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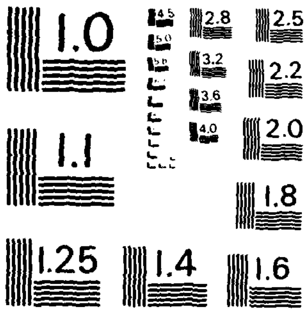

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This research was designed to determine the effects of cognitive/behavioral styles, in general, and of the General Incongruity Adaptation Level (GIAL), in particular, on physiological arousal under a variety of task conditions. It was found that load stressors in many cases produce changes in blood pressure levels which appear to parallel previous findings showing them to be related to various indices of task performance. Particularly the GIAL style (and to lesser degrees cognitive complexity and Type A, in that order) appear to mediate when load stressor effects on arousal do occur. The

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present research provides the basis for planned research efforts which will be concerned with potential covariation of task performance measures (such as risk taking and utilization of strategy) and physiological responsivity, as they are jointly affected by behavioral styles and task stressor (e.g., load) levels.

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Task Differences, Stylistic Characteristics and Physiological Arousal

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The effect of individual differences in the stylistic characteristics of Cognitive Complexity and Type A Behavior Pattern on performance in a number of tasks has been demonstrated (e.g., Streufert, Streufert and Denson, 1983; Streufert, Denson, Lewis, Henderson and Shields, in press). A great deal of evidence has been gathered which demonstrates that it is possible to predict task performance differences on the basis of these styles (Streufert, Streufert and Denson, 1982). Further, it has become clear that Cognitive Complexity and Type A can be used to predict physiological arousal, particularly cardiovascular arousal. What remains unknown is whether performance and arousal are meaningfully related to each other, that is, whether they tend to covary. Each of them may be independently predicted by these styles or they may relate to each other in some direct or indirect, partial or complete manner. For example, one such possible relationship would be: Style → Physiology → Performance.

Whether or not performance and arousal do tend to covary as a function of the effects of style would have important implications for the kind of intervention that would be required to modify a behavioral outcome such as degree of decision quality or risk taking. If they are not related, a purely cognitive approach (e.g., information, persuasion) may be sufficient to create behavioral change. On the other hand, if a relationship between performance and arousal does exist, any change strategy would have to consider -and modify- the associated affect-produced and arousal-mediated reinforcement history of the particular behavior. This, then, would become a significantly more complicated problem.

We are, however, still far from the point of devising interventions. It is necessary first to explore further the degree to which styles predict both performance and arousal, and the conditions under which this may occur. There is a great deal of information available about the relationship of stylistic characteristics to performance. However, much more needs to be learned about the effects of style on arousal, and, ultimately, the effects of style on arousal and performance in combination. The current research focuses on the relationship of three style factors to physiological (cardiovascular) arousal.

Type A Behavior Pattern

In the late nineteen fifties, Friedman and Rosenman (1959) identified the Type A Coronary Prone Behavior Pattern, based initially on naturalistic observations of their patients. Since that time, a considerable amount of research, both epidemiological and experimental, prospective and retrospective, has been concerned with this pattern and its consequences. The Type A individual is characterized as competitive, hard-driving, time urgent, and hostile. Conversely, the Type B personality displays these traits to a significantly lesser degree. It has repeatedly been demonstrated (e.g., Dembroski, MacDougall, Herd and Shields, 1979) that the Type A individual, as compared with the Type B, responds to situations of challenge with greater cardiovascular arousal.

Cognitive Complexity

Cognitive Complexity (Streufert and Streufert, 1978) is a style which describes how individuals perceive, process and utilize the information which they receive from the environment. Persons are categorized according to the degree of multidimensionality they display. The more multidimensional individual has several (or many) cognitive dimensions of judgment available. Incoming information can be viewed in a variety of ways, processing is flexible and complex, and output in the form of decisions tends to be responsive to many aspects of the situation, to be integrated, and to be strategic. The less multidimensional person may, in contrast, have only one or very few dimensions of judgment available. Information is often viewed from only a single perspective, can be processed quickly, but relatively rigidly, and decision making output often takes the form of simple, one-to-one responses to a single item of incoming information. These differences in Cognitive Complexity (multidimensionality) are not correlated with intelligence as measured by standard IQ tests, but have significant consequences for behavior and performance on various kinds of tasks.

Recent efforts have begun to demonstrate that differences in level of multidimensionality are able to predict or account for differences in physiological (cardiovascular) arousal in various situations. Streufert, Streufert, Dembroski and MacDougall (1979) investigated the relationship among Cognitive Complexity, Type A/B and physiological arousal during a stressing cognitive task and a reaction time task. The results of this study were, in part, surprising. Cognitive Complexity scores, as measured by the Sentence Completion Test, distinguished between Type B subjects who show considerable systolic blood pressure arousal (delta from baseline) to cognitive stress and those who demonstrate little arousal. In addition, Sentence Completion Test scores predicted systolic blood pressure responses to challenge in the reaction time task as well as or better than Type A/ Type B categorization.

In another study, Streufert, Streufert and Denson (1983) examined the effects of differences in Type A behavior and differences in Cognitive Complexity on blood pressure responses to four different task stressors. The results suggest that blood pressure elevations and variability are greater for more multidimensional subjects than for those who are less multidimensional (i.e., less complex). While Type A multidimensional persons appear to be particularly physiologically responsive to stressful social tasks, Type B multidimensional persons appear to respond with greater blood pressure elevations to cooperative social tasks and to non-social task environments.

The available data on the relationship between Cognitive Complexity and cardiovasuclar arousal demonstrate that arousal can be predicted from differences in dimensionality, sometimes more reliably than by Type A.

General Incongruity Adaptation Level

Although they represent quite different individual difference characteristics, the Type A behavior pattern and Cognitive Complexity have in common the fact that they are styles of behavior and information processing. In other words, both describe the ways in which people think and behave, rather than the associated content; they deal with how persons think and act, not with what they think and do. It appears, therefore, that stylistic characteristics may be important factors in the production of cardiovascular arousal as well as in their effect on performance. For this reason, interest has turned to a third stylistic variable: General Incongruity Adaptation Level (GIAL). The GIAL variable is of particular importance here since the underlying theoretical statements attempt to predict joint outcomes in performance and arousal (affect).

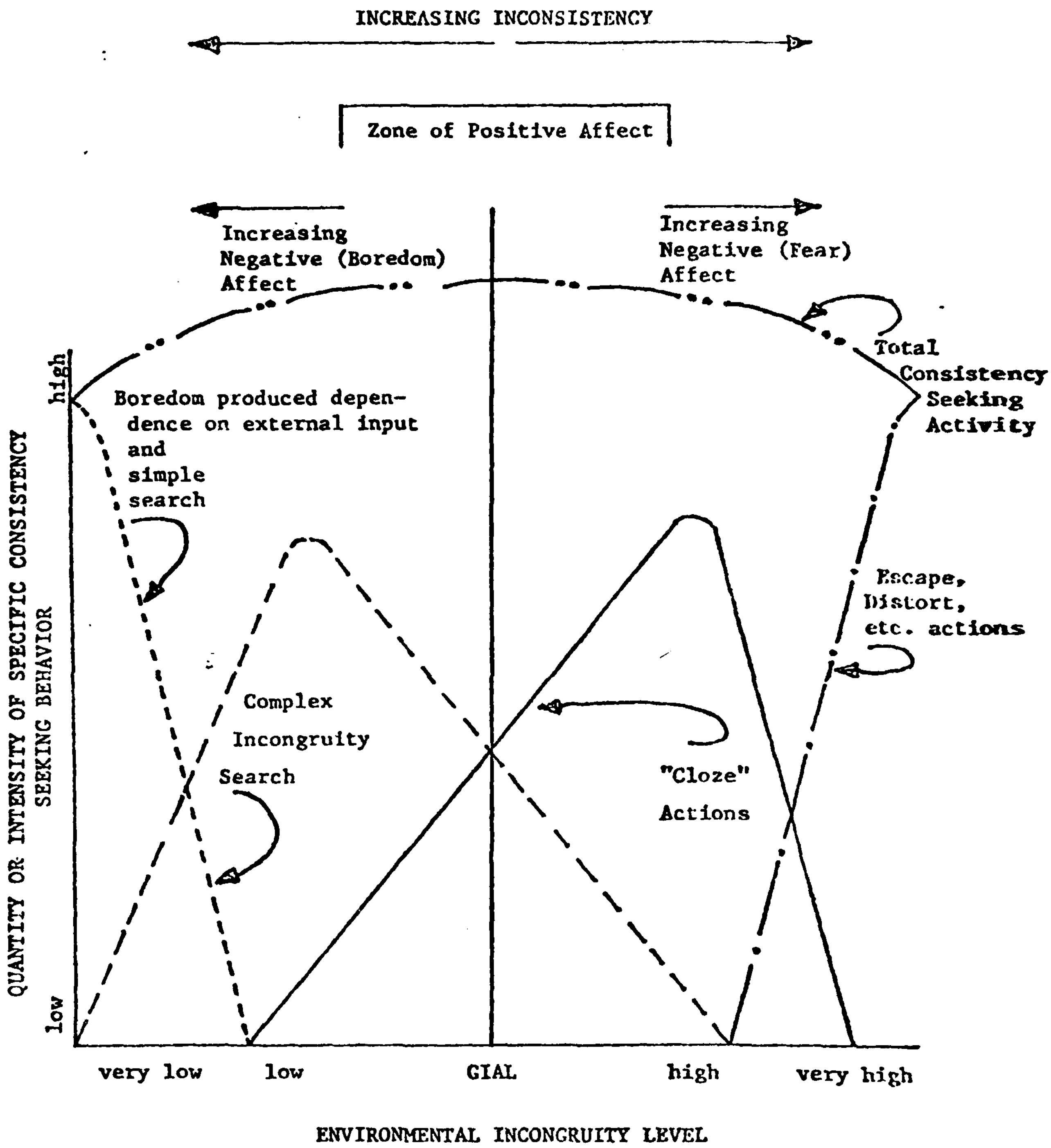
General Incongruity Adaptation Level theory (Streufert and Streufert 1978) was formulated in an attempt to resolve the apparent conflict between two theoretical approaches to human motivation. One side of the conflict (e.g., Osgood and Tannenbaum, 1955) described motivation as an attempt to maintain consistency and to avoid inconsistency and incongruity in one's environment. Other researchers and theorists, however, viewed motivation as a push toward novelty and variety-seeking, an attempt to bring a certain degree of incongruity into one's environment (e.g., Maddi, 1968). Based on an adaptation level approach, the General Incongruity Adaptation Level theory is an attempt to integrate congruity-seeking and novelty-seeking into an overall explanation of human motivation.

The theory states that, over time, an individual is exposed to a certain typical amount of incongruity in his/her environment. He or she learns to expect this amount of incongruity and becomes adapted to it. This "amount" of environmental incongruity represents the individual's general incongruity adaptation level or GIAL. This level may be relatively high, implying the need to create and maintain an environment which provides considerable <u>incongruent</u> input, or relatively low, implying the need to maintain a considerable degree of <u>congruent</u> input from the environment. The term "general incongruity" is used to mean the toal amount of novelty, ambiguity, surprise, imbalance, dissonance, disagreement, failure, conflict, etc. which an organism typically encounters.

The GIAL defines the <u>optimal</u> incongruity level for any individual. As with any other adaptation level, the GIAL would motivate cognitive activity whenever the general incongruity currently being experienced by the individual departs from the expected or optimal value. Individual differences in the GIAL are presumed to be a function of the specific person's past experience. An individual who grows up in a culture or family/school setting that provides little incongruity would come to expect little incongruity and, consequently, would develop a relatively low GIAL. In contrast, a person growing up in a very incongruent environment would expect high levels of incongruity and would develop a high GIAL.

As can be seen in Figure 1, the adaptation level model proposes that activity is maximally motivated as the environmental conditions depart from the GIAL <u>in either direction</u> (known here as "inconsistency"). When these conditions provide incongruity which is below the GIAL, the individual tends to become bored and will engage in simple and then more complex search behavior designed to increase incongruity. As environmental conditions begin to approach and then exceed the GIAL, complex search will be eliminated and replaced by "Cloze" search which is behavior designed to decrease incongruity. Finally, when the level of environmental input is far more incongruent than the GIAL, the individual will begin to distort perceptions and may even engage in escape behaviors. It should be remembered that this description, and Figure 1, refer to the interaction of a single individual with his/her environment, as mediated by that individual's GIAL.

The GIAL theory proposes a number of different potential relationships among level of environmental incongruity (relative to GIAL), performance/behavior and affect/arousal. Although little empirical evidence has been



INCREASING INCONSISTENCY
Zone of Positive Affect
Increasing Negative (Boredom) Affect
Increasing Negative (Fear) Affect
Total Consistency Seeking Activity
Boredom produced dependence on external input and simple search
Complex Incongruity Search
"Cloze" Actions
Escape, Distort, etc. actions
QUANTITY OR INTENSITY OF SPECIFIC CONSISTENCY SEEKING BEHAVIOR
high
low
very low
low
GIAL
high
very high
ENVIRONMENTAL INCONGRUITY LEVEL

Figure 1

gathered so far, the most likely relationship appears to be one in which affect/arousal are optimal (positive/moderate) at incongruity input levels close to the GIAL, with increasing negative affect as input moves away from the GIAL in either direction. As suggested earlier, however, the precise form of these relationships needs to be specified in further research. For our present purposes, we must particularly be concerned with the nature of the relationship between differences in the GIAL style and effects on physiological arousal.

In order to understand the potential associations between General Incongruity Adaptation Level and arousal, it is necessary to look at a comparison of individuals whose style of behavior is motivated by differing GIALs. Although the GIAL may be located at an infinite number of points between the extremes of high and low, for the sake of simplicity we will talk of a comparison between High GIAL and Low GIAL (measurement will be discussed below).

The Present Research

The present research was designed to determine whether persons who display a behavioral style characterized by a high General Incongruity Adaptation Level demonstrate higher levels of cardiovascular arousal in a variety of situations, when compared with persons who display a style characterized by a low General Incongruity Adaptation Level. In addition to GIAL, the effects of Cognitive Complexity (level of multidimensionality) and Coronary Prone Behavior Pattern (Type A/Type B) will be considered. The inclusion of these variables, both known to relate to arousal, will potentially permit increased understanding of the components of each of these styles which may actually contribute to elevated arousal.

It has been repeatedly demonstrated (e.g., Streufert, et al., 1979) that Type A and Type B persons, as well as more and less multidimensional persons, respond differentially to challenging situations. Challenge, whether social or non-social, can also be viewed as a form of incongruity, which could have differential effects on persons differing in GIAL. Therefore, subjects in the current research are exposed to three different tasks, two social, one non-social, which vary in the type and [illegible]el of challenge they present: The Type A Structured Interview, the Comp[illegible]ty Interview, and a Visual-Motor Task. Systolic and diastolic blood pr[illegible], utilized as indices of cardiovascular arousal, are measured at baseline and during all tasks.

This study is conceived as an initial step in an effort to determine the effects of behavioral styles on both performance and arousal and to specify the degree to which these effects are independent or the degree to which they covary.

METHOD

Experimental Procedure

Forty-two adult male paid volunteers participated as individuals in the research. Total time spent in the experimental setting was approximately four hours per person. Upon arrival at the laboratory, each subject was individually briefed about forthcoming events; his signature on a consent form was obtained. The subject was then taken to an experimental room where a blood pressure cuff was placed on the dominant arm. The cuff allowed the measurement of systolic blood pressure and diastolic blood pressure at two-minute intervals.* Blood pressure was measured on the dominant arm during the interview tasks (see section on Challenge Task Settings, below) and on the non-dominant arm during the visual-motor task.

After attaching the cuff, the experimenter sat at a desk across from the subject and asked a number of biographic questions. Responses to these questions were recorded by the experimenter on paper. The purpose of this brief interview was to put subjects at ease and to accustom them to the presence of the cuff on their arms; results were not included in any data analysis. Upon completion of the biographic interview, the subject was asked to sit back and relax for a few minutes. The experimenter remained in the room and worked quietly on a set of papers. Subsequently, the subject was exposed to a series of task and measurement conditions, described below. These included: Type A Structured Interview, Cognitive Complexity Interview, Visual-Motor Task, and the GIAL Self Description Questionnaire. The order in which these tasks were presented was reversed for half the subjects to avoid an order effect; none was obtained.

Challenge Task Settings

All subjects in the research were exposed to three task settings presenting varying degrees of challenge. To obtain comparisons between a standardized challenge situation and an equivalent, non-challenging setting, two interviews were employed.

Type A Structured Interview

The Type A Structured Interview method was designed by Rosenman and Friedman (c.f., Rosenman, 1978) to measure Type A characteristics. The Type A

*Measurements were taken automatically by a Vitastat 900D and recorded on tape. Alarms were set to sound if blood pressure would exceed 200 mmHg systolic. Two successive readings at this level were considered dangerous and would have resulted in termination of the subject's participation in the research. No such readings were, however, obtained.

interview was conducted by an unfriendly, aggressive, and somewhat hostile experimenter who appeared to possess the time urgent, driven, and competitive Type A style. The interviewer asked a number of questions of the subject, but seemed to pay little attention to the responses, cut them short, expressed annoyance, and challenged the reasonableness of some of the subject's statements. The interview was conducted by an experimenter trained in the method by Rosenman. Subjects considered the experience to be quite unpleasant, stressful, and challenging.

Complexity Interview

A contrasting interview, without external stressor impact, was presented by a different experimenter. The Complexity Interview, designed by Streufert and Streufert (c.f., Streufert and Streufert, 1978), represents a social interchange on pre-selected topics carried out in a pleasant, non-challenging interpersonal atmosphere. The experimenter handed the subject a set of cards, each of which contains the stem of a sentence (e.g., "When someone competes with me...."). The subject was asked to complete the sentence on the card and add several additional sentences on the same topic. A social interchange ensued in which subjects typically expressed many of their personal feelings and concerns. After a subject completed responses to one card, the experimenter asked several additional, non-leading questions to encourage more statements on the topic. When the subject's entire repertoire of responses to that topic was exhausted he was asked to go on to the following card. A total of twelve cards was presented

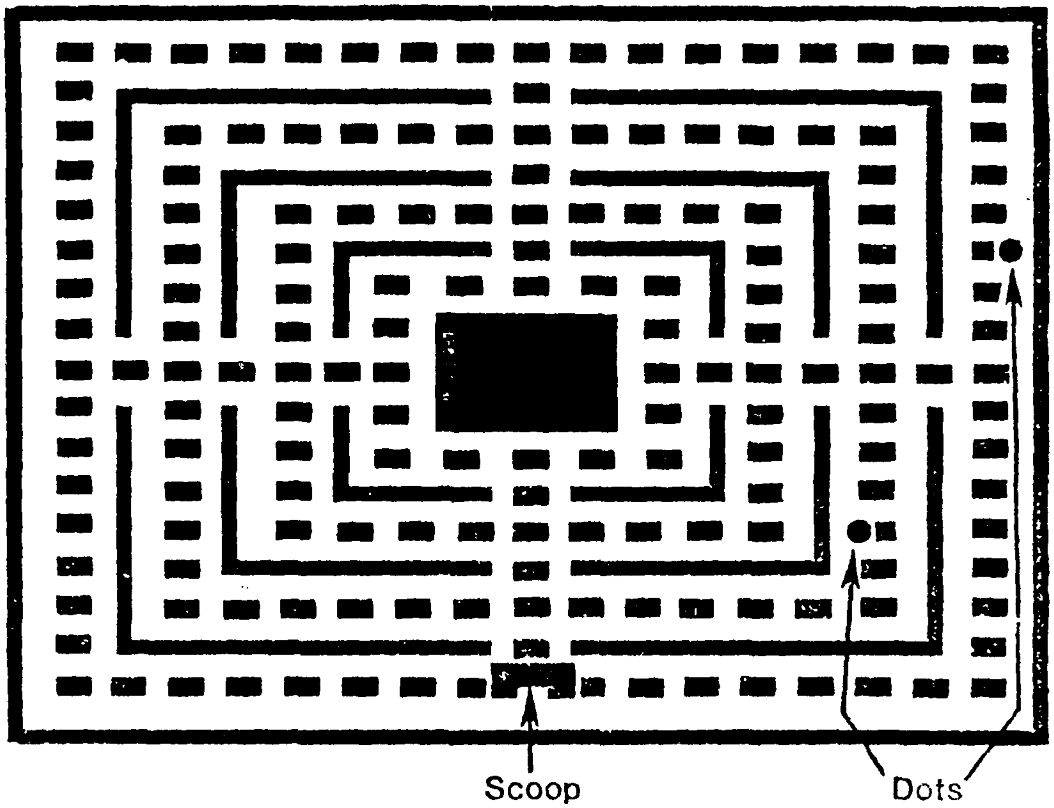
Most of the subjects found the interview pleasant. Many of them expressed surprise that they had communicated so many of their personal feelings to a previously unfamiliar interviewer. Subjects agreed that the Complexity Interview was low in challenge.

Video Game Task

In addition to the high and low challenge interview settings, a visual-motor task was presented in the form of a video game. This task was chosen to provide a task environment which is equivalent to those utilized by other experimenters (e.g., Dembroski, MacDougall and Shields, 1977; Dembroski, et al., 1979) in studies of the effects of task challenge conditions on blood pressure elevations. The video game was introduced with televised instructions which were detailed enough to allow all subjects, including those without previous experience with such games, to understand the task. The particular task used was selected for its general interest across divergent groups of potential subjects and because it did not rely on previous experience with video games.

The game* utilizes a series of concentric passageways filled with a number of squares which the subject is to collect with a "scoop-like" object which is moved by operating a handle on a small box placed on the subject's desk. The matrix of passageways which appears on the video screen is presented in Figure 2. The subject begins with a score of five points. Scooping up one square adds five points to the subject's score. Moving through one unit of empty space between the squares subtracts one point from the score. Continuous movement through spaces filled with squares would add 5-1=4 points for each square collected. Moving through spaces where no squares are present would subtract one point for each empty space, including those spaces occupied

*The task was generated by an Apple II+ Computer utilizing a floppy disk program developed specifically for this research by the Wise Owl Workshop.



TASK MATRIX

Figure 2

previously by squares. In other words, to obtain as high a score as possible, it is useful to avoid moving through blank spaces, i.e., to move so that as many squares as possible can be picked up in one continuous series of moves. Movement is possible only through passageways. Movement across solid lines is not possible.

In addition to the squares, from one to eight dots (differently colored) can appear on the matrix shown in Figure 2. The dots move randomly along the passageways of the matrix, reversing their direction (again randomly) from time to time. The dots are to be avoided: colliding with them is considered an error, costing the subject 100 points for each collision. A collision removes the dot to a different random position in the matrix so that a second collision due to the same error does not occur.

The computer program permits the experimenter to systematically vary a number of characteristics which apply during any one task period. The characteristics which can be modified are: (1) The speed of movement for both the subject's scoop and the dots which the subject is to avoid. Speed can be increased or decreased in four equal interval steps; (2) the number of dots on the screen (varying from one to ten); and (3) a score (displayed on the screen throughout the task period) representing an experimenter-selected value indicating either the average score obtained by other subjects on their first try or (optionally) the highest score obtained by any subject. In addition, the experimenter is free to select the number of task periods which are to be presented to subjects. Each period lasts until the subject has successfully scooped up all the squares from the matrix on the video screen. The subject's current score is continuously displayed at the bottom of the screen. As stated above, the score starts at +5 and increases as more and more squares are captured. It decreases with collisions and with movement through blank spaces. The score may become a negative value if the subject moves through blank spaces 2.5 times more often than squares are captured or if the subject repeatedly loses blocks of 100 points by collisions with dots.

Instructions to Subjects

Subjects were presented with detailed video taped instructions about the operation of the task. They were reminded to avoid collision with white dots and were also told about the loss of points created by moving through blank spaces. They were further asked to try to do as well as possible, to avoid letting scores drop below zero, and to try hard again during the next task period if they are not as successful as they might wish during a previous period. While the subjects were presented with the consequences of failing to use strategy, they were not told what strategy should be used to obtain maximal scores. Instructions were moderately challenging, and may be considered somewhat below the challenge and competition level induced by Dembroski, MacDougall, Shields, Petitto and Lushene (1978). The levels of challenge and competition selected for these instructions were based on challenge levels frequently found in work environments. Subjects were told to expect different speed levels and different numbers of dots to be avoided from one game period to another. At the highest load (see below) level, challenge levels reached those used by Dembroski and others. The actual number of periods that would be played was not specified to subjects in advance.

Load Manipulation

Subjects were initially given a practice trial to familiarize themselves with the task and eliminate or decrease the potential effects of previous experiences with video games. For the practice task, speed was held at level

1 (low) and only one dot was presented in the matrix. At the conclusion of this task period (and after each subsequent period), the subject responded to a number of seven-point scales (manipulation checks). After completing the scales, the subject was asked whether he was ready to try the task again. All subjects responded positively in all cases.

Subjects participated in four task periods following the practice period. The number of moving dots to be avoided, representing the load manipulation, was systematically varied for these four periods. Either 2, 4, 6 or 8 dots were placed in the matrix. From a number of random sequences for the load manipulation, 25 were chosen (via a counterbalancing procedure) to assure that specific load levels would not occur inordinately often at any sequence position. Speed for all four task periods was held at level 2 (moderate). Subjects were not aware of what their next load level would be until the matrix with the relevant number of dots appeared on their screen at the beginning of the task period.

A read-out at the bottom of the video screen informed the subject during the first (practice) period that the average score obtained by other subjects during their first try had been 435. That score level was rather easy to achieve and was surpassed by all but two of the subjects in the study. For the following four task periods, the subscript on the screen indicated that the highest score obtained by any subject so far had been 898. None of the subjects achieved or surpassed that score.

Measurement: Dependent Variables

Measurements of systolic blood pressure and diastolic blood pressure were taken throughout the sequence of tasks at two-minute intervals, except when subjects were working on questionnaires. Measurements obtained during the Complexity Interview, the Type A Interview, and the four (non-practice) playing periods of the visual-motor task were, after conversion to change scores, entered into the data analysis. The number of readings taken during each task condition was limited to four in order to avoid undue compression of the subject's arm.

Baseline readings of systolic and diastolic blood pressure were taken during a resting period following the presentation of video-taped instructions. These readings were obtained under non-social conditions in which the subject sat alone watching a kaleidoscopic display of colors on the video screen.* Measurements for each of the task conditions were averaged to obtain a single score and compared with these non-social baseline values. Discrepancies between the task levels and the resting levels were expressed as mean delta values. These values, representing change in blood pressure from baseline, were employed as the units of analysis for this research.

Measurement: Independent Variables

All subjects were administered the GIAL-SD, a questionnaire measure of General Incongruity Adaptation Level. Based on a median split procedure, subjects were divided into groups of high and low GIAL. Initial analyses for these overall GIAL scores produced data which suggested the value of learning more about the components of that score in the population of interest. For this purpose, the GIAL-SD measure was administered to a sample of 146 persons who did not participate in any other aspects of the study. The test

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*Non-social baseline levels were also obtained at the end of the experimental session and during the rest periods between game periods. Data analysis indicated no differences in systolic and diastolic blood pressure among these various non-social baseline conditions.

results were then factor analyzed, using a varimax rotation. The factors obtained through that analysis were used in the calculation and analysis of GIAL scores as reported here. This procedure has permitted a more precise explication of the effects of various components of the GIAL score than would have been possible with the use of overall scores alone.

The Type A interview was scored by two judges according to the procedures developed by Rosenman, Friedman and associates. Both scorers were trained by Rosenman. Discrepancies in assigned score values did not exceed one point and were resolved by discussion. The Complexity Interview was scored according to procedures developed by Streufert and Streufert. The developers of the measure did the scoring; discrepancies between assigned score values did not occur. As a result of the scoring procedures: 12 subjects were identified as less Cognitively Complex/Type A; 12 subjects were identified as Cognitive Complex/Type A; 9 subjects were placed into the less Cognitive Complex/Type B category; and, 8 subjects were placed into the Cognitive Complex/Type B category. One subject was not categorized since he fell between Type A and Type B (Type X) and, in addition, was marginal in the categorization based on the interview for cognitive complexity. Data analysis was based on the forty-one remaining subjects.

RESULTS AND DISCUSSSION

Factor Analysis of the GIAL Test

Responses to the GIAL-SD from a non-experimental sample of 146 adults were subjected to Factor Analytic procedures. A varimax rotation was used to extract a maximum of thirty factors. Twenty-nine factors were obtained, accounting for the entire variance in the responses. Approximately 50% of that variance was accounted for by the first five factors. Eigen values for Factor 6 and beyond began to approach asymptote. Consequently, only the first five factors were considered in subsequent analysis.

The five factors obtained were: Factor 1, Variety-Seeking, accounting for 16% of the variance; Factor 2, Novelty-Seeking, accounting for 9% of the variance; Factor 3, Desire for Predictability, accounting for 7.5% of the variance; Factor 4, Desire for Action, Adventure and Travel, accounting for 6% of the variance; and, Factor 5; Consistency-Seeking, accounting for 5.5% of the variance.

Factor scores for each GIAL test item were obtained by weighing each item by the factor loadings on each of the five factors (loadings below .19 were not considered). On the basis of this procedure, individual scores for the subjects in this research could be calculated on overall Incongruity Adaptation and on each of the component characteristics of GIAL, derived from the scores computed on the basis of weights for the individual factors. The overall GIAL score was a factor-weighted value computed by the summation of all individual item factor scores according to the following formula: Factor 1 + Factor 2 - Factor 3 - Factor 5.

Overall GIAL Analysis

On the basis of the overall Incongruity Adaptation scores, subjects were divided into High GIAL and Low GIAL groups via a median split procedure. As a result, subjects could be placed into two levels of each of three "between" factors for further analysis: High GIAL vs. Low GIAL, Type A vs. Type B, and Cognitively Complex vs. Cognitively Less Complex.

With a total of 41 subjects in the research, cells in the design became uneven, with some containing relatively small numbers of entries. Data analysis must consider the implications of these restrictions and Analysis of Variance procedures which are employed in the data analysis cannot produce meaningful higher order interactions which include all three of these factors. Where significant interactions of these three factors or of all three of these factors with other factors in the design do occur, they must be viewed with caution. Two-way interactions and the effects and interactions of factors reflecting repeated measures ("within" design factors), as well as main effects are, of course, not affected by these restrictions.

Overall Analysis

The data for overall Incongruity Adaptation scores were analyzed in a five-way Analysis of Variance design including the previously discussed between factors: GIAL, Type A and Complexity. In addition, two within factors based on repeated measures assessment were included: Blood Pressure (systolic vs. diastolic) and Tasks (Complexity Interview, Type A Interview, Visual-Motor Task). The dependent measure for this analysis (and all subsequent analyses) is delta blood pressure, i.e., the discrepancy between measured mmHg during the tasks (averaged across measurements) and baseline measurements (again averaged) obtained during the period in which subjects were resting alone. Changes in blood pressure from baseline which represent increases are viewed as evidence for arousal.

A significant main effect for GIAL ($F = 6.80$, 1/33 d.f., $p = .013$) was obtained. Persons with higher GIAL scores demonstrated much greater elevations in blood pressure readings across all task conditions. A marginally significant

F ratio (F = 2.83, 1/33 d.f., p = .098) was also obtained for Cognitive Complexity. Persons scored as complex showed higher blood pressure arousal values than those scored as less cognitively complex. Interestingly, there was no effect of Type A on arousal.

Not surprisingly, a main effect for tasks was obtained (F = 11.16 2/66 d.f., p < .001). As reported previously by Streufert, et al. (in press) by far the highest arousal levels (delta from baseline) were obtained in the Complexity Interview. Being able to open up and express one's innermost feelings tends to create much higher arousal levels than the experience of the challenging Type A interview.

A significant interaction of GIAL by Tasks (F = 3.11, 2/66 d.f., p = .05) suggests that High vs. Low GIAL characteristics may affect delta arousal differentially in the three tasks employed. For that reason, separate four-way Analyses of Variance (eliminating the Task factor) were performed for the Complexity Interview deltas, for those obtained during the Type A Interview, and for those obtained during the Visual-Motor Task.

In interpreting these separate analyses, the GIAL main effects are of particualr interest. For the Complexity Interview, the GIAL main effect remains marginally significant (F = 3.04, 1/33 d.f., p = .087). The analysis for the Type A Interview produced a highly significant main effect (F = 10.33, p = .003), while the GIAL main effect during the Visual-Motor Task (F = .256) failed to reach significance. It appears, then, that the effectiveness of the GIAL measure is of particular importance in the social settings, especially, however, in the externally-challenging social setting generated in the Type A Interview. In contrast to the predominance of the GIAL effect in the social settings, a significant Type A main effect (F = 4.26, 1/33 d.f., p = .044) was obtained for blood pressure deltas during the Visual-Motor Task. It should be noted that other researchers who have demonstrated the effectiveness of Type A in the prediction of arousal to challenge have generally used non-social tasks similar to the video game employed here. Their data are replicated in this research. It appears, then, that GIAL differences are predictors of socially-based arousal while Type A differences (even though scoring is based on a social challenge situation) are predictors of non-social task challenge-based arousal.

Analyses for GIAL Factors

The GIAL theory was based on early cognitive research data and on physiological research data, primarily derived from non-human responses. It has not been tested previously against human physiological responses. As stated above, the overall GIAL score is calculated from factor loadings on the separate factors. It would appear to be useful to determine whether and to what degree these factors separately aid in the prediction of physiological human arousal. Where one or more of these factors do not contribute, they could, for the present purpose, be eliminated from consideration. To conclude whether all or only some of the factors are useful in the prediction of cardiovascular arousal, separate Analysis of Variance procedures based on subject selection into High and Low categories on each factor were employed. As indicated earlier, placement into the High vs. Low categories on each of the Factors was accomplished by weighting each GIAL test item response with factor loadings of .19 or above.

Variety-Seeking

The Analysis of Variance for Factor 1 (Variety-Seeking) included the same five factors, with their respective levels, as utilized in the overall

GIAL analysis. The main effect for Variety-Seeking was marginally significant ($F = 2.90$, $p = .09$). Neither Complexity nor Type A had any effect on arousal. Tasks again differed considerably in delta blood pressure ($F = 12.88$, $p < .001$). A marginally significant Variety-Seeking by Blood Pressure interaction suggested separate analysis for systolic vs. diastolic blood pressure. High vs. low Variety-Seeking scores had no effect on systolic blood pressure elevations, but did significantly affect diastolic arousal ($F = 4.81$, 1/33 d.f., $p < .05$). The same analysis again produced a Type A by Tasks interaction, indicating higher elevations of diastolic blood pressure during the Visual-Motor Task for Type A persons. The GIAL-predicted elevations in diastolic pressure, however, were general, holding for all tasks in which the subjects had participated. It appears, then, that Factor 1, representing variety-seeking, is a general predictor of diastolic arousal across tasks.

Novelty-Seeking

The Novelty-Seeking responses of subjects, based on factor scores obtained for Factor 2, were again analyzed with a five-way Analysis of Variance technique. None of the main effects (Type A, Complexity, Novelty-Seeking) reached significance in this analysis. Tasks again differed in measured arousal ($p < .001$). Marginally significant interactions of Novelty-Seeking with Complexity and Blood Pressure suggested secondary analysis of the differences between high and low Novelty-Seekers in the high/low Complexity by systolic/diastolic Blood Pressure categories. These analyses demonstrated that complex subjects who score high on Novelty-Seeking show considerably more arousal than less complex subjects ($p = .07$), but particularly in readings of systolic elevations ($p = .019$). Differences between the means for both Type A and Type B subjects are striking: while elevations for persons scoring low on Novelty-Seeking average 2 mmHg, those who score high on Novelty-Seeking typically show elevations of more than 10 mmHg.

Factor 2, Novelty-Seeking, appears to be oriented toward systolic blood pressure, but is likely restricted to cognitively complex individuals in its effect. It may well be useful in explaining why cognitively complex persons, in general, tend to show somewhat elevated blood pressure responses to challenge. Those elevations, particularly if they are systolic, may be produced by those complex individuals who are novelty seekers.

Desire for Predictability

The Desire for Predictability (Factor 3) analysis yielded the usual Task ($p < .001$) differences, but no significant main effects for Type A, Complexity, or Desire for Predictability. However, a marginal interaction effect of Desire for Predictability with Blood Pressure suggested separate analysis for diastolic vs. systolic blood pressure in a four-way Analysis of Variance. Again, the interest here is in the Desire for Predictability main effect. No differences between high and low scorers were obtained for systolic blood pressure. However, analysis of diastolic elevations produced a significant main effect ($F = 4.08$, $p = .048$). Persons scoring high on Desire for Predictability (reflecting low GIAL) demonstrated greater blood pressure elevations across the various tasks.

Calculation of the overall GIAL score subtracted the value of the Desire for Predictability factor from the total GIAL score. Such a procedure would imply that for the utilization of the GIAL score as a predictor of arousal, the low scorers on this factor would show greater arousal. The opposite is, however, the case. A corrected GIAL score should then add, not subtract, responses on Desire for Predictability.

Desire for Action, Adventure, Travel

Factor 4 reflects an interest in action and adventure, although that desire was not necessarily extreme. For example, such test items as "I would like to travel to extremely unfamiliar places like distant planets" did not elicit unanimous enthusiasm from high scorers on this factor. They not only wanted to travel to unfamiliar places, but also to familiar places which they had previously enjoyed. In other words, the emphasis is on action and travel with moderate adventure levels.

A five-way Analysis of Variance for Factor 4 produced only the Tasks main effect ($p < .001$). Effects for Type A, Complexity and Action, Adventure, Travel did not reach significance. However, significant interactions for Action, Adventure, Travel by Tasks ($F = 3.83$, 2/66 d.f., $p = .026$) and for Action, Adventure, Travel by Blood Pressure ($F = 4.32$, 1/33 d.f., $p = .043$) were obtained. The first of these interactions indicates considerably greater arousal upon challenge in the Type A Interview for persons scoring high on Action, Adventure, Travel compared with lesser differences in the same direction for the Complexity Interview, and no differences in the Visual-Motor Task. The Action, Adventure, Travel by Blood Pressure interaction indicates that, in general, persons scoring high on this factor produced greater systolic arousal, while person scoring low on this factor showed little differences or, in some cases, greater diastolic arousal. The Desire for Action, Adventure and Travel factor may, upon further analysis, turn out to be an additional useful predictor of arousal. This usefulness would be enhanced if additional test items are written which distinguish more clearly between those persons who are seeking activity in the form of "variety" and those who are seeking adventure in the form of "novelty". Further, it needs to be determined why this factor remains independent of Factors 1 and 2. Part of the reason for this independence may be the large number of factors obtained. If a limit of ten factors had been set to account for all the variance, components of this particular factor may have rotated into loadings for Factors 1 and 2.

Consistency-Seeking

The Consistency-Seeking (Factor 5) analysis again yielded the highly significant main effect for Tasks ($p < .001$) and a significant Blood Pressure by Task interaction ($p = .021$). The Consistency-Seeking main effect, as well as main effects for Complexity and Type A, were not significant. However, a near significant interaction of Consistency-Seeking with Blood Pressure ($F = 3.68$, 1/33 d.f., $p = .06$) was obtained, suggesting the need for additional analysis of delta arousal values for systolic and diastolic blood pressure separately.

A four-way Analysis of Variance for systolic blood pressure deltas yielded a marginally significant main effect for Consistency-Seeking ($p = .096$), indicating slightly higher arousal levels for persons scoring low on the factor (i.e., persons who are not consistency-seekers). The equivalent four-way Analysis of Variance for diastolic blood pressure deltas did not yield any significance for factors or for interactions related to consistency-seeking. In general, then, Factor 5 contributes very little to the prediction of arousal across the various task conditions in the research.

An Overview

Interpretation of the various GIAL Factors in terms of their importance for the prediction of physiological arousal is meaningful only if the Factors (and other measures) are relatively independent of each other. To determine their degree of independence, correlations of the factor scores with each other and with the Type A and Complexity measures were obtained. These correlations are presented in Table 1.

Table 1: Correlations of Factors with Each Other and with Cognitive Complexity and Type A

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Cognitive Complexity	.18	.43	-.05	.17	-.26
Type A	-.05	.18	.11	.10	0
Factor 1	X	.35	-.18	.18	-.14
Factor 2		X	-.10	.44	-.67
Factor 3			X	-.09	.22
Factor 4				X	-.2
Factor 5					X

The highest common variance among the measures obtained was 45% between Factors 5 and 2, suggesting the requirement of care in adding scores from these two factors. Beyond that limitation, however, the potential dependence of the measures on each other need not be of concern.

We may then consider the capacity of the various measures (including the overall GIAL compound of factor scores) to predict delta systolic and diastolic arousal across the three task conditions. The degree of success for the measures is evident from Table 2.

TABLE 2: Summary of significant and marginally significant ($p < .10$) effects of various measures on arousal

MEASURES

TASK:	Complexity Interview Task		Type A Interview Task		Video Game Task	
BLOOD PRESSURE:	Systolic	Diastolic	Systolic	Diastolic	Systolic	Diastolic
Type A	none	none	none	none	significant	significant
Cognitive	marginal	marginal	marginal	marginal	marginal	marginal
GIAL	marginal	marginal	significant	significant	none	none
Factor 1: Variety-Seeking	none	significant	none	significant	none	significant
Factor 2: Novelty-Seeking	significant for complex Ss only	marginal for complex Ss only	significant for complex Ss only	marginal for complex Ss only	significant for complex Ss only	marginal for complex Ss only
Factor 3: Desire for Predictability	none	significant	none	significant	none	significant
Factor 4: Action, Adventure, Travel	significant	none	significant	significant	significant	none
Factor 5: Consistency-Seeking	marginal	none	marginal	none	marginal	none

It is particularly interesting to note that the several factors in the GIAL analysis have separate and quite different predictive capacity for systolic vs. diastolic blood pressure and, to some degree, for different tasks. The overall GIAL score did not do quite as well, although its lesser predictive capacity is probably due to the inversion of one of the factors from the predicted direction. With a modification of the use of that factor, the predictive capacity of the overall GIAL could be greatly improved. Even more useful would be the development of a GIAL type measure which is directly based on the respective Eigen values of the factors in the varimax rotation, combined with their weighted predictive capacity for systolic and for diastolic arousal which could, in future research, be obtained from multiple regression analyses.

Conclusions

It was the purpose of this research to study the functions of various cognitive/behavioral styles, in general, and of General Incongruity Adaptation Level (GIAL), in particular, as they affect physiological arousal under a variety of task conditions. The resulting data are, without question, rather rich in observed relationships. Many require further research and analysis to clarify the joint effects of styles and stressors on arousal.

As discussed earlier, relationships between styles and performance and between styles and arousal have previously been reported, particularly on the basis of this research program. The additional data reported here suggest that, at least in some cases (e.g., load), the same stressor conditions will produce both arousal and changes in performance (e.g., use of strategy, risk taking and other characteristics, as reported in previous technical reports). Moreover, these changes seem to occur more generally and to a greater degree in persons with specific stylistic characteristics. Such observations would suggest the following questions: (1) Do physiological arousal and performance covary as an effect of stressor experiences? and (2) Is such covariation, if it does exist, mediated by specific stylistic characteristics? If covariation between arousal and performance changes is found, interventions designed to, for example, increase the use of strategy in decision making or decrease risk taking under stress, would have to proceed according to quite different guidelines than if no covariation is obtained. The next research steps in this project will attempt to determine whether or not such covariation does exist for risk taking and for measures of decision making.

REFERENCES

Dembroski, T. M., MacDougall, J. M., Herd, J. A. and Shields, J. L. Effect of level of challenge on pressor and heart rate responses in Type A and B subjects. Journal of Applied Social Psychology, 1979, 9, 209-228.

Dembroski, T. M., MacDougall, J. M. and Shields, J. L. Physiological reactions to social challenge in persons evidencing the Type A coronary prone behavior pattern. Journal of Human Stress, 1977, 3, 2-9.

Dembroski, T. M., MacDougall, J. M., Shields, J. L., Petitto, J. and Lushene, R. Components of the Type A coronary prone behavior pattern and cardiovascular responses to psychomotor performance. Journal of Behavioral Medicine, 1978, 1, 159-176.

Friedman, M. and Rosenman, R. H. Association of specific overt behavior patterns with blood and cardiovascular findings: blood cholesterol level, blood clotting time, incidence of arcus senilis, and clinical coronary artery disease. Journal of the American Medical Association, 1959, 169, 1286-1296.

Maddi, S. R. The pursuit of consistency and variety. In, R. P. Abelson, E. Aronson, W. J. McGuire, T. M. Newcomb, M. J. Rosenberg and P. H. Tannenbaum (Eds.) Theories of cognitive consistency: A sourcebook. Chicago: Rand McNally, 1968.

Osgood, C. E. and Tannenbaum, P. H. The principle of congruity in the prediction of attitude change. Psychological Review, 1955, 62, 42-55.

Rosenman, R. H. The interview method of assessment of the coronary prone behavior pattern. In, T. M. Dembroski, S. Weiss, J. L. Shields, S. Haynes and M. Feinleib (Eds.) Coronary-prone behavior. New York: Springer Verlag, 1978.

Streufert, S. and Streufert, S. C. Behavior in the complex environment. Washington, D. C.: V. H. Winston and John Wiley, 1978.

Streufert, S., Streufert, S. C., Dembroski, T. M. and MacDougall, J. M. Complexity, coronary prone behavior, and physiological response. In, D. J. Oborne, M. M. Gruneberg and J. R. Eiser (Eds.) Research in psychology and medicine. London: Academic Press, 1979.

Streufert, S., Streufert, S. C. and Denson, A. L. Cognitive complexity, Type A behavioral style and load as predictors of visual-motor task performance. Office of Naval Research, Technical Report No. 10, December, 1982.

Streufert, S., Streufert, S. C. and Denson, A. L. Information load stress, risk taking and physiological responsivity in a visual-motor task. Journal of Applied Social Psychology, 1983, 13, 145-163.

Streufert, S., Streufert, S. C. and Denson, A. L. Effects of four task stressors on blood pressure responses in persons differing in Type A Coronary Prone Behavior and Cognitive Complexity. Office of Naval Research, Technical Report No. 11, March, 1983.

Streufert, S., Streufert, S. C., Denson, A. L., Lewis, J., Henderson, R. and Shields, J. L. Differential effects of work related stressors on cardiovascular responsivity. In, I. Sarason and C. Spielberger (Eds.) Stress and anxiety, Vol. 11. Washington, D. C.: Hemisphere, in press.

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