RELATIONSHIPS OF PSYCHOSOMATIC STATES TO EMOTIONAL DISTURBANCE AND DIFFUSE AUTONOMIC ACTIVITY

Thesis for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY

Richard J. Bonier

1961

This is to certify that the

thesis entitled

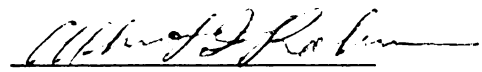
Relationships of Psychosomatic States to Emotional Disturbance and Diffuse Autonomic Activity

presented by

Richard J. Bonier

has been accepted towards fulfillment of the requirements for

Ph.D. degree in Psychology



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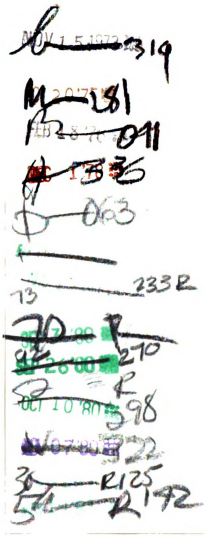

ABSTRACT

RELATIONSHIPS OF PSYCHOSOMATIC STATES TO EMOTIONAL DISTURBANCE AND DIFFUSE AUTONOMIC ACTIVITY

by Richard J. Bonier

The two major objectives in the present investigation were: (a) to test for the presence of a relationship between emotional disturbance and psychosomatic illness, and (b) to assess the presence or absence of a relationship between psychosomatic disturbance and diffuse autonomic activation, with emotional disturbance held constant.

The experiment was divided into two broad phases, the "emotional disturbance" and the "autonomic involvement" phase. The latter segment was again subdivided into autonomic activity during resting and stress phases. In the "emotional disturbance" assessment phase 567 Ss were administered the Maudsley Personality Inventory Neuroticism Scale (MPI N-Scale) and a specially constructed Psycho Somatic Inventory (PSI). The Ss, 339 male undergraduates and 228 female students at Michigan State University, were then classified into three groups on the basis of PSI responses; high, intermediate, and low psychosomatization. Sequence of administration of the MPI and PSI was varied among student subsamples for the assessment of possible order effects. The high and low psychosomatization groups, both sexes, were then compared with respect to N-score. As hypothesized, high psychosomatization groups of both sexes achieved significantly greater mean N-scores than the low psychosomatization samples. An order effect with respect to administration of the MPI and PSI was also noted in the female sample, though it failed to obscure the above-noted group differences. No order effect was observed in the male sample.

From the general male samples of 98 Ss high and 118 Ss low in psychosomatization, three smaller samples were drawn for the purpose of testing the hypotheses related to autonomic involvement, a high-psychosomatization, high neuroticism group; a low psychosomatization, low neuroticism group; and a control group, low-psychosomatization-high neuroticism. The size of the samples were 20, 24, and 20, respectively. All subjects were tested on the PGR during a resting phase of ten minutes and a stress phase in which three stressors, auditory, "emotional," and visual, were administered. The stressors consisted of a sudden loud noise, the threat of an embarrassing question to follow, and presentation of a picture judged to have shock value. PGR measures obtained consisted of three "resting phase" indices and four "stress phase" indices. The resting phase measures were: base level, conductance; change in base level conductance from beginning to termination of resting phase, and a measure of the frequency of bursts of PGR resistance-activity during the resting phase. Stress measures consisted of three measures of maximum PGR change in conductance following each stressor, and a measure of change in base level during the stress period.

The hypotheses associated with the second phase related to both rest and stress; support from the findings was contingent upon the high psychosomatization group showing significantly greater tonus or lability upon the seven measures, as compared with the two low-psychosomatization groups. Support further depended upon the absence of any significant difference between the two low psychosomatization groups. Failure of any and all of these circumstances to obtain was considered failure to support the hypotheses, with respect to any given measure. Results on all seven PGR variables revealed a fairly confused picture. None of the over-all comparisons achieved significance as predicted and hence the hypotheses were not supported. Scattered significant differences between groups and

provocative trends alternately suggested an influence upon PGR activity of the variable "emotional disturbance" and also a tendency of the psychosomatic variable toward predicted directions. The psychosomatic (high) group does for the most part show elevation of PGR on the seven variables, but inconsistency of findings with respect to the control group makes any more systematic interpretation of the findings difficult. Results are not conclusively negative enough to assume the absence of some meaningful relationships within the areas of psychosomatic and emotional disturbance.

The apparently high relationship between responses on the MPI and PSI led to a discussion of the nature of the control group, high on MPI and low on PSI factors. These Ss were quite rare, and the possibility was raised that they may differ in additional respects, the additional variables perhaps being related to PGR activity in some other systematic way.

A factor analysis of scores on the MPI and all seven PGR variables, the three groups pooled, yielded three clusters of factor loadings. Neuroticism failed to show any significant correlations with any of the PGR variables, a finding suggestive of an absence of relationship between emotional disturbance and autonomic innervation, and concordant with other findings reported in the literature. Each of the three factors was labelled: "stress-rest," "resting tonus" and "lability." The last factor manifested the largest loadings among four PGR variables. The nature of the clusterings appeared meaningful with respect to the relationships among the PGR measures. The factor analytic findings appear to emphasize the need for replicational studies concerning the stability of the factors, and should the clusters show reliability, greater forethought in selection of PGR measures for given research problems is necessary, since different measures, all PGR, appear to measure different aspects of associated autonomic states.

Approved _____
Committee Chairman

Date Dec. 11, 1961

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By

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A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Psychology

1961

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ACKNOWLEDGMENTS

The writer wishes to acknowledge most gratefully the assistance of the following people, as well as others who, in a great many different ways, contributed to the progress of the dissertation.

Of the faculty, Professors Paul Bakan, Donald Grummon, and Milton Rokeach served on the dissertation committee during the initial stages. Professors Alfred Dietze and Charles Hanley provided their guidance during the later stages. Professor Albert I. Rabin served as committee chairman through the entire course of thesis development.

I wish especially to thank Professor Rabin for his extensive assistance throughout the thesis work, particularly with respect to the exhaustive evaluation of the work's theoretical basis. I wish also to thank Professor Hanley for his interest and initiative in extending the meaning of the study beyond its original parameters, investigating relationships among the various measures, and investing his own efforts in these pursuits. I am grateful to Dr. Joseph Reyher for his continued interest in the research, and for his frequent and helpful suggestions concerning application and statistical evaluation of the PGR material. Dr. Robert Ringer of the Poultry Department was most generous in his loan of the Grass Polygraph and research quarters.

Of my colleagues, I particularly wish to express my gratitude to James Clark, of the Computer Lab, for his assistance in interpreting the data of this study to MISTIC, and to James N. Allen, who gave most generously of his time in the laborious statistical evaluation of the data. My thanks also to Miss Martha Andrews, who suffered most amicably through the typing of more than one revision.

Finally, I am deeply indebted to my friends for their unselfish support and encouragement, a largesse which contributed immeasurably to the progress and conclusion of the dissertation.

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CHAPTER I

INTRODUCTION

PROSPECTUS

The organization of the following pages is oriented around two basic, related, issues: (1) the emotional etiology of "psychosomatic" disturbance is questioned, and (2) inquiry is directed toward the generality of autonomic involvement associated with manifestations of a psychosomatic disturbance.

DEFINITION

White (1948) offers a definition of psychosomatic disturbance which is generally accepted. The term psychosomatic is defined as "disturbances in which emotional maladjustment leads to chronic disfunction in some organ system," and further limits its use to "Those disorders in which chronic maladjustment is the primary process and somatic disfunction is the result or byproduct." Implicit in this qualification is the assumption that intrinsic to all somatic disorders is an emotional component, though in many instances the emotional component may be secondary to the organic disfunction, i.e., an emotional response to a physical disorder. White suggests the term "somatopsychic" for the latter class.

One further limitation is introduced for the purpose of effecting a distinction between hysteria and psychosomatic disturbance. White reserves the latter term for "those cases in which the somatic disfunction is in organs controlled by the autonomic nervous system" (1948). This qualification is also stressed by Alexander and French (1948); "the bodily symptoms of hysteria; the sensory and motor symptoms such

as paralysis and anesthesia--occur in organs innervated by the cerebrospinal portion of the nervous system." Alexander is especially concerned with establishing this distinction; whereas conversion symptoms are in part characterized by their symbolic value and psychological utilization as partial discharge of impulse no symbolic meaning relevant to the emotional conflict is assumed in the case of psychosomatic symptoms (Alexander 1948). They are not presumed to represent symbolically the impulses pressing for expression. Whereas the paralyzed arm of the hysteric may represent a conflict associated with the desire for, and sanctions against, physically aggressing against some object, the peptic ulcers of a patient, for example, are presumably devoid of symbolic content. It is assumed that the autonomic nervous system functions sufficiently beyond voluntary control to preclude the possibility of unconsciously motivated establishment of symptoms symbolizing the underlying conflict. Whte's definition is generally consonant with definitions held by most authorities. In summary, it restricts the use of the term "psychosomatic disturbance" to disturbances in which chronic emotional maladjustment, as the primary process, leads to a byproduct of chronic disfunction in some autonomic organ system.

For the purposes of the present paper, the terms psychosomatic illness or disturbance, and organ neurosis, are used interchangeably.

HISTORY

Associations between emotional and physiological states.

Although philosophically the nature of the mind-body relationship has been an issue extending far back in history (represented, for example, in the classic Greek, Egyptian, and Hebraic cultures) there has been a relative paucity of empirical findings upon which to theorize until recent times. In a less rigorous sense, a mind-body interaction has been

acknowledged frequently in the therapeutic practices of most cultures, and has been reflected as well in their informal lore. White (1948) observes the colloquial terms ("white with rage," "sick with fear," etc.

Pavlov's (1928) work with the conditioning of autonomic response to previously neutral stimulus situations provided the first and perhaps most influential series of data upon which subsequent progress in this field has been based. The assumption that autonomic function may selectively respond to stimuli other than the internal homeostatic mechanisms is especially critical to Alexander's theory of psychosomatic specificity, and in terms of chronicity of organ malfunction, an integral part of most contemporary theories.

In 1932 W. B. Cannon extended Pavlov's findings more directly into the area of psychosomatic disorder when investigating the influences of emotional stimuli upon the visceral activity of animals and Harvard students. (Cannon, 1932) Various emotional states were found to be associated with specifiable autonomic processes, viz., the liberation and metabolism of body sugar during and after states of "excitement." Whereas Pavlov had established the possibility of extra-homeostatic mechanisms (conditional stimuli) developing influential associations with autonomic function, Cannon introduced the specific concept of possible conditional stimuli of "emotion."

Flanders Dunbar (1935) compiled what remains the most comprehensive summary of empirical and clinical findings establishing the existence of relationships between physiological function and "feelings" (2251 articles). Consistencies noted in these findings, as well as Dunbar's interpretations derived therefrom, serve as one of the basic matrices from which has stemmed subsequent speculation of characteristic "personality patterns" associated with various disorders. Dunbar herself constructed a considerable variety of such personality patterns supposedly associated with different psychosomatic states,

but most of these failed to obtain much support or verification. Grinker (1953) criticizes this and similar positions for their static approach to personality, the absence of comparison with healthy subjects and other psychosomatic groups, and the frequent similarity of profile summaries, possessing so many overlapping elements as to negate the possibility of empirical investigation. Subsequent approaches to characteristic "personality patterns" have shown more sophistication and continue to influence contemporary thought, particularly in the applied areas.

During this early period of development a somewhat divergent approach manifested itself in Kretschmer's work (1930) relating psychosomatic diseases to body type. Although this approach has failed to meet with widespread acceptance, Sheldon (1940) has further extended its theoretical development with the concept of "somatic destiny" which is in turn associated with his definition of somatotype as a structural state maintaining its identity despite manifest changes in appearances.

DISCUSSION

The researches of Pavlov, Cannon, et al, conclusively established the following: (1) autonomic function may be influenced by, and conditioned to, stimulus situations formerly unrelated to its activation. (2) Such stimulus situations may include emotional states and stimuli associated with emotional states.

These findings place on sound empirical basis the theoretical positions which fundamentally assume the influence of transitory emotion upon physiological changes. Less empirically investigated has been the equally important issue, the nature of chronic homeostatic imbalance. Currently generally accepted but with minimal objective support is the assumption that a chronic state of emotional arousal will continuously elicit corresponding autonomic activity. Such a parallel chronic process is considered essential to the development of irreversible tissue changes,

the hallmark of fully-developed psychosomatic disease. Despite these qualifications the hypotheses that (a) a chronic emotional state may obtain (b) which chronically influences autonomic activity (c) which results in tissue change and the development of physiological disorder, are of a low level of inference. Little extrapolation from controlled observations is necessary, therefore, to conclude that a chronic emotional disturbance may precipitate a disorder physiological-anatomical in nature (though the operation of homeostatic adaptation to a persistent stimulus of this nature demands further investigation).

SUMMARY

In the preceding paragraphs, folklore and more recent empirical studies have been cited which describe the existence of a reciprocal relationship between emotional and physiological states. Evidence is conclusive that states of emotional arousal are temporally associated with physiological conditions of arousal. The work of Pavlov, Cannon and Dunbar has been especially significant in this respect. The work cited related specifically to emotional and physiological states examined contemporaneously in a cross-section of time. The studies to not, therefore, deal with the association of emotional states with pathologically (or chronically) disturbed physiological states, though they have led to theorizing with respect to the influences of chronic emotional disturbance upon physical health. These theories will be examined in the following section.

PSYCHOSOMATIC DEVELOPMENT: CURRENT THEORY

The empirical findings described in the preceding section, viz., that states of emotional arousal may engender autonomic nervous system arousal and excitation of associated organs, have formed the basic and necessary conditions for construction of theories of psychosomatic etiology.

The logical extension of these findings thus related the aforementioned observations of normal function to pathological process in both the emotional and physical spheres. The definition of psychosomatic disturbance now assumes relevance in this context. If a transitory state of emotional arousal may create a similarly transitory state of physiological arousal, then, it is postulated, a chronic state of emotional arousal may create a similarly chronic state of physiological arousal. The gap between normal and pathological process is thus theoretically bridged through the use of empirical findings associated with healthy function. Chronic physiological excitation induced by an emotional condition is thus a state of psychosomatic disturbance. O'Kelly emphasizes these factors: "This is the common dynamic basis of all psychosomatic disorders: That the person is constantly exposed to emotion provoking stimuli in situations where the possibility of escaping or minimizing the stimuli is impossible" (1949). The basic condition of emotional disturbance underlying the somatic disorder is universally acknowledged and inherent in the synonymous term of "organ neurosis." The "neurotic" state of individuals manifesting psychosomatic symptoms is explicitly described by Fenichel (1945), Bastiaans (1952), White (1948) and others.

It is important to clearly identify the assumptions permitting the above theorizing which identifies certain physical illnesses as engendered by and associated with underlying emotional disturbance. The following three assumptions are especially critical:

1. Chronic states of emotional disturbance obtain.
2. Chronic excitation of certain organ systems obtains.
3. Organ systems do not adapt to the related emotional disturbance, but remain chronically excited.

Beyond this point two broad theoretical areas diverge, both of which therefore accept the emotional etiology of psychomatic illness. These areas relate to the "specificity" vs. the "generality" of autonomic involvement in psychosomatic disturbance.

SUMMARY

A logical step has been made which theoretically relates psychosomatic disturbance (rather, illness commonly designated as psychosomatic) to an underlying (causal) state of emotional disturbances. Illnesses categorized as "psychosomatic" are therefore assumed to be generally valid indices of concomitant emotional disturbance. The theoretical transition from statements of temporary influence of emotion upon the autonomic nervous system and its related organs, to statements relating emotional disturbance and physical illness, depend upon three basic assumptions, (1) emotional chronicity may obtain, (2) chronic organ excitation may obtain, and (3) the excited organ systems do not adapt to the related emotional disturbance, but remain chronically excited. None of these three assumptions has yet been empirically validated.

THEORY OF PSYCHOSOMATIC SPECIFICITY

Alexander's theoretical developments (1948) remain among the most clearly articulated in the field. While accepting among his basic postulates that "the relative importance of these two sets of (etiological) factors (organic and emotional) varies from case to case within the same disease entity" (p.v.) and thus specifying the necessity of assuming a constitutional or "x" factor, this qualification is generally disregarded in his theory of psychosomatic specificity.

Despite major points of divergence from some theoretical positions in this area Alexander's theory may be regarded as a basic paradigm, and will for this reason be examined in some detail within this context. The theoretical model may be expressed as follows:

1. "All healthy and sick human functions are psychosomatic.
2. Emotions are always associated with concomitant action patterns within (expressed through) a portion of the autonomic nervous system and its innervated organs.

3. For specific emotions there are appropriate concomitant vegetative patterns.

4. Emotions repressed from overt expression lead to chronic tensions, thus intensifying in degree and prolonging in time the concomitant vegetative innervation.

5. The resulting excessive organ innervation leads to disturbance of function which may lead eventually to morphological changes in the tissues." (Alexander, 1948)

By Alexander's definition psychosomatic disturbances are vegetative responses and anatomical changes associated with chronic states of emotional disturbance. As Saul (1939) expresses the concept, "The nervous system is like a hydrostatic system; when the emotional level of energy is dammed up by voluntary inhibition the discharge occurs through the vegetative nervous system." This particular tenet finds expression in almost all theories of psychosomatic development, i.e., despite wide areas of theoretical divergence most schools assume that necessary conditions for psychosomatic development are:

1. Chronic emotional conflict, associated with

2. At least partial blockage of impulse-based action.

While the existence of condition 1 is generally taken for granted, there is much dissension with respect to empirical relations of condition 2. Alexander, as stated above, posits specific blockage of action patterns and their "specific" autonomic correlates. The following example, that of peptic ulcer development, illustrates both Alexander's position and it Pavlovian antecedents:

A peptic ulcer patient is assumed to be conflicted with respect to the receiving of dependent gratifications. A typical case may be that of an individual possessing strong dependent motivations repressed from awareness and defended against in behavior, e.g., through reaction formation by which a facade of hyper-independence is maintained, the feared nuturant relationships being thus avoided. The repressed affect, ungratified, maintains continual pressure for expression. Since the

earliest dependent relationship was associated with sucking and intake of nutriment the relationship of dependence-sucking/food intake is postulated as persisting in the unconscious. Thus the constant unconscious pressure for expression of dependency-impulses simultaneously, through conditioned associations, activates the associated food-intake mechanisms, viz., gastric hypersecretion. The chronic nature of the affect mobilizes a chronic state of gastric hyperactivity ultimately producing peptic ulceration.

SUMMARY

Theories of psychosomatic specificity assume, as do all psychosomatic theories, that an underlying neurotic condition is associated with the organ malfunction. Specificity hypotheses postulate, however, that different types of emotional conflicts activate different autonomic nervous system pathways and hence are represented by specific organ pathologies. Common examples of this are the assumptions of the underlying problem in control of hostility with essential hypertension, difficulty in the handling of dependency needs with peptic ulcer, etc. Alexander and other specificity theorists thus assume specific personality disturbances associated with the organ affected, though the actual process of malfunction is portrayed in terms of classical conditioning, in contrast to conversion disorders; i.e., the organ system manifestly affected bears a meaningful dynamic relationship to the specific emotional disturbance, the relationship being effected through "involuntary" autonomic pathways rather than through the interference with voluntary function of hysteria.

While not denying the possibility, this school of thought is not concerned with the question of diffuse physiological arousal as an element of all psychosomatic illnesses; the concept is theoretically superfluous. The basic premise is that specific emotional conflicts selectively activate discrete organs or organ systems.

EVALUATION OF SPECIFICITY THEORIES

The specificity hypothesis has suffered heavily at the hands of both research and subsequent theoretical discourse. Characteristic conflicts associated with the various psychosomatic states have not been found for the most part, and in those instances of positive findings, replication studies have often failed to support earlier findings (Klein, 1948; Krasner, 1953; Waxenburg, 1955; Brown, 1958). Research by Geovaccini (1956) and Ritter (1957) further indicates that a psychosomatic state rarely exists in isolation, that manifestation of one state is generally an indication that other "organ neuroses" are present in the same patient. Both Ritter and Geovaccini found this to be characteristically true, and to present a partial explanation of negative results with respect to Alexander's theory, i.e., theories of specificity postulate certain conflict-syndromes as associated with different psychosomatic states. It follows that, on the basis of the specificity hypothesis, the presence of multiple psychosomatic states must be associated with multiple conflict-syndromes. However, specificity theory has operated on a more simplified premise that multiple states do not coexist; psychosomatic research has tended to look for single relationships between a given physiological illness and an emotional conflict. Results have been overwhelmingly negative. On the basis of Ritter and Geovaccini's findings, the fallacy of designs seeking isomorphic relationships is apparent; e.g., a group of "ulcer patients" may fail to show any characteristic emotional conflict pattern. A closer look at this "homogeneous psychosomatic group," however, may reveal a great deal of heterogeneity with respect to possession of additional psychosomatic illnesses. In view of the fact that Alexander himself acknowledges the existence of multiple extra-emotional determinants of psychosomatic illness, even the most sophisticated of research and statistical techniques are unlikely to show specific relationships between disease patterns (e.g., asthma) and emotional syndromes

(e.g., ambivalence toward the mother), should they in actuality exist. Especially in light of the abundance of negative findings, more basic research into the validity of fundamental psychosomatic assumptions appears justified, i.e., that emotional disturbance underlies all psychosomatic pathological states, irrespective of the manifest heterogeneity with respect to organ affected.

Mendelson states that "anxiety, repressed hostility, dependent cravings, inferiority feelings, etc., cut across psychosomatic lines." (1956) Mendelson quotes Alexander as currently acknowledging that "somatic predisposition may exist, as many patients with the same nuclear conflict fail to manifest psychosomatic disturbance."

Grinker (1953) questions the logical consistency of Alexander's theoretical system; "Although consisting of unconscious character traits uncovered only by psychoanalytic procedures, they are still very close to the profiles of Dunbar. The monotonous formulations of dependency, frustration and aggression, even though juggled into so-called specific dynamic configurations, are unsharp universals."

Offering some support for Alexander, Sandler (1958) notes that thinking of a motoric act involved minute activation of the relevant musculature. Sandler's conclusions that a chronic state of "thinking of a specific motoric act will chronically innervate the certain related muscle systems, leading to tissue disfunction," are not unlike Alexander's specificity hypotheses. The findings, however, are based entirely upon observations of motor musculature, rather than the smooth-muscle activation of psychosomatic disease.

The relationship between psyche and soma is perhaps most clearly stated in Alexander's theoretical description of the dynamics underlying peptic ulcers, in which the chronic thinking (unconscious) of the dependent needs and their associated food and sucking intake also chronically innervate the related gastric muscle systems, leading to gastric hypersecretion

and anatomical changes. Sandler's findings, however, are derived from investigation of the normal process in a temporal cross-section, and generalization to pathological chronic process must acknowledge the qualifications discussed earlier.

SUMMARY OF EVALUATION

Theories of psychosomatic specificity have been evaluated both empirically and theoretically. Their basic assumptions, that chronic emotional disturbance underlies the somatic representations, and that the somatic symptoms bear meaningful dynamic relationships to the emotional disturbance, have as yet not been adequately supported.

The research of Geovaccini and Ritter indicates that individuals with psychosomatic disturbance tend to have more than one type of psychosomatic organ distunction, thus weakening support for specificity hypotheses. Grinker feels that Alexander's characteristic trait patterns tend to overlap, thus negating proper empirical inquiry.

PSYCHOSOMATIC GENERALITY

Theories of generality are for the most part logically more parsimonious than specificity hypotheses. Two related aspects of the generality position are the primary subject matter of this dissertation, i.e., generality of autonomic nervous system involvement and the emotional base of psychosomatic disturbance.

This theoretical position adheres to the three criteria described earlier (chronicity of emotional and physiological arousal) and lack of organ adaptation to chronic excitation) and therefore, is similar to specificity hypotheses in postulating underlying emotional disturbance. However, the "choice" of organ breakdown is considered dynamically irrelevant. Hans Selye (1956) is one of the more articulate exponents of the generality approach. In Selye's terms, chronic emotional disturbance,

as the stress situation, produces general autonomic excitation and involvement. The system is activated into a "General Adaptation Syndrome" (GAS) which, though in ordinary situations has adaptive value, results in chronic organ excitation and organ breakdown as a function of the chronic nature of the stressful stimulation. Cannon's (1932) investigations of "fight-flight" reactions to perceived stressful stimulation are supportive of Selye's position. Cannon portrayed the entire sympathetic and parasympathetic nervous system as being activated during stress situations. The generality hypothesis of psychosomatic disturbance is an extension of Cannon's observations of normal, temporary process to abnormal, chronic process. The schematization of excitation of all organs influenced by the autonomic nervous system during stress is further described by Ford (1937).

Funkenstein (1957) using epinephrine-injection, has also observed diffuse autonomic nervous-system arousal. Following injection of epinephrine in subjects, an increase was noted in palmar conductance, systolic blood pressure, heart rate, cardiac output, forehead temperature, central nervous system stimulation, and blood sugar level, accompanied by a decrease in systolic blood pressure, peripheral resistence, hand temperature, and salivary output. The secretion of epinephrine is from the adrenal medulla, which also simultaneously secretes norephinephrine, a substance which in many respects activates opposing processes.

On the basis of response to the mecholyl test it was found that individuals differed with respect to characteristic epinephrine-norepinephrine balance. Funkenstein then found that, separating subject groups into "epinephrinelike" and "nonepinephrine like" with respect to measured secretion, the former group manifested more behavioral anxiety responses, and the latter more "anger-out" responses, when placed in stress situations, e.g., the cold pressor test. Martin (1961) questions the nature of the group differences, noting that different emotional responses

to the same stressor may generate different adrenal secretion, rather than vice versa. Schachter (1957) in a partial replication, found results similar to those of Funkenstein, though no control related to Martin's criticism was employed. Regardless of the direction of origin, however, both studies support the position of generalized activation during stress.

As with specificity hypotheses, the generality position must address itself to the issue of why one organ manifests observable psychosomatic disturbance and others do not. The principle of multiple determination is employed, with no systematic attempt to assign relative weights to various determinants. Future research may investigate this issue, but presently it is felt that insufficient evidence is available to warrant theorizing in this area. Some of the various determinants postulated are somatic compliance, constitution, weakening through previous illness, etc. In essence, although the entire autonomically-excited organ system may be in a state of arousal, the onset of psychosomatic disturbance of a certain organ is seen as evidence of a reduced capacity of that organ to maintain chronic excitation.

Grinker (1953) focuses primarily upon emotional experiences in childhood which may tend to impair proper development of somatic functions in their process of development concomitant with psychosexual growth. In this sense specific psychological meaning for the various psychosomatic disorders are avoided, stress being placed primarily upon the experience of anxiety at a later point, involving reactivation of childhood conflict as well as its associated states of somatic development, or function. Grinker's approach is essentially one of searching for principles of function unifying the diverse psychosomatic disorders. The specific disorder manifest by an individual is considered secondary, especially in terms of a relative dearth of current empirical material justifying more specific theorizing.

Some empirical studies supporting a nonspecific approach have been cited, especially Ritter (1957) and Geovaccini (1956). Ritter concluded that emotional stress may call forth generalized autonomic activation, the development of observable psychosomatic malfunction being thus more a function of organ weakness, constitutional hyper-reactivity of an autonomic subsystem (e.g., circulatory), previous physical traumata, etc.

Ritter's assumptions are similar to those of Grinker in that no particular dynamic picture is posited as explanation for the manifestation of a given somatic syndrome; the focus is primarily upon the relationship of emotional stress and arousal of the entire autonomic system. Similarly, Grace, Wolf, and Wolff (1951) regard stressful life situations as calling forth emotional responses associated with a "monotonously similar pattern of swelling, hyperemia, hypersecretion, and hypermotility." It is further the conclusion of this group that insufficient data are presently available to speculate with respect to organ choice.

SUMMARY

According to adherents of generality hypothesis, organ choice in psychosomatic illness is of secondary importance. The entire autonomic nervous system and related organs are assumed to experience chronic excitation stimulated by the chronic presence of stress in the individual. All organs, from pupillary response to gastrointestinal motility, are hypothesized to be activated, though not all of these organs manifest observable psychosomatic pathology. The manifestation of psychosomatic pathology in one or more organ systems is attributed to multiple determinants, among which may be such factors as somatic compliance, constitution, previous disease process; all or any of these factors may predispose the particular organ breakdown in the presence of extended hyperfunction. It follows logically, therefore, that on the basis of

generality hypothesis, in the presence of a manifest psychosomatic disturbance all other autonomically-innervated organ systems should also show an increased state of arousal. This proposition has as yet not been empirically investigated.

THEORY

Psychosomatic illness and emotional disturbance

In much of the preceding section, the assumption that psychosomatic disturbance is associated causally with emotional disturbance has been stated with varying degrees of explicitness. According to Fenichel (1945), "It is clear that the attitude or the blocking of discharge and not the symptom itself is the object of analysis." Fenichel speaks of the organ neurotic as a "dammed-up person," in whom expression of some affect is prevented. "All affects are carried out by motor or secretory means." The organ neurotic is blocked motorically but a state of vegetative arousal persists. Although the neurosis may have arisen with respect to a specified emotional conflict, e.g., the handling of aggressive impulses with respect to the father, and in this sense the various organ neuroses may differ, "underneath this diversity, however the neurotic nucleus has a fairly simple pattern . . . The (psychosomatic) patient develops in a world that offers unusual threat to his security" (Fenichel, 1945).

Wolff (1950) states that "the common denominator in psychosomatic illness is the interpretation of an event as threatening. This implies anxiety, conscious or unconscious, and the need to formulate a protective reaction pattern." Alexander's (1948) concept of "vegetative retreat" is of the same nature, characterizing psychosomatically disturbed individuals as "patients who, rather than actively face stress situations, withdraw into the behavior and bodily function of childhood." In the original definition of "psychosomatic disturbance" and in most of the subsequent material, psychosomatic states have been regarded as observable physiological

manifestations of underlying emotional disturbance and neurotic process. According to the generality hypothesis, the observable organ malfunction has no specific dynamic meaning beyond being a physiological response to continued emotional stress. A causal relationship between the neurotic stress experience and the psychosomatic illness is thus postulated. A great deal of research has been executed which investigates the nature of the relationship between emotional disturbance and psychosomatic illness.

Psychosomatic illness and emotional disturbance:

Animal Studies

Some valuable work has recently been done in comparative psychology. Saurey et al. (1956) induced gastric ulcer formation in white rats through creation of approach (hunger)-avoidance (shock) conflict. Insofar as it is possible to extend these findings they would offer some confirmation of the hypotheses discussed in the previous section. The paucity of corresponding data warrant replicational studies, as well as direct investigation with respect to human functions. Since most human conflict is closely associated with verbal processes the value of comparative studies is open to question. While the simplicity of environmental manipulation in this research is methodologically advantageous, insofar as it offers support of previously-stated hypotheses it not only avoids the question of multiple determination of symptoms, but also tends to lend spurious support to the hypothetical corollary, i.e., the occurrence of a state of autonomic disturbance (of the group of disorders commonly defined as "psychosomatic") implies a state of underlying emotional disturbance. The fact that emotional stress conditions may generate psychosomatic disturbances (experimentally supported in comparative research) does not necessarily imply its converse, i.e., that the presence of a psychosomatic disturbance indicates underlying emotional disequilibrium.

Lindzey (1960) subjected four different strains of homozygous mice to noxious auditory stimulation for extended periods, and noted both physiological hyper-response (defecation, urination) and development of timidity. Of especial relevance for generality hypotheses is the fact that the four strains differed greatly with respect to the influence upon them of the noxious stimulation, thus suggesting the importance of somatic compliance and other factors, e.g., inheritance. This study is of course subject to the same qualifications as those mentioned concerning Saurey's research.

Hospital studies: emotional disturbance and psychosomatic illness.

While there is no dearth in the research literature of positive findings reporting significant relationships between neurosis (or neuroticism) and psychosomatic pathology, (e.g., MacFarland and Seitz, 1938, Weider, 1948) these findings can in most cases be attributed to spurious factors. That is, although such a relationship should, on the basis of current theory, exist, it is the writer's position that the relationship has yet to be empirically validated. What constitutes the criteria for psychosomatic pathology has been clearly delimited and defined (Fenichel, 1945; Alexander, 1948), and widely accepted within psychology and psychiatry. In research, however, these definitions are only infrequently heeded. Tests of neuroticism generally contain a considerable number of somatization items on the a priori assumption that they legitimately represent one dimension of neurosis. Conversely, tests of psychosomatization are not uncommonly loaded with neuroticism items. High relationships between such measures are thus probably spurious.

MacFarland and Seitz (1938) developed a Psycho-Somatic Inventory divided into "physiological" and "psychological" categories. He reported that both sections of the scale significantly discriminated in the expected direction between neurotic clinic outpatients and "normals" (college

undergraduates) (N=82 and 82), and further that both sections of the test correlated significantly with each other (r = .75, .60, .71, .51, for normal and neurotic males and females, respectively). The difference in somatization scores between the normal and neurotic groups may in large part be a function of age. Greater range in age was manifest in the neurotic population, as well as a significantly greater mean age. Furthermore, many of the "physiological" items violate generally accepted criteria and seem highly contaminated with "neuroticism" items, e.g., "feel nervously broken down," "feel well and happy," "excited or nervous," "physically depressed or miserable," and "fidgety and restless." A marked relationship between "psychosomatization" as measured here, and neurosis, could hardly fail to be shown, with items worded in this manner and more seriously, unrelated to physiological functions generally accepted as representing psychosomatic pathology.

Krasner compared patients with duodenal ulcer, patients with ulcerative colitis, and "normals" with respect to IQ and responses to the Guilford-Martin Personality Factor Inventory. Ulcerative colitis patients had significantly higher IQ values than the other two groups, and the two "psychosomatic groups" responded similarly on the Inventory, while differing significantly from the normal groups. Unfortunately the findings were not interpreted on the basis of relevant theory. Replication, with larger sized samples would appear essential.

Klaber (1960) investigated differences in overt and covert expression of hostility in neurodermatitis. Some specificity theorists posit repressed hostility underlying the development of neurodermatitis. Twenty neurodermatitis patients and a control group of twenty patients with nonpsychogenic skin disorder were given the TAT (index of covert hostility) and a "Manifest Scale of Hostility." As predicted, neurodermatitis patients showed greater frequency of covertly hostile responses and less overt hostility responses than the control group. Results indicate the presence

of emotional etiology to this psychosomatic illness, and further support specificity theory. Method of diagnosis of neurodermatitis introduces a major qualification, though: the diagnosis depends in large part upon the physician's perception of the psychological state, as well as the absence of manifest physiological cause of the disease.

Hambling (1951) found that a drop of blood pressure followed verbalization of hostility in patients with essential hypertension. Hambling concluded that "disorder of function is due to the prolonged effect of undischarged affect." Replication of this study with a control group would seem to be necessary. It would seem reasonable that verbalization of hostility in groups of "normals" or "nonpsychosomatic circulatory illness" patients may also result in a drop of blood pressure.

In an exploratory study of Blacky responses with a small group of peptic ulcer patients, Blum and Kaufman (1952) observed two classes of reaction to underlying oral-passive needs: (1) the classical suppression of dependency motivation and a counterphobic denial, and (2) overt acceptance of passive needs, accompanied by further demandingness. The samples are admittedly small and lacking in adequate controls, though the findings, while in part concordant with clinical impression and specificity hypothesis, fail to support Alexander in that more than one dynamic pattern was observed to be associated with peptic ulceration. Alexander limited the associated dynamics to one specific syndrome.

Badal (1957) found that peptic ulcer patients who were operated upon for the ulcer generally manifested an aggravation of a "neurotic condition" subsequently. The conclusion was ventured that the psychosomatic symptom somehow served as a defense against emotional decompensation. The study is based upon retrospective reports by staff personnel, and is subject to the usual bias-contaminations. This study also reflects the frequent tendency in psychosomatic research to ignore controls.

Barendregt (1960) compared hospitalized neurotics, patients with psychosomatic disturbance, and "normals" with respect to performance on Eysenck's neuroticism scale and a sociability scale. Research design was predicated upon hypotheses of Bastiaans (1961), a European psychiatrist, which seem to be an elaboration of concepts popularly maintained in this country as well, but lacking articulation within a theoretical framework, i.e., that psychosomatic patients are individuals who maintain a "normal facade" over an internal conflict condition, the somatic symptoms being the only manifestation of emotional pathology. On this basis Barendregt predicted that psychosomatic patients would most resemble neurotic patients on Eysenck's neuroticism scale (as a measure of "inner disturbance") while more closely resembling normals on a sociability scale, Eysenck's Extraversion-Introversion Inventory (as a measure of manifest behavior). These predictions were borne out. A serious drawback in this otherwise provocative research design lies in the manner of the selection of the psychosomatic group. Patients with organic malfunction were chosen for the psychosomatic group on the basis of the ward physician's judgment concerning each particular patient, rather than on the basis of the illness-syndrome. A possible confounding therefore exists, by which Barendregt may more likely have been examining a group of patients with physical illness judged by the physician to be also emotionally disturbed.

Klein (1948) in a large-scale study of 100 ulcer patients, found that "the cases were diverse (with respect to personality functioning) and no specific relationship to gastrointestinal complaints could be discovered." Conclusions were based upon evaluation of psychiatrists' diagnoses of patients' dynamics. These findings are rather surprising in view of the contamination which so often exists with respect to psychiastrist judgment; the association between repressed dependency needs and peptic ulcers has long since become a part of psychiatric lore,

yet despite this probable confounding of the diagnoses, no relationships were found; in a sense, then, the study was "stacked" in favor of positive findings. In the presence of ambiguity a psychiatrist or any rater is most likely to decide an issue with reference to established attitudes. Despite this fact, no particular "ulcer personality" was noted.

Waxenburg (1955) reported extensive psychological test findings on two psychosomatic "experimental groups"; 20 asthmatic, and 20 ulcerative colitis, hospitalized women. A control group of 20 women with malignant tumor were also tested. These patients were screened to eliminate those with multiple disorders, a factor which may render results ungeneralizable to other psychosomatic populations, but which does permit of investigation of psychological variables related to specific psychosomatic entities. The three groups were compared with respect to Rorschach, Bender-Gestalt, Human Figure Drawing (DAP), Word Association, and Thematic Apperception Test (TAT) responses.

Evaluation of all responses yielded, according to Waxenburg, "consistently negative findings"; specific areas in which differences failed to be shown were, "coarctated records, Rorschach movement (M), color responses (EC), inanimate human percepts (H), bony anatomical responses (An), and on the TAT and Word Association Tests, no evidence of differences with respect to passivity and dependency needs, projected strivings and aggressive drives. No indication on the DAP was shown of differences with respect to psychosexual identification. The author concluded that a question appeared legitimate concerning the validity of an emotional base of psychosomatic illness vis-a-vis illnesses considered more physiological in origin. The study was also, of course, an evaluation of specificity hypothesis with respect to differences existing between different types of psychosomatic affliction. The use of a control group renders the findings especially worthy of consideration. Virtually all research in the area of psychosomatic theory is performed with hospitalized subjects, the normal

control groups generally being drawn from hospital personnel or outside sources. This, too, introduces a confounding effect; groups are differentiated not only with respect to presence-absence of psychosomatic symptoms, but also presence or absence of hospitalization. The possibilities exist, therefore, that (1) the experience of hospitalization is influential in the production of dependent-variable behavior, (2) the psychosomatic hospitalized population is not representative (again, in terms of a dependent variable) of a broader, non-hospitalized population to which research conclusions are usually generalized. It seems possible that individuals with "psychosomatic complaints" who present themselves for hospitalization are in some respects qualitatively different from the vast majority of individuals with psychosomatic complaints who remain outside the hospital. In terms of severity of illness alone a difference may be expected, at which point the concept of "somatopsychic" factors assumes major relevance, i.e., the severity of the physical illness produces emotional response.

The present study, testing nonhospitalized populations differing with respect to emotional disturbance and psychosomatic process, is based upon the above considerations.

EVALUATION OF RESEARCH

Longitudinal studies of humans in chronic states of emotional conflict are as yet untried though this design seems essential for acquisition of knowledge concerning response of the autonomic system to chronic states engendering physiological arousal. As mentioned earlier, little or no research has yet been attempted for the assessment of adaptive response of an organ system to continued excitation.

Dekker (1958) portrayed "the usual psychosomatic research approach to date as involving almost exclusively anecdotal material, clinical observation, psychoanalysis, or biographical anamnesis. There appears

to be little controlled, rigorous research." A very common "research design" in this area consists of the clinical impressions and observations of a psychiatrist with respect to the behavior of one patient with psychosomatic symptomatology. Although these studies are valuable in affording insights for subsequent research, they are all too often influential in promulgating the stereotyped psychosomatic "personality profiles" which tend to be adopted with varying degrees of inflexibility in clinic practice.

Brown (1958) extended his critique of research, "when carefully controlled studies were made, varieties of relationships are found to be statistically insignificant, or disconcertingly significant only within the particular context of the experiment." Brown further observes that replications of positive findings are "generally lacking, or if present, discouraging."

SUMMARY

A representative number of studies investigating the association of psychosomatic disturbance and emotional disturbance has been described. While positive findings are not entirely absent, it is the opinion of the writer, and of current surveyors of the research literature (Grinker, 1953; Mendelson, 1956; Brown, 1958; Dekker, 1958) that the existence of such an association has yet to be empirically supported by properly designed studies.

Some broad characteristics of psychosomatic research have been described and evaluated. While the measurement techniques are often generally accepted procedures (Barendregt, 1960), the choice of experimental and control groups frequently render generalizations for the findings impossible. The majority of well-controlled studies report negative findings, rendering questionable the existence of psychological/emotional differences between individuals with psychosomatic illness and those with

nonpsychosomatic, or no, illness. Selection of experimental groups from non-hospitalized populations would appear to circumvent many of these objections. Positive findings in hospitalized groups fail to answer a normative question, i.e., how generalizable are the conclusions to the far larger population of ambulatory individuals with psychosomatic illness(es).

GENERAL SUMMARY

The preceding discourse has represented an attempt at elucidation of certain aspects of the conditions of "psychosomatization" which seem both testable and relevant to current theoretical understanding. These issues may be summarized as follows:

1. Psychosomatic disturbance as an index of emotional disturbance. Research to date has not unequivocally established this group of illnesses as psychologically distinct in any respect from other illnesses, and therefore the higher level of inference that psychosomatic illness represents emotional disturbance, is as yet unsubstantiated.

2. Physiological responses to stress. The conditions of psychosomatic disturbance have been further regarded with respect to the presence of a state of diffuse autonomic lability as characterizing all syndromes, irrespective of the particular organ system manifestly affected.

As stated earlier in this paper, the purpose of the research to be reported is twofold, related to two aspects of current theory of psychosomatic illness. The relationship of emotional disturbance to manifest "psychosomatic" symptomatology is questioned, as well as the relationship of diffuse autonomic activation to manifest symptomatology. Both of these issues may be considered fundamental to "generality" theory, in that both are assumed to exist. Absence of the former condition (relationship between emotional disturbance and psychosomatic illness)

would represent a failure to support both generality and specificity theories. Absence of the latter condition (diffuse ANS involvement associated with manifest symptom) would represent a failure to support the generality position. Positive findings with respect to the latter variable, while not offering disconfirmation of the specificity position, would suggest the need for greater emphasis upon the multiple factors related to the etiology of psychosomatic illness, and thereby still further reduce support for isomorphic parallels between certain disease syndromes and specific emotional conflict-areas.

In the event that emotional disturbance and somatization should be shown to be highly related, the question may then arise as to whether the autonomic lability investigated is primarily a function of the state of chronic anxiety associated with the psychological condition or of the psychosomatic state in terms of generality hypothesis, i.e., somatic compliance, organ weakness in the presence of generalized autonomic activation, etc. In part such a question is logically unsound, since the two variables, anxiety and autonomic innervation, are based upon disparate levels of inference, and not strictly comparable. The concept "anxiety" involves inference from an observable state of autonomic hyperfunction, hence the circularity of such reasoning.

Recent studies and surveys of the research literature place into further question the existence of any relationship between anxiety and autonomic innervation. Sarason, in a comprehensive survey of the literature stated that "several investigators have sought relationships between anxiety and a variety of physiological measures (e.g., GSR). Although work in this area seems only to be getting under way, the results to date have been largely negative" (1960). Sarason entertained three explanations of the generally negative findings: (1) experimental stress situations are not sufficiently like stress situations defined by the clinician. "High and low anxious subjects may differ in physiological response under threat

but not under nonthreat conditions." Yet the extreme stress situations employed by Ax (1953) and Schachter (1957) were also associated with equivocal findings. Malmo and Shagass (1949), using painful thermal stimulation of the forehead as stress found no differences between a group of severe anxiety neurotics and early schizophrenics with respect to percentage change in GSR during stress. (2) individual autonomic patternings may tend to obscure group differences. Lacey (1950, 1953, 1958b) hypothesized on the basis of his findings that stable intra-individual response-stereotypies exist, rendering conventional statistical approaches to group differences useless. Other authorities are at variance, however. Funkenstein (1957) posits stable patterns of diffuse autonomic activation cutting across individual variation, characterizing two polar conditions as "epinephrine-like" and norepinephrine-like." Martin (1961) also assumes a stable pattern of activation cutting across group differences, and notes that even in Lacey's samples, though there may have been individual differences in terms of magnitude of various autonomic responses, all subsystems investigated showed increased activation during stress. Martin concluded that although the existence of intraindividual autonomic response-stereotypy was of theoretical interest, the presence of diffuse activation permitted of research at the group level as well. The response stereotype observed by Lacey seems tenable within the framework of generality theory, as well. (3) absence of a relationship between anxiety and physiological variables. The preponderance of negative results in the presence of a wide variety of methodological approaches lends support to this position. Gunderson, (1953) in a comparison of palmar conductance levels between 110 "early schizophrenics" and 488 aviation cadets, found no differences. A similar large-sample study by Wenger (1948) also yielded generally negative findings with respect to evidence of relationships between anxiety and physiological correlates.

There seems to be sufficient justification in the literature for questioning the association between anxiety and physiological correlates, both theoretically and empirically. The present study in part represents an attempt to examine independently the relationship of anxiety and "psychosomatization" to states of physiological activity.

CHAPTER II

PROBLEM AND HYPOTHESES

Statement of the problem:

The hypotheses and research outlined below have been designed to investigate the presence of a relationship between psychosomatic illness and emotional disturbance, and the relationship between psychosomatic illness and generalized autonomic involvement. The need and justification for both these lines of inquiry have been described above with respect to theory and empirical research. The following study is in part also a normative one, addressed to the following considerations:

1. Relative frequency of occurrence of psychosomatic conditions within a general unhospitalized population.
2. Granted the existence of multiple determinants of psychosomatics conditions, to what degree if at all can an association with emotional disturbance be demonstrated?

Statement of Hypotheses

The specific hypotheses formulated to test for emotional disturbance and autonomic arousal are as follows:

Emotional Disturbance

Hypothesis I. Subjects classified as high in psychosomatic symptomatology will manifest higher scores on the index of emotional disturbance than subjects classified as relatively devoid of psychosomatic symptoms.

Autonomic Activity

Hypothesis II. Subjects high in psychosomatic symptomatology will manifest greater autonomic arousal during a resting phase than subjects relatively devoid of psychosomatic symptoms, irrespective of degree of associated emotional disturbance.

Hypothesis III. Subjects high in psychosomatic symptomatology will manifest greater autonomic arousal during a stress phase than subjects relatively devoid of psychosomatic symptoms, irrespective of degree of associated emotional disturbance.

CHAPTER III

METHOD

A. Subjects

A Psychosomatization Inventory (Appendix A) and Eysenck's Maudsley Personality Inventory (Appendix C) were administered to a general population of 567 Michigan State University undergraduates, 228 women and 339 men enrolled in 24 introductory psychology, humanities, social science, and communication skills classes. Sizes of classes ranged from 10 to 45 students. The numerical breakdown of students in the different classes is as follows: psychology, 58; social science, 242; humanities, 184; communication skills, 83. Ages of males ranged from 17 to 36, with a mean of 21.25 years. Women's ages ranged from 17 to 34, with a mean of 20.01 years.*

For the evaluation of Hypothesis I, the male group was trichotomized into High, Intermediate and Low psychosomatization, with N's of 98, 123 and 118 respectively (for criteria of classification see "Instruments: Modified Psychosomatic Inventory").

From the male population of 339 subjects, three experimental groups (high psychosomatization-high neuroticism, HH; low psychosomatic high neuroticism, LH; low psychosomatic-low neuroticism, LL) of 20, 20, and 24, respectively, were selected for the testing of Hypotheses II and III, plus a "buffer" sample of 4 additional subjects in each of the three groups. Buffer subjects were to be used in the statistical evaluations only if other subjects were replaced for valid reasons,

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*A t-test of the difference in mean age between the male and female groups resulted in a t of 3.54, $p < .01$. This would appear to represent the expected differences in age between males and females within the college setting.

e.g., demonstrable machine-artifacts in the GSR recordings. No such need was shown. Only one student refused cooperation in the initial sample of 567 subjects. One additional student refused cooperation in the second phase of the research, stating that work and study commitments made compliance with research requests impossible.

Women respondents, tested solely with respect to Hypothesis I,* were trichotomized into High, Intermediate and Low psychosomatization with N's of 66, 94, and 68, respectively.

B. Instruments

1. Independent Variable

Psychosomatization Inventory. This self-report inventory (Appendix A) was constructed specifically for the purpose of the study, i.e., for the identification of individuals differing with respect to possession of psychosomatic disturbance. Pilot administrations of the scale with two college undergraduate populations of 65 and 40 indicated sufficient discriminatory power for the acquisition of experimental extreme groups of N = 20, 20, and 24 within a general test population of 200. This stipulation was expecially rigorous; within the male population of 339 subsequently tested it was possible to identify two groups of "extreme-high psychosomatization" and "low psychosomatization" with N = 50 and 50.

Items were selected and modified from the Cornell Index (Weider, 1949) and the MacFarland P-S Inventory (MacFarland and Seitz, 1938); both of these tests are bipartite, including items referring to both vegetative disfunction and "neuroticism." The MacFarland Scale is designed primarily for detection of psychological and/or physiological disfunction in adolescent and adult groups. The Cornell Index is a screening device initially developed for armed forces use.

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*Lacey and Lacey (1958a) report a significant effect of time of menstruation upon measures of autonomic activity. Only larger samples or unfeasible temporal controls could circumvent this possible bias-effect, and hence only male subjects were tested.

Inasmuch as the psychosomatization scale used in this study derives in part from the MacFarland and Cornell scales, information concerning their reliability and validity may be of relevance.

MacFarland P-S Inventory. The MacFarland, as the Cornell, inventory is divided into physiological and psychological sections. MacFarland employed an N. of 82 neurotic patients and 82 normal college students. The two groups were significantly distinct in the expected direction with respect to scores on both subscales. These findings, however, are subject to the qualifications noted earlier in the survey of research literature.

The reliability of the MacFarland inventory was determined both by the split-half and retest methods. Split-half reliability obtained from administration to 100 normal males and corrected for the whole test by the Spearman-Brown prophecy formula was found to be .86 for Part I (physiological) and .80 for part II (psychological). Reliabilities based upon retesting of 52 normal males were: Part I, .73, Part II, .75.

Cornell Index. Skewness of score-distribution on the Cornell Index necessitated use of the Kuder-Richardson technique. Reliability coefficient obtained by the Kuder-Richardson formula for one thousand subjects tested at five induction stations is .95. Items were chosen for inclusion in the Cornell Index on the basis of item analyses and the determination of critical ratios and validity values. All items had critical ratios of 2.5 or above. Three subsections (neurocirculatory psychosomatic symptoms, "other" psychosomatic symptoms, and gastrointestinal psychosomatic symptoms) refer to somatization tendencies, and seven to neuropsychiatric symptoms. Cutoff levels were derived from comparison of scores with medical and psychiatric "accepts" and "rejects." "Method C" of the index scoring techniques rejected 83% of psychiatric rejects and 20% of psychiatric accepts, with respect to presence-absence of psychosomatic symptomatology.

Modified Psychosomatic Inventory. Both of the above scales employ standard numerical scoring techniques. The present inventory is designed solely for the trichotomization of respondents in terms of gross degree of somatization (high, medium, and low). Three response-categories are provided to determine appropriate classification; 45 items relating to presence-absence of various physiological syndromes, corresponding categories for indication of frequency of occurrence of a syndrome, and an open-ended section for inclusion of an estimation concerning chronicity of the state. A fourth section is included for estimation of degree of psychological and/or physiological discomfort, but was found to be a poor discriminator in terms of its relationship with the other three variables.

The forty-five items referring to psychosomatic process are derived from MacFarland and Weider, checked and modified against Dunbar (1935), White (1948) and Alexander (1948) with respect to criteria of inclusion. Specific illness-syndromes were further derived and checked against other sources, e.g., for ulcerative colitis (Grace, et al., 1951), peptic ulcers (Wolff and Wolf, 1943), essential hypertension (Hambling, 1952), gastrointestinal imbalance (Whiting and Child, 1953). The first 31 items concern what may be considered "psychosomatic process," referring to states of autonomic hyperfunction in the gastrointestinal, circulatory, respiratory, dermal, auditory, visual, and other smooth-muscle systems, not at present diagnosed as a symptom of a discrete disease-entity.

Items 32 through 45 relate to discrete disease-syndromes presumed in the aforementioned literature to be psychosomatic in origin. An arbitrary point of two years' chronicity or greater was established for consideration of an item with respect to "high psychosomatization." Item #39 (sinus headache) is not considered a psychosomatic illness, but was included to facilitate a distinction between it and diagnosed migrane and "nervous" headaches.

The subjects were directed to indicate "yes" or "no" on items 32-45 as to whether the illness had been diagnosed by a physician. Responses were considered only if the response "yes" had been given in association with the symptom. A further attempt was made to eliminate false positives by directing respondents to indicate in "Blank A" the diagnosed origin of any illness checked. Clear indication of diagnosed somatic etiology prevented inclusion of the item as "psychosomatic" for that subject. Respondent-cooperation was generally high throughout this questionnaire, and responses were typically thorough.

Classification: Criteria.

High Psychosomatization. Inclusion was determined by the stated presence of any of the symptoms represented by items #1 through 31, with a frequency of occurrence of "Always" or "Often" and with an associated chronicity of not less than two years, and/or presence of any of the thirteen psychosomatic-illness items (#32-45) diagnosed as such by a physician and with a chronicity of greater than two years.

Intermediate Somatization. Inclusion was determined by absence of use of "always" and "often" frequency categories, presence of more than two "At-times" responses, and an absence of diagnosed psychosomatic illness of greater than two years' chronicity.

Low Psychosomatization. Inclusion necessitated less than three "At-times" responses, no "often" or "always" responses, and no diagnosed psychosomatic illness.

Reliability. The 339 males were classified into three groups of high, intermediate and low somatization with N's of 98, 123, and 118, respectively. Fifty questionnaires were drawn at random from the total sample and classified independently by two judges, the writer and an advanced doctoral candidate in clinical psychology. The criteria of

classification were known to both judges. Complete agreement was reached in 84% of the cases; in the remaining 16% all disagreements involved disparities of one classification level, a highly significant degree of concordance.

The 228 women were classified in the high, intermediate and low groups with N's of 66, 94, and 68, respectively--apparently a more leptokurtic distribution than that of the male sample.

Criteria of Inclusion, Experimental Sample: The purpose of the above trichotomies was for a comparison of somatization groups with respect to response on Eysenck's neuroticism scale (Hypothesis I). Three male experimental groups were subsequently drawn from the above high and low somatization groups after applying more stringent critia toward a reduction of the high and low groups of N's of 50 each. The three groups to be selected from the two pools of 50 subjects were identified as "high somatization-high neuroticism" (HH), "low somatization-low neuroticism" (LL), and a control group, "low-somatization-high neuroticism" (LH). A fourth control, "high somatization-low neuroticism" seemed somewhat superfluous, and on the basis of findings reported in a later section, difficult to obtain.

Inclusion in the more limited sample of 50 "high somatization" was weighted more strongly toward responses indicating presence of a discrete, diagnosed psychosomatic disease. Inclusion in the sample of 50 "low somatization" necessitated the absence of "At-times" responses, no diagnosed psychosomatic diseases, and "seldom" responses with frequency less than four and greater than zero. This last criterion was employed as a crude "lie scale" on the priori assumption that a respondent exclusively checking "never" on the frequency section was consciously or unconsciously denying the presence of indeterminately greater frequency with respect to some of the items. Seven subjects responded to the inventory in this manner.

Validity. Except insofar as the present scale may possess a "borrowed" validity based upon the inventories from which items it has been constructed (with the exception of items #32 through 45), no validational work has been attempted. In terms of its relationship to Eysenck's MPI, discussed in a later section, an estimate of its concurrent validity may be made.

2. Dependent Variable

Neuroticism Scale. Eysenck's Maudsley Personality Inventory (MPI) (Appendix C) has been employed for the testing of Hypothesis 3, concerning the relative distribution of emotional-disturbance characteristics with respect to the groups high and low in psychosomatization. The MPI has been widely and successfully used, particularly in western Europe and England, for identification of emotionally disturbed subpopulations, both in research and screening procedures. Recently it has been employed in other studies of psychosomatic phenomena (Bastiaans, 1961; Barendregt, 1961) and shown to be capable of discriminating among different experimental populations.

For the purposes of this study an especially desirable attribute of Eysenck's scale is the absence of overlapping items between the psychosomatization scale and the neuroticism inventory which could artifactually produce positive findings. Unlike almost all other widely used tests of neuroticism, Eysenck includes no items relating to somatization tendencies, e.g., sweating, tremor, diarrhoea. The MPI contains 48 self-reference items to which the subject may respond "Yes," "?," or "No." The scale was standardized in England (Eysenck, 1958) upon a population of 1800 normals, and by Bendig (1959) in the United States upon 1500 normal college students. The mean neuroticism scores for both groups are quite similar, 19.89 and 20.91, respectively.

Comparison with other scales.

Bendig (1960) reports a factor analytic investigation of ten "anxiety" and "neurotism" inventories, including the Taylor MAS, Cattell's Anxiety Scale, Edwards' Social Desirability Scale, Winne Neuroticism Scale, and Eysenck's MPI. One booklet of 230 items was administered to 400 college students. Three factors were extracted, Emotionality (Em), Falsification (F), and Sex (Sx). Separate factors for "anxiety" and "neuroticism" were not demonstrated, and Bendig concluded that the two were operationally identical, naming the common factor "Em." "The MAS and the MPI appear to be the best 'markers' for the Em factor and Cattell's and Winne's neuroticism scales can be eliminated as being too contaminated by extraneous factor variance" (Bendig, 1960). The MAS and MPI were also shown to have minimal factor loadings on Sx and F, the finding suggesting that the MPI and MAS are relatively free of response-set and social-desirability contaminations. Because of the absence of somatization items, the MPI is more adapted to the purposes of this study than Taylor's scale.

Scoring of the MPI N-Scale (neuroticism) is based upon an equal number of "Yes" and "No" self-reference items. Eysenck protected the scale against one form of response-set by alternation of item-scoring criteria; for one-half the items a "yes" response yields a neuroticism score, and for half the items a "no" response contributes to the N-score. Both sets are dispersed throughout the inventory. Maximum and minimum possible scores are 46 and 0.

Reliability. Eysenck (1959) reports split-half and Kuder-Richardson reliability coefficients calculated "on many samples." For the Neuroticism scale these values lie between .85 and .90. Retest reliabilities available on 100 cases (normal) are around .83. Bendig (1959), with three samples of male American college students (N = 77, 100, 48), found Kuder-Richardson (formula 20) reliabilities of .86, .86, and .90 respectively.

With a sample of female college students (N = 45, 58, 33) the K-R 20 reliabilities were .79, .84, and .85. The mean neuroticism score for a sample of 714 college males was 20.19, SD = 10.71; for 350 females, mean score was 21.63, SD = 10.45. These values compare with those obtained in the present study as follows: 339 males, M = 22.29, SD = 10.47; 228 females, M = 23.04, SD = 11.19.

Validity. Eysenck (1959) reports a significantly higher mean neuroticism score for 166 hospitalized neurotics vs. 1800 normals (M = 30.82, 19.89 respectively). Bendig (1959) in the reliability study discussed above, referred to reliability material with respect to performance on the neuroticism scale by six neurotic populations, but unfortunately omits any reference to the mean scores. In a separate report of results obtained involving the concept of construct validity, Eysenck (1957) finds considerable support for the scale.

Reliability:

Position Effects. Since both the Psychosomatization and Neuroticism inventories were administered simultaneously in this study, an attempt was made to assess the influence of position, and indirectly the falsification factor. Of the male group, 208 subjects were given the psychosomatic inventory first, and 131 received the neuroticism scale first. Mean neuroticism score of the first group was 22.23 (S = 10.95) and of the second group, 22.39 (S = 9.71). The mean difference of .16 is associated with an insignificant "t" value of .15 (Table 1); hence it seems safe to assume the absence of an order effect on the MPI within the male population.

Of the female group, 127 subjects received the Psychosomatic scale first, with a mean neuroticism score of 24.38 (S = 11.60); the group of 101 females receiving the neuroticism scale first yielded a mean N-score of 21.35 (S = 10.71); the mean difference of 3.03, with a "t"

value of 1.92, approaches significance at the .05 level (Table 1). It seems therefore probable that an order effect does exist with the female population, though its nature is unclear. The fact that a female respondent is likely to appear somewhat more "neurotic" on the test if the N-scale is administered second may be a function of a residual associated with responding to the Psychosomatic scale, or it may also be related to the fact that when the neuroticism scale is administered second in the test booklet it is "buried" and hence less accessible to the view of the respondent's neighbors. This possible contamination is negligible in terms of the utilization of the female group in this study, however.

Galvanic Skin Response. Palmar-palmar skin resistance was recorded on a Grass recorder, with a constant current of 50 microamps through relatively non-polarizing zinc-zinc sulphate electrodes. The skin resistance is recorded linearly in ohms, and the recording range is automatically reset as skin resistance goes above or below the limits of the kymograph.. Accuracy of the readings is within $\pm$ 10% up to 100,000 ohms.

The GSR would seem to be an especially well-suited approach for the measurement of autonomic lability, both for the high sensitivity of the instrument and the relatively great feasibility of taking series of measurements over an extended period of time. As noted earlier in the introduction, theoretical and empirical evidence supports a position of significant positive covariance of all autonomic subsystems (Cannon, 1932; Ford, 1937; Funkenstein, 1957). Lacey and Lacey (1958a) also noted significant intercorrelations among various measures of autonomic activity (respiratory, circulatory, and PGR), all indices varying in the same direction at a given point in time. On this basis, then, a record of the variations in PGR activity may be regarded as an index of the diffuse variations in over-all autonomic activity, and hence as a means of testing Hypotheses II and III. On an a priori basis, no one subsystem (e.g., PGR)

Table 1. Position Effects: Comparison of mean neuroticism score between groups receiving MPI first and second in a two-test battery with the psychosomatic inventory.

Group	M. MPI First	SD	M. MPI Second	SD	M. Diff.	t*	p
Male	22.39	9.71	22.23	10.95	.16	.15	ns
Female	21.35	10.71	24.38	11.60	3.03	1.92	<.07

*Two tailed t test.

can be assumed to covary in activity with any of the other subsystems of observed pathology (Psychosomatization scale) more highly than others.

Reliability of GSR. Lacey and Lacey (1958a) with an N of 28 report test-retest reliabilities (48-hour interval) of .76 for measurements taken during a state of rest, with a probability of occurrence of less than .001; test-retest reliabilities (48-hour interval) for measurements taken during a "stress situation" are .71, also with a p. of less than .001.

Validity of GSR as an index of over-all autonomic function. The studies of Lacey and Lacey (1958a) and Funkenstein (1957) demonstrating significant covariance of autonomic subsystems were noted above. Woodworth (1939) points out that the sweat glands are innervated by the sympathetic division of the autonomic nervous system. "We remember also that the sympathetic is supposed to act diffusely so that all these effects occur together. So we get the suggestion that PGR is an index of this whole autonomic activity, and probably so delicate an index that it is obtainable even when the sympathetic is only very slightly aroused, i.e., when emergency is itself very slight and far removed from the primitive situations in which the emergency reaction is of practical utility to the organism." (Woodworth, 1939, p. 282) Woodworth cites empirical evidence comparing PGR with other measures of autonomic function (blood pressure, respiration) and concludes that "PGR is probably much more precise as an indicator of the moment of autonomic activity" (1939, p. 284). More recently other investigators (Funkenstein, 1957) have shown the artificiality of a dichotomization between parasympathetic and sympathetic function, since activation of one "system" is closely associated with activation of the other.

C. Procedure

Administration of the two inventories was accomplished during class lecture time and was therefore spread over a period of two weeks,

from July 10 through July 21, 1961. Approximately 45 minutes was needed for administration of both tests. Subjects had been apprised of the testing beforehand by the class instructors, that cooperation was not compulsory, and that the purpose and findings of the research would be communicated to the students by the end of the term. The testing was presented as part of a large scale survey being conducted throughout the college; it was further implied that the project was being carried out in conjunction with other national surveys. Every attempt was made to reassure the students of the anonymity of their responses despite the fact that they were being asked to place their names on one of the inventories. The Psychosomatic Inventory was represented as a normative survey of common day-to-day aspects of physiological functioning; the utility of such a survey was stressed in terms of the relative ignorance extant with respect to national norms in this area. The examiner requested that the respondents' names be placed in an appropriate blank for the purpose of "random selection" of a small percentage of students for further interviewing. Seven respondents failed to comply with this request, these individuals being fairly evenly dispersed among the three somatization-neuroticism categories.

Approximately one week following group administration of the Psychosomatic Inventory and the MPI subjects designated as belonging to the three extreme groups were contacted for cooperation in subsequent individual interviews.

During the weeks of individual GSR testing 14 subjects "forgot" or were otherwise unable to keep the appointment. All of these subjects were again contacted and their cooperation finally gained. Individual testing of the three experimental subgroups was begun July 24 and completed August 11, 1961. Subjects were seen individually for an hour from 8 A.M. to 8 P.M. The three groups were randomly distributed in so far as possible with respect to day of the week and time of day tested. Individual testing was accomplished in an air-conditioned room, temperature maintained at

74° F. $\pm 5^{\circ}$F. Windows were covered and insulation was sufficient to prevent audible outside interference.

Verbalized pre-experimental apprehension appeared to be minimal; most subjects asked initially of the purpose and nature of the procedures, and were informed that following the session any questions would be answered, but that foreknowledge might conceivably bias their responses. An effort was made to put all subjects at their ease by petty conversation during the twenty-minute "hydration phase" before actual testing.

Once in the experimental room the subject was seated in a comfortable chair, his left arm resting at waist height upon an adjacent table. The GSR apparatus was placed to the subject's left, somewhat behind the field of vision, and faced away from the subject. The subject could not see the control board. Lighting was above and behind the subject; lighting was absent in the direct field of vision, darkening that portion of the room and reducing extraneous stimulation. Once seated the subject was connected to the apparatus, and the machine described briefly. A considerable number of subjects asked if it were a "lie detector"; it was acknowledged that this measure was used in some circumstances in association with other measurements as a lie detector, but that was not its purpose here. The subjects were encouraged to relax, and told that after the initial twenty minute hydration period the machine would be turned on to record their "characteristic GSR during a resting state"; no advance indication of a subsequent stress period was given, and during questioning following testing no subjects could recall having anticipated a stress phase.

A number of approaches to GSR measurement were taken with respect to both Hypotheses II and III. All three groups (High Psychosomatic-High Neuroticism, Low Psychosomatic-High Neuroticism, Low Psychosomatic-Low Neuroticism) were exposed to all experimental conditions. For the hypotheses to be supported, autonomic activity in both stress

and resting states must be shown to be more a function of Psychosomatization than Neuroticism; thus the first group (HH) is predicted to show greater GSR activity during rest and stress than the other two groups (LH, LL), these two groups (LH, LL) showing no significant differences with respect to magnitude of the GSR variables. GSR recordings were taken continuously from beginning of the rest period until completion of all stress stimulation.

Hypothesis I. Testing of Hypothesis I was accomplished during the initial group administration of the Psychosomatic Inventory and MPI, involving a comparison of the high and low psychosomatic groups on Eysenck's N-score (N = 98 and 118, males, and 66 and 68, females, respectively). Comparison involving more extreme groups of male subjects (N = 50, 50) was also made for the assessment of Hypothesis I with respect to degree of psychosomatization.

Hypothesis II. Autonomic activity during a state of rest. Following the pre-experimental period of 20 minutes to allow hydration of the skin underlying the skin resistance electrodes (Lacey and Lacey, 1958b) recordings were taken for a period of ten minutes with the subject at rest. Three measurements were subsequently derived from this phase:

(1) Initial base level, palmar conductance (BL). Conductance, or log 1/resistance, has been shown to be normally distributed, while the resistance measure, although more conveniently derived directly from the PGR readings, is highly skewed in distribution (Lacey, 1956). Initial base level reading (BL) was taken precisely at the beginning of the measured ten-minute rest period.

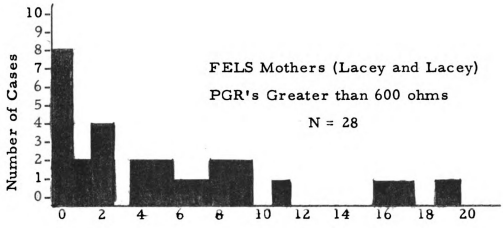
(2) Base level difference (BLD), an index of the degree of change in ohms conductance during the test period, is derived from the difference between initial base level conductances and base level conductance at termination of rest. Both of these measures have been used frequently (Sherman and Jost, 1942; Ax, 1953; Schachter, 1957).

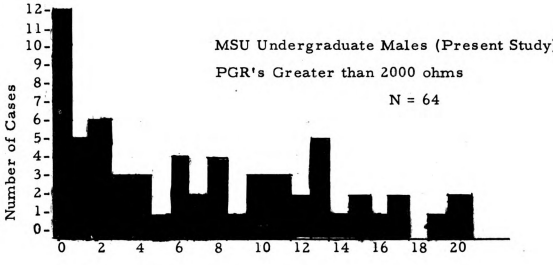
(3) Fluctuation of Resistance Level (FR). This measurement has been used and originated by Lacey and Lacey (1958a), and reported to be uncorrelated with other GSR measures (palmar conductance); the authors report "only a slight and negative correlation between level of tonus (conductance) and bursts at rest (fluctuations of ohms-resistance)." Lacey further reports high reliability of group distributions with respect to this variable (ibid.), i.e., similar distributions of burst-frequency were shown for all groups tested by Lacey. The ten-minute resting phase was divided into twenty half-minute periods; the number of periods in which one or more bursts of resistance greater than 2000 ohms occurred were then counted, yielding a maximum possible score per subject of 20, and a minimum score of zero. Lacey and Lacey (1958) employed a cutoff point of 600 ohms, but to achieve a similar distribution of scores (Fig. 1) with this sample it was necessary to increase the cutoff point to 2000 ohms. This finding is compatible with Lacey's study, at which time a negative correlation of -.15 was observed between age and GSR bursts. The mean age of Lacey's sample was 40.3, with a range of from 27 to 57, as compared with a mean age of 20.87 and range from 17 to 33 in the present study.

Hypothesis III. Autonomic reactivity to stress stimuli. All subjects were exposed to three stress situations, given in the same order for all subjects. A measurement was obtained for maximum stress-response in each situation, as well as an over-all measurement of the change in conductance (SC) from a point immediately prior to the first stimulus to a point immediately prior to the last stimulus. Maximum stress-response for each stimulus (S) was determined by change in conductance level immediately prior to stimulus-presentation, to maximum elevation of conductance following presentation.

(1) auditory stimulus (S1). Two minutes following the completion of the resting phase the stimulus is presented with no advance notion to the

Figure 1. Comparison of results obtained with frequency of PGR bursts during a resting phase: Lacey and Lacey (1958a) and present study.





subject. A four-ounce glass inkwell is dropped from a height of three feet above a stainless steel table, about four feet to the left and behind the subject. A period of at least three minutes then ensues, until the slope of readjustment shown on the kymograph recording falls below a 15^{o} incline. This procedure is observed following each of the three stress stimuli.

(2) emotional stimulus (S2). The examiner states to the subject that, "I realize this next question I'm going to ask you may be quite embarrassing: if you find it too embarrassing, you're under no compulsion to answer." A wait of one minute followed, after which the examiner asked the subject if he had ever been brought before the dean of students. Maximum stress response was measured in the initial one-minute interval.

(3) visual stimulus (S3). The examiner placed a $9\frac{1}{2}$" by 12" picture (Appendix D) judged to have shock effect about two feet before the subject and asked for a title for the picture. The picture was a painting of a wounded marine (LIFE magazine, June 11, 1945) on a Pacific beachhead. The artist, Tom Lea, described the scene: "Mangled shreds of what was once an arm hung straight down as he bent over in his stumbling, shock-crazy walk. Half his face was bashed pulp. The other half bore a horrifying expression of abject patience. Grotesquely his blood-soaked uniform was coated with coral grit. Marines who were about to plunge into battle stared, cursed, saw him collapse in a red puddle on the sand." As with the other stimuli, measurement was made of maximum GSR deflection following presentation. PGR recording was continued until slope of adaptation shown on the kymograph reached 15^{o} or less--for all subjects, maximum PGR occurred within the first minute following stimulus administration.

Summary:

Hypothesis I is tested with the MPI and Psychosomatization Scale, administered to a general sample of 567 subjects. It was predicted that groups high in psychosomatization would show higher mean neuroticism scored than groups low in psychosomatization.

GSR is employed for testing of Hypotheses II and III as follows: Hypothesis II (three separate measures); tested solely during initial ten-minute rest period. It was predicted that the high psychosomatization group would show greater PGR activation than both low somatization groups, irrespective of degree of neuroticism.

(a) magnitude of initial level of conductance (analysis of variance).

(b) magnitude of change from initial to final conductance level (analysis of variance).

(c) frequency of thirty-second intervals in which fluctuations in resistance exceed 2000 ohms. (Kruskal-Wallis H Test and White's T Test).

Hypothesis III (four separate measures); tested during stress period. The same predictions with respect to PGR activation were made as in Hypothesis II.

(a) maximum change of conductance following auditory stress stimulus (t test).

(b) maximum change of conductance following emotional stress stimulus (t test).

(c) maximum change of conductance following visual stress stimulus (t test).

(d) magnitude of change from pre-stimulus 1 to pre-stimulus 3 (t test).

Table 2. Summary of Operational Design.

Phase	Operations
Assessment of emotional disturbance underlying psychosomatic symptomatology	Administration of MPI (N-Scale) and Psychosomatic Inventory 1. Selection of groups high and low in psychosomatization. 2. Comparison of high and low groups with respect to N-Scores.
Assessment of diffuse autonomic activity as a function of psychosomatization tendency	Administration of PGR to three groups, all subjects receiving identical treatment. (HH = high psychosomatic, low neuroticism; LL = low psychosomatic, low neuroticism; LH = low psychosomatic, high neuroticism.
During rest	1. Pre-PGR 20-minute hydration phase. 2. Ten-minute resting phase; base level (BL) and base level-difference measurement (BLD).
During stress	1. Auditory shock-stimulus presented; followed by adaptation period, until PGR kymograph decline reaches 15° or less. 2. Subject threatened with possible embarrassing question. Same adaptation period as in #1. 3. Subject shown upsetting picture. Same adaptation period follows.

CHAPTER IV

RESULTS

HYPOTHESIS I:

Assessment of emotional disturbance related to psychosomatic symptomatology.

It was hypothesized that if emotional disturbance were related to development of psychosomatic illness, it would manifest itself in elevated N-scores among the group judged to be high in psychosomatic symptomatology, as compared with another group of subjects judged to be low in psychosomatic symptomatology. To test for a relationship between the two variables, a number of groups judged high and low in psychocomatization were compared with respect to mean scores on the MPI N-scale. F tests for homogeneity of variance between groups were not significant. The obtained mean differences were tested against an hypothesized mean error difference of zero. Three comparisons of groups with respect to high and low somatization were made. The first comparison was made between all individuals in the initial general classification of "high" and "low" somatization. The second comparison was made between 50 individuals subsequently classified as "extreme high" and 50 "extreme low" with respect to somatization. The pool of 64 subjects to be tested in the second part of the research design were to be drawn from this more restricted sample. The third comparison was made between female subjects classified as "high" and "low" in somatization. A second comparison with the female groups using more restricted samples was not made, since females were not tested in the second phase of the research.

All comparisons were computed with two-tailed t tests of significance. All of the obtained t values proved significant (Table 3). Significance with respect to the first and second comparisons is of course to be expected, the second groups merely representing a subsample from the larger initial population. The additional comparison was made for the purpose of providing more complete data concerning changes in the probability of chance occurrence of the derived mean differences with samples judged to be still higher in psychosomatization. Theoretically an isomorphic relationship is to be expected between degree of somatization and emotional disturbance, and the results reported support this position.

Males:

The initial comparison was made between 98 "high" and 118 "low" psychosomatic males. Both samples represent a combination of two subgroups with respect to order of test administration. Approximately 60% of the male subjects responded first to the Psychosomatic (PS) Inventory and second to the MPI, with the remaining 40% of the subjects being given the MPI first and the PS Inventory second. As stated earlier, no order effects were manifest, and hence N-score data were pooled.

The mean N-scores for "high" and "low" psychosomatization groups of 26.12 and 18.44 respectively, show greater separation when the two more extreme "high" and "low" subgroups (N = 50, 50) are compared. Mean N-score for the "high" group is elevated to 28.00, while N-score for the "low" group is reduced to 14.60. Probability of occurrence of mean differences of these magnitudes is in both cases less than .001, though the considerably higher t value for the extreme group (7.32 vs. 5.45) indicates a smaller actual probability associated with the mean difference.

Table 3. Age Information

Group	N	Mean Age	SD
All Males	339	21.25	3.47
All Females	228	20.01	4.80
High Psychosomatic Males	98	21.69	3.68
Low Psychosomatic Males	118	21.18	3.46
Extreme High Psychosomatic	50	21.74	3.84
Extreme Low Psychosomatic	50	21.40	4.48
High Psychosomatic Females	66	19.68	3.38
Low Psychosomatic Females	68	20.26	5.09

Neither the general nor extreme psychosomatization groups differ significantly with respect to mean age. The general group of 98 "highs" with a mean age of 21.60 differs from the 118 "lows" by .51 years, mean age for the "lows" being 21.18. An F test of the homogeneity of variance between groups is insignificant. The t test of the mean differences yields an insignificant t value (Table 4). Age differences failed to manifest themselves in a comparison of extreme "high" and "lows" as well, and in fact the mean difference, .34, shows a reduction in age disparity. These findings are at variance with the popular belief that psychosomatization is more common within groups of more advanced age, though a more rigorous test of the belief would be a comparison of relative frequencies of psychosomatic symptomatology between two groups selected on the basis of age differences alone. With more samples, trend analysis may indicate differences in the expected direction, however; in both comparisons described above, the "high" psychosomatic groups show slightly higher mean age than the "low" groups.

Females:

On the basis of the very high N-score differences between the male groups, comparisons of female "high" and "low" psychosomatization groups were made for pooled samples, irrespective of order of administration of the two inventories. Despite the fact that the women differed on N-score means between the two groups receiving the tests in different sequence, the most rigorous test of hypothesis I appeared to be a comparison of pooled scores. A significant t in this instance would suggest that the differences are maintained in the expected direction, cutting across the observed order effects. Mean N-score of the 66 subjects judged "high" was 27.21, compared with a mean score of 18.57 for the 68 subjects judged "low" in psychosomatic symptomatology. The mean difference of 8.64 is associated with a t value of 4.43, with a probability of occurrence of less than .001.

Table 4. Mean neuroticism scores: groups high and low in psychosomatic symptomatology.

Group	High Psychosomatic N	Mean	SD	Low Psychosomatic N	Mean	SD	M. Diff.	t*	df	p
Males, initial sample	98	26.12	10.53	118	18.44	9.91	7.68	5.45	214	.001
Males, extreme sample	50	28.00	10.18	50	14.60	7.93	13.40	7.32	98	.001
Females, initial sample	66	27.21	11.42	68	18.57	11.17	8.64	4.43	132	.001

*Two tailed tests.

The hypothesis was supported in all of the above statistical operations. The relationship between the two tests appears to be very high (Discussion Chapter), much higher than anticipated, considering the divergent content of items represented in the two tests. While the hypothesis and its theoretical base are supported, a further question as to the factorial similarity of the two tests seems justified. Data reported in this study are inappropriate for use in providing an answer, since the PS Inventory was prepared for discrimination among extreme groups, yielding broad classes of respondents. A numerical adaptation of the Inventory would be necessary for an investigation of factorial similarity. The necessity for the control group LH (low psychosomatic-high neurotic) in the second phase of the study is emphasized by the above findings.

HYPOTHESIS II:

It was hypothesized that if autonomic activation were to operate with psychosomatization, it would manifest itself in heightened PGR level and PGR activity during a state of rest. Three PGR measures were obtained for each subject during a state of rest: BL (initial base level), BLD (change in base level from initial reading to final level upon termination of the resting phase, and Fr (frequency of PGR fluctuations during rest, of a magnitude greater than 2000 ohms resistance). If the hypothesis was to be supported on any or all of these measures, a significant difference between the high psychosomatization group (HH) and both low psychosomatization groups (LL, LH) would have to be shown, with the HH group manifesting greater PGR level and/or frequency of bursts. Support for the hypothesis further depends upon a lack of difference between the two low psychosomatization groups being shown. Any conditions other than these stated would represent a failure to confirm the hypothesis. More than one approach to PGR measurement seems

justified on the basis of Lacey and Lacey's (1958b) well-documented assertion that these PGR measures are unrelated.

Base Level, Conductance. Although the hypotheses clearly imply directionality, most basically implied are the presences of differences among the three groups with respect to base level of conductance. For this reason a simple analysis of variance was first applied to the data; a significant F would warrant subsequent analysis of intergroup differences with the t test for unmatched independent samples. The scores used in all statistical manipulations were conductance measures, converted from the resistance readings by the logarithm, 1/Rl. Each score was derived from an arbitrary point upon the PGR record at which the ten-minute resting phase was begun.

A preliminary F test of the homogeneity of variances was insignificant. The analysis of variance of the mean differences among groups was .30, also insignificant. As a result, subsequent t tests were not carried out. On the basis of observation of the mean scores for each group, no trend is in evidence. All three means cluster around the value, 15.00, the LL group having the highest mean (Table 5). Insofar as this measure is concerned the hypothesis fails to obtain support.

Base Level Difference, Conductance. As with initial base level measure, although directionality is implied with respect to magnitude of base level difference, more fundamental is the assumption of significant differences among groups. Base level difference was computed by deriving the difference between the initial and final conductance readings. It is not possible to subtract one resistance reading from the other and subsequently derive a conductance measure of the magnitude of change from the difference. Such a procedure fails to avoid the severe skewness inherent in resistance figures.

A preliminary F test of the homogeneity of variances was insignificant. An analysis of variance of the mean differences among groups was .34, also insignificant. Consequently further analysis of the data by t tests

Table 5. Analysis of variance: mean scores, base level PGR conductance at the beginning of a resting phase.

Group	Mean	SD	MS Within	MS Between	df	F	p
HH	15.69	10.22					
LL	16.54	12.25	118.27	34.98	61.2	.30	ns
LH	14.03	9.67					

Table 6. Analysis of variance: mean scores, change in base level PGR conductance from initial to terminal base level during a resting phase.

Group	Mean	SD	MS Within	MS Between	df	F	p
HH	2.88	2.57					
LL	2.42	2.09	5.80	1.98	61.2	.34	ns
LH	2.98	2.59					

was not accomplished. No directionality as predicted was manifest on the basis of observation of the means. Furthermore, the orders of magnitude of the mean values follow a different sequence than that obtained among groups on the base level measure (Table 6). Statistical analysis of base level difference data fail to lend confirmation of the hypothesis. All differences shown on this measure are less than one micro-ohm unit of conductance; the largest difference is .56 and the smallest, .10. These rather negligible values would appear to place in doubt the utility of the base level difference measure, unless modifications are introduced in its use, e.g., a longer time interval between initial and terminal measures, employment of larger experimental groups, etc.

Frequency of PGR Bursts. The procedure for deriving a measure of PGR "burst frequency" has been described in an earlier section. Frequency of half-minute intervals in which a resistance-deflection of greater than 2000 ohms is shown, yields one score per subject. It was noted by the writer that bursts tend to follow clusters, i.e., each subject appeared to display a characteristic "burst pattern" in which a relative lack of resistance-deflections would alternately give place to clusters of PGR bursts varying in intensity and duration. Hence the probability was fairly high that a half-minute interval manifesting one burst would also manifest more than one. Lacey and Lacey (1958a) also observed characteristic burst patterns which held up consistently throughout the examination time. Lacey further observed that the patterns show considerable intra-individual reliability upon retesting. Despite the consistency of the measure, however, the within-groups (pooled) distribution of PGR bursts is highly skewed (Fig. 1); extreme skewness was noted in both Lacey's studies and the present data. Degree of skewness increases with an increase in the magnitude of the ohms used as a cutoff point, though 2000 ohms appeared to be the ideal criterion in the present study, vs. 600 ohms in Lacey's samples. Because of extreme lack of normality of distribution the Kruskal-Wallis H Test (Siegel, 1956), a nonparametric

analysis of variance, was applied to the data (Table 7). This test necessitates pooling individual scores across groups, ranking the data and summing ranks for each separately. The H Test is an analysis of the significance of differences among the summed ranks for the three groups. The highest rank is associated with the lowest score. Analysis of the data yielded an H of 8.23, with a probability of occurrence of less than .02.

On the basis of observation, however, the particular distribution of T-values (rank sums) indicates failure of the data to support the hypothesis. The highest rank, as predicted, is with a low-psychosomatization group (LL), but the lowest rank (indicative of the greatest frequency of PGR bursts) is found in the other low-psychosomatization group (LH), the high-somatization group occupying an intermediate position. Because the observed direction of T values deviates from that predicted, indiscriminate application of one-tailed tests of the individual group differences is unjustified. Since no significant differences are predicted consistently with respect to comparisons between LH and LL groups, only two-tailed tests are appropriate for those comparisons. Since direction is reversed from that predicted in the comparison of HH and LH groups, the only appropriate one-tailed comparison is that between the HH and LL groups.

The nonparametric equivalent of the t test for unmatched independent groups used in this study is the White's T Test, based upon separate rankings of frequency data (Table 8). Siegel (1956) describes White's T as having power approaching that of the parametric t test. Separate re-rankings for each of the three comparisons is necessary; with sample size greater than 15, Z-approximations of normal curve probabilities are derived from the T-values. All three intergroup comparisons fail to reach a significance level of .05 or less. Only the comparison between HH and LL approaches significance ($<.06$, one-tailed) in the predicted

Table 7. Kruskal-Wallis H Test: ranked frequencies of PGR burst greater than 2000 ohms resistance during resting phase.

Group	N	T	T^2/N	H	p
HH	20	684.5	23,427.01		
LL	24	736.0	22,570.67	8.23	.02
LH	20	659.5	21,747.01		

Table 8. White's T Test: individual group comparisons of ranked frequencies of PGR burst greater than 2000 ohms resistance during a resting phase.

Group	Sum Ranks	T	SD	Z	p
HH	478	450	51.00	1.22	<.06*
LL	512				
HH	416.5	410	36.97	.18	ns
LH	403.5				
LL	504	450	51.00	1.06	<.14
LH	446				

*One-tailed test.

direction. Using a two-tailed test, the comparison between LL and LH is associated with a probability of occurrence of less than .14, while a two-tailed comparison between HH and LH yields an entirely insignificant Z-value (18). The fact that the HH and LH scores approach significance suggests tentatively that the second factor, high vs. low neuroticism, may be more closely related to burst-frequency, called by Lacey (1956) a measure of autonomic "lability" (as opposed to autonomic tonus, purportedly measured by conductance-level data). Insofar as the present study is concerned, however, this measure fails to support the hypotheses.

HYPOTHESIS III:

To support Hypothesis III it is necessary to demonstrate greater increase in tonus among the high psychosomatic subjects (HH) than the subjects low in psychosomatization in states of rest and/or stress, irrespective of the neuroticism factor (LL, LH). Four separate statistical comparisons have been made among the three groups with respect to each of the three stress stimuli as well as a measure of "stress change" in base level, from a pre-stimulus 1 level to a pre-stimulus 3 level. The latter measure therefore yields an estimate of variations among groups in the progressive increase in tonus during the stress phase. The first three measures concern immediate and maximum increase in tonus following presentation of a stressor, while the latter measure may be regarded as an index of the degree of failure to resume an earlier pre-stress resting level of tonus. All measures are calculated from the $\log^1/R1$-$\log^1/R2$ change. Lacey notwithstanding, all data dealing with change in tonus-level during stress are associated with highly heterogeneous variance in score distribution. Simple analyses of variance are therefore inappropriate. In an attempt to reduce heterogeneity of variance all conductance scores were transformed by a square root conversion. This transformation failed

to appreciably reduce heterogeneity, however, and pilot attempts at a second square root conversion indicated that it also would not adequately affect the distribution. Failure of different approaches to transformation of the data appears to be a function of the nature of the heterogeneity, produced almost entirely by four extreme scores within each stress phase. A closer examination of the PGR protocols gave no reason to assume that these extreme scores were the product of an extraneous artifact, and hence exclusion of the subjects responsible for the heterogeneity did not appear warranted.

A survey of relevant statistical literature indicates that heterogeneity of variance does not seriously affect the validity of the t test, although traditionally violating one of its assumptions (Lindquist, 1953: Boneau, 1960). Boneau reports statistical evaluation of repeated samples with heterogeneity of variance of considerably greater magnitude than those obtained in the present study, and concluded that "the violations produce a negligible effect on the distribution of t's" (Boneau, 1960). On the basis of these findings, a series of individual t comparisons were made between groups.

AUDITORY STRESS STIMULUS (S1).

A visual inspection of mean change during stimulation for the three groups indicates direction as predicted. The group high in psychosomatization (HH) manifests a considerably higher mean change in conductance than the two groups low in psychosomatization (LL, LH). One-tailed t comparisons between HH-LL, and HH-LH groups were employed, therefore, the comparison of LL-LH (no significant differences predicted) involving a two-tailed test. None of the comparisons reach the five percent level of probability, though the derived t probabilities are suggestive of a tendency in the expected direction (Table 9) approaching significance.

Table 9. Mean Scores: maximum PGR to auditory stress stimulus (S1).

Group	Mean	SD	Mean Diff.	t	df	p
HH	18.40	31.03	9.70	1.37	42	<.10*
LL	9.74	6.71				
HH	18.40	31.03	8.98	1.18	38	<.12*
LH	9.42	13.62				
LL	8.74	6.71	.68	.20	42	<.50
LH	9.42	13.62				

*One-tailed tests.

EMOTIONAL STRESS STIMULUS (S2).

Visual inspection of mean change during S2 presentation also indicates mean differences among the three groups as predicted. The group high in psychosomatization manifests a mean value almost twice as great as that shown by either LL or LH groups, while the latter two groups are virtually identical. Hence, statistical comparisons between HH-LL and HH-LH again employed one-tailed tests, the last comparison (LL-LH) using a two-tailed test. Once again none of the t values reach the 5 percent level of confidence, though as with the S1 comparisons, the obtained t probabilities are suggestive of an approach to significance in the predicted directions (Table 10).

VISUAL STRESS STIMULUS (S3).

Visual inspection of the mean changes for each group during administration of the visual stressor fail to show the magnitude of expected differences manifested in the previous two comparisons, though again the differences in each case are in the predicted direction (Table 11). However, there also exists a rather pronounced difference between LL-LH groups, contrary to expectation, the LH group manifesting a considerably greater change in S3 than the LL group. However, once more individual t comparisons of the three groups fail to reach significance. The trend in the expected direction of the p values also fails to suggest differences approaching significance as predicted, though the HH-LL difference is again associated with a p-value similar to those obtained under S1 and S2 conditions($<.12$).

Despite consistent mean differences among groups in the predicted direction, none of the statistical comparisons support the hypothesis. The large differences noted by inspection appear to be at least to a considerable degree a function of the heterogeneous variance in scores noted

Table 10. Mean Scores: maximum PGR to emotional stress stimulus (S2).

Group	Mean	SD	Mean Diff.	t	df	p
HH	17.33	28.07	6.65	1.15	42	<.12*
LL	9.66	10.90				
HH	17.33	28.07	7.88	1.16	38	<.12*
LH	9.45	11.49				
LL	9.66	10.90	.21	.06	42	<.90
LH	9.45	11.49				

*One-tailed test.

Table 11. Mean Scores: maximum PGR to visual stress stimulus (S3).

Group	Mean	SD	Mean Diff.	t	df	p
HH	17.42	29.74	8.24	1.19	42	<.12*
LL	9.18	9.28				
HH	17.42	29.74	4.60	.51	38	<.35*
LH	12.82	27.76				
LL	9.18	9.28	3.64	.56	42	<.30
LH	12.82	27.76				

*One-tailed test.

above. Statistical operations in the t tests in each case tended to dissipate what appeared to be a real difference. The relative consistency of probability estimates associated with t values of the differences between obtained means further suggests a significant relationship supportive of the hypothesis. Since a trend analysis is inappropriate, however, the measures being made on the same subjects, the validity of the consistencies remains a question.

STRESS CHANGE (SC).

For Hypothesis III to be supported on the basis of this variable it is necessary to demonstrate a significantly greater magnitude of change in level of tonus among the group high in psychosomatization (HH) as compared with the two groups (LL, LH) low in psychosomatization. It is further predicted that the two groups low in psychosomatization shall show no significant differences with respect to stress change. All of these conditions must be met, as in the comparisons above, if the hypothesis is to be supported.

As in visual inspection of the stress-stimulus means, all mean differences are in the predicted direction. The greatest mean differences are between the HH-LL and HH-LH groups, the HH group showing greatest change in base level tonus during the stress phase. A fundamental difference between stress-change data relating to base level tonus and the above maximum stress-response data relating to each stress stimulus and its maximum PGR, is evidenced by the relative homogeneity of variance in the stress-change data. An F test for homogeneity of variance yields an insignificant F, indicating relative lack of the marked heterogeneity manifest in the S1, S2, and S3 scores.

Three t tests between groups yield equivocal findings; the comparison between HH and LL groups yields a t of 2.17, with a probability of occurrence of less than two percent, a significant finding (Table 12). However, the HH-LH comparison reaches a significance level of less than twenty

Table 12. Mean Scores: increase in PGR conductance during a three stimulus stress phase.

Group	Mean	SD	Mean Diff.	t	p
HH	9.28	8.09	4.65	2.17	<.02*
LL	4.63	5.62			
HH	9.28	8.09	2.34	.86	<.20*
LH	6.94	9.12			
LL	4.63	5.62	2.31	.99	<.30
LH	6.94	9.12			

*One-tailed test.

percent. The LL-LH comparison is associated with a p of <.30. As with findings reported in the Fr comparisons, it appears that the second variable, neuroticism, may also exert some effect in terms of group differences in both tonus and lability. In the case of the stress-change variable, however, the hypothesis fails to achieve support, only one of the two t values reaching significance. Again, the distribution of t probabilities shows a trend in the predicted direction.

INTERCORRELATIONS AMONG VARIABLES

Trends noted throughout the above findings suggested the possibility of meaningful intercorrelations among some of the variables measured. To assess possible correlations, 29 tetrachoric correlation-scattergrams were drawn among all eight variables numerically represented (neuroticism, N; stress stimulus 1, S1; stress stimulus 2, S2; stress stimulus 3, S3; frequency of half-minute intervals with PGR bursts greater than 2000 ohms resistance, Fr; stress change, SC; base level conductance, BL; base level difference, conductance, BLD). Results obtained in scattergrams were strongly suggestive of significant intercorrelations, and a matrix of intercorrelations was computed (Table 13). On the basis of visual inspection intercorrelations among the eight variables appeared to be clustered around two, and perhaps three, factors. Thurstonian centroid factor analysis indicated the presence of at least two clear-cut factors, and a "principle axis" analysis followed by a varimax orthogonal rotation of factors (MISTIC) isolated three factors. Unrotated factor loadings on the three factors are shown in Table 14.

As expected, S1, S2, and S3 appear to be factorially highly similar. More surprising are the relatively high loadings on this factor (Factor 1) shown by Fr and Sc. According to Lacey and Lacey (1958a), Fr is virtually unrelated to measures of tonus. The high loadings on Factor One shown

Table 13. Tetrachoric Correlation Matrix: interrelationships among eight experimental variables.*

S1	(+.79)							
S2	+.84	(+.98)						
S3	+.84	+.91	(+.95)					
Fr	+.57	+.68	+.80	(+.96)				
SC	+.48	+.68	+.52	+.12	(+.73)			
BL	+.26	+.12	+.10	-.26	+.01	(+.89)		
BLD	+.34	+.24	+.12	-.06	+.32	+.43	(+.31)	
N	-.10	+.10	-.10	-.22	+.10	+.02	+.10	(+.09)
	S1	S2	S3	Fr	SC	BL	BLD	

*Communalities derived through iterative estimation, Program K7, MISTIC.

Table 14. Factor loadings of eight experimental variables on factors 1, 2, and 3.

Variable	Factor 1	Factor 2	Factor 3
S1	+.869025021	+.145716232	-.119844689
S2	+.979614288	+.041500491	+.156276297
S3	+.960290226	-.120564769	-.108199956
Fr	+.735025940	-.571557386	-.300147700
SC	+.603337352	+.231311917	+.555866092
BL	+.133125800	+.828017477	-.440081384
BLD	+.255669492	+.494281037	+.039499323
N	-.044765395	+.168903723	+.252651951
Eigen values	3.626	1.376	.709

by variables S1, S2, and S3 suggests a more meaningful treatment of these data would be achieved by treating them together.

Table 15 represents t values obtained with HH-LL, HH-LH, and LH-LL comparisons derived from stress responses to the three stimuli averaged together. Associated probabilities indicate that these pooled estimates are a better measure of Hypothesis III; mean difference between HH-LL is associated with a probability of occurrence of less than .08, while HH-LH difference is associated with a probability of occurrence of less than fifteen percent. While these figures also fail to statistically support the hypothesis, the approach to support is greater than that shown in the individual stressor-comparisons.

Table 15. Mean Scores: averaged maximum PGR's to three stress stimuli.

Group	Mean	SD	Mean Diff.	t	p
HH	17.77	28.63	8.57	1.41	<.08*
LL	9.20	8.30			
HH	17.77	28.63	7.21	.97	<.15*
LH	10.56	16.95			
LL	9.20	8.30	1.36	.32	<.70
LH	10.56	16.95			

*One-tailed test.

CHAPTER V

DISCUSSION

INITIAL PHASE: PSYCHOSOMATIC SYMPTOMATOLOGY AND EMOTIONAL DISTURBANCE

Results reported, i.e., that the "high psychosomatic" group manifested significantly higher mean neuroticism scores than the "low psychosomatic" group, are strongly supportive of Hypothesis I. This hypothesis is derived from the most fundamental assumption underlying psychosomatic medicine, i.e., that the manifestation of a psychosomatic symptom is an index of underlying emotional disturbance reflected in the soma. A number of important considerations relate to findings associated with Hypothesis I.

Experimental Sample. As in all research, the question arises as to the justification of generalizing the findings to a larger population. The initial population, MSU undergraduates, represents specific age ranges and socioeconomic groupings. The age range is from 17 to 34, with a mean of around 21 years. Socioeconomic levels represented by the sample are clustered primarily about the middle class, with a disproportionate lack of representation among the upper and lower classes. The degree of bias may be expected to be markedly lower with respect to lower-class representation in the MSU sample, however, as is the case with most state college populations.

Age and Psychosomatization. It is generally believed that frequency of psychosomatic and other physiologic complaints increases with age. To the extent that the belief is valid, normative data gathered in this study concerning frequency of psychosomatic disturbances within a general

population should be restricted in terms of generalization to an older general population. However, the absence of any significant difference in mean age between the initial and extreme "high" and "low" psychosomatic groups suggests that if there is an increase in frequency of psychosomatic complaints with age, the increase is not especially great.

Social Class and Psychosomatization. Assuming that the present sample is most representative of a middle-class population, the consideration arises as to relative frequency of appearance of psychosomatic symptoms within upper and lower class groups. Ruesch (1951) cites a number of studies indicating a high frequency of somatization within lower class groups. On the basis of his findings, it appears that at the very least, psychosomatization is as common within lower class milieux as within the middle class. Ruesch's data are in close agreement with those obtained by Hollingshead and Redlich (1957) and Bonier and Fingar (1958). Both Ruesch (1957) and Bonier and Fingar (1958) found only minimal somatization among upper class subjects, however. These findings are in clear conflict with the impression of the socially striving "status seekers" of the upper-middle and lower-upper socioeconomic groups, at times considered the sole possessors of the world's peptic ulcers and spastic colons. The disparity between the empirical findings and popular lore may be a function of the samples tested, in all probability poorly representative of the upper class, the small N's of this group, and/or the nature of the instruments used to measure somatization tendencies (self-reference Q-sorts).

Frequency of Psychosomatic Symptomatology: Criteria employed for determination of high, intermediate, and low psychosomatization were absolute, neither based upon nor transformed to, normal curve-approximations. For this reason, insofar as it is possible to generalize findings to larger samples, the results are quite surprising. In a college population, whose members may be considered well nourished and cared for,

almost one-third of the individuals were classified as manifesting a high frequency of physiologic disturbance. Somewhat more than one-third of the sample was judged intermediate with respect to frequency of psychosomatic symptoms. Only 118 subjects, approximately one-third, were judged to be relatively free of indications of some imbalance in autonomic functioning. The Inventory is only a crude approximation of a respondent's state of physiologic health, and perhaps most useful in this context for the generation of more refined investigations concerning development of norms with respect to frequency of autonomic disturbance. In view of the fact that a test respondent's most likely falsification of an item is toward a more desirable picture of himself, however, (witness the many Lie Scales included in objective inventories) the present findings suggest that the frequency of psychosomatic disturbance within this population may be at least as high as the frequencies obtained.

In evaluating these data it is also important to consider the nature of the Psychosomatic Inventory items, only thirteen of which dealt with clear-cut, diagnosed psychosomatic illness. All other items refer to psychosomatic "disturbance," i.e., chronic and persistent imbalance of some autonomic organ system, not diagnosed up to time of testing as a discrete illness. The majority of individuals classified as "high psychosomatic" would fall primarily into this latter category of psychosomatic "disturbance," although the "intermediate" classification is more exclusively constituted of subjects with this type of physiologic disturbance. The absence of age differences between groups of subjects high and low in psychosomatic symptomatology may most probably be explained by the Inventory's category for physiologic disturbance not yet diagnosed as a discrete illness. It seems likely that these already chronic states will over a period of years develop into full-fledged psychosomatic illness, though there exists a paucity of empirical material relating to the usual course of onset of psychosomatic illnesses.

Psychosomatic Illness and Emotional Disturbance. In many of Alexander's theoretical formulations, great care is taken to avoid implying an isomorphic relationship between psychosomatic illness and underlying emotional disturbance. Most other theorists in psychosomatic medicine as well emphasize the multiple determination of symptoms commonly defined as psychosomatic in nature, positing a considerable variety of physiological etiologies all leading to the same manifest symptom. In view of the sophistication of psychology and medicine today, any other position would appear to be ill-considered and indefensible. It is in view of these facts, however, that the results obtained in the present study are especially striking. The relationship between emotional disturbance and psychosomatic symptomatology would appear to be extremely close, suggesting that the manifestations of autonomic imbalance are one dimension of a syndrome of emotional disturbance. The trepidation with which many current theorists posit a relationship between emotional and physiologic disturbance, acknowledging a wide variety of other nonpsychological conditions of cause, appears less warranted on the basis of these findings than those cited in the Introduction. The great many negative findings in the area of psychosomatic medicine are at variance with the strong relationship shown between the MPI and the PS Inventory. Particularly, the results indicate that the manifestation of psychosomatic symptoms is a good predictor of underlying emotional disturbance and conversely, the probability appears high that the existence of emotional disturbance in a given case will in time develop an association with physiologic disturbance of a chronic nature. As noted above, the apparent close relationship between the two indices suggests that both variables are expressions of a single syndrome.

ARTIFACT: A number of other explanations may also be employed to explain the findings, none of which would support the validity of the above interpretation. Insofar as these criticisms may be valid, the

Hypothesis would fail to receive support. The fact that the above findings are considerably at variance with other attempts to examine the relationship between emotional factors and psychosomatic illness (Introduction) especially promotes caution. In the following pages, a few types of possible artifacts are discussed.

Response Set: The validity of either inventory may be questioned with respect to response set, i.e., the tendency of a respondent to answer an item using some criterion other than the actual content of the item. A tendency to answer all items the same way, irrespective of item content, renders results useless, at least insofar as they are used to measure some criterion represented in the items. The MPI is constructed to avoid this form of response set, as the answer suggesting neuroticism varies from item to item in an irregular pattern.

Another form of response set is that related to the "social desirability" value of items. Most inventory items are clearly loaded with a social desirability factor, e.g., sickness vs. health, emotional well-being vs. pathology, social prominence vs. social ostracism, etc. Clearly, the greater the subject-response to the element of social desirability inherent in each item, the less the item measures what it is designed to measure. In the factor analysis of neuroticism and anxiety inventories described earlier, Bendig isolated three factors, one of which relates to "social desirability" as a form of response set. This factor (F), an indication of degree of falsification of responses, was associated with a negligible factor loading in the MPI N-scale. Bendig concluded that the MPI was a relatively pure, uncontaminated measure of Emotionality.

The determination of response set operating in the PS Inventory is more difficult to assess. Inspection of the protocols indicates that the first type of response set, i.e., perseveration within one response-category, was virtually absent. Only seven subjects were noted to respond to all items in the same way (i.e., checking a frequency of "None"), and

these protocols were discarded for any further statistical use, though even in these cases the responses may conceivably represent a valid statement of the respondent's state of health. With the exception of these seven protocols, all other tests show a considerably wide range of usage of all response categories, offering some indirect indication that the subjects were responding to the content of the items rather than the social desirability or perseveration factor.

It may be argued that all PS items are loaded with a social desirability factor in that good physical health is highly valued within the general culture. It therefore may follow that an individual willing to perceive and acknowledge pathology in himself on the MPI may continue to acknowledge pathology of a physical nature on the PS Inventory, irrespective of its actual presence. The results of Bendig cited above offer a partial disconfirmation of this criticism. The items on the PS scale were carefully constructed to reflect a maximum of objectivity and a minimum of subjective response. Most physiological-symptom inventories reflect the greater objectivity in some degree with respect to reliability data. In all of the sources cited in the survey of the literature, tests possessing both physiological and psychological subsections reported greater reliability in test-retest comparisons of the physiological section vis-a-vis the psychological section (Bendig, 1959; MacFarland and Seitz, 1938; Weider, 1948). Great care was taken on the present PS Inventory to avoid the pitfall of qualitative items noted on the MacFarland Inventory; respondents were asked simply to indicate presence or absence of manifest states of physiologic disturbance, i.e., concrete observable events. Falsification of such items requires a much greater distortion of reality than falsification of an item related more to feelings about oneself, poorly anchored in time and space, and about which a subject may legitimately experience considerably greater doubt concerning the relationship of the state and the item attempting to identify it.

Choice of Groups. The present study involves a comparison of two nonhospitalized groups drawn from the same population and differing with respect to degree of psychosomatization. Construction of the hypothesis was for the purpose of assessing the presence or absence of emotional disturbance within a psychosomatic sample. Although results reinforce the theoretical position, one may question the etiology of the emotional disturbance as measured. In terms of our definition of somatopsychic disturbance, there remains a possibility that the emotional disturbance noted is a function of an emotional reaction to a stressful state of physiological pathology. If this were the case, the question of etiology would remain open. The use of a nonhospitalized sample would appear to circumvent this objection, at least in part; the fact that the individuals have not hospitalized themselves and are in fact functioning within a competitive environment indicates that they do not feel immobilized by the physiological illness. In this respect the results are felt to be more representative of the general psychosomatic population, as opposed to samples of subjects tested within a hospital setting.

Pursuing further the direction of etiology, if the relationship between the two variables were in the direction of psychosomatization as a causal factor engendering the neuroticism, on theoretical grounds one would not expect to see the relationship established with respect to these two particular tests. The PS Inventory is, as noted above, a highly objective inventory dealing with concrete, observable events. The MPI N-scale, unlike many contemporary tests of neuroticism, for the most part does not include items related to one's self-perception, but rather consists primarily of self-report items related to what one actually does in given situations, and concentrates most heavily upon items dealing with different dimensions of the respondent's social relationships. While one might expect an alteration in an individual's feelings about himself as a function of severe discomfort experienced in chronic autonomic

imbalance, it seems unlikely that the physiological discomfort would as readily be translated into measurable modifications of interpersonal modes of relating.

A further refinement of methodology employed in the testing of Hypothesis I might involve the testing of an additional group of subjects, also nonhospitalized, possessing a range of physiological disorders of approximately the same chronicity and intensity as in the "Psychosomatic" group, but diagnosed as physiogenic in origin.

Item Overlap. The high relationship between the two inventories may be regarded as a function of communality of items, both scales possessing some of the same, or similar, items. This objection has been noted parenthetically earlier; the MPI N-scale is entirely devoid of somatization items, and was chosen for that reason. The PS Inventory has no items relating to behavior in interpersonal situations, nor to attitudes about the self. Since the inventory adequately discriminated among groups and further manifested a high relationship with an independent measure as predicted on the basis of theory, it would appear that further exploration with other populations could be fruitful, e.g., investigation of different psychiatric populations, social strata, etc. If the high relationships with indices of neuroticism noted in this study persist, the inventory should have some value as a screening device, especially in that its purpose should be less readily apparent than conventional psychiatric screening inventories. For this reason it would be of value to devise a scoring system for the inventory for the derivation of one, or at most, two subscores. One score may relate to the subsection dealing with psychosomatic "process," the other with psychosomatic disease.

"Emotionality." Bendig found that tests of neuroticism and anxiety are factorially identical with respect to that which they attempt to measure. The label "Em," standing for "emotionality" was felt to be an appropriate generic term for the variable represented by the factor. Bendig was not

implying an emotionality in terms of a tendency toward extraversion and relatively free expression of emotional impulse. The choice was arbitrary, as is the case with any label for a concept isolated in factor analysis. On the basis of the nature of Taylor's MAS and Eysenck's MPI, both described as factorially quite similar, it would appear that the common factor might as easily be labelled "emotional disturbance," a term which would also more clearly emphasize the relationship of the MPI N-scale to the hypothesis and its underlying theory. Theory implies a relationship between psychosomatic disturbance and emotional disequilibrium, not neurosis as a diagnostic syndrome. The nature of the psychiatric entity underlying psychosomatic disturbance is secondary and only rarely referred to in the literature of psychosomatic medicine beyond the most basic assumption of emotional disturbance, irrespective of psychiatric diagnostic entity.

SECOND PHASE: PSYCHOSOMATIC DISTURBANCE AND DIFFUSE AUTONOMIC AROUSAL

Tonus vs. Lability. Lacey distinguishes between "tonus" and "lability" (1958a), identifying the latter with what appeared to be spontaneous, endogenous (unrelated to external stimulation) fluctuations in PGR activity, and the former with levels of PGR, irrespective of fluctuations. The two categories are not entirely discrete, however. Measurements of maximum change in level of tonus following administration of a stressor also relate to the concept of lability; a more labile individual would theoretically be expected to manifest a greater change in tonus than an individual classed as relatively non-labile. The present study utilized Lacey's critierion of lability in observations made during the resting phase, and a "change of tonus level" criterion of lability during the stress phase. The orthodox measure of tonus during a state of rest was also employed. The hypotheses stated that regardless of type of

measurement employed, individuals high in psychosomatization should show greater indices of autonomic activity, either tonus or lability, than individuals low in psychosomatization, both during a resting state and a stress phase.

The Control Group. The variable of emotional disturbance was predicted to be unrelated to autonomic activity, and hence a control group was included (LH) in the research. On the basis of the very close relationship observed in the first phase of the study, question may be raised as to the justifiability of separating the variables "emotional disturbance" and "psychosomatic process," though empirically this could not be anticipated. Despite the close relationship, it was possible to draw from the initial population three extreme groups, one of which (the control) may in retrospect be considered virtually an anomaly, low in psychosomatization and high in neuroticism (Mean score = 31.50). The relative rarity of the individuals represented in the control group raises a consideration that these subjects may be qualitatively different from the other two groups in more respects than the criterion variables. This group seemed in a number of instances responsible for failure of the findings to support the hypotheses. While the HH and LL groups behaved in almost all instances as predicted, responses of the LH group failed to follow any consistent pattern, sometimes simulating the performance of the HH group and at other times more closely resembling the LL group, which theoretically they were predicted to consistently resemble. As stated above, however, the rather surprising rarity of individuals representative of this group introduces the possibility that the group differs from HH and LL in other respects as well, perhaps in terms of some property related to the dependent variables in a manner producing the inconsistency of LH group performance.

Base Level, Conductance. The complete absence of support for either Hypothesis II or III, despite the variety of approaches to measurement utilized seems instructive. Comparison of groups with respect to

base level conductance and change in base level conductance during the resting phase yields no significant differences between groups. On base level, the HH and LH groups manifest the lower mean values, indicative of a state of autonomic activation somewhat less than that manifested by the LL group. This reversal from prediction controverts not only the present hypotheses, but also hypotheses relating to the association of anxiety and autonomic indices; although the data fall far short of significance, the differences are in the direction of less autonomic innervation associated with the two high-anxiety groups. The mean differences are at the very most suggestive of further inquiry, should other studies also find reversals in this direction.

Studies Reporting Inconsistent Findings. Findings involving reversals of this nature are reported in the literature; Sherman and Jost (1942) found that 15 neurotic children manifested significantly lower palmar conductance during a frustrating situation than 18 "well-adjusted" children. Jurko, et al. (1952), found a similar negative relationship between states supposedly accompanied by anxiety and PGR; 25 normals, 20 neurotics (hospitalized) and 10 "early schizophrenics" were tested on heart rate, respiration rate, respiration variability, and palmar conductance before and during administration of the Rosenzweig P-F test. All indices with the exception of palmar conductance showed significantly greater rate and amplitude in the patient groups, vis-a-vis the normals. Palmar conductance was significantly higher for "normals" and lowest for neurotics both before and during administration of the P-F test. Replication of these studies seems warranted, however, especially in view of the bewildering array of apparently incompatible findings. Some studies report PGR and other autonomic indices highest in anxiety patients and lowest in groups of ulcer patients (Lewinsohn, 1956), while still other studies report conflicting findings upon replication of an identical research design (Gunderson, 1953; Wenger, 1948). Sarason's impression of a multiplicity of inconsistent and negative findings in the area of

autonomic indices and their relationship to clinical variables seems well taken. He in part attributed the inconsistencies to a failure of researchers to adequately reproduce stress situations within the laboratory. Yet the findings of Ax (1953) and Schachter (1957) employing almost traumatizing stress situations, are also associated with conflicting results. The present study, while far from traumatizing the subjects, did manage to elicit subjective experiences of apprehension and mild upset, insofar as the subjects' retrospective reports may be credited. All stress situations elicited elevations in PGR, though systematic group differences failed to appear.

Base Level Difference, Resting Phase. A patterning of mean scores opposite to that observed with the base level conductance measure is also manifest with the base level difference measure (resting phase); again the HH and LH measure appear to "hang together," in this instance manifesting greater mean score values than the LL group, indicative of greater tonus-level. As with the first series of comparisons, however, the differences fail to reach significance. Consistent association of the HH and LH groups irrespective of the measure under consideration may indicate a meaningful relationship of the two groups with respect to the neuroticism variable, despite an apparently inconsistent series of relationships of the two variables to the dependent variables.

PGR Lability. Such a "hanging together" is further evidenced with respect to the variable, Fr (frequency of PGR bursts during rest), an index of PGR "lability." Greater frequency of PGR bursts is manifest in the HH group than the LL group, with an associated probability of less than six percent. This almost-significant difference is in the predicted direction, but a comparison of the differences between HH and LH fails to even approximate significance, while the probability associated with the LL-LH difference is less than 14 percent, two-tailed, the LH group manifesting greater frequency of PGR bursts. These findings also are

suggestive of a relationship between emotional disturbance and autonomic activity, irrespective of the presence or absence of psychosomatization, though a similar consistency of patterning is not manifest on the stress measures. As noted earlier, the fact that all seven variables (PGR) are repeated measurements upon the same subjects negates the possibility of a trend analysis. While a significant relationship between the HH and LH groups would indicate the influence of the neuroticism, or Emotionality, factor, the nature of its relationship to PGR (and autonomic) activity would remain unclear. In some cases the HH-LH groups show greater PGR tonus, and in other cases less, than the LL group.

Stress Measures. Each of the four stress measures are associated with greater HH-group mean stress-response vis-a-vis the LL and LH groups, though, as noted in the Results chapter, none of the differences reach significance. The clustering of the two high-neuroticism groups is less in evidence, though consistently the LH group shows greater mean stress-response than the LL group; the probabilities in all cases are much greater in these comparisons than in the HH-LL and HH-LH mean differences. The great variability of scores on all stress measures with the exception of stress change, conductance, places the usefulness of measures of maximum stress-response on the PGR in question. The variances on all resting PGR measures were homogeneous. If evaluation of groups with respect to stress-response is theoretically relevant, then insofar as the present heterogeneous variances are representative, larger experimental groups may be necessary if actual significant differences are to be measured. A more restricted evaluation, involving only stress change (changes in base level during stress) would avoid the problem of real differences masked behind the heterogeneous variances, but would perhaps excessively restrict experimental inquiry. Lacey's findings (1956) would indicate that the heterogeneous variances obtained in the present study are typical. Unfortunately reports of the nature of

score-variances are only occasionally included in the research literature.

Response Stereotypy. A possible explanation of negative findings and findings only approaching significance may reside in Lacey and Lacey's (1958a) concept of response-stereotypy. The authors observed reliable patternings of autonomic arousal during rest and stress phases, different and characteristic patternings being manifest for each subject. Whereas one individual may show greatest response to stress in circulatory arousal, another may show greatest response in PGR or respiration, etc. Insofar as these response categories exist, the nomothetic approach to testing groups for mean difference on autonomic measures would appear to be inappropriate and incapable of uncovering real group differences, unless extremely large groups were tested (Lacey and Lacey acknowledged that in their sample all indices showed elevation during stress, though each individual varied with respect to subsystem manifesting greatest arousal). The authors suggest that orthodox group testing can be carried out successfully only if first the subject's particular response pattern is known, and a "lability score" computed. Groups would then be compared with respect to individually computed "lability scores" based upon each subject's autonomic index showing greatest responsivity.

Lacey's findings and conclusions are not universally accepted, however; a number of studies have yielded significant findings despite failure to employ a lability score. Martin (1961), while acknowledging the possibility of response-stereotypy during a resting state, maintains that in the presence of stress-stimulation individual differences would wash out, all autonomic indices showing similar degrees of elevation, thus justifying the use of orthodox methods in effecting group comparisons. The research literature abounds with conflicting results, however, and although Lacey's admonitions may be presently insufficiently documented, they clearly emphasize the need for further work in the assessment of the stability of response-stereotypy during stress.

Machine Artifacts. The following paragraphs represent a summary of communications concerning possible built-in artifacts in the GSR:* Most methods of measurement derive the resistance from a skin potential supposedly produced by an impressed current. Unfortunately there are internally generated skin potentials and contact potentials, the measured potential being the result of summing the voltage actually due to skin resistance, plus the spurious potentials. These effects can be minimized by operating at high current densities, but because the skin resistance is extremely non-linear and decreases more than three orders of magnitude as current densities approach maximum, the resultant data are not comparable with other sets of data.

An artifact is also introduced with respect to electrode size; as size of the contact increases, resistance decreases, but not "in a straight line," as a function of compensation by the non-linearity of skin resistance. Size of contact is an important variable, since the contact is measuring a "representative sample" of potentials, among which there is some degree of variation. The smaller the contact, the possibly less-representative sampling obtained, especially since GSR is also sensitive to body movements.

Insofar as these considerations are valid, they introduce an added explanation of the confusion represented in GSR studies, many of which have involved large scale replicational techniques (Wenger, 1948; Gunderson, 1953).

Autonomic Function and Neuroticism. Possible relationships between PGR tonus and lability were discussed in an earlier section; group mean differences were somewhat suggestive, if not statistically significant, of a relationship. However, inspection of the tetrachoric correlation matrix (Table 12) indicates consistently low and insignificant

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*Personal Communication, Feldstein, R., Scientific Prototype Mfg. Corp., New York. Oct. 12, 1961.

correlations between neuroticism and all seven of the PGR variables measured. The neuroticism scores are the pooled values of all three groups, N = 64. Neuroticism consequently also shows negligible loadings on each of the three factors. On the basis of these figures the present study is most representative of the many studies cited by Sarason (1960) which fail to show any relationship between anxiety and autonomic correlates, in this instance PGR activation.

PGR-Variable Clusters: Factor 1. Inspection of the loadings on Factor 1 indicate a clustering of the variables S1, S2, S3, Fr, and SC. All five of these variables relate to "lability" as opposed to tonus; four of the measures are computed during stress, while Fr is a measure of lability during a resting state. The heavy loading of Fr on Factor 1 seems to be at variance with Lacey's findings; Lacey felt that as a measure of lability, Fr was unrelated to conductance, being a measure of endogenous autonomic nervous system activity related to the physiological constitution of the individual rather than to stress and "emotionality." The relatively heavy loading of SC on this factor would appear to be an indication that it is not an entirely independent index of PGR.

Factor 2. Only three indices show a loading on this factor, Fr, BL, and BLD. The latter two indices show positive relationships, while Fr manifests a high negative loading. Both BL and BLD are measures of tonus. The high negative loading of Fr would tend to lend support to Lacey's definition of Fr as an index of endogenous lability. All three measures are associated with the resting state, hence an appropriate label for this factor may be "resting-state tonus."

Factor 3. Only two indices manifest significant loadings on Factor 3; stress-change (positive) and Base Level (negative). The nature of their relationship seems unclear, though both are fundamentally base-level indices, one associated with resting phase and the other with stress phase.

Insofar as this aspect of their relationship is meaningful, the common factor may possibly represent a "rest-stress" dimension.

Although a question may exist concerning the proper naming of the three factors identified in the analysis, the fact that different and supposedly unrelated PGR measures show clusterings seems meaningful. Replication of these operations with other samples would be worthwhile for the purpose of estimating the reliability of the three factors. If the factors continue to appear, selection of variables or combinations of variables with highest loadings on a given factor would promote refinement of current research methods. Presently any and all PGR variables are employed for the measurement of an unqualified "autonomic state"; the existence of three factors suggests, however, that all PGR variables are not measuring the same processes, and may with varying degrees of appropriateness be employed in different research problems. Further work is necessary in identifying the meaning of the factors and their relationships with other criteria. A spelling-out of the meaning of different PGR indices would facilitate more rigorously-designed research and promote greater comparability of findings, thus ultimately leaving behind what Sarason describes as a welter of contradictory findings.

Suggestions for further research. Although Hypotheses II and III were not statistically supported, sufficient trends and isolated significant group differences are in evidence to suggest the utility of further work in this area. Attempts to identify group differences with respect to the same hypotheses may yield more consistent findings with utilization of Lacey's "lability score" or some other PGR measure shown to have a meaningful relationship to the variables in question. Lacey actually uses the term "lability score" for two distinct, separate phenomena. The burst-frequency (Fr) discussed earlier was employed by Lacey as a "lability score." However, in the present section the term refers to a score derived from multiple weighted measurements of autonomic subsystem activity, the measurements being combined for one score.

The factor analysis conducted in the present study has shown that the PGR does have some reliability, even in the presence of the heterogeneous variances noted with the stress information, and that different PGR measures apparently relate quite meaningfully to separate phenomena (viz., "stress-rest," "resting tonus," and "lability"); further support for these findings should emphasize the need for more consideration of the nature of PGR measures employed within a given research design.

Should subsequent findings support hypotheses asserting a relationship between psychosomatization and diffuse autonomic arousal, irrespective of the presence-absence of emotional disturbance, subsequent breakdown of psychosomatic groupings may be valuable, particularly within the context of specificity hypothesis. An analysis of the present data on the basis of psychosomatic subgroupings does not appear feasible in view of the small samples this would yield. An investigation of psychosomatic subgroups in a non-hospitalized population would be of value in terms of generalizing Alexander's psychiatric inferences to the (apparently) large population of ambulatory individuals with specific psychosomatic illnesses.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The two major objectives in the present investigation were: (a) to test for the presence of a relationship between emotional disturbance and psychosomatic illness, and (b) to assess the presence or absence of a relationship between psychosomatic disturbance and diffuse autonomic activation, with emotional disturbance held constant.

The experiment was divided into two broad phases, the "emotional disturbance" and the "autonomic involvement" phase. The latter segment was again subdivided into autonomic activity during resting and stress phases. In the "emotional disturbance" assessment phase 567 Ss were administered the Maudsley Personality Inventory Neuroticism scale (MPI N-Scale) and a specially constructed Psycho Somatic Inventory (PSI). The Ss, 339 male undergraduates and 228 female students at Michigan State University, were then classified into three groups on the basis of PSI responses; high, intermediate, and low psychosomatization. Sequence of administration of the MPI and PSI was varied among student subsamples for the assessment of possible order effects. The high and low psychosomatization groups, both sexes, were then compared with respect to N-score. As hypothesized, high psychosomatization groups of both sexes achieved significantly greater mean N-scores than the low psychosomatization samples. An order effect with respect to administration of the MPI and PSI was also noted in the female sample, though it failed to obscure the above-noted group differences. No order effect was observed in the male sample.

From the general male samples of 98 Ss high and 118 Ss low in psychosomatization, three smaller samples were drawn for the purpose of testing the hypotheses related to autonomic involvement, a high-psychosomatization, high neuroticism group; a low-psychosomatization, low neuroticism group; and a control group, low-psychosomatization-high neuroticism. The sizes of the samples were 20, 24, and 20, respectively. All subjects were tested on the PGR during a resting phase of ten minutes and a stress phase in which three stressors, auditory, "emotional," and visual, were administered. The stressors consisted of a sudden loud noise, the threat of an embarrassing question to follow, and presentation of a picture judged to have shock value. PGR measures obtained consisted of three "resting phase" indices and four "stress phase" indices. The resting phase measures were: base level, conductance; change in base level conductance from beginning to termination of resting phase, and a measure of the frequency of bursts of PGR resistance-activity during the resting phase. Stress measures consisted of three measures of maximum PGR change in conductance following each stressor, and a measure of change in base level during the stress period.

The hypotheses associated with the second phase related to both rest and stress; support from the findings was contingent upon the high psychosomatization group showing significantly greater tonus or lability upon the seven measures, as compared with the two low-psychosomatization groups. Support further depended upon the absence of any significant difference between the two low psychosomatization groups. Failure of any and all of these circumstances to obtain was considered failure to support the hypotheses, with respect to any given measure. Results on all seven PGR variables revealed a fairly confused picture. None of the over-all comparisons achieved significance as predicted and hence the hypotheses were not supported. Scattered significant differences between groups and provocative trends alternately suggested an influence upon PGR activity

of the variable "emotional disturbance" and also a tendency of the psychosomatic variable toward predicted directions. The psychosomatic (high) group does for the most part show elevation of PGR on the seven variables, but inconsistency of findings with respect to the control group makes any more systematic interpretation of the findings difficult. Results are not conclusively negative enough to assume the absence of some meaningful relationships within the areas of psychosomatic and emotional disturbance.

The apparently high relationship between responses on the MPI and PSI led to a discussion of the nature of the control group, high on MPI and low on PSI factors. These Ss were quite rare, and the possibility was raised that they may differ in additional respects, the additional variables perhaps being related to PGR activity in some other systematic way.

A factor analysis of scores on the MPI and all seven PGR variables, the three groups pooled, yielded three clusters of factor loadings. Neuroticism failed to show any significant correlations with any of the PGR variables, a finding suggestive of an absence of relationship between emotional disturbance and autonomic innervation, and concordant with other findings reported in the literature. Each of the three factors was labelled: "stress-rest," "resting tonus" and "lability." The last factor manifested the largest loadings among four PGR variables. The nature of the clusterings appeared meaningful with respect to the relationships among the PGR measures. The factor analytic findings appear to emphasize the need for replicational studies concerning the stability of the factors, and should the clusters show reliability, greater forethought in selection of PGR measures for given research problems is necessary, since different measures, all PGR, appear to measure different aspects of associated autonomic states.

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APPENDICES

APPENDIX A

1161 Personal Health Inventory

Directions: Listed below are statements concerning aspects of your general health. In Column A underline the response best fitting you. Then in Column B estimate the number of years you recall having this condition. If it is of recent origin, specify the number of months since onset. Finally in Column C indicate the degree of discomfort experienced when the condition occurs. Please respond to all items as thoroughly and accurately as possible.

COLUMN A Underline the response which best describes you.		COLUMN B For how many years (or months) have you had this condition?	COLUMN C Degree of physical or psychological discomfort. (Great, Much, Some, None). Use initials (G, M, S, N).
1. Vomiting	Always Often At-Times Seldom Never		
2. Fatigued or exhausted	Always Often At-Times Seldom Never		
3. Pains in neck, chest, or back	Always Often At-Times Seldom Never		
4. Abdominal cramps	Always Often At-Times Seldom Never		
5. Twitching of face, hands, or shoulders	Always Often At-Times Seldom Never		
6. Rapid beating of heart without exercise	Always Often At-Times Seldom Never		
7. Hand trembling or shaking	Always Often At-Times Seldom Never		
8. Intestinal gas and/or flatulence	Always Often At-Times Seldom Never		
9. Feel faint or do faint	Always Often At-Times Seldom Never		
10. Frequent defecation (bowel movements)	Always Often At-Times Seldom Never		
11. Ringing, buzzing, etc., in ears	Always Often At-Times Seldom Never		
12. Stomach gas (belching, etc.)	Always Often At-Times Seldom Never		
13. Hayfever	Always Often At-Times Seldom Never		
14. Difficulty in swallowing	Always Often At-Times Seldom Never		
15. Nauseous feeling	Always Often At-Times Seldom Never		
16. Dryness of the mouth	Always Often At-Times Seldom Never		
17. Sweating even in cool weather	Always Often At-Times Seldom Never		
18. Eye pains with no known disorder	Always Often At-Times Seldom Never		

continued

APPENDIX A - Continued

COLUMN A Underline the response which best describes you.	COLUMN B How many years?	COLUMN C Degree of discomfort
19. Severe skin itching ..... Always Often At-Times Seldom Never		
20. Spells of dizziness..... Always Often At-Times Seldom Never		
21. Difficulty in breathing..... Always Often At-Times Seldom Never		
22. Clouding or misting of vision ..... Always Often At-Times Seldom Never		
23. Secretion of pus or other matter in ear..... Always Often At-Times Seldom Never		
24. Feel physically run down..... Always Often At-Times Seldom Never		
25. Indigestion..... Always Often At-Times Seldom Never		
26. Spells of feeling hot or cold..... Always Often At-Times Seldom Never		
27. Diarrhoea..... Always Often At-Times Seldom Never		
28. Urinate frequently..... Always Often At-Times Seldom Never		
29. Aching of muscles without exercise..... Always Often At-Times Seldom Never		
30. Constipation ..... Always Often At-Times Seldom Never		
31. (Women) Irregular menstruation .. Always Often At-Times Seldom Never		

For the following items, please also indicate (on dotted line) "yes" or "no" as to whether a physician has diagnosed the condition.

32. Asthma..... Always Often At-Times Seldom Never		
33. Essential hypertension (high blood pressure)..... Always Often At-Times Seldom Never		
34. Eczema, Urticaria ..... Always Often At-Times Seldom Never		
35. Hemorrhoids ("piles") ..... Always Often At-Times Seldom Never		
36. Mucous Colitis (spastic colon) .... Always Often At-Times Seldom Never		
37. Rheumatoid arthritis..... Always Often At-Times Seldom Never		
38. Reynaud's Disease..... Always Often At-Times Seldom Never		
39. Sinus headaches..... Always Often At-Times Seldom Never		
40. Migraine headaches..... Always Often At-Times Seldom Never		
41. "Nervous headaches" ..... Always Often At-Times Seldom Never		

continued

PPENDIX A - Continued

COLUMN A						COLUMN B	COLUMN C
or the following items, please also indicate (on dotted line) "yes" or "no" as to whether a physician has diagnosed the ondition.							
2. Ulcerative colitis (intestinal ulcers).	Always	Often	At-Times	Seldom	Never		
3. Peptic (stomach) ulcers.....	Always	Often	At-Times	Seldom	Never		
4. Glaucoma.....	Always	Often	At-Times	Seldom	Never		
5. Rhinitis.....	Always	Often	At-Times	Seldom	Never		

. According to my doctor, the difficulties listed in item(s) number _____ is (are) due to:

. A physical difficulty of mine not listed above is:

. My greatest physical shortcoming is:

. Comments:

APPENDIX B

High Psychosomatic Group: Item numbers checked with occurrence "Always" or "Often," with chronicity greater than two years, and psychosomatic disease syndromes with chronicity greater than two years diagnosed by physician.

Subject No.	Somatization Items
w86	16 : essential hypertension
y83	25 : asthma : hemorrhoids
y119	peptic ulcer
w114	essential hypertension : migraine: nervous headache
y105	4 : 8 : 12 : hemorrhoids : nervous headache
w44	2 : 10 : 24 : 25 : 28 : asthma : migraine
w79	8 : 18 : urticaria : rheumatoid arthritis : nervous headache
w88	2 : 7 : 8 : 10 : 12 : 15 : 20 : 25 : 27 : mucous colitis : nervous headache
w208	13 : 21 : asthma : hayfever
y99	asthma
w47	2 : 13 : 17 : 21 : 24 : asthma : urticaria : nervous headache
y72	1 : 12 : 15 : 24 : nervous headache
y100	3 : peptic ulcer : nervous headache
y6	3 : 17 : 18 : migraine; nervous headache
w138	7 : 10 : 28 : 30 : nervous headache
y108	hemorrhoids : nervous headache
w15	8 : 10 : 12 : 25 : mucous colitis : urticaria
w45	2 : 3 : 4 : 17 : 24 : 25 : hemorrhoids : migraine: nervous headache
w127	8 : 12 : 17 : 25 : 29 : asthma : nervous headache
w83	13 : 21 : asthma : essential hypertension : urticaria

APPENDIX C

Maudsley Personality Inventory

1. Are you happiest when you get involved in some project that calls for rapid action?
2. Do you sometimes feel happy, sometimes depressed, without any apparent reason?
3. Does your mind often wander while you are trying to concentrate?
4. Do you usually take the initiative in making new friends?
5. Are you inclined to be quick and sure in your actions?
6. Are you frequently "lost in thought" even when supposed to be taking part in a conversation?
7. Are you sometimes bubbling over with energy and sometimes very sluggish?
8. Would you rate yourself as a lively individual?
9. Would you be very unhappy if you were prevented from making numerous social contacts?
10. Are you inclined to be moody?
11. Do you have frequent ups and downs in mood, either with or without apparent cause?
12. Do you prefer action to planning for action?
13. Are your daydreams frequently about things that can never come true?
14. Are you inclined to keep in the background on social occasions?
15. Are you inclined to ponder over your past?
16. Is it difficult to "lose yourself" even at a lively party?
17. Do you ever feel "just miserable" for no good reason at all?

18. Are you inclined to be overconscientious?

19. Do you often find that you have made up your mind too late?

20. Do you like to mix socially with people?

21. Have you often lost sleep over your worries?

22. Are you inclined to limit your acquaintances to a select few?

23. Are you often troubled about feelings of guilt?

24. Do you ever take your work as if it were a matter of life or death?

25. Are your feelings rather easily hurt?

26. Do you like to have many social engagements?

27. Would you rate yourself as a tense or "highly-strung" individual?

28. Do you generally prefer to take the lead in group activities?

29. Do you often experience periods of loneliness?

30. Are you inclined to be shy in the presence of the opposite sex?

31. Do you like to indulge in a reverie (daydreaming)?

32. Do you nearly always have a "ready answer" for remarks directed at you?

33. Do you spend much time in thinking over good times you have had in the past?

34. Would you rate yourself as a happy-go-lucky individual?

35. Have you often felt listless and tired for no good reason?

36. Are you inclined to keep quiet when out in a social group?

37. After a critical moment is over, do you usually think of something you should have done but failed to do?

38. Can you usually let yourself go and have a hilariously good time at a gay party?

39. Do ideas run through your head so that you cannot sleep?

40. Do you like work that requires considerable attention?

41. Have you ever been bothered by having a useless thought come into your mind repeatedly?

42. Are you inclined to take your work casually, that is as a matter of course?

43. Are you touchy on various subjects?

44. Do other people regard you as a lively individual?

45. Do you often feel disgruntled?

46. Would you rate yourself as a talkative individual?

47. Do you have periods of such great restlessness that you cannot sit long in a chair?

48. Do you like to play pranks upon others?

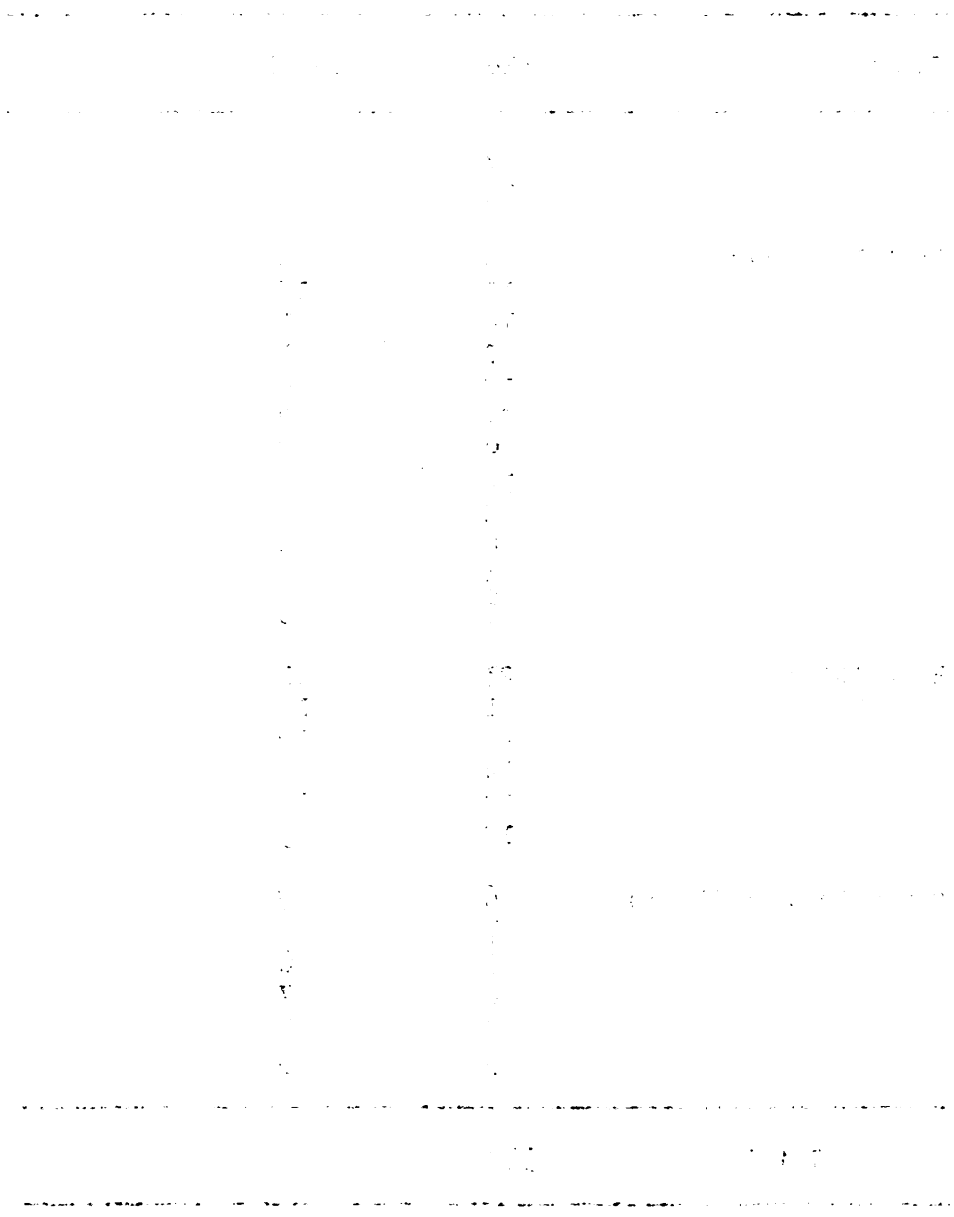
APPENDIX D

VISUAL SHOCK STIMULUS

APPENDIX E

DISTRIBUTION OF 567 SUBJECTS GIVEN PSYCHOSOMATIC INVENTORY AND MPI SCALE ACCORDING TO LECTURE CLASSES

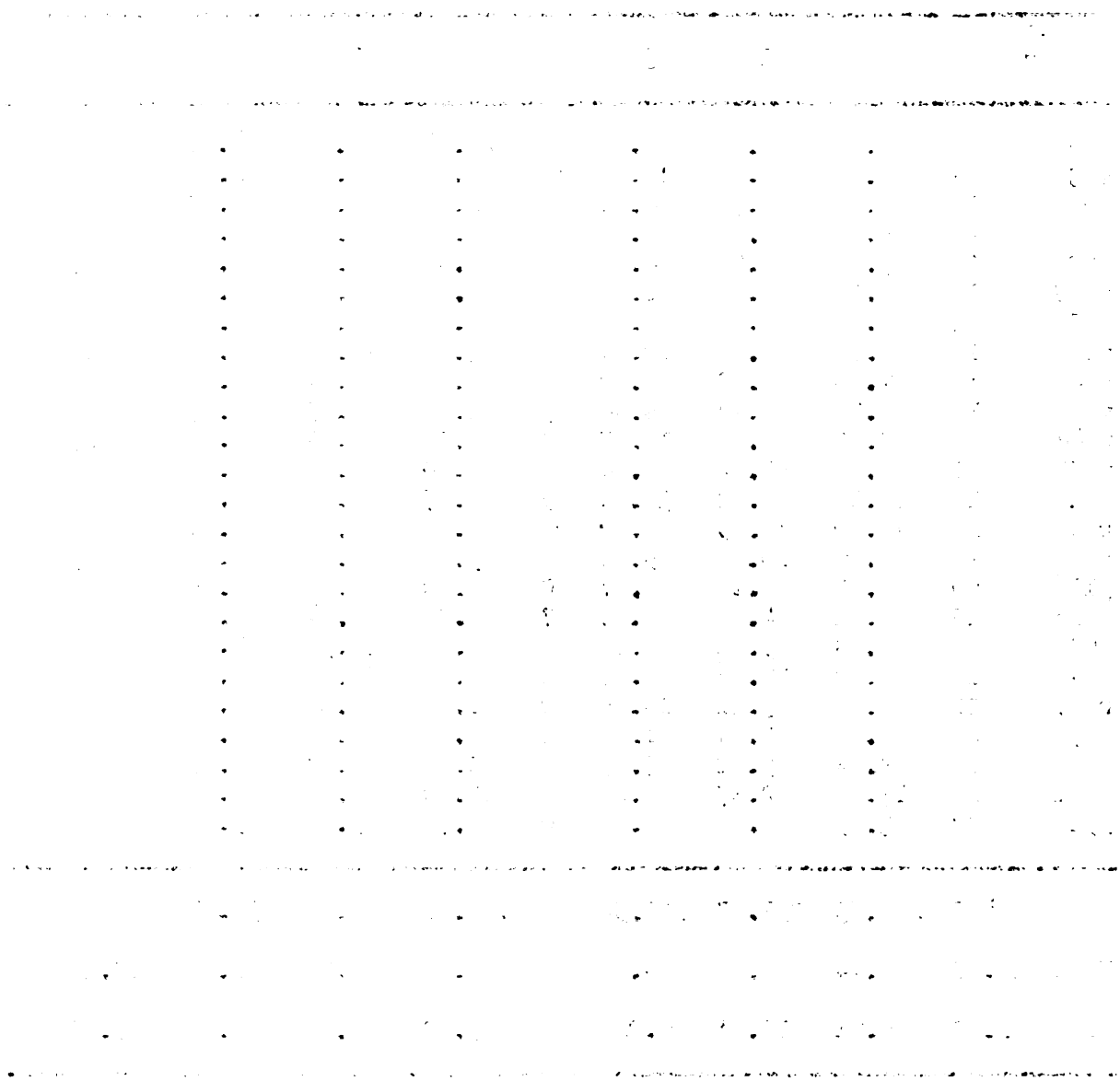
Class	Male	Female
Psychology	27	9
	15	7
Social Science	8	10
	13	12
	18	21
	7	7
	12	9
	21	9
	9	8
	12	9
	8	8
	5	4
	9	9
	9	5
Humanities	23	11
	31	13
	20	12
	14	9
	20	10
	12	9
Communication Skills	6	5
	7	8
	7	6
	8	7
	9	6
	9	5
Total	339	228



APPENDIX F

SCORES ON EIGHT EXPERIMENTAL VARIABLES: LL GROUP

Subject Number	Age	S1	S2	S3	Fr	SC	BL	DLD	N
w22	25	13.42	11.98	16.93	11	21.74	9.11	4.35	14
w73	19	15.34	15.98	13.15	13	15.49	12.97	2.05	14
y29	19	3.04	3.70	4.15	11	2.54	3.03	.20	10
w78	20	15.26	9.82	7.43	13	1.90	13.70	2.13	12
w52	29	3.88	6.04	4.66	19	.52	10.59	2.07	7
y102	19	.04	.82	1.88	0	.31	3.30	.19	10
w42	22	3.47	3.92	2.96	1	6.06	23.92	.90	16
w40	19	10.55	8.57	10.14	17	3.75	11.21	2.19	16
w94	19	7.70	4.60	3.13	4	1.42	32.57	1.44	13
w133	18	.39	1.18	4.34	3	1.20	4.13	.37	19
w144	19	10.82	8.48	17.67	14	2.26	13.83	2.96	17
w173	21	26.19	41.62	20.04	6	2.50	40.00	3.29	19
y51	18	12.13	27.23	32.90	9	2.17	3.29	.30	13
w49	22	16.60	10.65	8.12	20	2.33	4.92	.34	8
y38	18	7.36	10.39	5.31	0	5.71	15.01	7.14	3
y116	20	.04	.18	.27	0	.10	4.58	.05	18
y126	25	4.52	4.20	2.25	7	1.02	31.04	.02	8
w53	20	6.83	5.41	2.49	3	2.29	20.57	3.08	9
y74	18	16.03	37.76	23.85	2	13.75	20.53	4.03	20
w115	22	4.10	3.21	15.05	10	2.74	3.33	.14	8
w17	20	6.25	3.44	1.24	2	6.30	12.72	6.20	10
y27	18	3.64	5.02	3.45	15	1.08	21.37	1.05	21
y121	19	17.28	2.37	3.25	2	12.40	22.08	4.48	6
y52	20	3.45	4.70	4.38	0	.74	45.66	5.36	19
Sum	495	209.73	231.87	220.54		111.22	397.06	53.01	320
Mean	20.62	8.74	9.66	9.19		4.63	16.54	2.42	13.33
SD	2.92	6.71	10.91	9.28		5.62	12.25	2.09	5.25



SCORES ON EIGHT EXPERIMENTAL VARIABLES: LH GROUP

Subject Number	Age	S1	S2	S3	Fr	SC	BL	BLD	N
yl15	19	.98	10.33	.59	4	2.82	3.21	.62	34
y75	18	6.28	3.87	4.63	0	.21	31.06	5.98	43
wl57	22	1.00	3.11	4.25	11	2.46	2.82	.45	32
y76	18	1.83	.82	.85	0	.81	19.76	4.34	24
yl18	19	15.25	15.52	9.95	5	13.84	28.65	.59	32
wl12	25	1.88	4.88	2.74	1	1.94	21.69	6.23	32
y61	19	14.68	18.12	7.63	8	18.45	26.04	3.11	32
w87	24	8.23	9.63	8.62	13	.39	22.93	2.71	32
w48	19	.03	.60	.62	0	.19	2.36	.10	32
wl77	21	6.81	11.79	9.64	12	8.73	3.42	.54	33
wl60	20	2.49	5.87	6.49	10	11.64	5.70	2.50	22
w201	22	11.05	8.15	6.70	6	9.57	21.19	1.43	22
y30	19	7.11	5.60	6.64	13	.94	6.26	8.82	36
w81	20	8.76	9.98	6.23	6	6.75	18.08	2.97	39
wl54	22	56.16	53.57	128.57	17	34.34	21.23	1.97	29
y34	20	.31	1.46	3.66	0	1.30	11.31	6.20	29
w51	17	34.82	10.44	13.11	8	21.42	5.13	7.22	30
y76	18	8.01	10.35	23.14	20	2.12	10.29	1.87	27
wl53	22	2.61	4.46	.44	4	.61	16.08	1.13	31
w28	19	.23	.52	11.83	0	.37	3.48	.78	39
Sum	403	188.47	189.07	256.33		138.90	280.69	59.56	630
Mean	20.15	9.42	9.45	12.82		6.94	14.03	2.98	31.50
SD	2.11	13.62	11.49	27.76		9.12	9.67	2.59	5.11

SCORES ON EIGHT EXPERIMENTAL VARIABLES: HH GROUP

Subject Number	Age	S1	S2	S3	Fr	SC	BL	BLD	N
w86	20	1.67	1.93	1.44	1	.16	19.76	.40	26
y83	20	5.98	51.22	46.00	1	16.50	33.33	3.71	42
y119	18	15.01	5.36	8.99	16	.76	6.73	1.98	22
w114	20	10.46	16.63	14.43	0	12.99	22.12	3.91	25
y105	27	11.30	11.90	5.05	20	.36	14.29	4.47	27
w44	26	12.29	13.59	10.41	10	4.60	19.46	1.03	38
w79	23	6.42	9.04	13.47	8	3.34	17.64	.57	22
w88	22	8.39	9.69	8.09	1	18.42	12.54	7.81	24
w208	20	86.38	33.33	80.00	12	22.85	8.78	1.82	11
y99	20	1.19	1.54	1.42	2	3.99	12.55	5.00	32
w47	19	122.49	125.38	115.74	7	23.50	12.07	2.95	32
y72	18	23.15	12.16	10.61	15	7.05	14.68	1.92	34
y100	21	33.19	13.71	8.84	7	17.79	26.81	2.83	23
y6	20	4.81	12.88	5.55	13	21.48	8.19	4.15	32
w138	20	8.44	3.66	1.26	2	9.94	44.05	2.56	40
y108	19	.49	2.88	3.25	6	6.60	3.59	1.22	33
w15	24	4.62	2.04	3.50	0	2.34	16.42	10.06	34
w45	20	.73	11.24	3.76	2	8.61	2.13	.31	42
w127	19	8.99	6.04	3.70	0	3.39	4.99	.68	27
w83	25	1.91	2.34	2.89	3	.85	13.66	.33	28
Sum	421	367.91	346.56	348.50		185.53	313.78	57.71	595
Mean	21.05	18.40	17.33	17.42		9.28	15.69	2.88	29.75
SD	3.20	31.03	28.07	29.74		8.09	10.22	2.57	7.77

APPENDIX G

FACTOR LOADINGS OF EIGHT EXPERIMENTAL VARIABLES FOLLOWING VARIMAX ROTATION

Variable	Factor 1	Factor 2	Factor 3
S1	.772	.322	-.303
S2	.818	.555	-.096
S3	.933	.268	-.079
Fr	.932	-.159	.252
SC	.296	.799	-.019
BL	-.003	.013	-.947
BLD	.063	.330	-.446
N	-.172	.254	-.020

APPENDIX H

SAMPLE PORTION: PGR RECORD, RESTING STATE (above) AND STRESS PHASE (below)