

The same interaction plot for improvement versus regularity at 6 weeks had the following form:

Figure 18

INTERACTION PLOT - REGULARITY 6 WEEKS

Improvement in SCL at 6 weeks versus Regularity of Practice

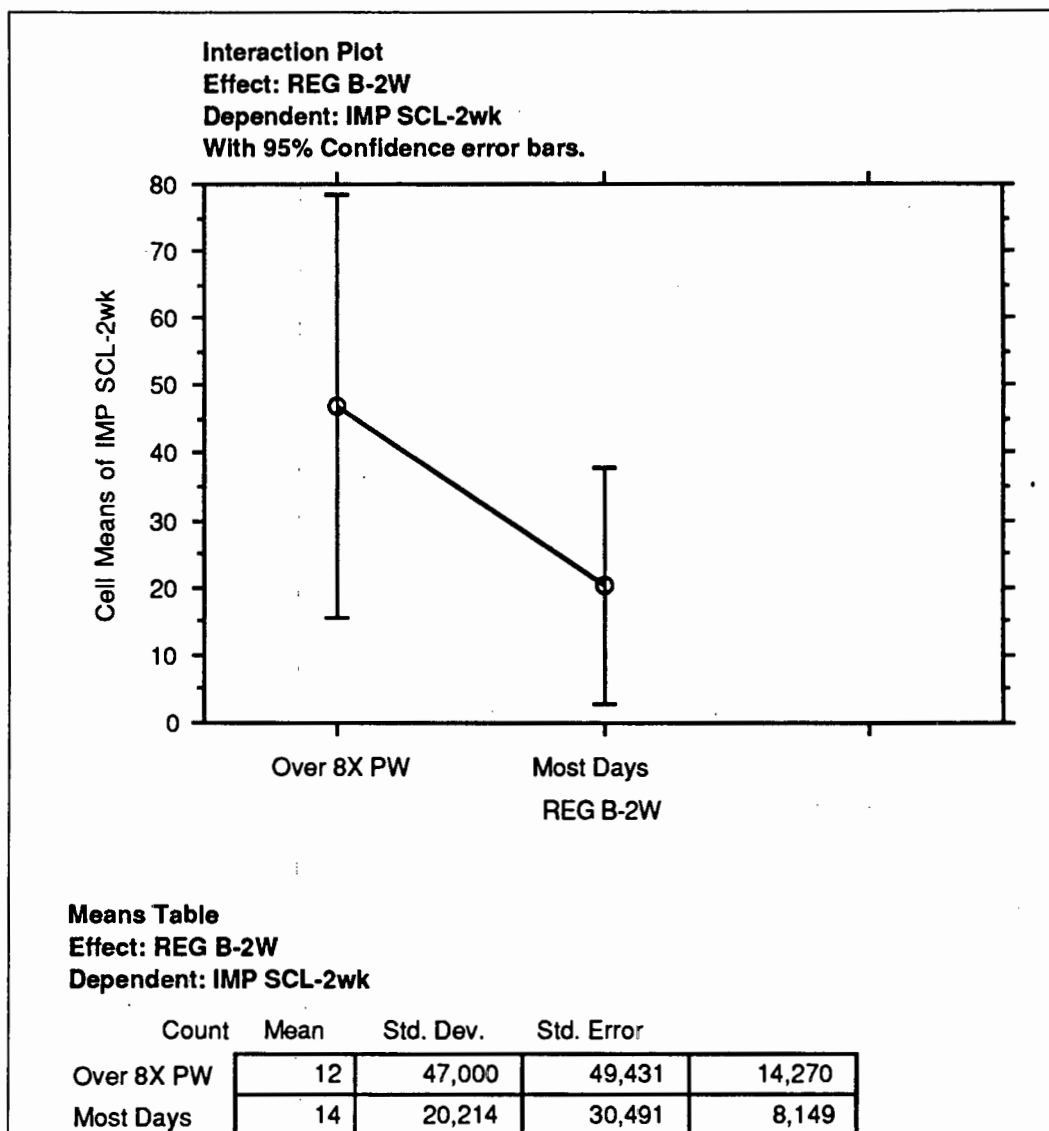


And for improvement versus regularity at 2 weeks posttest:

Figure 19

INTERACTION PLOT - REGULARITY 2 WEEKS

Improvement in SCL at 2 weeks versus Regularity of Practice



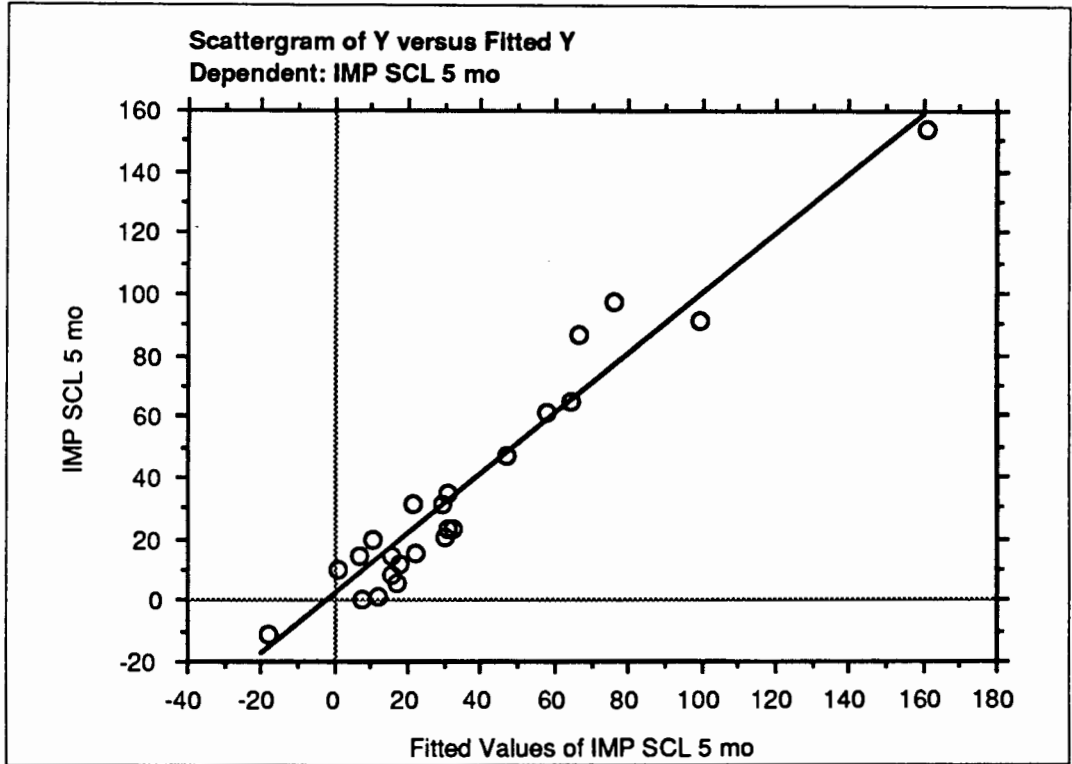
This plot suggested a clearer relationship between regularity of practice and reductions in stress levels. The usual tests⁶ for linearity were then performed:

⁶ As mentioned, the logic of these tests is presented in Appendix U.

Figure 20

SCATTERGRAM FOR IMPROVEMENT IN SCL

Improvement in SCL at 5,5 months against predicted improvement



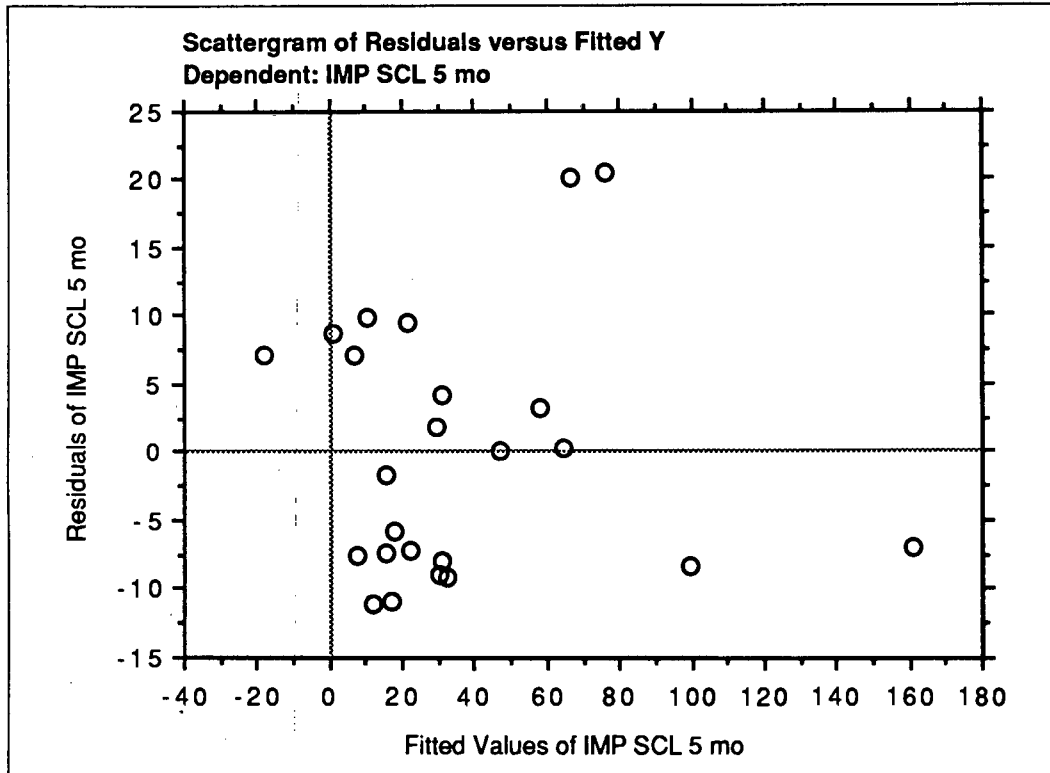
Calculated values for improvement presented a remarkable fit.

Proceeding to the plot of residuals:

Figure 21

SCATTERGRAM FOR RESIDUALS

Residuals against predicted improvement in SCL at 5,5 months



Residuals were fairly evenly spread across fitted values, supporting assumptions of linearity for the model.

A major defect in the foregoing analysis was attrition via row-wise deletion of cases where data series were incomplete. The following conclusions flowing out of the analysis can therefore only be regarded as tentative.

1. The overall model was a very efficient predictor of improvement in the dependent variable, with 93% of the variance in

improvement scores accounted for by the model ($F = 12,655$; $DF = 13, 10$; $P < 0,0002$).

2. SCL score at pretest was a significant predictor of improvement in SCL score at 5,5 months posttest (Partial- $F=34,117$; $DF=1, 10$; $p < 0,0002$).

3. No demographic variables reached significance although age group approached significance ($p < 0.08$) with greater improvements in younger groups.

4. Regularity at 5,5 months was not a significant effect in this model, nor in similar models constructed for 6 weeks and 2 weeks post-treatment. However the interaction plot drawn for the two week model clearly suggests increased improvement with greater regularity.

FAKING

According to Derogatis (1977):

In adult non-patient populations it has been our experience that males with a PST⁷ of 3 or less and females with a PST of 4 or less are often consciously denying symptoms in an effort to represent themselves as 'unemotional', 'stable', and 'well-integrated.'... Individuals with scores at or below these values have a high probability of having consciously attempted to minimise their symptomatic distress on the SCL-90-R (Derogatis, 1977: 36).

This study therefore rejected SCL scores associated with a positive symptom total ≤ 3 for males and ≤ 4 for females. During data analysis

⁷ PST = positive symptom total, i.e., number of questions scored 1 or greater.

it was noticed that there seemed to be a large number of questionnaires being rejected for this reason among the on-site controls. An analysis of SCL data points yielded the following table:

Table 27

WERE THE ON-SITE CONTROLS FAKING?

Analysis of SCL questionnaires rejected for "diminished" scores

Number of SCL-90-R Questionnaires			
	Total	Rejected	% Rejected
TM	152	15	9,9
PMR	58	6	10,3
On-site controls	28	6	21,4
Off-site controls	30	-	-

Consideration of the table above suggested the on-site control subjects may have been faking their questionnaire responses possibly in order to present the facade that "I don't need TM to reduce stress." Recall that this group appeared initially hostile to the introduction of TM into the company. Therefore SCL data from the on-site controls was interpreted with caution. This also confirmed the wisdom of having made unfakeable physiological measurements such as blood pressure simultaneously with the SCL measurements taken in the study.

The next question was whether the rejection (i.e., "faking") rate increased as the study progressed. Did subjects become bored with

repeated administration of the same questionnaire and resort to minimising their responses, perhaps in order to get through and back to work? Consideration of the table below suggested a tendency to increased rejection as the study progressed, suggesting a growing tendency to fake.

Table 28
WERE THE ON-SITE GROUPS FAKING?

Number of SCL-90-R Questionnaires			
	Total	Rejected	% Rejected
At first pretest	77	0	0
At second pretest	26	2	7,7
At two weeks	41	5	12,2
At six weeks	59	8	13,6
At 5,5 months	65	12	18,5

It is important to note that the rejection of diminished scores (at posttest only) would have had the effect of making the results presented here conservative, i.e., the results were reduced by excluding very low scores.

The analysis now turned to an examination of the subjective evaluations made at the 6-week followup and posttest points.

SUBJECTIVE EVALUATIONS

Subjective evaluations were analysed to establish further support or otherwise for hypotheses one (that experimental groups would show improvements over time) and two (that improvements would be greater for TM than for PMR). Subjective comments were collected at 6-weeks post treatment using a course evaluation questionnaire specially designed for this purpose (see Appendix L).

The first question of interest was whether TM and PMR subjects scores differed on the numerical evaluation of their "satisfaction with the course so far" at 6-weeks post-treatment. The answer to this was established in the negative by performing a one-factor ANOVA on the evaluation scores, using TM/PMR as the grouping factor. The results follow below:

Table 29

ANOVA TABLE FOR SUBJECTIVE EVALUATIONS

All TM (groups 1-4) and all PMR (groups 5-6) at 6-weeks post
treatment

ANOVA Table					
Source	df	Sum of Squares	Mean Square	F-Value	P-Value
TM/PMR	1	2,416	2,416	,749	,3926
Residual	35	112,828	3,224		

Dependent: EVAL

Means Table					
Effect: TM/PMR GROUP					
Dependent: EVAL					
	Count	Mean	Std. Dev.	Std. Error	
TM	29	7,621	1,781	,331	
PMR	8	7,000	1,852	,655	

An insignificant p-value led the analysis not to reject the null hypothesis that the evaluation scores were the same for both test groups.

The next step was to investigate the subjective comments. The responses are located in Appendix G.

These comments were analysed by percentage of responses reporting positively on each question. A tabulation of the responses follows:

Table 30

ANALYSIS OF SUBJECTIVE COMMENTS

All TM (groups 1-4) and all PMR (groups 5-6) at 6-weeks post
treatment—positive response to question on:

	Relation -ships	%	Product -ivity	%	satisfied	%	benefits	%	
TM	yes	16	59	17	63	11	92	23	100
	no	11	41	10	37	1	8	0	0
	total	27	100	27	100	12	100	23	100
PMR	yes	5	63	3	38	5	83	8	100
	no	3	38	5	63	1	17	0	0
	total	8	100	8	100	6	100	8	100

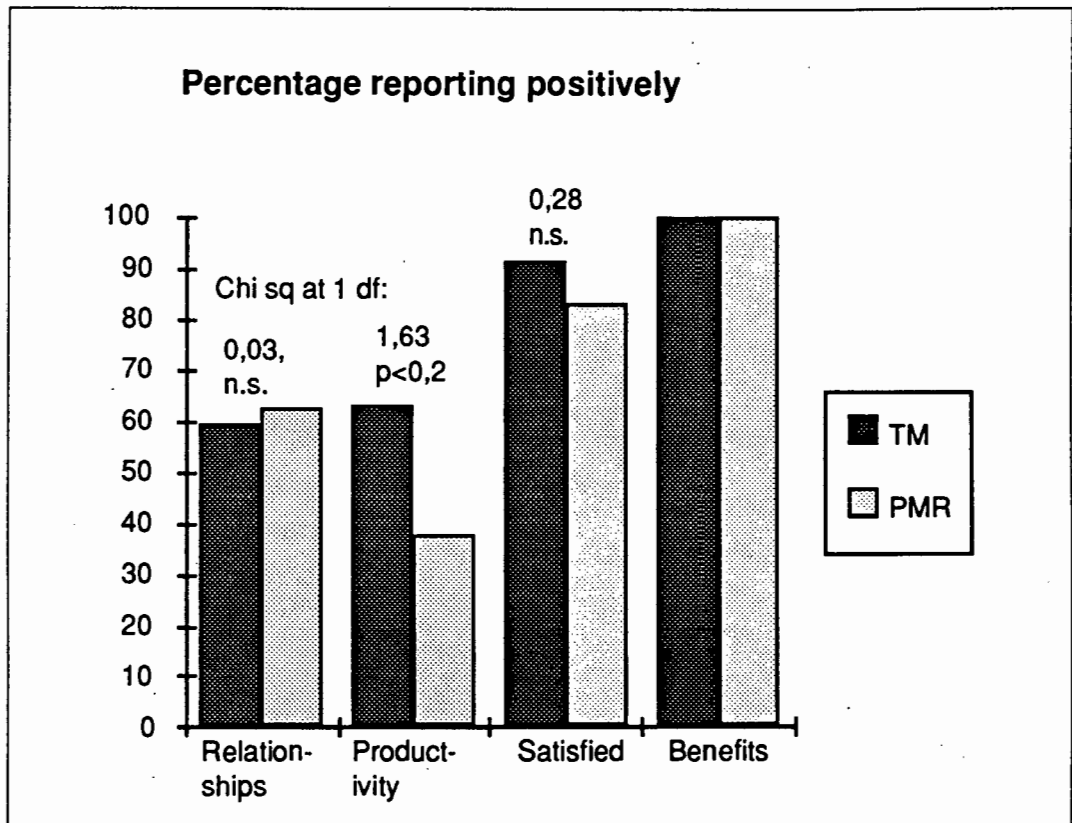
Plotting these percentages gave the following chart:

(see overleaf)

Figure 22

ANALYSIS OF SUBJECTIVE COMMENTS

All TM (groups 1-4) and all PMR (groups 5-6) at 6-weeks post treatment



As can be seen from the chart, the only near-significant difference between the TM and PMR groups was on responses to the productivity question. (Chi square calculations were performed by constructing a contingency table and testing it using StatView Student of Abacus Concepts, 1991).

The above analysis was then extended by tabulating the benefits named in response to the question on benefits, plus spontaneous comments following the satisfaction rating.

Seventy-one such comments on perceived benefits of the training were made by on-site subjects. The analysis classified comments into three categories in order to be able to assess whether the responses duplicated dimensions on the SCL-90-R or gave additional information. Of the 71 responses, 45 were classified as physiological/health/symptomatic improvement, 19 as psychological improvement and 7 as sociological/productivity improvement.

Analysing by response across TM and PMR gave the following contingency table:

Table 31

CONTINGENCY TABLE FOR TM VERSUS PMR RESPONSES

All TM (groups 1-4) and all PMR (groups 5-6) at 6-weeks post treatment—number of times benefit mentioned:

	TM	PMR	Totals:
Psychological benefits	15	4	19
Physiological/ health benefits	35	10	45
Sociological/productivity benefits	6	1	7
Totals:	56	15	71

Was the number of benefits mentioned for TM proportionally greater than for PMR? The following analysis suggests there were no significant differences between the TM and PMR groups on observed frequencies (StatView Student, 1991).

Table 32

CHI SQUARE ANALYSIS OF TM VERSUS PMR RESPONSES

All TM (groups 1-4) and all PMR (groups 5-6) at 6-weeks post treatment—number of times benefit mentioned:

Contingency Table Analysis	
	Summary Statistics
DF:	2
Total Chi-Square:	,229 p = ,8918
G Statistic:	,248
Contingency Coefficient:	,057
Cramer's V:	,057

The high p-value suggested an insignificant probability.

Considering both TM and PMR groups together, the most frequently mentioned benefit was "relaxation" and "calm", accounting for 16 out of 45 in this category.⁸ These benefits correspond to the SCL-90-R scales of somatisation and anxiety.

Unlike Carrington et al (1980), the next most-frequently mentioned benefit was "reduced tiredness", "increased energy" and "more alertness", with 11 out of 45 mentions of benefits in this category. The remainder of the physiological/health/symptomatic benefits included "reduced blood pressure" (3 mentions), "less headaches" (3), "sounder sleep" (2), and single mentions of

⁸ This was similar to Carrington et al's (1980) finding that relaxation and calm were the most frequently (30 out of 50) mentioned benefits of an intervention consisting of "clinically standardised meditation", the "respiratory one method" and PMR.

"improved health", "look younger", "feel great", "ulcer more under control", and "less pain."

The 19 mentions of psychological benefits included "more philosophical about life", "better outlook", "more objective", "more personal discipline", "more personal control", "more patient", "laugh easier", "more self-confident", "less worry", "more tolerant", "less irritable" and "I just love myself for me now."

The 7 mentions of improved sociology/productivity included "increased productivity-keeps me going", "reduced procrastination", "increased concentration" and "improved relationships." As can be seen from the contingency table above, only one comment in this category originated from the PMR group (improved relationships). However, this did not represent a significant difference between groups because of the smaller proportion of PMR subjects.

In conclusion, this analysis of subjective evaluations was broadly supportive of hypothesis one.

With respect to hypothesis two, that greater benefits would flow from TM training than from PMR, the results were not so clear. Although statistical relationships were not significant, the trend for TM improvements to exceed those for PMR—as seen in earlier analyses—was also seen here.

CONCLUDING ANALYSIS

At this point the analysis was finally ready to attempt an answer to the question of whether experimental groups differed significantly from controls at the end of the experimental period.

It had been established that the only nuisance variable of significance was SCL at pretest. Accordingly a one-factor analysis of covariance was performed for the effect of type of training on SCL posttest scores, including SCL score at pretest as the covariate. There were five levels of the independent variable: TM, TM+PMR, PMR only, on-site controls and off-site controls. Statistical control of nuisance variables is discussed by Winer (1962: 578-94), and the manual execution of this procedure is demonstrated by Kerlinger (1973: 648). The procedure below tested the significance of the differences between means after statistically controlling for the impact of the nuisance variable, or covariate, on the dependent or criterion variable, SCL score at 5,5 months posttest. Effectively it did this by subtracting the variance due to the covariate from the total variance accounted for by the regression of all dependent variables on the independent variable. According to Kerlinger (1973) the remaining variance may be tested using the relation:

$$F = \frac{(R^2_{All} - R^2_{co}) / (k_1 - k_2)}{(1 - R^2_{All}) / (N - k_1 - 1)}$$

where k_1 is the number of independent variables associated with R^2_{All} , the larger R^2 ; k_2 is the number of independent variables associated

with R^2_{∞} , the smaller R^2 ; and N is the total number of observations. (Kerlinger, 1973: 649).

As usual the analysis was performed here using SuperANOVA, giving the following table from which it was seen that the partial F value (corresponding with the above relation) for type of training was 2,81. This was significant with 4, 42 degrees of freedom and $p < 0,04$.

Table 33
ANCOVA ON SCL POSTTEST BY GROUP

All test groups: TM (groups 1-4 combined), PMR+TM (5), PMR only (6), on-site controls (7), plus off-site controls (8)

ANOVA Table Partial-F values					
Source	df	Sum of Squares	Mean Square	F-Value	P-Value
TYPE OF TRAINING	4	7897,087	1974,272	2,810	,0373
SCL-PRE	1	3755,289	3755,289	5,345	,0258
Residual	42	29507,127	702,551		

Dependent: SCL-5,5M

Model Summary
Dependent: SCL-5,5M

Count 48
R ,545
R-Squared ,297
Adj. R-Squared ,214
RMS Residual 26,506

	df	Sum of Squares	Mean Square	F-Value	P-Value
Model	5	12481,185	2496,237	3,553	,0091
Error	42	29507,127	702,551		
Total	47	41988,312			

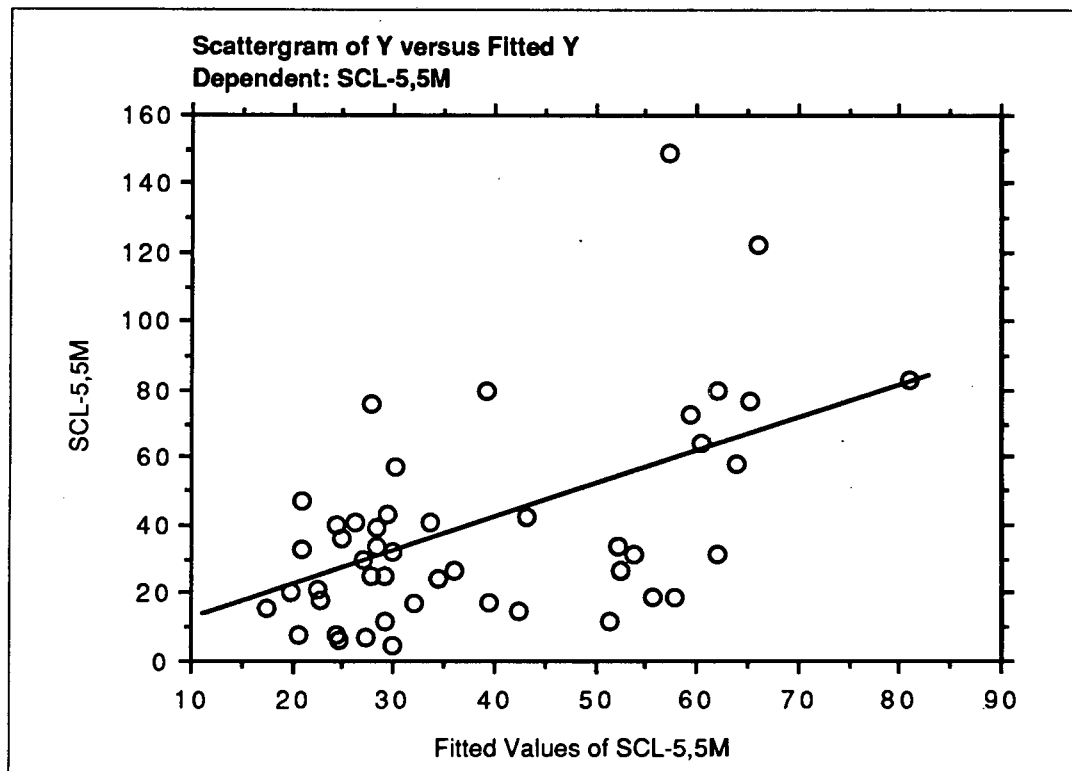
A reasonably large R^2 and significant F for the overall model ($F = 3,553$; $DF 5, 42$; $p < 0,0091$) suggested the model was significant with type of training representing a significant effect ($p < 0,0373$).

A visual check of the relationship between actual and fitted values of the dependent variable was then performed. Plotting these means yielded the following chart:

Figure 23

SCATTERGRAM OF SCL POSTTEST-ACTUAL versus FITTED

All test groups: TM (groups 1-4 combined), PMR+TM (5), PMR only (6), on-site controls (7), plus off-site controls (8)



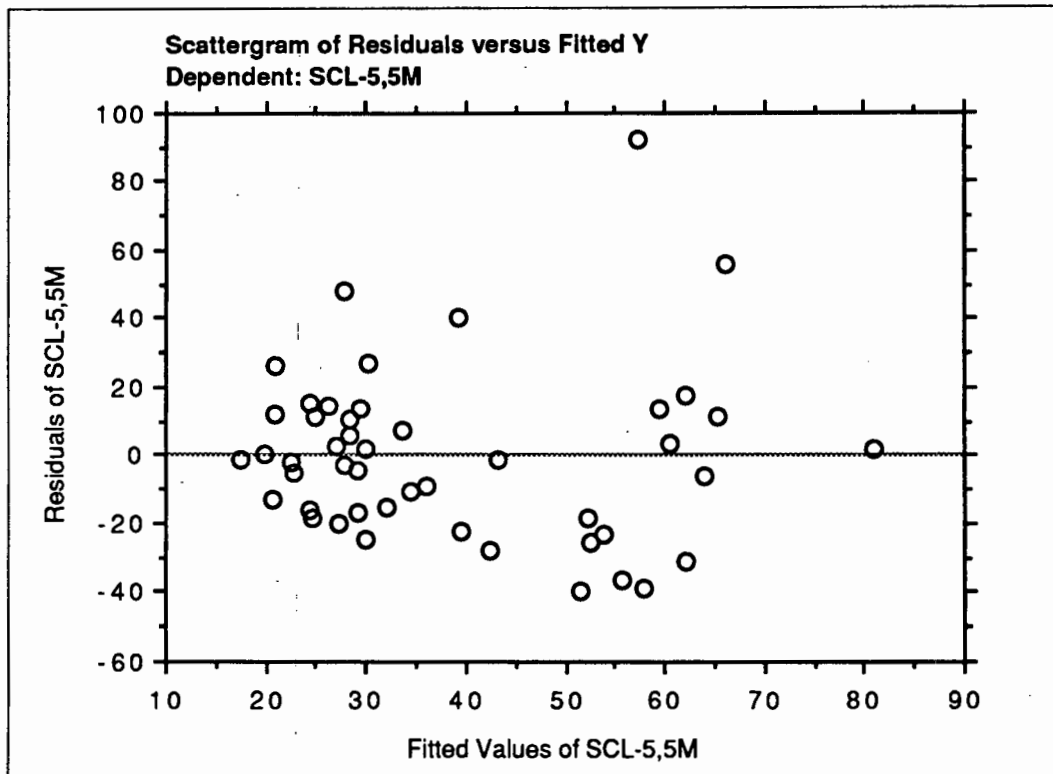
With the exception of one outlier, there appeared to be no substantial challenge to the usual assumptions of linearity. Before

proceeding to examine group means, residuals were plotted against values of the dependent variable:

Figure 24

SCATTERGRAM OF SCL POSTTEST-RESIDUALS versus FITTED VALUES

All test groups: TM (groups 1-4 combined), PMR+TM (5), PMR only (6), on-site controls (7), plus off-site controls (8)



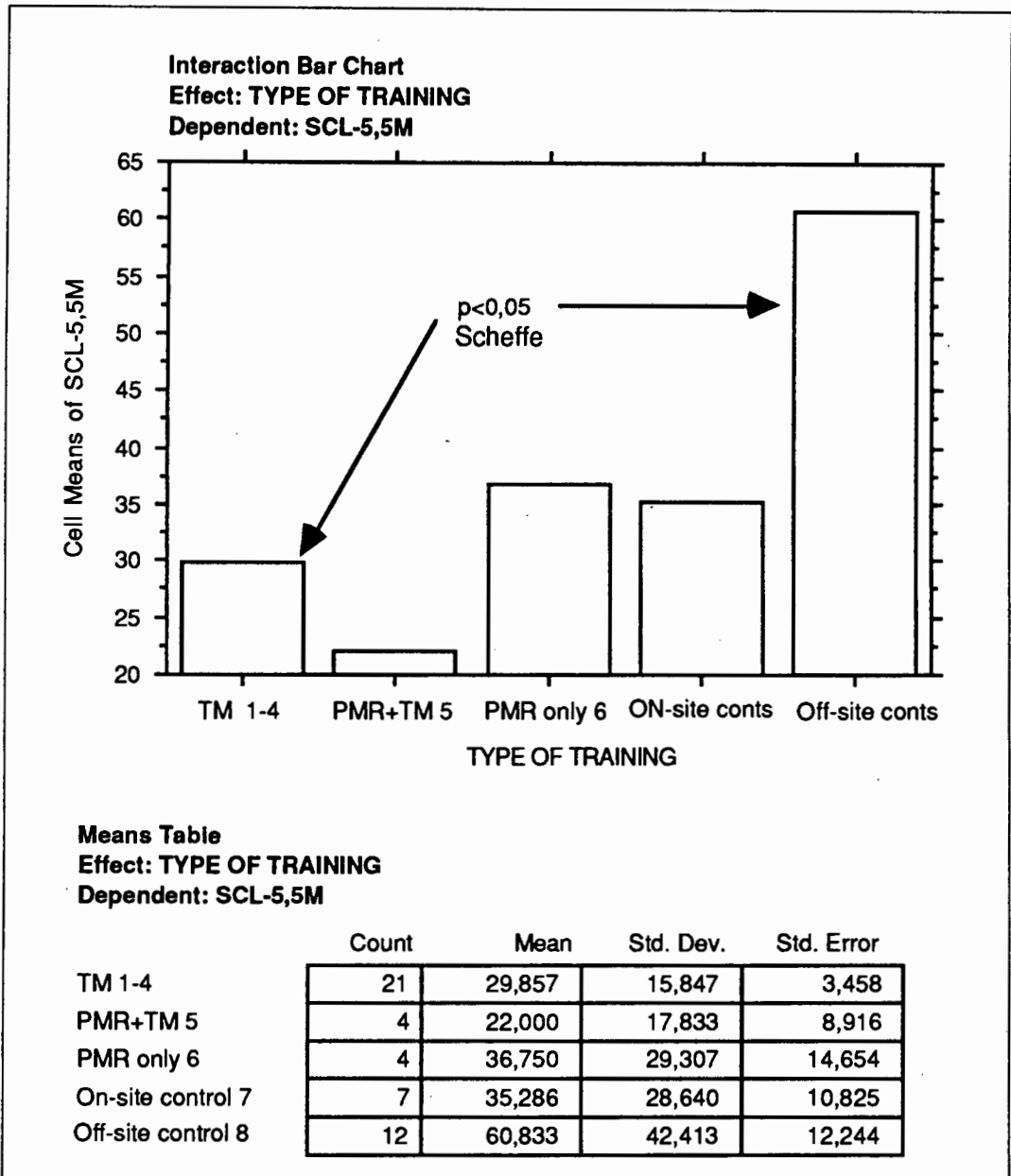
The cone shape suggested by the plot was considered not sufficiently well-developed to warrant transformation of the independent variable and re-analysis.

Accordingly the analysis proceeded to examine group means:

Figure 25

BAR CHART OF SCL GROUP MEANS AT POSTTEST

All test groups: TM (groups 1-4 combined), PMR+TM (5), PMR only (6), on-site controls (7), plus off-site controls (8)



Off-site controls appeared to have an SCL mean score very different from the TM groups. The analysis therefore proceeded to the

question of which cell means differed significantly from one another. According to Abacus Concepts (1989: 206) the Games-Howell post-hoc procedure is one of the more useful recently (1976) developed multiple comparison procedures. However it requires each cell sample size (n) to be at least 6—and two groups above had only $n = 4$.

Scheffe's S procedure is known to be robust to violations of assumptions of normality and homogeneity of variance (Abacus Concepts, 1989; Huysamen, 1981). It is furthermore relatively conservative and does not require cell n to be ≥ 6 , so it was chosen for use here.

Using Scheffe's post-hoc procedure to evaluate the results on a pairwise basis, there was a significant difference between the off-site control group mean and the mean of the combined TM group ($p < 0.0491$). The analysis is shown below:

Table 34

SHEFFE'S POST-HOC COMPARISON OF SCL MEANS AT POSTTEST

All test groups: TM (groups 1-4 combined), PMR+TM (5), PMR only (6), on-site controls (7), plus off-site controls (8)

Scheffe's S				
Effect: TYPE OF TRAINING				
Dependent: SCL-5,5M				
Significance level: ,05				
	Vs.	Diff.	Crit. diff.	P-Value
PMR+TM 5	TM 1-4	7,857	46,581	,9897
	On-s control 7	13,286	53,517	,9574
	PMR only 6	14,750	60,376	,9598
	Off-site control 8	38,833	49,296	,1896
TM 1-4	On-s control 7	5,429	37,265	,9941
	PMR only 6	6,893	46,581	,9938
	Off-site control 8	30,976	30,898	,0491
On-s control 7	PMR only 6	1,464	53,517	1,0000
	Off-site control 8	25,548	40,608	,4046
PMR only 6	Off-site control 8	24,083	49,296	,6513

S

S = Significantly different at this level.

The off-site group mean was significantly different to the TM groups.

Dunnett's post-hoc procedure for comparing a control to all other means can be used as a more powerful one-tailed test (Abacus Concepts, 1989: 212). Using this procedure, the PMR+TM mean was also found to be significantly different from the off-site controls at the 5% significance level as shown below:

Table 35
DUNNETT'S POST-HOC COMPARISON OF SCL MEANS AT
POSTTEST

All test groups: TM (groups 1-4 combined), PMR+TM (5), PMR only
(6), on-site controls (7), plus off-site controls (8)

Dunnett One-Tailed: mean < control				
Effect: TYPE OF TRAINING				
Dependent: SCL-5,5M				
Significance level: ,05				
	Vs.	Diff.	Crit. diff.	
Off-site control 8	PMR+TM 5	-38,833	34,095	S
	TM 1-4	-30,976	21,370	S
	On-site control 7	-25,548	28,086	
	PMR only 6	-24,083	34,095	
S = Significantly different at this level.				

These outcomes suggested support for hypothesis one that there would be a significant effect due to the experimental intervention.

The Dunnett test further suggested a near-significant difference between the on-site and off-site controls at 5,5 month posttest, suggesting that on-site controls had also shown improvement and thereby support for hypothesis four. However the small sizes of the non-TM groups and the suggestion that faking may have influenced SCL results for the on-site controls had to be weighed before drawing firm conclusions from the analysis.

Before proceeding with other elements of the analysis, consideration of the table above prompted a question regarding interaction between the type of training and initial SCL main effects. Did SCL at pretest influence SCL posttest scores differently, depending

on the treatment group? The answer to this was negative as shown by the ANOVA table below, constructed by including the interaction factor in the analysis.

Table 36
ANCOVA ON SCL POSTTEST BY GROUP

All test groups: TM , PMR+TM, PMR only, on-site controls, plus off-site controls—with interaction factor added

ANOVA Table of Partial-Fs					
Source	df	Sum of Squares	Mean Square	F-Value	P-Value
TYPE OF TRAINING	4	346,260	86,565	,118	,9751
SCL-PRE	1	390,985	390,985	,535	,4690
SCL-PRE * TYPE OF TRA...	4	1733,630	433,407	,593	,6698
Residual	38	27773,498	730,882		

Dependent: SCL-5,5M

As may be seen, an insignificant p-value is associated with the partial-F for the interaction factor.

The analysis now turned to the second part of hypothesis one, that there would be an experimental effect increasing over time. This question was approached by constructing a repeated-measures analysis of variance model with SuperANOVA (Abacus Concepts, 1989) using SCL data at pretest, 6-week and 5,5-month posttest. The questions of interest here were: 1. whether or not the test scores (averaged over treatments) changed over time, and 2. whether or not the pattern of change over time was the same for the different treatments.

The ANOVA table for the analysis is shown below:

Table 37

REPEATED MEASURES ANOVA—SCL SCORES

Test groups only - TM (1-4), PMR/TM (5), PMR only (6)

ANOVA Tables of partial Fs							
Source	df	Sum of Squares	Mean Square	F-Value	P-Value	G-G	H-F
TRAIN TYPE	2	3461,932	1730,966	1,279	,2967		
Subject(Group)	24	32493,056	1353,877				
TIME	2	7539,766	3769,883	7,039	,0021	,0109	,0088
TIME * TRAIN TYPE	4	227,462	56,866	,106	,9798	,9189	,9330
TIME * Subj(Group)	48	25707,921	535,582				

Dependent: SCL SCORES

Table of Epsilon Factors for df Adjustment		
Dependent: SCL SCORES		
	G-G Epsilon	H-F Epsilon
TIME	,563	,621

The only significant main effect appeared to be that of time ($p < 0,0021$). According to Abacus Concepts (1989), the table indicates two adjustments for p-value based on the extent to which the correlation of observations violates the validity of the p-values for univariate repeated measures hypothesis tests. Examination of the table showed that the Greenhouse-Geisser (G-G) and Hunyh-Feldt (H-F) adjusted probability values were both significant at $P < 0,0109$ and $0,0088$ respectively. On this basis the null hypothesis that there was no training effect over time could confidently be rejected.

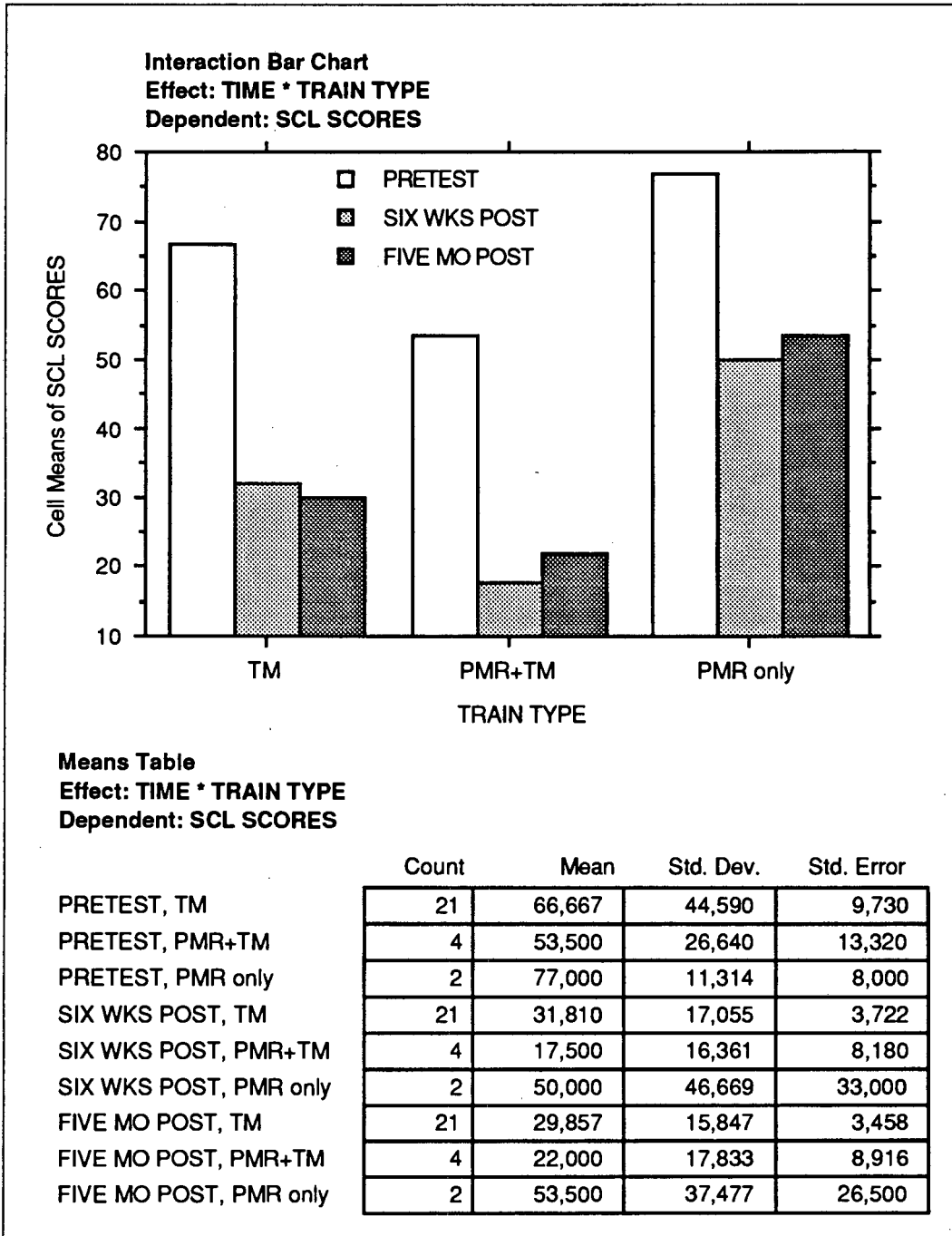
The fact that the effect of training type was not significant was not surprising, given that the test included pretest scores which had already been shown to be the same for all groups.

Plotting the cell means for the three treatments at three measurement points in time yielded the following chart.

Figure 26

BAR CHART OF SCL-90-R SCORES—IMPROVEMENT OVER TIME

Test groups only - TM (1-4), PMR/TM (5), PMR only (6)



SCL score was clearly seen to improve over time in the case of the TM groups. This tendency was not so clear in the other groups, but no conclusions may be drawn because of the small group sizes involved.

This analysis was repeated with the physiological stress parameters: SBP, DBP, HR and BR: First SBP—excluding from the analysis any subject with an initial SBP of less than 98 mmHg. As with the above analysis group 7 was excluded at this stage because no 6-week posttest measurements were made on physiological stress parameters. As the tables show, no significant effects or interactions were found.

The four ANOVA tables follow in a group, each with its corresponding bar chart—for test groups only—TM (1-4), PMR+TM (5), PMR only (6). Because each composite table fills a page, all four table headings are set out below, followed by the tables themselves.

Table 38

REPEATED MEASURES ANOVA—SYSTOLIC BLOOD PRESSURE
SCORES OVER TIME

Table 39

REPEATED MEASURES ANOVA—DIASTOLIC BLOOD PRESSURE
SCORES OVER TIME

Table 40

REPEATED MEASURES ANOVA—HEART RATE SCORES OVER
TIME

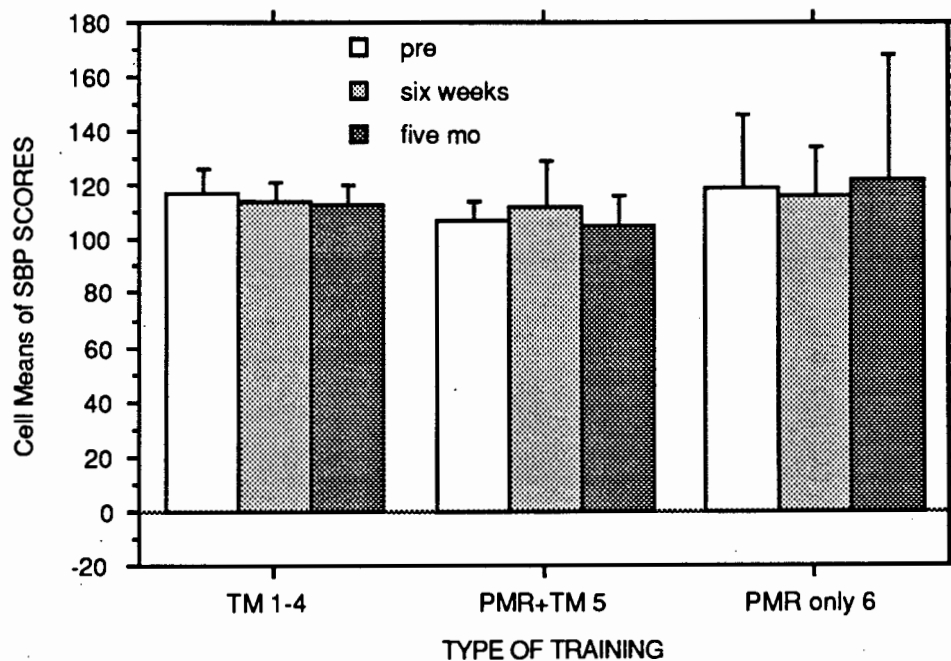
Table 41

REPEATED MEASURES ANOVA—BREATH RATE SCORES OVER
TIME

Table 38. Systolic Blood Pressure**ANOVA Table of partial Fs**

Source	df	Sum of Squares	Mean Square	F-Value	P-Value
TYPE OF TRAINING	2	664,263	332,131	,564	,5766
Subject(Group)	23	13546,392	588,974		
TIME.	2	2,454	1,227	,028	,9726
TIME. * TYPE OF TRAINI...	4	245,795	61,449	1,392	,2514
TIME. * Subject(Group)	46	2030,018	44,131		

Dependent: SBP SCORES

Interaction Bar Chart**Effect: TIME. * TYPE OF TRAINING****Dependent: SBP SCORES****With 95% Confidence error bars.****Means Table****Effect: TIME. * TYPE OF TRAINING****Dependent: SBP SCORES**

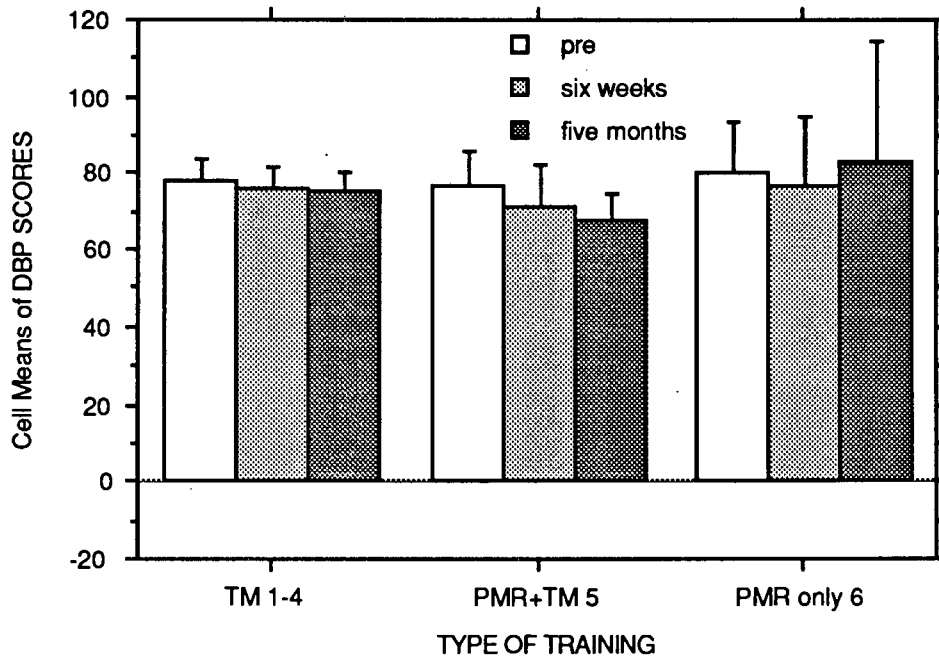
	Count	Mean	Std. Dev.	Std. Error
pre, TM 1-4	19	117,526	17,907	4,108
pre, PMR+TM 5	4	107,080	4,787	2,394
pre, PMR only 6	3	118,890	11,094	6,405
six weeks, TM 1-4	19	113,938	16,022	3,676
six weeks, PMR+TM 5	4	112,500	10,230	5,115
six weeks, PMR only 6	3	116,667	7,268	4,196
five mo, TM 1-4	19	113,193	14,219	3,262
five mo, PMR+TM 5	4	105,835	6,735	3,368
five mo, PMR only 6	3	122,780	18,357	10,599

Table 39. Diastolic Blood Pressure

ANOVA Table Source	df	Sum of Squares	Mean Square	F-Value	P-Value
TYPE OF TRAINING	2	354,234	177,117	,747	,4850
Subject(Group)	23	5453,910	237,127		
TIME..	2	140,156	70,078	1,811	,1749
TIME.. * TYPE OF TRAIN...	4	152,801	38,200	,987	,4239
TIME.. * Subject(Group)	46	1779,579	38,686		

Dependent: DBP SCORES

Interaction Bar Chart
 Effect: TIME.. * TYPE OF TRAINING
 Dependent: DBP SCORES
 With 95% Confidence error bars.



Means Table
 Effect: TIME.. * TYPE OF TRAINING
 Dependent: DBP SCORES

	Count	Mean	Std. Dev.	Std. Error
pre, TM 1-4	19	78,509	10,613	2,435
pre, PMR+TM 5	4	77,083	5,505	2,753
pre, PMR only 6	3	80,557	5,359	3,094
six weeks, TM 1-4	19	75,965	11,698	2,684
six weeks, PMR+TM 5	4	71,250	6,986	3,493
six weeks, PMR only 6	3	76,667	7,264	4,194
five months, TM 1-4	19	75,175	10,451	2,398
five months, PMR+TM 5	4	67,497	4,409	2,204
five months, PMR only 6	3	82,777	12,622	7,287

Table 40. Heart Rate

ANOVA Table

Source	df	Sum of Squares	Mean Square	F-Value	P-Value
TYPE OF TRAINING	2	125,391	62,695	,174	,8412
Subject(Group)	23	8276,263	359,838		
TIME...	2	101,143	50,571	,569	,5702
TIME... * TYPE OF TRAI...	4	216,242	54,060	,608	,6590
TIME... * Subject(Group)	46	4090,912	88,933		

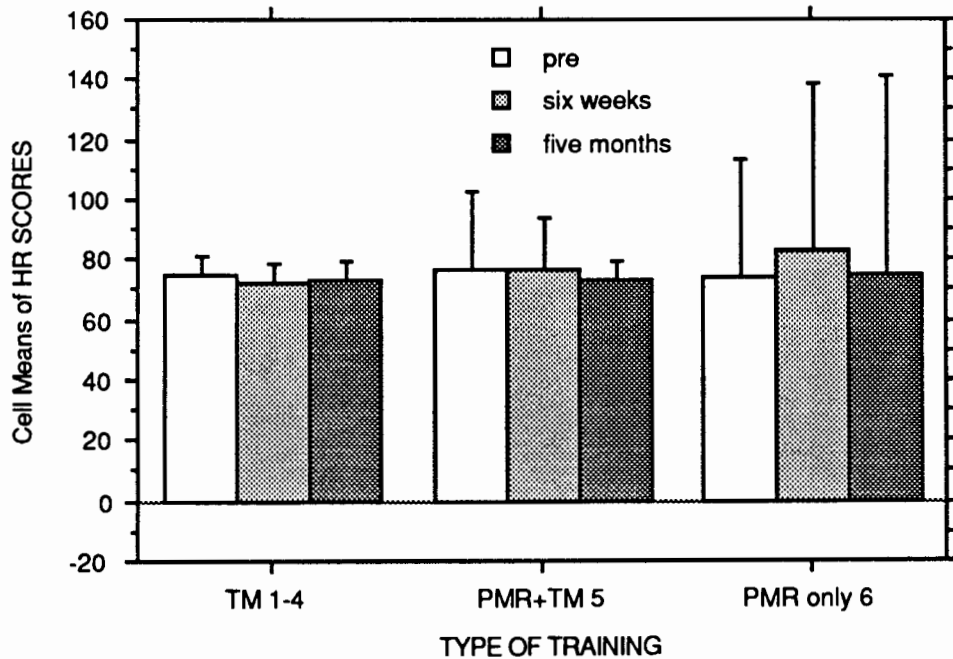
Dependent: HR SCORES

Interaction Bar Chart

Effect: TIME... * TYPE OF TRAINING

Dependent: HR SCORES

With 95% Confidence error bars.



Means Table

Effect: TIME... * TYPE OF TRAINING

Dependent: HR SCORES

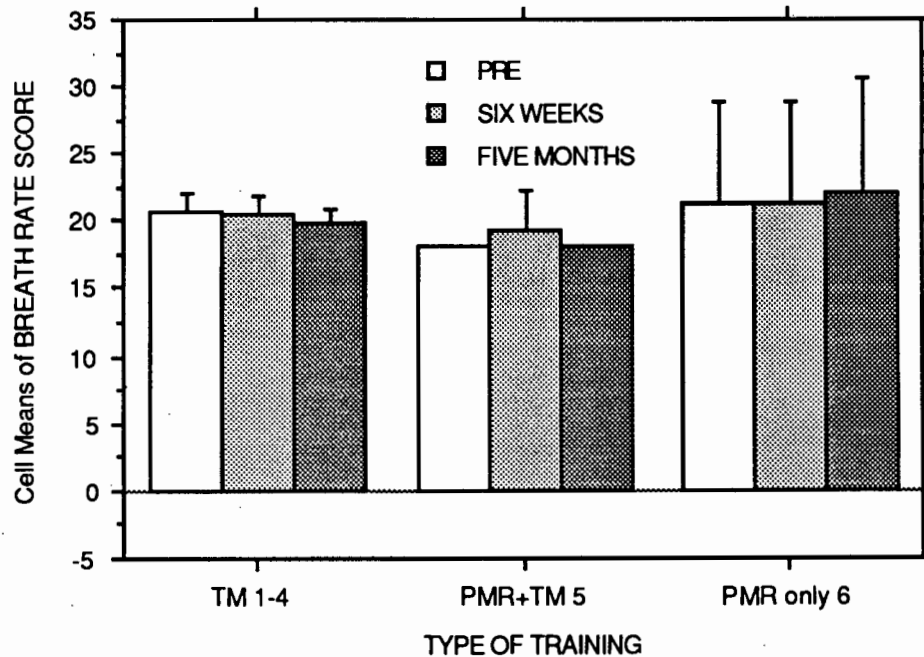
	Count	Mean	Std. Dev.	Std. Error
pre, TM 1-4	19	74,737	12,635	2,899
pre, PMR+TM 5	4	77,000	16,125	8,062
pre, PMR only 6	3	74,000	15,875	9,165
six weeks, TM 1-4	19	72,632	11,548	2,649
six weeks, PMR+TM 5	4	76,500	10,630	5,315
six weeks, PMR only 6	3	83,333	22,301	12,875
five months, TM 1-4	19	73,526	12,937	2,968
five months, PMR+TM 5	4	73,000	3,830	1,915
five months, PMR only 6	3	74,667	26,633	15,377

ANOVA Table **Table 41. Breath Rate**

Source	df	Sum of Squares	Mean Square	F-Value	P-Value
TYPE OF TRAINING	2	44,865	22,433	2,083	,1508
Subject(Group)	20	215,425	10,771		
TIME....	2	1,403	,702	,177	,8386
TIME.... * TYPE OF TRAI...	4	5,713	1,428	,360	,8355
TIME.... * Subject(Group)	40	158,693	3,967		

Dependent: BREATH RATE SCORE

Interaction Bar Chart
Effect: TIME.... * TYPE OF TRAINING
Dependent: BREATH RATE SCORE
With 95% Confidence error bars.



Means Table
Effect: TIME.... * TYPE OF TRAINING
Dependent: BREATH RATE SCORE

	Count	Mean	Std. Dev.	Std. Error
PRE, TM 1-4	17	20,588	2,895	,702
PRE, PMR+TM 5	3	18,000	0,000	0,000
PRE, PMR only 6	3	21,333	3,055	1,764
SIX WEEKS, TM 1-4	17	20,471	2,601	,631
SIX WEEKS, PMR+TM 5	3	19,333	1,155	,667
SIX WEEKS, PMR only 6	3	21,333	3,055	1,764
FIVE MONTHS, TM 1-4	17	19,882	2,058	,499
FIVE MONTHS, PMR+TM 5	3	18,000	0,000	0,000
FIVE MONTHS, PMR only 6	3	22,000	3,464	2,000

Having noted the lack of main effects or interactions, it was concluded that the second part of hypothesis 1 was not strongly supported by the physiological data. However a trend of increasing size of improvements was clearly visible over time for the TM groups in each chart.

This brought the analysis to two final questions. Firstly, was the pilot TM group mean different from the on-site TM group at the 2-week posttest—i.e., did self selection make any difference? This was resolved in the usual way by performing a one-factor analysis of variance on the two week SCL scores, using initial test scores as the covariate as shown below:

Table 42
 ANCOVA ON SCL SCORES AT TWO WEEK POSTTEST
 On-site TM (groups 1-4) versus Pilot TM group (9)

ANOVA Table					
Source	df	Sum of Squares	Mean Square	F-Value	P-Value
TM GROUP	1	143,642	143,642	,230	,6347
SCL-PRE	1	18721,196	18721,196	29,927	,0001
Residual	36	22520,381	625,566		

Dependent: SCL-2WK

Model Summary					
Dependent: SCL-2WK					
Count	39				
R	,682				
R-Squared	,465				
Adj. R-Squared	,436				
RMS Residual	25,011				
	df	Sum of Squares	Mean Square	F-Value	P-Value
Model	2	19594,542	9797,271	15,661	,0001
Error	36	22520,381	625,566		
Total	38	42114,923			

Although the overall model was an efficient predictor of SCL at two weeks, TM group proved to be a non-significant effect. Accordingly the null hypothesis that the groups were equivalent at 2-week posttest failed to be rejected.

The second and final question was: was there any significant difference between the on-site TM group and long-term TM group mean at the 5,5 month posttest? This was resolved by performing a one-factor analysis of variance on the 5,5 month SCL scores, but

without using initial test scores as the covariate, as none were available for the long-term TM group:

Table 43
ANOVA ON SCL SCORES AT 5,5 MONTH POSTTEST
On-site TM (groups 1-4) versus long-term TM group (9)

ANOVA Table					
Source	df	Sum of Squares	Mean Square	F-Value	P-Value
TM GRP	1	996,128	996,128	1,922	,1735
Residual	39	20211,433	518,242		

Dependent: SCL-5,5M

Model Summary					
Dependent: SCL-5,5M					
Count	41				
R	,217				
R-Squared	,047				
Adj. R-Squared	,023				
RMS Residual	22,765				
	df	Sum of Squares	Mean Square	F-Value	P-Value
Model	1	996,128	996,128	1,922	,1735
Error	39	20211,433	518,242		
Total	40	21207,561			

Means Table				
Effect: TM GRP				
Dependent: SCL-5,5M				
	Count	Mean	Std. Dev.	Std. Error
ON-SITE TM	26	30,500	16,707	3,277
LONG TERM TM	15	40,733	30,744	7,938

There was no significant main effect. The analysis accordingly failed to reject the null hypothesis. There was no significant difference

between the on-site and long-term TM groups at 5,5 month posttest on SCL-90-R score means.

This concluded the statistical analysis of the data.

QUALITATIVE EVALUATION AT THREE-YEAR FOLLOWUP

Having analysed these findings and discussed them with management, three years passed, during which two further followup meetings were held with programme participants. Positive comments made at these meetings prompted further questions about the long-term outcome of the intervention at the company level of analysis. Management's continued positive disposition toward the researcher made it possible to seek answers to these new questions.

Accordingly, structured interviews were conducted with a sample of seven respondents at the survey company and, in addition, two respondents at a second company. Staff interviewed at the survey company were the Chief Executive, Deputy Managing Director, Administration Manager, Data Processing Manager, Marketing Director, Financial Manager and Information Services Manager. At the second company, the staff interviewed were the Advertising Liaison Co-ordinator (a partner) and the Creative Director. The second company was a small advertising agency employing about 10 staff, 8 of whom had learnt TM through a TM centre a year previous to the interview.

The quantitative results discussed earlier suggested an affirmative answer to the general research question—was TM effective in reducing stress? Interviews were then structured to broaden this finding and to extend the question by asking—what happened to the company as a whole following the intervention? Did organisational effectiveness improve? Did the health of the company improve? Did the company grow and prosper?

Answers to structured interview questions also suggested an affirmative answer, though causality was not addressed. From the responses it was clear that training in TM was followed by positive outcomes at both organisations surveyed. It was also clear that interviewees were in some cases very unwilling to ascribe the improvements to TM.

The first question was designed to extend the quantitative findings by asking interviewees what benefits had been noticed from TM practice. Seven of the nine respondents claimed TM was beneficial, mentioning specific benefits such as "releasing stress", "calming yourself down", "better reactions to people", "getting less uptight", "easier to live with", "getting through the aftermath of a fall", "being more patient", "being refreshed", "circumstances coming to feel less stressful", "feeling better", "life working better and in subtle ways", "improved general sense of well being", and "helped work."

Respondents were asked whether they had noticed any changes in their work life. Six of the nine respondents mentioned improvements in work life ranging across "handling a huge workload", "doing

wonderful things", "being more patient", "getting the energy to go on", "operate more efficiently", and "enhanced creativity."

Asked specifically whether they had noticed any improvement in personal productivity, three respondents mentioned gains such as "mellowing out", "calming down", "less checking of work is necessary", and "possibly some slight enhancement of creativity both in terms of ideas and graphics." Asked whether they had noticed any changes in colleagues since they learnt TM, seven of the nine respondents mentioned improvements including health, "helping to handle pressure", "making you more alert", "quite laid back", "doing things in a quiet way without rushing around so much", "a better atmosphere", "cameraderie", "handling stress better" and "slightly more relaxed."

Asking respondents whether they had noticed any change in productivity or output elicited positive responses in four out of the nine respondents. Positive comments included: "different atmosphere and better productivity", "we find we are more accurate the first time around", "definitely improved", "we were concerned (before TM, about a colleagues creative output) and now we are not", "my wife tells me I am more patient", "TM helped us to deal with the more pressurised 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 TM, responses were 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 TM 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". At the second survey company: "Hit rate improved in terms of delivering what the client required. I would say in terms of billings its most noticeable ... the times were challenging but we came through better ... what I find was that there was an improvement in the peoples' attitude towards the inevitable pressures where previously they would get wobbly. Now (after TM) they seem to be more accepting and they seem to be able to handle it better and there is no doubt in my mind that translates into improved work performance."

Respondents were then asked whether they had noticed any other changes in the organisation since so many had learnt TM. Responses from the survey company indicated many substantial changes in the company over the three years since learning TM. These changes were not so visible at the second survey company which seemed mainly to have weathered difficult economic circumstances better than had been expected. However, only a year had passed since members of the second company had learned TM. At the first survey company, very

many changes took place over the three years following the intervention. These changes were:

1. Staff numbers increased to 115 from 80 at the time of the intervention, representing growth of 44%.
2. The company was planning to move from its present 1450 sq. metres premises to 2100 sq. metre premises in a new building.
3. The company was about to relaunch itself with a new corporate identity.
4. Two new directors had been appointed.
5. A major new business opportunity had been developed, in the form of a customer satisfaction measurement service contributing about 15% of turnover. Service awards had been presented to the survey company by the franchisor two successive years.
6. Most staff now had networked personal computers on their desks.
7. There had been a gain in market share.
8. Turnover 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%).

In the words of respondents: "1992 (the year after TM) 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 its 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".

Asked the direct question: *How would you rate the overall health of the company since January 1991?* the Marketing Director replied "Could say its healthier. Its gone up and down in between, turnover has gone up about 20% compounded." (Earlier in the same interview he said that turnover had increased 20-25%.)

The full transcripts are set out in Appendix M: *structured interviews*. Reading these transcripts conveys the impression that the TM intervention was followed by positive outcomes at both companies. However, it is difficult to ascribe these outcomes to TM, because this study has not developed the theory base to enable it to attempt to do so. This issue is discussed further in chapter V.

Chapter V now turns to a discussion of the significant issues raised by the analysis including improvement in the on-site controls.

CHAPTER V

DISCUSSION

RECAP

This study was originally designed to evaluate the impact of a stress reduction intervention, Transcendental Meditation at the worksite. Progressive Muscle Relaxation was chosen as a control treatment. Once a suitable company had agreed to participate in this study, practical difficulties necessitated the departure from the original experimental design, obscuring comparison between TM and PMR. However, the experimental core of the original design was actually enhanced by the creation of a waitlist control condition because instruction of the PMR group was delayed six weeks due to the non-availability of an instructor.

The effects of TM and PMR were eventually investigated across six different treatment groups, plus an on-site non participating control group, evaluated on seven dependent variables: one psychological, four physiological and two climate. A detailed statistical analysis was then conducted on the dependent variables. The variables were:

1. Psychological Stress Symptoms assessed by the administration of the SCL-90-R instrument of Derogatis (1977). Primary outcome measure for this study was raw score on this questionnaire.

2. Systolic Blood Pressure (SBP) averaged over three readings made at the worksite between 10h00-15h00. Measurements were taken by a trained nurse, using a standard upright mercury sphygmomanometer, with subjects seated.

3. Diastolic Blood Pressure measured as above.

4. Heart Rate, and

5. Breath Rate.

6. The WARMTH dimension of a 40 item company climate questionnaire developed by Gelfand, as reported and used by Nasser & Schmickl (1986) to investigate perceptions in South African companies.

7. The SUPPORT dimension of the above questionnaire. (In addition, the other seven dimensions of this questionnaire were also studied for interest.)

The measurements were not taken in conjunction with any period of meditation. In other words, the measurements represented steady-state parameters.

In addition to the above dependent variables, further information was collected on credibility of the training and expectancy of results, subjective evaluation of benefits of the training, and usage of medication. In addition, structured interviews were conducted in order to complement and interpret the climate findings.

At the outset of the study it appeared that productivity data would be unavailable. However, at the end of the intervention management provided limited turnover data, but declined permission to publish it.

Nevertheless, the turnover and headcount data did enable the researcher to comment on overall company productivity over the intervention.

The intervention was conducted over six months with five assessment periods: pretest, intervention, and posttests at 2 weeks, 6 weeks and 5,5 months. Followups were conducted at 18 months and at three years, at which point the structured interviews took place. The group of on-site controls who were not trained in stress reduction were measured on all seven dependent variables prior to the intervention and again at 5,5 months post.

In addition a further group of off-site controls were measured only on the psychological dependent variable before the intervention and at 5,5 months post. A further three groups were also only measured on psychological stress symptoms. These were a pilot group who learnt TM in a TM centre (pre- and posttest), a group of long-term meditators (posttest only), and a normative group whose data was collected over a period of about 18 months in order to establish SCL-90-R score norms for the South African working population.

Previous reviews of the stress literature have highlighted a shortage of good evaluative experimental research on stress management, particularly at the worksite. Furthermore, existing research has tended to be methodologically flawed and has evaluated a wide range of unstandardised stress management techniques. Another difficulty has been that the stress concept itself lacks adequate definition. It is not surprising therefore that of the hundreds of

studies on "stress-reducing" techniques, this study located only 21 actually done at the worksite, of which only one was a TM study.¹

So despite a substantial *clinical* literature on TM, up to the present there have been a mere handful of TM worksite studies. Further, with the exception of the very recent studies, multi method multivariate approaches have not been widely used to assess the multi-faceted construct of stress.

The global aims of the study were to develop improved methods for stress management by performing a well-controlled experimental intervention at the worksite and assessing its impact on psychological stress symptoms, physiological stress parameters and climate; and in doing so to extend to the "real" world the results of previous studies conducted in clinical settings.

Four general research hypotheses were developed. They were: 1. the intervention will be effective in reducing stress with respect to the dependent variables mentioned above; 2. that of the interventions TM would be more effective in reducing stress; 3. that changes would be correlated across all the dependent variables; and 4. that on-site controls would also show improvement following the intervention. These general research hypotheses were translated to specific null hypotheses in order to subject them to experimental scrutiny. In addition, over thirty further research questions were asked and answered during the course of the statistical analysis.

¹ A further three TM studies by Gustavsson (1992), and one by Alexander et al (1993) came to light after the experiment. In addition, two non-TM studies, one by Norvell, Belles, Brody and Freund (1987) and one by Bruning & Frew (1987) surfaced in the final search of the literature.

Results, in brief, were that hypothesis one (that TM would be effective with effect increasing over time), was supported on the psychological dimension by both within subjects comparison ($p < 0,0002$, paired-t, $n=21$)² and between subjects ($p < 0,05$, unpaired-t, $n = 21,7$).³ Physiological changes also supported hypothesis one across SBP ($p < 0,05$, paired-t, $n = 27$)⁴ and DBP ($p < 0,04$, paired-t, $n=27$).⁵

Heart and breath rate changed in the predicted direction but results did not reach significance. Climate improved initially, but the improvements showed signs of reversal⁶ at 5,5 months posttest, probably due to intervening retrenchments. Hypothesis 1 was supported across both SUPPORT ($p < 0,005$, $N = 23$ pairs, Wilcoxon)⁷ and WARMTH (n.s. trend), but only at 6 week posttest.

Hypothesis two was that TM would be more effective than PMR in promoting beneficial psychological and physiological changes. Positive organisational set on TM, the late start of the PMR group and the retrenchments announced during PMR 6-week posttests invalidates any attempt to compare TM and PMR effect sizes. Subjective comments suggested that TM was perceived to be more satisfying; TM practice rates were higher (and attrition rates lower, though it is hard to blame PMR for this). Furthermore six of the PMR group were taught TM, at their insistence, after six weeks of PMR

² See chapter IV, figure 7 and table 8.

³ See chapter IV, figure 25 and table 41.

⁴ See chapter IV, figure 8 and table 10.

⁵ See chapter IV, figure 10 and table 10.

⁶ See chapter IV, figure 13b.

⁷ See chapter IV, table 16b..

practice. At the 6-week posttests there were no significant differences between TM and PMR group means on the SCL-90-R.

Hypothesis three (that there would be correlations between beneficial changes) found mixed support. Reductions in stress levels were correlated across psychological (SCL) and physiological (SBP, DBP) parameters. Beneficial changes in company climate were negatively correlated with physiological variables, but showed a tendency to correlate positively with psychological variables.⁸

Hypothesis four, that the on-site controls would also demonstrate improvements, even if they did not volunteer for training in relaxation, was supported by within subjects comparison ($p < 0,03$, $N=7$),⁹ despite small sample sizes. This finding, although extraordinarily interesting, can only be regarded as tentative because a between subjects comparison failed to reach significance.¹⁰

Organisational changes following the intervention were also very interesting. At three-year followup the company appeared to be doing very well. Turnover appeared to have risen for three years, ever since the month of retrenchments. Staff numbers were up to 115, which was 44% higher than at the start of the intervention. In a few months the company was to move from its present 1450 square metre premises to 2100 square meter premises in a new building. The company was also re-launching itself with a new corporate identity. These changes and reservations about linking them to TM are

⁸ See chapter IV, table 23 and Appendix U, table R.

⁹ See chapter IV, figure 7 and table 8.

¹⁰ See chapter IV, figure 25 and table 42.

discussed presently in the section: *Organisational outcomes following training in TM.*

COMPARISONS WITH PREVIOUS RESEARCH

Comparisons with previous research very clearly indicate the study was successful in its goal of replication of previous findings.

It extends previous clinical research (see below) which found reductions in blood pressure, heart and breath rates following TM practice. This important *physiological* finding validates the psychological *self-report* based finding made in this same study, that TM can be effective in reducing stress levels.

The table below compares the findings of this study with several others:

(see overleaf)

Table 44
COMPARISON OF BLOOD PRESSURE FINDINGS

All comparisons paired-t

Authors	Pretest SBP/DBP	Posttest SBP/DBP	Subjects	Signifi- cance	Comments
Benson & Wallace (1972)	150 94	114 88	22 Hyper- tensives	p<0,001 p<0,005	Independent of meditation, anti- hypertensive medication or whether medi- cation changed.
Lovell- Smith et al (1976)	118 95	112 74	18 normals - 5 hyper- tensives (DBP >90)	p<0,005 p<0,001	Measurements followed a 10 min TM practice
Cooper & Aygen (1978)	126,4 82,7	119,2 78,1	23 normals age 44: 15 m, 8 f	p<0,001 p<0,001	
Agarwal & Kharbanda (1979)	156,8 101,8	140,0 91,9	16 mild- moderate hyper- tensives (DBP>90)	p<0,001 p<0,001	Following 3-6 months TM
This study	112,3 75,8	109,5 72,8	21 normals + 3 hyper- tensives (DBP>90)	p<0,04 p<0,05	Independent of meditation or medication
This study	153,3 95,6	134,4 87,8	3 hyper- tensives (DBP>90)	p<0,003	These were the 3 highest DBP at pretest in the above group.
This study	99,4 62,8	100,6 67,2	3 "hypo- tensives" (DBP<65)	n.s. p<0,346 Near sig p<0,078	These were the 3 lowest DBP at pretest in the above group.

Consideration of the table suggests the findings of this study to be in line with those of other (clinical) studies, validating the measurements taken here.¹¹ In addition, this study appears to extend previous clinical work by finding suggestions of normalisation in blood pressure—where the blood pressure of subjects with low initial DBP actually tended to increase at 5,5 months after treatment.

Turning to psychological stress symptoms, the findings here correspond closely with those of Carrington et al, (1980) who found similar reductions in stress symptoms on the SCL-90-R in groups using PMR, "Clinically Standardised Meditation" and the "Respiratory One Method." This study extends these findings by finding correlations between psychological stress symptoms, and physiological stress parameters not reported in the work reviewed for this study.

Carrington et al (1980) found a 60% reduction on SCL-90-R raw scores for experimental groups over 5,5 months (from 67 to 27, $p < 0,01$, $N=104$). For controls the reduction was 41%, from 72 to 42. Significance level was not reported for controls so can perhaps be assumed to be not significant. The same figures found here were combined test groups reduced 55% (from 67 to 30, $p < 0,00001$, paired-t, $n = 29$) while on-site non participating controls reduced 49% (from 70 to 35, $p < 0,034$, paired-t, $n = 7$). At the same time off-site controls reduced 23%, from 79 to 61 (n.s.).

¹¹ Some subjects complained the blood pressure readings taken here were "different from their doctor."

This latter result suggests the operation of a nuisance variable such as regression toward the mean or pretest sensitisation. Or perhaps just doing the test is a powerful stress-reduction technique in and of itself.¹² This phenomenon is not unknown and in fact has been utilised by the Canadian government according to Ivancevitch & Matteson (1990). Government authorities circulated a health risk appraisal to over three million Canadians on the basis of a testing programme that indicated that "one person out of every three who completed the form would modify some unhealthy aspects of lifestyle for at least a while" (Ivancevitch & Matteson, 1990: 250).

IMPROVEMENTS IN CONTROLS

The phenomenon whereby controls improve as well as experimental groups, is sometimes called the Hawthorne Effect and was first noted in a study carried out at the Hawthorne works of the Western Electric Company between 1924 and 1927. The phenomenon was thought to be related to somehow "making the workers feel important" (Murphy (1984).

In this study the improvement noted in controls was unlikely be due to the Hawthorne effect, as the controls were non-participants, and had no special attention from the researchers or management other than two requests to complete SCL questionnaires and have physiological measurements taken.

¹² It is also possible that the productivity skills or the two hour discussion on stress conducted during the workshop attended by the off-site controls somehow led to the improvement.

The phenomenon of improvements in controls has recently been widely reported in the stress literature. Peters, Benson and Porter (1977) noted a "small and non-significant improvement" in a "symptoms index" in a volunteer control group of 36 white-collar workers. *However 54 non-volunteers showed no improvements.* In Peters et al's study the non-volunteers attended only two testing sessions—at the beginning and end of the study, whereas the volunteers were randomly assigned to one of the three experimental and control groups, filled out questionnaires *daily for 12 weeks*, and had *seven biweekly* blood pressure measurements. Considering the implications of the Hawthorne experiments, it is not surprising that they showed improvements! What may be surprising is that the improvements did not reach significance.

In another phase of this study Peters, Benson and Peters (1977) also noted a declining tendency in SBP over a two week pre-intervention baseline period. This has been attributed elsewhere to the possible operation of a "placebo effect" (Carrington, et al 1980).

Using the SCL-90-R in a "clinically standardised meditation" intervention, Carrington et al (1980) found a 41% symptom reduction in 31 controls which was "impressive in its own right." (It was 55% in the present study.) There was a "significant difference in symptom reduction" between the experimental and control groups. The statistical significance of the improvement on baseline is however unclear in Carrington et al's study. Carrington et al attribute the improvement either to a non-specific or placebo effect, due to

expectation, or to possible "self-initiated interim treatments over the course of the study."

The present study used non-volunteer controls who at the outset refused to participate in relaxation training. They were therefore likely neither to have been subject to the expectation factor nor the self initiated treatments mentioned by Carrington et al.

Thomas (1982) noted "concurrent improvements" in some cases between participants and controls in a programme involving 200 of which one-third were controls. Subjects were volunteer employees and an approximately equal number of spouses. The programme consisted of a three day workshop on "holistic health improvement and stress management" with pre- and posttests and a six-month followup.

In a literature survey, Murphy (1984) mentioned 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. He suggested the following explanation:

It has been the authors experience that workers have a great deal of interest in stress management programmes and positive attitudes are generated whenever an organisation allows employees to participate in such programmes. Workers feel that the organisation is concerned about them and this results in a desire among participants to make the programme successful. Such a state of affairs *would explain in part* (my italics) 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: 8).¹³

This explanation seems to regard all control conditions as equivalent. In fact the controls Murphy mentions involved either alternative treatments such as "self relaxation, stress education" or waitlist. These comparison conditions may however not be comparable with one another.

In any event, the present study used both randomised waitlist controls (the PMR group, which waited six weeks) as well as *non-volunteer* controls both on- and off-site. Only the on-site controls showed significant improvement. This would support the axiomatic view that a feeling of importance was operating, except for the fact that the controls here *did not volunteer for training* in either TM or PMR. In fact some of the initial attitudes expressed informally by the non-volunteers were quite negative—particularly towards TM.

The phenomenon usually seems to be de-emphasised¹⁴ in the discussion of findings or is regarded as being due to the operation of some environmental nuisance variable as discussed above. This study proposes two explanations alternative to those mentioned above.

¹³ It is interesting that Murphy proposed different explanations for controls' self-report and physiological measurement improvements. The present study found both types of measures to be correlated. Therefore it should not be necessary to propose different explanations.

¹⁴ 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*. As he puts it: "It is significant that studies which found significant effects in both control and trained groups utilised 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 subject 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. Perhaps Murphy's statement was indicative of rutted thinking.

The first is that it is conceivable that the calming effects of TM (as evidenced by decreases in blood pressure of members of the test groups) extended to their behaviour. In this case, their social interactions with the non-participating controls could have been less stressful for the non-participants. This could account for reductions on their SCL scores—and as these self-report scores appear to correlate with blood pressures—their blood pressure reductions as well.

In support of this social interactions explanation, the overall climate appeared to improve, at least initially, before the announcement of retrenchments. However, in trying to understand the mechanisms linking improvements in test and control groups, the negative correlations noted between the movements of WARMTH/SUPPORT and the physiological variables sounded a cautionary tone. Examination of Gustavsson's (1992) model of the transcendent organisation (represented here as figure 4 in chapter III) suggested that these poor correlations may mean that the linkage between test and controls takes place at a more abstract level than the level of social interactions, i.e., interactive consciousness. These more abstract levels are represented in figure 4 as collective consciousness, and below that, purely abstract pure consciousness.

The second possible explanation (alternative to the traditional arguments) is that the non-participating controls were positively influenced by a field effect operating at the level of the collective consciousness or pure consciousness.

The TM literature contains some forty published and unpublished references to a phenomenon found in the geographical vicinity of large groups practising Transcendental Meditation and its extension, the TM-Sidhi programme. This phenomenon sees reductions in negative environmental tendencies such as crime rate, accident rates and social unrest whenever the size of the practising group exceeds a certain threshold number of participants.

Hagelin (1989), Orme-Johnson, Dillbeck, Wallace and Landrith (1982) and others have suggested a "field-theoretic model" to explain the apparent action-at-a distance nature of these findings. In terms of the model, all members of a given population may be subject to the favourable influence of "coherence"¹⁵ generated by the group practicing the Transcendental Meditation and TM Sidhi programme.

The phenomenon is reported whenever the practicing group reaches a threshold size (of 1% of the population practicing TM, or even the square root of 1% of the population practicing the Transcendental Meditation and TM Sidhi programme together in a group). In the present study, the number of TM participants exceeded 50% of the entire company. Furthermore, the technique was being physically practiced on the premises at least once a day by up to 10 as a group, together, over lunch-hour in an empty office.

Perhaps the striking improvements in controls' psychological and physiological stress parameters here were due to the operation of a more localised version of the same phenomenon, termed the

¹⁵ Electroencephalograph (EEG) studies report coherent states of brain function are associated with the practice of Transcendental Meditation and TM-Sidhis (see Chalmers et al, 1989).

"Maharishi Effect" (Borland and Landrith, 1974) after Maharishi Mahesh Yogi who is said to have predicted the phenomenon in 1960 (Hagelin, 1989).

If this is so it would need to be tested more rigorously in an experimental design using larger groups and random allocation of subjects to experimental and control groups across several companies. This should be possible to do in practice using the following design (0 represents an observation and x an intervention):

Group 1. Test	0 ₁	x	0 ₂
Group 2. On-site control	0 ₃	-	0 ₄
Group 3. Local off-site control	0 ₅	-	0 ₆
Group 4. Remote off-site control	0 ₇	-	0 ₈

Staff would be randomly assigned to groups 1 and 2 within the company volunteering for training in TM (Company A) This company would need to have a staff of about 100 and to have the majority (say 60 %) instructed in TM to generate the hypothesised Corporate Maharishi Effect. Group 2 would be a waitlist or non-volunteer control group. Group 3 would be drawn from staff of a different company (Company B) located *in the same building* to control for social interaction effects. Group 4 would be drawn from the staff of a third company (Company C) at a remote location. Staff of Companies A, B and C should be blind to the conditions of the experiment at other companies and should not have contact with one another.

Gustavsson (1990) reports an experiment using a design somewhat similar to that proposed above where 48 staff of a Swedish company

("Company X") were instructed in TM. A total of 28 controls not instructed were located in an on-site office and another office several kilometres away. Although this design was used explicitly to control for a possible Maharishi Effect (Gustavsson, 1992: 300), his report of mixed results does not appear to deal with changes in controls specifically in this context.

Gustavsson & Harung (1994) have very recently called for an experiment such as proposed above, saying: "There is considerable theoretical basis and empirical experience to justify such an experiment and the outcome is likely to be successful" (1994: 38).

Gustavsson (1992) cites a private communication with German consultants who claim that the number of TM-meditators needed to produce a threshold effect was 5% in organisations with more than 1000 employees, 20% with 100 employees, 40% with 50 employees and 50-100% with 10 or less employees. The consultants emphasised their calculations are unscientific and only made on performance variables such as profit. These threshold sizes are much larger than those for the Maharishi Effect mentioned above, so the effect might not technically be due to the Maharishi Effect itself, but something similar.

A brief examination of some of the experimental evidence for the Maharishi Effect follows:

A recent study by Orme-Johnson and his co-workers (1988), as mentioned earlier, reported improvements in the quality of life in Israel and a reduction in the intensity of the conflict in neighbouring

Lebanon, as predicted in advance, concomitant on the group practice of the Transcendental Meditation and TM-Sidhi programme in Jerusalem.

An earlier study by Dillbeck, Landrith & Orme-Johnson (1981) reported there appeared to be a "phase transition" to decreased crime rate after cities reached a threshold where 1% of the urban population had been instructed in TM. Univariate analysis of covariance of the reduction in crime rate in 1973 was significant ($p < 0,02$) and a reduction of the crime trend in 1972-1977 was found to be significant at $p < 0,002$. These crime rate reductions were found to be independent of variation in demographic variables such as median years education, stability of residency, per capita income, percent of persons age 15-29, percentage unemployed and percentage of families with incomes below poverty level. The study compared 24 U.S. cities with populations between 10 000 -100 000 with 24 matched control cities.

Dillbeck, Banus, Polanzi & Landrith (1988) found evidence for a causal influence on decreased crime associated with practice of the TM technique. They examined a random sample of 160 U.S. cities varying in size from 250 000 to 50 000. They related percentage of TM programme participants in the population to deviation of observed crime rate from that predicted by linear regression from the city's prior trend between 1964-1971. Cross-lagged panel analysis from 1972 to 1978, controlling for four out of nine demographic variables found to be significantly associated with the crime rate, indicated that the percentage of TM participants in 1972 predicted decreased crime in

following years. The effect produced by the TM programme corresponded to approximately 18% reduction in the crime trend.

Dillbeck, Cavanaugh, Glenn, Orme-Johnson and Mittlefehldt, (1987) have reported that time series analysis found decreased crime in metropolitan Manila in the Philippines during the period of group practice of the Transcendental Meditation and TM-Sidhi programme by a group exceeding the square root of 1% of the population. Using Box-Jenkins time series impact assessment analysis of a 5-month intervention period compared to pre-and post-intervention base lines, they found a significant decrease ($p < 0,005$). The authors mention that crime returned to its previous level when the coherence-creating group left and asserted that because this group was composed largely of westerners and was able to improve the quality of life in an Asian population, this was an indication that the field effect they postulate was operating on a fundamental level that transcended cultural or ethnic differences in diverse social structures.¹⁶

Using the same Box-Jenkins experimental design on an intervention in Delhi the same authors (Dillbeck et al, 1987) reported a decrease in crime of 11% associated with the group practice of the Transcendental Meditation and TM-Sidhi programme during the experimental period. There were no significant changes in police procedural policy during this time nor were any seasonal changes associated with the intervention. (According to the authors this

¹⁶ See the transcendent organisation, chapter III: figure 4.

represented a replication of the previous study in another cultural setting).

The same article (Dillbeck et al, 1987) reported a positive influence on the quality of life in the state of Rhode Island as measured by factors such as reduced crime and accident rates flowing from a group of 300 participants in the Transcendental Meditation and TM-Sidhi programme in June - September 1978. Monthly quality of life data was gathered from January 1974 to December 1980. Box-Jenkins time series impact assessment analysis contrasted Rhode Island with the state of Delaware which has similar size, population and demographics. They reported a significant improvement during the experimental period ($p < 0,01$). The authors concluded that this experiment demonstrated a causal relationship between these field effects and the quality of life in an entire state.

The same article reports a replication of these effects in Puerto Rico between April and July 1984. Decreased crime rate was noted during the experimental period, which returned to previous levels when the group size decreased suddenly at the end of the period. Here however, the effect was only marginally significant ($p < 0,025$).

Orme-Johnson, Gelderloos, & Dillbeck (1988) studied a composite quality-of-life index over a 24-year period. They found the total predicted influence of people who had learned the Transcendental Meditation technique in the U.S. combined with those participating in the large group practicing the Transcendental Meditation and TM-Sidhi programme in TM in Iowa was associated with significantly

improved quality of life in the U.S. A quality-of-life index composed of 12 social indicators including crime rate and hospital admissions rate from 1960-1984 was compared using multiple regression analysis with numbers practising the Transcendental Meditation and TM-Sidhi programme. The authors assert a significant increase in quality of life took place in 1976 following a sharp rise in the number of TM meditators in 1975. A second marked increase in the quality of life occurred in 1982-1984 corresponding with the achievement of a threshold group of the square root of 1% of the U.S. population (i.e., about 1600 people) practising the Transcendental Meditation and TM-Sidhi programme in Iowa ($p < 0,001$). The field effects on quality of life appeared to be stronger in Iowa than in the U.S. as a whole.

Dillbeck (1990) examined the relationship between violent deaths in the U.S. and the size of the coherence-creating group in Iowa between 1979-1985. Using Box-Jenkins time series impact assessment analysis and transfer function analysis he found significant decreases in the violent death index when the size of the coherence-creating group in Iowa was "relatively larger" ($p < 0,01$), particularly when it exceeded the square root of 1% threshold for the U.S. He concluded that the Maharishi Effect is a field effect which seems to result in an holistic influence of reducing turbulence and violence even in national life.

Assimakis (1989) related the size of the Iowa coherence-creating group to a monthly quality of life index, including traffic fatalities and days lost in strikes in Canada between 1972 and 1986. Box-Jenkins time series impact assessment analysis suggested there was a significant

improvement in the overall quality-of-life index ($p < 0,001$) during periods when the size of the coherence-creating groups in the U.S.A. exceeded the square root of 1% of the total population of the U.S.A. and Canada.

The theoretical basis proposed to explain the observations noted above would seem to be beyond the scope of a dissertation in business administration. However further background is set out in Appendix S: *field effects*.

This Maharishi Effect appears to impact not only sociological variables such as crime rate, but economic variables as well. Cavanaugh (1987) and his co-workers (1988, 1989) tested a field-theoretic hypothesis in a series of studies of U.S. and Canadian unemployment and inflation. Controlling for other key economic variables (business cycle fluctuations, changes in industrial production, monetary growth, rate of change of crude materials prices and intensity of aggregate supply and demand shocks), he found significant ($p < 0,000001$) reductions in Okun's Misery Index during and following months in which the size of the coherence-creating group in Iowa exceeded the square root of 1% threshold.

So, in summary, it is a replicable, scientific (even if controversial) fact that group practice of Transcendental Meditation and TM-Sidhi programme is associated with—indeed causes—reductions in societal incoherence measurable as reductions in crime and violence and improvements in positive social and economic trends. The Maharishi Effect seems to be mediated by the unified field of contemporary

quantum physics which is held to be the fundamental field from which all force and matter fields emerge. Further it has been proposed that this unified field is in fact "pure consciousness" itself. The evidence for this is suggested to be the observations mentioned earlier, in addition to certain passages in the Vedic texts of ancient India and seems to be corroborated by the reports of those claiming to experience higher states of consciousness (as discussed in Appendix S).

What is the relationship between stress and higher states of consciousness? According to Alexander and his co-workers (in Alexander & Langer, 1990), stress creates incoherent excited states of psychophysiological functioning that restricts awareness. He cites Maharishi's assertion that the unrestricted, least excited state of pure consciousness could only be fully maintained when the nervous system is freed from the influence of accumulated stress.

Thus, neutralisation of stress (as facilitated by the TM programme), is considered critical in the development of higher states of consciousness (Alexander et al, 1990: 315).

So a possible link has been suggested above between the improvements of controls that were expected in this study and a possible field effect which appears to be produced when TM is practised together as a group. Furthermore a link has been suggested with stress, or more specifically stress *reversal* in the sense that higher (i.e., more coherent) states of consciousness experienced in the course of the practice of TM (as discussed by Alexander et al, 1990) may be able, via the mediation of the all-embracing unified field, to affect the

behaviour of others in the proximity of, but not necessarily in direct contact with, members of the TM-practicing group.

In this study possible signs of this effect were noted on two separate occasions. The first was when PMR Groups 5-6 were re-ptestesed on the SCL-90-R three weeks after all TM groups had completed their instruction (and six weeks after initial pretest). At this point they were found to have improved 25% on pretest, i.e. from 73 to 55 ($p < 0,005$, $n=15$). This is a substantial improvement to have to explain away with traditional arguments of Hawthorne etc. Unfortunately, there were no corroborating physiological measures, but all the evidence presented here suggests that they would have improved too, had the measurements been done.

The second occasion was when the on-site non-participating controls were posttested five months after all TM groups had received their instruction. As mentioned they were found to have improved 49% on the SCL-90-R, i.e. from 70 to 35 ($p < 0,034$, paired-t, $n=7$).

This time there *were* corroborating physiological measures. Group mean SBP decreased from 107,6 to 104,5 mmHg; and DBP decreased from 77,4 to 70,9. However heart rate and breath rate showed small increases (71,2 - 72,8 beats per minute and 18,9 - 19,3 breaths per minute).¹⁷

Returning to SCL-90-R scores, recall that a smaller, 41% improvement in controls at 5,5 months has elsewhere been referred

¹⁷ None of these physiological changes reached significance, except DBP, which was of borderline significance. This became significant at $p < 0,004$ after excluding the case with lowest initial DBP (which showed an increase at 5,5 months).

to as "impressive" (Carrington et al, 1990). The substantial 49% improvement in on-site controls here should be compared with the 23% improvement in off-site controls (from 79 to 61, n.s.). This difference between on-site and off-site groups is what the study found so interesting.

As alluded to earlier, other researchers have attributed improvements in controls to the operation of either Hawthorn Effects, social interaction effects, self-initiated treatments, expectation or placebo effects. The present study is arguing that of these candidates for explaining the improvements seen in on-site controls, only social interaction effects would seem plausible. However, considering the *magnitude* of the improvements and the literature on the Maharishi Effect, perhaps a field effect is also a likely candidate. If this is so it would perhaps be appropriate to refer to the effect as the *Corporate Maharishi Effect* as a special case of, and to distinguish it from, the Maharishi Effect.

This idea requires testing in a formal design as mentioned earlier, to distinguish the proposed Corporate Maharishi Effect from social interaction effects. One spinoff from such a study could be the notion of leverage of training expenditure. Train more than the threshold number (say 40-60%, depending on the size of the organisation) of members of an organisation in TM—to realise individual psychological and physiological benefits across the entire organisation.

CLIMATE

Responding to earlier workers' (e.g. Murphy, 1984) calls for multivariate stress research, this study decided to investigate climate as a possible way of assessing organisational effectiveness in the absence of readily available productivity measures at the outset of the study.

The question then arose as to what type of climate would be appropriate for the successful functioning of an organisation such as the survey organisation, a marketing research consultancy. Nasser & Schmickl (1986) cited Litwin & Stringer's 1968 guidelines in this regard.

According to these guidelines, affiliation-oriented climates are appropriate where close relationships are demanded for effective job functioning: "...for example team efforts and highly cohesive production groupings." An affiliation-oriented climate would clearly be apposite in the case of the survey company—where gathering, collation, analysis and presentation of market research information requires good teamwork and clear thinking.

Nasser & Schmickl further asserted that in large complex organisations, where highly competent and motivated people are working together but where some non-coercive means for generating organisation cohesion and team spirit is required, affiliative climates would be appropriate. In addition, for the facilitation of more feeling-oriented relationships and the development of interpersonal sensitivity, affiliative climates are ideal. These requirements would all seem to fit the characteristics one could argue as being ideal for a

management consultancy such as the survey company. To create an affiliation oriented climate the guidelines proposed that management should:

- allow the development of close, warm relationships (increase WARMTH)
- provide considerable support and encouragement for the individual (increase SUPPORT)
- provide considerable freedom and very little structure or constraint (reduce STRUCTURE) and
- give the individual the feeling that he is an accepted member of a family group (increase IDENTITY).

Nasser & Schmickl suggested that achievement-oriented climates are appropriate in areas that demand individual initiative and calculated risk-taking and in organisations seeking rapid growth in a changing environment. This would also seem to be an ideal specification for organisation development in the survey company, being a market research consultancy in a rapidly changing business environment. To create an achievement-oriented climate the guidelines proposed that management should:

- emphasise personal responsibility (increase RESPONSIBILITY)
- allow calculated risks and innovation (increase RISK).
- give recognition and reward for excellent performance (increase REWARD).

- create the impression that the individual is part of an outstanding and successful team (increase IDENTITY). In addition,
- structure (rules, procedures and formal communication channels) must be no more than moderate to average (reduce STRUCTURE).

It would be highly *inappropriate* for the survey organisation to have a power-oriented climate as these are more appropriate for hierarchy-bound organisations such as the army and for organisations where work is highly routine and repetitive such as manufacturing. Therefore—inverting the guidelines proposed by Nasser & Schmickl for the creation of a power-oriented climate—to improve the climate in a market research consultancy, management should:

- not provide considerable structure (reduce STRUCTURE)
- not allow individuals to obtain positions of responsibility or authority and high status (reduce STATUS)
- not encourage the use of formal authority as a basis for resolving conflict and disagreement (reduce STRUCTURE).

Summarising the above strategies, desirable changes on the dimensions measured by the climate instrument used here would therefore seem to be as summarised in the table below:

Table 45

DESIRABLE CLIMATE DIMENSION MOVEMENTS

Desired movement to create a climate oriented to:

	greater achievement	greater affiliation	less power	All three together
WARMTH		↗		Increase
SUPPORT		↗		Increase
STRUCTURE	↙	↙	↙	Decrease
RESPONSIBILITY	↗		↙	No change
REWARD	↗			Increase
RISK	↗			Increase
STANDARDS	↗			Increase
CONFLICT			↗	Increase
IDENTITY	↗	↗		Increase

The table above suggests that in terms of the guidelines proposed by Nasser & Schmickl (1986), desirable climate movements would all be positive, except for STRUCTURE (decrease) and RESPONSIBILITY (which is ambiguous).

How did the results of this intervention compare with the desirable shifts as set out above? Initial improvement trends at 6 week posttest seemed to reverse at 5,5 month posttest, as shown below.

Table 46
 DESIRABLE VERSUS ACTUAL CLIMATE DIMENSION
 MOVEMENTS

Showing shifts at 6 week and 5,5 month posttest —TM groups 1-4 only

DIMENSION	Desired movement	Actual movement at 6 weeks after TM	Further movement, 3 months after retrenchments
WARMTH	Increase	Increased	Decreased
SUPPORT	Increase	Increased	Increase reduced
STRUCTURE	Decrease	Same	Slight decrease
RESPONSIBILITY	No change	Slight decrease	Slight increase
REWARD	Increase	Increased	Increase reduced
RISK	Increase	Increased	Decreased
STANDARDS	Increase	Increased	Decreased
CONFLICT	Increase	Decreased	Increased slightly
IDENTITY	Increase	Decreased	Decreased further

p<0,005

It was noted that according to the original hypothesis 1 (of WARMTH and SUPPORT improvements) and the above analysis of desirable changes, this intervention seemed to produce initially positive results, i.e., in a direction supportive of hypothesis 1. However, after the retrenchments (in week 12 of the study) the initial improvements dissipated somewhat, yielding mixed results over the period of evaluation.

Discussion of the findings and individual question wordings with management suggested the reversals may have been due to the trauma of the retrenchments three months before final posttest. In

addition, the 5,5 month whole-company shifts may have been due to a generally negative trend that some staff reported as having flowed out of the management style of the new management. It was suggested that for a year or so after the management buy-out (about a year before the intervention) management was "quite casual." Thereafter the new management started to flex its muscles and may have generated some negative perceptions in the process.

Interviewed after three years, staff members suggested that this negative slide in perceptions only ceased after a further intervention by management consultants (about two years after TM). "There was a lot of dissatisfaction with the new management's way of handling things, so there was not a lot of warmth...and it was getting worse..." Staff were apparently frank during the "Origo survey," during which, when they were asked to describe the behaviour of the organisation as an animal, "some replies were quite brutal."

One other study of climate changes following a TM intervention was located after completion of the experimental phase of the present study. In two separate studies in a Swedish company ("Company X") Gustavsson recently (1992) investigated "group spirit" and also "creative climate" using an inventory by Ekvall. He reported somewhat perplexing results after TM:

The results from the two climate studies are paradoxical and unexpected. The individual effects of TM indicate that the climate in reality ought to have improved, both concerning the spirit and care, and creativity in the light of the development of the mental health in the direction of more holistic thinking and creativity. In the open interview questions, the answers indicate that the climate really had improved in those offices where TM

was introduced, but the questionnaires still show the contrary in many cases (Gustavsson, 1992: 310).

He continued by proposing an interesting explanation:

The answers on the questionnaire reflect in the beginning a difference between the individual's experience of how the climate *ought* to be, but is not present in the climate yet. The resulting answer is a worsening of the climate in the questionnaire without any corresponding worsening of the climate in reality. The worsening is then an expression for (sic) the *increased demands* on the creative climate. When I did follow ups of the climate (4 months after the 7 month posttest), the climate better corresponds to the demands and a clear improvement can be seen in the questionnaires. This trend is striking in the experimental offices in the study too. I interpret the questionnaire as an expression of increased demands for creative activity (Gustavsson, 1992: 310).

Gustavsson concluded

...it is difficult to make distinctive conclusions in the climate tests. The climate is formed by both the people and organisation processes. We have seen both types of influence on the climate in the study - how change of jobs, locality and reorganising, which are expressions of outer organisational variables, and how TM, which is an expression of the development of the collective consciousness, influence the climate (Gustavsson, 1992: 311).

His explanation is interesting in the light of the South African work of Coles (1984) which suggested that practice of Transcendental Meditation and TM-Sidhi Program was associated with significantly lower levels of perceived stressfulness of significant life events. Her work, supported by more recent work by Ahlström (1991), suggests that cognitive appraisal of life events shifts positively with the practice of TM.

However, Gustavsson interpreted his findings by stating "my interpretation (is) that these findings reflect increased demands on the climate, or new meanings applied to the concepts describing the climate in the questionnaire..." (Gustavsson, 1992: 314). This would seem to imply a view that the cognitive shift is not in a positive direction i.e., contrary to the observations above. This interesting area would seem to require further investigation within the field of cognitive psychology.

In conclusion, the climate results of this study seem to be somewhat more positive than those reported by Gustavsson (1992). This may have been due to the fact that here over half the entire staff learned TM. With everyone working out of a two storey building, no one could have been unaware of the intervention or out of range of the sentiments it generated (or field effects proposed earlier).

If these results can be replicated, it would suggest that TM may possibly have a useful role in organisation development (OD). OD is defined by Gibson, Ivancevitch & Donnelly as:

...a planned, managed, systematic process to change the culture, systems and behaviour of an organisation, in order to improve the organisation's effectiveness in solving its problems and achieving its objectives
(Gibson, Ivancevitch & Donnelly, 1988: 694)

These writers further cite the work of Winn in asserting that the three sub-objectives of OD are changing attitudes or values, modifying behaviour, and inducing changes in structure and policy.

The present study has demonstrated that decreases in stress levels were accompanied by initially positive overall changes in climate,¹⁸ despite unfavourable circumstances relating to management style. Further, it is arguing that TM had a causal role in these changes in stress levels. It therefore argues that TM may have an OD role in the promotion of positive changes in company climate.

ORGANISATIONAL OUTCOMES FOLLOWING TRAINING IN TM

Improvements in individual function have been widely reported following regular TM practice (as described in the section on *the Transcendental Meditation literature* in chapter II). It would seem to be a commonsense proposition that these improvements at the individual level would translate into improvements in organisational effectiveness.

The findings of the three-year follow-up of this study are suggestive of positive organisational outcomes including growth in turnover and market share.

No formal research demonstrating a causal linkage between the implementation of TM at the worksite and positive outcomes at the organisational level of measurement was located for this study.

¹⁸ And recall that the climate shifts on warmth and support (see chapter IV, figure 13b) showed a tendency to correlate positively with psychological stress scores, even though they tended to correlate negatively with physiological stress parameters (see chapter IV, table 23). These results of overall climate *improvement*, despite poor/mixed correlations with psycho-physiological variables and despite unfavourable organisational circumstances, suggest that Gustavsson's collective consciousness, or endogenous variables (affected by TM) may be more potent influencers of climate than the "outer organisational variables" or exogenous variables. Poor correlations with psycho-physiological variables suggests that much has yet to be learned about the mechanisms by which these climate changes manifest themselves.

However, there appears to be a ground swell of anecdotal evidence from TM case histories in other countries suggesting this linkage. Names have been changed in the cases presented below.

Bankers Fidelity, Australia

TM was introduced into Bankers Fidelity in Sydney in 1989 following presentation of TM as a stress management modality during a lateral thinking training programme for corporate executives by the author of the present study. Commencing with the most senior executives, including the Managing Director, 50-60 individuals took the course over a two year period. At that time the complement of Bankers Fidelity was about 700. According to Rigby,¹⁹ who delivered the programme:

Individual results were as for other corporate TM programmes, with commonest reports in the first few days being more clarity, efficiency, energy and calmness, along with increased patience and tolerance of others. Longer term results appeared to be in the direction of greater personal stability, better health, career progress and family stability.

Rigby continued to describe positive organisational outcomes:

Coinciding with the uptake of the TM programme, BF Australia emerged into a period of unprecedented growth and prosperity. This was highly counter-cyclical as the period in question was a period of heavy recession for the economy as a whole and the banking community in particular. BF gained the award for Investment Bank of the Year and Managing Director, Rod Fitzgerald the award for Banker of the Year. This high performance distinguished BF Australia both from other investments banks in Australia and from branches of BF in other countries such as the USA and Europe.

¹⁹ Personal communication - telefax from Byron Rigby, Dec 1994.

It is felt that the TM programme contributed to BF's success in these years along with a number of other potent favourable factors including the unique talent of Rod Fitzgerald and a willingness to tackle innovation.

Automotive Chemicals, USA

Marcus (1990) profiles a case history of Automotive Chemicals in the US. He claims that after four years of flat sales and declining profits TM was taught to 80% of the staff. Over a four year period sales doubled and profits grew five times. Annual sales per employee grew from US\$133 000 to 250 000 while labour costs as a percentage of sales decreased 39%. Absenteeism was cut in half in the hourly work force.

Federation Mining

Federation Mining acquired Whisky Creek in the late 1980's. Prior to the acquisition, Federation possessed one mine and was led by a small team of geologists, engineers, metallurgists and others under the direction of a talented mining geologist. After acquisition there were seven mines and 28 senior executives. Following an introduction by the author of this study, Rigby made a series of presentations on TM to the senior executives. He described the experience as follows:

Almost all of the 28 senior executives entered the corporate development programme (TM). Following introduction of senior executives and families, further programmes were introduced at mine sites in four further points in Australia. Approximately 200 out of 700 employees and their families were taken through instruction in TM. Follow up of the initial

questionnaires showed considerable reductions in symptomatology of all kinds.²⁰

Rigby then described the organisational outcomes as follows:

During the time of the programmes Federation's fortunes evolved. In the year following instruction in TM the company was given the award for 'Takeover of the Year.' Almost all executives from both companies remained loyal and enthusiastic participants in the new expanded company resulting in minimal loss of expertise.

...a consulting firm as well as TM expertise were brought in to engineer the melding of the Federation and Whisky Creek teams. This was accomplished by a combination of informal and formal events including mining and business exercises, think tanks and presentations, mixing of new and old staff, social, sporting and other informal activities and a thorough review of the mechanics of change (based on an appreciation of the mechanics of TM) ...

Already in a good financial position due to forward sales with a cash surplus of \$50-60 million and no debts, the company expanded in a measured way acquiring new leases and avoiding the main pitfalls of excessively rapid growth. Share prices did not entirely reflect the company's health and vigour, a phenomenon common with gold companies. The company has remained vital, changing and innovative and has retained exceptional loyalty from its employees and executives as private and confidential consultations with the executives have confirmed. During the period 1988 to 1994 a number of other corporate improvement programmes have been introduced besides TM.²¹

Nationwide Mutual Funds

According to Swanson & Oates (1989: 98) TM was offered to the entire sales staff of 350, of whom 55% participated in the first year.

²⁰ Rigby is a consultant physician in Psychiatry.

²¹ Personal communication- fax from Byron Rigby, Dec 1994.

They claim that within a year sales turnover increased 250%, with the TM participants accounting for the bulk of the increase. Now new staff are routinely offered TM. Sales staff do in-home selling and this group reported the following benefits which they ascribed to TM: reduced tension and anxiety, reduced insomnia, increased energy and motivation, improved interpersonal relationships. Reports of increased ease of communication and greater sensitivity to needs of family and work were common.

The following table summarises the organisational outcomes in the survey companies and case histories presented above. The organisations were:

1. The survey company—South African research consultancy
2. The second survey company—South African advertising agency
3. Bankers Fidelity —Australian merchant bank
4. Automotive Chemicals—American manufacturer
5. Federation Mining—Australian gold mines
6. Nationwide Mutual Funds—American financial services

The table follows overleaf:

Table 47

POSITIVE ORGANISATIONAL OUTCOMES FOLLOWING TM

Organisation	1	2	3	4	5	6
Head count	80	10	700	na	700	350
% trained in TM	60	80	7	80	30	55
Evidence of:						
Turnover growth substantial or exceeded expectations	√	√	√	√		√
Productivity grew (e.g. sales turnover per employee increased)	√	√		√		√
Company or management won awards	√		√		√	
Company climate or motivation improved	√			√		√
Improved interpersonal relationships*	√		√			√
Communication or creativity improved*	√	√				√
Profit growth substantial or counter cyclical			√	√		
Company growth in size or staff numbers	√					
New business opportunities uncovered	√					
Improved corporate image or identity	√					
Company restructured successfully					√	
Increased market share	√					
Absenteeism reduced				√		

*Strictly speaking, these were improvements at the individual level of analysis. They are mentioned here because of their importance to organisational effectiveness.

There thus appears to be a broad range of possible organisational benefits of TM. An American management consultancy reported improved ability to handle change and a "high degree of group coherence" (Swanson & Oates, 1989: 100-101). Australian reports range from increased corporate flexibility and responsiveness, to assisting rationalisation of the management process at an Australian Real Estate brokerage which reported "long term personal benefits which can hardly fail to be reflected in corporate cohesion and solidarity."²²

Most case histories, such as those profiled by Marcus (1990), have not been formally evaluated, and if they have, the focus of the evaluation has been on individual benefits. The presentation of results has generally been to management and may thus be expected to lack scientific objectivity.

It is sometimes difficult to find hard data on company performance. The present study is a case in point. Management flatly refused to make sensitive turnover data available to the researcher. The Managing Director said:

I'm not keen to give you absolute figures. We can give you growth figures...because I think people could identify us and no ways am I giving someone else my figures... why should I let you have the information which could be sitting in UCT's library for any Tom, Dick or Harry to read (Interview, 1994).

The stated reason was reasonable, but when asked for figures which would allow the construction of an index of turnover Rands per salary rand—which would be totally anonymous and could not

²² Rigby, personal communication, 1994. Rigby ascribed this quote to the Managing Director.

possibly weaken the company's competitive position, the response from the Managing Director was:

I don't know how relevant that is because the makeup of our staff has changed considerably from when we did TM ... the type of staff we have recruited has changed. We have different directors on board, different philosophies in many ways. I'm not sure if you drew some conclusions from those figures they would be relevant conclusions (Interview, October, 1994).

What is so interesting about these responses is that almost a year earlier, the researcher had an almost identical conversation with the Deputy Managing Director.

Researcher: So you are saying 1991 wasn't a great year?

Deputy MD We didn't make our target, we retrenched. ... Then 1992 was much better. And this year was a fantastic year. But there were a number of factors coming together and I would be most hesitant to ascribe it to TM (Interview, December, 1993).

Once again there seemed to be evidence of sensitivity toward any connection of positive organisational consequences with TM.²³

The researcher then tried another approach. He showed the Deputy Managing Director the chart of monthly invoiced sales (figure 5a in chapter III).

Researcher: You say you have done well. What are the facts? ... It sure does look like 1991 was

²³ Schmidt-Wilk (personal communication, September, 1994) has mentioned an anecdote with similar overtones. According to Schmidt-Wilk, a divisional manager of a GM subsidiary in the USA had a chart on his office wall showing divisional sales and numbers of staff trained in TM. When a visitor ridiculed him for implying a causal connection between the two variables, he removed the chart and it was never seen again. Schmidt-Wilk is a doctoral candidate at Maharishi International University in Iowa.

a black year. Now you are saying the graph is continuing to go up?

Deputy MD: Oh yes. Ever since. no doubt about that. ...

So sales turnover had increased. But in the next breath the Deputy MD repeated the same issue: "but what I am worried about is that you put in this wonderful graph which says it is all due to TM" (Interview, December, 1993).

Despite these difficulties, consideration of the anecdotal evidence presented above yields the impression that at the organisational level of analysis, benefits from TM may be expected which are in some ways analogous to those for individuals. An individual learning TM can, on the basis of a voluminous literature, expect measurable improvements in health-related parameters such as energy levels and reductions in blood pressure, anxiety and illness rates. Considering the individual's life as a whole, improved energy levels and health is likely to translate into a more successful life. Whatever this success may be is a complex function of that individual's heredity and environment. Thus, while the outcome cannot be predicted it inevitably means that life gets better. This is the theme of numbers of inspirational books on TM which, though they may be criticised as being "unscientific," confusing cause and effect and presenting only anecdotal evidence, convey a feeling for a broad range of benefits following regular TM practice.

Now, the individual is the unit of the organisation. It would therefore seem commonsense to expect that if a substantial number of individuals in the organisation practiced TM, improvements in

individual health would translate into analogous overall improvements in corporate health, considering the organisation as a whole. The case histories presented above (including the two survey companies) suggest this would be the case, with some companies reporting increases in market share or sales turnover, other companies weathering recessions or takeovers and all companies' individuals reporting personal gains. Again, the nature of the organisational improvements must be a complex function of the circumstances of the company itself, within the matrix of environmental factors such as business cycle, competitive situation, economic situation, political situation and so forth. The above discussion is therefore an argument for the face validity of the results presented here.

It would seem that with apparently growing acceptance of alternative therapies (Ferguson, 1994; Ullman, 1993) formal research would be useful to investigate whether a causal relationship indeed exists between TM and positive organisational outcomes including improved climate and productivity.

METHODOLOGICAL WEAKNESSES

As mentioned earlier, there are many challenges to the validity of worksite research. This study originally set out to do an empirical evaluation of a stress reduction technique in the traditional manner, i.e., using random selection of representative samples, a primary and alternative treatment, and matched non-treatment controls.

However, it very quickly became obvious that in practice the investigation would have to take the form of a case study. The traditional question this raises is—can the results of a worksite case study be generalisable²⁴ to the universe of worksites? For this to be so, presumably the survey company would have to be chosen randomly by statistical methods—which as Gustavsson points out "makes most case study research impossible" (Gustavsson, 1992: 327).

Nevertheless, the research needed to be done; so when opportunity knocked, the study went ahead.

The survey company was an atypical South African company in that the Deputy Managing Director was already practising TM. This means that the staff would presumably have had a positive mental set on TM to the extent that the deputy M.D. had made her practice known. This would presumably increase the chances of a successful TM intervention in the company. According to the SAAAE (the South African TM parent body) there are numbers of South African business leaders who practice TM.²⁵ Therefore there must be a subset of South African companies to which the overall experience in this study would be directly generalisable.

Another way in which the survey company differed from typical South African companies was in having a large ratio of female to male staff (83%). According to Derogatis "there have been repeated

²⁴Alexander 1993 studied an intervention at two separate sites "to determine the generalisability of treatment outcomes".

²⁵ However, it is the author's experience that they generally do not make their practice public.

observations of significant relationships between sex and levels of psychopathology." (Derogatis, 1977: 13).

This study was not concerned with pathology, but rather with normality. Nevertheless, turning to the normative data collected for the South African population of seminar attendees, it was found that for 30 females in the sample, mean raw score in the SCL-90-R was 81,4 (s.d.=44,1), whereas as for the 220 males, it was 63,1 (s.d.=39,4).

This difference was statistically significant at $p < 0,02$ (unpaired-t, two tail). Accordingly an argument that the ratio of males to females would bias results would be taken seriously. The possibility also exists that a stress reduction programme such as TM would find readier acceptance in a predominantly female environment.

Having conceded the weaknesses in selection of the survey company and in the use of case-framework, weaknesses in the empirical side of the study also need to be addressed.

All participants in the study were volunteers. It is difficult to see how this could be otherwise in a contemporary study on humans. Nevertheless it is known that the mere act of volunteering for a therapeutic intervention can somehow precipitate improvements in the volunteers condition without undergoing treatment (see e.g. Coleman, Butcher & Carson, 1980: 671). As Gwynne-Jones recorded: "In my experience, dramatic changes may be induced merely by patients' decisions to refer themselves for treatment" (1985: 5).

This study was not alone in this practical matter, as without exception other researchers have also studied volunteers (e.g. Alexander et al, 1993; Carrington et al, 1980; Peters et al, 1977).

Some critical questions must still be asked. Firstly, did all volunteers have an equivalent chance of being allocated to the six test groups for this experiment? The answer is yes; using the randomisation procedure described earlier which stratified groups by management level and sex. However four (out of 64 volunteers for the experiment) had indicated they did not wish to learn TM. They were accordingly assigned to the same group and that group designated Group 6 - the last group to be trained (in PMR). As discussed earlier, this group was not crucial to the major research questions eventually asked by the study.

Secondly, did each of the five remaining experimental groups have an equivalent chance of being assigned to each of the five remaining treatment conditions? The answer is yes; groups were randomly allocated to treatment conditions 1 - 5. Inevitably diary clashes meant that two or three volunteers changed groups before receiving training—but it is argued these changes were not damaging to the scientific integrity of the experiment as the male/female and management level ratios were unaltered. These issues were taken very seriously indeed in this study, in view of the frequency with which methodology is criticised in the stress management literature. Recall that the Solomon comparisons referred to in the chapter on *results* were across groups 1-4, which were true experimental groups. The on-site non participating controls were therefore outside the

experimental core of the study. This is why the findings of improvements in the on-site controls (and not in the partially matched off-site controls) were so interesting. If the on-site controls *had* been randomised, they would arguably have been *more* likely to have manifested improvements due to the operation of Hawthorne, self-selection, self-initiated interim treatments, expectation or placebo effects.

Continuing this theme of intrusive practicalities—what Human (1994) has referred to as the "contextual nature of organisational life," two important events had a significant impact on the outcome of this study. The first was a six week delay in providing instruction for the PMR group occasioned by the non-availability of a PMR instructor at the time called for by the experimental design. This meant that although the original intention to compare TM and PMR was hampered, effectively the PMR group ended up serving as a randomised 6-week waitlist control group. When the PMR group was re-prettested just before PMR instruction, SCL scores were found to have reduced significantly. As discussed this may have been partly due to the operation of the proposed Corporate Maharishi Effect and was a portent of the eventual near-significant improvements in the 5.5 months posttest results of the on-site non participating controls. What appeared to be a setback opened an interesting area of findings.

Another challenge to the integrity of the study, as already mentioned, was the fact that the programme champion was already known by the staff to be a TM practitioner. Therefore despite any attempts to level the playing field by presenting TM and PMR as

equivalent relaxation techniques, inevitably staff favoured the technique apparently endorsed by the Deputy Managing Director. This fact, together with the delays in providing training and the eventual insistence of the PMR group on learning TM, effectively invalidated fair comparison of PMR against TM.

A second significant event was the announcement, in week 12 of the study, of retrenchments amounting to about 10 per cent of the staff. This meant that certain posttests actually straddled an event which could be regarded as an organisational stressor. This announcement was made just prior to the PMR 6-week posttest and probably explains some of the anomalous PMR physiological results (SBP, Heart Rate and Breath Rate, all increased at the PMR 6-week posttest). Once again an apparent setback opened a window to additional insights into the mechanics of organisational stress responses.

Statistical power and sample sizes

Another challenge was the difficulty in having all subjects complete questionnaires and measurements on time due to intense work pressures in a service environment. Inevitably this led to some attrition at posttest. Attrition rates on the training itself, i.e., the follow up sessions, were relatively low. It was not difficult to get subjects to attend follow up sessions, but it was difficult to have them attend the "right" follow up sessions. Therefore when it came to data analysis time, as mentioned, data attrition rates at 5,5 months posttest

were eventually 32% for Group 1-4 combined, 56% for Groups 6-7, and 36% for the on-site controls. The management of the data-collection process was partly to blame for this state of affairs. Another reason was resignations and retrenchments which affected one member of Group 3, two members of Group 4, five members of Group 5, four members of Group 6, and three members of Group 7. Inclusion of the missing data could have affected the final results. A further reason for attrition in the data was the deletion of 27 SCL-90-R data points (9,7% of total on-site) where there was evidence of faking, as mentioned in *results*. This only affected the posttest results of 13 on-site subjects and had the effect of making the reported improvements conservative i.e., posttest means would have been lower, had the "diminished" results been included. One further maverick SCL data point was rejected where the nurse had recorded that day: "daily injection for appetite suppression." These various sources of bias can obviously never be entirely eliminated from a worksite study of this nature, but it is to be hoped that some sources will cancel the effects of others.

For the above reasons sample sizes differed from pretest to posttest. Therefore comparison of pretest and posttest results were made using both paired and unpaired statistical procedures to use all available information, and the results were generally reported for both.

According to Orme-Johnson & Dillbeck (1986)

...for a moderate effect size to be detected there should be a minimum of 15 subjects per group for between subject comparisons (i.e., unpaired groups) and 10 subjects per group for within subject comparisons i.e.,

paired or matched groups (Orme-Johnson & Dillbeck 1986: 96-98.)

Does this mean the findings of this study are invalid because of small sample sizes? It is argued this is not the case for several reasons.

Firstly, the two most important comparisons (TM pre- versus 5,5 months posttest, and TM post- with the off-site controls posttest), had sample sizes which even at posttest were adequate in terms of Orme-Johnson & Dillbeck's requirements for the detection of a moderate effect size. The TM pre-post comparison used 21 matched pairs which would have been adequate for the detection of even a small effect size. As it happened, the effect size was relatively large, leading to a very high level of statistical significance ($p < 0,0002$) despite large variability in the data (pretest mean was 64, standard deviation 49). Group size was thus twice the size called for by Orme-Johnson & Dillbeck to detect even moderate effect sizes. The TM post/off-site control comparison had only 12 in the smaller group. Orme-Johnson & Dillbeck called for 15 subjects per group for unpaired group comparisons. The wisdom of this guideline can be seen in the fact that for this comparison the significance was only $p < 0,05$. As mentioned earlier, the use of an unpaired group procedure tends to yield lower significance levels than a matched or paired-t procedure, provided this is appropriate.

The second reason it is argued that the findings are statistically robust is that appropriate statistical techniques were used. An example of this is Scheffe's-S which is known to be robust and to be valid for comparisons of very small groups, i.e. less than six.

Furthermore, parametric procedures were used wherever possible. This was because they are known to be more powerful than non parametric tests (Runyon & Haber, 1980: 307). Furthermore, one-tail tests were used wherever appropriate in terms of the hypothesis under test. One-tail tests are more powerful than two-tail tests provided the posttreatment shift has been in the predicted direction, for reasons discussed in a footnote earlier.

In conclusion, while it is conceded that statistical power²⁶ is greater for large sample sizes—if results are found to be significant using appropriate tests even with small sample sizes, results should not be discarded without careful consideration. This is of course provided that appropriate sampling and randomisation procedures have been used.

A final reason why it is argued these findings are robust is that results were in line with previous clinical and laboratory research and were correlated across psychological and physiological variables.

External validity

Because of this concurrence of results with previous research, it is argued that the psycho-physiological findings of this study have a high level of external validity—i.e., the results are safely generalisable to other organisations. With the climate findings however, this may not be the case, as special circumstances at the survey company are likely to have influenced the results. As mentioned in chapter II, a

²⁶i.e. the probability of rejecting the null hypothesis when it is in fact false.

recent study by Heaney et al (1993) found that following a stress reduction intervention in two different labour relations contexts, perceptions of climate improvements were only seen in the "co-operative labour relations" context, and not in the "traditional labour relations" context.

Therefore, external validity of the findings related to organisational variables would have been increased were more than one organisation to have participated in the study—as in the study by Alexander et al (1992)²⁷. As discussed, structured interviews of members of an additional organisation were used here to attempt to determine whether responses differed qualitatively outside the survey organisation. These responses appeared to be in line with those recorded at the survey company. Furthermore, the case studies presented here also seemed to indicate broadly similar trends toward improved organisational effectiveness and responsiveness to change following TM.

Delimitations of the study

The study did not attempt to evaluate the host of alternative approaches to stress reduction now available, but confined itself to a meditation/relaxation orientation.

In the absence of accessible productivity measures at the outset, the study attempted to evaluate company climate with the intention of inferring productivity gains therefrom in conjunction with the

²⁷ However Alexander et al did not examine overall organisational change as done here.

qualitative data. Climate data provided mixed support for the notion of improved productivity and organisational effectiveness, and qualitative data provided unambiguous support.

The study, as originally conceived, did not attempt formally to evaluate whether the treatments complemented each other if used in conjunction with one another. However, a departure from the original design provided an opportunity to comment on complementarity. The comment is that the treatments appeared to complement one another, but very small sample sizes may have rendered the comparisons insignificant.

The study did not attempt to evaluate the range of success at mastering the treatment programmes.

METHODOLOGICAL STRENGTHS

It is argued that this study was useful because it was:

- conducted at the worksite (only 23 worksite studies were located out of hundreds of studies on stress reducing techniques),
- experimental, with both quantitative and qualitative components (very few methodologically sound studies were located),
- sufficiently powerful (very few studies used sample sizes giving adequate statistical power),

- multi method and multivariate in nature (measurements were made using several methods and physiological, psychological and organisational variables were measured),
- unique (no studies were found to attempt to correlate psychological with physiological and other variables), and
- durable (evaluation was over a six-month intervention followed up after 18 months and three years).

SIGNIFICANCE OF THE FINDINGS

The practical significance of the findings presented here are:

1. That TM and PMR are useful modalities where a company desires to reduce stress symptoms of its employees.
2. That TM in particular has value as a non-pharmacologically-based blood pressure-reduction intervention for borderline and hypertensive staff members.
3. That both techniques are easy and practical to administer, though TM appears to provide greater benefits (both objective and perceived) and compliance rates may therefore be higher.
4. Even if compliance (i.e., practice) rates are below what a training manager would possibly desire, the benefits of TM seem surprisingly robust even at rates of practice as low as a few times per week (versus the recommended twice per day).

5. That it is not necessary to train all staff in TM as the operation of Hawthorne, field or Corporate Maharishi effects secures the benefits even for non-participants.
6. That implementation of TM across a substantial proportion of company staff may lead to positive organisational outcomes in the long-term, including improvements in productivity and organisational effectiveness.

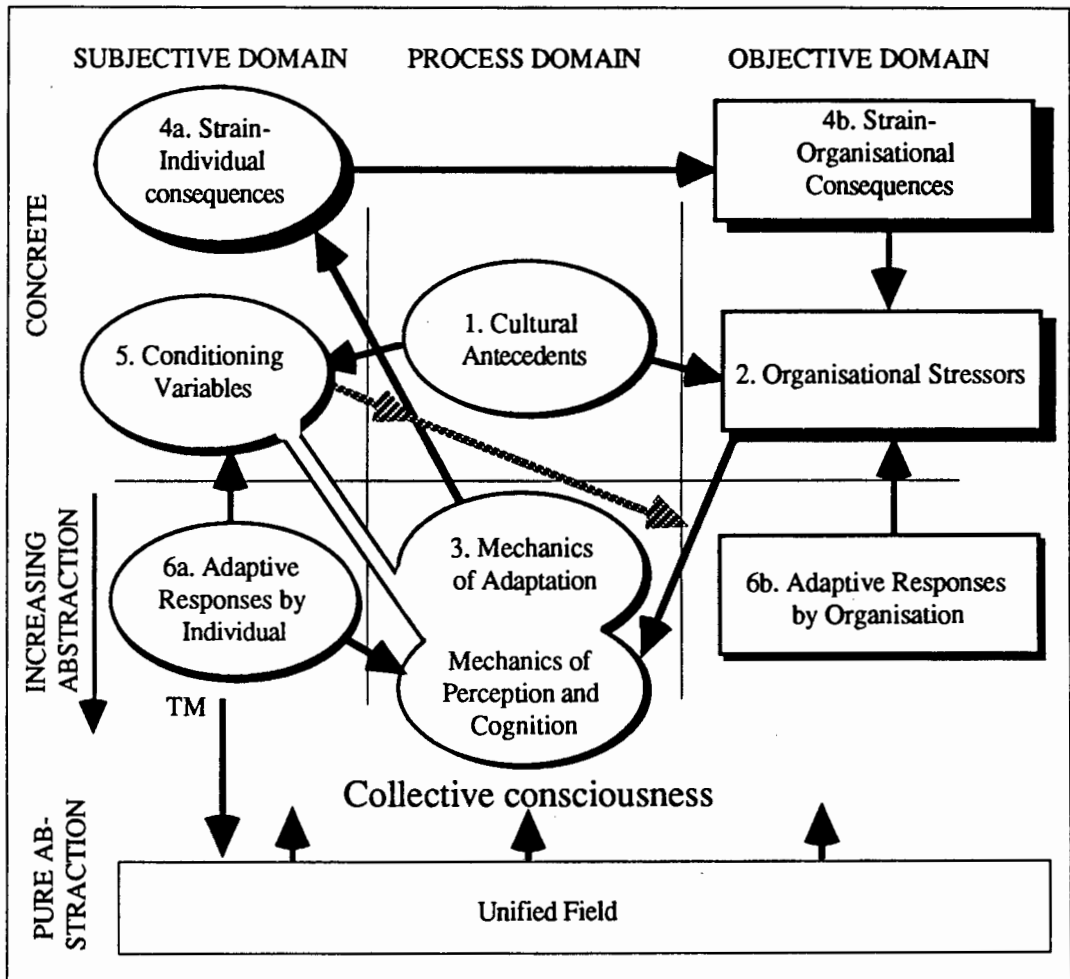
PROPOSED HIERARCHICAL MODEL OF JOB STRESS AND COPING

The following model is now proposed in order to address some of the weaknesses of the model set out in figure 1a in chapter I. and of the definition of stress derived therefrom. The model is based on figure 1a and responds to Strümpfer's (1987: 538) discussion which was paraphrased in chapter I: *toward an operational definition of stress*.

The model uses essentially the same job stress elements as set out in figure 1a. However, the elements are arranged so as to clarify the nature of the elements and certain relationships between them. The model is as follows:

Figure 27

PROPOSED HIERARCHICAL MODEL OF JOB STRESS AND COPING



Based on figure 1a, see chapter I: *Toward an operational definition of stress*. As before, solid arrows indicate direct influences. Striped arrows indicate processes that condition, i.e., strengthen or weaken direct influences. The sketch preserves the numbering scheme used in figure 1a. Contents of boxes are omitted here for clarity.

Confusion between the concepts of conditioning variables and cultural antecedents was noted in discussion of the figure 1a model with graduate students. In addition, individual and organisational consequences of stress were previously lumped together in box 4, and individual and organisational adaptive responses in box 6. These difficulties were addressed as shown by introducing a distinction between subjective, process and objective variables. Conditioning

variables²⁸, individual responses and consequences are represented as lying in the subjective domain, while organisational responses and consequences lie in the objective domain. Cultural antecedents (e.g. place of residence, family conditions, ethnicity, etc.) are represented as lying in the process domain because these variables are a function of the individual's interaction with his or her environment. Subjective variables are represented as ovals and objective as rectangles.

Another, more subtle, difficulty with the previous scheme was that it did not represent degree of tangibility, measurability or concreteness of the concepts. For example, staff turnover and absenteeism are easy to measure—internal mechanics of perception and cognition are not. Therefore an hierarchy of abstraction²⁹ was introduced, as shown, in an attempt to clarify which concepts are likely to be "hazy" as Nasser & Schmickl (1986) characterised the company climate concept. Concrete concepts are at the top (with big shadows) and tend to become more abstract (with smaller shadows), the lower they are placed on the diagram. At the bottom of the diagram lies a domain of pure abstraction, the unified field of quantum physics as discussed in Appendix S.

In addition, the model represents all classes of job stress variables as being embedded in a field of "collective consciousness" as discussed by Gustavsson (1992: 33, 152-219) and Heaton & Herron (1988: 231).

²⁸ e.g. heredity, hardy personality, etc. Conditioning variables are represented here as being intimately linked with, almost inseparable from oval 3, the internal mechanics of perception, cognition and adaptation.

²⁹ This idea is borrowed from the teaching materials used at Maharishi International University, Fairfield, Iowa, which uses similar "unified field charts" as part of its interdisciplinary approach to relate all aspects of a discipline to each other and to their unified source.

Gustavsson defines collective consciousness as: "...created by individuals expressing the transcendental consciousness, which could be said to be a continuous field (i.e., the unified field) connecting all humans at the most abstract level of creation" (1992: 219). It is proposed that all classes of variables shown above interact with the collective consciousness and hence the unified field. This implies that an individual entering an organisation consisting of many "highly stressed" individuals would himself tend to become "more stressed," in the same way that an individual returning to South Africa prior to the recent elections could hardly have failed to pick up something negative from the collective consciousness of the country at that time.

One reason for proposing this addition to the job stress model is that it may provide an expanded or alternative³⁰ explanation for the observation of improvements in on-site controls in this study. This has been discussed in chapter III in the section on *validity of climate as a link between stress reduction and productivity*, and also in chapter V: *discussion: improvements in controls*.

Another reason is that it may actually simplify the model. This is by opening the way to interpreting the complex interrelationships of the model as being driven by changes in a more abstract underlying field, the collective consciousness of the organisation. Such a view would be consistent with a systems view of nature as elaborated by Lazlo (1972) and Pelletier, who stated:

Overwhelming evidence from the physical sciences supports continuity between matter and energy and the

³⁰ i.e., Alternative to the traditional discussions of the Hawthorne effect, as mentioned later.

emergent properties of whole systems (Pelletier, 1992: ixxviii).

As mentioned in chapter III, TM is held to provide access to the unified field. If this is so, it would provide the basis of the theory of field effects proposed in this study as a possible explanation for the improvements noted in on-site controls. The TM/unified field linkage is indicated in figure 27 above.

Further linkages, additional to those represented in figure 1a (from which this model is derived), are the links between individual and organisational consequences (e.g. absenteeism) and organisational stressors (e.g. overload). These linkages provide a feedback loop which could also provide a possible explanation for the improvements noted in on-site controls.

Finally, the use of the term "strain" is endorsed to resolve the ambiguities inherent in the use of the term "stress" as discussed at length in chapter I and used thereafter in this report. In addition, "strain" implies negative consequences of stress—which aligns the model with the approaches of Caplan et al (1975), Maharishi (1972), Alexander et al (1990) and Wallace et al (1988); all of whom regard stress (i.e., strain) as a deviation from normal.

CONCLUSION

This study has demonstrated support for hypothesis 1 that Transcendental Meditation was effective in reducing stress levels at the worksite. Some support was also found for hypothesis 3 that stress reversal improvements in psychological and physiological variables were positively correlated, and were accompanied by a tendency toward overall improvements in climate. Furthermore a small improvement in sales turnover per head of staff was noted in the last month of the intervention, and this appears to have been sustained following the intervention. In addition, support was also shown for hypothesis 4 that the practice of TM by a substantial on-site group—who manifest stress reductions—is associated with correlated improvements in psychological and physiological stress variables measured on controls who did not participate in the intervention.

For this phenomenon, the operation of a field effect (to be termed the Corporate Maharishi Effect) is proposed as a possible explanation, alternative and complementary to the traditional arguments of Hawthorne, placebo, social interaction, self-initiated treatment or expectation effects. This proposed Corporate Maharishi Effect phenomenon seems deserving of further investigation.

Experience during the study, confirmed by evidence from structured interviews and subjective evaluations, was that the intervention was conducted without undue disruption to work

schedules; that it led to subjective perceptions of gains in areas such as personal and work relationships and productivity, and that the intervention was greatly appreciated by participants. Furthermore the three years following the intervention saw positive organisational change, substantial growth and improvements in organisation effectiveness. While the theory base was not sufficiently developed here to allow these developments to be causally related to TM, the experience at the survey company was echoed in anecdotal reports from elsewhere, and to a limited extent in the responses from a second survey company. This challenging area—relating organisation development to stress reduction in general and TM in particular—begs further research.

A third related area inviting future research is the relationship between stress reduction, company climate, productivity and possible intervening variables such as industrial relations practices.

Following consideration of the findings of this study and of its preceding literature, a slightly modified view of the overall job stress process has been offered here. This has been done in the form of an hierarchical model of job stress and coping and is offered as a tentative framework to guide future thinking in this area. Does this model and study throw more light on stress? Perhaps they do, in the introduction of a unified field perspective, in the correlations found between the psychological and physiological measures, and in the suggestion of positive organisational outcomes following stress reduction.

But to place all this into perspective, possibly the *wisest* definition of stress that was encountered during the present survey came not from a learned dissertation, but from a lay participant in a self-improvement workshop held in Johannesburg. Together with others in a group he was asked "what is stress?" Without hesitation he replied "lack of holiness!"

CHAPTER VI

SUMMARY

Stress in organisations has been widely blamed for psychological, physical and behavioural ill effects costing hundreds of billions of dollars annually. Yet despite a large clinical and laboratory literature on stress reduction there is a dearth of data on stress management at the worksite itself. Many problems confront the stress researcher including the concept of stress itself which continues to elude a scientifically acceptable definition.

Nevertheless this study wished to evaluate a stress reduction intervention at the worksite and hoped to evaluate its impact on productivity, as well as on the psychological and physiological variables which were the primary focus of the study. As the study unfolded and it became apparent that the intervention was effective, the focus of the study was broadened in order to ask the question—what might be the consequences for organisational development (OD)?

TM¹ was chosen as the treatment, i.e., independent variable, and PMR the control treatment. The variable of interest was "stress levels" defined for purposes of this study as the individual's psychological,

¹ Transcendental Meditation of Maharishi Mahesh Yogi. Other abbreviations used here are: PMR = Progressive Muscle Relaxation of Jacobson; SCL = Stress Symptoms Checklist; SBP = systolic blood pressure; DBP = diastolic blood pressure; HR = heart rate; BR = breath rate.

physiological and behavioural responses to the total of internally and externally driven demands on that individual. Following the recommendations of previous researchers (e.g. Murphy, 1984; Newman & Beehr, 1979) a multi-method multivariate approach was adopted for the measurement of stress.

Dependent variables were psychological stress symptoms, measured by raw score on the stress symptoms checklist questionnaire (SCL-90-R of Derogatis, 1977, the primary outcome measure); physiological stress parameters, (SBP and DBP, breath and heart rates); and the WARMTH and SUPPORT dimensions of a climate instrument (the industrial barometer, developed by Litwin & Stringer, and revised for SA conditions by Gelfand as reported by Nasser & Schmickl, 1986). The climate data was collected because at the outset of the study it was uncertain whether any productivity data would be available. Additional data was collected on demographics, expectancy, regularity of practice and subjective evaluations. The research design was strongly experimental, using an extended Solomon four group design to control for nuisance variables. The study was necessarily set in a case study context because it was worksite research. Other organisational data was gathered by interview three years after the intervention in order to complement and interpret the experimental findings.

Four research hypotheses were formulated and a number of other research questions framed following a review of the stress literature.

Hypothesis one was that the treatments would be effective with effect increasing over time. Hypothesis two was that TM would be more effective than PMR in promoting beneficial psychological and physiological changes. Hypothesis three was that there would be a direct correlation between beneficial changes across all three areas: psychological stress symptoms, physiological stress parameters and climate. Hypothesis four was that on-site controls would also demonstrate improvements, even if they did not volunteer for training in relaxation.

A suitable survey company was located and the staff briefed on the benefits of stress reduction. Sixty-four volunteered for training in either Transcendental Meditation or Progressive Muscle Relaxation, though the overwhelming majority indicated a preference for TM. This was due probably at least in part to the fact that the Deputy Managing Director was already practicing TM. In due course 41 were taught TM and 18 PMR. In addition 12 non-volunteers agreed to pre and posttesting across the psychological, physiological and climate measures proposed for the experiment.

The intention had been to compare TM and PMR but the comparison was obstructed by lack of availability of a PMR instructor on time. Furthermore a stressful event in the form of the announcements of retrenchments took place in the week of PMR posttesting leading, on analysis of data, to apparent increases in stress levels of the participants at

that point. Shortly thereafter, six of the PMR participants insisted on learning TM, so the plan to wait 5,5 months before final posttesting was abandoned, and the group was taught TM instead.

For purposes of comparison and control, four other studies were conducted in addition to the main one. These were of 15 long term TM practitioners, 16 off-site controls, 22 volunteers who learned TM in a TM centre, and a normative group of 250 participants in productivity workshops. The only measure used for these groups was the SCL-90-R.

Pretesting was conducted in the week before the intervention at the survey company. Posttesting was done during training follow up sessions at two weeks, six weeks and 5,5 months. Further follow ups took place at 18 months and three years after the intervention. Data were filed in a personal computer database and analysed in detail using standard statistical software.

Hypothesis 1 was supported—that TM would be effective in reducing stress levels as measured by SCL-90-R raw scores ($p < 0,0002$ at 5,5 mo posttest, paired-t; or $p < 0,0005$, unrelated groups). Additional support was suggested by the finding that at 5,5 months posttest, TM groups' SCL-90-R scores were significantly lower ($p < 0,05$, Scheffe's post-hoc) than those of off-site controls (matched on age and occupation variables but not on sex). Hypothesis 1 was also supported on the blood pressure dimension (SBP $p < 0,05$ and DBP $p < 0,04$ at 5,5 mo posttest, Students t, matched pairs). Heart and breath rates showed a decreasing trend as predicted,

though these changes failed to reach statistical significance. Climate improved initially, but the improvements showed signs of reversal at 5,5 months posttest, probably due to intervening retrenchments. Hypothesis 1 was supported across both SUPPORT ($p < 0,005$, $N = 23$ pairs, Wilcoxon) and WARMTH (n.s. trend), but only at 6 week posttest.

Hypothesis 2, that TM would be more effective than PMR, was tentatively supported in the lower levels of statistical significance for the PMR reductions in SCL-90-R scores at six week posttest. On the physiological measures, results were mixed, with PMR showing better than TM in the case of DBP at six weeks. PMR groups showed a significant decrease in DBP ($p < 0,04$, paired-t), but a significant *increase* in heart rate ($p < 0,02$ paired-t) at six weeks. These comparisons (i.e. of TM versus PMR), while interesting, were rendered invalid by practical difficulties with executing the original experimental design.

Hypothesis 3, that stress measures would be positively correlated, found mixed support. Some support came from a correlation analysis which found significant positive correlations between SBP/DBP and WARMTH/SUPPORT ($p < 0,01$, 53 df). Further positive correlations of borderline significance were noted between SCL/DBP and SBP/BR ($p < 0,1$). However negative correlations were noted between the climate and physiological variables WARMTH/BR ($p < 0,05$) and SUPPORT/ BR (borderline— $p < 0,1$). An overall tendency for climate to improve was noted concurrently with the psycho-physiological improvements.

Hypothesis 3 was also supported by a multiple regression analysis (reported separately as Appendix U) which found that DBP and log SBP each contributed significantly to the predictable variance in transformed (log) SCL-90-R scores (DBP partial-F=9,417; DF=1, 48; $p<0,0035$ and log SBP partial-F=6,208; DF=1, 48; $p<0,0162$).

Associated with the psycho-physiological improvements, limited turnover and staff complement data available suggested a small overall company productivity gain over the intervention.

Hypothesis 4, that on-site controls would *also* show improvements, was supported at 5,5 month posttest ($p<0,034$, paired-t, one tailed), with reductions in SCL scores of the same order of magnitude (51%) as for the TM groups (52%), suggesting the operation of social interaction, Hawthorne or field effects. Although smaller than off-site control scores, these on-site 5,5 month posttest scores failed to differ significantly from off-site controls (matched on age and occupation variables but not on sex).

Analysis of subjective comments was broadly supportive of hypothesis one, with the majority of comments covering positive perceived physiological/health benefits such as "relaxation", "calm", "reduced tiredness", "increased energy" and "more alertness." Regarding hypothesis 2, observed frequencies of positive comments did not differ significantly between TM and PMR groups. However the same trend for

TM improvements to exceed those for PMR was also seen here, particularly in the productivity area.

As mentioned, productivity appeared to improve slightly over the six months of the intervention. Interview data suggested this improvement was sustained. Structured interviews three years after the intervention suggested increased company effectiveness and growth.

No references to such organisational outcomes² following training in TM were found in the formal literature. Furthermore, insufficient evidence is presented here to establish a causal link between TM and positive long-term organisational outcomes—although those found here are interesting and in line with both the microscopic findings of this study and anecdotal evidence of macroscopic improvements elsewhere.

These findings of positive outcomes at the organisational level of analysis are thus not generalisable to all organisations until a more widely representative sample of firms can be studied. If these findings can be replicated and anecdotal reports corroborated, however, it suggests a useful role for Transcendental Meditation in the process of organisation development. The relationship between TM and outcomes at the

² As mentioned in chapter II, other workers (Gustavsson, 1993, Alexander, et al, 1992, Friend, 1978, and Frew, 1974) have also studied TM in organisations, but their measures were purely self-report based and may therefore be regarded here as made at the *individual* or microscopic level of analysis. However, climate may be regarded as an *organisational* or macroscopic variable, as discussed in chapter II. As mentioned in the section on climate in chapter V, Gustavsson (1993) found ambiguous changes in "group spirit" and "creative climate" following TM. He described these results as "paradoxical and unexpected" given that he did find positive changes in these variables using other measures (structured interviews) at the individual level of analysis.

macroscopic or organisational level of analysis clearly begs further research.³

Regarding the validity of the individual findings in the light of modest sample sizes, the two most important statistical comparisons (TM pre-versus posttest and TM posttests versus off-site controls at final posttest) on the main outcome measure (SCL-90-R) were based on a final group sizes of 21 and 12 respectively. This latter group size may be regarded as borderline, but not unacceptable, in the light of other researchers' comments (Orme Johnson & Dillbeck, 1986; Runyon & Haber, 1980).

Modest group sizes (some were 10 at pretest) and attrition at posttest curtailed the statistical power and challenged the validity of some between group comparisons. Nevertheless, detailed statistical analysis, supported by qualitative data, made it possible to draw justifiable conclusions about the results of the experiment.

It was suggested that the magnitude of the improvements in on-site controls may be due to the operation of field effects similar to the Maharishi Effect noted by other researchers in the vicinity of groups practicing Transcendental Meditation. The term Corporate Maharishi Effect was proposed to distinguish it from this phenomenon because the threshold numbers of TM practitioners required to produce the field effect in companies may be much higher than for the Maharishi Effect. Further research in this area also seems justified.

³which would also address the issue of possible gender bias referred to in chapter V.

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APPENDIX A

DEMOGRAPHIC, EXPECTATION AND SUBJECTIVE EVALUATION
DATA

SUB- JECT	GROUP	LEVEL	AGE	SEX	6- WEEK EVAL	EXPEC AT START	REG AT 2W	REG AT 6W	REG AT 5,5M
1	1	3	25	F	10	80	1	1	1
2	1	1	65	M	7	43	1	1	4
3	1	3	53	F	10	53	2	2	2
4	1	4	22	F	5	63	2	2	4
5	1	4	47	F	10	75	1	2	2
6	1	4	28	F	10	72	1	1	2
7	1	1	40	M	4	55	2	4	4
8	1	4	45	F	9	64	1	1	1
9	1	3	31	F	7	58	1	4	
10	1	3	27	F	6	54	2	2	4
11	1	2	45	F	7	69	1	2	2
12	2	4	21	F	8	70	1	1	
13	2	3	35	F	8	61	2	2	2
14	2	2	52	F	9	62	1	2	4
15	2	3	30	F	5	63	2	3	4
16	2	3	46	F		69	2	3	
17	2	4	44	F	6	40	1	2	4
18	2	2	45	M	8	63	1	1	2
19	2	4	35	F	7	40	1	1	2
20	2	4	26	F	10	57	1	1	2
21	2	1	44	F		42	1	3	4

Level = Level of seniority (1 is senior management, 4 is clerical)

6-Week eval = Score on course evaluation at six week post-instruction (higher is better)

Expec at start = Score on expectation questionnaire before instruction (higher is better)

Reg at 2 weeks = regularity at two weeks post-instruction (1 is seven or more times per week, 4 is stopped practice)

SUBJECT	GROUP	LEVEL	AGE	SEX	6-WEEK EVAL	EXPEC AT START	REG AT 2W	REG AT 6W	REG AT 5,5M
22	3	4	23	M	8	56	1	2	4
23	3	3	30	F		70	2	3	4
24	3	4	52	M	8	78	1	1	1
25	3	4	60	F		41	2	3	4
26	3	3	44	F	10	64	1	1	1
27	3	2	50	F	7	61	2	2	2
28	3	4	27	F	6	17	2	2	
29	3	3	29	F		69	2	3	3
30	3	3	56	F	7	65	2	2	
31	3	4	42	F		76	1	1	
32	4	2	37	F	5		4	4	4
33	4	3	55	F		63	2	2	2
34	4	4	23	F		70	2	3	4
35	4	3	23	F		73	2	3	3
36	4	4	53	F		47	1		
37	4	2	47	F	10	48	2	2	2
38	4	4	30	F		60	1		
39	4	3	31	F	7	57	2	2	3
40	4	3	43	M		68			
41	4	4	29	F	7	60	2	2	3
42	5	4	30	M	10	71		2	1
43	5	4	34	F	6	66		2	
44	5	4	31	F	6			2	4
45	5	4	28	F		51			
46	5	4	24	F		54		2	2
47	5	4	19	F		63			
48	5	2	34	F	8	48		2	3
49	5	4	46	F		64		1	2
50	5	1	34	F		48		4	4
51	5	4	46	F	8	68		1	2
52	5	4	44	F		37			

SUBJECT	GROUP	LEVEL	AGE	SEX	6-WEEK EVAL	EXPEC AT START	REG AT 2W	REG AT 6W	REG AT 5,5M
53	6	3	46	F				2	4
54	6	3	29	F		51		4	4
55	6	4	48	F	6	46		3	4
56	6	3	46	F	8			2	4
57	6	4	30	F		48			
58	6	2	41	M		56		2	
59	6	2	34	F	4			4	4
60	7	4	37	F		65			
61	7	4	33	F		40			
62	7	4	53	F		49			
63	7	4	56	F		70			
64	7	4	44	F		37			
65	7	4	58	F		40			
66	7	4	28	F		54			
67	7	4	47	F		43			
68	7	3	42	F					
69	7	4	48	F		38			
70	7	4	47	F		16			
71	8		35	F					
72	8		39	M					
73	8		31	F					
74	8		31	M					
75	8		40	F					
76	8		28	F					
77	8		32	M					
78	8		44	M					
79	8		32	F					
80	8		41	F					
81	8		27	M					
82	8		30	F					
83	8		33	M					
84	8		38	M					
85	8		34	F					
86	8		41	M					
87	8		38	F					

SUBJECT	GROUP	LEVEL	AGE	SEX	6-WEEK EVAL	EXPEC AT START	REG AT 2W	REG AT 6W	REG AT 5,5M
88	8		35	F					
		Yrs practice							
89	9	15	47	M					
90	9	8	41	M					
91	9	17	49	M					
92	9	18	42	M					
93	9	23	59	F					
94	9	3	25	M					
95	9	2	28	M					
96	9	8	32	M					
97	9	0,1	35	F					
98	9	0,5	37	F					
99	9	1	36	F					
100	9	25	48	F					
101	9	16	46	M					
102	9	1	22	M					
103	9	16	34	F					
104	10		41	F					
105	10		59	F					
106	10		24	F					
107	10		28	F					
108	10		40	F					
109	10		39	F					
110	10		32	F					
111	10		61	F					
112	10		50	F					
113	10		41	M					
114	10		22	M					
115	10		52	F					
116	10		37	F					
117	10		32	F					
118	10		25	M					
119	10		41	F					
120	10		21	F					
121	10		51	F					

SUB- JECT	GROUP	LEVEL	AGE	SEX	6- WEEK EVAL	EXPEC AT START	REG AT 2W	REG AT 6W	REG AT 5,5M
122	10		30	F					
123	10		58	M					
124	10		30	F					
125	10		41	F					

APPENDIX B

SCL-90-R RESULTS

SUBJECT	GROUP	SCL-PRE	SCL-PRE2	SCL-2WK	SCL-6WK	SCL-5,5M
1	1	54		27	17	7
2	1	32		17	18	18
3	1	40		25	18	40
4	1	89		27	34	24
5	1	218		70	48	64
6	1	41				
7	1	5				
8	1	31		13	6	
9	1	52		54	19	
10	1	42		55	48	36
11	1	78		28	30	17
12	2			71	17	
13	2			67	70	61
14	2			12	11	
15	2			49	4	18
16	2			27	15	
17	2			43	43	26
18	2			103	98	51
19	2			23	6	
20	2			20		
21	2			54	40	10
22	3	56	48	22	14	25
23	3	59	44	81	58	39
24	3	64	113	41	28	43
25	3	22	18	24	28	33
26	3	31		25	15	21
27	3	39	23	20	16	8
28	3	85		110	53	41
29	3	114	111	34	6	17
30	3	60	42	31	24	
31	3	58	56	37	6	

SCL-PRE = Raw grand total score on the SCL-90-R instrument pre-instruction

SCL-PRE2 = Score at second pretest

SUBJECT	GROUP	SCL-PRE	SCL-PRE2	SCL-2WK	SCL-6WK	SCL-5,5M
32	4	8				
33	4	49		37	33	41
34	4	133		96	58	42
35	4	53		5	38	30
36	4	200		73	111	
37	4	32			27	18
38	4	103		6	55	
39	4	69		40	64	57
40	4	15				
41	4	41		27	17	6
42	5	137	129			
43	5	107	109		107	
44	5		5			
45	5	48	34			
46	5	25	16		4	
47	5	133	89		88	
48	5	48	15		42	47
49	5	92	27		10	5
50	5	31	13		8	16
51	5	43	34		10	20
52	5	72				
53	6	35	45			25
54	6	101	113			15
55	6	69	38		17	27
56	6	85	79		83	80
57	6	27				
58	6	130	104		84	
59	6	52	27		14	
60	7	211				73
61	7	30				
62	7	25				
63	7	50				
64	7	20				8
65	7	19			6	
66	7	66			18	32
67	7	58			45	34

SUBJECT	GROUP	SCL-PRE	SCL-PRE2	SCL-2WK	SCL-6WK	SCL-5,5M
68	7	172				12
69	7	55			46	76
70	7	61				12
71	8	174				83
72	8	48				
73	8	97				77
74	8	81				80
75	8	81				31
76	8	34				27
77	8	104				
78	8	90				58
79	8	57				149
80	8	49				19
81	8	100				122
82	8	145				.
83	8	166				
84	8	60				19
85	8	9				
86	8	41				31
87	8	53				
88	8	33				34
89	9					91
90	9					54
91	9					28
92	9					9
93	9					6
94	9					137
95	9					96
96	9					41
97	9					24
98	9					95
99	9					13
100	9					
101	9					12
102	9					25
103	9					43
104	10	94		37		

SUBJECT	GROUP	SCL-PRE	SCL-PRE2	SCL-2WK	SCL-6WK	SCL-5,5M
105	10	61		18		
106	10	128		34		
107	10			41		
108	10			45		
109	10	27		5		
110	10	231		170		
111	10	145				
112	10	44		13		
113	10	97		75		
114	10	57		53		
115	10	79		73		
116	10	12				
117	10	143				
118	10	23		23		
119	10	40				
120	10	114				
121	10	23				
122	10	66				
123	10	22		12		
124	10	115		76		
125	10	136		54		

APPENDIX C

SYSTOLIC BLOOD PRESSURE RESULTS

SUBJECT	GROUP	SBP -PRE	SBP -PRE 2	SBP -2WK	SBP -6WK	SBP -5,5M
1	1	121,67		111,67	111,67	105,67
2	1	151,67		155,00	158,33	135,00
3	1	103,33		115,00	107,33	103,33
4	1	93,33		88,33	91,67	90,00
5	1	113,33		115,00	105,00	110,00
6	1	113,00		120,00	116,67	111,67
7	1	105,00		110,00	96,67	105,00
8	1	116,67		123,33	111,67	128,33
9	1	95,00		100,00	106,67	
10	1	105,00		96,67	100,00	95,00
11	1	105,00		105,00	102,50	101,67
12	2			103,33	118,33	
13	2			113,33	100,00	98,33
14	2			120,00	116,67	100,00
15	2			121,67	116,67	110,00
16	2			110,00	98,33	
17	2			118,33	121,67	118,33
18	2			135,00	136,67	136,67
19	2			108,33	103,33	100,00
20	2			110,00	115,00	108,33
21	2			115,00	111,67	118,33
22	3	96,67	100,00	96,67	115,00	101,67
23	3	98,33	88,33	98,33	96,67	96,67
24	3	93,33	98,33	101,67	93,33	101,67
25	3	160,00	136,67	138,33	135,00	141,67
26	3	98,33	93,33	90,00	95,00	103,33
27	3	148,33	130,00	130,00	125,00	126,67
28	3	90,00	76,67	98,33	95,00	91,67
29	3	93,33	108,33		108,33	93,33
31	3	156,67	131,67	140,00	150,00	

SUBJECT	GROUP	SBP -PRE	SBP -PRE 2	SBP -2WK	SBP -6WK	SBP -5,5M
32	4	123,33		125,00	125,00	118,33
33	4	123,33		123,33	128,33	126,67
34	4			106,67	110,00	100,00
35	4	101,67		96,67	98,33	93,33
37	4	120,00		121,67	113,33	128,33
38	4	95,00		101,67	101,67	
39	4	115,00		103,33	123,33	113,33
41	4	110,00			115,00	106,67
42	5	111,67			111,67	
43	5	108,33			103,33	
44	5				126,67	128,33
46	5	113,33			121,67	101,67
47	5	90,00			101,67	
48	5	103,33			100,00	106,67
49	5	103,33			120,00	100,00
50	5	93,33			98,33	95,00
51	5	108,33			108,33	115,00
52	5	143,33				
53	6	128,33			121,67	135,00
54	6	96,67				90,00
55	6	121,67			120,00	131,67
56	6	106,67			108,33	101,67
57	6	121,67				
58	6	100,00				
59	6	91,67			91,67	95,00
60	7	133,33				110,00
62	7	128,33				108,33
64	7	93,33				93,33
65	7	100,00				106,67
66	7	113,33				103,33
67	7	108,33				119,00
68	7	100,00				90,00
69	7	100,00				103,33
70	7	91,67				106,67

APPENDIX D

DIASTOLIC BLOOD PRESSURE RESULTS

SUBJECT	GROUP	DBP -PRE	DBP- PRE2	DBP -2WK	DBP -6WK	DBP -5,5M
1	1	78,33		71,67	73,33	63,33
2	1	95,00		93,33	103,33	88,33
3	1	71,67		71,67	75,00	68,33
4	1	63,33		60,00	63,33	53,33
5	1	86,67		78,33	76,67	76,67
6	1	81,67		90,00	86,67	83,33
7	1	68,33		61,67	60,00	60,00
8	1	71,67		83,33	73,33	88,33
9	1	76,67		76,67	73,33	
10	1	85,00		63,33	60,00	63,33
11	1	73,33		75,00	60,00	68,33
12	2			61,67	75,00	
13	2			78,33	66,67	66,67
14	2			76,67	85,00	78,33
15	2			70,00	70,00	65,00
16	2			73,33	68,33	
17	2			86,67	78,33	75,00
18	2			85,00	76,67	78,33
19	2			70,00	68,33	70,00
20	2			65,00	76,67	76,67
21	2			83,33	61,67	83,33
22	3	65,00	65,00	65,00	71,67	68,33
23	3	76,67	66,67	71,67	70,00	71,67
24	3	66,67	69,00	70,00	65,00	65,00
25	3	100,00	81,67	91,67	81,67	88,33
26	3	61,67	60,00	60,00	68,33	63,33
27	3	91,67	90,00	80,00	83,33	86,67
28	3	63,33	51,67	66,67	68,33	66,67
29	3	68,33	71,33		71,67	65,00
31	3	106,67	93,33	88,33	110,00	

SUBJECT	GROUP	DBP -PRE	DBP- PRE2	DBP -2WK	DBP -6WK	DBP -5,5M
32	4	85,00		78,33	80,00	81,67
33	4	75,00		75,00	76,67	71,67
34	4			78,33	65,00	68,33
35	4	65,00		61,67	65,00	61,67
37	4	83,33		90,00	90,00	88,33
38	4	60,00		68,33	63,33	
39	4	78,33		83,33	91,67	83,33
41	4	63,33			68,33	71,67
42	5	78,33			70,00	
43	5	90,00			76,67	
44	5				95,00	90,00
46	5	78,33			78,33	65,00
47	5	70,00			66,67	
48	5	83,33			61,67	63,33
49	5	70,00			73,33	68,33
50	5	63,33			65,00	65,00
51	5	76,67			71,67	73,33
52	5	100,00				
53	6	86,67			73,33	88,33
54	6	75,00				56,67
55	6	78,33			85,00	91,67
56	6	76,67			71,67	68,33
57	6	80,00				
58	6	73,33				
59	6	61,67			63,33	56,67
60	7	98,33				85,00
62	7	93,33				68,33
64	7	73,33				63,33
65	7	70,00				65,00
66	7	80,00				71,67
67	7	81,67				76,00
68	7	71,67				65,00
69	7	66,67				65,00
70	7	61,67				78,33

APPENDIX E

HEART AND BREATH RATE RESULTS

SUBJ ECT	GR- OUP	HR -PRE	HR- PRE2	HR -2WK	HR -6WK	HR 5,5M	BR -PRE	BR- PRE2	BR -2WK	BR -6WK	BR -5,5M
1	1	84		76	76	72	24		18	24	18
2	1	96		64	76	60	24		22	18	18
3	1	88		72	74	84	24		18	24	24
4	1	68		56	80	68	18		18	22	18
5	1	80		84	72	76	22		20	18	24
6	1	76		64	64	64	18		16	18	20
7	1	54		56	58	57	16		16	18	18
8	1	92		72	80	64	24		17	24	18
9	1	72		76	96		16		18	24	
10	1	56		64	56	60	18			24	18
11	1	54		58	64	52	18		16	18	18
12	2			80	68				24	20	
13	2			72	65	76			18	20	18
14	2			76	64	80			20	20	24
15	2			80	88	84			24	22	24
16	2			76	68					18	
17	2			74	72	100			20	18	24
18	2			68	58	56				22	18
19	2			76	68	76			24	20	20
20	2			76	60	64			20	18	18
21	2			96	68	80			24	20	22
22	3	68	60	68	64	60	18	18	20	20	18
23	3	68	84	84	76	76	20		18	18	22
24	3		60	76	60	80				22	24
25	3	80	72	84	76	68		20	20	20	18
26	3	72		80	76	88	18		20	20	20
27	3	72	64	60	52	72	20	18	18	18	20
28	3	76	100	80	84	76	18		22	20	18
29	3	92	96		72	80	24	24		22	24
31	3	96	92	104	84		24		22	22	

SUBJECT	GROUP	HR-PRE	HR-PRE2	HR-2WK	HR-6WK	HR-5,5M	BR-PRE	BR-PRE2	BR-2WK	BR-6WK	BR-5,5M
32	4	68		76	60	92	18			20	20
33	4	88		80	84	96			22	22	22
34	4			68	56	56				22	16
35	4	60		72	68	88	18		18	20	20
37	4	84		74	96	88	24		24	24	22
38	4			68	72				18	22	
39	4	72		72	84	76	24		18	20	20
41	4	76			88	64	20			22	18
42	5	88			96		24			24	
43	5	76			80		20			24	
44	5				74	72				18	20
46	5	76			82	76	18			20	18
47	5	58			72		18			25	
48	5	100			88	76	18			20	18
49	5	64			64	72				18	20
50	5	48			56	56	20			20	18
51	5	68			72	68	18			18	18
52	5	64					18				
53	6	68			92	68	24			24	24
54	6	92				84	24				22
55	6	62			58	52	18			18	18
56	6	92			100	104	22			22	24
57	6	104					22				
58	6	72					20				
59	6	58			68	68	18			18	18
60	7	76				96	20				22
62	7	64				60	20				18
64	7	60				60	18				18
65	7	68				76	18				22
66	7	72				84	18				18
67	7	64				72	18				18
68	7	72				76	16				20
69	7	100				84	24				20
70	7	65				56	18				18

APPENDIX F

CLIMATE RESULTS

SUBJECT	GROUP	WARMTH -pre	WARMTH -5,5 mo post	SUPPORT -pre	SUPPORT -5,5 mo post
1	1	81,25	87,50	62,50	68,75
2	1	100,00	93,75	93,75	93,75
3	1	93,75	100,00	93,75	93,75
4	1		68,75		50,00
5	1	75,00	87,50	75,00	75,00
6	1	93,75	87,50	81,25	93,75
7	1	93,75	100,00	93,75	100,00
8	1	87,50	100,00	62,50	68,75
9	1	87,50		68,75	
10	1	87,50	81,25	75,00	62,50
11	1	75,00	75,00	68,75	75,00
13	2		68,75		68,75
14	2		75,00		75,00
15	2		87,50		87,50
17	2		62,50		75,00
18	2		68,75		62,50
19	2		62,50		75,00
20	2		87,50		75,00
21	2		93,75		93,75
22	3	87,50	81,25	68,75	68,75
23	3	100,00	100,00	50,00	81,25
25	3	93,75	87,50	75,00	81,25
26	3		87,50		87,50
27	3	81,25	68,75	68,75	62,50
28	3	75,00	68,75	62,50	68,75
29	3	75,00	68,75	25,00	37,50
30	3	68,75		81,25	
31	3	93,75		75,00	

SUBJECT	GROUP	WARMTH -pre	WARMTH -5,5 mo post	SUPPORT -pre	SUPPORT -5,5 mo post
32	4	93,75	87,50	68,75	81,25
33	4	75,00	75,00	62,50	62,50
34	4	75,00	68,75	75,00	68,75
35	4	93,75	68,75	81,25	50,00
36	4	62,50		68,75	
37	4	75,00	75,00	75,00	75,00
38	4	50,00		56,25	
39	4	68,75	75,00	93,75	81,25
40	4	93,75		87,50	
41	4	75,00	68,75	68,75	62,50
42	5	93,75	75,00	62,50	75,00
43	5	81,25		75,00	
44	5		81,25		87,50
45	5	75,00		75,00	
46	5	81,25	87,50	62,50	75,00
47	5	81,25		56,25	
48	5	87,50	93,75	81,25	75,00
49	5	93,75	93,75	81,25	100,00
50	5	68,75	68,75	75,00	68,75
51	5	75,00	56,25	50,00	62,50
52	5	56,25		68,75	
54	6	87,50	100,00	56,25	81,25
59	6	81,25	75,00	68,75	75,00
60	7	87,50	87,50	87,50	100,00
61	7	75,00		75,00	
62	7	81,25	100,00	100,00	100,00
65	7	75,00	62,50	87,50	68,75
66	7		62,50		62,50
67	7	75,00	68,75	75,00	75,00
68	7	62,50	75,00	68,75	75,00
69	7	87,50	75,00	87,50	68,75
70	7				

APPENDIX G

SUBJECTIVE COMMENTS

Numbers before each quote indicate the subjects' group.

Have you noticed any improvements in your relationships with others?

- 1 "Yes, maybe in reverse. Where I will now take up the issue with the people/person whom it concerns whereas before I took my frustration out on the people close to me.
- 1 More patient
- 1 Yes, more tolerant and understanding of their problems.
- 1 Yes
- 1 Yes, with my kids
- 1 No
- 1 No.
- 1 No, nothing outstanding.
- 1 Not really yet. Had a lot of stress lately.
- 2 I don't seem to be as impatient as I was. Also I listen more intently to the things going on around me.
- 2 Yes, less rush, more centred on the self.
- 2 more relaxed
- 2 No
- 2 not really
- 2 some of my colleagues say I am calmer at work.
- 2 not so up-tight
- 2 Yes, tend to be more objective. Look at a situation almost 'from the outside'.
- 3 No drastic improvement.

- 3 I cannot notice any difference
- 3 Yes, more relaxed and handling of problems easier.
- 3 yes
- 3 No, I still feel the same as before
- 3 Not so impatient any more
- 4 Not really
- 4 Yes - more patience
- 4 Yes, a bit. I do not get agitated so fast and tend to have more patience.
- 4 No
- 5 Yes, more positive. Taking full charge of my life. (Used to think others can do it for me!) Feeling important as all others.
- 5 Not really. I seem to be more irritable.
- 5 Yes
- 5 Not really
- 5 Yes, but I am not sure whether it is from their side or my side.
- 6 I didn't notice anything
- 6 Even though I no longer practice I am aware of the importance of being relaxed and when tense situations arise I will take myself off and relax for a few minutes.
- 6 I am not as uptight and force myself to relax more this means am not as susceptible to the moods of others."

Have you noticed any improvement in your personal productivity?

- 1 Yes definitely! have lots more energy - get round to doing more than ever before. I cope better with situations which previously made me quite anxious. Generally feel less hassled and yet I am busier /get more done.
- 1 No.

- 1 Yes. Can keep much calmer in a stressful situation. Much clearer thinking pattern.
- 1 Yes
- 1 Yes, take life more seriously
- 1 I definitely have more energy
- 1 No
- 1 A little. Seem to get through more.
- 2 I learn a lot more and quicker too. I seem to be more attentive to the odds and sods I have to do.
- 2 Can cope with more but seem to be getting more work too
- 2 like to be on the go all the time
- 2 No
- 2 no
- 2 It seems to get better sometimes. Perhaps its related to how many times a day I manage to meditate.
- 2 more ?
- 2 not yet
- 3 Slight increase - more alert
- 3 Yes I can notice any improvement by sleeping well and no more worries
- 3 Yes, after lunch have more energy can pressure more easily.
- 3 yes
- 3 No, as above
- 3 No
- 4 No. Under pressure at the moment, no drop off in productivity
- 4 Yes
- 4 Not really. I am usually quite organised but perhaps I have become even more so
- 4 No

- 5 Yes, more alert, efficient and effective
- 5 No
- 5 Yes
- 5 Not really
- 5 Yes, but it started before going on this course.
- 6 As above
- 6 I think I've always been a high productivity person with things that interest or stimulate me.
- 6 I have reverted to my own method of relaxation, i.e. switching off for about 20 mins when I get home from work and reading a novel before joining my family.

Comment on your satisfaction with the programme so far?

- 1 "I have given TM a fair chance and the benefits have been real and in many instances surpassed all expectation.
- 1 Has helped to relax me, given more energy, less stress.
- 1 I find myself a bit nicer to others and have confidence in myself.
- 1 Still positive
- 1 I really enjoy it
- 1 I find it restful when I get a chance to do it but I don't feel any real benefits.
- 1 Would probably improve if I can fit one more session in per day.
- 2 At times I do feel as if it is a waste of time but these I find is when I really need it the most.
- 2 Feel great if done twice a day
- 2 I feel my blood pressure is under control but I am not so sure about other psychological aspects. Needs more time.
- 3 I feel that TM definitely is a good stress reducer but the problem is discipline to practice it.
- 3 Ulcer more under control, seldom get headaches and no more pain in my shoulder.

- 3 I would say I am neutral because I don't see any change or difference to myself.
- 4 Too soon to tell. No perceived difference in attitudes and lifestyle
- 4 Quite satisfied. Perhaps because I only have the time to do it once a day.
- 5 Although I couldn't do it twice a day as require, I got more out of the little and later improved
- 5 It refreshes me and helps me go on and on.
- 6 I do not have too much irritation
- 6 I've learnt the importance of not being suddenly awoken from sleep. This really upsets my system. Feel tense when this happens. I will then relax and come of this state slowly.

Please describe what sort of benefits you have noticed from your practice?

- 1 "Less tired during the day and more philosophical about setbacks.
- 1 Sleep is better. Stop thinking stressful thoughts before going to sleep and clear the mind. Sleep is therefore sound and much more beneficial. Definitely more energy and less stress.
- 1 I have felt good while doing TM and there are superficial improvements in relationships with others, more especially with personal discipline and control. I haven't been doing it regularly enough to notice definite or constant improvement.
- 1 My health has improved and I do not feel as tired as I used to before.
- 1 Better outlook on life - very laid-back, more focussed on life and handle my kids better
- 1 I find that I get more out of the day. I face problems as they arise instead of putting them off until later. My morning med is usually a little rushed but I am determined to do 1 a day. The afternoon one id always very good and I always look forward to it.

- 1 The only one is that it keeps me going through the 'slow' patches of the day, i.e. mid-afternoon or for going out in the evening.
- 1 When I have done it I do feel refreshed about an hour later and have more energy. If I am going out in the evening I do try to fit one in to give me more "go"
- 2 Calmer, more easy going, more patient and laugh easier. This is quality I have missed for years.
- 2 The need for discipline - if you don't do it, you don't benefit.
- 2 More relaxed, particularly after a had day's work. When doing twice a day people have commented I look younger.
- 2 If practised regularly I feel less tired during the day.
- 2 Lowering of blood pressure, more alert at better concentration at times.
- 2 Feel happier and more relaxed.
- 3 more self-confident, less worrying, more relaxed, more alert.
- 3 Putting on weight, no headaches, far more relaxed, just love myself for me now.
- 3 less impatient.
- 3 I noticed that I am sleeping well now and after doing it. I never feel tired.
- 3 More tolerant.
- 4 Did feel more relaxed when I did TM but its not yet a priority in my life.
- 4 Less irritable, more relaxed, better relationship with children
- 4 When I first started I experienced a reduction in the number of headaches (I usually get them every day). Now they are back again but I think it is because I am quite stressed at the moment.
- 4 Restfulness
- 5 Alertness of the mind and the relaxation of the body.

- 5 However irritable I seemed to be I also tended to be more in control. I seemed somewhat more confident in myself. But declined rapidly when my friend was killed
- 5 Very relaxed. Improvement in relationships. More energy. If I don't do it I'm very miserable.
- 5 Blood pressure has improved particularly at certain times of the month. Was very uptight last week.
- 5 Nothing special except feeling more objective about certain issues.
- 6 I feel very energetic, calm
- 6 See comments 4. However I do feel that I can relax better watching TV or reading at times when I have a lot on my mind - in order to rid my mind of these thoughts.
- 6 I am more aware of the need to relax.

APPENDIX H

SCL-90-R QUESTIONNAIRE

INSTRUCTIONS:

Below is a list of problems and complaints that people sometimes have. Please read each one carefully. After you have done so, please fill in one of the numbered circles to the right that best describes HOW MUCH DISCOMFORT THAT PROBLEM HAS CAUSED YOU DURING THE PAST WEEK INCLUDING TODAY. Mark only one numbered circle for each problem and do not skip any items. If you change your mind, erase your first mark carefully. Read the example below before beginning, and if you have any questions please ask the technician.

SEX

MALE

FEMALE

NAME: _____

LOCATION: _____

EDUCATION: _____

MARITAL STATUS: MAR. ___ SEP. ___ DIV. ___ WID. ___ SING. ___

DATE		
MO	DAY	YEAR

ID. NUMBER

AGE

VISIT NUMBER: _____

EXAMPLE

HOW MUCH WERE YOU DISTRESSED BY:

1. Bodyaches

NOT AT ALL	A LITTLE BIT	MODERATELY	QUITE A BIT	EXTREMELY
0	1	2	<input checked="" type="radio"/>	4

HOW MUCH WERE YOU DISTRESSED BY:

1. Headaches
2. Nervousness or shakiness inside
3. Repeated unpleasant thoughts that won't leave your mind
4. Faintness or dizziness
5. Loss of sexual interest or pleasure
6. Feeling critical of others
7. The idea that someone else can control your thoughts
8. Feeling others are to blame for most of your troubles
9. Trouble remembering things
10. Worried about sloppiness or carelessness
11. Feeling easily annoyed or irritated
12. Pains in heart or chest
13. Feeling afraid in open spaces or on the streets
14. Feeling low in energy or slowed down
15. Thoughts of ending your life
16. Hearing voices that other people do not hear
17. Trembling
18. Feeling that most people cannot be trusted
19. Poor appetite
20. Crying easily
21. Feeling shy or uneasy with the opposite sex
22. Feelings of being trapped or caught
23. Suddenly scared for no reason
24. Temper outbursts that you could not control
25. Feeling afraid to go out of your house alone
26. Blaming yourself for things
27. Pains in lower back
28. Feeling blocked in getting things done
29. Feeling lonely
30. Feeling blue
31. Worrying too much about things
32. Feeling no interest in things
33. Feeling fearful
34. Your feelings being easily hurt
35. Other people being aware of your private thoughts

	NOT AT ALL	A LITTLE BIT	MODERATELY	QUITE A BIT	EXTREMELY
1	0	1	2	3	4
2	0	1	2	3	4
3	0	1	2	3	4
4	0	1	2	3	4
5	0	1	2	3	4
6	0	1	2	3	4
7	0	1	2	3	4
8	0	1	2	3	4
9	0	1	2	3	4
10	0	1	2	3	4
11	0	1	2	3	4
12	0	1	2	3	4
13	0	1	2	3	4
14	0	1	2	3	4
15	0	1	2	3	4
16	0	1	2	3	4
17	0	1	2	3	4
18	0	1	2	3	4
19	0	1	2	3	4
20	0	1	2	3	4
21	0	1	2	3	4
22	0	1	2	3	4
23	0	1	2	3	4
24	0	1	2	3	4
25	0	1	2	3	4
26	0	1	2	3	4
27	0	1	2	3	4
28	0	1	2	3	4
29	0	1	2	3	4
30	0	1	2	3	4
31	0	1	2	3	4
32	0	1	2	3	4
33	0	1	2	3	4
34	0	1	2	3	4
35	0	1	2	3	4

HOW MUCH WERE YOU DISTRESSED BY:		NOT AT ALL	A LITTLE BIT	MODERATELY	QUITE A BIT	EXTREMELY	
36.	Feeling others do not understand you or are unsympathetic	36	0	1	2	3	4
37.	Feeling that people are unfriendly or dislike you	37	0	1	2	3	4
38.	Having to do things very slowly to insure correctness	38	0	1	2	3	4
39.	Heart pounding or racing	39	0	1	2	3	4
40.	Nausea or upset stomach	40	0	1	2	3	4
41.	Feeling inferior to others	41	0	1	2	3	4
42.	Soreness of your muscles	42	0	1	2	3	4
43.	Feeling that you are watched or talked about by others	43	0	1	2	3	4
44.	Trouble falling asleep	44	0	1	2	3	4
45.	Having to check and double-check what you do	45	0	1	2	3	4
46.	Difficulty making decisions	46	0	1	2	3	4
47.	Feeling afraid to travel on buses, subways, or trains	47	0	1	2	3	4
48.	Trouble getting your breath	48	0	1	2	3	4
49.	Hot or cold spells	49	0	1	2	3	4
50.	Having to avoid certain things, places, or activities because they frighten you	50	0	1	2	3	4
51.	Your mind going blank	51	0	1	2	3	4
52.	Numbness or tingling in parts of your body	52	0	1	2	3	4
53.	A lump in your throat	53	0	1	2	3	4
54.	Feeling hopeless about the future	54	0	1	2	3	4
55.	Trouble concentrating	55	0	1	2	3	4
56.	Feeling weak in parts of your body	56	0	1	2	3	4
57.	Feeling tense or keyed up	57	0	1	2	3	4
58.	Heavy feelings in your arms or legs	58	0	1	2	3	4
59.	Thoughts of death or dying	59	0	1	2	3	4
60.	Overeating	60	0	1	2	3	4
61.	Feeling uneasy when people are watching or talking about you	61	0	1	2	3	4
62.	Having thoughts that are not your own	62	0	1	2	3	4
63.	Having urges to beat, injure, or harm someone	63	0	1	2	3	4
64.	Awakening in the early morning	64	0	1	2	3	4
65.	Having to repeat the same actions such as touching, counting, or washing	65	0	1	2	3	4
66.	Sleep that is restless or disturbed	66	0	1	2	3	4
67.	Having urges to break or smash things	67	0	1	2	3	4
68.	Having ideas or beliefs that others do not share	68	0	1	2	3	4
69.	Feeling very self-conscious with others	69	0	1	2	3	4
70.	Feeling uneasy in crowds, such as shopping or at a movie	70	0	1	2	3	4
71.	Feeling everything is an effort	71	0	1	2	3	4
72.	Spells of terror or panic	72	0	1	2	3	4
73.	Feeling uncomfortable about eating or drinking in public	73	0	1	2	3	4
74.	Getting into frequent arguments	74	0	1	2	3	4
75.	Feeling nervous when you are left alone	75	0	1	2	3	4
76.	Others not giving you proper credit for your achievements	76	0	1	2	3	4
77.	Feeling lonely even when you are with people	77	0	1	2	3	4
78.	Feeling so restless you couldn't sit still	78	0	1	2	3	4
79.	Feelings of worthlessness	79	0	1	2	3	4
80.	The feeling that something bad is going to happen to you	80	0	1	2	3	4
81.	Shouting or throwing things	81	0	1	2	3	4
82.	Feeling afraid you will faint in public	82	0	1	2	3	4
83.	Feeling that people will take advantage of you if you let them	83	0	1	2	3	4
84.	Having thoughts about sex that bother you a lot	84	0	1	2	3	4
85.	The idea that you should be punished for your sins	85	0	1	2	3	4
86.	Thoughts and images of a frightening nature	86	0	1	2	3	4
87.	The idea that something serious is wrong with your body	87	0	1	2	3	4
88.	Never feeling close to another person	88	0	1	2	3	4
89.	Feelings of guilt	89	0	1	2	3	4
90.	The idea that something is wrong with your mind	90	0	1	2	3	4

APPENDIX I

CLIMATE QUESTIONNAIRE

This appendix sets out the questionnaire questions grouped by dimension, followed by the questionnaire itself. Scoring can be inferred from the direction of the question. For example, Question 1 would score 1 for "strongly agree," while question 13 would score 4, i.e., more is "better." The questions are as follows:

SUPPORT

5. You don't get much sympathy from higher ups in this organisation if you make a mistake.
13. Management makes an effort to talk with you about your career aspirations within the organisation.
29. The philosophy of our management emphasises the human factor, how people feel, etc.
36. When I am on a difficult assignment I can usually count on getting assistance from my boss and co-workers.

REWARD

3. We have a promotion system here that helps the best man to rise to the top.
11. In this organisation rewards and encouragements rather than criticisms are emphasised.
19. In this organisation people are rewarded in proportion to the excellence of their job performance.
33. There is not enough reward and recognition given in this organisation for doing good work.
38. If you make a mistake in this organisation you will be punished.

STRUCTURE

1. The jobs in this organisation are clearly defined and logically structured.
9. In this organisation it is sometimes unclear who has the formal authority to make a decision.
17. The policies and organisation structure of the organisation have been clearly explained.
25. Red tape is kept to a minimum in this organisation.
32. Excessive rules, administrative details, and red tape make it difficult for new and original ideas to receive consideration.
40. In some of the projects I've been on, I haven't been exactly sure who my boss was.

RESPONSIBILITY

2. We don't rely too heavily on individual judgement in this organisation; almost everything is double-checked.
10. Around here management resents you checking everything with them; if you think you've got the right approach you must go ahead.
18. Supervision in this organisation is mainly a matter of setting guidelines for your subordinates; you let them take responsibility for the job.
26. You won't get ahead in this organisation unless you stick your neck out and try things on your own sometimes.

RISK

12. Our business has been built up by taking calculated risks at the right time.
20. Decision-making in this organisation is too cautious for maximum effectiveness.
27. Our management is willing to take a chance on a good idea.
34. We have to take some pretty big risks occasionally to keep ahead of the competition in the business we're in.

CONFLICT

- 7. The best way to make a good impression around here is to steer clear of open arguments and disagreements.
- 15. The attitude of our management is that conflict between competing units and individuals can be very healthy.
- 23. We are encouraged to speak our minds, even if it means disagreeing with our superiors.
- 30. In management meetings the goal is to arrive at a decision as smoothly and quickly as possible.

WARMTH

- 4. A friendly atmosphere prevails among the people in this organisation.
- 21. Its very hard to get to know people in this organisation.
- 28. People in this organisation tend to be cool and aloof toward each other.
- 35. There is a lot of warmth in the relationship between management and workers in this organisation.

STANDARDS

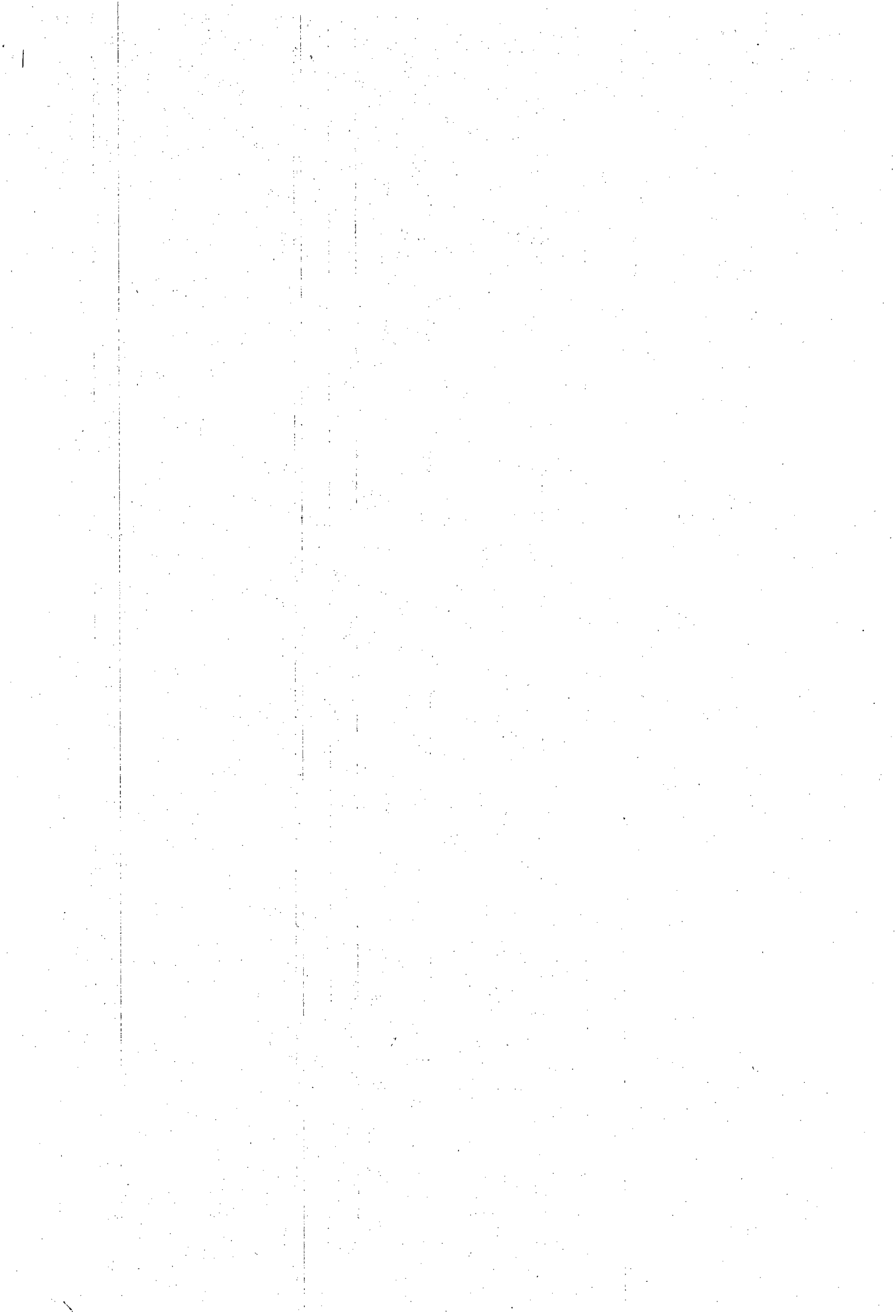
- 6. In this organisation we set very high standards for performance.
- 14. Our management believes that no job is so well done that it couldn't be done better.
- 22. Around here there is a feeling of pressure to continually improve our personal and group performance.
- 37. To get ahead in this organisation its more important to get along than it is to be a high producer.
- 39. In this organisation people don't seem to take much pride in their performance.

IDENTITY

- 8. People are proud of belonging to this organisation.
- 16. I feel that I am a member of a well-functioning team.

24. As far as I can see, there isn't much personal loyalty to the company.
31. In this organisation people pretty much look after their own interests.

The actual questionnaire follows overleaf.



ORGANISASIEKLIMAAT VRAEBOOG

deur J. GELFAND

INSTRUKSIES:

Dui asseblief u antwoord op elke stelling aan deur 'n kruisie (X) te maak oor die antwoord wat u beskouing die noukeurigste weergee.

U antwoord op elke stelling behoort 'n eerlike weergawe te wees van u persoonlike gevoel of opinie.

Daar is geen tydbeperking nie, maar u word versoek om die vraelys in een ononderbroke periode te voltooi.

VOORBEELD:

Stelling (1):

Die poste in hierdie organisasie is duidelik bepaal en logies saamgestel.

STEM BESLIS SAAM	GENEIG OM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
------------------	-------------------	----------------------	----------------

In hierdie geval het die proefpersoon aangedui dat hy geneig is om saam te stem met die stelling. Indien hy bv. besluit verskil het, sou hy sy kruis oor die laaste blokkie geplaas het, ensovoorts.

MOET ASSEMBLIEF NIE OP DIE VRAEBOOG SKRYF NIE.
 MERK U ANTWOORDE OP DIE ANTWOORDBLAD WAT VOORSIEN WORD.
 STUUR U VRAEBOOG TERUG TESAME MET U ANTWOORDBLAD.

ORGANIZATIONAL CLIMATE QUESTIONNAIRE
 by J. GELFAND

INSTRUCTIONS :

Please indicate your response to each statement by making a cross (X) over that response which most accurately reflects your view.

Your response to each statement should be an honest reflection of your personal feelings or opinion.

There is no time limit but you are requested to complete the questionnaire in one uninterrupted period.

FOR EXAMPLE :

statement (1) --

The jobs in this organization are clearly defined and logically structured.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
------------------	-------------------	----------------------	---------------------

In this case, the respondent felt inclined to agree with the statement. If he definitely disagreed, for example, he would have placed his cross in the last box, and so forth.

DO NOT WRITE ON THE QUESTIONNAIRE.
 MARK ALL YOUR ANSWERS ON THE ANSWER SHEETS PROVIDED.
 RETURN YOUR QUESTIONNAIRE TOGETHER WITH YOUR ANSWER SHEET.

1. Die poste in hierdie organisasie is duidelik bepaal en logies saamgestel.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
------------------	------------------------	----------------------	----------------

2. Ons verlaat ons nie te veel op individuele oordeel in hierdie organisasie nie; byna alles word dubbel nagesien.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
------------------	------------------------	----------------------	----------------

3. Ons het 'n bevorderingstelsel in die organisasie wat die beste persoon help om die top te bereik.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
------------------	------------------------	----------------------	----------------

4. 'n Vriendelike atmosfeer heers tussen die mense in hierdie organisasie.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
------------------	------------------------	----------------------	----------------

5. Jy kry nie veel simpatie van die persone bokant jou in hierdie organisasie indien jy 'n fout maak nie.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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6. In hierdie organisasie stel ons bate hoë standaarde vir taakverrigting.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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7. Die beste manier om 'n goeie indruk in die organisasie te maak, is om ope argumente en meningsverskille te vermy.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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8. Mense is trots om aan hierdie organisasie te behoort.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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9. In hierdie organisasie is dit soms onduidelik wie die formele gesag het om 'n besluit te neem.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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2.

1. The jobs in this organization are clearly defined and logically structured.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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2. We don't rely too heavily on individual judgment in this organization; almost everything is double-checked.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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3. We have a promotion system here that helps the best man to rise to the top.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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4. A friendly atmosphere prevails among the people in this organization.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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5. You don't get much sympathy from higher ups in this organization if you make a mistake.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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6. In this organization we set very high standards for performance.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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7. The best way to make a good impression around here is to steer clear of open arguments and disagreements.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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10. Hier neem die Bestuurder jou kwalik indien jy alles met hulle wil nagaan; indien jy dink jy het die regte benadering, moet jy voortgaan.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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11. In hierdie organisasie word belonings en aanmoedigings eerder as kritiek, beklemtoon.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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12. Ons besigheid is opgebou deur berekende risiko's op die regte tydstip te neem

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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13. Die Bestuurder poog om met jou te praat oor jou loopbaanaspirasies binne die organisasie.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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14. Ons Bestuurder glo dat geen werk so goed gedoen word dat dit nie beter gedoen kan word nie.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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15. Die houding van ons Bestuurder is dat botsing tussen mededingende eenhede en individue baie gesond kan wees.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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16. Ek voel dat ek lid is van 'n goedwerkende span.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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17. Oie beleid en organisasie samestelling van die organisasie is helder duidelik.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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18. Toesig in hierdie organisasie is hoofsaaklik gebaseer op die daarstel van riglyne vir jou ondergeskiktes; jy laat hulle toe om verantwoordelikheid vir die taak te aanvaar.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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8. People are proud of belonging to this organization.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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9. In this organization it is sometimes unclear who has the formal authority to make a decision.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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10. Around here management resents you checking everything with them; if you think you've got the right approach you must go ahead.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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11. In this organization rewards and encouragements rather than criticisms are emphasized.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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12. Our business has been built up by taking calculated risks at the right time.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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13. Management makes an effort to talk with you about your career aspirations within the organization.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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14. Our management believes that no job is so well done that it couldn't be done better.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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19. In hierdie organisasie word mense beloon in verhouding met die voortreflikheid van hulle taakverrigting.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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20. Besluitneming in hierdie organisasie is te versigtig vir maksimum doeltreffendheid.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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21. Dit is uiters moeilik om mense in hierdie organisasie te leer ken.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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22. Hier heers 'n gevoel dat gedurig druk uitgeoefen word om ons persoonlike en groepprestasies te verbeter.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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23. Ons word aangemoedig om ons opinie uit te spreek al beteken dit ook dat ons met ons meederes verskil.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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24. So ver ek kan sien is daar nie veel persoonlike lojaliteit teenoor die maatskappy nie.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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25. Romp-slomp word in hierdie organisasie tot die minimum beperk.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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26. In hierdie organisasie kom jy nie vooruit nie, tensy jy iets waag en soms probeer om iets self te doen.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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27. Die Bestuurder is bereid om 'n kans te waag met 'n goeie idee.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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15. The attitude of our management is that conflict between competing units and individuals can be very healthy.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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16. I feel that I am a member of a well-functioning team.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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17. The policies and organization structure of the organization have been clearly explained.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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18. Supervision in this organization is mainly a matter of setting guidelines for your subordinates; you let them take responsibility for the job.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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19. In this organization people are rewarded in proportion to the excellence of their job performance.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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20. Decision-making in this organization is too cautious for maximum effectiveness.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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21. It's very hard to get to know people in this organization.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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22. Around here there is a feeling of pressure to continually improve our personal and group performance.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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23. We are encouraged to speak our minds, even if it means disagreeing with our superiors.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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24. As far as I can see, there isn't much personal loyalty to the company.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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25. Red-tape is kept to a minimum in this organization.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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26. You won't get ahead in this organization unless you stick your neck out and try things on your own sometimes.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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27. Our management is willing to take a chance on a good idea.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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28. People in this organization tend to be cool and aloof toward each other.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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28. Mense in hierdie organisasie is geneig om koel en afsydig teenoor mekaar te wees.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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29. Die lewensbeskouing van ons Bestuurder beklemtoon die menslike faktor, hoe mense voel, ens.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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30. In vergaderings is die doel om so gou en glad as moontlik tot 'n besluit te geraak.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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31. In hierdie organisasie sorg mense hoofsaaklik vir hul eie belange.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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32. Oormatige reëls, administratiewe besonderhede en rompslomp maak die oorweging van nuwe en oorspronklike idees moeilik.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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33. Daar word in hierdie organisasie nie genoeg beloning gegee en erkenning verleen aan die doen van goeie werk nie.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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34. Soms moet ons taamlike groot risiko's neem om voor te bly in die wedloop in die besigheid waarin ons is.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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35. Daar is 'n groot mate van hartlikheid in die verhouding tussen die Bestuurder en werknemers in hierdie organisasie.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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29. The philosophy of our management emphasizes the human factor, how people feel, etc.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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30. In management meetings the goal is to arrive at a decision as smoothly and quickly as possible.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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31. In this organization people pretty much look after their own interests.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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32. Excessive rules, administrative details, and red-tape make it difficult for new and original ideas to receive consideration.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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33. There is not enough reward and recognition given in this organization for doing good work.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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34. We have to take some pretty big risks occasionally to keep ahead of the competition in the business we're in.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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35. There is a lot of warmth in the relationship between management and workers in this organization.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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36. Wanneer ek 'n moeilike taak te verrig het, kan ek gewoonlik daarop reken om hulp van my baas en medewerkers te kry.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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37. Om in hierdie organisasie vooruit te kom, is dit baie belangriker om oor die weg te kom as om 'n hoë produseerder te wees.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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38. Indien jy 'n fout in hierdie organisasie maak, sal jy gestraf word.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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39. Dit blyk nie of mense in hierdie organisasie trots is op hulle taakverrigting nie.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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40. In sommige van die projekte waarin ek betrokke was, was ek glad nie seker wie my baas was nie.

STEM BESLIS SAAM	GENEIG OM SAAM TE STEM	GENEIG OM TE VERSKIL	VERSKIL BESLIS
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36. When I am on a difficult assignment I can usually count on getting assistance from my boss and co-workers.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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37. To get ahead in this organization it's more important to get along than it is to be a high producer.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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38. If you make a mistake in this organization you will be punished.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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39. In this organization people don't seem to take much pride in their performance.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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40. In some of the projects I've been on, I haven't been exactly sure who my boss was.

DEFINITELY AGREE	INCLINED TO AGREE	INCLINED TO DISAGREE	DEFINITELY DISAGREE
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ORGANIZATIONAL CLIMATE QUESTIONNAIRE
by J. GELFAND

INSTRUCTIONS :

Please indicate your response to each statement by making a cross (X) over that response which most accurately reflects your view.

Your response to each statement should be an honest reflection of your personal feelings or opinion.

There is no time limit but you are requested to complete the questionnaire in one uninterrupted period.

FOR EXAMPLE :

statement (1) ---

The jobs in this organization are clearly defined and logically structured.

DEFINITELY AGREE	<input checked="" type="radio"/> INCLINED TO AGREE	<input type="radio"/> INCLINED TO DISAGREE	DEFINITELY DISAGREE
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In this case, the respondent felt inclined to agree with the statement. If he definitely disagreed, for example, he would have placed his cross in the last box, and so forth.

DO NOT WRITE ON THE QUESTIONNAIRE.

MARK ALL YOUR ANSWERS ON THE ANSWER SHEETS PROVIDED.

RETURN YOUR QUESTIONNAIRE TOGETHER WITH YOUR ANSWER SHEET.

ORGANISASIEKLIMAAT VRAEBOOG

deur J. GELFAND

INSTRUKSIES:

Duf asseblief u antwoord op elke stelling aan deur 'n kruisie (X) te maak oor die antwoord wat u beskoning die noukeurigste weergee.

U antwoord op elke stelling behoort 'n eerlike weergawe te wees van u persoonlike gevoel of opinie.

Daar is geen tydbeperking nfe, maar u word versoek om die vraelys in een ononderbroke periode te voltooi.

VOORBEELD:

Stelling (1):

Die poste in hierdie organisasie is duidelik bepaal en logies saamgestel.

STEM BESLIS SAAM	<input checked="" type="radio"/> GENEIG OM TE STEM	<input type="radio"/> GENEIG OM TE VERSKIL	VERSKIL BESLIS
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In hierdie geval het die proefpersoon aangedui dat hy geneig is om saam te stem met die stelling. Indien hy bv. besluit verskil het, sou hy sy kruis oor die laaste blokkie geplaas het, ensovoorts.

MOET ASSEBLIEF NIE OP DIE VRAEBOOG SKRYF NIE.

MERK U ANTWOORDE OP DIE ANTWOORDBLAD WAT VOORSIEN WORD.

STUUR U VRAEBOOG TERUG TESAME MET U ANTWOORDBLAD.

APPENDIX J

OPINION SURVEY

A FEW SHORT QUESTIONS...REGARDING YOUR EXPECTATIONS FROM THIS COURSE.

(Please rank on a scale where 1 = "not at all", 10 = "very much so")

1. **DOES TM MAKE SENSE TO YOU?**.....write your score here ...>

2. **HOW CONFIDENT ARE YOU THAT THE COURSE WILL BE EFFECTIVE IN IMPROVING ...**

YOUR FEELINGS OF STRESS.....

YOUR BLOOD PRESSURE.....

YOUR PERSONAL/WORK PRODUCTIVITY.....

YOUR CLARITY OF THINKING.....

YOUR CONCENTRATION.....

YOUR ENERGY LEVELS.....

YOUR RELATIONSHIPS WITH FAMILY/CO-WORKERS..

3. **HOW CONFIDENT WOULD YOU BE IN RECOMMENDING THIS COURSE TO A FRIEND?**

4. **DO YOU WISH TO RECEIVE INSTRUCTION IN**

(tick ONLY one)

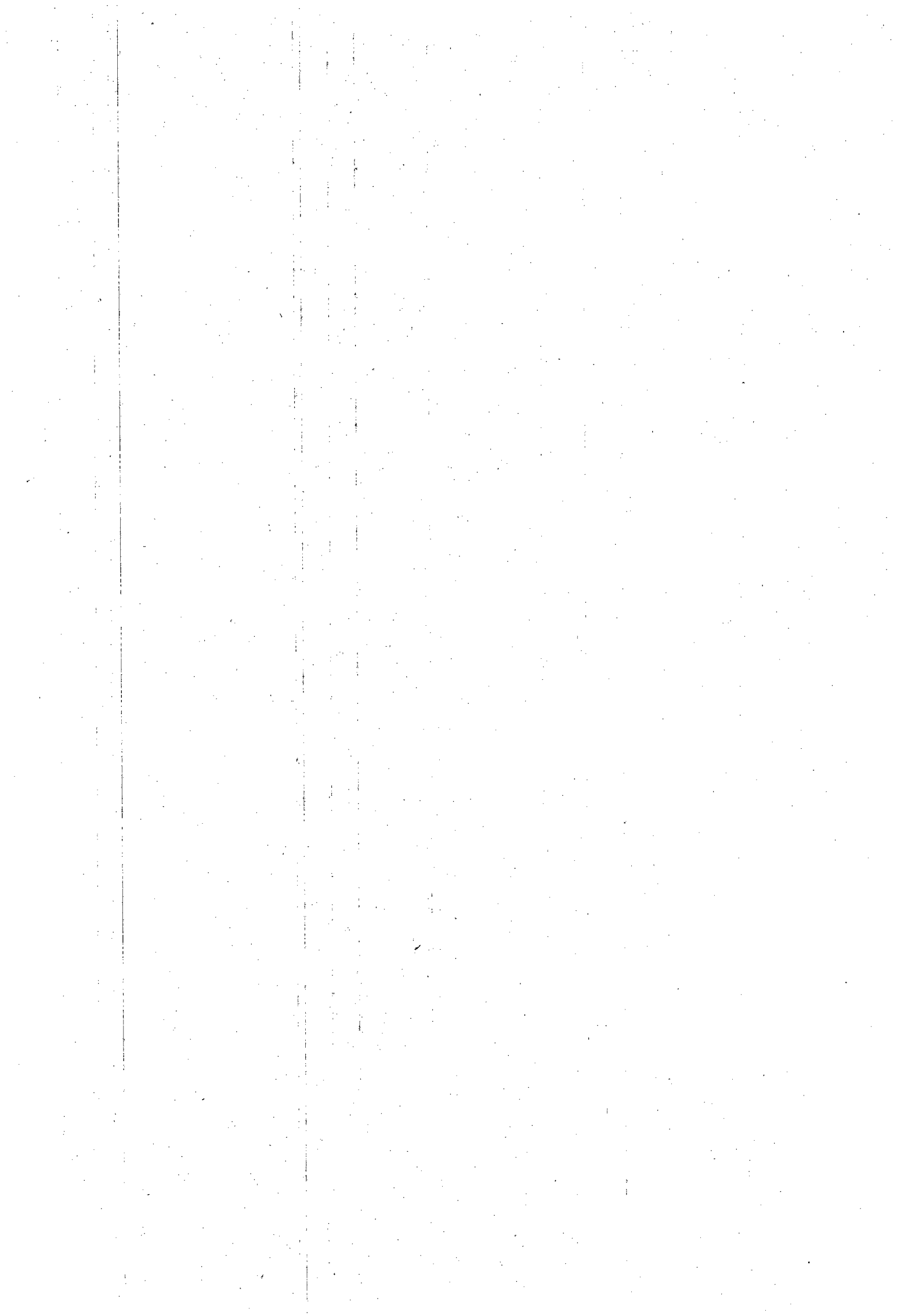
TM ?

PMR ?

NEITHER ?

Name

Date today.....



APPENDIX K

T M TRANSCENDENTAL MEDITATION PROGRAMME

COURSE APPLICATION FORM

NAME.....

.....
Date of Interview

.....
Date of Instruction

.....
Interviewer

.....
Instructor's Signature

THIS FORM IS NOT TO BE TAKEN AWAY.

2

Please fill in this form for enrollment and as a step towards personal instruction into the Transcendental Meditation technique the practical aspect of the Science of Creative Intelligence, as taught by Maharishi Mahesh Yogi. This information will be kept confidential.

Name.....Age.....Marital Status.....

Postal Address.....Telephone (H).....

.....Postal Code.....(W).....

Permanent Address (if different from above).....

Are you under 21 and living with your parents? Yes.....No.....

(If yes, please furnish a signed letter from your parents stating that they are aware that you are beginning the practice of the Transcendental Meditation technique and they approve.)

Educational qualifications (School, College or University).....

.....

.....

Profession/Occupation.....

.....

Full Time.....Part Time.....Retired.....

Spouse's Occupation.....

Have you ever used any form of meditation, other spiritual practice, or programme for self-improvement?

Yes.....No.....

If yes, Name of teacher, organisation
and/or book(s)

for how
long?

Describe experiences and
results

What is your present state of mind? Good..... Worried..... Tense..... Please describe
..... Do you sleep well? Yes..... No.....

What is your present state of health?..... Have you ever had any prolonged physical conditions such as heart or
respiratory trouble, etc.? Please describe.....

Are you at present undergoing medical treatment from your doctor or hospital?.....

Have you ever been (or are you now) under the care of a psychiatrist or on any other psycho-therapeutic programme?
Yes..... No..... If yes, when?.....

What type of programme?.....

Have you ever taken hallucinogenic drugs?..... Other drugs?.....

How did you hear about the Transcendental Meditation programme?.....

How did you hear about this series of lectures?.....

For what reason do you wish to be given this technique of meditation?.....

The above information is furnished voluntarily by me in requesting an interview preceding personal instruction with a teacher trained by Maharishi Mahesh Yogi. I wish to begin the unique practice of Transcendental Meditation to further my own personal development. I realize the importance of verification and intellectual understanding of experiences in the Transcendental Meditation technique and its effects in daily life, and therefore I will attend the necessary sessions during the first four consecutive days of personal instruction and subsequent sessions necessary to ensure maximum progress.

I agree that all instruction in the Transcendental Meditation technique is for my own personal use, in order to insure the effectiveness of the teaching, I agree that I will not directly or indirectly impart or disclose to anyone the mantra I receive or its instructed use. I further agree that I will not disclose, publish, or in any way attempt to instruct or impart the technique of Transcendental Meditation until such time as I have received personally from Maharishi Mahesh Yogi the training necessary to become a qualified teacher of the Transcendental Meditation Programme.

.....

.....

Date

Signature

Instructor's Comments:

.....

.....

APPENDIX L

SIX WEEK EVALUATION QUESTIONNAIRE

1. Frequency of practice 8 or more X per week *
 2 - 7 X
 Once per week
 Stopped practice on or about.....(date).

*Please comment on frequency:

2. Have you noticed any improvement in relationships with others?
 Comment?

3. Have you noticed any improvement in your personal productivity?
 Comment?

4. Please rate your **satisfaction** with the programme so far (✓ one)

very satisfied neutral very dissatisfied

 Comment?

5. Please rate how much **value** you feel you have had from the programme:

a great deal a fair amount no value

6. Please describe what sort of benefits you have noticed from your practice?

Name

Date

APPENDIX M

STRUCTURED INTERVIEW

A structured interview was conducted with a sample of 7 respondents at the survey company and 2 respondents at the second company.

The quantitative results discussed earlier had suggested an affirmative answer to the general research question—was TM effective in reducing stress? Interviews were structured to broaden this finding and to extend the question by asking—what might be the effects on the organisation as a whole? Did organisational effectiveness improve? Once again, the following answers suggested an affirmative answer, qualified by the lack of a theory base, thus disallowing a causal interpretation.

From the responses it is clear that TM was followed by positive outcomes at both organisations surveyed. It is also clear that interviewees were in some cases fiercely unwilling to ascribe the improvements to TM.

CW was the Deputy Managing Director and TM programme champion, responsible for the participation of the survey company.

WL was the "do everything" Admin Manager, handling "all the service side plus all aspects of personnel." Her education was Matric "plus odd training courses." She was 49 years old, had started with the company 20 years previously and had been in the present position for

about 17 years. She was responsible for coordination of the TM training, the provision of training rooms and the communication of timetables to participants.

SG was Chief Executive of the survey company. She had an Honours Degree in Chemistry (3 years) and an MBA from Wits Business School (3 years part time). She was 47 years of age and had been with the company for 8 years, of which 5 years had been in the present position.

SB was Data Processing Manager of the survey company. She had a Matric (i.e., 12 years school) and had been in the position 5 years.

PSW was Marketing Director of the survey company responsible for generating business, and the co-ordinating, advertising and selling of the CSM (Customer Satisfaction Measurement) service. He had a BA and was 44 years old. He had been a director for 10 of his 14 years with the company.

LO was Financial Manager of the survey company. She had completed 11 years of school and then had to leave because her parents had passed away. About 5 years later she did a CIS through Damelin College. She had joined the company over 7 years previously and was 51 years old.

BB was the Information Services Manager for the survey company. Her job was "basically helping executives in their research." She was UK educated with 13 years at school and a 3-year General

Degree in sociology, psychology and economics, . She was 57 years old and had been in her present position for about 2,5 years.

GA was Advertising Liaison Co-Ordinator for the second survey company. He had a Matric (12 years at school) and an arts degree with a major in communication. He was 35 years old and had been a partner for 7 of his total of 11 years with the company, a small advertising agency.

SW was Creative Director of a small advertising agency (the second survey company). He had a Matric (12 years of school) plus 3 years at Art School doing a Graphic Design Diploma. He was 39 years old and had been with his company for 7,5 years.

Responses to the questions relevant to the issues set out above were:

1. What benefits have you noticed from TM ?

CW: I think it was very beneficial at the time. I have not heard one person who participated who didn't think it was of value. The big problem is to get everybody to continue. Its a funny phenomenon, I have it myself and I don't know how to explain it. For me I think it is absolutely essential. I don't do it regularly though, I do it when I need it.

WL: Well I got remarried. I definitely find it does release the stress. *How do you explain this?* Because you calm yourself down and you give yourself time for yourself. I'm very bad by putting other people first and maybe those 20 minutes would have been more beneficial for me.

SG: Not really.

PSW: I lead a stressed life which shows in terms of skin allergies although when I do have psoriasis its at a time when I don't think I'm stressed but maybe its underlying. That's the one visible demonstration of being stressed and that hasn't

improved. It just comes in cycles. They say its stress related but I can't pick up a pattern.

LO: I just remember being a lot calmer and my reactions to other people were a lot better. I now get uptight and shorter tempered which didn't happen then. Had a lot more patience. *How do you explain this phenomenon?* There isn't an alternative explanation. I certainly wasn't on tranquillisers.

BB: I think he (my husband) found me a lot easier to live with. Actually I think, looking back on it, this might be useful because this was a terrible experience I have just had (She had a fall). I think TM helped me a lot. I'm not just saying that; because it did. Everyone kept saying to me 'you are very calm and taking it very well.' But I think over the years it has built in something. But I accepted it and eventually you have to accept it (when I had the accident). The acceptance of the fact that I could not move and was completely dependent on everyone else. Yes, I think I'm a much calmer person. *Has your life changed in any way since practising TM?* Well, only in that direction. *How do you explain this?* I think you are reaching into another part of yourself you didn't even know existed before. You can just wipe out everything. We all rush around with all these things buzzing around in your head. That was a big advantage for me.

SB: I've done it too irregularly. I know I am a better person when I do it. Far more patient. You end up being refreshed. *How do you explain this?* I believe meditation is deep and beneficial. Its a purely physical thing.

GA: Personal: I have noticed a greater calmness where I'm able to take more stressful things in my stride. Business: More or less the same thing. And I would also say there seemed to be less stressful circumstances. A double benefit.

SW: That's a difficult one. I know there have been a lot of benefits that supposedly happen as a result of TM. I found that I do feel better for having done TM but I wouldn't say its been dramatic. At the same time I find my life works better and in subtle ways. I suspect there have been benefits, i.e., a general sense of well-being. Possibly it has helped my work, my creativity. *Has your life changed in any way?* Nothing dramatic. I just feel better for it. How much better, I find difficult to establish. *How do you explain this phenomenon. Other alternatives?* There have been no other reasons to explain it.

2. Have you noticed any changes in work life ?

WL: When you have been doing a job for so long its difficult to assess yourself. I handle a huge work load. I don't have an assistant. *How do you explain that?* Its what's expected of me. I have to do it. People say 'give it to Wendy and she'll do it.' I'm not on any fancy drugs but my exercise is my leveller.

SG: No.

SB: Because I was irregular I would be over-claiming if I said I noticed benefits. But you can meditate and do wonderful things. You feel good, alert, more patient and that also goes for your home and children. Meditation is really and truly rest. I find it better than sleep. When I have had a good meditation I'm more patient.

LO: I was a lot more patient at the time. Had some staff changes and I should have been a lot more patient.

BB. That's a difficult one for me to answer because the job I have now is far less stressful than the one I was in when we started TM. So I can't really attribute that to TM. The job I am in now is nowhere near as stressful as the previous one. *Is that really an objective thing, or are you just saying that because it feels so?* Definitely, definitely not. The most stressful job in this company I think is in the field. But I enjoyed it and I don't really get the same pressures now. *You couldn't predict, if you had been in the same job all the time, how you would have felt about it then.* Oh, I think it would have helped, I'm sure. I think I would have been doing it more often at lunch times too. *Now if you say it would have helped, how would you explain that?* Well, because you forget all the problems, you let your mind go completely blank, it refreshes you, gives you the energy to go on.

GA: I believe I have. Its become less stressful and I believe I operate more efficiently. Possibly because I feel "less bound" as you mentioned a moment ago.

SW: Other than enhanced creativity but to what extent I cannot say. If anything it has enhanced it but no huge change.

3. Have you noticed any improvement in personal productivity or quality of work since learning TM?

WL: Hard to assess. I don't know whether I can attribute it to TM. As you get older you learn to manage your life better and the more work you have the more you have to plan. If I left today they would replace me with 3 people. That's not a pat on the back. I know another person wouldn't handle it. Just wish management would realise that. *How do you explain that?* You mellow out and TM calms you down and you assess things. I'm not a great one for throwing toys out my cot as such. I can but in my position I can't afford to do that but if I do, then others will say 'if Wendy can do it, so can we'.

SG: No.

SB: Not significantly but when I've done TM I find I have to go back less, i.e., checking work is less necessary; you make less errors. *How do you explain this phenomenon?* Its real rest.

PSW: Not consistently. Its improved but I'm not totally satisfied with my performance.

LO: Never took particular notice of that. Think I still work much the same now.

BB. Its very very difficult for me to answer that because the job has changed so much.

GA: I imagine there must be, but its not a night and day situation and I cannot say yes.

SW: Possibly slight enhancement. *When you say 'enhanced creativity' are you using it in the sense of that application, what your mainstream job is?* I have to think of ideas and that's the central point. *Concepts or graphics?* Both.

4. Have you noticed any changes in colleagues since they learned

TM?

WL: I did when they were practicing it. Tremendously. Someone like Joan and Sarah, who don't want to practice any more, the change in them was unbelievable and we experienced it with Sarah who had pneumonia. When she came back she was so much better. It was incredible.

SG: I personally don't think so. Certain people have benefited, CW says she benefits from doing TM occasionally, Lucy says she really benefits. I think its very much a personal

thing. If it fits into your life style and you feel there is a real need for it then you will find the time to do it. Lucy is also in a very stressful job - she's got deadlines, a lot of people to deal with, she finds it very useful. Different people handle stress in different ways and if TM is for those people to handle stress, that's fine. I handle stress in a different way. Or maybe my stress tolerance levels are higher in that I often thrive when I have too much to do whereas some people often collapse when they have too much to do. So maybe the individuals know they benefited but I certainly did not find a discernible difference.

SB: It was very topical. They believed they were different at the time. Everyone believed in what we were doing. Its difficult here because we work under incredible pressure. TM helps you handle pressure and makes you more alert.

PSW: Yes, Lucy. I think she has a fairly tough time but she's quite laid back. She's at peace with herself.

LO: There was a general feeling of people doing things in a quiet way. Not rushing around so much and being over-stressed.

BB. So few are practising now. Casting *your mind back*? Oh, it was a much better atmosphere. I think everyone noticed that in the beginning when everyone was doing it. How? Calmer, more cheerful, less stressed. It was almost like camaraderie because you were all doing the same thing. *Did that camaraderie extend across people not doing TM?* Yes, I think so. Definitely had that effect, whatever you called it. *So it sounds like what you are saying is that although my questionnaire showed some of these things going backwards, they should have gone forwards. People gave these scores on the questionnaires but actually their experience wasn't like the replies. It felt better?* Right at the beginning when everyone was doing it and coming along to you for the first month or so. It didn't carry on like that.

GA: The most obvious one for me was SW. He has an even more pressurised position because he is responsible for He has to write a report. How long does it take you to come up with a good idea - an hour, a day, a week? Under extremely difficult circumstances be proved to be totally reliable and unstressed. Before TM, like most people he showed signs of strain whereas afterwards he seemed to be able to handle it much better. *Do you have a specific anecdote such as "there*

was a client and such and such a thing happened"? or examples to elaborate? Nothing springs to mind. Its a combination of attitude and performance. Its just strengthened over a period. So there is no alternative explanation, such as he won the Rhodesian sweep? No. Its fairly obvious.

SW: Very slight. Not very pronounced. Slightly more relaxed but not necessarily in every case. GA is more relaxed but not others.

5. Have you noticed any changes in relationships since learning TM?

WL: Those of us who learnt TM had quite a bonding, we really did.

SG: Question skipped

SB: No.

PSW: No

LO: Yes. A lot more tolerant and patient.

BB: Not particularly. My husband says I'm easier to live with.

GA: Not markedly. But subtle and obviously for the better.

SW: Not dramatic. But my wife tells me I'm more patient.

6. Since so many people have learned TM have you noticed any changes in productivity or output?

WL: We did find at the time when we were practicing there was a different atmosphere and better productivity. But maybe it was because the economy was good, who can tell.

SG: Not really. Our output is often very dependent on the work flow that is actually happening and quality is also tied in with that. Sometimes the best quality work is not necessarily done when we have the most time to do it. And also some people work under pressure better than others. I personally didn't see a discernible difference.

SB: Our sort of work has to be accurate. After TM we may find we are more accurate the first time around.

PSW: Lucy is the only one. WL does it.

LO: I don't work much with them here so its a difficult one to answer.

BB. No.

GA: Definitely improved. How? One of the things we find is that in trying to arrive at the big idea, the one that is going to do it, there are two ways of doing this. Either the light goes on (here Grant clicked his fingers to make the point the light goes on) or he goes through a sequence of others in a brainstorming situation and this leads to something where you look at it and say: 'Great.' Now at times in the past with the same people we had grave concerns as to maybe they had reached the limit of their creative competence and it came to the extent that in January last year (a month before TM) we actually said to the guys "Look, no hard feelings and all that but we need more out of this whole process and you are unable to give it. So lets not pursue this until it comes to an unpleasant conclusion. We know you either—Now whether it was that warning or not, which certainly they accepted, although it wasn't delivered in a warning fashion, but certainly the creative execution of the work improved to the extent where we are quite happy. Then we were concerned and now we are not concerned (i.e. after learning TM in March to August 1993). And all this applies essentially to the creative people which would be four in number (including SW).

SW: Not dramatic. But my wife tells me I'm more patient. *Any changes in productivity or output?* I'm not absolute about the whole thing. I find changes difficult to observe. I'm not cynical but I am a sceptic but the fact that I am doing it indicates that I feel there is something. *Let me rephrase the question. If you have noticed any changes, irrespective of whether its TM or not, say in the first 6 months of the year, don't link it to TM.* Any changes I find are so variable - they may be positive for a while but then they could be negative for a while afterwards, all of which I suspect is outside of TM. By negative I mean that our working environment has become more pressurised which I think it entirely an outside force. Under those circumstances TM helped us to deal with the more pressurised working environment which it most probably has. *If you and a lot of people said the same thing, you did TM for a while then things got frantic, then maybe*

there is a relationship. There is a possibility that some period after a large number of people in the company learnt TM, there is an event that happens, someone leaves or there is a crisis or retrenchment as at (the survey company). A lot of people mention that during the course of the study, the MD left, the whole company changes - does this ring any bell? Grant says no., I say absolutely no.

7. Since so many learned TM, have you noticed any changes in the quality of life of the group?

WL: Difficult. A lot have left.

SG: Question skipped

SB: Yes slightly. Definitely for myself. I have more energy.

LO: There might have been. I'm not one of the people who go to TM and sit around and have a discussion.

BB: Earlier on it was better. *How would you explain if things felt better, there was more camaraderie, more cheerful, less stressed, more calmer and so forth, what would explain that? Well, as I said to you, everyone was doing it in groups at that stage and I think its just this feeling you are all part of one whole. That 'whole' you are talking about, is it in the sense of being in a group or a deeper 'whole? Deeper. There was actually a very nice atmosphere because I think everyone felt so much more refreshed. There was a point of contact where you could all talk about it and you were in groups with people you didn't usually mix with in the work place. There were all sorts of different people in your group - you were a mixture. It was actually very nice.*

GA: There has been an improvement there possibly as a result of stress not being such a major factor.

SW: As a group, no. I'm speaking from an individual point of view but I could single out people in the group who to me have benefited from TM. However, other extraneous factors could have an impact on the group or the company and that overrides TM. *Any signs of nature support some months after TM -more contracts, being due to TM or not? Something did happen after that but I'd say it was purely coincidental. Any documentation of these changes available?*

We would be able to track our billings, for example for the last quarter. GA would be able to give you that

8. Have you noticed any changes in company productivity since so many learned TM?

WL: The company has had much more exposure and vision. We were very much more in the public eye. We seem to have grown and I think that's been over the last 3 years. Whether its because SG has been MD, I don't know. Any *explanation for this phenomenon?* Maybe change in management. SG took over as MD five years ago and she really only came into her own after the first 2 years as N... was still resident. Those first 2 years were absolute hell (the year before TM and the year of TM). N... is still here until December but only comes in for about 3 hours a week now. Each year his hours decreased. By 1992 he definitely started phasing out and SG was able to project herself. Last year we had a staff survey and then there was a huge thing with Origo. People don't like change and suddenly the company was changing its whole profile. New people come in with new vision and ideas. Origo wrote a report which SG has. SG reported back as it was. Very emotional as everything was totally anonymous.

SG: Question skipped.

SB: Well I can only speak for the department. Individual people definitely yes. I am not sure about the whole company. Some people were very resistant to it initially and they created clashes. It was very difficult. We felt better and others were extremely anti. It was a them/us situation. It put a damper on things. They said these difficulties were purely religious. They said it (TM) was unchristian. Did *those individuals who were not practicing TM take strain at that time?* No. They took great comfort in their religion. It seemed to help them cope but it did cause conflict between the TM and non-TM group. This could have been quite disastrous before we started. But somehow we managed to overcome it.

PSW: There are so many variables - not easy to put that into a realistic situation.

LO: Yes. A lot more willingness amongst the staff to help instead of leaving people sitting here until 10 at night to sort out their problems. Regarding the second part of your

question, I can't talk for the company as a whole. Our department is very small and we stay as a unit and unless someone specifically told me about something I wouldn't know. But in our department, yes. Problems were put on the table and sorted out there and then. It became a case of the staff being more together against this little upset that was going on above us. We were sticking together. So *what you are saying is that at the time the new management were finding their feet and there was a bit of a we-they. The new owners were flexing their muscles and there was a bit of ill-feeling at the time. Yes, for a long while. The staff talk among themselves. Zeroing in on the impact of TM at the time you are saying that doing TM together and sitting together, people were possibly more relaxed and there was a change in the willingness, et etc. how would this have changed the feeling of staff vs management, if at all?* The staff were more united.

BB: I would say 3 years ago (i.e., the year TM was implemented), yes there was probably a change. I think it's very sad it all stopped. I think perhaps there should be a policy of the company to try and encourage people to go back to it. I actually suggested it last year. We had a caring and commitment campaign and suggestions were called for and I said that those who had learnt TM should be encouraged to start again. I think it had a very good effect. I think CW should start it again. *If you were to suggest it, what reasons would you put forward for that. What would you say it would do for the company?* You mix and get together with other people you don't normally work with. That may sound a bit strange but what has happened here is the company has grown to such an extent, maybe not to you but it has. Difficult to explain to someone from the outside, but there is a very different atmosphere and there are a lot of people here who suddenly come across a face upstairs they have never seen before. So now we have a lot of people who never did learn TM.

GA: Hit rate improved in terms of delivering what the client requires, I would say in terms of billings its most noticeable - the circumstances were very adverse, economically, we went through tough times the whole of our last financial year but we were not hit so hard. The times were challenging but we came through better. *How do you explain this. TM? If it was, I couldn't put my finger on it. Are you aware of any sources or data that might give support?* Difficult one. One of those

things where we came through tough times very well. Don't know it would have been prior to TM. Can say it was one of our worst years in our history but we got through it well. If you saw the billings you would say you guys didn't make a fortune. We didn't but we came through some extremely challenging circumstances in good shape. So *if you plotted a graph of the company's 'health'?* The earlier years were outstanding. The last two years were economically challenging for the company and we had various problems with clients not spending their usual amounts. There is no doubt about it that the more pressure people are under the more likelihood there is for errors, administrative errors and even maybe not the required amount of thought gets put into something simply because they don't have the time or they feel hassled. In our business its easy to feel hassled. So *you can't specify that there were so many errors ...?* What I did find was that there was an improvement in the people's attitude towards the inevitable pressure where previously they would get wobbly. Now (after TM) they seem to be more accepting and they seem to be able to handle it better and there is no doubt in my mind that that translates into improved work performance. *So basically you are saying that errors and things are part of your life and without monitoring them you are seeing improvements, especially under pressure?* Yes. *Are you saying, without putting words into your mouth, it becomes a lot easier to solve problems because people get a lot less dug into positions when problems do occur?* I think so. Yes, I think that would be fair to say that. But its difficult because its not like a production line where every 10th one was a dud and now its much less than that. No its not anything like that but overall to judge, and there have been times where the possibility of a serious error occurring is good and we got through those very well. *Do you have any monitoring systems where, for example you put up ten proposals and of every ten say eight get accepted?* No, that would be very difficult to implement. I guess if we had to go through it on an audit type basis I would say, I would definitely say there is an improvement in what we call our hit rate where you present something and there is a chance it is either accepted or rejected ... *Are you saying that there is an overall better feeling in the room when you are making a presentation and that therefore people are more receptive and whether nature is doing this or whether you are more polished in your delivery, that there is an*

improvement? Well, as I have said, our product is the creative product. The guy looks at it and if he likes it and if it works for him and it makes sense and it answers the requirements of the brief and so on, he is going to As I said before our competence is that where we are going to present something we used not to be really sure that it was strong enough to go through with and it would be sold but we wanted more of an acceptance rather than a resignation to the product. We wanted more ownership of the product. And so as a result the creative product that we sell we were looking for an improvement in ... This is a totally nebulous thing ... because it is so subjective but then I would say the improvement came from better creative product that we would sell more successfully. *When you say 'sell more successfully' you are saying that the sale would take place but that the feeling was better?* Yes, certainly. *In terms of billings going back to January 1993 how has this been if you were to plot a graph of your turnover. We are not tying this to TM but I would like to know how your turnover has been?* There wasn't an immediate ... Last year, the whole of last year, was not our best year due to a combination of things, mainly the economic situation and political uncertainty. So there was, I mean we were keeping our heads above water. But really nothing spectacular. And that continued in that vein until the end of the year. So even afterwards (after the rest of the staff started learning TM) nothing spectacular happened. However, from the beginning of this year we hit a big increase in turnover and it just hasn't stopped. *And when did that change take place?* It was actually February 1994 (Eleven month after learning TM). Already in January there was a lot more activity and in our game activity can take a long time to mature. *The MD of (the survey company) once said a very significant thing to me. She said 'We are not doing so great but the competition sure is a shambles.' I thought that was a very meaningful thing because it seemed to me that the coherence in the company following the introduction of TM was increased but they did not realise this was the case. But by comparison or by contrast the competition was incoherent. So while they thought they hadn't changed, they could only measure their progress against how things were outside the company. So it seems to me this is more than a coincidence. Now does this ring any bells in terms of your experience?* No.

SW: We were working harder, whether more efficient would vary from individual to individual. *How do you explain this? Too vague to comment.*

9. Have you noticed any other changes in the organisation since so many have learned TM?

CW: A retrenchment. Then 1992 (the year after TM) was much better. And this year (1993) was a fantastic year. But there were a number of factors coming together and I would be most hesitant to ascribe it to TM. *That's OK. We don't have a problem with ascription but the fact is that something happened and that was the dead wood went. There was only one retrenchment and that was in May 1991. You must have had to have hired people as the volume increased? We hired new people and we were lucky in getting good people because our opposition went down. So you vis-a-vis the opposition were better. Someone made a very interesting comment to me about a year ago - about December 1992. I think you said this: 'Well, I don't know how we're doing but the competition sure is a shambles.' An interesting comment. Yes, we benefited from that - some of their big accounts and we got their people. So both ways we scored. I am convinced its the good people we had. It really made us successful because all our strength is people - it attracts different types of business. You say you have done well. What are the facts? I will show you the graph that I have made because you gave me figures to August 1991. It sure does look like 1991 was a black year. Now you are saying that the graph is continuing to go up? Oh yes, ever since, no doubt about that.*

SB: No, not because of TM. The staff is half different now. There are new people, the company has grown hugely. TM came soon after our management change. We had a mini boom in the first quarter of this year.

PSW: *Could you briefly outline any new business areas you have penetrated since 1991? CSM - very. Customer Service Measurement. How successful - what percentage? 5 to 50%. How has the competition changed since that time? Probably a few more small guys. We have always had one serious competitor and that's the same and there is another company that has been through changes of staff but is possibly more competitive and aggressive since 1991 - that's Research International. Who had an abrasive MD who left. Change in*

management. The IRA is quietly dying and continues to die, research surveys always been there, no different. *Overall market share?* We monitor that through AMRO - Association of Market Research Organisations - and its going up. Probably over the 3 year period its picked up 1 or 2%. *Have any legislation changes taken place which could affect you?* No. *Reason for Origo survey?* To get a more participative approach, i.e., style of management, involvement of staff and MAGS groups. That's been a very good safety valve. Origo started the ball rolling. Its more participative. *How would you rate the overall health of the company, since January 1991?* Could say its healthier. Its gone up and down in between, turnover has gone up about 20% compounded (in years of inflation of around 10%). *You have had good growth in turnover, you are getting a building that's quite a lot bigger, more staff. What other changes contribute to this success?* There's basically been a change in structure from N... running the company. You now have people with experience, and definitely in terms of people we have a good group of middle people who have come in. CSM came in 1993/94. We looked for companies specialising in that area we could network with and they equally were looking for companies around the world. N... was over there, saw them and pursued it. The technology will take a bigger leap now, it will give us more, putting in new computer systems, upgrading computers.

BB: No.

GA: Not really. I believe if more practised there would be more of an effect. I think we must get (a TM teacher) in to get the laggards going to expose the new people. Pete says he is doing it and is very positive about it. But I have a suspicion he's not doing it as often as he should. I would say that I am happy with the way things have gone. We have certainly since then gone through some very challenging periods, especially since some people in the organisation - as I told you a while back we had some resignations - and in a company that size everyone is key and the people handled it surprisingly well. Certainly we expected some time there was going to be something's got to give.

SW: We have been looking at the future in a broader context. We have done exactly what you suggested in a slightly bigger way, look at where we are going to go in the next 3 years rather than in the next year. Whether this can be attributed to

one individual's point of view or something that is prevalent, that necessitated it from a group point of view, I don't know. More than that we have been looking at different kinds of accounts in that period you mentioned, but its debatable whether that can be attributed to TM. *Lets interpret that by saying you have become slightly more objective and not caught up in the day to day events? Yes, that would be true. Explain this phenomenon?* You could argue its through necessity, through frustrations, dealing with certain kinds of accounts, we have had to look at something bigger. Also the experience of the benefits of that kind of account working out fairly well in practice means we would like to get more of that type of account.

APPENDIX N NURSES RECORD SHEET

Occasion

NAME DATE TIME	SBP	DBP	PULSE	COMMENTS: Medication? Current upsets?
	1			
	2		BR RATE	
	3			

NAME DATE TIME	SBP	DBP	PULSE	COMMENTS: Medication? Current upsets?
	1			
	2		BR RATE	
	3			

NAME DATE TIME	SBP	DBP	PULSE	COMMENTS: Medication? Current upsets?
	1			
	2		BR RATE	
	3			

NAME DATE TIME	SBP	DBP	PULSE	COMMENTS: Medication? Current upsets?
	1			
	2		BR RATE	
	3			

NAME DATE TIME	SBP	DBP	PULSE	COMMENTS: Medication? Current upsets?
	1			
	2		BR RATE	
	3			

NAME DATE TIME	SBP	DBP	PULSE	COMMENTS: Medication? Current upsets?
	1			
	2		BR RATE	
	3			

NAME DATE TIME	SBP	DBP	PULSE	COMMENTS: Medication? Current upsets?
	1			
	2		BR RATE	
	3			

415
APPENDIX O
TM EXPERIENCE SHEET
TRANSCENDENTAL MEDITATION PROGRAMME

SECOND DAY FOLLOWING INSTRUCTION

Name

Date

Instructor

Inst. Signature

Please write in this space

How many times have you meditated since your last checking?

How long did you meditate each time?

Did you at any moment find that you were unaware of body and surroundings?

Did thoughts disturb you?

During meditation did you notice any change in your breathing?

Approximately how many times do you lose the mantra during each meditation?

Do you remember any moments when there was no mantra and no thoughts?

After meditation do you feel inclined to rest, or do you feel energetic?

Have you noticed any indication of increasing clarity of mind?

Have you noticed any improvement in your relationship with others?

Has anyone remarked upon any change in you?

How do you feel today as compared to yesterday?

Do you now feel that you have understood how to meditate?

Any other remarks?

USE OTHER SIDE IF NECESSARY

GE

Come tomorrow for verification of experiences and further instructions at.....

APPENDIX P

PMR EXPERIENCE SHEET

PROGRESSIVE MUSCLE RELAXATION PROGRAMME

1st Day following instructions

Name _____

Date _____

Instructor _____

Inst. Signature _____

Please write in this space

How many times have you relaxed since your last checking?

How long did you relax each time?

Did you feel that time during relaxation passed quickly?

Did you at any moment find that you were unaware of body and surroundings?

Did you at any moments feel some happiness within?

Did thoughts disturb you?

During relaxation did you notice any change in your breathing?

During relaxation did you feel so relaxed as to feel sleepy?

How do you feel today as compared with other days?

Are you satisfied with your relaxation so far?

Any other remarks?

APPENDIX Q

SOLOMON TESTS

1. COMPARE GROUPS 1/2 FIRST POST-FOR PRETEST SENSITISATION

t-Test: Two-Sample Assuming Unequal Variances

	1-post1	2-pos1
Mean	35,11	46,90
Variance	383,86	790,10
Observations	9,00	10,00
Pearson Correlation	#N/A	
Pooled Variance	598,93	
df	16,07	
t	-1,07	
P(T<=t) one-tail	0,15	
t Critical one-tail	1,75	
P(T<=t) two-tail	0,30	
t Critical two-tail	2,12	

TEST DATA	
1post1	2-pos1
27	71
17	67
25	12
27	49
70	27
	43
	103
13	23
54	20
55	54
28	

Solomon design

1	O	X	O	CF
2		X	O	
3	O		O	
4			O	

Wilcoxon's matched-pairs signed-rank test

T+=	15
T-=	21
T= (least)	15
From, tables (Huysamen, 1981: 243) for N=8 pairs,	
Tcrit (p<0,005)=	0
Tcrit (p<0,01)=	2
Tcrit (p<0,025)=	4
Tcrit (p<0,05)=	6

TEST DATA		[dif]	dif	rank
1post1	2-pos1			
55	54	1	1	1
13	23	10	-10	2
25	12	13	13	3
27	49	22	-22	4
54	20	34	34	5
70	27	43	43	6
27	71	44	-44	7
17	67	50	-50	8

T is not less than Tcrit
Do not reject null hyp
Groups are not sig diff

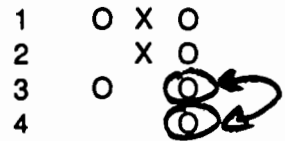
2. COMPARE GROUPS 3/4 FOR PRETEST SENSITISATION

t-Test: Two-Sample Assuming Unequal Variances

	3- pre 2	4-pre 1
Mean	56,88	70,30
Variance	1314,98	3538,01
Observations	8,00	10,00
Pearson Correlation	0,72	
Pooled Variance	1013,43	
df	15,11	
t	-0,59	
P(T<=t) one-tail	0,28	
t Critical one-tail	1,75	
P(T<=t) two-tail	0,56	
t Critical two-tail	2,13	

TEST DATA	
4-pre 1	3- pre 2
8	48
49	44
133	113
53	18
200	
32	23
103	
69	111
15	42
41	56

Solomon design



3. COMPARE GROUPS COMBO 1+3/2+4 FOR PRETEST SENSITISATION

t-Test: Two-Sample Assuming Unequal Variances

	1-post1	2-pos1
Mean	45,35	58,60
Variance	892,62	2194,25
Observations	17,00	20,00
Pearson Correlation	#N/A	
Pooled Variance	598,93	
df	32,66	
t	-1,04	
P(T<=t) one-tail	0,15	
t Critical one-tail	1,69	
P(T<=t) two-tail	0,31	
t Critical two-tail	2,04	

TEST DATA	
1post1	2-pos1
27	71
17	67
25	12
27	49
70	27
	43
	103
	13
	23
	54
	20
	55
	54
	28
3-pre 2	4-pre 1
48	8
44	49
113	133
18	53
	200
	23
	32
	103
111	69
42	15
56	41

Solomon design



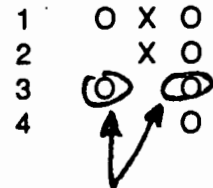
4. COMPARE GROUPS 3 pre/post for PRETEST SENSITISATION

t-Test: Two-Sample Assuming Unequal Variances

	3-pre 1	3-pre 2
Mean	58,80	56,88
Variance	698,84	1314,98
Observations	10,00	8,00
Pearson Correlation	0,81	
Pooled Variance	754,92	
df	12,47	
t	0,13	
P(T<=t) one-tail	0,45	
t Critical one-tail	1,78	
P(T<=t) two-tail	0,90	
t Critical two-tail	2,18	

TEST DATA	
3-pre 1	3-pre 2
56	48
59	44
64	113
22	18
31	
39	23
85	
114	111
60	42
58	56

Solomon design



t-Test: Paired Two-Sample for Means

	3-pre 1	3-pre 2
Mean	59,00	56,88
Variance	690,00	1314,98
Observations	8,00	8,00
Pearson Correlation	0,81	
Pooled Variance	769,43	
Hypothesised Mean Difference	0,00	
df	7,00	
t	0,28	
P(T<=t) one-tail	0,39	
t Critical one-tail	1,89	
P(T<=t) two-tail	0,79	
t Critical two-tail	2,36	

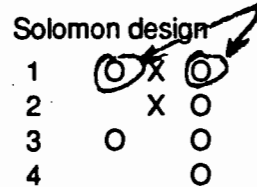
TEST DATA	
3-pre 1	3-pre 2
56	48
59	44
64	113
22	18
39	23
114	111
60	42
58	56

5. COMPARE GROUPS 1 pre/post check TREATMENT EFFECT

t-Test: Two-Sample Assuming Unequal Variances

	1-pre	1-post 1
Mean	62,00	35,11
Variance	3192,00	383,86
Observations	11,00	9,00
Pearson Correlation	0,66	
Pooled Variance	598,93	
df	12,81	
t	1,47	
P(T<=t) one-tail	0,08	
t Critical one-tail	1,78	
P(T<=t) two-tail	0,17	
t Critical two-tail	2,18	

TEST DATA	
1-pre	1-post1
54	27
32	17
40	25
89	27
218	70
41	
5	
31	13
52	54
42	55
78	28



t-Test: Paired Two-Sample for Means

	1-pre 1	1-post 1
Mean	70,67	35,11
Variance	3444,25	383,86
Observations	9,00	9,00
Pearson Correlation	0,66	
Pooled Variance	754,92	
Hypothesised Mean Difference	0,00	
df	8,00	
t	2,22	
P(T<=t) one-tail	0,03	
t Critical one-tail	1,86	
P(T<=t) two-tail	0,06	
t Critical two-tail	2,31	

TEST DATA	
1-pre 1	1-post1
54	27
32	17
40	25
89	27
218	70
31	13
52	54
42	55
78	28

Wilcoxon's matched-pairs signed-rank test

T += 42
 T -= 3
 T= (least) 3
 From, tables
 (Huysamen, 1981: 243)
 for N=9 pairs,
 Tcrit (p<0,005)= 2
 Tcrit (p<0,01)= 3
 Tcrit (p<0,025)= 6
 Tcrit (p<0,05)= 8

TEST DATA					
1-pre 1	1-post1	[dif]	dif	rank	
52	54	2	- 2	1	
42	55	13	- 13	2	
32	17	15	15	3,5	
40	25	15	15	3,5	
31	13	18	18	5	
54	27	27	27	6	
78	28	50	50	7	
89	27	62	62	8	
218	70	148	148	9	

T is less than
 Tcrit
 Reject null hyp
 Groups are sig diff at the p<0,01 level.

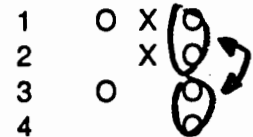
6. COMPARE GROUPS 1,2/3,4 FOR TREATMT EFFECT

t-Test: Two-Sample Assuming Unequal Variances

	1-post1	3- pre 2
Mean	41,32	64,33
Variance	602,23	2461,65
Observations	19,00	18,00
Pearson Correlation	#N/A	
Pooled Variance	598,93	
df	24,55	
t	-1,77	
P(T<=t) one-tail	0,04	
t Critical one-tail	1,71	
P(T<=t) two-tail	0,09	
t Critical two-tail	2,06	

TEST DATA	
1post1	3- pre 2
27	48
17	44
25	113
27	18
70	
	23
13	111
54	42
55	56
28	
2post1	4-pre 1
71	8
67	49
12	133
49	53
27	200
43	32
103	103
23	69
20	15
54	41

Solomon design



APPENDIX R

TRAINING PROCEDURE USED FOR IMPARTING PMR

The following procedure was used by the trainer to impart the procedure of progressive muscle relaxation. The trainer used the following words:

Science tells us that when we think about things our muscles may tense faintly even without being aware of it. This is what we could call nervous tension. In this personal instruction you will learn how to locate the sensation of tenseness and then how to relax - with practice, relaxation will become a habit and you will have more energy and feel better.

The trainees were then instructed to stretch out in any way they felt comfortable on a couch or easy chair and were asked to lie quietly.

After about 1 minute the instruction was now you can gradually let your eyes close. After a further minute: you can keep your eyes closed for the rest of the session. Now think about your left arm. Bend the left hand back at the wrist, not the elbow. What do you feel? The trainee was directed to feel the sensation of tenseness separate from the feeling of strain in the wrist itself. Now by its own weight let the hand flop. What do you feel? The trainee was directed to feel the sensation of tenseness disappearing.

After 2 minutes the same sequence of instructions was repeated twice.

After 3 repetitions of the above sequence the trainer pointed out: did you notice how easy it is to relax? It requires no effort. This hand movement is just an example to show how *tenseness* feels. Contraction of muscles before relaxing does not increase the relaxation. Its just to experience that relaxation is the opposite of tenseness. Now just lie and relax with the eyes closed. Don't mind the time. I'll be back.

The trainee was then left to relax with the eyes closed for 15 minutes.

After 15 minutes the trainee was instructed to slowly open the eyes and thereafter fill out the experience sheet (shown as Appendix P). The instructor then covered the following points: This is progressive muscle relaxation. Its progressive because you learn to relax more and more progressively, because you learn to relax one group of muscles and then another, and because with daily practice you will gain the habit of relaxing progressively.

Trainees were instructed to practice twice daily for 20 minutes either at home or at work lying, sitting or reclining. The procedure they were instructed to practice at home or at work was think of your left arm and notice the sensation of tenseness. Then flop. Don't move around, its not necessary. Its not necessary to repeat to myself 'I am relaxing'. Its not necessary to contract every time, only every 3rd session or so will it be necessary to actually pull the left wrist back as

you were shown today. The purpose of all this is to recognise the sensation of tenseness. Tomorrow you will practice diminishing tensions.

Trainees were instructed to repeat this procedure twice at home before meals and to return the following day for the first follow up session. The procedure followed at the first follow up 24 hours following the personal instruction was as follows.

The session was held as a group meeting. First experiences were discussed during the practice. Then the following points were made by the trainer: Research has suggested that the benefits of progressive muscle relaxation are increased energy, reduced fatigue, greater efficiency and some people have noticed even things like reduction in headaches and improvement in digestion. Concentration has been seen to improve and also memory. Some studies also suggest reduced blood pressure.

Now what has muscle tension got to do with worry, fear and anxiety. Tests show that if you imagine a stressful event the muscles will tense up as if that event were actually happening, e.g. research at the University of Chicago using electrodes placed in the eye muscles showed that when subjects were asked to imagine the Eiffel Tower eye muscle activity would take place. This eye muscle activity was exactly the same as if the subjects were told to actually 'look up'. In other tests subjects were asked to imagine lifting a brick. Tension was noted in the muscles of the arm. When they were asked to consciously relax those muscles the image of lifting the brick rapidly faded. So in daily

life there is faint muscle activity which can lead to muscle tension. If you can learn to relax particular tensions the mind will settle and you stop recalling the event that lead to the tension in the first place. There also appears to be a link between voluntary and skeletal muscle activity, i.e. if you are able consciously to relax your skeletal muscles the involuntary muscles over which we usually think we have no control also seem to relax. It was pointed out that tension is part of life. You cannot remove tension or you die. It is possible to control tension, its so very important to relax. It was also pointed out that it is not always necessary to be able to locate the tension but it can help if the tension is located. Eventually relaxation becomes automatic.

The trainer then led the trainees through the following relaxation procedure as a group.

First sit comfortably. Now gradually close your eyes. (Wait 1 minute). Now gently bend your left hand back at the wrist. Do you feel the *tenseness*? Good. Now by its own weight let the hand *flop*. Do you feel the tenseness disappears? See how easy it is. (A further minute elapses). Now bend the left hand *forward* at the wrist. Do you feel the tenseness? Now relax your hand. See how easy it is. (A further minute elapses). Now raise the left hand using your biceps. Do you feel the tenseness. Now relax the tenseness. Feel how the tenseness disappears. See how easy it is. Now push down using the triceps. Do you feel the tenseness? Now relax the tenseness. See how easy it is. (A further minute elapses). Now tense the whole arm, make the muscles a little stiff. Increase more and more and hold this for about

30 seconds. (30 seconds elapse). Now let the tension go a little less. A little less. A little less. Now the arm is completely relaxed. (Pause for a few seconds). Now go past the point where the arm is completely relaxed - we call this *going negative*. So whatever you have been doing to this point - continue this on and on. (Now allow 15 minutes to elapse).

The group is then allowed to relax for 15 minutes. The entire session lasted about an hour and 10 minutes. (Experience sheets were filled out at the beginning as on the first day). The group is then told to practice *going negative* at home, morning and evening before meeting again for the second follow up.

Procedure for the second follow up: At the beginning of the session experience forms were filled in and experiences discussed. By now the group is feeling easier with the instructor and more personal experiences surface such as tummy rumblings. The instructor uses these experiences to reinforce points made previously such as the relationship between relaxation of the voluntary or striped muscles and relaxation in the smooth involuntary muscle systems in the body. Therefore it is not surprising when people report that tummy aches and headaches become less after some days of practice of relaxation. The instructor then makes four specific points: 1. Beware of developing the habit of contracting before relaxing. 2. It is therefore poor practice to always contract before relaxing. Don't let contracting before relaxing become a habit. 3. Therefore don't stiffen as you relax.

Begin to relax from whatever stage you find yourself. If you are ever unsure as to what tension feels like relax for 5 minutes, then do the left arm wrist bending exercise as learned on the first day. 4. It is not necessary to repeat to yourself 'my legs are getting heavy,' etc. Now recapping on the day of personal instruction, you were shown how to recognise tension and yesterday, at the first follow up, you learned to diminish tensions past the relaxation point and to actually *go negative*. Today we will check tension in major muscle groups. We will be first tensing for about 15 seconds and then flopping for about 15 seconds on each of the major muscle groups. The whole procedure will take about 10 minutes. The instructor points out the muscle groups: forearm, underarm, biceps, triceps, shin, calves, front thighs, rear thighs, buttocks, abdomen, neck and shoulders, facial muscles and muscles round the mouth.

Now starting with the forearm make the forearm tense (hold this for about 15 seconds). Now *flop*. Let the muscles *go negative*. (15 seconds). Now the underarms. Tense (15 seconds). *Flop* (15 seconds). And so on through all the muscle groups as enumerated above.

At the end of this procedure trainees are instructed to follow the same procedure at home as follows: Tense for 15 seconds and flop for 15 seconds each of the muscle groups starting with the arms then legs, abdomen, shoulders, neck, eyes and mouth and then use the balance of 20 minutes to *go negative*. The instructor points out that the sole purpose of all this is to relax the muscle systems progressively letting other effects and experiences come as they may.

This second group follow up session takes about an hour and 5 minutes.

At the third follow up session the procedure is to fill out experience sheets as before and then the trainer sums up as follows: Remember that we have a vicious circle wherein thoughts become mirrored by the body's tensions. In a sense the event becomes the cue to tense the muscles. These muscle tensions are mirrored by the mind. So the thoughts make the muscles tense and tense muscles make the mind anxious. In this way it can be seen that the situation may be the trigger for anxiety but is not necessary the cause of the anxiety so what we are doing here is to teach a new habit. Its nervous re-education and if you are more relaxed you will do better at dancing, typing, speaking and all sorts of other activities. As muscle tensions die away so does the thinking activity therefor one will be less anxious, sleep better and so forth.

The instructor emphasises the importance of twice daily practice for about 20 minutes. Practice can be done sitting in a chair at work or reclining or even lying down. Point out that when lying down the practitioner will very often go to sleep so it may be better merely to recline. Daily practice can consist of tensing and relaxing the left arm as done on the day of personal instruction or tensing and relaxing the whole arm and then noticing diminishing tension and *going negative* as was shown on the first follow up or alternatively tensing and *going negative* on all muscle groups as shown in the second follow up or alternatively just flopping as we will do today. The instructor further

points out the importance of not cutting off the process early even if relaxation doesn't seem to flow. It is also important to come out of the procedure slowly taking 2 or 3 minutes to wind up before going on with activity.

The group then does a 20 minute relaxation session wherein they are instructed merely to "just flop".

The conclusion in this session was to point out a study cited by Jacobson (1957) wherein 15 700 cadets at an academy practising progressive muscle relaxation exhibited fewer accidents, less anxiety, greater energy, less fatigue, greater efficiency, less headaches, improved digestion, improved concentration and memory and reduced blood pressure. The instructor points out it is unnecessary to make a habit of going tense before relaxing so you can relax from wherever you are and it is not necessary to talk yourself into being relaxed and to say 'I am getting heavier,' etc, etc. He then repeats that the sole purpose of all this is to relax progressively letting other effects come as they may. (The 15 000 cadets were air force cadets cited by Jacobson in the Journal of Psychiatry and a study was done by Neufeldt).

Tests show that when you imagine a stressful event you tense muscles as if you were actually doing it. If you relax these particular tensions your mind settles and ceases to imagine or reflect or recall the event. This can all be done as successfully while active as while lying down according to Jacobson. Its a popular view that an event increases anxiety such as hearing and noise and jumping. However if

one is generally relaxed that same noise will not lead to the same response. Therefore the situation may be the trigger but is not necessary the cause of the anxiety.

APPENDIX S

FIELD EFFECTS

Over the past decade or two unified field theories have been proposed and debated in theoretical physics circles. According to Hagelin (1989)

It was Einstein's deep conviction that the laws of nature had a simple, geometric, unified foundation, and that this unification could be understood by the human intellect. Within the past two decades, a number of important breakthroughs in this area have led to a progressively more unified understanding of the laws of nature, culminating in the recent discovery of completely unified field theories. These theories afford, for the first time, a self-consistent and completely unified description of the elementary particles of forces in terms of a single, self-interacting field.(Hagelin, 1989)

This self-interacting field, the unified field, is held to contain the potential for the entire universe, as a tree is contained within the seed. (Hagelin, 1989). The unified field is further held to be fundamentally a field of consciousness (Maharishi, 1986).

Here the term "consciousness" is used in a much broader sense than is common to everyday experience. It is used to denote a completely universal field of which, ultimately all forms and phenomena in the universe comprise.

At present the Maharishi Effect, which refers to the extended field effects produced by the collective practice of TM and its extension the TM-Sidhi programme, provides the most striking empirical evidence

in support of the above description linking consciousness with unified field theories.

According to Hagelin:

Over 30 consecutive studies provide powerful evidence that the group practice of the TM-Sidhi program by as few as the square root of 1% of the population can reduce political violence, crime and other manifestations of societal incoherence. These studies employ standard sociological measures to assess the influence of groups of experts collectively practising the TM-Sidhi program on a surrounding population"(Hagelin, 1989).

One especially critical experimental test of this hypothesis that group practice of these techniques by a critical threshold number could positively affect sociological measures was conducted in Israel in August and September of 1983 (Orme-Johnson et al, 1988). The researchers lodged the experimental protocol five months in advance of the actual experiment with an independent review board of scientists in the U.S. and Israel. The prediction was that group practice of these techniques would reduce stress in the collective consciousness of Israel and Lebanon. Box-Jenkins ARIMA intervention, cross-correlation, and transfer function analyses were used to study the effects of changes in the size of the group variables reflecting the quality of life in Jerusalem and Israel and also the war in Lebanon.

Increases in the size of the group had a statistically significant effect on the individual variables and on the composite quality-of-life index.

According to Hagelin:

...cross-correlations and transfer functions indicated that the group had a leading relationship to change on the quality of

life indicators, supporting a causal interpretation. There was a 34% reduction in war intensity and a 76% reduction in war deaths during the periods of high TM-Sidhi participants. Time series analysis demonstrated that the effect could not be attributed to seasonality (such as weekend effects or holidays) or to changes in temperature. It was hypothesised that the influence occurs on a fundamental and holistic level of nature. (Hagelin, 1989)

According to the Orme-Johnson et al, (1988), many alternative explanations for the results could be discounted. The authors of the study addressed issues such as assemblies being held when the conflict was improving anyway (dates were announced months in advance), progression towards the mean (improvement was substantially away from the mean), positive changes were found to occur immediately before the improved events could be reported in the press, measurement bias (raters were blind as to the nature of the hypotheses, the independent variables, and the theory on which the hypotheses were based), etc.

According to Hagelin:

these research findings clearly have profound implications concerning our understanding of consciousness and its relation to the physical world. Indeed, they appear to invalidate completely the prevailing psychological and sociological paradigm".

Hagelin then presents an analysis which argues that these results are consistent with the current framework of unified quantum field theories, but require an expanded physical framework for our understanding of consciousness:

Although it would be more accurate to say that the Maharishi Effect data constitutes evidence for an 'action at a distance' with respect to consciousness rather than a 'field effect' *per se*,

physics has historically come to associate action at a distance with field phenomena. The observed attenuation of the effect with distance (i.e., the fact that a relatively small group in Lebanon produced an effect comparable to a group of over 7000 halfway round the globe) would support such a field-theoretic interpretation. The quadratic dependence of the intensity of the effect upon the size of the coherence-creating group is also characteristic of a field phenomenon in which the radiators are operating coherently"(Hagelin, 1989).

Hagelin is saying that the intensity of the effect is a function of the square of the size of the coherence-creating group. He goes on to assert:

"However, there are certain features of the Maharishi Effect that are not easily understood on the basis of a conventional field. The main difficulty with the simple field-theoretic model is in understanding the observed data on the basis of any of the *known* fields. The only *known* candidates for such long-range interactions are electromagnetism and gravity. Any conventional gravitational interaction between individuals is presumably orders of magnitude too weak. Moreover, it is generally agreed that the electromagnetic interaction between individuals would also be too weak to give rise to any significant effects. ... while we therefore feel it is essential to pursue possible electromagnetic mechanisms for the Maharishi Effect, these mechanisms at present appear unable to account for the observed phenomenology. ... if conventional mechanisms are unable to account for the observed data, then some unconventional mechanism involving new physics is obviously needed. Since there are no other long-range forces of electromagnetic or comparable strength, one is led to consider alternative theoretical frameworks that could serve to bridge the substantial distance factors involved. One such framework is suggested by the structure of space time geometry at the scale of super-unification - the proposed domain of pure consciousness. (Hagelin, 1989)

Hagelin then proceeds to suggest that the Maharishi Effect data can be viewed as evidence "that individual consciousness can access

the scale of super-unification, consistent with the proposed identity between pure consciousness and the unified field." He then raises the question how human consciousness could possibly interact with physics at such fundamental scales. According to Hagelin :

This question stems from a recent but widespread understanding that consciousness is purely a product of complex biochemical and electro-physiological processes in the brain. Such a viewpoint may seem compatible with the restricted range of experience available in waking consciousness (in which consciousness itself is not directly perceived), but it is clearly incompatible with experience in higher states of consciousness. For example, in a state of pure consciousness, consciousness experiences itself as the unified source and fountainhead of all the laws of nature: all forms and phenomena in the universe are experienced to emerge from there ... Hagelin (1989: 60).

APPENDIX T

WORKSITE STRESS PROGRAMMES

APPENDIX

WORKSITE STRESS PROGRAMMES SUMMARY

<u>REFERENCE</u>	<u>SUBJECTS</u>	<u>RESPONSE MEASURES</u>	<u>COMMENTS</u>
<p>Abbamoto, Matheny & Dievanayagam (1979)</p> <p>Cited in Murphy (1984)</p>	<p>6 police officers</p> <p><u>TRAINING METHODS</u></p> <p>Biofeedback passive relaxation</p> <p><u>PROGRAMME FORMAT</u></p> <p>Weekly sessions for 8 weeks; 2-week base-line; 1-month follow-up</p>	<p>SBP, DBP, Hand Temp, tension.</p> <p><u>RESULTS-POST TRAINING</u></p> <p>SBP, EMG, Hand Temp, tension improved.</p> <p><u>RESULTS-FOLLOWUP</u></p> <p>Positive responses to programmes in all officers</p>	<p>Physiological changes were within-session only and marginally significant.</p> <p>No physiological follow up</p> <p>Officers still practise at follow-up.</p>

<p>REFERENCE Allman (1985)</p>	<p>SUBJECTS 60 in two companies</p> <p>TRAINING METHODS "Multimodal workshop"</p> <p>PROGRAMME FORMAT Random assign to stress workshop and control. 2 day workshop. Followup at 3 months</p>	<p>RESPONSE MEASURES Somatogenic stress, psychological stress, environmental stress, (SVA-R). Plus : weight; SBP, DBP, HR Resting, BR resting, cigarette consumption</p> <p>RESULTS-POST TRAINING</p> <p>RESULTS-FOLLOWUP Sig improvements in therapy group vs controls only on net stress and psychological stress vectors. No change on environmental or somatic stress vectors</p>	<p>COMMENTS A methodologically weak study. No physiological posttests. No correlation found at pretest between SVA-R and physiological measures except between weight and somatic stress. High correlations found between no. of cigarettes smoked, HR & BR. Poor controls and statistical analysis procedures. The only S A Study.</p>
<p>REFERENCE Carrington, Collings, Benson, Robinson, Wood, Lehr, Woolfolk & Cole (1980)</p>	<p>SUBJECTS 154 telephone company workers self selected for stress</p> <p>TRAINING METHODS ROM meditation CSM meditation muscle relax controls</p> <p>PROGRAMME FORMAT Workers self-taught at home; phone contact by trainer; follow-up</p>	<p>RESPONSE MEASURES SCL-90-R Psychological measures</p> <p>RESULTS-POST TRAINING</p> <p>RESULTS-FOLLOWUP Somatization, depression, hostility, inter-personal sensitivity improved.</p>	<p>COMMENTS No physiological data. Practisers got more benefits. Control group also showed large symptom reductions. Meditation superior for symptom reduction</p>

<p><u>REFERENCE</u> Drazen, Nevid, Pace & OBrien (1982) Cited in Murphy 1984)</p>	<p><u>SUBJECTS</u> 22 mildly hypertensive white-collar workers</p> <p><u>TRAINING METHODS</u> C/B skills anxiety management controls</p> <p><u>PROGRAMME FORMAT</u> 10 weekly sessions; small groups</p>	<p><u>RESPONSE MEASURES</u> SBP, DBP</p> <p><u>RESULTS-POST TRAINING</u> SBP, DBP</p> <p><u>RESULTS-FOLLOWUP</u> None reported</p>	<p><u>COMMENTS</u> All groups showed decreases in SBP and DBP. Non-specific effects noted as important.</p>
<p><u>REFERENCE</u> Forman (1981) Cited in Murphy (1984)</p>	<p><u>SUBJECTS</u> 16 school psychologists</p> <p><u>TRAINING METHODS</u> C/B skills muscle relax controls</p> <p><u>PROGRAMME FORMAT</u> 2-hour weekly sessions for 6 weeks</p>	<p><u>RESPONSE MEASURES</u> Anxiety JDI (5 scales)</p> <p><u>RESULTS-POST TRAINING</u> Anxiety, job satisfac., positive attitudes toward work and supervisor</p> <p><u>RESULTS-FOLLOWUP</u> None reported</p>	<p><u>COMMENTS</u> A second study using schoolteachers found improved perception of psychological services after training.</p>

<p><u>REFERENCE</u> Friend (1977)</p>	<p><u>SUBJECTS</u> 50 Mental health workers</p> <p><u>TRAINING METHODS</u> Meditation (TM)</p> <p><u>PROGRAMME FORMAT</u> 7 step workshop. Followup questionnaires at 3 months and 1 year</p>	<p><u>RESPONSE MEASURES</u> Job Description Index (JDI) TABP</p> <p><u>RESULTS-POST TRAINING</u></p> <p><u>RESULTS-FOLLOWUP</u> Mood improved. Relations improved. Work habits improved. Satisfaction with supervision improved at 3 months. Marginal improvement in supervisors ratings.</p>	<p><u>COMMENTS</u> Unpublished paper. Methodologically unsound. Inadequate controls. Random assignment. Difficulties experienced with follow-up program, but basic workshop was easy to conduct.</p>
<p><u>REFERENCE</u> Ganster, Mayes, Sime & Tharpe (1982) Cited in Murphy (1984)</p>	<p><u>SUBJECTS</u> 79 public agency workers</p> <p><u>TRAINING METHODS</u> C/B skills muscle relax biofeedback controls</p> <p><u>PROGRAMME FORMAT</u> 8 weekly 2-hour sessions; large groups, 4-month follow-up</p>	<p><u>RESPONSE MEASURES</u> Urinary norepinephrine, symptoms, irritation</p> <p><u>RESULTS-POST TRAINING</u> Epinephrine, depression</p> <p><u>RESULTS-FOLLOWUP</u> Epinephrine, norepinephrine, depression, anxiety</p>	<p><u>COMMENTS</u></p>

<p>REFERENCE</p> <p>Manuso (1979)</p> <p>Also in Schwartz, (1980).</p> <p>Also cited in Murphy (1984),</p>	<p>SUBJECTS</p> <p>30 workers with headache, anxiety problems</p> <p>TRAINING METHODS</p> <p>Biofeedback muscle relax imagery breathing exercises</p> <p>PROGRAMME FORMAT</p> <p>3 sessions per week, 5 weeks;</p> <p>1-week base-line; 3-month follow-up</p>	<p>RESPONSE MEASURES</p> <p>EMG, symptoms, clinic visits, interference with work</p> <p>RESULTS-POST TRAINING</p> <p>EMG, symptoms, clinic visits, interference with work.</p> <p>RESULTS-FOLLOWUP</p> <p>EMG, symptoms, interference with work improved.</p>	<p>COMMENTS</p> <p>No control group used.</p> <p>Multimodal training was effective on all measures.</p> <p>Cost-benefit=1:5.52 projected over 3 years.</p>
<p>REFERENCE</p> <p>Murphy (1983)</p> <p>Cited in Murphy (1984)</p>	<p>SUBJECTS</p> <p>28 nurses</p> <p>TRAINING METHODS</p> <p>Biofeedback muscle relax controls</p> <p>PROGRAMME FORMAT</p> <p>6 daily session sm. groups 2-day base-line; 3-month follow-up</p>	<p>RESPONSE MEASURES</p> <p>EMG, HTemp anxiety, satisfac., coping, sleep problems, SCL90R</p> <p>RESULTS-POST TRAINING</p> <p>EMG(MR) HTemp (bio) anxiety (all)</p> <p>RESULTS-FOLLOWUP</p> <p>Sleep disturbances (all) coping (MR) headaches, satisfac. (bio) work energy (bio)</p>	<p>COMMENTS</p> <p>No physiological follow-up, within-session effects only on EMG and HTemp, self-relax groups also showed significant survey benefits</p>

<p>REFERENCE Murphy (1984)</p>	<p>SUBJECTS 38 highway maintenance workers</p> <p>TRAINING METHODS Biofeedback muscle relax controls</p> <p>PROGRAMME FORMAT 6 daily sessions, 2-day base-line; 3-month follow-up</p>	<p>RESPONSE MEASURES EMG, anxiety, BSI, coping, HTemp</p> <p>RESULTS-POST TRAINING EMG, tension, quality of sleep</p> <p>RESULTS-FOLLOWUP EMG, sleep problems, stress symptoms, alcohol use</p>	<p>COMMENTS Controls showed change on all subjective measures. EMGs regressed toward base-line at follow-up. Treated groups showed less regression at follow-up relative to controls.</p>
<p>REFERENCE Payne Gair (1982) (Abstract)</p>	<p>SUBJECTS 60 - 30 blue collar 30 white collar</p> <p>TRAINING METHODS Stress awareness Time budgeting Muscle relaxation Meditation (ROM)</p> <p>PROGRAMME FORMAT Random assignment to stress workshop, placebo workshop and WL control.</p>	<p>RESPONSE MEASURES Frequency of practise stress level (WQ) health level (employment level)</p> <p>RESULTS-POST TRAINING No change in stress or health levels. Stress workshop group used techniques more.</p> <p>RESULTS-FOLLOWUP</p>	<p>COMMENTS White collar workers more positive toward stress mmt techniques, more healthy and had more opportunity to practice. Use of techniques correlated with WQ Scores, workshop rating and recall. PSTRI scores correlated negatively with attitude towards stress management techniques. Worried subjects reported less stress.</p>

<p>REFERENCE Peters, Benson & Porter (1977) Peters, Benson & Meters (1977) Also Peters, 1981 as cited in Murphy (1984)</p>	<p>SUBJECTS 194 office workers</p> <p>TRAINING METHODS ROM meditation self-relaxation wait-list non-volunteers</p> <p>PROGRAMME FORMAT 1 session; 4-week base-line; 8-week evaluation; 6-month follow-up</p>	<p>RESPONSE MEASURES SBP,DBP, symptoms, performance, mood state, satisfaction</p> <p>RESULTS-POST TRAINING SBP, DBP, symptoms, performance, mood state, satisfaction improved.</p> <p>RESULTS-FOLLOWUP SBP,DBP, symptoms, performance, alcohol use satisfaction improved.</p>	<p>COMMENTS Good control groups except at followup. Self-relaxation group showed significant effects on some measures. Practisers gained more benefits. No control group at follow-up</p>
<p>REFERENCE Peterson (1981) Cited in Murphy (1984)</p>	<p>SUBJECTS 81 clerical employees</p> <p>TRAINING METHODS C/B skills muscle relax C/B MR controls</p> <p>PROGRAMME FORMAT 6 weekly sessions; 1-week base-line; 6-week follow-up</p>	<p>RESPONSE MEASURES SBP, DBP, EMG, HTemp, SCL90R, HR, anxiety, coping systems</p> <p>RESULTS-POST TRAINING DBP, EMG, HTemp, HR, anxiety, coping systems improved</p> <p>RESULTS-FOLLOWUP SBP DBP HTemp HR anxiety coping systems improved</p>	<p>COMMENTS MR effective in reducing physiological stress levels and improving coping ability. Combination of strategy was not as effective.</p>

<p>REFERENCE Puente & Beiman (1980)</p>	<p>SUBJECTS 60 male and female self-referred clients</p> <p>TRAINING METHODS Cognitive restructuring progressive relaxation Behaviour Therapy(BT) TM + Self-relaxation (SR)</p> <p>PROGRAMME FORMAT 7 x 1 1/2 hour sessions over 2 weeks</p>	<p>RESPONSE MEASURES Cardiovascular and subjective stress responses to stressful slides</p> <p>RESULTS-POST TRAINING Heart rate response decreased sig. in BT & SR groups. No change in self-report, or TM & WL groups</p> <p>RESULTS-FOLLOWUP</p>	<p>COMMENTS Ss responded to an ad for therapy. BT & SR more effective than TM or WL in reducing cardiovascular stress response. Therapeutic suggestion and positive reinforcement of progress held to be responsible for results. Expectancy not controlled. Random assignment after screening. Not at worksite. Seem to misunderstand TM rationale.</p>
<p>REFERENCE Rose & Veiga (1984)</p>	<p>SUBJECTS 43 undergrad business students</p> <p>TRAINING METHODS Progressive muscle relaxation cue-controlled relaxation coping skills training cognitive modification & WL controls</p> <p>PROGRAMME FORMAT "Stress management" course and "careers planning course" (controls) posttests after 1 month during stressful exam week.</p>	<p>RESPONSE MEASURES Anxiety (STAT) Locus of control (Rotter) TABP (JAS)</p> <p>RESULTS-POST TRAINING Significant state & trait anxiety reductions -</p> <p>RESULTS-FOLLOWUP State and Trait anxiety reductions maintained after 1 month</p>	<p>COMMENTS Results seem similar to managers reported by Roskies (1980) and Suinn and Bloom (1978). Therefore may be generalizable to managers.</p>

<p>REFERENCE Roskies (1979) Cited in Roskies. (1980)</p>	<p>SUBJECTS 27 type A male senior managers 39-59</p> <p>TRAINING METHODS Progressive muscle relaxation (13) + psychotherapy controls</p> <p>PROGRAMME FORMAT 14 sessions of 1 1/2 hours. Pre & post tests. Practise PMR 15 min 2 x daily 6 month follow-up.</p>	<p>RESPONSE MEASURES Resting blood pressure serum cholesterol psychological measures</p> <p>RESULTS-POST TRAINING Serum cholesterol reduced. SBP reduced time pressure reduced life dissatisfaction reduced</p> <p>RESULTS-FOLLOWUP serum cholesterol reduced, SBP reduced, time pressure reduced, life dissat., reduced. PMR results significantly different from psychotherapy only at followup.</p>	<p>COMMENTS Ss responded to ads, screened by Structured Interview. Selected only Type A Ss. Random assignment to treatment (PMR) and control (Psychotherapy). Well controlled, but programme not run at worksite.</p>
<p>REFERENCE Roskies (1980)</p>	<p>SUBJECTS 66 male managers</p> <p>TRAINING METHODS Muscle relaxation, RET, communication skills, problem solving, stress management</p> <p>PROGRAMME FORMAT 13 weekly meetings in group of 10 for 1 1/2 hours</p>	<p>RESPONSE MEASURES Psychological state BP-home readings Serum cholesterol & testosterone</p> <p>RESULTS-POST TRAINING</p> <p>RESULTS-FOLLOWUP</p>	<p>COMMENTS Results not available. Preliminary paper only</p>

<p>REFERENCE Scheingarten (1981) Cited in Murphy (1984)</p>	<p>SUBJECTS 8 steel company managers</p> <p>TRAINING METHODS Muscle relax exercise C/B skills</p> <p>PROGRAMME FORMAT 3-day seminar</p>	<p>RESPONSE MEASURES SBP, DBP</p> <p>RESULTS-POST TRAINING SBP, DBP</p> <p>RESULTS-FOLLOWUP None reported</p>	<p>COMMENTS No control group used Workers were normo-tensive at start of seminar</p>
<p>REFERENCE Schleifer (1981) Cited in Murphy (1984)</p>	<p>SUBJECTS 22 mixed hypertensive workers</p> <p>TRAINING METHODS Muscle relax controls</p> <p>PROGRAMME FORMAT 5 weekly sessions; 4-week base-line</p>	<p>RESPONSE MEASURES SBP, DBP, EMG, coping, anxiety</p> <p>RESULTS-POST TRAINING DMP, EMG, coping, anxiety</p> <p>RESULTS-FOLLOWUP None reported</p>	<p>COMMENTS Self-relax group showed equivalent decreases in SBP and DBP post-training. Workers on hypertensive medication at start-up.</p>

<p><u>REFERENCE</u> Steinmetz et al. (1982) Cited in Murphy (1984)</p>	<p><u>SUBJECTS</u> 243 mixed workers</p> <p><u>TRAINING METHODS</u> Muscle relax C/B skills</p> <p><u>PROGRAMME FORMAT</u> Variable format for total of 8 hours</p>	<p><u>RESPONSE MEASURES</u> Stress symptoms, job stress</p> <p><u>RESULTS-POST TRAINING</u> Stress symptoms, job stress</p> <p><u>RESULTS-FOLLOWUP</u> None reported</p>	<p><u>COMMENTS</u> No control group used. Pre-post surveys not coded by individual. No time effects examined</p>
<p><u>REFERENCE</u> Thomas G.R. (1982) (abstract)</p>	<p><u>SUBJECTS</u> 200 , managers + spouses</p> <p><u>TRAINING METHODS</u></p> <p><u>PROGRAMME FORMAT</u> 9 month Program: 3 day workshop on 'health improvement & stress management' Pre & post tests & interviews , 6 month</p>	<p><u>RESPONSE MEASURES</u></p> <p><u>RESULTS-POST TRAINING</u></p> <p><u>RESULTS-FOLLOWUP</u> alcohol intake reduced exercise increased TABP reduced felt stress reduced</p>	<p><u>COMMENTS</u> Subjects volunteered. 3 corporate locations. High initial enthusiasm which declined at follow-up. Modest improvements in 'a number of scales'. In some cases concurrent improvements found both in participants and controls.</p>

APPENDIX U

**CORRELATIONS BETWEEN VARIABLES: A MULTIPLE
REGRESSION ANALYSIS**

The following multiple regression analysis was performed to complement and extend the correlation analysis presented in chapter IV. The analysis did not address the issue of causality, i.e., although it addresses the regression of physiological and climate variables on SCL⁰ scores, it does not imply that these variables *caused* the variation in SCL scores.

Having established support for hypothesis three (that stress symptoms, physiological parameters and climate variables would be correlated) the data was examined again to uncover further relationships between the variables.

PHYSIOLOGICAL VARIABLES

Recall the correlation analysis performed in chapter IV (Table 18). For convenience, this is repeated below.

⁰ Recall SCL = stress symptoms checklist, SBP = systolic blood pressure, DBP = diastolic blood pressure, BR = breath rate, HR = heart rate.

Table 18
CORRELATION MATRIX PHYSIOLOGICAL PARAMETERS

Groups 1-6 at pretest, N = 38

	SBP-PRE	DBP-PRE	HR-PRE	BR-PRE
SBP -PRE	1			
DBP -PRE	,833	1		
HR -PRE	,311	,328	1	
BR -PRE	,367	,294	,648	1

Note: 21 cases deleted with missing values.

SBP correlated very closely with DBP. There also appeared to be significant correlations between the other physiological variables.

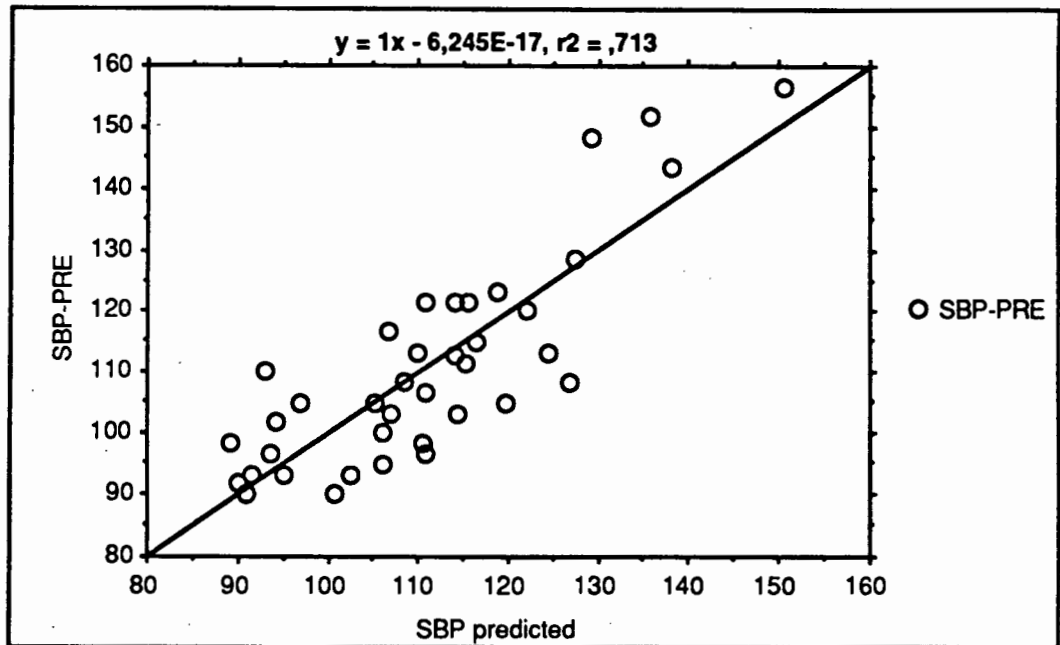
Had this been a case of simple regression, a scattergram would now have been useful to give a visual indication of the relationships between the variables. This not being possible with multiple regression, an extra data column was created, consisting of the values of the chosen dependent variable (SBP) predicted by the regressors DBP, HR and BR. A scattergram of SBP was then plotted against predicted SBP .

Shown below is the scattergram of actual values of SBP versus the values predicted by the regression equation $y' = a + b_1 x_1 + b_2 x_2 + b_3 x_3$ (where a is the intercept, b the beta coefficients and x the physiological variables DBP, HR and BR)

The scattergram graphically illustrates a substantial correlation between the actual and predicted values of SBP with no deviant cases.

Figure A
SCATTERGRAM OF SBP AGAINST PREDICTED SBP

At pretest - groups 1-6



This figure was plotted in response to a suggestion by Kerlinger (1973: 620):

"Although using and reporting regression plots in this manner is not common practice in education, sociology and psychology, it probably should be. Not only can the relation be studied in detail; specific features of the data can be singled out for special attention."

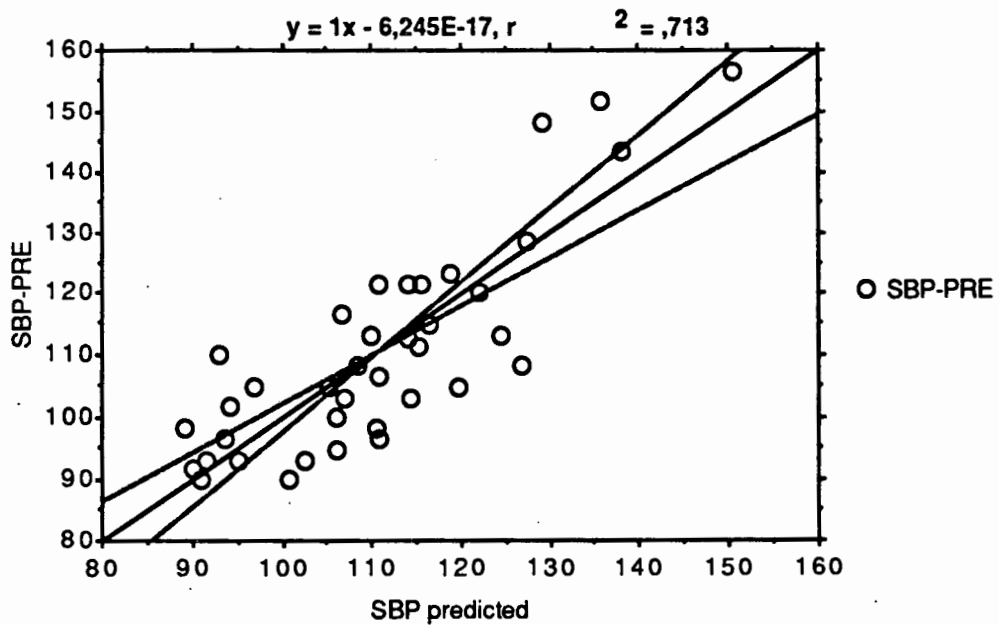
Examination of this chart raised the question whether there was indeed a simple linear relationship between SBP and predicted SBP? The regression line was seen to pass below most values of predicted SBP of less than 100 or over 130. Perhaps the residuals were not independent of the observed values. To attempt an answer, 95%

confidence bands were added to the slope of the regression line, giving the following chart:

Figure B

SCATTERGRAM OF SBP AGAINST PREDICTED SBP

At pretest - groups 1-6, with 95% confidence limits on slope

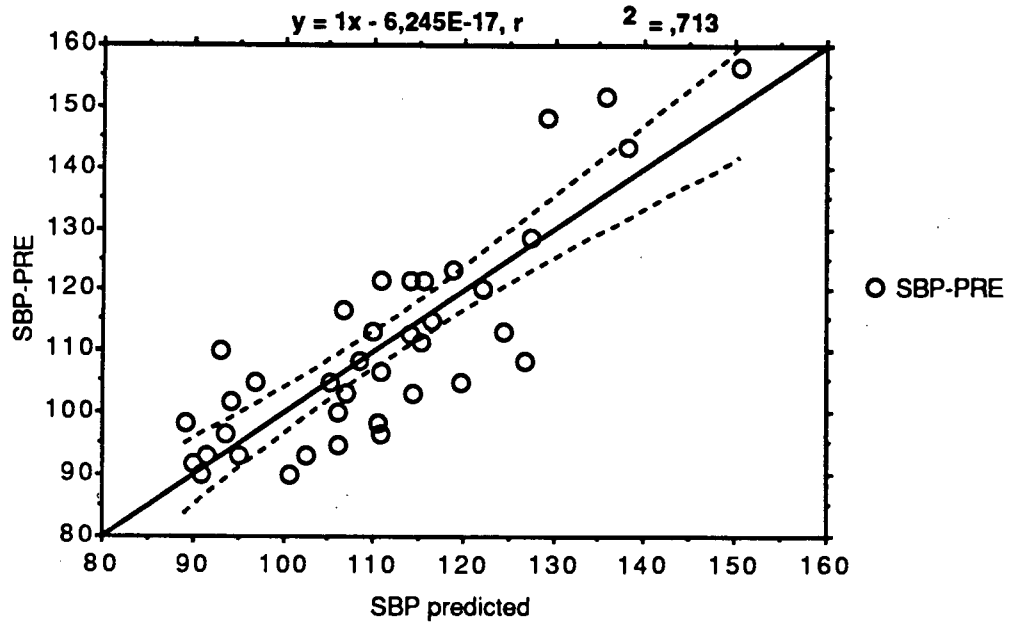


Outlying data points still appeared to lie above the line at the upper end. Adding 95% confidence bands for the true mean of SBP yielded the following chart:

Figure C

SCATTERGRAM OF SBP AGAINST PREDICTED SBP

At pretest - groups 1-6, 95% confidence limits on true mean of SBP

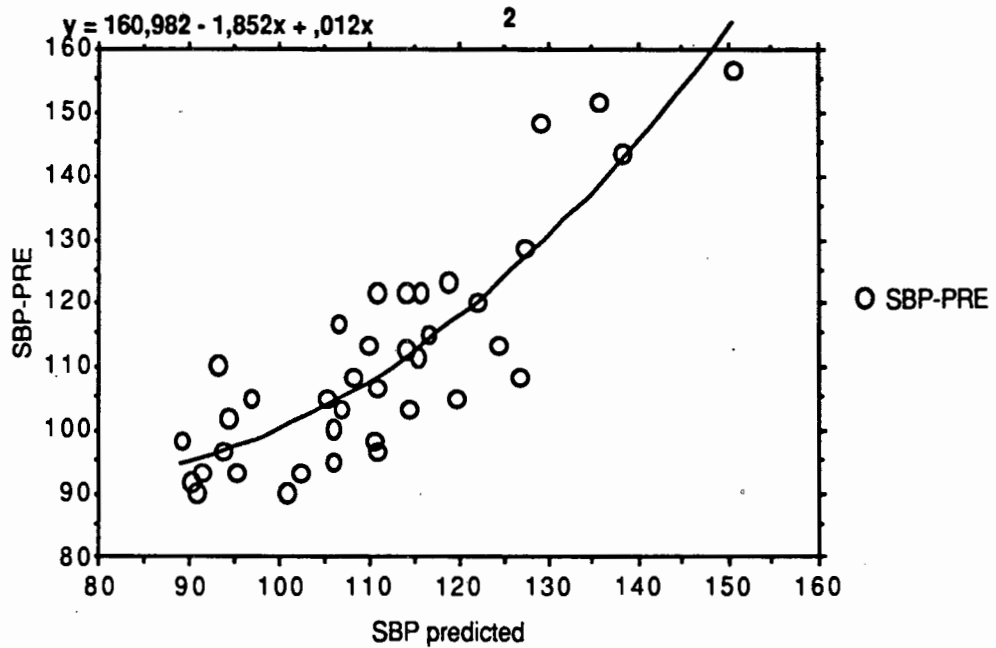


Outlying points still lay above the regression line at the upper end, so a curvilinear regression model was introduced in another attempt to improve the fit. Fitting a second order polynomial regression line yielded the following chart:

Figure D

SCATTERGRAM OF SBP AGAINST PREDICTED SBP

At pretest - groups 1-6, 2nd order polynomial regression line fitted

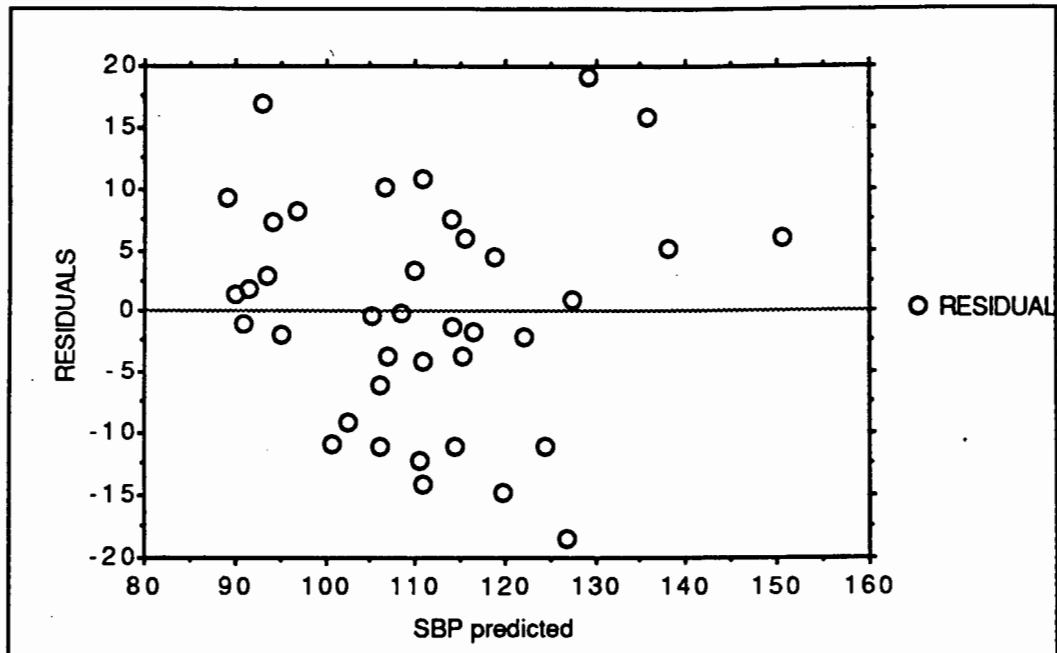


This regression line appeared to fit the plot slightly better than the straight line. However, considering the similarity between the last two charts, for the purposes of the present study it seemed unimportant to decide one way or the other what regression line fitted best.

Then, as a final test of whether the assumptions of a general linear model were met, residuals were plotted against fitted values of SBP:

Figure E
SCATTERGRAM OF RESIDUALS AGAINST PREDICTED SBP

At pretest - groups 1-6



The plot showed a band of constant width, largely independent of predicted SBP, the fitted value. It was noticed however that residuals at either end had a tendency to be larger and positive. According to Abacus Concepts (1989: 188) a band of constant width indicates that the assumptions were met viz. that the dependent variable (SBP) is composed of a linear portion and a portion due to random variability. It is a critical assumption that this random portion has a normal distribution, with the contribution of each observation being independent of each other observation.

Having thoroughly scrutinised the data, a multiple regression analysis was then performed to assess the significance of the

correlations between physiological parameters as set out in the table earlier.

Table F
MULTIPLE REGRESSION ANALYSIS

Physiological Parameters - Groups 1-6 at Pretest- (StatView Student)

Multiple Regression Y: SBP-PRE 3 X variables				
Count:	R:	R-squared:	Adj. R-squared:	RMS Resid:
38	,844	,713	,687	9,54

Analysis of Variance Table				
Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	3	7669,598	2556,533	28,09
RESIDUAL	34	3094,462	91,014	p = ,0001
TOTAL	37	10764,06		

Residual Information Table			
SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
6369,457	18	20	2,058

Note: 21 cases deleted with missing values.

This table shows that 38 sets of observations were used to compute the multiple correlation coefficient R . R^2 , the proportion of the variance of the dependent variable (SBP) predictable from the variables: DBP, HR and BR is seen to be 0,713. According to Kerlinger (1973: 618) this R^2 should be interpreted conservatively if the sample is small (<200). Accordingly a corrected R^2 should be calculated using the formula:

$$R_c^2 = 1 - (1 - R^2) \left(\frac{N-1}{N-n} \right)$$

where R_c^2 is corrected R^2 , N is sample size and n is the total number of variables in the analysis. Using StatView Student (1991) software, the

value of R_c^2 was calculated to be an adj. R-squared of 0,687. An unbiased estimate of the proportion of SBP variance predicted by the other physiological variables is thus 69%. RMS residual is the standard deviation of the residuals i.e. of the errors of prediction. In the ANOVA table the total sum of squares (10764,06) was partitioned into predictable (regression) and unpredictable (residual) sums of squares. The F ratio was then calculated as:

$$F - test = \frac{\text{Regression Mean square}}{\text{Residual Mean Square}}$$

where regression mean square is the variance of the fitted values and residual mean square is the variance of the residuals.

A calculated F value of 28,09 for 3 and 34 degrees of freedom was found to be significant at a probability level of $p < 0,001$. The study concluded that these are significant results because the amount of predictable variance (regression mean squares) is significantly greater than zero.

For interest the beta coefficient table was then calculated as shown below:

Table G
 MULTIPLE REGRESSION BETA COEFFICIENTS
 Physiological Parameters - Groups 1-6 at Pretest

Beta Coefficient Table				
Variable:	Coefficient:	Std. Err.:	t-Value:	Probability:
INTERCEPT	-2,497			
DBP A-PRE	1,265	,154	8,201	,0001
HR A-PRE	-,077	,148	,522	,6053
BR A-PRE	1,066	,752	1,418	,1654

Inserting the values set out in the first column here into the general regression equation mentioned earlier gives the regression equation to predict SBP as

$$\text{SBP predicted} = -2,497 + 1,265 \text{ DBP} - 0,077 \text{ HR} + 1,066 \text{ BR}$$

This analysis was then tested by processing the same data in SuperANOVA (1989): First the ANOVA table was generated. This table shows partial-F values which are the squares of the t-values in the previous table calculated with StatView Student, as shown in Table G.

Table H
 MULTIPLE REGRESSION ANALYSIS

Physiological Parameters - Groups 1-6 at Pretest-calculated with
 SuperANOVA

ANOVA Table - Partial-F values					
Source	df	Sum of Squares	Mean Square	F-Value	P-Value
DBP A-PRE	1	6121,454	6121,454	67,259	,0001
HR A-PRE	1	24,771	24,771	,272	,6053
BR A-PRE	1	182,881	182,881	2,009	,1654
Residual	34	3094,462	91,014		

Dependent: SBP A-PRE

Residual values reflected here are identical to those of Table F except that regression values are here analysed into their component values for DBP, HR and BR. Deepening the analysis in this way using alternative software was both a useful check and gave confidence in the algorithms built into the software.

The balance of the analysis is shown below:

Table I
BALANCE OF MULTIPLE REGRESSION ANALYSIS
Physiological Parameters - Groups 1-6 at Pretest-calculated with
SuperANOVA

Model Summary					
Dependent: SBP A-PRE					
Count	38				
R	,844				
R-Squared	,713				
Adj. R-Squared	,687				
RMS Residual	9,540				
	df	Sum of Squares	Mean Square	F-Value	P-Value
Model	3	7669,598	2556,533	28,090	,0001
Error	34	3094,462	91,014		
Total	37	10764,060			

Model Coefficient Table				
Dependent: SBP A-PRE				
	Beta	Std. Error	t-Test	P-Value
Intercept	-2,497	14,199	-,176	,8615
DBP A-PRE	1,265	,154	8,201	,0001
HR A-PRE	-,077	,148	-,522	,6053
BR A-PRE	1,066	,752	1,418	,1654

Model summary values were seen to be identical to the ANOVA table values of Table F calculated with StatView Student. Model coefficient table values here were seen to be identical to those of the beta coefficient table (Table G) also prepared with StatView Student.

In conclusion, the only statistically significant relationship was found to be between SBP and DBP (Partial $F=62,259$; $DF=1,34$; $p<0,0001$), while that between SBP and BR approached significance.

This was directly in line with the findings presented in chapter IV, which found these correlations were significant at $p < 0,05$ or better in all cases except SBP/HR, and DBP/BR.

However only pretest data for groups 1-6 was used for this preliminary analysis which thus spanned only 37 data series. As described in chapter IV, the analysis was then extended to every case available — i.e. also using second pretest, 2-week posttest, 6 week posttest and 5,5 month posttest including groups 1-7. This gave potentially 350 cases for analysis, but after deletion of rows for missing data 185 remained. A correlation matrix was then calculated to compare with Table 18.

Table 19

CORRELATION MATRIX PHYSIOLOGICAL PARAMETERS

Groups 1-7 - all tests: 350-165=185 cases

	SBP	DBP	HR	BR
SBP	1			
DBP	,811	1		
HR	,109	,126	1	
BR	,139	,071	,601	1

Note: 165 cases deleted with missing values.

Correlation coefficients for the larger analysis were seen to be broadly similar to those displayed in table 18. A multiple regression analysis of the same data yielded the following table:

Table J
MULTIPLE REGRESSION ANALYSIS

Physiological parameters - Groups 1-7 - all tests - 185 cases

ANOVA Table (partial Fs)					
Source	df	Sum of Squares	Mean Square	F-Value	P-Value
DBP	1	26162,451	26162,451	350,706	,0001
HR	1	110,114	110,114	1,476	,2260
BR	1	378,749	378,749	5,077	,0254
Residual	181	13502,501	74,599		

Dependent: SBP

Model Summary
Dependent: SBP

Count 185
R ,816
R-Squared ,667
Adj. R-Squared ,661
RMS Residual 8,637

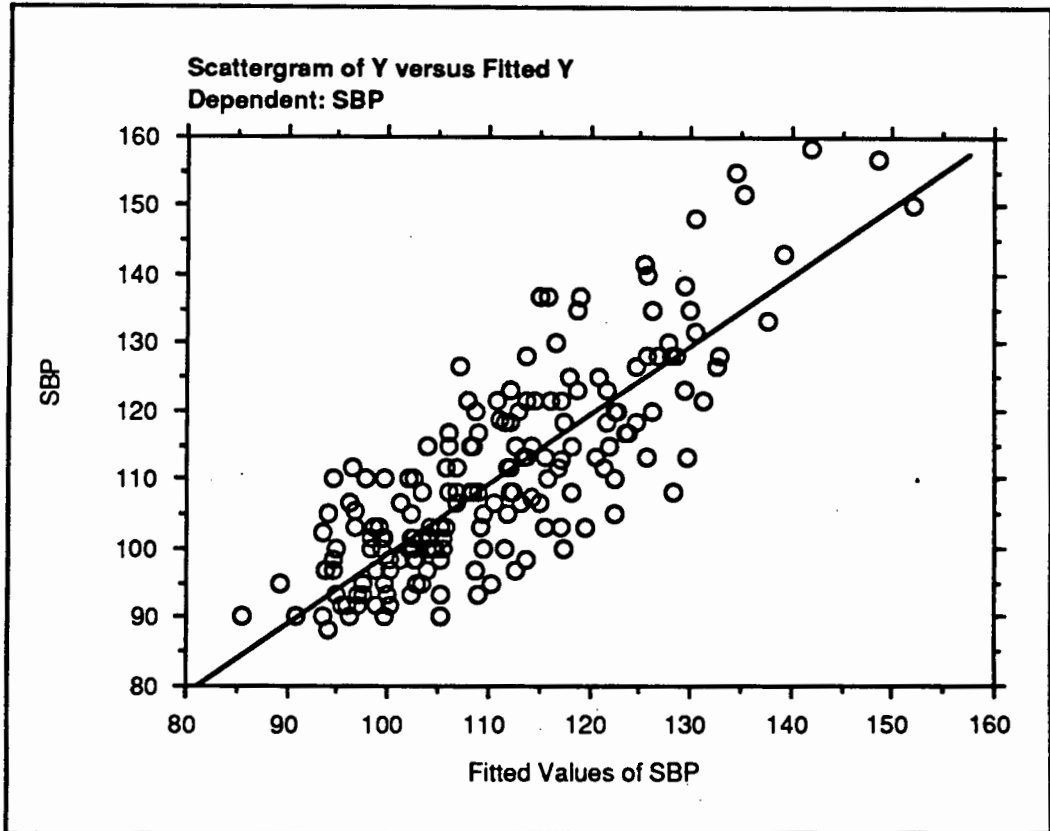
	df	Sum of Squares	Mean Square	F-Value	P-Value
Model	3	26985,295	8995,098	120,579	,0001
Error	181	13502,501	74,599		
Total	184	40487,796			

On examination, the relationship between SBP and BR was now seen to be significant (Partial-F=5,077; DF=1, 181; $p < 0,0254$).

This analysis was now extended further by plotting the same charts as earlier viz. scattergrams of SBP vs predicted or fitted SBP (Y vs Y') and residuals vs fitted SBP (residual vs Y')

Figure K
SCATTERGRAM OF FITTED SBP AGAINST PREDICTED SBP

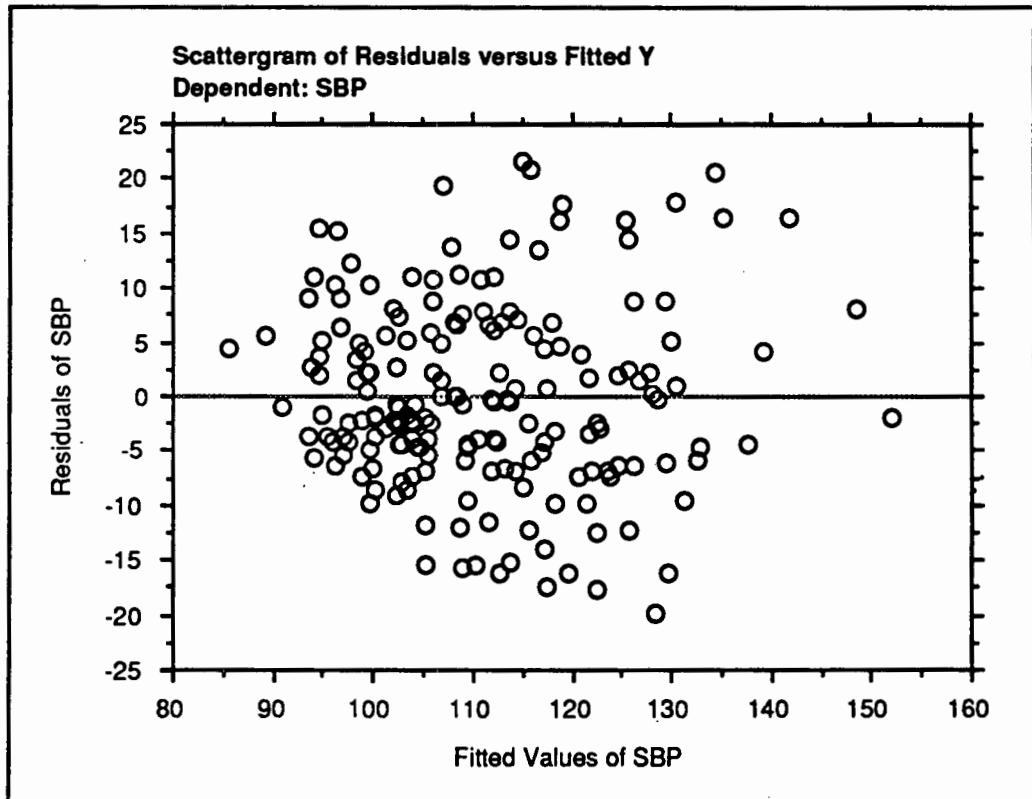
Groups 1-7 - all tests - 185 cases



Consideration of this chart suggested that the assumption of a straight regression line was no longer justified in the light of the increased number of cases spanned by the analysis.

Figure L
SCATTERGRAM OF RESIDUALS AGAINST PREDICTED SBP

Groups 1-7 - all tests - 185 cases



This second chart had a cone shape suggesting that the spread of residuals was wider for the larger fitted values. According to Abacus Concepts (1989: 190):

"This indicates that the variance of the observations increases as the mean (sic) increases, and generally indicates that the dependent variable should be transformed by a logarithmic or square root transformation before regression or ANOVA is carried out."

The dependent variable, SBP was accordingly transformed into its base-10 logarithm, its base-2 logarithm and its square-root and the same charts plotted. The transformation that yielded the best results

was the base-10 log transformation. This yielded the following ANOVA Table and plot:

Table M
MULTIPLE REGRESSION ANALYSIS AND SCATTERGRAM
Of log SBP, DBP, HR and BR - Groups 1-7 - all tests - 185 cases

ANOVA Table Partial-F values

Source	df	Sum of Squares	Mean Square	F-Value	P-Value
DBP	1	,367	,367	344,547	,0001
HR	1	,001	,001	1,350	,2468
BR	1	,006	,006	5,369	,0216
Residual	181	,193	,001		

Dependent: log SBP

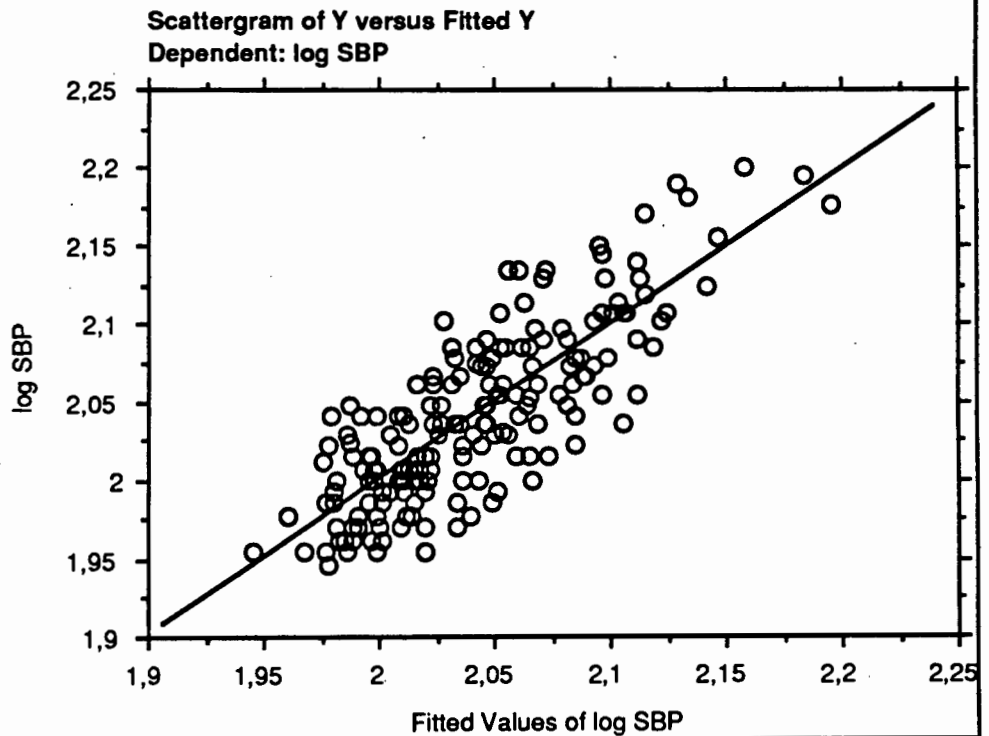
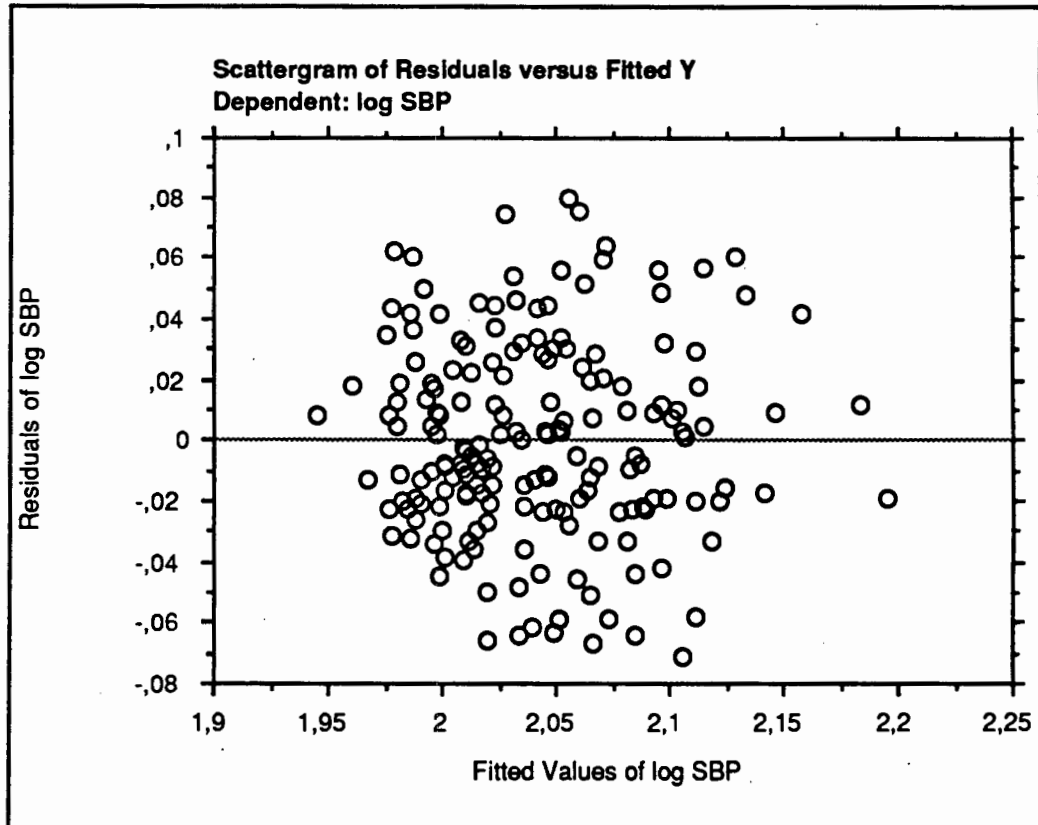


Figure N

PLOTS OF LOG SBP AND RESIDUALS AGAINST FITTED LOG SBP

Groups 1-7 - all tests - 185 cases



These plots indicated the model came closer to meeting the assumptions of linearity. It was accordingly concluded that there is a significant correlation between log SBP and DBP (Partial-F=344,547; DF=1, 181; $p < 0,0001$) and between log SBP and Breath Rate (Partial-F=5,369; DF=1, 181; $p < 0,0216$).

PSYCHOLOGICAL VARIABLES

As before, it was now appropriate to add psychological stress data to the analysis. The logic of the next few steps is set out in chapter IV, embracing tables 20 - 22.

CLIMATE VARIABLES

Before proceeding to a multiple regression analysis, Warmth and Support scores were added and a final correlation matrix calculated for all variables, as set out in chapter IV:

Table 23

CORRELATION MATRIX: PSYCHOLOGICAL, PHYSIOLOGICAL AND CLIMATE PARAMETERS

Groups 1-7 - all tests: SBP>98, 311-256=55 cases

Correlation Matrix for Variables:		X ₁ ... X ₇					
	SCL	SBP	DBP	HR	BR	WARMTH	SUPPORT
SCL	1						
SBP	,004	1					
DBP	,259	,778	1				
HR	,108	,134	,088	1			
BR	,094	,231	,157	,71	1		
WARMTH	-,092	,015	,051	,188	,279	1	
SUPPORT	-,072	,038	,111	,145	,238	,424	1

Note: 256 cases deleted with missing values.

As discussed, adding the climate variables had the effect of reducing the number of cases for analysis because of incomplete data series. This severely restricted the usefulness of this analysis. However it was noted that SCL was positively correlated with all except the climate variables. The climate variables were such that an increase in score represented an improvement, so the negative correlation with the other variables (which *decreased* with improvement) was expected.

The direction of the correlation was therefore supportive of hypothesis three, that psychological, physiological and climate variables would be positively correlated.

Now extending the analysis in chapter IV, a multiple regression analysis was then performed as an alternative way to assess the significance of the correlations shown above:

Figure O

MULTIPLE REGRESSION ANALYSIS-ALL VARIABLES

SCL SBP, DBP, HR, BR, Warmth and Support - Groups 1-7 - all tests:

SBP>98, 311-256=55 cases

ANOVA Table of Partial-F values					
Source	df	Sum of Squares	Mean Square	F-Value	P-Value
SBP	1	13173,396	13173,396	7,461	,0088
DBP	1	20152,912	20152,912	11,414	,0015
HR	1	282,273	282,273	,160	,6910
BR	1	772,669	772,669	,438	,5114
WARMTH	1	1177,171	1177,171	,667	,4182
SUPPORT	1	1198,122	1198,122	,679	,4141
Residual	48	84746,986	1765,562		

Dependent: SCL

Model Summary		Residual Summary	
Dependent: SCL		Dependent: SCL	
Count	55	SS[e(i)-e(i-1)]	196623,903
R	,466	number >= 0	19
R-Squared	,217	number < 0	36
Adj. R-Squared	,119		
RMS Residual	42,019		

	df	Sum of Squares	Mean Square	F-Value	P-Value
Model	6	23454,760	3909,127	2,214	,0577
Error	48	84746,986	1765,562		
Total	54	108201,745			

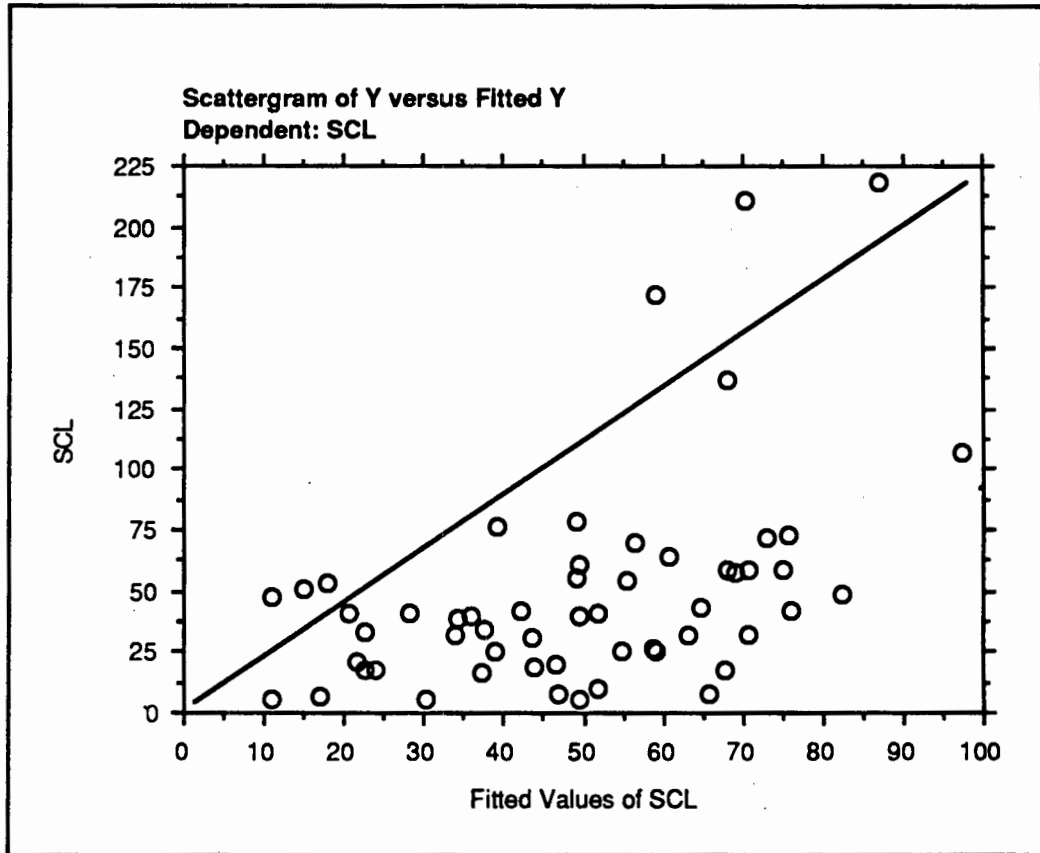
Low p values for SBP and DBP suggested that a null hypothesis of no linear relationship between blood pressure and SCL score could be rejected. However, examination of the model summary was cause for concern. The small values of R, R^2 , adjusted R^2 and the relatively large sizes of RMS residual suggested that overall the independent variables did not do a very good job of explaining variation in SCL score. A further warning that the assumptions of linearity may not hold was sounded by the residual summary, which indicated that there were more negative than positive residuals. This suggested that a linear regression model may not be the most appropriate one for the data.

Accordingly, as with earlier analyses, plots of SCL versus fitted SCL and residuals versus fitted SCL were made:

Figure P

SCATTERGRAM OF SCL AGAINST FITTED SCL

Groups 1-7 - all tests - 185 cases

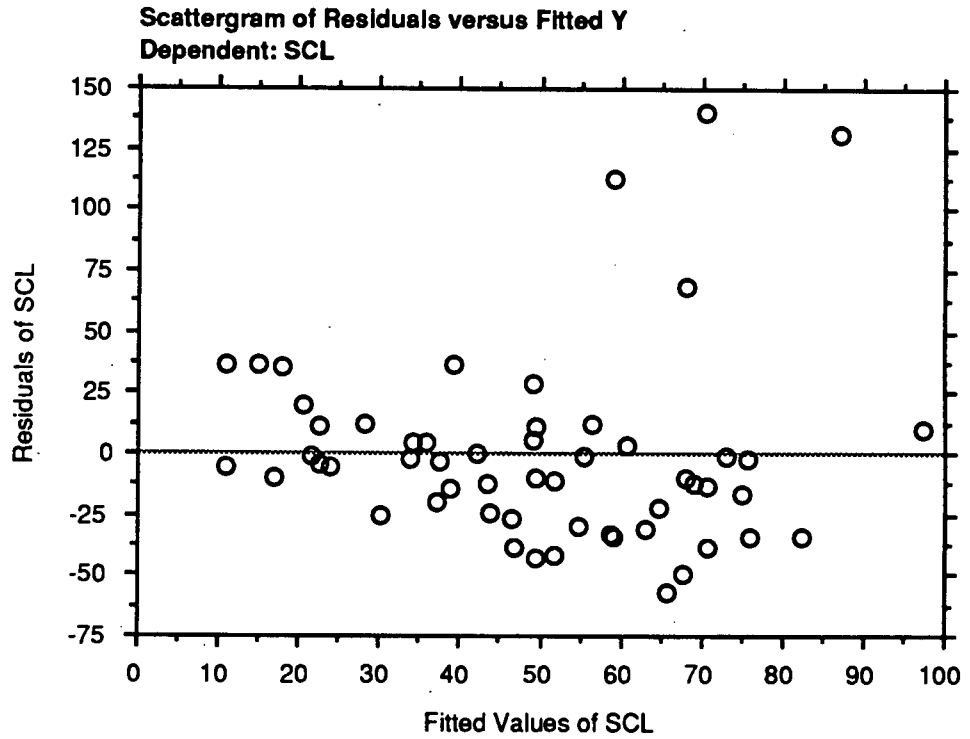


This plot showed a very poor fit between SCL and SCL values predicted by the linear regression equation. The second plot shown below had the familiar cone shape suggesting that variance of the observations increases as the fitted values increase and that SCL should be transformed before regression (as was the case earlier with SBP)

Figure Q

SCATTERGRAM OF RESIDUALS AGAINST FITTED SCL

Groups 1-7 - all tests - 185 cases



The analysis was then repeated after transforming SCL to log SCL, and then repeated again using both log SCL (as the dependent variable) and log SBP (as one of the regressors) with the following results.

Table R
 MULTIPLE REGRESSION ANALYSIS - TRANSFORMED
 VARIABLES

Log SBP, DBP, HR, BR, Warmth and Support on log SCL - Groups 1-7 -
 all tests: SBP>98, 311-256=55 cases

ANOVA Table Partial-F values					
Source	df	Sum of Squares	Mean Square	F-Value	P-Value
log SBP	1	,747	,747	6,208	,0162
DBP	1	1,133	1,133	9,417	,0035
HR	1	,057	,057	,473	,4950
BR	1	,143	,143	1,190	,2808
WARMTH	1	,125	,125	1,039	,3132
SUPPORT	1	,242	,242	2,009	,1628
Residual	48	5,773	,120		

Dependent: log SCL

Model Summary		Residual Summary	
Dependent: log SCL		Dependent: log SCL	
Count	55	SS[e(i)-e(i-1)]	12,037
R	,490	number >= 0	30
R-Squared	,240	number < 0	25
Adj. R-Squared	,145		
RMS Residual	,347		

	df	Sum of Squares	Mean Square	F-Value	P-Value
Model	6	1,820	,303	2,522	,0334
Error	48	5,773	,120		
Total	54	7,594			

Overall model significance was seen to have improved to the point where the null hypothesis (that there was no linear relationship between log SCL and the independent variables) could be rejected (F=2,522; DF=6, 48; p<0,0334).

This model was repeated once more using log DBP instead of DBP. Overall fit worsened slightly, so the above model was accepted as the best linear regression model. A final check was then made as before on assumptions of linearity, by making the following residual plots:

Figure S

SCATTERGRAM OF FITTED LOG SCL VS LOG SCL

Groups 1-7 - all tests - 55 cases - Log SCL against fitted log SCL. 95% confidence bands added for slope of regression line and for true mean of log SCL. Bottom: Residuals against fitted log SCL.

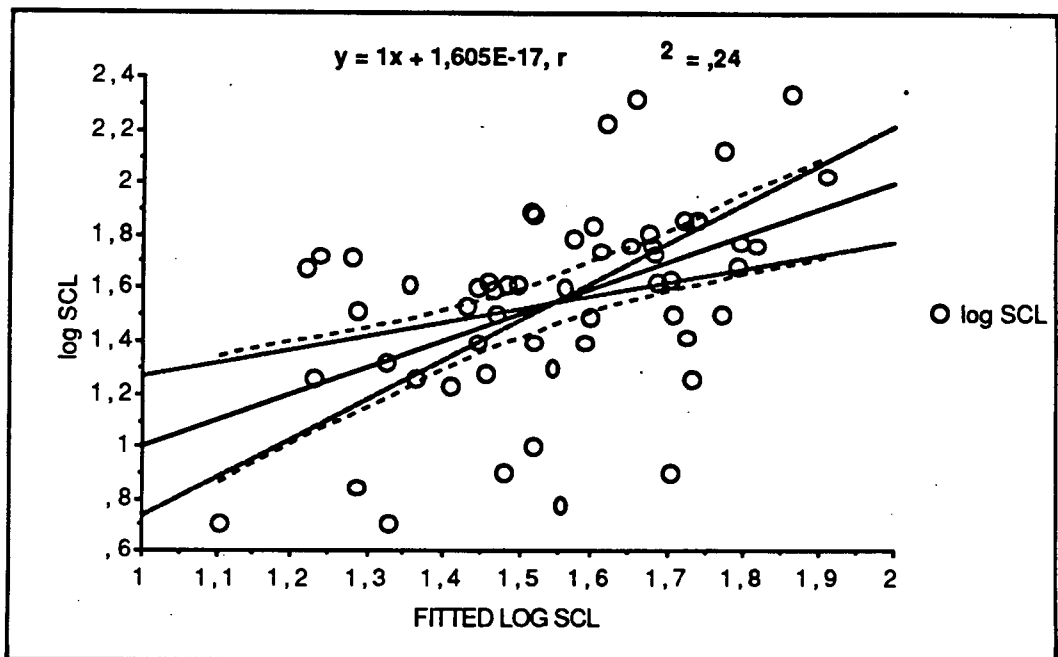
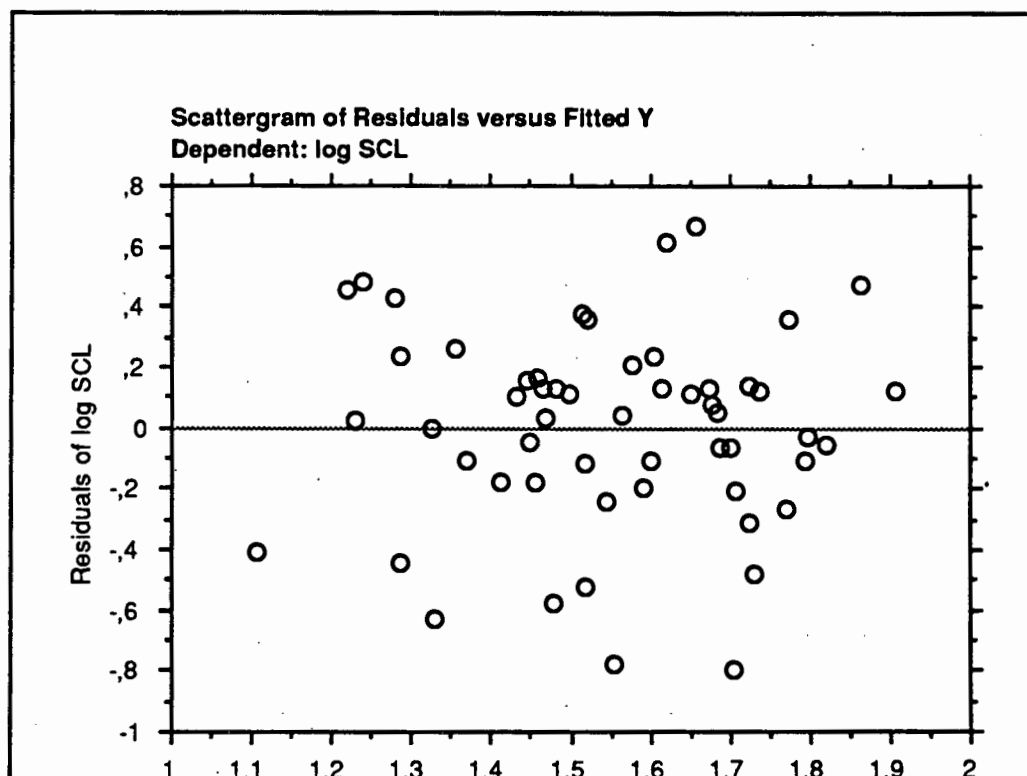


Figure T
SCATTERGRAM OF RESIDUALS

Groups 1-7 - all tests - 55 cases - Residuals against fitted log SCL.



Visual inspection of these plots suggested that this model satisfied the assumptions for linearity discussed earlier. Accordingly it was concluded that this multiple regression model accounted for a statistically significant proportion of the variance of the dependent variable, log SCL ($F=2,522$; $DF=6, 48$; $p<0,0334$).

Further, examining the ANOVA table of partial-F values, it was concluded that the addition of DBP and log SBP each contributed significantly to the predictable variance. That is, given the other variables in the regression model, their inclusion was statistically

significant (DBP partial-F=9,417; DF=1, 48; $p<0,0035$ and log SBP partial-F=6,208; DF=1, 48; $p<0,0162$).

No other variables were found to be significant, but the climate variable Support approached significance (partial-F=2,009; DF=1, 48; $p<0,1628$).