INDIVIDUAL DIFFERENCES RELATED TO STRESS

BY

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ABSTRACT

The purpose of this study was to determine whether differences in how people respond in a stressful situation might be related to underlying differences in personality and cognitive functioning. The four individual differences selected for study were conceptual complexity, type A behaviour pattern, locus of control, and trait anxiety. The study consisted of two sessions, one in which the subject completed the four questionnaires, and the second in which he participated in a stress experiment. During the second session the subject was allowed to practise a difficult visual-motor task for seven trials, and then on the eighth trial was required to compete against another student who was actually a confederate of the experimenter and performed the task exceptionally fast. Heartrate was recorded throughout the experiment as a physiological measure of stress, pleasantness ratings were obtained as a more cognitive, evaluative measure, and performance on the task was recorded as a behavioural measure of stress.

None of the personality dimensions was related to how stressed the subjects became physiologically, as measured by heartrate, or to how well they performed under stress. However, there were significant differences between internals and externals in terms of how pleasant they experienced the stress, internals reporting higher levels of pleasantness than externals. Significant intercorrelations among the personality variables were found as well (conceptual complexity and

Type A behaviour; locus of control and anxiety), and these as well as the other findings were discussed in terms of the importance of cognitive factors in the experience of stress.

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INTRODUCTION

This study will explore the relationship between four pre-selected personality dimensions and the stress response of subjects placed in a competitive situation. The aim will be to identify those personality characteristics which are most associated with high levels of physiological arousal and subjective unpleasantness. The four dimensions which have been selected are: Conceptual Complexity (Harvey, Hunt and Schroder, 1961; Schroder, Driver and Streufert, 1967), Type A Behaviour Pattern (Friedman and Rosenman, 1974), Locus of Control (Lefcourt, 1976), and Trait Anxiety (Spielberger, 1970).

A review of the literature on stress reveals an immense diversity and complexity of definitions and theoretical perspectives. The focus of research extends from the microscopic to the macroscopic, from isolated biochemical reactions and neurological processes to complex behaviour in individuals, groups, and cultures. Several symposia (Appley and Trumbull, 1967; McGrath, 1970; Sarason and Spielberger, 1975; Spielberger, 1972) have reflected a concern for a greater synthesis of interest and empirical findings from a range of different disciplines.

Hans Selye (1976) pioneered some of the early work in the field of stress with his interest in the biological pattern of adaptation to diverse kinds of stressors. It was this apparently predictable program of adaptation which for him represented the stress response, and he came to define stress as "the nonspecific response of the body

to any demand" (1976, p. 1). Although this definition has been the subject of much debate and criticism both because of its rather all-encompassing vagueness (eg., Arnold, 1967) and because of its insistence upon the nonspecificity of the stress response (eg., Lacey, 1967), it has the distinct advantage of being a holistic definition which focuses on the totality of adaptive changes which can be elicited by any kind of stressor, physical or cognitive.

To Selye (1976), the biological pattern of adaptation represents a prototype of a more generalized principle in human functioning, and just as the body's defenses are sometimes inappropriately vigorous and eventually even maladaptive (eg., an allergic reaction), so too the automatic patterns of learned behaviour which constitute personality can be potentially maladaptive. The elicitation of alarm in a genuinely dangerous situation for example, would be an adaptive response facilitating immediate action, while the same state of alarm in a more innocuous situation would only result in unnecessary stress on the whole person. It is Selye's belief that man can and must acquire the ability to selectively attune himself to environmental demands by deliberately modifying his automatic response tendencies when they prove to be maladaptive. To Selye this is the secret to successful living in modern society.

This same belief in the role of self-conscious change and cognitive control over one's responses to personal stresses as the necessary impetus for effective coping has been the central tenet of several psychotherapies (eg., Ellis, 1963; Glasser, 1965; Meichen-

baum, 1977). It has also been reflected in a vast body of stress research where there is a growing emphasis on the mediating influence of cognitive processes in the interpretation and appraisal of a stressful situation (eg., Lazarus, 1966), the anticipation of and preparation for a stressful event (eg., Arnold, 1967; Averill, 1973; Lazarus, Averill and Opton, 1974; Mandler, 1972), and the organization and effectiveness of subsequent coping behaviour (eg., Meichenbaum, 1977).

This is an age of decreasing physical hardship but accelerating psychosocial demands, and current medical research is clearly showing the extent to which these take their toll on physical and mental well-being (Friedman and Rosenman, 1974; Holmes and Masuda, 1974: Rahe, 1974). Such research underscores the growing need for even more information about the characteristics of people at high risk for stress-related disorders of health and how they might cope more effectively and adaptively with the stresses in their lives. This need has been answered in part by a rapidly proliferating body of self-help books which have popularized various relaxation techniques and a new self-awareness and health-consciousness. It is also being met through the research contributions of investigators like Suinn (1975) and Meichenbaum (1977) who have shown that the modification of cognitive strategies used in preparing oneself for a stressful situation can produce a more effective style of coping. In both circles, the lay and the scientific, the emphasis seems to be more on finding ways of guiding people toward effective inner change

rather than trying to remove all the potential stressors in the outer world of events.

This emphasis reflects an awareness of the fact that stress is the very essence of change and growth, and that the goal of research is not to eliminate stress, but to determine at what levels and in what ways people can optimally channel it to facilitate their own growth and well-being. Zubek's (1969) research has shown that excess stimulation or demand is not the only way to cause human distress. A lack of stimulation is also distressing and can result in a loss of psychological integrity. Selye (1976) has been one of the leading advocates of the view that stress is neither good nor bad; it is simply a state of arousal which is an inherent consequence of an active and challenging existence. It is how one perceives the experience and how one subsequently attempts to cope with it which ultimately tinges the experience as pleasant ('eustress', Selye, 1976) or unpleasant ('distress'). According to Selye, the person who is able to learn to respond selectively and rationally to the demands in his life, and in proportion to the seriousness of those demands, will maintain a satisfying equilibrium with his world and minimize the distress.

This ability to respond appropriately and rationally in a stressful situation is really the critical focus of stress research. People differ greatly in the extent to which they tend to feel threatened by events in their lives, with some people tending to perceive threat around every corner and always overreacting to that threat, and others

remaining relatively more impervious to threat (Spielberger, 1970). Some people seem to prefer to confront a stressor and become actively involved in working through it, while others respond more helplessly with avoidance and withdrawal (Barrell and Price, 1977). Some people tend to cope with excessive demands by accelerating the pace of their everyday activities to ridiculous and self-defeating proportions, while others pace themselves more appropriately (Friedman and Rosenman, 1974). Each of these coping styles represents a particular behavioural adaptation to stress which tends to be associated with its own set of physiological effects and which is more or less effective in helping the individual through the stressful experience with a minimum of ill-effects. It is these individual differences in how stressed people become, how they interpret that stress, and how they attempt to cope with it which researchers must explore to determine whether there are characteristic styles of functioning which are more adaptive in terms of both the short and the long-term well-being of the total person, and whether there are identifiable personality traits associated with these differences in coping.

Research of this kind provides an essential base of information for psychological practitioners who wish to help their clients deal more effectively with the stresses in their lives. The goal of the present research is to determine whether some of the differences in how people respond in a stressful situation might be associated with certain personality features, and four personality dimensions have been selected for this purpose. Perhaps if we knew more about what

kinds of people are most vulnerable to the 'distress' of living, or in what kinds of situations certain kinds of people are most likely to be distressed, we might be able to help people toward a better understanding of themselves. According to Selye (1976) such a form of self-understanding must be the first step in learning to modify and control one's responses to stressful life events.

Conceptual Complexity

The common thread in the theories of cognitive balance (eg., Heider, 1958; Newcomb, 1953) has been the notion that man's cognitive structures tend to be organized into homeostatic, balanced units which minimize inconsistency and threat of change. Festinger (1964) has developed this notion into the theory of cognitive dissonance. Adorno et al (1950) and Rokeach (1960) have capitalized on a similar notion in describing the resistance and inflexibility of the authoritarian personality and the closed mind. The fundamental observation of each of these investigators has been that any tendency toward changing one's most central ideas about oneself and one's world represents a threatened change in the pattern of one's relatedness to the world and is experienced as inherently stressful.

Harvey, et al (1961) and Schroder, et al (1967) have proposed a comprehensive theory of personality development and organization based upon the idea that conceptual systems progress from concrete structure and simple integrative capacity toward more abstract,

structure and more complex integrative capacity. The fundamental unit is the 'concept' which is the mediating link between subject and object. It is the cognitive schema representing a particular unit of experience to the individual. Conceptual system begin to develop at birth as the infant assimilates the data of experience. Given certain optimal environmental conditions of complexity and challenge which enrich and diversify the young child's experience of the world without threatening to overwhelm him, conceptual systems will develop toward maximum abstractness and complexity. In short, this means that the individual will tend to perceive and assimilate the data of experience more easily and flexibly, that he will use such information to generate complex beliefs, attitudes, and behaviour, that he will be more open to the conflict and ambiguity of life, and less likely to feel threatened by change or inconsistency in his world (Harvey and Ware, 1967; Schroder et al, 1967; Suedfeld, 1964).

People who are conceptually less complex are typically antagonistic toward change. They prefer and excel in situations where the demands are simple and concrete (Ware and Harvey, 1967), they tend to perceive more inconsistency in the world and are more upset by it (Harvey and Ware, 1967), they tend to perceive the world in terms of black-white alternatives and stereotyped dictates, and they generally have a much lower tolerance for ambiguity and stress (Bottenberg, 1969; Schroder et al, 1967).

The difference between complex and less complex people which

is most relevant for stress research is the fact that while more complex people are able to draw from past experiences to actively create new integrations and interpretations of present experiences, less complex people tend to behave as if the world were rigidly fixed. In an environment of constant change and novel demands requiring innovative responses, the stereotyped and inflexible behaviour of the less complex person could become maladaptive. Less complex people revert more quickly to primitive, concrete functioning in the presence of stressors, while more complex people continue to remain open and attentive to the experience (Schroder et al, 1967; Suedfeld, 1964).

The need to derive order and meaning from the world, to make sense out of the data of experience while still maintaining a meaningful integrity of the self, has been a recurrent theme in much stress and anxiety research. As early as 1939 Goldstein for example, reported from his work with brain-damaged patients that even minute changes in the structure of their surroundings tended to produce overwhelming distress. More recent work has still revolved around the idea that any interruption in the ongoing organization and assimilation of experience is inherently stressful (eg., Epstein, 1972; Mandler, 1972; McReynolds, 1976). Such interruptions and the anxieties they arouse are however the very essence of life, and situations which provoke incongruence by exposing the individual to conflicting or undesirable information about himself or his world should ideally be conceived as growth-enhancing opportunities. However, all too often such situations provoke distress rather than personal growth when they

threaten the overall stability of the self (Epstein, 1972) or when they expose the individual to demands for which he has no effective repertoire of responses (Mandler, 1972). It is precisely in situations of this sort that the flexibility, openness, and innovative behaviour of the complex individual should be of greatest advantage.

Type A Behaviour Pattern

Both medical and psychological researchers have recognized the tremendous importance of cognitive factors in the maintenance of a state of heightened arousal (Johns, 1973; Lazarus, 1966), but research is just beginning to explore the relationship between specific coping strategies and the physiological adaptations which accompany them. One such line of research has been carried on by Friedman and Rosenman (1974) who have rigorously studied a cluster of behavioural traits which are strongly implicated in the development of coronary heart disease. Extensive studies, both retrospective and prospective, have shown that this particular pattern of behaviour which they have labelled "type A behaviour pattern" is a more significant contributor to the development of coronary disease than either hypertension or blood cholesterol (Friedman and Rosenman, 1974). It is the chronic disposition to treat life as a continous struggle against time and other people and the accelerated pace of all activities which are the characteristic features of this behaviour pattern.

Other researchers have suggested that the time urgency, competitiveness, and overstriving of the type A person represent an attempt to exert control over the environment (Glass, 1977). In other words, this particular pattern of behaviour represents an adaptation to the stress of too many demands and a perceived lack of personal control. The type A pattern is not only a threat to physical health, but also a sign of increasing psychological rigidity and stereotypy. Considering that over 50% of the American population is estimated to be of the type A disposition, and that coronary heart disease is one of the leading causes of death in our society, (Friedman and Rosenman, 1974) the maladaptiveness of this style of coping with stress is a serious problem. Future research will hopefully continue to identify which specific kinds of environmental stressors are likely to provoke the type A pattern of behaviour and which specific aspects of the pattern are responsible for such a heightened susceptibility to cardiovascular disease.

Locus of Control

There is a large body of research which indicates that people who believe that they can exert some control over a stressor actually experience less stress than people who feel helpless to control or avoid the stressor (Averill, 1973; Glass et al, 1971; Kaufer and Goldfoot, 1966; Pervin, 1963). The belief that one is capable of controlling or withstanding the stressor, which can be enhanced by

increased availability of information about the stressor and prestress instruction in how to cope with it (Langer et al, 1975; Lazarus and Alfert, 1964), seems to facilitate cognitive preparation for the stressor and a coping style of active confrontation and working through the stress. This in turn, is associated with greater coping effectiveness and less subjective distress.

One approach to the study of stress and coping has revolved around the idea that it is in the situation as perceived and construed by the individual that threat exists, and that it is the perceived inability to respond effectively which creates distress (Lazarus, 1966; Mandler, 1972; Sells, 1970). Whether the inability to respond is an objective appraisal of reality or a subjective distortion, the fact remains that the belief that one is helpless only magnifies the threat and actually inhibits effective coping. Certainly the extent to which one believes he is in control is likely to vary from individual to individual and within the same individual depending on the nature of the stressor. Nevertheless, there may be some element of personal style involved as well, with some people engaging themselves in an internal language of self-deprecation and others tending more towards self-confirmation and reassurance. (Meichenbaum, 1977). Typically, people who engage themselves in self-communications which are positive and reassuring are better able to prepare themselves cognitively for stress. As a result, they develop a greater sense of being in control and they ultimately cope more effectively.

The belief in personal control and the confidence in one's ability to cope with a particular stressor are perhaps the most crucial determinants of coping style and effectiveness. If people are to assume command of their immediate responses in a stressful situation and deal rationally with the threat as Selye suggests they should (1976), they must first believe that they actually have the ability to exert some degree of control. They must have some expectancy of success. Research suggests that expectancy of control is a dispositional variable of quite generalized applicability, and that people tend to have a characteristic style of either believing that they themselves are responsible for and in control of the events in their lives, or that their lives are in the control of some external force of luck or fate. This style has been studied for many years as a generalized trait under the name 'locus of control' (Lefcourt, 1976). One would expect that people who are relatively internal in their perceived locus of control would be more likely than externals to engage in effective coping behaviours, including cognitive preparation, self-reassurances, and a more active style of working through the stress. These people would be more adaptive under a wider range of stressful situations.

Trait Anxiety

According to Selye (1976), the only way to overcome the constant threats and demands of contemporary society is to rationally and

deliberately modify one's automatic response tendencies, weighing the seriousness of the threat and responding appropriately. Such a perscription would be particularly well directed at the high 'trait anxious' individual who tends to perceive threat in a wide variety of situations and who constantly overreacts to that threat (Spielberger, 1970).

The person who scores high in trait anxiety reports that he generally feels unhappy, overburdened, tense, and insecure, and that he tends to perceive life as a succession of difficulties and unpleasant experiences. It is possible of course that some of this negative world-view is objectively justified. However, if anxiety is thought of as a state of diffuse, undirected arousal following threat, with the crucial feature of the anxious state being the unavailability of an appropriate avenue of response (Epstein, 1972), then high trait anxiety may be a reflection of a generalized tendency to feel helpless in stressful situations. Active involvement in working through a stressful situation would tend to inhibit helplessness and anxiety by promoting a sense of personal effectiveness. Perhaps the trait anxious individual tends to engage in avoidance and denial strategies which would magnify the seriousness of the threat, emphasize his sense of helplessness, and increase his distress rather than engaging in cognitive work aimed at constructively preparing for a stressful event. As a result he cannot envision himself coping effectively and he perceives himself as victimized and helpless.

Hypotheses

The four personality dimensions which have been outlined would seem to be important determinants of the organization and effectiveness of coping behaviour in a stressful situation. In order to test this hypothesis subjects were placed in a stressful experimental situation and physiological, cognitive and behavioural measures of stress were recorded. The stressor was a one-minute competition on a complex task with another first year student. Performance on the task was the behavioural measure of stress, and since the task was selected on the basis of its complexity, it was predicted that performance would tend to deteriorate among those subjects who became most stressed. A self-report measure of stress was included to determine whether subjects differed in how they interpreted the stressful experience. Since Selye (1976) has argued that stressful experiences need not be automatically conceived as 'distressful', it seemed appropriate to try and measure how pleasant the subjects found the situation, and to determine whether such a dimension could be meaningfully related to the other stress measures and to any particular personality type.

(1) More complex subjects should be expected to be generally more open and attentive to a wider scope of information about themselves, and less threatened by the uncertainty and conflict of competition. Since they are more likely than less complex subjects

to perceive themselves and their abilities along several dimensions, performance on the task and the possibility of failure should be perceived as less centrally related to their sense of self-worth. It was predicted on the basis of such reasoning that more complex subjects would tend to be less stressed physiologically, that they would be less likely to experience the situation as unpleasant, and that their performance under stress would remain the same or improve.

(2) Subjects classified as type A's should be expected to respond to the inherent threat of competition with the increased efforts at gaining control which are so typical of their style of coping with stress. On the basis of such reasoning it was predicted that type A's would become more stressed physiologically than B's, that they would tend to experience the situation as more unpleasant, and that their performance would tend to deteriorate.

(3) Subjects classified as internal in their perceived locus of control should have a greater sense of confidence and effectiveness in their ability to act successfully in a stressful situation. On the basis of such reasoning it was predicted that they would become less stressed physiologically than externals, that they would tend to experience the situation as less unpleasant, and that their performance under stress would remain the same or improve.

(4) Subjects classified as high in trait anxiety should be expected to be highly sensitive to the threat of competition. On the basis of such reasoning it was predicted that high anxious

subjects would become more stressed physiologically, that they would tend to experience the situation as more unpleasant, and that their performance would tend to deteriorate.

METHOD

Subjects

Forty-eight first year introductory psychology students volunteered to participate in this experiment. Each received two credits toward their final mark in the course. The sample consisted of 12 males and 36 females, all between the ages of 18 and 25 except for one woman, aged 45. None of the subjects had ever participated in a psychology experiment before.

Apparatus

During the preliminary testing session four tests were administered. These were: the Paragraph Completion Test of conceptual complexity (Schroder, Driver and Streufert, 1967), the student version of the Jenkins Activity Survey for health prediction (Krantz, Glass and Snyder, 1974), Rotter's Locus of Control scale (Rotter, 1966), and the State-Trait Anxiety Inventory (Spielberger, 1970).

(1) The Paragraph Completion Test

Many measures of conceptual complexity have been developed over the years under various construct names (eg., Barron, 1953; Bieri, 1955; Budner, 1962; Kelly, 1955; Pettigrew, 1958; Scott, 1962).

However, the paragraph completion test (PCT) appears to be one of the most useful and well-validated in current usage.

The PCT is a semi-projective test which requires the subject to respond to several unfinished sentence stems expressing ideas of uncertainty (eg., "when I am in doubt"), and interpersonal conflict (eg., "when I am criticized"). One stem appears at the top of each page, and the subject is instructed to write two or three sentences in response to each. In the present study each subject was allowed exactly two minutes for each stem.

The forty-eight protocols obtained in this study were scored by a trained rater (Elizabeth Ballard, University of British Columbia). Each item response was independently scored along a seven-point scale extending from low to high complexity. The specific criteria for scoring are outlined in Schroder et al (1967). Then, an average complexity rating was made by averaging the two highest scoring (ie., most complex) stems. The result was a complexity score which could range anywhere from 1 to 4. For the present study a second rater scored five of the protocols as a reliability check, and the ratings were basically the same.

Inter-rater reliability for this test varies from .80 to .95 with two trained and independent raters (Bottenberg, 1969; Schroder et al, 1967). When sentence stems are properly scored verbal fluency is not a significant influence (Gardiner and Schroder, 1972). There is however a significant correlation between intelligence, as

measured by a variety of tests, and conceptual complexity (Schroder et al (1967). This should not be thought of as a confounding influence however since theoretically the link between intelligence and conceptual complexity should be strong if intelligence tests measure even in part the abstractness and complexity of cognitive structures.

(2) The Jenkins Activity Survey (student version)

The original identification of type A behaviour pattern was made on the basis of a standard taped interview which was later rated according to certain criteria such as the expression of time urgency, hostility etc., A more standardized approach was made possible with the development of a self-report questionnaire, the Jenkins Activity Survey for health prediction (JAS), and several recent revisions (Jenkins, Rosenman, and Zyzanski, 1972), one of which is a student version (Krantz, Glass, and Snyder, 1974).

The student version consists of 44 items, 21 of which are used to measure type A behaviour. Theoretically a subject's score could range from 0 to 21, with higher scores indicating high type A, but in actual practise the majority score between 7 and 8 (Glass, 1977), and a score above 8 is usually considered indicative of a type A individual.

The original validation of the questionnaire was done on 3500 men who were engaged in a prospective study of heart disease (Rosenman et al, 1964). Subsequent follow-up examinations confirmed that the

diagnosis of the pattern was reliably consistent for both the interview and the questionnaire methods, and remarkably predictive of future heart disease (Rosenman et al, 1966).

(3) The Locus of Control Scale

Rotter's scale (1966) is a forced-choice questionnaire with pairs of statements making up each item. One of the alternative statements in each pair reflects greater externality. The scale is scored by summing the total number of external statements agreed with from each pair. Thus, the higher the score, the greater the externality. Six of the 23 items are fillers designed to make the scale less reactive. The remaining 17 items were adapted by Rotter from James' 60-item scale (1957).

An extensive body of normative data is available for Rotter's scale (Lefcourt, 1976). Some of the various populations of subjects studied include students at an undergraduate level, such as Introductory Psychology students.

The test-retest reliability of the scale has been reported as ranging from .55 to .72, depending upon the length of time between testings (Rotter, 1966), and from .49 to .83 (Hersche and Schiebe, 1967). The main criticism which has been raised against Rotter's scale is that it tends to be very reactive, and correlations between scores on Rotter's scale and measures of social desirability range from ±.07 to -.35 (Hjelle, 1971; Joe, 1972; Lefcourt, 1974; Rotter, 1966).

(4) The State-Trait Anxiety Inventory

The State-Trait Anxiety Inventory (STAI) consists of two separate scales for measuring trait anxiety and state anxiety (Spielberger, 1970). The A-trait scale consists of 20 statements, and the subject is required to respond according to how he generally feels. Examples of the statements are "I am happy", "I feel secure", "I feel pleasant", and the subject can respond according to four response categories, 'almost never', 'sometimes', 'often', or 'almost always'.

The range of possible scores is from 20 to 80, with a high score indicating high trait anxiety. Normative data for large samples of college students are available in the manual (Spielberger, 1970). The test-retest reliability of the A-trait scale varies from .73 to .86 (Spielberger, 1970).

During the second experimental session subjects were required to perform a task alone and in competition, and four dependent measures were used to monitor how much stress they experienced: a physiological measure (tonic heartrate), a cognitive measure (perceived pleasantness), and two behavioural measures.

(1) Tonic Heartrate

Continuous heartrate recordings were made by means of a polygraph with a finger pickup transducer (Gilson Model M5R). The polygraph was situated behind a set of shelves so that the subjects could

not see the recording.

The use of any single physiological measure of arousal has been the subject of much debate in the literature (Elliott, 1969, 1972, 1974; Lacey, 1967, 1974), and the current trend is toward a more multimethod approach in measurement (Laux, 1976). However there is good evidence in the literature that heartrate is a useful measure of changes in arousal in situations involving incentive manipulations and task performance (Elliott, 1974), and that increases in tonic heartrate are a good indicator of cognitive stress (Blix, Stromme, and Ursin, 1974).

(2) Perceived Pleasantness

Subjects were instructed in the rating of pleasantness by referring them to an eight inch by eleven inch pleasantness scale can be found in Appendix 1. This was a 21 point scale which was labelled from 'extremely unpleasant' to 'extremely pleasant' at the extremes, and 'neither pleasant nor unpleasant' at the middle. The subject was instructed to select the number which represented most accurately his present perceptions.

(3) Digit-Letter Substitution Task

Each Subject was required to perform eight variations of a digit-letter substitution task, one of which has been reprinted in Appendix 11. The task involves copying letters as quickly as possible beneath

a series of numbers according to a given code. However, the letters were to be printed backwards and upsidedown by the subject, even though the letters appeared printed normally in the code itself. It was thought that such a task would be fairly complex.

Procedure

In the first of the two experimental sessions each subject was asked to complete the four questionnaires in an office where there was complete privacy and confidentiality was assured. Appointments were scheduled at this time for the second part of the study, but no information was offered as to its nature.

As the subject arrived for the second session he was greeted and asked to be seated at a table in a laboratory room of standard office size. He was informed that his heartrate would be recorded throughout the session, and the plethysmograph was attached to the index finger of his nonpreferred hand. He was then told that at various times throughout the experiment he would be asked to rate how pleasant he found doing something, and that he would be required to give a number from the pleasantness scale. The scale itself was explained thoroughly, and the subject was encouraged to ask questions if anything needed clarification. The subject was reassured that nothing harmful would happen to him during the experiment, and he was asked to make himself comfortable and relax completely for five minutes. During that time his heartrate was continuously recorded

and at the end of the five minutes he was asked to make his first rating of pleasantness.

The digit-letter substitution task was then explained very carefully, and the subject was allowed to ask questions. After it was clear that he understood the task the practise trials began. Each trial was 60 seconds long, and started and ended at the sound of a buzzer which simultaneously marked the interval on the polygraph recording. Immediately after each trial the subject was asked to rate how pleasant he had found that trial, and the task was scored in front of him. If there were errors the subject was shown how to correct them, and then the following trial began.

After the seventh practise trial and the seventh rating of pleasantness the experimenter excused herself from the room momentarily and returned with the competitor for the competition trial. The competitor was introduced by name as another first year student, was asked to be seated across the table from the subject, and was also attached to the polygraph by means of a finger pickup. The competitor was in fact a confederate of the experimenter who had practised the task until he was able to perform it at a consistent rate every time.

The subject and the competitor were then informed that they would be competing against each other to see who could perform the task faster. The trial began and ended as before with the buzzer, and the subject and the competitor were asked to rate the pleasantness of the trial. A two minute interval of questionning followed in which the subject was asked if he had heard anything about the experiment

and if he had any ideas about it that he wanted to express. The plethysmograph was left on during this time in order to collect a two minute recovery heartrate.

A complete debriefing followed in which the role of the competitor was explained and questions were encouraged. The purpose of the experiment was explained so that the entire experience of participation in the experiment would be as meaningful and worthwhile as possible. A verbal commitment to confidentiality was obtained from each subject.

The verbatim instructions and procedure have been reprinted in Appendix 111.

RESULTS

The purpose of this study was to determine whether the personality and cognitive differences outlined previously would be related to how stressed subjects became when exposed to the experimental stressor. Table 1 presents the means and standard deviations for each of the four predictor variables for this sample of 48 subjects.

Table 2 presents the correlation matrix for the predictors and indicates two significant correlations: between conceptual complexity and type A behaviour pattern, and between locus of control and trait anxiety.

Four kinds of measures were recorded throughout the study in order to monitor different aspects of the total stress response of each subject. Heartrate recordings for minute intervals corresponding to each trial of the task represent the physiological measure of stress. Perceived pleasantness ratings after each trial represent the cognitive or subjective measure of stress. Quantitative performance on the task, as measured by the total number of substitutions completed including errors, and qualitative performance, as measured by the number of errors made on each of the trials, represent the two behavioural measures of stress. The means and standard deviations for these measures are presented in Table 3 and Figure 1.

Table 1

Means and Standard Deviations for the Predictor Variables

	Mean	Standard Deviation
Conceptual Complexity (CC)	1.86	.50
Type A Behaviour (TA)	7.62	3.21
Locus of Control (LOC)	10.31	3.48
Trait Anxiety (ANX)	39.87	8.17

Table 2

Correlation Matrix for the Predictor Variables

	TA	LOC	ANX
CC	.41***	.007	.12
TA		-.23	-.06
LOC			.41***

* $p < .10$
** $p < .05$
*** $p < .01$
**** $p < .001$

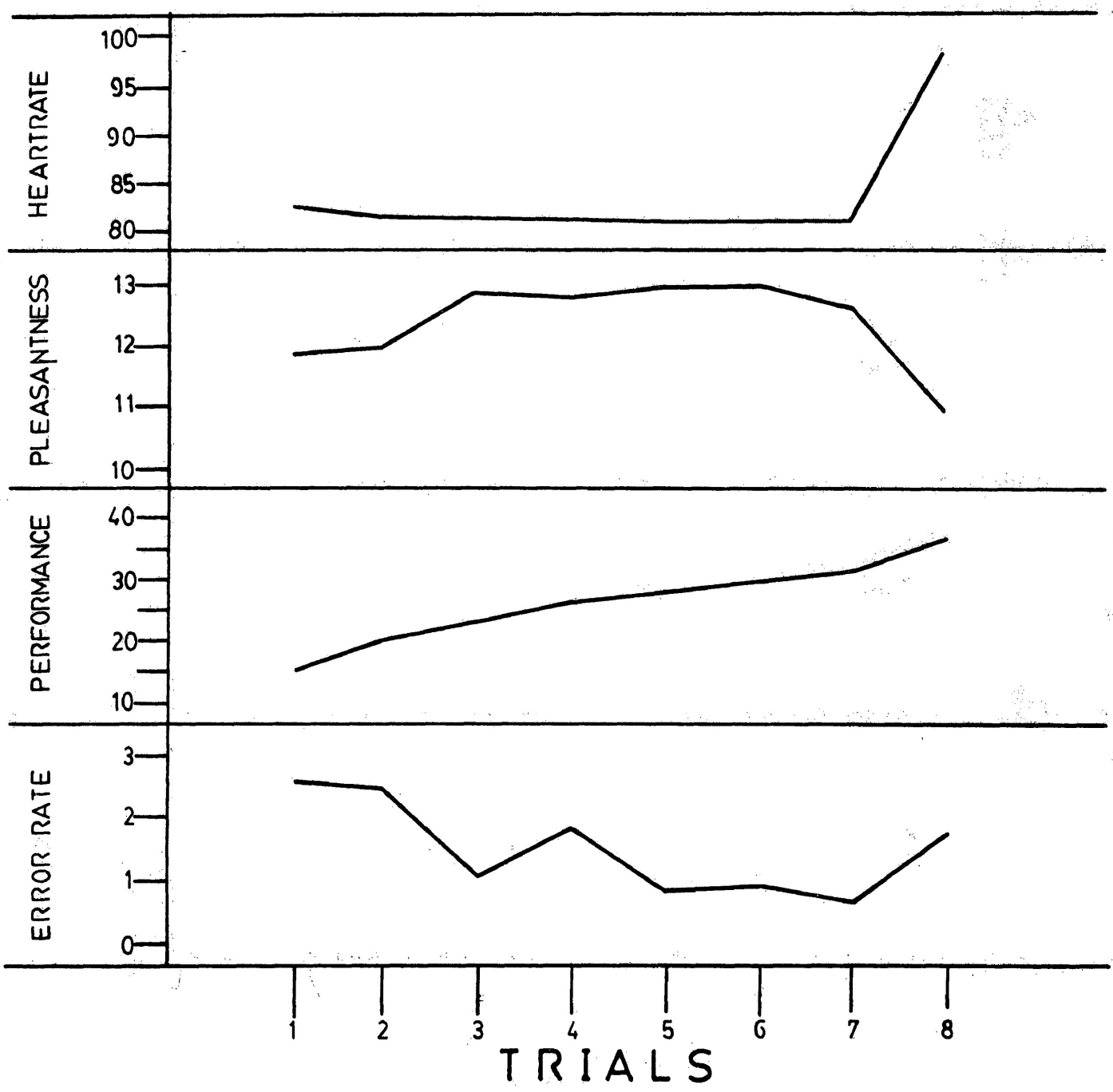
Table 3

Means and Standard Deviations for the Stress Measures

Trial	Heartrate (bpm)		Pleasantness		Performance (# of subs)		Errors	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
1	82.9	12.2	11.8	2.9	15.5	4.9	2.6	2.9
2	81.4	12.2	11.9	2.8	20.1	5.7	2.4	2.3
3	81.4	11.6	12.8	2.6	23.7	6.1	1.1	1.8
4	80.8	11.4	12.7	2.3	26.6	6.5	1.7	2.1
5	80.5	11.4	12.9	2.4	27.9	6.3	0.9	1.5
6	80.8	11.2	12.9	2.4	30.3	6.5	0.9	1.6
7	80.7	11.1	12.6	2.4	31.9	6.4	0.7	1.9
8	98.5	15.8	10.9	2.4	36.7	6.4	1.8	2.1

FIGURE 1

PHYSIOLOGICAL, COGNITIVE, AND BEHAVIOURAL MEASURES ACROSS TRIALS



To determine whether there were significant changes over the eight trials in any of the four stress measures, four repeated-measures analyses of variance were performed. For the heartrate data there were significant differences among the eight trials, $\underline{F} = 88.75$, $p < .0001$. For the pleasantness data there were also significant differences among the eight trials, $\underline{F} = 7.80$, $p < .001$. For the performance data there were significant differences among the eight trials, $\underline{F} = 278.13$, $p < .0001$, and for the error data there were significant differences among the eight trials, $\underline{F} = 8.60$, $p < .0001$.

Then, to determine more specifically whether the introduction of the stressor on trial eight was effective in producing significant changes in each of the stress measures, the Student Newman-Keuls procedure for multiple comparisons was used with a .05 level of significance. The results of the comparisons for the heartrate data indicate that trials 1 through 7 form a homogenous subset of means while the mean heartrate for trial 8, the stress trial, is significantly different from all the others. The same procedure applied to the pleasantness data indicates that the ratings for trials 1, 2, and 7 and for trials 2 through 7 form homogenous subsets, while the rating of trial 8 is significantly different from all the others. The same test applied to the performance data indicates that the average performance on each trial is significantly different from every other trial. To determine whether the performance increment on the stress trial represented an even greater and more significant

increment than those of the preceding trials, a more conservative procedure for multiple comparisons was selected and the significance level was set at the more stringent .01 level. Scheffe's procedure was the one selected. With this more stringent test the performances on trials 1, 2, and 3 were still all significantly different. However, performance on trials 4 and 5 was basically similar, as was performance on trials 5 and 6, and trials 6 and 7. However, performance on trial 8 was significantly different from all of the preceding trials. Returning to the Newman-Keuls procedure for the error rate data, trials 3, 5, 6 and 7 form a homogenous subset, trials 3, 4, 5, 6 and 8 form a homogenous subset, and trials 1, 2, 4 and 8 form a homogenous subset.

A correlational analysis was done to determine whether there were any significant relationships between the four measures of stress, or in other words, to determine whether the four measures were monitoring roughly parallel changes in level of stress, such that changes in one measure were systematically reflected in changes in the others. Correlation matrices were computed between the four measures for each trial, and these matrices are presented in Tables 4 - 10. The matrices are presented in terms of change scores from one trial to the next rather than in raw score form since it is the progressive change in the measures over successive trials regardless of individual differences in the initial scores which is of interest.

Tables 4 - 10 indicate some reasonably consistent relationships over the seven practise trials. In general, performance change and

Table 4

Correlations Among Stress Measures

Trial 1 to Trial 2

	PPchg1	Pchg1	Echg1
HRchg1	.02	.19	-.33**
PPchg1		.05	-.19
Pchg1			.13

* $p \leq .10$
** $p \leq .05$
*** $p \leq .01$
**** $p \leq .001$

HRchg1 = the change in heartrate between trial 1 and trial 2
PPchg1 = the change in pleasantness between trial 1 and trial 2
Pchg1 = the change in performance between trial 1 and trial 2
Echg1 = the change in error rate between trial 1 and trial 2

Table 5

Correlations Among Stress Measures

Trial 2 to Trial 3

	PPchg2	Pchg2	Echg2
HRchg2	.24*	.58****	-.24*
PPchg2		.38***	-.38***
Pchg2			.001

* $p \leq .10$
** $p \leq .05$
*** $p \leq .01$
**** $p \leq .001$

Table 6

Correlations Among Stress Measures

Trial 3 to Trial 4

	PPchg3	Pchg3	Echg3
HRchg3	.31**	.39***	.14
PPchg3		.36***	-.06
Pchg3			.09

* $p \leq .10$ *** $p \leq .01$
** $p < .05$ **** $p < .001$

Table 7

Correlations Among Stress Measures

Trial 4 to Trial 5

	PPchg4	Pchg4	Echg4
HRchg4	.05	.37***	.02
PPchg4		.08	-.005
Pchg4			.33**

* $p \leq .10$ *** $p \leq .01$
** $p < .05$ **** $p < .001$

Table 8

Correlations Among Stress Measures

Trial 5 to Trial 6

	PPchg5	Pchg5	Echg5
HRchg5	.37***	.40***	.13
PPchg5		.53****	.03
Pchg5			.07

* $p < .10$ *** $p < .01$
** $p < .05$ **** $p < .001$

Table 9

Correlations Among Stress Measures

Trial 6 to Trial 7

	PPchg6	Pchg6	Echg6
HRchg6	.19	.31**	-.02
PPchg6		.46**	-.22
Pchg6			-.07

* $p < .10$
** $p < .05$
*** $p < .01$
**** $p < .001$

Table 10

Correlations Among Stress Measures

Trial 7 to Trial 8

	PPchg7	Pchg7	Echg7
HRchg7	-.21	.18	-.11
PPchg7		.22	-.004
Pchg7			.08

* $p < .10$ *** $p < .01$
** $p < .05$ **** $p < .001$

pleasantness change are positively correlated, heartrate change and performance change are positively correlated, and heartrate change and pleasantness change are positively correlated. Table 10 indicates that there are no significant intercorrelations on the stress trial.

The Stress Measures

The data collected during trial 8, the stress trial, will from this point on be referred to as the 'stress measures', while the data from trial 7, the last of the practise trials, will be referred to as the 'basal measures'. Stress heartrate, stress pleasantness, stress performance, and stress error rate were the criterion scores for four separate multiple regression analysis which were done to determine whether there were any significant relationships between the personality measures and how stressed the subjects became. This kind of analysis allows one to isolate and sequentially remove from the total variability in the criterion those proportions of variability which are uniquely associated with each variable in a given set of predictor variables.

(1) Stress Heartrate

The first regression analysis was done using stress heartrate as the criterion, and the variability associated with basal heartrate and sex were removed first in the analysis to ensure that the proportions of variability associated with the personality measures

would be independent of the possible confounding influence of individual differences in basal heartrate and the law of initial value (Wilder, 1967), and differences which might arise between males and females. After removing the variability associated with the basal measure and with sex, the unique proportions of variability associated with each of the four personality measures were removed in order of greatest contribution to the total explained variance. The results of this analysis are presented in Table 11.

Inspection of the table will reveal that the only predictor variable which was associated with a significant proportion of the variability in the criterion (.54) was the basal heartrate measure, F (1, 41) = 54.07, $p < .001$. There was a borderline sex difference which, although not significant at the conventional level, indicates a tendency for the females to be more stressed physiologically than the males, F (1, 41) = 2.98, $p < .10$. None of the personality measures was associated with a significant proportion of the variability.

(2) Stress Pleasantness

The second regression analysis was done using stress pleasantness as the criterion variable, and the variability associated with basal pleasantness ratings and with sex were removed first, followed by the variability associated with the personality measures. Table 12 summarizes the results. The basal measure was again associated with a significant proportion of the variability (.09), F (1, 41) = 5.35, $p < .05$. There were no sex differences. The only personality

Table 11

Multiple Regression Analysis on Stress Heartrate

Variable	Multiple R	R Square	RSQ Change	Simple R	F
Basal HR	.73	.54	.54	.73	54.07****
Sex	.75	.57	.03	.28	2.98*
Conceptual Complexity	.76	.58	.01	-.09	1.11
Type A Behaviour	.76	.58	.00	.07	.52
Locus of Control	.77	.59	.01	-.07	.63
Trait Anxiety	.77	.59	.00	.13	.17

df = (1, 41)

* p < .10
** p < .05
*** p < .01
**** p < .001

measure which was associated with a significant proportion of the variability was the locus of control measure (.11), $\underline{F}$ (1, 41) = 6.44, $p < .05$.

(3) Stress Performance

The third regression analysis was done using stress performance as the criterion variable. Table 13 summarizes the results. The basal measure was again associated with a significant proportion of the variability (.76), $\underline{F}$ (1, 42) = 147.65, $p < .001$, and there was a significant sex difference indicating that females performed significantly better than males, $\underline{F}$ (1, 41) = 4.17, $p < .05$. However, none of the personality measures was associated with a significant proportion of the variability.

(4) Stress Errors

The fourth regression analysis was done using stress error rate as the criterion variable. Table 14 summarizes the results. The basal measure was again associated with a significant proportion of the variability (.13), $\underline{F}$ (1, 41) = 6.91, $p < .05$. There was no sex difference. None of the personality measures was associated with a significant proportion of the variability, but there was a trend worth noting. The locus of control measure was associated with a marginally significant proportion of the variability (.05), $\underline{F}$ (1, 41) = 2.96, $p < .10$.

Table 12

Multiple Regression Analysis on

Stress Pleasantness

Variable	Multiple R	R Square	RSQ Change	Simple R	F
Basal Pleasantness	.31	.10	.10	.31	5.35**
Sex	.31	.10	.00	.02	.04
Locus of Control	.46	.21	.11	-.31	6.44**
Conceptual Complexity	.48	.23	.02	.12	1.18
Trait Anxiety	.51	.26	.02	-.22	1.28
Type A Behaviour	.51	.26	.00	.14	.25

df = (1,41)

* $p < .10$
** $p < .05$
*** $p < .01$
**** $p < .001$

Table 13

Multiple Regression Analysis on

Stress Performance

Variable	Multiple R	R Square	RSQ Change	Simple R	F
Basal Performance	.87	.76	.76	.87	147.65****
Sex	.88	.78	.02	.16	4.17**
Conceptual Complexity	.89	.79	.01	.16	.99
Trait Anxiety	.89	.79	.00	.00	.16
Locus of Control	.89	.79	.00	.05	.07
Type A Behaviour	.89	.79	.00	-.02	.07

df = (1,41)

* $p < .10$
** $p < .05$
*** $p < .01$
**** $p < .001$

Table 14

Multiple Regression Analysis on

Stress Errors

Variable	Multiple R	R Square	RSQ Change	Simple R	F
Basal Errors	.35	.13	.13	.35	6.91**
Sex	.37	.14	.01	-.05	.53
Locus of Control	.44	.19	.05	.15	2.96*
Trait Anxiety	.46	.21	.02	.00	1.13
Conceptual Complexity	.48	.23	.02	.07	1.02
Type A Behaviour	.50	.25	.02	-.20	1.03

df = (1, 41)

* p < .10
** p < .05
*** p < .01
**** p < .001

DISCUSSION

The purpose of the present study was to explore the hypothesis that certain personality and cognitive differences among people might be associated with some of the variability in the way people respond to stressors. Although the theoretical formulations of the four predictors which were selected for this study would suggest such an hypothesis, it is certainly clear from the present results that any differences among subjects in terms of the way they responded and how stressed they became were not consistently associated with those particular differences in personality and cognitive functioning. Some possible reasons for the absence of empirical support will be discussed later in this section. However, to adequately deal with this problem it is first necessary to discuss what actually did occur, how stressed the subjects became, and how this was reflected in each of the stress measures.

Also, it is essential at this point to note that this particular sample of subjects was not atypical on any of the predictor variables. The scores are well within the usual reported range for a college population on the type A measure (Glass, 1977), the locus of control measure (Lefcourt, 1976), and the trait anxiety measure (Spielberger, 1970). There is no normative data available at present for the conceptual complexity measure.

The Stress Measures

In general over the seven practise trials the average level of physiological arousal fell as the subjects familiarized themselves with the requirements of the situation. At the same time the pleasantness of each successive trial gradually levelled off into the 'slightly pleasant' range, performance steadily increased, and the number of errors made decreased.

The results also indicate that changes in performance and changes in pleasantness tended to be highly related on the practise trials, and that the more a subject's performance increased on a particular trial, the more he tended to increase his rating of pleasantness. Since performing the task was the only salient feature of the experimental situation up to that point, it is possible that the subjects would tend to base their ratings of pleasantness on their perception of their improvement on the task, but on the basis of one correlation such an interpretation must be offered only tentatively.

The relationship between heartrate change and performance change indicates that although heartrate tended to decrease over the practise trials while performance steadily increased, the greatest increments in performance from a particular trial to the next one occurred among those subjects whose heartrates increased during that interval. In addition, the positive correlation between heartrate change and pleasantness change would suggest that incremments in physiological

arousal are also associated with greater increases in pleasantness. However, one could speculate that this correlation is simply an elaboration of the former. That is, as heartrate increases so does performance, and it is the increment in performance which is perceived as pleasant.

The introduction of the stressor on trial eight was effective in producing a sudden increase in arousal for the majority of subjects. Although each subject experienced the situation differently, and the magnitude and subjective experience of the stress varied considerably among the 48 subjects, the average increase in heartrate reveals that in terms of the physiological measure the competition was a stressful experience--significantly more stressful than the preceding trials. In addition, the average rating of pleasantness fell on the stress trial, indicating that the competition was not only stressful but subjectively more unpleasant as well. The relationship between heartrate and pleasantness which had been typical of the practise trials, with increases in arousal and improved performance being accompanied by greater perceived pleasantness, is reversed on the stress trial where there is a nonsignificant but notable tendency for the subjects who became most stressed to lower their ratings of pleasantness the most.

While heartrate increased and pleasantness decreased on the stress trial, performance rose sharply and significantly and the error rate rose to a level comparable to the error rate of the first few trials. This finding is the reverse of what had been predicted,

namely that performance would tend to decrease on the stress trial. One would expect that the task of writing letters backwards and upsidedown would be a novel and rather complex task, and consequently one would predict that performance would begin to deteriorate as a subject's level of arousal became superoptimal. The conclusion suggested by the present data is that the task was not in fact as complex as had been thought, and that the level of arousal associated with performing the task in competition was actually sufficient to result in an even further enhancement of performance, but not enough to cause a deterioration in performance. The only qualification to this conclusion is the fact that the error rate increased on the stress trial, reflecting a slight deterioration in the quality rather than the quantity of performance. However, this increase was not enough to be considered significant. So, although it is reasonable to predict an eventual deterioration in performance as task complexity and/or arousal escalates (Hackman, 1970), one must also predict an enhancement of performance at lower, more optimal levels of arousal. Of course, this optimal level of arousal for a given task varies among individuals, and in this connection it is interesting to note that two of the 48 subjects actually performed more poorly on the stress trial than on the last practise trial. The correlation between heartrate change and performance change which had been typical of the practise trials, with increases in arousal being associated with increases in performance, is no longer significant on the stress trial.

It seems that the relationship between arousal and performance is not as consistently predictable for an entire group of subjects who individually have been differentially stressed, and who each in addition must have a different range of optimal arousal for a given task.

The fairly consistent rating of the stress trial as less pleasant than the preceding trial is an interesting finding. The results indicate that there was a tendency for the subjects whose performance improved the most on the stress trial to report a less dramatic drop in pleasantness, but the relationship is not significant. Whereas on previous trials performance change and pleasantness change had been consistently related, this relationship is considerably attenuated on the stress trial in spite of the fact that the subjects generally performed exceptionally better on the stress trial than on any preceding trial. One could argue that the sudden salience of the threat of losing self-esteem as a result of the competition would be inherently unpleasant, and that this, rather than one's obvious improvement in performance, would be the more salient feature of the situation. In addition, one could argue that the pleasantness of each successive trial was at least partially determined by one's perception of how well one had performed. On the practise trials the only standard for making such an evaluation was one's performance on the preceding trial, and the improvements accompanying continued practise were likely to add to the pleasantness of that trial. On the stress trial however, regardless of how well one performed in

comparison to the preceding trial, the competitor performed even better. The internal standard was suddenly replaced by the external standard set by the competitor's superior performance.

Not all of the subjects rated the stress trial as less pleasant than the preceding tial. Nine subjects actually rated it as more pleasant, and these nine were no different from the other 39 in terms of how stressed they became (mean heartrate increase of 14.4 bpm and 18.5 bpm, respectively, $t = 1.04$), or in terms of how much their performance improved (mean increase of 5.8 letters and 4.6 letters, respectively, $t = 1.02$). However, these nine subjects were significantly more internal on the locus of control measure than the rest of the subjects (mean scores of 7.7 and 10.9 respectively, $t = 2.59$, $p < .01$). This finding will be discussed in greater detail later in this section.

Conceptual Complexity

None of the predicted relationships between conceptual complexity and response to a stressful situation was verified in this study. Although speculation over negative findings is at best tentative, one could predict that given a more critical experimental situation, differences could have emerged between complex and less complex subjects. The present experimental stressor may not have been of sufficient intensity, duration, or complexity for the differences between complex and less complex subjects to emerge. It is known that

the differences between them in terms of their effectiveness in coping emerges most distinctly in situations involving complex input and demands, and that in relatively undemanding situations this difference is attenuated (Schroder et al, 1967). The present negative findings should be an invitation to further research aimed at identifying those stressors to which conceptually complex and less complex people are in fact differentially sensitive, and determining whether there are differenees in the cognitive strategies they use to cope with them.

One might expect for example that the kind of internal dialogue proposed by Ellis (1963) as the more rational and healthy way of construing one's world (eg. "I may fail, but that doesn't mean I'm a terrible person" as opposed to "I may fail, and then I'll be worthless"), would come more naturally to the conceptually complex individual who is more accepting of inconsistency and conflict and less prone to categoricall black-white judgements about himself and his world.

Type A Behaviour

None of the predicted relationships between type A behaviour and response to a stressful situation was verified in the present study. According to some recent research into the physiological response of type A's under stress, the behavioural adaptation of the type A to stress is strongly associated with a specific tendency to high systolic blood pressure, and it is this increased systolic

response rather than heartrate which is the crucial physiological feature of the type A syndrome (Manuck, Craft, and Gold, 1978; Manuck and Garland, in press). These investigators have found no difference between type A's and B's in terms of how stressed they become if heartrate is the sole criterion for measuring stress level.

According to these findings, the fact that type A's and B's appeared to be equally stressed in this present study is therefore not surprising. What is surprising however is the fact that type A's, with their relentless striving and competitiveness, rated the pleasantness of the stress trial much the same as the type B's.

Locus of Control

According to the present data there was no difference between externals and internals in terms of how stressed they became physiologically, but there was a significant difference between them in terms of how pleasant they found that stress. In other words, although internals and externals were equally aroused according to the heartrate measure, their cognitive interpretations of that arousal were quite different. Externals were significantly more likely than internals to rate the stress trial as less pleasant than the preceding trial, even though they performed no differently as a group than the internals.

Two explanations can be advanced for such a finding. First of

all, internals would be less likely than externals to judge their own performance on the task by the external standard of the competitor's performance. They might therefore be more inclined to feel good about their performance inspite of the fact that they lost the competition. Their own improvement on the stress trial may have acted as a more salient standard for self-evaluation. This explanation of course rests upon the assumption that a subject's satisfaction with his own performance influenced the pleasantness of that trial.

A second explanation for this finding lies in the work of a number of investigators who have shown that people who believe themselves to be in control or who believe that they are competent to handle a stressor successfully, do in fact experience less subjective distress and show more effective coping behaviour (Averill, 1973; Glass et al, 1971; Langer et al, 1975; Lazarus and Alfert, 1964; Meichenbaum, 1977). Internals may then have a greater tendency to cognitively label stressful events as positive events ('eustress' as opposed to 'distress' in Selye's terminology), and such a disposition might underlie the higher ratings of pleasantness found in the present study. The belief in personal control, operating as an ongoing style of interpreting and giving meaning to experience, probably affirms and enhances the expectancy of success, thereby promoting a more active involvement in the resolution of problems and goals and a greater disposition to feel excited and challenged rather than anxious and victimized by the stresses of life.

Future research with locus of control and stress should explore the short-term and long-term physiological effects associated with differences in perceived control and their implications for the overall adjustment and wellbeing of the individual. Barrell and Price (1977) for example, have shown that the tendency to actively confront a stressful situation tends to be associated with a specific cluster of physiological effects, while the tendency to avoid and deny the stressor tends to be associated with a different set of effects. Recent work with type A behaviour and stress also seems to indicate that the cluster of behavioural tendencies which typify this personality type represent a coping style with its own very particular set of physiological effects, namely hyertension and coronary disease. These lines of research highlight the tremendous importance of understanding how different coping styles influence the physiology of the organism and its total wellbeing.

A secondary finding of some interest in the present study was that although internals and externals completed approximately the same number of substitutions on the stress trial, internals tended to make fewer errors ($p < .10$). Perhaps internals, believing themselves to be in control and responsible for how well they performed, actually applied themselves more to the task and paid more attention to accuracy.

Trait Anxiety

It was predicted that those subjects who had been classified as more anxious would become more stressed in this experimental situation than the less anxious subjects, but the results indicate that there were no such differences. Low trait anxious subjects were just as stressed as high anxious subjects.

One could argue that the absence of a difference between anxious and nonanxious subjects in terms of how stressed they became was really the fault of an inappropriate physiological measure, and that some other measures in combination might have been more sensitive to differences in physiological responsiveness. This is a valid argument which can be equally well applied to this study as a whole, and which certainly should invite further research. The person who scores high on the trait anxiety scale is reporting that he generally feels unhappy, nervous, and tense. One wonders the extent to which such feelings are simply the result of a disposition to perceive arousal situations in a negative light and to report them as unpleasant. Is there a possibility for example, that anxious people are really no more aroused in a stressful situation than nonanxious people, but that they consistently experience that arousal as unpleasant?

The absence of relationship between trait anxiety and the pleasantness rating of the stress trial is quite surprizing. If trait anxious people have a greater tendency to perceive stressful situations as threatening, then why was this not reflected in a similar tendency to rate the stress trial as unpleasant? Although the relevant correlation is in the predicted direction, it is clearly not significant.

Sex Differences

Since the competitor was male, and the subjects were both male and female, one might expect differences between male and female subjects in terms of how stressed they became if the effect of having a same-sex rather than a different-sex competitor is an important determinant of the magnitude of stress experienced. The results indicate that the female subjects tended to be more stressed physiologically, although the correlation was not significant at the conventional level ($p < .10$). In addition to this, the females performed significantly better than the males without committing any more errors. This finding may actually be a behavioural elaboration of the first. That is, because they were more stressed, or more motivated, they tended to perform better.

Intercorrelations Among the Predictors

(1) Locus of Control and Trait Anxiety

The correlation between trait anxiety and locus of control indicates that externals were significantly more likely than internals to report feelings of chronic anxiety. Lefcourt (1976) has provided an excellent summary and rationale for a group of similar findings. Externals tend to perceive themselves as existing in a world of uncertain and uncontrollable events, and are therefore more likely to feel chronically ineffective in their dealings with life, more

threatened by a wide variety of situations, more helpless and distressed.

If anxiety is thought of as a state of diffuse, undirected arousal resulting from a perceived inability to respond properly and perceived helplessness (Epstein, 1972), then perceived control would understandably be a deterrent to anxiety. Meichenbaums (1977) clinical research clearly shows how the belief in personal control facilitates cognitive preparation and effective coping, thereby promoting a sense of competence and resourcefulness and reducing the inherent distressfulness of feeling helpless.

(2) Type A Behaviour and Locus of Control

In the present study, the negative correlation between type A behaviour and locus of control indicates a tendency for type A's to be more internal than B's. The correlation did not however reach statistical significance.

Glass (1977) has attempted to relate these two constructs in an effort to explain the underlying dynamics of the type A syndrome. He has argued that the chronic time-urgent and struggling behaviour of the type A personality is the product of an excessive need to maintain control over the environment, and that given the appropriate lifestyle of intense demands this need reaches such proportions that it exhausts his adaptability. The type A is in effect, an excessive internal.

Although there has been an impressive body of research behind

this hypothesis, recent work has highlighted a very basis and essential difference between the type A and the internal (Manuck et al, 1978; Manuck and Graland, in press). It is not the type A's belief that he can control his environment which is his most typical characteristic, but his obsessive need to exert and maintain that control at any expense. When exploited by just the right amount of environmental stressors, this need manifests itself in the accelerated and urgent behaviour which is so typical of his efforts to cope. The type A behaviour pattern is a behavioural adaptation to the threat of too many demands and a possible loss of control.

(3) Conceptual Complexity and Type A Behaviour Pattern

A positive and highly significant correlation (.43) between type A behaviour and conceptual complexity indicates that type A subjects were significantly more complex than type B's. If anything, one would anticipate the reverse, that the chronic urgency, competitiveness and overachievement of the type A would be reflective of an underlying obsession with one all-consuming goal and a consequent narrowing of experience. Certainly this would seem more typical of a conceptually simple individual.

Schroder et al (1967) have argued that the development toward conceptual complexity involves a complex interplay between biological and environmental forces, and that the necessary catalyst for each successive step in the evolving process of development is the presence of environmental complexity and challenge. If the complexity of one's

environment continues throughout life to have the same profound influence on the shaping of one's cognitive structures, then one might expect the environment of the type A person, which is by nature full of accelerated demands and challenges, to be a rather potent and ongoing impetus for growth toward higher levels of complexity. The tendency of the type A person to immerse himself in a lifestyle of intense overinvolvement and overstriving could as an end result actually enhance the development of more complex cognitive structures. This kind of reasoning seems to imply however, that conceptual complexity is more a coincidental by-product of the type A syndrome rather than a coexisting feature of perhaps some other underlying commonality. Only further research can determine whether type A behaviour and conceptual complexity are both the products of some underlying perceptual commonality such as a tendency to scan the environment more extensively, to take in and process more information simultaneously, for example. One could also speculate that the conceptually complex person, by virtue of his preference for complexity and challenge, might eventually predispose himself to the typically type A sort of lifestyle of ever-increasing diversity and ever-decreasing adaptability. On the basis of one correlation such speculation is at best tentative, and only further research can clarify these issues.

Summary

This study was unsuccessful in its major purpose: to identify particular personality types which become most stressed in a psychosocially stressful situation such as competition. On the level of casual observation alone one is led to believe that the relatively enduring traits and dispositions we call personality have tremendous influence on the organization of our perceptions and behaviour. At the level of empirical verification however, a precise mapping of personality traits to specific and predictable patterns of physiological and behavioural responses is a much more complicated matter. This study has been limited by the very vastness of the question to which it was addressed.

First of all, the problem itself was to some extent improperly formulated. The question of 'who becomes most stressed' is really not the vital issue. If people become stressed in different ways, or if their particular style of coping with stress produces a particular configuration of physiological effects, then the question should be rephrased from the global to the specific: 'How do different people respond physiologically to a stressor of this sort, and are there responses which characteristically facilitate or accompany effective coping?' One physiological measure alone cannot be expected to properly reflect all the intricacies and varieties of the physiological response to a stressor. Heartrate, for example, can be expected to reflect a more global state of arousal, but it is the specific

details and differences elicited by variations in biological sensitivity and variations in coping styles which are potentially of greatest interest and importance for the stress researcher. The type A adaptation to stress represents one such variation which involves a very specific tendency to high blood pressure and coronary disease, and much more research is needed to identify other potential maladaptive styles and their long-term effects on the wellbeing of the individual. This means a shift in emphasis from the quantitative concern for 'who becomes most stressed' to the study of qualitative differences in stress responses and their implications for the overall adjustment of the individual.

The present research highlights another consideration for future research. Aside from the fact that a single physiological measure may be insuffieient evidence for concluding that person A became more stressed than person B, a single experimental situation may also be insufficient basis for concluding that one personality type is more easily stressed than another. One simply must specify the nature of the stressor which did or did not elicit a difference in stress response. Type A's for example, function quite similarly to B's in some situations, but critical differences emerge in other situations (Manuck et al, 1978). The interaction between personality and situational variables (eg., kind of stressor, probability of mastery, opportunity to act), is the proper focus of stress research. One could argue for example, that a coping style of active involvement and confrontation in a stressful situation is preferrable to avoidance

and withdrawal, but certainly this would not be the case in a situation where there is absolutely no possibility of success and mastery. Such a coping style would only result in failure and frustration.

One last observation should be made about the importance of cognitive factors in the experience of stress. Selye (1976) has argued that we can choose how we respond in a stressful situation. We can rationally weigh and minimize the threat and think of it as a challenge and an opportunity for self-growth. It is the ability to transform the activities of living into 'eustress' experiences rather than 'distress' which characterizes healthy stress management.

The present study has surveyed a large body of literature which suggests that the disposition to interpret a stressful experience as a positive event (eustress) is in part related to the belief in personal control. In addition, the present data indicate that the more one perceives oneself as the centre of control, the more likely one is to rate a stressful experience as pleasant. Meichenbaum's work (1977) carries this even further: the more one believes in one's ability to successfully exert control in a stressful situation, the more effectively one will in fact cope. The belief in one's abilities is a powerful device in stress management.

One of the most important aims of stress research is the gathering of information which is of practical value both to clinicians and to the public at large. Continued exploration of the role of personality and coping styles is an important activity in an age of increasing

psychosocial stress and increasing public awareness of the need for better stress management. Although the present research has not been productive in terms of such an aim, it has suggested some avenues of possible improvement for future research of this sort.

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APPENDICES

APPENDIX L

PLEASANTNESS SCALE

21

20

19 extremely pleasant

18

17 very pleasant

16

15 pleasant

14

13 slightly pleasant

12

11 neither pleasant nor unpleasant

10

9 slightly unpleasant

8

7 unpleasant

6

5 very unpleasant

4

3 extremely unpleasant

2

1

APPENDIX 11

0	1	2	3	4	5	6	7	8	9
A	J	Y	G	K	D	R	F	L	B

3	5	1	0	6	6	2	0	6	9	9	2	9	7	5	9	5	3	2	0	5	7	7	3	4
9	6	9	8	2	6	6	2	2	4	2	4	0	1	5	9	6	7	4	9	0	7	5	8	9
0	5	0	1	4	9	0	9	6	6	3	3	6	7	4	6	9	0	9	6	3	3	4	8	8
2	1	9	9	8	0	8	5	2	8	2	6	3	7	2	9	2	9	2	3	6	5	0	2	6
5	6	6	7	0	0	0	2	2	1	5	0	1	9	3	9	9	5	9	1	6	2	3	7	7
7	1	3	0	1	3	5	7	4	2	8	3	6	3	6	7	3	0	5	8	8	7	2	2	9
5	8	7	4	8	3	1	4	4	6	8	0	2	3	7	3	1	2	5	2	9	6	3	6	7
3	6	2	3	0	4	8	2	9	6	3	8	3	5	2	2	3	8	1	6	6	4	0	9	4

APPENDIX 111

THE PROCEDURE AND INSTRUCTIONS

- bring the subject in, ask him his name and introduce yourself. Explain that you are going to keep a record of his HR during the experiment. Explain the plethysmograph and attach to the index finger of subject's nonpreferred hand. Get the recording working properly. Read the following instruction.

I want you to sit here for a little while -- about five minutes -- and relax completely so I can get a record of your heartrate at a resting level. Just relax, and don't think about the experiment. There is nothing to worry about -- you won't be embarrassed or hurt in any way.

Every once in a while during this experiment I am going to ask you to rate how pleasant you found doing something. For example, at the end of the relaxation period I'll ask you: How pleasant were the last few seconds of the relaxation period? Then I want you to give me a number from the pleasantness scale right here (point to the scale). If, for example, you found the relaxation period pleasant, you should say 15 (point). Or, if you found it very unpleasant you should say 5 (point). Or, if for some reason you just can't decide whether it was pleasant or unpleasant, you should say 11 (point). So, whenever I ask you to rate how pleasant something was you'll have to give me a number. That number can vary anywhere from 1 to 21 (point). Any question? During the relaxation

period I want you to relax as much as you can. You can try rating just to yourself how pleasant you are finding the relaxation -- just for extra practise. During the relaxation period you will have to keep the plethysmograph as still as possible. You should move around as little as possible, and you won't be able to ask any questions. So, if you have any questions, you can ask me now. (Encourage questions). Now you should make yourself as comfortable as possible so you can stay still and relaxed.

- go behind the shelves, ask the subject if he is comfortable and relaxed. Press the event marker to indicate the beginning of the relaxation period on the polygraph. Remain quiet. After the five minutes, press the event marker again.

OK...the relaxation period is finished now. How pleasant did you find the last few seconds of the relaxation period?

- record the subject's response. Bring out the first trial of the task and please it on the table in front of the subject.

This is the digit-letter substitution task. What you have to do is this: under each of these numbers (point) I want you to put in the appropriate letter from above. For example, under the 3 you would put in a G, under the 5 you would put in a D, and so on. Now, when you fill in the letters, I want you to print them backwards and upsidedown. Remember now -- backwards AND upsidedown. You are to start here (point) and continue on without skipping any. When you reach the end of the line simply go on to the next line. You have to do the substitutions in the order they appear down here (point). You cannot do all the 0's, then all the 1's etc. Also, if you make

any mistakes, simply go on. Any questions? Get yourself comfortable so you will be able to do the task without moving your finger.

- turn the task upsidedown on the table. Pick up the buzzer and read the following:

When I am ready to have you begin the task I will say 'turn over your task', and you will turn the task over with your free hand, remembering to keep the plethysmograph still. Then I'll say 'ready?'. And when you are ready you should say 'yes'. Then after you have said yes I will say 'OK', and I'll buzz the buzzer like this (demonstrate. When I buzz the buzzer, you begin doing the task as qucikly and as well as possible. Then when the time is up, I'll buzz the buzzer again, and you'll have to stop immediately, put your pencil down, and turn the task over. Once again remember how important it is for you to keep your hand perfectly still. Any questions?

- run the first trial. As soon as the trial is finished, say:

How pleasant did you find that trial?

- score, point out errors, show subject how to correct errors. Bring out second trial and place face down on table.

This is another variation of the same task. You do it the same way as the first one. Remember to work as quickly as possible.

- run the second trial the same way, then trials 3 through to 7. At the end of the seventh trial, excuse yourself from the room memontarily to get the competitor.

- bring the competitor in to the room introduce him as another first year student, seat him opposite the subject, and attach the plethysmograph. Bring out two tasks for trial 8 and place face down on the table.

By now you both know how to do the digit-letter task. Now I

am going to have you do another form of the same task. The only difference between this one and the earlier trials is that instead of doing the task as quickly and as well as possible, I also want you to try and do it faster than the other person. In other words, we're going to have a competition. I'll let you know who won at the end of the experiment. When I am ready to have you compete I'll say 'turn over your tasks', and you should turn your tasks over with your free hand, remembering to keep your other hand still. Then I'll say 'ready?', and when you're ready to begin you should both say 'yes'. After you both have said yes, I'll say OK, and I'll press the buzzer like this (demonstrate). When I buzz the buzzer, you begin doing the task as quickly ans as well as possible, while at the same time trying to beat the other person. Then when the time is up I'll buzz the buzzer agin (demonstrate), and you'll have to stop immediately, put your pencils down, and turn your tasks over. Once again, remember to keep your plethysmographs still. OK?

- run the competition trial. As soon as the trial is finished say 'How pleasant did you find that trial', first to the subject and then to the competitor (competitor is instructed to give the same rating as the subject). Take 60 seconds to score the trial, and another 60 seconds to talk to the subject about the experiment. Remove the plethysmograph after the 2-minute interval, and debrief the subject.