THE EFFICACY OF PREPARATION, DISTRACTION, AND INFORMATION, ON DECREASING THE STRESS RESPONSE

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COHEN

UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES
4301 JONES BRIDGE ROAD
BETHESDA, MARYLAND 20814-4799

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Lorenzo Cohen
Department of Medical & Clinical Psychology
Uniformed Services University of the Health Sciences

Abstract

Title of Thesis: The efficacy of preparation, distraction, and information on decreasing the stress response.

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This dissertation examined the efficacy of providing preparation, distraction, and information on attenuating response to a laboratory stressor. The impact of different mechanisms thought to mediate stress, such as coping technique, perceived control, predictability, and preparedness for the stressor, were also examined.

Seventy five subjects were randomly assigned to five groups. One group received procedural information and was allowed to prepare for the stressor. Another group was given stressor pre-exposure and then engaged in a distraction task. The third intervention group was given stressor pre-exposure. Two control groups were included, controlling for the psychological and physiological effects of stressor pre-exposure and information provision. After the interventions, subjects were exposed to 6 minutes of mental arithmetic. Psychological, physiological, and behavioral measures were assessed throughout the study.

Results showed that all three intervention groups exhibited less stress compared to the control groups. The group given stressor pre-exposure plus distraction showed a

decrease in stress across a greater number of indices than the other intervention groups including smaller changes in negative affect, lower cardiovascular reactivity, and fewer behavioral aftereffects. Results also showed that Monitor scores (subjects who tend to seek out information about stressful events) predicted stress responding, and this relationship was dependent on whether subjects were in the intervention groups or control groups. Further, the more predictable the task, the more prepared subjects felt, and the less out of control subjects reported being during the task, the lower the self-reported stress levels. Perceptions regarding ability to stop the task positively predicted the physiological impact of the stressor. Results are discussed in relation to mechanisms responsible for stress reduction, and implications for future research.

THE EFFICACY OF PREPARATION, DISTRACTION, AND INFORMATION ON DECREASING THE STRESS RESPONSE

by

Lorenzo Cohen

Thesis submitted to the faculty of the Department of Medical and Clinical Psychology of the Uniformed Services University of the Health Sciences in partial fulfillment of the requirements for the degree of Doctor of Philosophy 1994

Dedication

This dissertation is dedicated to my grandfathers, Harry Cohen and Luigi Scaravelli. Even though they were not alive for the completion of my Ph.D. their presence within me made it all possible.

My grandfathers share their dedication with my soul-mate Alison Jefferies, who's faith and love helped me through this whole process.

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INTRODUCTION

Overview

This dissertation tested the effectiveness of individual components of common stress-reduction interventions. Issues examined included the effects that preparation for, distraction from, or information about a laboratory stressor had on decreasing the stress response. Variables measured included psychological, behavioral, and physiological components of the stress response during three time periods. The first period was after initial exposure to a stressor, or a rest period for control subjects, and before re-exposure. This represented an anticipatory period during which subjects either prepared for the upcoming stressor, were distracted from the upcoming stressor, or were provided no intervention. The next period was during stressor exposure, when the subjects were completing the task. The last period was during recovery after the task. Further, this study sought to determine the primary mechanisms involved in stress reduction procedures.

The following literature review explores field and laboratory research examining interventions aimed at reducing stress, pain and discomfort during surgery procedures, and the impact on recovery from surgery. Stress reduction techniques examined are information provision, relaxation, and cognitive-behavioral methods. This review will first define stress, the stress response and

consequences of stress, including psychological, behavioral, physiological, and biochemical aspects. The next section examines studies using stress-reduction interventions to diminish stress associated with medical procedures and the methodological problems with these field studies. Following this is a section examining the mechanisms responsible for the beneficial effects of the stress-reduction procedures. This will include an examination of appraisal and coping mechanisms, and three components thought to be important to most interventions; predictability, distraction, and control.

The Stress Concept

The stress literature is difficult to interpret due to many inconsistencies or contradictory findings. Different operationalizations and definitions of stress have caused confusion in the literature, as have different theories explaining the same construct. Much of what we know about stress was developed from different disciplines, with traditional psychosocial and biological perspectives only recently integrated. Historically, models of stress did not correspond well and definitions focusing on different organ systems, time frames, and conceptions of stress characterized its study for more than 50 years (Cannon, 1929; Selye, 1976; Lazarus, 1966; Lazarus & Folkman, 1984; Mason, 1975).

To minimize some of the inconsistencies in the definition of stress, many researchers have sought broader definitions of stress, with more complex investigative frameworks. Stress is best thought of as a psychophysiological process, usually experienced as a negative emotional state, that is both a product of appraisal of situational and psychological factors and an impetus for coping (Baum, Cohen, & Hall, 1993). In this sense stress is the central experiential state in a process linking perception of threatening or harmful events and responses to them (Lazarus & Folkman, 1984). Stressors, events posing threat or challenge or otherwise demanding effort and attention for adaptation, are judged in light of situational variables and personal attributes and assets. If stressors are appraised as menacing or challenging, specific responses directed at reducing the stress occur. This may take place upon confrontation with the stressor or during an anticipatory phase, prior to stressor exposure. Therefore, stress responses may be seen as supporting coping responses that are aimed at eliminating the sources of threat or demand or at reducing the emotional distress caused by the stressor (Baum, Cohen, & Hall, 1993).

Other issues contributing to inconsistencies in stress research are the conceptualization of intensity and duration of stressful experiences. Interacting with intensity and duration of the stressful event are factors describing

individual strengths and vulnerabilities to the stressor which will contribute to individual differences found in the stress research. Individual differences in appraisal, response strength, assets, and other relevant factors contribute to how intense or long a stressful episode will be or whether it is experienced as stress at all. Together, the power of a stressful experience, its duration, and the vulnerabilities and sources of strength that people bring to each situation should determine the degree to which stress affects an individual.

The Stress Response

Early research by Cannon and De La Paz (1911) showed that in the presence of a potentially harmful event there was an increase in circulating epinephrine (EPI). Cannon (1948) described this increase in sympathetic activity as an adaptive mechanism which prepares an organism for a "fight or flight". This catecholaminergic response could be viewed as advantageous to an organism, enabling it to better respond to danger.

Since these early studies there has been extensive research on the effect that stress has on brain and peripheral catecholamine levels. Many studies have shown that release of catecholamines, as indexed by urinary and plasma levels, increase after exposure to stressful events (Baum, Gatchel, Fleming, & Lake, 1981; Mason, 1974;

Schaeffer & Baum, 1984). Researchers also demonstrated that inescapable shock produces a decrease in brain norepinephrine (NE) in most brain regions (Anisman, Pizzino, & Sklar, 1980; cf. Weiss, Glazer, Pohorecky, Bailey, & Schneider, 1979). However, this depletion was reversed by administration of pargyline, a monoamine oxidase (MAO) blocker, (MAO is involved in the metabolism of released NE (Weiss et al., 1979)). Therefore it appears that it is not a decrease in NE synthesis *per se* that causes the depletion, but an increase in NE metabolism. To return to homeostatic NE levels, the organism needs to increase catecholamine production.

The physiological response occurring during exposure to a stressor is also accompanied by increases in other endocrine systems including, adrenocorticotropic hormone, somatotropic hormone (growth hormone), and pituitary-thyroidal hormone (Selye 1955; Mason, 1975). Extensive research examining the activation of the pituitary-adrenal cortical system during and after exposure to a stressor showed that cortisol was elevated (Baum, Schaeffer, Lake, Fleming, & Collins, 1985; Mason, 1975). Even though cortisol changes are sensitive to psychological factors, and can vary greatly due to situations and individual difference variables, increases in cortisol have long been accepted as accompanying the stress response, and has come to be used as one index of stress responding (Baum, Grunberg, & Singer,

1982). More consistent changes are seen in the pituitary-adrenal medullary system, and as a result the catecholamine hormones (EPI and NE) are also used as an index of stress responding (Baum, Grunberg, & Singer, 1992).

In conjunction with a physiological response, stress is also a product of an individual's psychological coping processes. Lazarus and Folkman's (1984) transactional framework defining the stress process, integrates situational differences with individual differences in determining how a person will respond to an event. An individual may become actively involved with the stressor in an attempt to decrease the aversiveness, problem-focused coping, and/or they may choose to take a more passive role concentrating on emotional adjustment to the event, emotion-focused coping.

Coping processes contribute to the substantial differences and apparent contradictions that exist in the stress field, and explain some of the inconsistencies found in the research. People use different coping strategies for different situations, and usually engage in different methods of coping for one event (Folkman & Lazarus, 1985). Further, different individuals will use different coping techniques for the same event. There is no right or wrong coping technique, what works for one individual may not work for another, and the common goal is to decrease the aversiveness of an event. And it is difficult to judge

efficacy, particularly in hindsight.

Coping is a primary behavioral response to threat, danger, or challenge and some of these responses directed at management of one's emotional state may have health-relevant consequences of their own (e.g., stress increases smoking, drug and alcohol use). In addition, possibly through a re-prioritization of concerns due to overload or narrowing of attention, behaviors that contribute to maintenance of good health may be inhibited.

Consequences of Stress

The physiological changes that take place during the stress response may have a negative impact on health. For example, increased sympathetic arousal during stress is believed to facilitate atherosclerosis by causing damage to arterial walls, increasing mobilization of lipids, and stimulating smooth muscle cell proliferation (Schneiderman, 1983). Further, Patterson, Zakowski, Hall, Cohen, Wollman, and Baum (1993) showed that both active and passive acute laboratory stressors decreased platelet activation time compared to non-stressed controls. These processes work together to generate atherosclerotic plaque over a long period of time. The hormonal cascade associated with stress also increases heart rate and blood pressure. Therefore, repeated exposure to stressors could contribute to increased blood pressure associated with hypertension, ischemia, and

eventually cardiac death (Kamarck & Jennings, 1991; Krantz, Helmers, Nebel, Gottdiener, & Rozanski, 1991).

Early correlational studies determined that stress was associated with increases in self-reported health problems (Holmes & Rahe, 1967). More recently, Cohen, Tyrrell, and Smith, (1991) showed that in a controlled setting stress increased susceptibility to the common cold. Some investigators report that stress may contribute to the etiology and progression of cancer (Gehde, & Balthrusch, 1990; Greer, Morris, & Pettingale, 1979; Morris, Greer, Pettingale, & Watson, 1981). Although this research is still quite controversial, there is evidence that stress decreases natural killer (NK) cell activity (Cohen, Delahanty, Smitz, Jenkins, & Baum, 1993; Kiecolt-Glaser, Garner, Speicher, Penn, Holliday, & Glaser, 1984; Sieber et al., 1992) which is a primary defense against metastatic tumor growth (Herberman & Ortaldo, 1981). Stress-induced decreases in NK cell function also have been linked to tumor growth in animals (Ben-Eliyahu, Yirmiya, Liebeskind, Taylor, & Gale, 1991).

Extensive research has determined that stress has an impact on the immune system, and this change is thought to be one of the primary mechanisms responsible for the negative health consequences of stress exposure. Exposure to chronic stress produces a decrease in a variety of immune cells including, monocytes, CD4, CD8, NK, and B cells

(Cohen, Hall, Temoshok, Patterson, & Baum, 1993; MacKinnon, Weisse, Reynolds, Bowles, & Baum, 1989). Further, function of various immune cells have been found to decrease after exposure to laboratory stressors (Cohen et al., 1993; Manuck, Cohen, Rabin, Muldoon, & Bachen, 1991) during examination periods (Kiecolt-Glaser et al., 1984) during marital disruption (Kiecolt-Glaser, Fisher, Ogrocki, Stout, Speicher, Glaser, 1987a) and during caregiving for Alzheimer patients (Kiecolt-Glaser, Glaser, Shuttleworth, Dyer, Ogrocki, Speicher, 1987b). The clinical significance of these changes are yet to be determined, although it is assumed that these stress-induced immune system changes do have an impact on health.

The sympathetic-adrenal medullary-catecholaminergic system has been implicated as a primary mechanism of stress-induced immune suppression; stimulation of beta-adrenergic receptors on lymphocytes affects cell activity, producing a decrease in the proliferative response of lymphocytes to mitogens (Carlson, Brooks, Roszman, 1989). Animal research has demonstrated that beta-receptor blockade prior to administration of amphetamine or corticotropin releasing hormone attenuated the immunosuppression caused by these substances (Irwin, Hauger, Jones, Provencio, Britton, 1990; Pezzone, Rush, Kusnecov, Wood, Rabin, 1992).

Along with the physiological consequences of the stress response, behavioral changes also occur. Stress increases

vulnerability to substance abuse and increases substance use in individuals already using drugs (Romelsjo, Lazarus, Kaplan, Cohen, 1991; Wills, 1986). This may lead to health problems associated with drug abuse. Stress also affects a range of other behaviors and appears to cause shifts in tolerance for frustration, patience, motivation, attention, and tolerance for detail, and these changes may constitute an additional source of influence on health (Glass & Singer, 1972).

Excessive levels of stress during medical procedures such as gastrointestinal endoscopy, dental procedures, and childbirth can lead to complications during the procedures such as heightened pain sensations, increased need for medication, and interference and prolongation of the procedures (MacDonald & Kuiper, 1983). Increased levels of stress prior to and during medical procedures may prolong the recovery process and increase the probability of postoperative complications. Due to the deleterious effects of stress on an organism it would seem to be beneficial to decrease stress levels and therefore the consequences of stress.

Stress and Medical Procedures

Most medical procedures are viewed as stressful experiences. Anxiety is caused by the prospect of experiencing pain and discomfort, being in a new unfamiliar

setting exposed to new procedures, and danger may be involved as well as the possible negative implications associated with diagnostic and prognostic procedures. Increased levels of stress prior to and during medical procedures may have an impact on compliance, the actual procedure, as well as recovery.

Stress and anxiety have been associated with vulnerability to conditioned nausea and vomiting (CNV), a side-effect of cancer chemotherapy (Bovbjerg, Redd, Maier, Holland, Lesko, Niedzwiecki, Rubin, & Hakes, 1990; Fredrikson, Furst, Lekender, Rotstein, & Blomgren, 1993; Watson & Marvell, 1992). One of the major problems in administering oncological procedures is compliance with chemotherapy and if decreasing stress and anxiety decreases CNV, compliance may increase (Carney & Burish, 1988). It has also been suggested that patients high in anxiety are at greater risk for complications during surgery. Williams, Williams, and Jones (1971) reported that patients with high preoperative anxiety needed larger doses of anaesthesia, which could place them at greater risk for complications during the procedures. Further, high levels of anxiety may interfere with a physician during invasive exploratory procedures and stress induced immune changes may increase complications due to infection.

Janis (1958) proposed that there was a curvilinear relationship between preoperative anxiety and postoperative

recovery. His theory posits that subjects experiencing moderate levels of preoperative anxiety will have faster recovery than subjects experiencing low or high levels of anxiety (Janis, 1958). There has been little support for Janis' model, with most current research supporting a more linear model. For example patients high in preoperative anxiety were found to have higher levels of postoperative depression, anger, fear, pain, medication use, and greater length of hospital stay compared to subjects experiencing moderate or low levels of preoperative anxiety (Johnson, Leventhal, & Dabbs, 1971; Sime, 1976).

Methods aimed at decreasing preoperative fear and anxiety could benefit the individual undergoing these procedures as well as benefit the medical community. These benefits could range from facilitating psychological adjustment by the patient and decreasing complications from the procedures, to decreasing hospital costs due to medication use and length of hospital stay. Medical facilities have begun implementing stress management training programs as part of basic medical procedures (Ludwick-Rosenthal & Neufeld, 1988). Most stress reduction procedures provide patients with a variety of techniques, assuming that some, if not all, will help reduce stress, fear, and anxiety. Unfortunately, this package approach does not reveal the mechanism(s) responsible for stress reduction, and therefore each patient receives intervention

techniques that are not necessarily helpful at reducing stress.

Stress Management During Medical Procedures

There are several methodological problems associated with most stress intervention studies. Studies frequently lack the appropriate control group(s) to draw any conclusions as to the mechanisms responsible for stress reduction. Further, many studies lack proper manipulation checks and measurement of stress, making it difficult to interpret the effects. Also, most intervention studies use a package approach, making it difficult to isolate the useful aspects of the treatment package.

Controlled laboratory experiments will aide in isolating the useful aspects of stress interventions, by exposing subjects to acute stressors after having them engage in various interventions. Since laboratory stressors are generally acute, this review will focus on stress-interventions as they relate to acute medical procedures and not chronic health problems or chronic stress exposure. In an attempt to understand the mechanism(s) for stress reduction, this review will focus on studies that sought to examine or compare specific intervention techniques, and not studies adopting a package approach. The techniques reviewed include preparatory information, relaxation procedures, and various cognitive-behavioral preparations.

Information Interventions

The majority of stress-reduction studies in medical contexts provide information to patients in an attempt to decrease anxiety caused by the procedures. Information-based interventions enable an individual to form accurate expectations about future events and increases predictability and a sense of control over the procedures. Patients are given a description of the procedural events and there sequence (procedural information) and/or the sensations likely to be felt during the procedures and recovery stages (sensory information). Most of this literature indicates that providing information decreases anxiety associated with medical procedures, but there appears to be a consistent interaction with individual difference variables such as coping style.

Wilson, Moore, Randolph, and Hanson (1982) exposed subjects undergoing gastrointestinal endoscopy examinations to sensory and procedural information. Results indicated that subjects given information showed smaller increases in heart rate and observer ratings of distress during the insertion of the tube than did a Regular Care Control Group given general information about the procedures. The Information Group was also provided instructions about appropriate and inappropriate behavior during the examination, making it difficult to determine whether it was information per se that decreased distress and arousal or

the coping and behavioral suggestions provided.

Jean Johnson and her colleagues have conducted a number of studies examining the efficacy of information based procedures at reducing the deleterious effects of medical procedures, and have investigated different variables confounding previous research (cf., Johnson, 1984). In an attempt to isolate the effects of information from the effects of behavioral adjustments made during gastrointestinal endoscopy examinations Johnson and Leventhal (1974) gave subjects either sensory and procedural information, behavioral instructions on breathing and swallowing techniques, or a combination of both. Patients in the Information or Information Plus Behavioral Instruction Groups exhibited less gagging during the procedures than the Behavioral Instruction Group or Control Group. This indicates that information alone is more efficacious for decreasing possible distress associated with gastrointestinal endoscopy examinations, and that behavioral coping information was only effective when combined with procedural and sensory information. The Information Plus Behavioral Instruction Group took longer to swallow the tube, but combined with the fact that they displayed less gagging, the data indicated that they may have had better control over the swallowing of the tube (Johnson & Leventhal, 1974).

Another study examined the efficacy of sensory versus procedural information for reducing the aversiveness of gastrointestinal endoscopy examination (Johnson, Morrisey, & Leventhal, 1973). Results indicated that either type of information resulted in less need for valium administration compared to a Control Group. Subjects receiving Sensory Information showed fewer physical movements related to distress compared to the Procedural Information Group, suggesting that sensory information is more beneficial for this type of procedure than procedural information.

Recently, Fourie and Nell (1990) sought to examine the efficacy of detailed versus brief information for decreasing the distress associated with gastrointestinal endoscopy examinations. The Detailed Intervention combined sensory and procedural information with behavioral coping strategies. The Brief Intervention Group received minimal procedural and sensory information, and just two behavioral strategies. The results showed that subjects receiving the brief intervention reported better mood and better behavioral adjustments to gastrointestinal endoscopy examination than the detailed intervention or a Regular Care Control Group. Results indicated that perhaps long interventions increase patients level of concern instead of reducing distress. Unfortunately, this study confounded length of intervention with information provided, obscuring the findings.

Kendall, Williams, Pechacek, Graham, Shisslak and Herzoff (1979) examined anxiety and behavioral adjustment to cardiac catheterization with and without information provision. The Information Group received both sensory and procedural information, and a Placebo Attention Control Group was included, as well as a Regular Care Control Group. The Placebo Attention Groups are necessary to control for the attention given to and by the experimental subjects in an attempt to isolate the effects of information. This group conversed with a therapist for the same amount of time the Information Group interacted with the therapist. Results indicated that the Information Group showed better behavioral adjustment ratings and lower anxiety compared to the two Control Groups.

Prior to cardiac surgery, Anderson (1987) exposed one group of patients to sensory and procedural information and another to sensory and procedural information plus coping preparations. He found that compared to a Regular Care Control Group exposed to general procedures, both intervention groups reported decreased anxiety pre and post surgery. Perceived control was also found to mediate anxiety levels regardless of group assignment. Further, subjects in the intervention groups showed lower levels of postoperative hypertension compared to Controls (Anderson, 1987).

Mills and Krantz (1979) examined the relationship between level of information (high/low) and choice (choice/no choice) of arm to have blood taken from for first time blood donors. They found that both the Choice Alone and the Information Alone Groups reported lower levels of self-reported discomfort and nurse ratings of distress compared to the combination of both Information And Choice. In other words, choice and information were independently helpful, yet when combined they were not helpful. These results may indicate that too much behavioral involvement in medical procedures may be detrimental to decreasing stress levels. Further, the authors speculated that the increased involvement with the procedures gave the subjects more control than they would have liked. Unfortunately, desire for or perceived control were not measured. Taken together, results from this study and others (Anderson, 1987; Johnson & Leventhal, 1974) indicated that information interventions are as effective, and often better, at reducing distress as information plus behavioral coping strategy interventions.

Information and Coping Style

In the Wilson et al. study described above, examining sensory and procedural information for subjects undergoing gastrointestinal endoscopy examinations, several relationships were found between coping style and patient adjustment. Emotional control and an independent coping

style were negatively correlated with valium administered during the procedures. Further, independence was negatively correlated with distress during tube insertion. Interactions were found between independence and information provision for heart rate increases during the procedures, in that patients provided information who were low in independence exhibited less heart rate increases than subjects high in independence or control group subjects high or low in indipendence. Also, patients low in avoidance given information reported less distress during tube insertion than control subjects low in avoidance (Wilson et al., 1982).

Auerbach, Kendall, Cuttler and Levitt (1976) separated subjects into internal and external locus of control (Rotter, 1966) to determine the efficacy of specific sensory and procedural information versus general information at increasing behavioral adjustment (fear, anxiety, pain) to tooth extraction. They found that subjects high in internal locus of control showed better adjustment when exposed to specific information than when provided general information. Subjects high in external locus of control were more poorly adjusted with specific information and better adjusted with general information. A second study (Auerbach, Martelli, & Mercuri, 1983) attempted to replicate the earlier findings and to examine the interaction between type of information and receptiveness to health care information as measured by

the Krantz Health Opinion Survey (KHOS; Krantz, Baum, & Wideman, 1980). Better adjustment was found for subjects in the Specific Information Group. Results indicated an interaction between Information Group and preference for information such that patients in the Specific Information Group who indicated high preference for information showed better behavioral adjustments compared to subjects with high information preference given General Information. The opposite pattern was found for subjects indicating low information preference, but this effect did not reach significance. The authors did not find a relationship between information provision and internal/external locus of control in relation to behavioral adjustment to the procedures. Since all procedures were identical to the 1976 study the importance of locus of control remains in question.

Miller and Mangan (1983) showed that personality dispositions measured via the Miller Behavioral Styles Survey (MBSS; Miller, 1987) interacted with level of information at reducing tension and anxiety prior to a diagnostic vaginal examination for cancerous cells. Specifically, Blunters (individuals who tend to avoid information) provided High Information reported increased levels of tension/anxiety compared to Blunters provided Low Information, and Monitors (individuals who tend to seek out information) provided High Information showed lower levels

of tension/anxiety compared to Monitors provided Low Information (Miller & Mangan, 1983). Andrew (1970) provided support for the effect of personality differences measured with a sentence completion test. When subjects were prepared for hernia surgery Sensitizers and Neutrals needed less medication and showed a faster recovery compared to Avoiders. No interaction was found between personality disposition and preparation for surgery (Andrew, 1970).

Recently, Ludwick-Rosenthal and Neufeld (1993) conducted a study to examine the interaction between level of information provided prior to cardiac catheterization and coping disposition as measured by the MBSS and the KHOS. When level of information provided matched patients desirability for information from the KHOS they reported decreased behavioral anxiety. Further, they found that problem focused coping was impeded when desirability for information did not match information condition.

Summary

There is considerable support for the idea that providing information prior to aversive medical procedures will decrease distress and arousal, and that individual differences mediate the effects. Results indicate that sensory information is more helpful for gastrointestinal endoscopy procedures, yet most studies find that both sensory and procedural information are beneficial. Several

studies reveal that information alone reduces stress as much as or more than information plus behavioral coping interventions. As expected, there is an interaction between an individual's coping disposition and level of information provision, whereby if there is not a match between information that the patient wants and what they receive, patients may derive more harm than benefit from the intervention procedures.

Unfortunately, except where indicated, few of the studies cited above state whether subjects had previous experience with the medical procedures. If previous experience with the procedures is not randomized across groups, then one group may have had more experience with the procedures confounding information provision with pre-exposure to the stressor. Most studies did not measure subjects level of knowlege of the procedures after information provision. Most studies failed to include the proper manipulation checks necessary to determine whether it was an increase in information <u>per se</u> which was the beneficial component of the interventions. If procedural and sensory information are the beneficial factors of these interventions, then future studies need to include a measure determining if patients level of information had actually increased. Another factor making interpretation of information interventions difficult is that most studies failed to include the proper control groups. The study by

Kendall et al. (1977) is the only one that included an attention control group. As well as including specific sensory and procedural information, these interventions increase level of attention given to patients as well as engaging them in distracting interactions. Without an attention control group it is difficult to separate the beneficial aspects of information from other variables such as attention or distraction.

Relaxation Interventions

Little research has examined the mechanisms whereby relaxation decreases anxiety during stressor exposure, yet several studies have examined the effects of relaxation training on aversive medical procedures. Most relaxation techniques employ what is called progressive muscle relaxation (Jacobson, 1970). The procedures have the patient progressively tense and relax each muscle group. In this way, after a tensing period the muscle is relaxed and loose and the patient will feel physical relaxation.

Corah and colleagues conducted several studies examining the effects of relaxation training in reducing the distress associated with dental procedures. The first study indicated that subjects in the Relaxation Groups showed significant decreases in distress from one session to another compared to a Control Group with no intervention (Corah, Gale, & Illig, 1979a). A replication study

indicated that patients in the Relaxation Group reported lower levels of distress from time one to time two and that women benefitted more than men from the relaxation techniques (Corah, Gale, & Illig, 1979b). This finding held for high as well as low dental anxiety patients. A third study by this research group indicated that anxiety decreased the same degree from session one to session two for both the Relaxation Group and the Control Group. Electrodermal responses decreased more for low dental anxiety relaxation patients compared to high dental anxiety control patients. Replication of the sex differences was not found (Corah, Gale, Pace, & Seyrek, 1981).

Therapy for treating cancer can be very aversive, and the side-effects tend to be conditioned to the environment. For example nausea and vomiting is a side-effect of cancer chemotherapy and patients report that negative affect and physiological reactions develop as they drive towards the hospital (Burish & Lyles, 1981). These feelings intensify the closer patients get to the procedure room and often patients will abort the treatment program due to conditioned nausea and vomiting (CNV; Watson & Marvell, 1992). Several laboratories have examined the effects of progressive muscle relaxation at decreasing CNV (cf. Carey & Burish, 1988). Overall, the research indicates that progressive muscle relaxation reduces physiological arousal, nausea, and

vomiting prior to and after the therapy session (Burish, Carey, Krozely, & Greco, 1987).

Subjects engaging in progressive muscle relaxation prior to gastrointestinal endoscopy examination showed less of an increase in heart rate and lower distress as rated by the physician compared to controls (Wilson et al., 1982). Relaxation subjects also reported increased positive mood after the procedures. Kaplan, Atkins, and Lenhard (1982) found that patients in a Progressive Muscle Relaxation Group prior to a sigmoidoscopy examination reported decreased levels of anxiety compared to Controls. Field (1974) found that depth of relaxation during the intervention prior to orthopedic surgery was negatively correlated with nervousness and positively correlated with recovery.

Summary

Although there is research indicating that relaxation procedures decrease stress and anxiety associated with medical procedures, little attention is given to whether it is relaxation causing the effect or a bi-product of the procedures (distraction, control etc.). Few studies have included an attention control group needed to determine whether the results obtained are due to the specific intervention used or due to other non-specific characteristics common to the procedures. Further, few studies, with the exception of the Field (1974) study, use

manipulation checks for levels of relaxation, making it difficult to determine whether relaxation is achieved.

Cognitive-Behavioral Interventions

Similar to information provision and relaxation procedures, most cognitive-behavioral interventions are aimed at reducing stress through reappraisal of the event and implementation of different coping strategies for overcoming the stress associated with the event. Some of the strategies use distraction, control over the situation (perceived or actual), attention focusing, and reevaluation of the stressor. Most cognitive-behavioral intervention studies have been conducted in the area of pain management, yet several of these studies apply to acute medical procedures.

In the series of studies by Corah et al. described previously, groups of subjects who either listened to music (1981) or played a video ping-pong game during the dental procedures (1979a, 1979b) were compared. Results indicated that listening to music had relatively no effect on any of the distress measures. However, the Music Distraction Group showed a significant decrease in autonomic sensations from session one to session two (Corah et al., 1981). The video game produced more dramatic results in relation to anxiety reduction. Physician reported distress and discomfort of the patients and patient self-reported distress and

discomfort was lower for the Video Game Group compared to the Control Group (Corah, et al., 1979a; Corah, et al., 1979b). When analyses were conducted by high/low dental anxiety, only high dental anxiety subjects showed a decrease in distress. Further, an interaction was found such that male subjects with low levels of dental anxiety playing the video game showed a decrease in distress and discomfort (Corah, et al., 1979b). Thus individual differences of gender and anxiety level prior to the procedures interacted with the stress reducing characteristics of distraction.

Langer, Janis, and Wolfer (1975) used cognitive reappraisal of the surgery situation as a method for stress reduction. Presenting patients with coping techniques, aimed at cognitive reappraisal by having them concentrate on the positive aspects of the surgery, resulted in lower levels of distress preoperatively, as well as fewer requests for pain medications postoperatively, compared to an attention control group. The study by Kendall et al. (1979) discussed above included an interactive cognitive-behavioral intervention. The intervention focused on changing patients interpretation of anxiety producing cues and using cognitive coping strategies to respond to the cues. They also included an information group, and two control groups; an Attention Control Group as well as a Usual Care Group. Results indicated that subjects receiving the cognitive-behavioral intervention showed lower anxiety ratings during

cardiac catheterization compared to the information alone group, and with the two control groups which did not differ from each other (Kendall et al., 1979).

The study by Kaplan et al. (1982) discussed previously also included two cognitive intervention strategies to reduce the distress of sigmoidoscopy. One group was asked to use positive thinking and focus attention internally on the control they could have over the situation. A second group was told to focus their attention externally, thinking about the expertise of the doctor and the doctors control. Results indicated that patients in both cognitive interventions displayed lower levels of anxiety, fewer body movements during the procedures, and fewer verbalizations of pain compared to an attention control group.

Several studies have tried to increase patients control over medical procedures as a means of stress reduction. As described above, Mills and Krantz (1979) allowed subjects to choose the arm which blood would be drawn for first time blood donors. When control was not combined with information the procedure reduced stress levels. Yet when control was combined with information stress levels were not decreased. Sechzer (1971) showed that if patients were allowed to self-administer pain medication after surgery they administered less medication than a usual care control group, and indicated greater satisfaction with the procedures (cf. White, 1988).

Summary

The aforementioned studies suggest that different cognitive-behavioral techniques, such as cognitive reappraisal or behavioral control, produce significant decreases in distress and anxiety prior to and during aversive medical procedures. Most of these studies, with the exception of the series by Corah et al., include the attention control group revealing that it is the intervention itself that is producing the positive effects and not a bi-product of the intervention such as attention. Unfortunately, most studies fail to include the proper manipulation checks or follow-ups to determine whether subjects are actually engaging in the cognitive-behavioral intervention presumably causing the positive outcomes. Due to this lack of measurement, it is also unclear which mechanisms increase the efficacy of the procedures.

There are several characteristics common to the interventions reviewed thus far; they all seem to increase the predictability of the event, distraction from the event, and perceived control over the event. Unfortunately, due to the confounding of different factors and the lack of manipulation checks it is difficult to determine the specific effects of each of these mechanism(s).

Several studies found that there was an interaction between a patient's typical coping style and the way in which the patient responded to the stress-reducing

procedures. Research indicated that when there was a match between an intervention and the patient's coping preference then the procedures have a higher chance of reducing stress. When there was not a match between intervention method and the individual's coping disposition, the intervention was ineffective. Future research needs to further explore the relationship between individual differences and type of stress-reducing intervention, and examine the relationship between coping style and specific characteristics believed to be efficacious at reducing stress (e.g., predictability, distraction, and control).

Modifiers of Stress

Appraisal and coping. From the literature reviewed to this point, it is clear that individual differences in the interpretation of an event and the manner in which one deals with the event interacts with the intervention to reduce stress and can have a dramatic effect on ones reaction to stress. Lazarus and Folkman (1984) posit that initial appraisal of the event will influence the secondary appraisal of coping possibilities and the implementation of coping techniques. The same event may be interpreted by one individual as posing a threat or challenge and by another as benign. This initial appraisal of the event is the first stage where individual differences become apparent. Once an individual has decided that an event does pose a threat or

challenge, then the individual will attempt to engage in a response which decreases the threat or challenge. This coping process is variable across situations as well as individuals.

One goal of coping responses made during stress are to eliminate the source of distress or manage the negative emotional and bodily states that ensue. This environmental adaptation is achieved through coping, which refers to a range of cognitive and behavioral actions taken to manage the demands of a stressful situation (Lazarus & Folkman, 1984). One's efforts may be directed at minimizing or eliminating the stressor or at accommodating to its effects, and several forms of coping are possible.

Lazarus (1966) identified two primary classes of coping; *problem-focused coping and emotion-focused coping.* The former, usually behavioral, involves activity aimed at altering the source of stress or one's relationship to it, thereby reducing stress. Emotion-focused coping, on the other hand, attempts to manage one's emotional responses to a stressor rather than the cause(s) of the stressor. Emotion-focused coping may be behavioral or "intrapsychic," and may include denial, withdrawal, reinterpretation of the situation, taking drugs, or other forms of making oneself feel better. Elaborations on the coping dichotomy have expanded the notion of coping to include management of resources (such as seeking information or social support)

and doing nothing at all (Lazarus & Folkman, 1984). Ultimately, coping appears to be focused primarily on two broader objectives: Problem focused coping represents a manipulative reaction, an attempt to control or eliminate a stressor, while emotion-focused coping is generally more of an accommodative response.

Different coping techniques are better for certain situations as well as for different individuals within similar situations. It is assumed that adopting emotion-focused coping is more adaptive for situations that are out of our control and problem-focused coping is more adaptive for situations that we can control. Yet it appears that individuals will usually use a combination of coping styles in managing a single stressor (Folkman & Lazarus, 1985). As was indicated above, stress-intervention research indicates that different intervention procedures are more effective for certain individuals based on coping preferences (Ludwick-Rosenthal & Newfeld, 1993). Therefore, to increase the efficacy of stress-interventions it is important to examine individual personality disposition variables before assigning people specific intervention techniques. The mechanisms that increase the efficacy of stress-intervention procedures, such as predictability, distraction, and control, may not necessarily be helpful to all individuals. Further research is needed to understand the interaction between the situation and the individual with particular

coping patterns, and which different mechanisms common to coping techniques are useful and for whom.

Predictability, Distraction, and Control

Current research examining mechanisms of the stress and coping process are relevant to isolating the contributing mechanisms of preparatory interventions. During the anticipation of a stressful event there are many coping techniques that allow one to better manage the upcoming event. Several of these coping techniques may contribute to the efficacy of stress-reduction interventions. Three of them will be elaborated on in this review, namely being able to predict the event, distracting oneself from the upcoming event, or increasing perceived or actual control over the event.

Preparatory interventions, through information provision, may give a person a sense of predictability over what they are to expect. Research has revealed that being able to predict an upcoming stressful event may allow one to engage in preparatory coping (e.g., prepare, avoid etc.) or since the element of surprise is removed, renders the event less stressful. Stress-reducing interventions may also distract an individual from the upcoming event. When a person is distracted they do not think about the stressful event that looms ahead. Instead they are absorbed with the present task, diverting attention away from the stressful

event. McCaul and Malott (1984) speculate that the stress-reducing properties of distraction are due to this sensory conflict. Preparatory interventions also may provide a person with perceived or actual control over the upcoming events. Perceived or actual control over a stressful event has been found to decrease the stress response (Gardiner, 1978; Glass & Singer, 1972). Studies of stress and immune function have shown the efficacy of control down to a cellular level (Sieber et al., 1992). The next three subsections will review human studies examining the stress-reducing properties of predictability, distraction, and control.

Predictability

Information provision, which is a result of stress-reducing interventions, tends to increase a subjects predictability of the events. This may come in the form of procedural or sensory information about the future event, or from knowledge that the individual already has in relation to the nature of the aversive event. Information, relaxation, and cognitive-behavioral stress-reducing procedures increase event predictability. The increased level of predictability may give the individual information needed to assess the available coping strategies and increase preparation for the situation (Lazarus & Folkman, 1984). If coping strategies are supplied as part of an

intervention, then the individual has some sense as to the event that they will encounter and can use the appropriate coping strategy suited to them. If coping strategies are not readily available, then by virtue of predictability the subject has a much better sense of how to prepare for the event.

Most of the theories supporting predictability as a mechanism of stress reduction are based on animal research. These studies demonstrate that given a choice, animals will choose a predictable aversive stimulus over an unpredictable aversive stimulus (cf. Badia, Harsh, & Abbott, 1979). These studies suggest that predictable stressors are less aversive than unpredictable unsignaled stressors. Several theories have tried to explain this phenomena, and no one theory seems to be complete on its own.

One explanation for the preference of predictable events is that they allow for anticipatory coping. This is the principal aspect behind the preparatory response hypothesis (Perkins, 1968). This theory contends that by having a signal, or some kind of predictability over when and what event will occur, an individual is able to prepare for the event, thereby decreasing its aversiveness. For example, if while sitting in your car at a traffic light, you notice a car approaching out of control in your rear-view mirror, you are able to brace yourself or even jump out of the car. Preparatory responses may help to decrease the

aversiveness of the stressor or even allow one to avoid stressors altogether.

Seligman (1968) offered an alternative explanation for the stress-reducing effects of predictability, namely the safety signal hypothesis. As the name implies, this theory states that having a warning prior to stressor onset informs one of when they are safe from the stressor. If there is no signal then the individual knows that the stressor will not occur, allowing them to remain in a more relaxed state than if they had no predictability over when the stressor would occur. This theory is supported in animal research, which has shown that when an animal does not have a signal prior to shock they exhibit greater sympathetic arousal and appear to be in a constant state of anticipatory arousal, uncertain of when the shock will occur (Weiss, 1971).

Both of these theories implicate control over the environment as an intervening factor. As will be pointed out below, predictability and control are closely related topics and are often confounded in research. The potentially beneficial effects of controllability may be ascribed to increased predictability. If an individual can control an event, then they will invariably have some predictability of the event. Yet predictability of an event does not necessarily afford the individual control over the event. This distinction is important because it implies that an event may be predictable without being controllable.

Therefore, investigation of predictability in the absence of control will reveal the extent which predictability contributes to stress reduction in control related stress-reduction interventions.

In a series of studies, Glass and Singer (1972) determined that subjects exposed to predictable shock or bursts of loud noise showed smaller changes in skin conductance compared to subjects exposed to random intervals of shock or noise. Further, they demonstrated that subjects exposed to unpredictable shock or noise found fewer errors on a proofreading task and showed a decreased tolerance for frustration on the Feather task (Glass & Singer, 1972). This series of studies will be discussed further in the section on control.

Research has revealed that as the uncertainty of an event increases its deleterious consequences increase. Epstein and Roupenian (1970) found that physiological arousal was highest under conditions of increased uncertainty of shock delivery to humans. However, Monat, Averill, and Lazarus (1972), in a similar study, found that there were no differences in probability of shock delivery conditions on GSR, heart rate, and self-report. Subjects also indicated that they preferred a 5% probability condition the most and the 100% condition the least even though the 100% condition gave the least uncertainty. This indicated that subjects preferred an ambiguous unpredictable

situation versus certain delivery of shock.

Predictability of a stressful event has also been shown to produce increases or have no effect on physiological and psychological arousal compared to unpredictable events. Petry and Desiderato (1978) found that subjects who had a clock predicting shock delivery exhibited increased physiological arousal during an anticipation period compared to subjects who had no clock available. Similarly, Zakowski (1993) found that pain and distress ratings were higher for subjects performing a cold-pressor task when they knew how long they were to keep their hand in the ice water and how long they could have it out, yet these same subjects showed decreased blood pressure levels and decreased immune activity. This indicated that there may have been psychophysiological de-coupling in that self-report measures indicated one finding and physiological measures indicated another (Zakowski et al., 1993). Opposite to the assumption, these studies found that having predictability of the stressor increased distress. Street, Baum, Singer, and Palacios (1984) found that subjects showed increased blood pressure in anticipation of a predictable stressor, but exhibited similar reactivity during actual exposure compared to a group with no predictability of the stressor. One interpretation of these findings is that the procedures may have inadvertently increased the amount of attention that subjects directed to the stressors, and therefore

differences in attention may explain the results. Unfortunately attention was not assessed in any of these studies making it difficult to determine the relationship between attention and predictability.

Matthews, Scheier, Brunson, and Carducci (1980) suggest that predictability decreases physiological arousal to stressors through decreases in attention allocation. They state that predictable stressors are less aversive due to less attention allocation since more is "known" about the event compared to unpredictable events. When subjects devoted equal amounts of attention to predictable and unpredictable stressors no differences were found between groups (Matthews, Scheier, Brunson, and Carducci 1980). The more one focuses attention on the upcoming event the greater the increase in arousal. Congruent with this hypothesis, Nomikos, Opton, Averill, and Lazarus (1968) found that longer anticipatory periods with cues to the upcoming stressor produced greater autonomic arousal to stressor exposure than shorter anticipatory periods without predictability.

Predictability and Coping

Miller (1980) suggested that individual differences, as well as situational differences, determine the efficacy of predictable versus unpredictable events at reducing stress to noxious events. Krantz et al. (1980) determined that

individuals in a health setting prefer differing amounts of information, and have a variety of different coping styles for different situations. Laboratory studies reveal an interaction between coping style and response to aversive events.

Some laboratory research supports the assumption that there is an interaction between individual differences and situational factors. Averill and Rosenn (1972) gave subjects the opportunity to have a warning signal prior to shock and a significant portion of subjects who could avoid the shock still chose to not have the warning signal. Personality factors were not found to be related to vigilant or non-vigilant coping strategies (Averill & Rosenn, 1972). Monat (1976) demonstrated that as shock became imminent temporal uncertainty led to an increase in avoidant style coping as opposed to vigilant coping. Further, with a long anticipation period avoidant style coping lead to a decrease in physiological arousal.

In an attempt to explain some of the differences apparent in Epstein and Roupenian (1970) and Monat et al.'s (1972) studies, Gaines, Smith, and Skolnick (1977) used the rod-and-frame test to examine the interaction between field dependency and event uncertainty (loud noise). They found that heart rate increased with increased certainty but only for field-independent subjects. Field-dependent subjects exhibited similar increases in heart rate for the 5%

condition as they did for the 95% condition, and the lowest levels for the 50% condition. These results held for the anticipatory period as well as impact of the stressor and recovery (Gaines, Smith, and Skolnick, 1977).

Summary

The hypotheses presented examining the stress-reducing efficacy of predictability are probably not mutually exclusive. Instead, a combination of the various theories would be applicable and most likely would be situation-specific. Most of the animal research indicates that predictability decreases the stress response, and given a choice, animals prefer predictable over unpredictable stressors. When one examines the human literature, the stress-reducing properties of predictability are less consistent. Many of the inconsistencies may be attributable to failure in separating several potentially confounding factors such as control, attention, or distraction, making interpretation difficult.

Lazarus and Folkman (1984) speculated that when theories of predictability are applied to field research in naturalistic circumstances the inconsistencies decrease. When examining field research it becomes apparent that individual differences become more significant predictors of outcome. Further, most studies have not examined the interaction between the individual and the specific

situation. To determine the true efficacy of predictability as a stress-reducing mechanism, future research needs to not confound predictability with other variables such as control or distraction through the inclusion of appropriate control groups and measurement techniques, and attempt to determine the role of individual differences in coping disposition.

Distraction

A factor common to many procedures aimed at stress reduction is distraction. Distraction is a method of coping with an anticipated stressor and on the surface distraction seems to help people cope with painful events. Lazarus and Folkman (1984) describe several methods of coping with an event which result in distraction from the stressor including, psychological distancing, denial, and avoiding thoughts of the stressor. Distraction can be viewed as a method of coping with a stressor by diverting attention away from the event which is causing stress. McCaul and Malott (1984) define distraction as a shifting of ones attention away from the stressful stimulus. The more attention that is focused on the distracting thought or task the less attention available for the stressor.

Few studies have examined the effects of distraction on stress-induced physiological or psychological arousal. As with many package approach interventions, the methods used confound different mechanisms of stress reduction, making it

difficult to examine the most effective aspects within the package. For example, in order to reduce the stress associated with hyperbaric oxygen therapy, Allen, Danforth, and Drabman (1989) compared a group of subjects exposed to a coping model film combined with a film distraction to a no-film control group. The intervention group was less aroused and more relaxed, yet due to the study design it is unclear whether distraction would have had an impact in the absence of the modeling film.

Most studies examining the relationship between distraction and stressful stimuli have concentrated on interventions to reduce pain. These studies have primarily examined the effects of distraction on pain perception during stressor exposure and not prior to the stressor. Barber and Cooper (1972) exposed college students to pressure pain while they worked on tasks requiring different attentional capacities: counting aloud by 1's, listening to a story, or counting aloud by 7's. Subjects in the second and third conditions reported less pain (Barber & Cooper, 1972). When Zakowski (1993) gave subjects onset and offset predictability of a cold-pressor task she found that these subjects reported higher pain and distress compared to subjects listening to random numbers. As mentioned above this may have been due to the greater attention paid to the task for the predictability group and greater distraction created by the random numbers in the unpredictable group.

These studies support the notion that the less attention available for the stressor the less effect it will have, yet it is not clear whether it was distraction per se producing reductions in stress because the researchers did not measure the attentional demands of the tasks.

Several researchers have found mixed results when examining the attentional model of pain reduction. Hodes, Howland, Lightfoot and Cleeland (1990) found that distraction decreased the pain associated with the cold-pressor task, regardless of level of distraction, yet showed no effect on tolerance for pain. Brucato (1978) had subjects engage in low, moderate, or high capacity distraction tasks when performing the cold-pressor. Instead of a linear relationship between pain and distraction he found that the greatest tolerance for pain was in subjects exposed to moderate capacity distraction. McCaul, Monson and Maki (1992) failed to reduce distress in response to cold-pressor pain across four experiments using distraction tasks demanding varying amounts of attention.

Studies examining pain reduction through distraction in clinical settings have also found mixed results. In attempting to examine the differences between distraction and perceived control at reducing self-reported pain, anxiety, and distress in dental patients, Fleischer, Baron, and Logan (1993) showed that both interventions decreased pain, anxiety, and distress compared to a control group,

with no differences between intervention groups. Unfortunately, as will be discussed below, most studies examining stressor control confound physical activity with task control, making it difficult to interpret whether the effects are due to physiological or psychological phenomena.

Distraction is a common mechanism in procedures aimed at reducing pain and CNV during cancer chemotherapy. In an attempt to decrease CNV associated with cancer chemotherapy, Redd, Jacobson, Die-Trill, Dermatis, McEvoy and Holland (1987) conducted two studies examining the efficacy of a video game distractor in decreasing CNV and anxiety in pediatric cancer patients. They found that subjects playing the video game showed lower levels of nausea than a Control Group given free access to toys, books, and games. Further, in the second study they found that the video game distractor decreased anxiety as well as nausea compared to controls. Redd and Andrykowski (1982) support the notion that distraction is a effective aspect of their intervention procedures, in that diverting ones attention may actually decrease severity of pain and CNV.

Contrary to the attention theories of distraction, Leventhal, Leventhal, Shachman, and Easterling (1989) indicated that mothers who monitored pain during childbirth reported reduced levels of distress. Perhaps attention to the pain/procedures increases a sense of predictability or

control, decreasing distress and pain greater than distraction alone.

Summary

The efficacy of distraction as a pain-and distress-reducing technique is far from clear. At present the results are mixed in relation to the mechanism(s) responsible for the stress-reducing effects of distraction. The attention capacity hypothesis (McCaul & Mallot, 1984) makes intuitive sense, yet there is little empirical support for this theory. Further, several recent studies find that distraction has no beneficial effect at reducing pain and distress in the laboratory (McCaul, Monson, & Maki, 1992) or clinical setting (Leventhal, 1992). Unfortunately, most studies examining the effects of distraction failed to measure control and predictability of the stressor, two possible mechanisms responsible for the stress-reducing properties of distraction. Leventhal et al.'s (1989) finding that attention is more beneficial than distraction may indicate that preparation for, or predictability of, a stressor is a more salient aspect of stress-reduction procedures than distraction.

Control

Close examination of many of the stress-intervention studies cited above indicates that subjects in the

experimental groups had an increased sense of perceived or actual control over the situation. The research examining control as a mechanism of stress-reduction has been guided by theories based on the assumption that control of aversive events is stress-reducing. As with predictability and distraction, perceived or actual control over a stressor has been found to be stress reducing, but the mechanism(s) of stress reduction remain unclear.

Several types of control are applicable to stress-reduction interventions. One that has received the most investigation is behavioral control over a stressor. In these situations a subject has behavioral control over the intensity or termination of a stressor by pushing buttons or flicking a switch (Solomon, Holmes & McCaul, 1980; Weisse et al., 1991). Most of this research has indicated that the belief that one will have control over the aversive event reduces arousal during the anticipatory stage (cf. Thompson, 1981). The stress-reducing properties of behavioral control are equivocal when the impact of the stressor is examined (Gatchel & Proctor, 1976; Glass, Reim, & Singer, 1971).

Most studies examining behavioral control of stressors have used a yoked-control model where the control group receives the same quality and quantity of the stressor as the experimental group which has control over the stressor. Unfortunately, level of activity cannot be controlled when examining behavioral control. Once the yoked-control group

realizes that the button has no function they tend to sit passively until the experiment is over, while the other group members are still actively engaged in "solving" the stressor. Solomon, Holmes and McCaul (1980) demonstrated that this causes a potential problem in that subjects that had behavioral control showed higher physiological arousal than subjects who could not control the event. Further, Weisse et al. (1991) indicated that subjects with control were much more active during the experimental session, and contrary to expectation, subjects with behavioral control over a stressor showing greater decreases in immune function compared to a group without control. However, Sieber et al. (1992) found that there was no stress-induced immune suppression if subjects were able to control and avoid bursts of noise. Unfortunately, neither of these studies equated the activity differences between the experimental and control groups and proper manipulation checks for perceived control and stress reactivity were not included.

Laboratory studies examining behavioral control of stressors not only do not control for activity levels, but they often allow the subject to escape the stressful event. The generalizability of this kind of procedure to field studies is questionable, especially in relation to the stress-reduction studies in medical settings, where subjects can not avoid or escape the stressor. A second type of control that is more generalizable to stress-interventions

is cognitive control.

Cognitive control provides the individual with the belief that they have a cognitive strategy to cope with the aversive event. This strategy is applicable to stress-intervention studies aimed at changing an individuals appraisal of the event. Most studies have found that cognitive control reduces self-reported anxiety and physiological arousal during the anticipation and impact of a stressor (e.g., Houston 1977; Holmes & Houston, 1974). The cognitive strategies employed in most studies are rather limited consisting of either avoidant or non-avoidant groups (Averill, O'Brian, & deWitt, 1977) distraction, imagery, or sensitization procedures (Spanos, Horton, & Chaves, 1975).

As with predictability, the results are mixed when different types of stressors are examined. Avoidant behavior, such as resignation, isolation, denial, and avoidant-thinking, prior to an examination decreased stress prior to the exam, yet performance on the exam was lower (Houston, 1977). Chodoff, Friedman, and Hamburg (1964) showed that avoidant behavior produced positive effects during initial coping with a traumatic event, but in the long run non-avoidant strategies proved more helpful. Further support for differential effectiveness of coping styles at differing times comes from a meta-analysis of 19 studies examining the effects of "attention" versus "rejection" coping styles on health outcome. Results

indicated that rejection was associated with better immediate adaptation and attention was more adaptive in the long run (Mullen & Suls, 1982).

A third type of control may be obtained through the enhancement of participation and choices surrounding the stressor. Janis (1983) suggested that increasing an individuals involvement and choice in stressful procedures will result in a sense of control. Langer and Rodin (1977) indicated that this type of procedure was helpful for people in a retirement home, yet subjects provided with the choice of which arm to have blood drawn were not more or less distressed than subjects not given the choice (Mills & Krantz, 1979). Fleischer, Baron, and Logan (1993) showed that instructing subjects that listening to music coupled with choice of volume setting would decrease dental stress and pain was as effective at reducing pain and distress as having subjects listen to incidental music with no specific instructions. This suggests that the distracting characteristics of the music were stress reducing rather than the control manipulation.

Several studies conducted by Glass and Singer (1972) indicated that the perception of control alone decreased physiological arousal upon impact of the stressor as well as the aftereffects on task performance. In support of these findings, Gardiner (1978) found that once a consent form included perceptions of control over the termination of the

experiment the differences between a perceived control group and a group not given control disappeared due to the increased perceived control present in the consent form. Further, field studies also support the efficacy of perceived control as a stress-reduction mechanism. Davidson, Baum, and Collins (1982) reported that after the nuclear accident at Three Mile Island, area residents who reported greater feelings of helplessness or less perceived control over their surroundings showed more signs of stress than did other subjects. Indices of stress for TMI subjects reporting more perceived control were virtually indistinguishable from control subjects'.

As has been noted above, individual difference variables need to be taken into account when trying to determine the efficacy of different intervention procedures. Logan, Baron, Keeley, Law and Stein (1991) showed that there was an interaction between desired control and how much control subjects felt they had during a dental procedure. Subjects with high desire for control coupled with low felt control reported the highest distress levels. Further, these researchers showed that sensory versus emotional focus also interacted with desired and felt control in relation to pain and distress during root-canal procedures (Baron, Logan & Hoppe, 1993). Focusing on sensory stimuli reduced pain and distress only for subjects high in desired control and low in felt control. Emotion focus reduced pain for

subjects with low desire and low felt control, yet sensory focus increased self-reported pain (Baron, Logan & Hoppe, 1993). Using this more transactional approach to stress reduction procedures takes into account the individual as well as situational factors (Folkman, 1984) and will decrease many of the inconsistencies found in stress research.

Summary

The studies reviewed above examining mechanisms responsible for the stress-reducing properties of interventions are mixed at best. Part of this stems from confounding of different factors, such as predictability, distraction, and control. Fleischer, Baron, and Logan (1993) showed that giving subjects control with distraction or distraction alone produced similar decreases in stress during dental procedures. Most studies providing subjects with behavioral or cognitive control over events also give the subjects predictability of the event as well as a certain amount of distraction. All cognitive-behavioral therapies increase a patients perception of control over the situation, whether they are actively involved in the procedure, being distracted or avoiding the event, or just able to predict the events due to the information provided. This makes it difficult to determine the effective component of the stress-reduction process. Laboratory studies are

needed that separate the various components to determine if any are useful on their own or whether a combination is more useful.

Conclusion

The stress-reduction research indicates that information, relaxation, and cognitive-behavioral interventions decrease stress levels prior to, during, and after acute medical procedures. Unfortunately, most of these field studies have considerable methodological problems, obscuring the beneficial components of the interventions. Primarily, most of the studies fail to include an attention control group which isolates the effective aspect of the intervention from attention given to the patient. Further, most studies fail to use proper manipulation checks, making it unclear whether patients were actually engaged in the intervention, and if it was the intervention per se responsible for stress-reduction. Due to these methodological issues it is difficult to determine the mechanism(s) responsible for the stress-reducing properties of these interventions.

The current theoretical conceptualization of stress that focuses on a more transactional model between the individual and the environment may help reveal more effective intervention procedures. Coping style preferences need to be taken into account in relation to the type of

stressor being encountered and method of intervention. Some subjects may prefer not to have to make choices, or be given information or control over the procedures they are to undergo. Further, information and control may increase ones sense of responsibility over the outcome of the event and therefore increase an individuals anxiety about the event. Individual coping styles need to be considered, in context with what is available to the individual, in order to reveal some of the inconsistencies in the literature.

Proposed Research

The present study examined techniques thought to be associated with stress reduction. Specifically, the stress-reducing effects of preparation for, distraction from, or information about an upcoming stressor were examined. The intensity of the stress response was examined during an anticipation period, during stressor exposure, and after the stressor. In order to isolate the various aspects of these stress-reduction interventions, five groups were studied (see Table One). Subjects in the first group (Instruction/Preparation) were pre-exposed to procedural information regarding the mental arithmetic task and told that they would be doing the task later in the experiment. They were then allowed to prepare for the upcoming task by performing the calculations to be administered during the task. In this group, subjects were both able to prepare for

the upcoming stressor and had some ability to predict the stressor as a result of the procedural information provided. Subjects in the next intervention group (Mental Arithmetic/Distraction) were pre-exposed to the actual mental arithmetic task, for 1 minute and were then told that they would be doing a longer version of the task later in the session. Following this, they engaged in a distracting task, computing unrelated arithmetic problems. After this, they were exposed to the stressor. The Mental Arithmetic/Distraction group was distracted from the upcoming stressor and received procedural and sensory information, increasing predictability prior to the task. The third intervention group (Mental Arithmetic/Rest) was simply pre-exposed to the mental arithmetic task, for 1 minute and told that they would be doing a longer version of the task later in the session. Therefore, these subjects were only provided with predictability regarding the upcoming stressor through procedural and sensory information, which stressor pre-exposure provided.

Two control groups were included to control for the effects of pre-exposure to mental arithmetic, preparation, distraction, and predictability. One group was pre-exposed to a different stressor, the Stroop task, for 1 minute and then exposed to the mental arithmetic task without preparation or distraction. These subjects had stressor pre-exposure, but no preparation, predictability, or

distraction from the upcoming stressor (Stroop/Rest). The second control group had no stressor pre-exposure, was not provided with information that might increase stressor predictability, and was not distracted from the upcoming stressor (Rest/Rest). Manipulation checks were used to determine the relationships among predictability, attention, distraction, control, and stress responding. "Monitor" versus "Blunter" (Miller, 1987) information styles, and "Desire for Control" (Burger & Cooper, 1979) variables were examined to determine whether a particular style was better than another at reducing stress among some groups of people (see Figure One for summary).

Hypotheses

1. Exposure to the mental arithmetic or Stroop task for 1 min will cause an increase in self-reported distress and cardiovascular reactivity during the exposure period. Specifically, subjects pre-exposed to mental arithmetic or Stroop for 1 minute (Mental Arithmetic/Distraction, Mental Arithmetic/Rest, Stroop/Rest) will report more distress and show greater changes from baseline in systolic blood pressure, diastolic blood pressure, and heart rate during the 1 minute task compared to subjects not pre-exposed to a stressor (Instruction/Preparation and Rest/Rest).

2. Distress and cardiovascular measures during anticipation of the mental arithmetic task will be lower for subjects allowed to prepare for, who are distracted from, or are unaware of the stressful task. During the anticipatory period, subjects able to prepare for, or be distracted from the upcoming stressor (Instruction/Preparation, Mental Arithmetic/Distraction), or are not aware of the upcoming stressor (Rest/Rest) would not differ from each other but will show slightly lower levels of distress and cardiovascular measures compared to the other two groups (Mental Arithmetic/Rest, Stroop/Rest). Due to the effects of anticipatory arousal, the group pre-exposed to the task with no intervention (Mental Arithmetic/Rest) may show slightly higher levels of distress and cardiovascular measures compared to the group with no predictability and are pre-exposure to a different stressor (Stroop/Rest).

3. Upon exposure to the full mental arithmetic task, subjects who were pre-exposed to the stressor and were given the opportunity to engage in a distracting task (Mental Arithmetic/Distraction) prior to re-exposure, will report lower levels of distress, and show less reactivity and fewer aftereffects, compared to the other groups. Subjects who were pre-exposed to procedural information and then engaged in preparatory task (Instruction/Preparation) will report lower levels of distress, exhibit less reactivity, and

experience fewer aftereffects, compared to the other three groups. Subjects with only predictability of the mental arithmetic task through task pre-exposure (Mental Arithmetic/Rest), will report less distress, show less reactivity and fewer aftereffects, compared to the two groups with no predictability or distraction (Stroop/Rest, Rest/Rest). The group that was pre-exposed to the Stoop and then the mental arithmetic task (Stroop/Rest) will report more distress, show greater reactivity, and more aftereffects compared to the group with no stressor pre-exposure and no predictability (Rest/Rest).

4. Score on the Monitor/Blunter scale and on the Desire for Control scale will be associated with levels of distress, reactivity, and aftereffects. The direction of the relationship will depend on whether subjects were in the intervention or control groups. For subjects in the three intervention groups (Information/Preparation, Mental Arithmetic/Distraction, Mental arithmetic/Rest) Monitor score and Desire for Control will negatively predict level of distress, reactivity, and aftereffects, and Blunter score will positively predict level of distress, reactivity, and aftereffects. For subjects in the two control groups (Stroop/Rest and Rest/Rest) Monitor score and Desirability For Control will positively predict level of distress, reactivity, and aftereffects, and Blunter score will

negatively predict level of distress, reactivity, and aftereffects.

5. Variables thought to mediate stress will be associated with levels of distress, reactivity, and aftereffects. Specifically, self-report questions measured in the study, such as perceived control over the task, ability to stop the task, ability to prepare for the task, preparedness for the task, helpfulness of the preparation, predictability of the task, and distraction from the task, will negativity predict level of distress, reactivity, and aftereffects caused by the stressor.

Methods

Overview

This study examined specific mechanisms of various stress-reduction interventions. The effects of preparation for, distraction from, and predictability of a stressor, achieved by providing information or pre-exposing subjects to the stressor, were examined. Three experimental groups and two control groups were included in this design. One group was pre-exposed to mental arithmetic task instructions and subjects were told that they would be doing the task later in the session. Two groups were pre-exposed to the mental arithmetic task for 1 minute, and subjects were told that they would be performing a longer version of the task later in the session. Predictability regarding procedural and/or sensory information of the upcoming task was provided to these first three groups. The first group received procedural predictability regarding the upcoming task, whereas the other two groups were given procedural and sensory information as a result of task pre-exposure. After pre-exposure to instructions or the task, each group was given a different intervention: 1) one group received preparation for the upcoming stressor, with the benefit of both preparation and procedural information; 2) another group was distracted from the upcoming stressor, representing distraction after getting procedural and sensory information; 3) the third group did not receive

preparation or distraction prior to the upcoming stressor, representing procedural and sensory information. Of the two control groups, one group was pre-exposed to a stressor different from the one they would be performing. This group had no preparation, predictability, or distraction, and controlled for the effects of stressor pre-exposure and information provision. To control for stressor pre-exposure the second control group did not know that they would be exposed to a stressor, and were given no opportunity for preparation, predictability, or distraction. The first control group performed 1 minute of the Stroop task and then the 6-minute mental arithmetic task, while the second control group performed the 6-minute mental arithmetic task without stressor pre-exposure.

Subjects

Seventy five subjects, between the ages of 19-45, participated in this study (38 men and 37 women). Power analyses were performed based on previous data collected in our laboratory (Zakowski, Cohen, Hall, Wollman, & Baum, 1993) which assessed cardiovascular and psychological changes during 6 minutes of mental arithmetic. Effect size for the dependent variables ranged from 0.4 to 0.8 therefore an effect size of 0.5 was used. Using an alpha level of .02 to control for multiple comparisons and a power level of .80 for five groups, it was estimated that 15 subjects would be

needed for each group, in order to observe significant cardiovascular and psychological changes as a result of exposure to the mental arithmetic task (Cohen, 1988).

Subjects were recruited through a newspaper advertisement in the Washington Post. When subjects telephoned in response to the advertisement the experiment was briefly described: "We are interested in peoples' performance on different task and how this affects mood and physiological measures. We will ask you to perform a simple task which will last approximately 10 minutes. You will also be asked to fill out various questionnaires before and after the task. We will be measuring blood pressure and heart rate during the task." Responses were kept confidential and compensation was $25. Subjects were excluded if they had any chronic health problems (including cardiovascular problems), consumed excessive amounts of alcohol or caffeine (more than six cups of coffee or more than three drinks of alcohol a day), had experienced any major life events in the past 2 months (divorce, death in the family, etc.), or suffered from any psychological problems needing treatment.

Design

Subjects were randomly assigned to one of five groups with 8 men and 7 women in each group: pre-exposure to instructions/ preparation group (Instruction/Preparation),

pre-exposure to stressor/distraction group (Mental Arithmetic/Distraction), pre-exposure to stressor/no intervention group (Mental Arithmetic/Rest), pre-exposure to different stressor/no intervention group (Stroop/Rest), no pre-exposure to stressor/no intervention group (Rest/Rest). All subjects performed 6 minutes of mental arithmetic with harassment. Repeated cardiovascular and self-reported mood measures were taken to examine changes associated with the stressor over time. Questionnaires were administered assessing background and demographic comparability of the groups, as well as level of perceived control, distraction, attention, and predictability of the task, the Monitor/Blunter personality attributes, and Desire for Control. Behavioral aftereffects due to the task were measured using the proofreading task and the Feather task (Glass & Singer, 1972).

Procedures

The experimental session was approximately 90 minutes long with each subject being run individually at one of five times: 7-9 am, 9-11 pm, 11 am to 1 pm, 1-3 pm, and 3-5 pm. Subjects were randomly assigned by gender and condition to one of the five time periods. Procedures were briefly reviewed with the subject and the experimental session began following written consent from the subject.

Thirty minutes of baseline blood pressure and heart rate measures were taken at the begining of the experimental session. Readings were taken every 5 minutes for the first 24 minutes of the baseline period, and every 2 minutes for the last 6 minutes of the baseline period. During the first part of baseline subjects filled out a background questionnaire, a math anxiety questionnaire (Fenneman & Sherman, 1976), the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbauhg, 1961), and a mood, and a baseline measure of mood (Zakowski et al., 1992).

Phase One - Pre-exposure: Subjects in the mental arithmetic instruction group (Instruction/Preparation) listened to pre-recorded taped instructions for the mental arithmetic task. Subjects were told that they would be performing this task later in the session. They then read a magazine for 1 minute. Subjects in the 2 mental arithmetic pre-exposure groups (Mental Arithmetic/Distraction, Mental Arithmetic/Rest) also listened to the pre-recorded instructions. After answering subjects' questions, the subjects were told that they were to perform the task for 1 minute and would later be asked to perform a longer version of the same task. They then performed 1 minute of mental arithmetic with harassment. Subjects in the different stressor pre-exposure group (Stroop/Rest) performed 1 minute of the Stroop task with interference. Instructions for the

Stroop task were also pre-recorded on tape. Following instructions, subjects were told that they would perform the task for one minute and later would be asked to perform a different task. Subjects in the no pre-exposure group (Rest/Rest) listened to taped instructions directing them to read magazines for 1 minute. One blood pressure and heart rate measure was recorded during the instruction period and one during the task for all groups. Following the 1 minute task subjects completed the mood questionnaire and a manipulation check assessing the stressfulness of the tasks.

Phase 2 - Intervention: Depending on group assignment subjects were asked to prepare for the upcoming mental arithmetic task (Instruction/Preparation), engage in a distraction task (Mental Arithmetic/Distraction), or told to sit and relax for 10 minutes (Mental Arithmetic/Rest, Stroop/Rest, Rest/Rest) before starting the next task (Phase Two: see section on Groups for specific procedures). Blood pressure and heart rate readings were measured every 2 minutes during this time. Just before starting the mental arithmetic task subjects completed the mood questionnaire.

Phase 3 - Task: At the end of the 10-minute intervention or rest period, pre-recorded instructions for the mental arithmetic task played for all subjects. Subjects then performed the mental arithmetic task for 6 minutes. Blood

pressure and heart rate readings were collected every 2 minutes during the task. Upon completion of the task, subjects then filled out the mood questionnaire, the perceived stress manipulation check, and a questionnaire assessing: subjective level of perceived control during the task, how prepared subjects felt for the task, whether subjects thought that what they did prior to the task helped their performance, how distracted subjects were prior to the task, how predictable they found the task to be, and how much attention they gave to the task during the rest period.

Phase 4 - Aftereffects: Subjects then worked on the Proofreading and Feather tasks which were used to assess stressor aftereffects. Blood pressure and heart rate readings were recorded every 2 minutes from the end of the task until subjects completed the Feather task.

After completing the aftereffects tasks, subjects filled out the Miller Behavioral Style questionnaire (Miller, 1987), the Desire for Control Scale (Burger & Cooper, 1979), the Schedule of Recent Experiences (SRE; Holmes & Rahe, 1967), as well as the Daily Hassles Scale (Kanner, Coyne, Schaefer, & Lazarus, 1981). Subjects were then debriefed and paid $25 for their participation (see table One for a summary of groups and procedures).

The mental arithmetic task is very stressful and subjects report strong feelings of resentment towards the

person administering the task. In order to minimize the effects from the task administrator a second experimenter administered all the tasks. Subjects were told that a second experimenter would be administering the tasks. The experimenter played the pre-recorded tapes, answered questions, and interfered with the subjects performance during the mental arithmetic task.

Mental Arithmetic Task

The mental arithmetic task with harassment has been shown to be a reliable stressor producing significant increases in blood pressure and heart rate (Krantz & Manuck, 1984). The task requires subjects to serially subtract by 7's from a four digit number as fast and as accurately as possible. During the task an experimenter continuously demands that the subject go faster, be more accurate, keep to the task etc. The pre-recorded instructions were as follows:

"The following performance test is concerned with the physiological effects of solving problems of the type that sometimes appear on math aptitude examinations. In particular we are interested in the relationship between your task performance and your hearts function. Thus the task involves performing a standard arithmetic operation in your head while we obtain our physiological measurements.

These are the instructions for the task, listen carefully. In a few moments I will announce a four digit number. Starting with that number your task will be to count backwards by sevens as quickly and as accurately as you can until I tell you to stop. For example if I give the number 1024 you would say, 1024, 1017, 1010, 1003, 996, 989, etc., until I tell you to stop. Throughout the procedures I will be recording the accuracy and the speed of your performance. Now here's another important part of the instructions. Several times after I say STOP, I will announce a new four digit number, your task is to again count backwards by sevens starting at the new four digit number. Remember to work just as fast and as accurately as you can, since both the speed and the accuracy of your responses will be used in determining your performance score. In addition if you do not try just as hard as you can we will not be able to gather accurate physiologic information. Remember that for our measurements it is important to remain still. If you have any questions ask them now, the task will begin in a few moments". After answering any potential questions the tape was turned back on. "Remember to work as quickly and as accurately as you can. The task will begin now. Begin counting backwards by 7's from the number 1276". The tape included the sound of a metronome to enhance the stressor. After 70 seconds the 4 digit number changed, and the task ended after 6 minutes.

Groups

Preparation group (Instruction/Preparation): After listening to the mental arithmetic task instructions, subjects read a magazine for 1 minute. Subjects were told that their reading would not be tested nor would they be asked to recall anything that they read. Then subjects were given a calculator and 5 sheets of paper on the top of which was printed the starting number for the subtractions which they would be doing during the mental arithmetic task (see Appendix A). Subjects were told that they might find the task easier by going through 10 of the subtractions for each of the numbers. They were told that they could not use the work sheets during the task and that trying to memorize the numbers would not help them, but that there might be some beneficial preparatory effects. The following instructions were given to the subjects:

"During the next ten minutes you will be allowed to prepare for the upcoming task. I will give you a calculator and on these pieces of paper we have written the actual numbers which you will start subtracting from for the task. You can prepare for the task by going through and subtracting by the appropriate number and calculating the list of numbers that you will be asked to calculate during the task. Calculate 10 numbers per starting number and write them down on the piece of paper. You will not be able to use the paper during the task, and we do not recommend

trying to memorize the numbers. This time may help you during the upcoming task. Do you have any questions? This is not a test and you are not going to be scored on accuracy or the amount completed, take your time. When you are finished doing ten subtractions per starting number you can sit and relax and look over the pages if you want". After 10 minutes of preparation procedures continued as described above.

Distraction group (Mental Arithmetic/Distraction): After completing the 1-minute pre-exposure to mental arithmetic, subjects were given a calculator and 5 work sheets with 40 arithmetic calculations on each (see Appendix A). Subjects were asked to use the calculator and spend the next 10 minutes going through the calculations. The following instructions were given to the subjects:

"During the next ten minutes you will be doing simple math before the upcoming task. I will give you a calculator and on this piece of paper we have written simple arithmetic problems for you to solve. You can go through the pages performing the appropriate calculations. This time may help you during the upcoming task. Do you have any questions? This is not a test and you are not going to be scored on accuracy or the amount completed, take your time". After subjects worked on these calculations for 10 minutes, then procedures continued as described above.

Pre-exposure/no preparation (Mental Arithmetic/Rest): After completing 1-minute pre-exposure to mental arithmetic, subjects were asked to sit and relax for the next 10 minutes. They were not given any reading materials during this time. The following instructions were given to the subjects:

"During the next ten minutes you will be asked to rest before the upcoming task. This time may help you during the upcoming task. Do you have any questions? This is not a test and you are not going to be scored on any of your behavior". Procedures continued as described above after 10 minutes of rest.

Pre-exposure Stroop/no preparation (Stroop/Rest): Subjects were administered a 1-minute Stroop task. The Stroop task is a color-word discrimination task, where names of colors are printed in different colors of ink. The meaning of the words does not correspond to the color of ink in which they are printed (e.g., the word "red" might be written in green ink). The subject's task is to identify the color in which each word is printed and ignore the meaning of the word (Stroop, 1935). Auditory interference was used to add to the stressfulness of the Stroop task. Subjects wore headphones over their ears and, a pre-recorded tape with two voices simultaneously calling out different colors was played throughout the task. After 1 minute of Stroop

exposure, subjects completed the measures mentioned previously. Subjects were then asked to sit and relax for the next 10 minutes. They were did not have any reading materials during this time. The following instructions were given to the subjects:

"During the next ten minutes you will be asked to rest before the upcoming task. This time may help you during the upcoming task. Do you have any questions? This is not a test and you are not going to be scored on any of your behavior". Following a 10 minute period, procedures continued as described above.

No pre-exposure/no preparation (Rest/Rest): Following 1 minute of magazine reading, subjects were asked to sit and relax 10 minutes. Subjects did not have any reading materials during this time. The following instructions were given to the subjects:

"During the next ten minutes you will be asked to rest before the upcoming task. This time may help you during the upcoming task. Do you have any questions? This is not a test and you are not going to be scored on any of your behavior". Procedures continued as described above following this 10 minute rest period.

Measures (see Appendix B)

Group Comparability Measures: During the first 15 minutes of the baseline period, subjects completed several questionnaires. Data regarding age, height, weight, education, income, occupation, marital status, race were collected. The Beck Depression Inventory was used to measure depression (Beck, Ward, Mendelson, Mock, & Erbauhg, 1961). Subjects also completed the Math Anxiety Questionnaire (Fenneman & Sherman, 1976), and a mood questionnaire (Zakowski, McAllister, Deal, & Baum, 1992) to measure baseline symptoms of stress. The mood questionnaire is a 24-item stress scale that has been shown to be a reliable measure of distress (Zakowski et al., 1992; Zakowski et al., 1993; Zakowski, 1993). This questionnaire asks subjects to rate the level of stress-related feelings which they are experiencing on five point scales ranging from 'not at all' to 'extremely'. The questionnaire has been factor analyzed to yield 4 subscales: Energy (alpha=.85), Negative affect (alpha=.90), Fearfulness (alpha=.85), and Nervousness (alpha=.87). Although there is a consistent absence of menstrual cycle phase effects on cardiovascular reactivity to stressors (Saab, 1989), female subjects completed a menstrual cycle questionnaire at the end of the study. This questionnaire asked subjects how long their average cycle lasted, how long menstruation lasted, the start date of their last menstrual period, and

the day when they expect their next menstrual period to begin.

Measures of more chronic stress were administered at the end of the experimental session due to possible interactions of these variables with this study's main dependent measures. Subjects completed a modified version of the Schedule of Recent Experiences (SRE; Holmes & Rahe, 1967) to measure the frequency and impact of various life experiences. The Daily Hassles Scale (Kanner, Coyne, Schaefer, & Lazarus, 1981) was administered to measure the frequency and intensity of negative or irritating daily events.

Measures of Stress

Self-report: Subjects completed the mood questionnaire at baseline, at the end of Phases One, Two, and Three in order to measure changes in self-reported stress levels. After completion of Phases One, Two, and Three, subjects completed a manipulation check questionnaire which asked them to rate, on a scale of 1 (not at all) to 7 (a great deal), how tired, bored, tense, stressed, and relaxed they felt during this time.

Cardiovascular: Blood pressure and heart rate were measured using an automatic blood pressure monitor (SpaceLabs.

Monitor) to provide measures of cardiovascular reactivity. During the first 24 minutes of the baseline period, measures were taken every five minutes. During the last 6 minutes measures were taken every two minutes. During Phase One, blood pressure and heart rate were recorded once during the instructions and once during the 1-minute task. During Phase Two, and throughout the rest of the session, blood pressure and heart rate were measured every 2 minutes.

Behavioral: Stressor aftereffects were measured behaviorally through performance on a proofreading task and the Feather task. The proofreading task has been found to be a reliable measure of stress responding within acute and chronic stress populations (Baum et al., 1983; Glass & Singer, 1972). Subjects are asked to read a written passage and to circle any typographical, contextual, and grammatical errors. Subjects were scored on the number of errors found, the amount of text read during the 5 minute task, and the ratio of errors found to text read.

The Feather task (Feather, 1961) tests tolerance for frustration. Glass and Singer (1972) showed that tolerance for frustration was reduced following stressor exposure. A shortened version of this task was used. Subjects were presented with two stacks of two different line diagrams and instructed to trace the diagram without lifting the pencil, and without tracing any line twice. Subjects' were told

that they could work on a particular figure until they were told to stop, after which they would have the choice of either trying another copy of the same figure or moving to the second stack of figures. The time limit for working on a particular copy of the figure was 40 seconds. The first figure was unsolvable and the second figure was solvable. Tolerance for frustration was measured by the number of trials undertaken before switching to the second puzzle.

Mediators of Stress

Upon completion of the task, the subjective impact of each of the stress-reduction techniques was measured. Specifically, subjects were asked how much they agreed with each of the following statements on a scale from 1 (not at all) to 6 (a great deal): "I had a lot of control over the task", "I could stop the task whenever I wanted to", "I felt overwhelmed and out of control throughout the task", "I was prepared for the task", "the period prior to the task allowed me to prepare", "in the future, preparing for the task would be helpful", "preparing for the task was helpful", "prior to the task I felt distracted", "I could predict what the task was going to be", "Prior to the task I concentrated my attention on what I would be doing".

Desire for control and desire for predictability were measured due to their potential interaction with the stress-reducing interventions. The Desire for control scale and

the Miller Behavioral Style Questionnaire were given after subjects completed the aftereffects tasks. The Desire for Control Scale (Burger & Cooper, 1979) asks subjects to rate items pertaining to control on a scale from 1 (doesn't apply to me at all) to 7 (always applies to me). The Miller Behavioral Style Questionnaire (Miller, 1987) classifies subjects on a 'Monitor' and 'Blunter' scale, based on self-reported behavior in response to four hypothetical stressful scenarios. High score on the Monitor scale indicates a person who tends to seek out information about stressful events, and high score on the Blunter scale indicates a person who tends to avoid information about stressful events.

Performance Measure

Level of performance during the mental arithmetic task was measured, due to the possible interaction between level of performance and stress responding. The number of subtractions completed was totalled, as was the percentage of correct subtractions (number correct/number completed).

Results

Overview

Group Comparability: Group comparability was examined using Chi-square or ANOVA depending on whether the variable was a qualitative categorical one or continuous data. Analyses were conducted comparing groups on age, height, weight, education, income, occupation, marital status, race, stage of menstrual cycle, math anxiety, recent life experiences, daily hassles, and depression. Comparisons among groups were also conducted for baseline measures of mood, blood pressure, and heart rate. Main effects comparing means were done using the Tukey post-hoc test.

Performance: Comparisons among groups on mental arithmetic performance were conducted using ANOVA. Further, correlations were computed between performance on mental arithmetic and math anxiety score with systolic blood pressure, diastolic blood pressure, heart rate, and self-reported distress during the task.

Manipulation Checks: Stress associated with the mental arithmetic and Stroop task 1-minute exposure was determined by analyzing the self-report and cardiovascular data. Group differences on the Phase One manipulation check scores were analyzed using MANOVA's, change from baseline for mood

scores using MANCOVA, and cardiovascular measures were analyzed using ANCOVA's. Main effects and interactions comparing means were conducted using the Tukey post-hoc test.

To examine the subjective impact of each of the intervention techniques, group differences in response to the questionnaire administered after the 6-minute mental arithmetic task were analyzed using MANOVA. Main effects and interactions comparing means were conducted using the Tukey post-hoc test.

Intervention Efficacy

Repeated measures multivariate analyses of variance and covariance were used for group comparisons of intervention efficacy. The efficacy of the interventions to diminish stress were thought to be modest, therefore main effects and interactions comparing means were conducted using Duncan post-hoc tests.

Self-reported Stress: Two repeated measures analyses were performed to examine the efficacy of the interventions at decreasing self-reported stress. First, a repeated measures MANCOVA (covarying for baseline mood scores) on change scores of mood during the intervention period and during the mental arithmetic task was analyzed. Second, a repeated measures MANOVA was conducted entering the raw scores from

the manipulation check questionnaires which were administered after the intervention period and after task exposure.

Cardiovascular Measures: Means across the specific time periods were calculated for blood pressure and heart rate measures. Baseline blood pressure and heart rate measures were calculated from the mean of the 3 readings recorded during the last 6 minutes of the baseline period. The Intervention cardiovascular measure was a mean of the last two readings during Phase Two. Recovery measures were means of the first five blood pressure and heart rate measures recorded after the task during the aftereffects performance tasks. Change scores were calculated by subtracting the mean during the intervention, each of the 4 measures taken during the task, and the mean during the recovery period, from the baseline score. Group cardiovascular comparisons were conducted using a repeated measures ANCOVA (covarying for baseline) entering the intervention change score, change score for each of the 4 readings during the task, and change score for the recovery period.

Aftereffects: Number of errors identified during the proofreading was adjusted for amount of material read for each subject resulting in percentage of errors found. Groups were compared using an ANOVA. Group performance on

the Feather task compared the number of attempts which were made on the unsolvable puzzle using ANOVA. Differences among groups were analyzed using the Tukey post-hoc test.

Mediators of the Stress Response: Hierarchical multiple regression analyses, with Bonferroni correction, were conducted predicting stress levels during the task and recovery (Negative affect, Fearfulness, and Nervousness, systolic blood pressure, diastolic blood pressure, and heart rate during instructions, mean task level, and mean recovery, and Feather task). Separate regressions were conducted combining the three intervention groups (Instruction/Preparation, Mental Arithmetic/Distraction, Mental Arithmetic/Rest), and combining the two control groups (Stroop/Rest, Rest/Rest). Predictor variables entered in the equation first included: baseline measures (e.g., blood pressure, heart rate, or mood levels) and then one of the following variables, 1) Monitor score, 2) Blunter score, or 3) Desirability for Control score.

Another set of regression analyses was conducted combining all of the groups for the following dependent variables: Negative affect, Fearfulness, Nervousness, stress, tension, tiredness, and relaxation level, systolic blood pressure, diastolic blood pressure, and heart rate during instructions, mean task level, and recovery, and Feather task. Predictor variables entered in the equation

first were group, baseline measure, and one of the following 1) control over the task 2) predictability of the task 3) ability to prepare 4) how prepared they were 5) distraction prior to the task 6) ability to stop the task. For Monitor, Blunter, and Desire for Control analyses a significance level of $p < .02$ was accepted. Due to the increased number of analyses using the remaining variables, a significance level of $p < .001$ was accepted (alpha = (J - 1)(.05)/K; J = number of groups and K = number of comparisons; Hays, 1988).

Group Comparability

Analyses of variance indicated that the groups were similar in age, height, weight, math anxiety, number of recent life experiences, life experiences adjustment score, number and adjustment score for daily hassles, and depression (see Table 2). Chi-square analyses showed that groups were also similar in education, income, job status, marital status, race, and for women, stage of menstrual cycle. Fifty seven percent of the subjects reported some college or a college degree, 2 percent high school, 40 percent graduate work; twenty seven percent indicated an income under $10,000, 42.7 percent $10-30,000, 18.6 percent $30-50,000, and 16 percent over $50,000; twenty four percent of the subjects were students, 65.4 percent were employed, and 10.6 percent were unemployed; fifty eight percent of the subjects were single, with 14 percent living with a

significant other, 32.4 percent married, and 9.5 percent separated/divorced; seventy two percent of the subjects were Caucasian, 22.7 percent were African American, 2.7 percent Latino, and 2.7 percent Asian.

Phase of menstrual cycle was calculated by subtracting the day of the session from the day they reported that their menstrual cycle started. Thirty five percent of the women were in the luteal phase of the menstrual cycle, 20.6 percent in the ovulatory phase, and 44.1 percent in the follicular phase.

There were no group differences in baseline mood sub-scales (Energy, Negative affect, Fear, and Nervous). ANOVA indicated that blood pressure, but not heart rate, was different across groups at baseline, $F(4,70)=2.56$ $p< .05$, for systolic blood pressure, $F(4,70)=2.44$, $p< .05$, for diastolic blood pressure. Tukey Post-hoc analyses indicated that the groups were not significantly different from each other for either measure, yet inspection of means indicated that the Instruction/Preparation and Stroop/Rest groups had higher means than the other groups (see Table 3).

Performance

No differences were found between groups on mental arithmetic performance measured by total number of errors, total number of subtractions completed, or total percentage of errors (see Table 4). Correlation analyses indicated

that there were no relationships between performance score or level of math anxiety and cardiovascular or mood measures over the experimental period. Due to these findings, performance score or math anxiety score were not entered as covariates for subsequent analyses.

Manipulation Checks (1 Minute Task)

Two-tailed correlation analyses showed that tiredness and boredom levels were correlated and stress, tension, and relaxation levels were correlated (see Table 5). Two-tailed correlation analyses also showed that Energetic mood, Negative affect, Fearfulness, and Nervousness scores were correlated (see Table 6). Due to these correlations, in order to determine whether a 1-minute exposure to mental arithmetic or to Stroop task was stressful the following analyses were conducted: two MANOVA's comparing groups on the manipulation check, a MANCOVA (covarying for baseline) comparing groups on change scores for mood, and three ANCOVA's comparing groups on the cardiovascular measures. The results suggest that both 1 minute exposure to mental arithmetic or Stroop task produces a significant increase in self-reported stress as well as cardiovascular measures.

Self Report: MANOVA of stress, tension, and relaxation levels (levels for relaxation were reversed) from the manipulation check questionnaire indicated a main effect of

group, $F(4,70)=33.23$ $p< .00001$, and distress measure $F(2,69)=19.39$, $p< .00001$. MANOVA for tiredness and boredom levels indicated a group by distress measure interaction, $F(4,70)=3.34$, $p< .01$. Tukey post-hoc analyses of combined mean tension, stress, and relaxation levels showed that subjects pre-exposed to mental arithmetic for 1 minute (Mental Arithmetic/Distraction, Mental Arithmetic/Rest) were more distressed than the other three groups, and subjects pre-exposed to the Stroop task (Stroop/Rest) were more distressed than subjects in the Rest/Rest group (see Table 7). Subjects pre-exposed to mental arithmetic for 1 minute (Mental Arithmetic/Distraction, Mental Arithmetic/Rest) were more tired than subjects in the Rest/Rest group (see Table 7). There were no group differences in boredom levels.

MANOVA examining change from baseline for Energetic mood, Negative affect, Fearfulness, and Nervousness, covarying for baseline, indicated a main effect of group $F(4,70)=22.22$, $p< .00001$, type of mood measure, $F=(3,67)=11.17$, $p< .00001$, and a group by mood measure interaction, $F(12,210)=7.87$. Post-hoc analyses indicated that the Mental Arithmetic/Distraction and Mental Arithmetic/Rest groups showed a greater increase in Negative affect, Nervousness and Fearfulness compared to the Instruction/Preparation and Rest/Rest groups. The Mental Arithmetic/Distraction group reported a greater increase in Negative affect and Nervousness, as compared to the

Stroop/Rest group (see Table 8). The Stroop/Rest group reported a greater increase in Negative affect than the Rest/Rest group (see Table 8). There were no group differences in Energetic mood.

Cardiovascular: A similar pattern of results was found when changes in blood pressure and heart rate were examined as a result of mental arithmetic or Stroop pre-exposure. ANCOVA of change from baseline, covarying for baseline, for the measure taken during the 1 minute tasks indicated a main effect of group for systolic blood pressure, $F(4,70)=14.10$, $p< .0001$, diastolic blood pressure, $F(4,70)=12.55$, $p< .0001$, and heart rate, $F(4,70)=14.41$, $p< .0001$. Post-hoc tests indicated that the Mental Arithmetic/Distraction and Mental Arithmetic/Rest groups exhibited a greater increase in systolic blood pressure, diastolic blood pressure, and heart rate during the 1 minute task than the other three groups (see Table 9). Results also indicated that the Stroop/Rest group showed a greater increase in systolic blood pressure than the Instruction/Preparation and Rest/Rest groups, greater increases in diastolic blood pressure than the Rest/Rest group, and greater increases in heart rate than the Instruction/Preparation group (see Table 9).

Summary

Results indicated that subjects exposed to 1 minute of

the mental arithmetic or Stroop tasks exhibited greater increases in self-reported stress, negative affect, and cardiovascular measures compared to the non-exposed groups. Results also indicated that subjects exposed to the mental arithmetic task exhibited a greater change in psychological and physiological measures than subjects exposed to the Stroop task.

Manipulation Checks for the Interventions

Correlation analyses indicated that several questions asking subjects' thoughts about the interventions were significantly correlated (see Table 10). Therefore, a MANOVA was conducted entering thoughts about the intervention period to determine if subjects in the intervention groups reported changes in the psychological variables of interest (levels for being out of control were reversed). Results indicated there was a main effect of group, $F(4,70)=14.96$, $p< .00001$, question asked, $F(9,62)=14.84$, $p< .00001$, and a group by question asked interaction $F(36,630)=5.10$, $p< .00001$.

Post-hoc analyses revealed that the Instruction/Preparation group scored significantly higher than the other four groups when asked whether they had been allowed to prepare, and the Mental Arithmetic/Distraction and Mental Arithmetic/Rest groups scored higher than the Stroop/Rest and Rest/Rest groups (see Table 11). Similarly,

when asked whether the preparation was helpful, the three intervention groups scored higher than the Rest/Rest control group (see Table 11). Subjects in the Mental Arithmetic/Distraction group reported significantly higher levels of distraction than the other four groups. The Mental Arithmetic/Rest group also reported greater distraction than the Rest/Rest group (see Table 11). The three intervention groups, reported greater levels of predictability than the Stroop/Rest and Rest/Rest groups (see Table 11). Subjects in the Instruction/Preparation and Mental Arithmetic/Distraction groups reported higher levels of concentration on what they would be doing than subjects in the Stroop/Rest and Rest/Rest groups, and the Instruction/Preparation group reported greater concentration than the Mental Arithmetic/Rest group (see Table 11). Results indicated that there were no differences between groups for sense of control during the task, perceived ability to stop the task, feelings of being out of control, whether they felt prepared for the task, and whether preparation would be helpful in the future.

Summary

The interventions produced changes in several psychological variables of interest. Subjects in all three intervention groups reported higher levels than control group subjects when asked if they had been allowed to

prepare for the task, and subjects in the Instruction/Preparation group reported the highest levels. The three intervention groups also reported that preparation was helpful compared to the Rest/Rest control group. Subjects in the Mental Arithmetic/Distraction group reported greater levels of distraction before the task than the other four groups, and the Mental Arithmetic/Rest group reported greater levels of distraction compared to the Rest/Rest control group. Subjects in all three intervention groups reported a greater sense of predictability of the task compared to the two control groups. The two intervention groups working on arithmetic problems before the task (Instruction/Preparation and Mental Arithmetic/Distraction) reported the highest level of concentration on what they would be doing.

Changes in Mood Over Time

Repeated measures MANCOVA was conducted to examine changes from baseline to intervention and task period examining each of the mood questionnaire subscales. The analysis was a 5 (group) by 4 (mood subscale) by 2 (time - questionnaire administration) repeated measures design, covarying for baseline scores. Results indicated a main effect for mood scale, $F(3,67)=21.37$, $p< .00001$, time, $F(1,70)=178.18$, $p< .00001$, a mood scale by time interaction, $F(3,67)=53.71$, $p< .00001$, and a group by mood scale by time

interaction, $F(12,210)=2.90$, $p < .001$.

There were no differences in change in Energetic mood from the intervention period to the mental arithmetic task (see Table 12 AVERAGE and Figure 1). There was an increase from baseline in Negative affect, Fearfulness, and Nervousness from the intervention period to the mental arithmetic task (see Tables 13-15 AVERAGE and Figures 2-4). Post-hoc analyses for between group comparisons revealed that there were no group differences in mood during the intervention period (see Tables 12-15 and Figures 1-4). Between group analyses during the mental arithmetic task revealed significant group differences for changes in Negative affect. After the 6 minute mental arithmetic task, Negative affect increased to a greater extent in the Rest/Rest group than in the Instruction/Preparation and Mental Arithmetic/Rest groups (see Table 13 and Figure 2, MA Task). There were no group differences for changes in Energetic mood, Fearfulness, or Nervousness.

Changes for the Manipulation Check Questionnaire Over Time

Two separate repeated measures MANOVA's were conducted for the manipulation check questions which asked subjects' level of relaxation, tension, stress, boredom and tiredness, after the intervention, and after the 6 minute mental arithmetic task. The first analysis, examining relaxation, tension, and stress, was a 5 (group) by 3 (distress

question) by 2 (time - questionnaire) repeated measures MANOVA. Results indicated a main effect for distress question, $F(2,69)=223.87$, $p < .00001$, time $F(1,70)=90.39$, $p < .0001$, and a distress question by time interaction $F(2,69)=60.18$, $p < .00001$. The second analysis, examining boredom and tiredness, was a 5 (group) by 2 (distress question) by 2 (time - questionnaire) repeated measures MANOVA. Results indicated a main effect for distress question, $F(1,70)=20.63$, $p < .00001$, and a distress question by time interaction, $F(1,70)=41.34$, $p < .0001$,

There were no changes in tiredness from the intervention period to mental arithmetic exposure (see Table 16 and Figure 5). There was a decrease in boredom and relaxation, and an increase in tension and stress from the intervention period to the mental arithmetic task (see Tables 17-20 and Figures 6-9).

Summary

Results indicated that the mental arithmetic task produced a decrease in relaxation, and boredom, and an increase in negative affect, nervousness, fearfulness, tension, and stress. The only group difference found indicated that the Instruction/Preparation and Mental Arithmetic/Rest groups showed less of an increase in negative affect from baseline after the mental arithmetic task than the Rest/Rest group.

Cardiovascular Changes Over Time

Three separate, 6 (intervention mean, 4 task measures, recovery measure) by 5 (group) ANCOVA's, covarying for baseline levels, were conducted for change from baseline for cardiovascular measures. For systolic blood pressure there was a main effect for time, $F(5,65)=64.75$, $p < .0001$, and a group by time interaction, $F(20,420)=1.8$, $p < .03$. There was a main effect for time, $F(5,65)=43.00$, $p < .0001$, and a group by time interaction, $F(20,420)=2.23$, $p < .005$ for diastolic blood pressure. Similarly, there was a main effect for time, $F(5,65)=25.81$, $p < .0001$, and a group by time interaction, $F(20,420)=1.86$, $p < .03$ for heart rate.

Results indicated that all groups exhibited an increase from baseline in cardiovascular measures from the intervention period to measures taken during the mental arithmetic task (see Tables 21-23 and Figures 10-12). Post-hoc analyses for between-group comparisons indicated no group differences during the intervention period. There were several significant between group differences for the initial cardiovascular reading during mental arithmetic instructions. The Instruction/Preparation group showed a smaller increase in systolic blood pressure than the Stroop/Rest group, as well as a smaller increase in diastolic blood pressure than the Mental Arithmetic/Distraction and Mental Arithmetic/Rest groups (see Tables 21-22 and Figures 10-11, instructions). The

Instruction/Preparation group also showed a smaller increase in heart rate than the Mental Arithmetic/Rest and Rest/Rest groups during task instructions (see Table 23 and Figure 12, instructions). During the first 2 minutes of the mental arithmetic task there were no differences among groups, all groups exhibited an increase in cardiovascular measures (see Tables 21-23 and Figures 10-12, 2 minutes).

Four minutes into the mental arithmetic task the Mental Arithmetic/Rest group showed a smaller increase in systolic blood pressure than the Rest/Rest group, and the Mental Arithmetic/Distraction group exhibited a smaller increase in diastolic blood pressure than the Stroop/Rest and Rest/Rest groups (see Tables 21-23 and Figures 10-12, 4 minutes). The last measure during the mental arithmetic task indicated that the Mental Arithmetic/Distraction group showed a smaller increase in diastolic blood pressure than the Instruction/Preparation, Mental Arithmetic/Rest, and Stroop/Rest groups, and a smaller increase in heart rate than the Rest/Rest group (see Tables 21-23 and Figures 10-12, 6 minutes).

Comparison of group means during the recovery period revealed several significant findings. The Mental Arithmetic/Distraction and Mental Arithmetic/Rest groups showed a smaller increase in systolic blood pressure than the Stroop/Rest and Rest/Rest groups, the Mental Arithmetic/Distraction group showed a smaller increase in

diastolic blood pressure than the Mental Arithmetic/Rest, Stroop/Rest, and Rest/Rest groups, and the Instruction/Preparation and Mental Arithmetic/Distraction groups showed a smaller increase in heart rate compared to the Mental Arithmetic/Rest, Stroop/Rest, and Rest/Rest groups (see Tables 21-23 and Figures 10-12, recovery).

Summary

All three interventions were efficacious at decreasing cardiovascular reactivity during some parts of the task and resulted in quicker post-task recovery compared to the control groups. Subjects in the Instruction/Preparation group exhibited lower levels of cardiovascular reactivity during task instructions, and a quicker heart rate recovery after the task. Subjects in the Mental Arithmetic/Distraction group showed diminished diastolic blood pressure and heart rate reactivity during the task, as well as a faster return to baseline for all cardiovascular measures. The Mental Arithmetic/Rest group exhibited diminished systolic blood pressure reactivity during the task as well as a quicker recovery after the task.

After Effects

Proofreading Task: Number of errors identified was adjusted for amount of material read for each subject, resulting in

percentage of errors found (errors identified/errors in amount of material read X 100). Group differences for the percentage of errors found were examined by ANOVA. There were no differences between groups for percentage of errors found, $F(4,70)=0.82$, $p< 0.5$ (see Table 24). This suggests that the interventions had no effect on proofreading behavior.

Feather Task: There was a significant difference among groups for the unsolvable puzzle, $F(4,70)=2.58$, $p< .04$, and no difference among groups for the solvable puzzle, $F(4,70)=1.35$, $p< .26$. Post-hoc analyses indicated that the Mental Arithmetic/Distraction group made more attempts at the unsolvable puzzle than the Instruction/Preparation group (see Table 25). This suggests that the Mental Arithmetic/Distraction group exhibited a higher tolerance for frustration, as compared to the Instruction/Preparation group.

Stress Response Mediators

Separate multiple regression analyses were conducted to determine if Monitor score, Blunter score, or Desire for Control score predicted scores on the Feather task, mood levels (Negative affect, Fearfulness, Nervousness), or cardiovascular levels during task instructions, mean score during the task, and during recovery, controlling for the

effects of baseline. Analyses were conducted either combining the three intervention groups or combining the two control groups.

Monitor: Results indicated that there was a relationship between Monitor score and stress levels which was dependent on whether subjects were in the intervention or control groups. Monitor score for subjects in the three intervention groups (Instruction/Preparation, Mental Arithmetic/Distraction, Mental Arithmetic/Rest) accounted for 12% of the variance for number of unsolvable puzzles attempted $t(1,36) = 2.22$, $p < .02$. Monitor score and baseline diastolic blood pressure accounted for 40% of the variance for diastolic blood pressure during task instructions, 55% of the variance for diastolic blood pressure during the task, and 69% of the variance for diastolic blood pressure during recovery. After removing the effects of baseline diastolic blood pressure, Monitor score accounted for 8% of the variance for diastolic blood pressure during task instructions, $t(2,35) = -2.20$, $p < .02$, 10% of the variance for diastolic blood pressure during the task, $t(2,35) = -2.38$, $p < .02$, and 11% of the variance for diastolic blood pressure during recovery, $t(2,35) = -3.55$, $p < .001$.

The positive relationship between Monitor score and number of puzzles attempted suggests that, for subjects receiving an intervention, the higher the score on the

Monitor scale the more puzzles attempted. This positive relationship indicates that lower levels of frustration are associated with higher Monitor scores. The negative relationship found between Monitor score and diastolic blood pressure during task instructions, exposure, and recovery, indicates that, for subjects receiving an intervention, the greater the Monitor score the less the diastolic blood pressure reactivity. These findings suggest that when subjects receive an intervention, high Monitor scores predict less diastolic blood pressure reactivity during stressor exposure and fewer behavioral aftereffects.

Analyses combining the two control groups (Stroop/Rest, Rest/Rest) indicated that, baseline Nervousness and Monitor scores accounted for 18% of the variance in Nervousness after the mental arithmetic task and baseline systolic blood pressure levels and Monitor scores accounted for 54% of the variance for systolic blood pressure during task instructions. After removing the effects of baseline, Monitor score accounted for 17% of the variance for Nervousness $\underline{t}(2,25)= 2.26$, $\underline{p}< .02$ and 15% of variance for systolic blood pressure during task instructions, $\underline{t}(2,25)= 2.79$, $\underline{p}< .01$. The positive relationship found for these analyses indicates that for subjects not receiving an intervention, the higher the Monitor score the greater the nervousness during the task and the greater the increase in systolic blood pressure during task instructions. These

findings suggest that when subjects do not receive an intervention high monitor scores will predict greater systolic blood pressure reactivity and nervousness during stressor exposure.

Blunter: For subjects in the intervention groups, baseline systolic blood pressure and Blunter scores accounted for 63% of the variance for systolic blood pressure during task instructions and 30% of the variance for systolic blood pressure during the task. After removing the effects of baseline systolic blood pressure, Blunter score accounted for 8% of the variance for systolic blood pressure during task instructions, $t(2,35) = -2.79$, $p < .008$, and 12% of the variance during the task, $t(2,35) = -2.48$, $p < .02$. The negative relationship suggests that, for subjects receiving an intervention, the higher the Blunter score the smaller the increase in systolic blood pressure during task instructions and the task.

For subjects not receiving an intervention, heart rate baseline scores and Blunter scores accounted for 33% of the variance for heart rate levels during the mental arithmetic task. After removing heart rate baseline scores, the Blunter scale accounted for 18% of the variance for heart rate during the task, $t(2,25) = -2.59$, $p < .02$. The negative relationship indicates that the higher subjects scored on

the Blunter scale the smaller the increase in heart rate during the task.

Desire for Control: The Desire for Control scale did not predict a significant portion of the variance for any of the stress variables.

Other Predictor Variables: Another set of regression analyses was conducted combining all of the groups for the following dependent variables: Negative affect, Fearfulness, Nervousness, stress, tension, tired, and relaxation level, systolic blood pressure, diastolic blood pressure, heart rate during instructions, mean task level, and recovery, and Feather task. Predictor variables entered in the equation first were group, baseline measure, and then one of the following 1) control over the task 2) predictability of the task 3) ability to prepare 4) how prepared they were 5) distraction prior to the task 6) ability to stop the task.

The only variables that significantly predicted variance in the stress variables at the $p < .001$ level were the questions which asked about predictability, level of preparation, lack of control during the task, and ability to stop the task. After removing the effects of group, which accounted for less than 1% of the variance, predictability of the task accounted for 19% of the variance for tension, $t(1,71) = -3.89$, $p < .0002$, and 20% of the variance for

stress, $t(1,71) = -3.84$, $p < .0003$. After removing the effects of group, which accounted for less than 1% of the variance, how prepared subjects were for the task predicted 19% of the variance for how relaxed subjects were, $t(1,71) = 4.11$, $p < .0001$. Baseline levels combined with group effects accounted for 13% of the variance for Negative affect during the task, 6% of the variance for Fearfulness during the task, and 5% of the variance for Nervousness during the task. After removing the effects of group and baseline score, how prepared subjects were for the task predicted 13% of the variance in Negative affect, $t(1,71) = -3.37$, $p < .001$, 18% of the variance for Fearfulness, $t(1,71) = -3.81$, $p < .0003$, and 19% of the variance for Nervousness, $t(1,71) = -3.92$, $p < .0002$.

After removing the effects of group and baseline score, subjects' perceived lack of control during the task predicted 17% of the variance for Fearfulness, $t(1,71) = 3.77$, $p < .0004$, and 14% of the variance for Nervousness, $t(1,71) = 3.22$, $p < .001$. Hear rate baseline scores and group accounted for 51% of the variance for heart rate during task instructions and 15% of the variance for heart rate during the task. After removing the effects of group and baseline score, subjects' perception regarding their ability to stop the task predicted 11% of the variance for heart rate during task instructions, $t(1,71) = 4.13$, $p < .0001$, and 12% of the variance during the task, $t(1,71) = 3.56$, $p < .0007$.

The negative relationship between task predictability and tension and stress suggests that the more predictable subjects found the task, the less they reported feeling tense and stressed. Similarly, the negative relationship between perceptions of preparedness and negative affect, fearfulness, and nervousness indicated that the more prepared subjects were for the task the less they reported negative affect, fearfulness, and nervousness. The positive relationship between perceptions of preparedness and level of relaxation suggests that the more prepared subjects felt the more relaxed they were during the task. Lack of control during the task positively correlated with fear and nervousness, suggesting that the more out of control subjects were the greater their fearfulness and nervousness. Finally, subjects perceptions regarding their ability to stop the task positively correlated with heart rate during task instructions, suggesting the greater subjects' perceived ability to stop the task, the higher the heart rate levels during the task.

Gender Differences

Gender did not play a large role in the relationships examined in this study. In addition to physical differences including height and weight, baseline blood pressure was higher in men than in women, systolic blood pressure, $F(1,73)=6.36$, $p<.01$ (109.61 ± 12.7 mmHg vs. 103.16 ± 9.1 mmHg),

diastolic blood pressure, $F(1,73)=7.15$, $p < .01$ (69.31±10.76 mmHg vs. 63.3±8.54 mmHg).

Heart rate reactivity during the task (mean of the 3 heart rate measures during the task) was lower for men than for women, $F(1,73)=3.87$, $p < .05$. Mean heart rate change from baseline was 9.07 (±6.6) for men and 12.51 (±8.7) for women.

Discussion

Overview

This research examined the efficacy of specific components of stress-reduction interventions using a laboratory stressor. Three intervention groups and two control groups were included. One intervention group was given procedural information regarding the stressor and allowed to prepare for the stressor. Stressor pre-exposure followed by distraction, before stressor re-exposure, was provided to a second intervention group. The third intervention group was pre-exposed to the stressor and given no opportunity for preparation or distraction. One control group was initially exposed to a different stressor than the task stressor to control for the psychological and physiological effects of stressor pre-exposure. The second control group received no intervention prior to stressor exposure.

In more conceptual terms the Instruction/Preparation group represented a group given procedural information about the stressor combined with a cognitive-behavioral task to prepare for the stressor. The Mental Arithmetic/Distraction group represented a group that were provided sensory and procedural information about the stressor, through task pre-exposure, combined with a behavioral distraction task. The third intervention group, Mental Arithmetic/Rest, represented a group that were simply provided sensory and

procedural information.

The main question asked was whether procedural information plus preparation, stressor pre-exposure plus distraction, or stressor pre-exposure alone, would temper stress responding during stressor exposure. Stress responding, along several indices, was attenuated in each of the three intervention groups. However, stressor pre-exposure plus distraction reliably attenuated stress responding across a greater number of indices than did the other stress reduction interventions.

Subjects in the mental arithmetic pre-exposure plus distraction group (Mental Arithmetic/Distraction) had diminished stressor aftereffects, as measured by the Feather task, compared to the procedural information plus preparation group (Information/Preparation), diastolic blood pressure and heart rate reactivity at the end of the task were lower, and recovery on all cardiovascular measures was quicker compared to the control groups. Some evidence of procedural information plus preparation effects were also observed. Subjects in the group given procedural information plus preparation showed smaller increases in negative affect compared to the Rest/Rest control group, lower cardiovascular reactivity during task instructions compared to the other intervention groups and control groups, and their heart rates returned to baseline faster after the task compared to the mental arithmetic pre-

exposure group and both control groups. Subjects pre-exposed to mental arithmetic followed by rest (Mental Arithmetic/Rest), showed smaller increases in negative affect, and smaller increases in systolic blood pressure during the task compared to the Rest/Rest control group, and a quicker systolic blood pressure recovery following the task compared to both control groups.

Stress Pre-exposure: It was hypothesized that, during the task pre-exposure period, the two groups pre-exposed to the mental arithmetic task for 1 minute (Mental Arithmetic/Distraction and Mental Arithmetic/Rest) and the group exposed to the Stroop task for 1 minute (Stroop/Rest) would demonstrate stress responding whereas subjects in the other two groups (Instruction/Preparation and Rest/Rest) would not. Exposure to mental arithmetic and Stroop tasks for 1 minute did increase self-reported stress, negative affect, and cardiovascular reactivity, as compared to the non-exposed groups. Mental arithmetic produced a greater change in psychological and cardiovascular measures of reactivity than did the Stroop task. These findings are similar to those previously found in this laboratory (Zakowski et al., 1994). Given that subjects exposed to the Stroop and mental arithmetic tasks experienced stress prior to task exposure, and the Stroop/Rest group did not show diminished stress responding during the 6 minute stressor,

the psychological and physiological effects of stressor pre-exposure may be ruled out as an explanation for the effects of the interventions.

Psychological Interventions: The effects of preparation, distraction, and stressor pre-exposure, suggested that the interventions did affect the psychological variables of interest. Subjects in all three intervention groups reported that the time prior to the task allowed them to prepare for the task compared to subjects in the control groups. Subjects in the group given procedural information plus preparation reported greater levels of perceived preparation than subjects in the other intervention groups. Mere pre-exposure to a stressful task enhances feelings of preparation, as evidenced by preparation reports in the two groups exposed to mental arithmetic prior to the task. However, the actual opportunity to prepare was shown to enhance perception of preparation to a greater extent than task pre-exposure.

The three intervention groups also reported that the preparation was helpful, compared to the Rest/Rest control group, and the intervention groups did not differ from each other. Subjects in the mental arithmetic pre-exposure plus distraction group reported greater levels of distraction before the task than the other four groups. The mental arithmetic pre-exposure group reported greater levels of

distraction compared to Rest/Rest control group. Subjects in all three intervention groups reported a greater sense of task predictability than the two control groups, and the intervention groups did not differ from each other. The two intervention groups who worked on arithmetic problems prior to the mental arithmetic task (Instruction/Preparation and Mental Arithmetic/Distraction) reported greater levels of concentration prior to the task than subjects in the control groups.

Contrary to expectation, the intervention groups did not differ from the control groups in perceived control during the task, perceptions regarding ability to stop the task, feelings of lack of control, feelings of preparedness for the task, and whether preparation would be helpful in the future. The lack of between-groups differences on being able to stop the task and perceived control may be due to the confrontational nature of the mental arithmetic task and the overwhelming nature of experimenter harassment during the task. The lack of between group differences when asked how prepared subjects felt for the task or if preparation would be helpful in the future may be attributed to the fact that there were no performance differences among subjects on the task. The mental arithmetic task is generally used as a stressor and not a performance measure, therefore it may have been difficult for subjects in the intervention groups to assume that they were prepared for the task or that there

would be any way to prepare for the task in the furure.

It was also hypothesized that anticipatory anxiety, associated with the intervention group's knowledge of the impending stressor, would cause between group differences on psychological and physiological dimensions of stress at the end of the intervention period. There were no group differences in cardiovascular measures or mood at the end of the intervention period. Individual components of the interventions may have been effective at diminishing anticipatory arousal through their impact on psychological variables which have been hypothesized to attenuate stress responding. For example, subjects in the mental arithmetic pre-exposure group reported that they felt they were allowed to prepare, that preparation was helpful, that they were distracted, and that they could predict the task. These perceptions were similar for the other intervention groups. Previous research has shown that distraction, preparation, or task predictability decreases anticipatory arousal (Monat et al., 1972; Niemela, 1973).

Stressor Exposure - Intervention Efficacy: It was predicted that subjects in the intervention groups would show lower levels of distress, cardiovascular reactivity, and fewer aftereffects than control group subjects during and after stressor administration. It was also predicted that the mental arithmetic pre-exposure plus distraction group would

be most efficacious in attenuating stress responding, that the procedural information plus preparation group would have intermediate effects, whereas mere pre-exposure would be the least efficacious of the intervention groups.

The mental arithmetic task did increase stress responding as measured by changes in mood, cardiovascular reactivity, and manipulation check data. The magnitude of the changes were consistent with previous studies in this (Zakowski et al., 1994) and other laboratories (Naliboff et al., 1992). Therefore, results from this study showed that the 6-minute mental arithmetic task increased stress responding.

Self-Report: The interventions were not as efficacious in terms of reducing self-reported stress as was predicted. The only group difference in mood was an attenuation in task-related negative affect in the procedural information plus preparation group and mental arithmetic pre-exposure group as compared to the Rest/Rest control group. This finding is consistent with previous research which found reduced distress to gastrointestinal endoscopy examination when subjects were given sensory or procedural information (Johnson et al., 1973) or exposed to a preparatory procedure (Kendal et al., 1979; Langer et al., 1975).

The addition of a distraction component to sensory and procedural information did not seem to produce a reduction

in negative affect. Pre-task distraction may have worked against the beneficial effects of information at a psychological level, resulting in denial or avoidance. Subjects' involvement in the distracting task may not have allowed them to engage in their preferred coping technique, and, through their inability to think about the upcoming stressor, may have produced a form of denial or avoidance. Denial and avoidance have been found to be ineffective as stress reduction techniques for psychological symptoms (Hare, 1965; Mullen & Suls, 1982). Although subjects in the mental arithmetic pre-exposure plus distraction group reported greater levels of concentration prior to the task, they also reported greater levels of distraction. Future research should examine denial and avoidance more closely as they relate to the acute stress response.

The modest intervention effects on self-reported stress levels may be the result of several factors. The overwhelming nature of the mental arithmetic task may have eliminated any possible variance in the self-report measures. Also, subtle attenuation of psychological stress by the interventions may not have been revealed on the Lickert scales used to measure subjective stress. The average score, across groups, for "stress" and "tension" was 5 out of 6. More sensitive measures may be needed in order to reveal subtle changes in psychological variables.

Cardiovascular: The interventions were more efficacious in terms of diminishing cardiovascular reactivity during and after stressor exposure. Exposure to procedural information plus preparation resulted in lower levels of overall cardiovascular reactivity during the instruction period, compared to the other groups, and a quicker heart rate recovery following the task, compared to the control groups. These results suggest that procedural information plus preparation decreased the anticipatory arousal which generally accompanies mental arithmetic instructions. Subjects were unaware of the interference component of the task, therefore, they felt that they were allowed to prepare for the task, and this resulted in decreased arousal during task instructions. Once the task began, procedural information plus preparation did not attenuate cardiovascular reactivity. Modest attenuation of cardiovascular reactivity and recovery in this intervention group may partly be due to the lack of pre-task sensory information. These results are not surprising since knowledge about how one will feel during a stressor has been shown to produce greater decreases in distress and arousal than a procedural information plus behavioral adjustment intervention (Johnson, 1984).

Support for the use of sensory information as a significant stress reduction method is also provided by data from the mental arithmetic pre-exposure groups. Subjects in

the mental arithmetic pre-exposure group, given procedural as well as sensory information, showed lower during-task systolic blood pressure reactivity and a quicker recovery after the task. The effects of sensory and procedural information were more dramatic when combined with cognitive distraction. Subjects in the mental arithmetic plus distraction group showed less diastolic blood pressure and heart rate reactivity during the task, as well as a quicker post-task recovery along all cardiovascular measures.

Pre-exposure to mental arithmetic did not produce a significant attenuation in cardiovascular reactivity during subsequent re-exposure to task instructions, as did procedural information plus preparation. Subjects in all three intervention groups reported a high level of task predictability, yet only subjects in the mental arithmetic pre-exposure groups understood the degree of task-related interference and physiological arousal prior to the actual task. This knowledge may have increased subjects anticipatory arousal prior to beginning the subtractions.

Support for the anticipatory arousal found in the present study is apparent when one notes the anticipatory arousal in the 95% or 100% shock conditions of previous studies (Epstein & Roupenian, 1970; Gains et al., 1977; Monat et al., 1972). The 95% and 100% shock conditions are analogous to the mental arithmetic pre-exposure groups in this study, because subjects pre-exposed to mental

arithmetic and subjects in the high shock conditions know the nature and the imminence of the stressor. The anticipatory arousal found in this study also is consistent with previous research from this laboratory (Street et al., 1984), and Petry and Desiderato (1978) which found that when shock delivery was predictable subjects showed greater anticipatory arousal.

The increased arousal during the instruction period apparent in the mental arithmetic pre-exposure groups may be responsible for the attenuated cardiovascular reactivity found during the task. Although this interpretation is plausible, the two control groups also showed increased reactivity during the instruction period, compared to the group given procedural information plus preparation, and neither control group showed attenuation of cardiovascular measures during task exposure or recovery. Furthermore, there is no support in the literature too the idea that high cardiovascular levels prior to a stressful task are associated with lower reactivity during stressor exposure.

Behavioral Aftereffects: The superior efficacy of stressor pre-exposure plus distraction is evident with examination of behavioral aftereffects. Subjects given mental arithmetic pre-exposure plus distraction showed the highest tolerance for frustration indicated by greater number of attempts on the unsolvable puzzle, as compared to subjects in the group

given procedural information plus preparation. Therefore, decreased cardiovascular reactivity was associated with fewer stress aftereffects. This finding is similar to the studies by Glass and Singer (1972) which showed that tolerance for frustration was greater in subjects who were less physiologically aroused.

There were no significant group differences on the proofreading task as measured by the quantity of material read or the percentage of errors found. This may be due to the fact that the subjects in the present study only worked on the task for 5 minutes, and, on average, completed only one and a half pages of the task. The studies by Glass and Singer (1972), which showed an increase in percentage of errors found for subjects who were less aroused, had subjects work on the task for 15 minutes. A shorter version of the proofreading task was chosen for the present study because two aftereffects tasks were used. Administration of manipulation check questionnaires followed by 15 minutes of proofreading would have made the Feather task over 20 minutes post-stressor, reducing the probability of finding aftereffects on this task. Although Baum et al. (1993) have found proofreading effects using a 5-minute proofreading task, their studies examined chronic stress populations. The proofreading task may need to be longer for acute stress studies, in which case detection of aftereffects may be accomplished with only one task.

One theory explaining the superior efficacy of sensory information over procedural information, proposes that sensory information provides *a priori* verification of sensations prior to the actual stressful procedure or event (Baum, Fisher, & Solomon, 1981). Subjects in the procedural information plus preparation group knew what the task was going, and, as a result, reported feeling that they had prepared for the task. This knowledge corresponded with an attenuation in cardiovascular reactivity during the instruction period. However, when the task began, they had no prior sensorial knowledge and the intervention showed little effect on cardiovascular reactivity during the task. Subjects who had been pre-exposed to mental arithmetic, showed increased levels of arousal during the instruction period, given that they were aware of what was to come. This sensorial knowledge attenuated arousal during the task given that they were prepared for the task-related sensations.

Mediators of the Stress Response: Coping style data collected in the present study supports the belief that individual coping styles need to be taken into account when considering appropriateness of interventions. Monitor score, in subjects in the intervention groups, was positively related to tolerance for frustration, and negatively related to diastolic blood pressure levels during

and after the stressor. Specifically, subjects who received high levels of information about the stressor, higher Monitor scores were related to lower diastolic blood pressure levels during the task and the recovery period, and fewer stressor aftereffects. The opposite was found for subjects in the control groups. Among subjects who received no information about the stressor, higher Monitor scores were related to increased systolic blood pressure levels during task instructions and more nervousness during the task. These findings indicate that a match between Monitor score and intervention method results in an attenuation of the stress response.

Blunter score was negatively related to systolic blood pressure levels during the task in subjects in the intervention groups. The greater the Blunter score, the lower the systolic blood pressure during task instructions and during the task. Although significant, Blunter score only accounted for 10% of the variance in systolic blood pressure during task instructions and during the task. For subjects in the control groups, Blunter score accounted for 18% of the variance in heart rate levels during the task. The higher the Blunter score for subjects receiving no information about the stressor, the lower the heart rate levels during the task.

The relationship between Blunter score and cardiovascular levels was in the predicted direction for

subjects in the control groups, but in the opposite direction for subjects in the intervention groups. The negative relationship between Blunter score and systolic blood pressure for subjects in the intervention groups may be attributable to the fact that the interventions did not increase subjects' sense of control over the task. They reported an increased sense of predictability of what the task was going to be, yet they did not report being in more control of the task, being able to stop the task, or being more prepared for the task than subjects in the control groups. Glass and Singer (1972) found that perceived control of a laboratory stressor attenuated the stress response along several dimensions, and Anderson (1987) found that perceived control mediated anxiety for patients undergoing cardiac surgery. If the interventions had increased subjects perceptions of task control, then perhaps Blunter score would have positively predicted stress responding.

Several variables were found to predict attenuation of stress responding across all groups. The more predictable the task, the more prepared subjects felt, and the less out of control subjects reported being during the task, the lower the self-reported stress levels. These results support theories on the effectiveness of predictability and control as mechanisms of stress reduction (Glass & Singer, 1972; Perkins, 1968; Seligman, 1968). A positive

relationship was found between subjects' perceptions regarding their ability to stop the task and heart rate levels during task instructions and during the task. This relationship is in the opposite direction than was predicted.

One explanation for these findings is that as subjects' ability to stop the task increases they begin to mobilize their defenses if an effort to prepare themselves to stop the stressor and they become more physiologically aroused. Subjects know that they can stop the stressor, yet they continue to subject themselves to it. Weisse et al. (1990) found that subjects given control over a stressor showed decreased immune function. One of the author's explanations is that subjects with task control also had increased activity levels. Although subjects in the present study were not monitored for activity levels, the increased sense of being able to stop the task did result in increased heart rate levels.

It was hypothesized that the control group that was pre-exposed to the Stroop task (Stroop/Rest) would show greater distress, reactivity, and aftereffects compared to the control group with no stressor pre-exposure (Rest/Rest). Results showed that the two control groups were not significantly different from one another on any of the stress variables. The differences that were found between the control groups were in relation to the intervention

groups. There was some indication that the Rest/Rest control group had a greater stress response to the mental arithmetic task compared to the Stroop/Rest control group. For example, the Rest/Rest group showed greater changes in heart rate during mental arithmetic task instructions, and greater changes in negative affect, systolic blood pressure, and heart rate during the task compared to the intervention groups. The Stroop/Rest group, on the other hand, did not show differences in these same variables compared to the intervention groups, yet showed greater changes in systolic blood pressure during mental arithmetic task instructions, and diastolic blood pressure during the task compared to the intervention groups. Both control groups had the same relationship to the intervention groups for the other measures during and after the task.

It is difficult to interpret the differences between the control groups in relation to the interventions, especially since there were no group differences on the psychological variables thought to mediate the stress response. Even though subjects in the Stroop/Rest group reported that they could not predict the task, exposure to the Stroop task may have given them the impression that the next task also would be stressful. This may have accounted for the increased systolic blood pressure during task instructions, and the diminished response during the task, compared to the Rest/Rest control group. Unfortunately,

there was no measure of subjects' perceptions on the level of stress that they would experience during the task.

The intervention groups were not highly different from one another in terms of efficacy. This may be due to the fact that each intervention was associated with significant changes in similar psychological variables (predictability, distraction, preparation) thought to be effective components of different stress reduction techniques. The differences that the interventions produced in the psychological impact, measured with the manipulation check questionnaire, were that the Information/Preparation group reported a greater sense of being allowed to prepare for the task compared to all groups, and the Mental Arithmetic/Distraction group reported a greater level of pre-task distraction compared to all groups. Even with these inter-group differences, all three intervention groups scored higher on these variables than the control groups.

The lack of effective differential manipulation of the psychological variables of interest may contribute to the similarities between the intervention groups. For example, all the intervention groups reported a high level of task predictability compared to the control groups, and a negative correlation was found between predictability and stress responding. Taken together these findings would suggest that predictability is a common factor mediating stress responding. Unfortunately, the three intervention

groups also reported higher levels of distraction and preparation, both known mechanisms of stress reduction. All three of these mechanisms (preparation, distraction, and predictability) may be contributing to stress reduction or there may be another mechanism common to the interventions which was not measured. For example, perhaps all three interventions allow subjects time for anticipatory coping. Although anticipatory coping was not measured in this study, exposing subjects to any type of information about an upcoming stressful event allows subjects time to engage in coping.

In the present study the interpretation of the beneficial effects of procedural information combined with preparation is limited. The procedural information provided to the Instruction/Preparation group was only partial, such that they knew what they were to do during the task, yet were unaware of the verbal harassment which they would receive. If subjects had been aware of the harassment component of the task then the manipulation would have been comparable to other information provision interventions.

Another limitation of this study was that all groups received the mental arithmetic stressor. Had this been a factorial design then a group of subjects would not have performed the 6-minute mental arithmetic task. This group would have controlled for the passage of time and changes in stress levels attributable to being in a laboratory setting.

Examination of the cardiovascular data indicated that by the end of the intervention period subjects' cardiovascular levels were near baseline. Blood pressure and heart rate levels would fluctuate over time, but the fluctuation would be slightly above or below the resting levels.

A laboratory model was used in the present study in an attempt to understand the specific contribution of different components of stress-reduction interventions. Unfortunately, the use of a laboratory model decreases the external validity of the results. Although laboratory models allow control of extraneous variables, the generalizability of the results to real world phenomena is limited. The task used in this study limits the generalizability further, in that the similarities between mental arithmetic and stressors encountered out of the laboratory, such as medical procedures, is questionable. Future research examining components of stress-reduction techniques in the laboratory should attempt to use a model with greater generalizability, such as a stressor that inflicts minor pain.

Despite these limitations, each of the three interventions attenuated stress responding to a degree, with sensory and procedural information plus distraction producing the greatest impact on stress responding during stressor exposure and recovery. Preparation, distraction, and provision of sensory information may be useful in

diminishing stress for real world phenomena such as aversive medical procedures. Future field and laboratory studies need to develop manipulations that will produce distinct psychological effects for variables thought to be relevant to stress reducing interventions.

Summary

This study examined the efficacy of specific components of stress-reducing interventions using a laboratory stressor. Three intervention groups were included. One group received procedural information plus preparation. Another group received procedural and sensory information, through task pre-exposure, plus distraction. The third group were exposed to procedural and sensory information through task pre-exposure. Two control groups controlled for the effects of stressor pre-exposure, and task predictability which resulted from information provision.

Results indicated that all three interventions produced a decrease in several stress indices. Subjects given stressor pre-exposure plus distraction showed attenuated stress responding across a greater number of indices than did the other stress reduction interventions, including, diastolic blood pressure and heart rate reactivity during the task, recovery for all cardiovascular measures after the task, and behavioral aftereffects. Subjects given procedural information plus preparation showed lower cardiovascular reactivity during task instructions, attenuated negative affect, and quicker heart rate recovery after the task. Subjects who were given stressor pre-exposure alone exhibited less systolic blood pressure reactivity during the task and recovery, and attenuated negative affect.

Few group differences in the interventions were found, making it difficult to determine if one method was better than another at decreasing stress. All three interventions produced a change in psychological variables which are thought to moderate stress responding (predictability, distraction, preparation), obscuring the individual efficacy of the interventions. Even though there was a lack of inter-group differences, the findings support previous research indicating that procedural and sensory information plus distraction was more effective at decreasing the stress response than the other interventions.

Subjects in the control group pre-exposure to a different stressor showed an increase in self-reported stress and physiological arousal during the pre-exposure period that was similar to the two intervention groups pre-exposed to the mental arithmetic task. Given that neither control group showed decreased stress indices, the passage of time and psychological and physiological arousal going into the task do not explain the results of the interventions.

Coping style, as measured by the Monitor scale, was found to mediate the effectiveness of the interventions. The higher the score on the Monitor scale for subjects receiving an intervention the lower the stress response and high Monitor scores for subjects in the control groups related to greater stress responding. This indicates that

an intervention may be maximally effective if it matches or is consistent with a subjects typical coping style.

Results from regression analyses indicated that high levels of task predictability and feelings of being able to prepare, and low levels of feeling out of control, were related to lower levels of stress responding. Subjects in the intervention groups indicated increased task predictability, ability to prepare for the task, and that the intervention was helpful, lending support to the notion that these variables were in part responsible for the efficacy of the interventions. In order to more fully determine the effective components of stress-reducing interventions, future research needs to develop laboratory interventions that allow greater distinction between psychological variables thought to decrease stress responding.

APPENDIX A

Subtract by 7's

Start from 1176

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Subtract by 7's

Start from 1258

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Subtract by 7's

Start from 1195

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Subtract by 7's

Start from 1344

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Subtract by 7's

Start from 1999

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1256 x 27	1145 + 78	2143 + 43	7564 x 89	2435 x 74	1236 - 73	1287 x 67
2257 x 9	1978 - 36	2345 x 77	4367 - 45	5698 - 92	7473 - 48	2356 x 13
1476 + 67	2768 x 98	7658 - 57	9878 - 45	3428 + 82	3894 + 98	4676 x 93
1567 x 53	5648 - 43	5647 + 99	2436 + 73	5438 x 19	8744 - 76	2587 x 56
3476 - 98	5623 - 23	1267 x 67	6546 + 76	4990 x 64	7864 + 33	
4790 x 67	8798 + 23	2476 - 56	7658 - 54	3267 + 24	4377 - 76	

1766 x 17	1545 + 88	2163 + 46	2564 x 35	6735 x 74	1436 - 63	6287 x 65
4557 x 75	1478 - 66	4345 x 67	3367 - 56	5678 - 42	6473 - 68	5356 x 53
2476 + 43	5768 x 68	5658 - 78	5367 - 75	4568 + 89	8894 + 48	1676 x 93
4567 x 63	9648 - 49	4647 + 79	5776 + 43	8938 x 69	5744 - 86	4587 x 46
3476 - 38	3623 - 53	5667 x 47	2446 + 36	6990 x 34	7564 + 73	
4350 x 57	2798 + 73	1476 - 43	7258 - 14	3235 + 54	6377 - 79	

7656 x 97	6145 + 76	2157 + 43	3564 x 59	2423 x 24	4436 - 73	5887 x 37
3257 x 24	6978 - 86	2465 x 43	5367 - 55	4548 - 52	8473 - 38	5356 x 15
1356 + 75	2778 x 48	3658 - 37	1878 - 35	2428 + 52	7694 + 18	3676 x 93
6567 x 83	6348 - 53	7647 + 69	2636 + 43	1438 x 49	2344 - 66	1587 x 43
7476 - 18	5623 - 63	5267 x 35	6636 + 36	4630 x 24	6864 + 63	
5790 x 47	2798 + 53	4476 - 46	9658 - 34	2267 + 32	4867 - 56	

5366 x 51	6545 + 58	3163 + 67	1564 x 85	7735 x 24	2436 - 65	1287 x 25
1557 x 44	3478 - 56	6345 x 57	7367 - 36	6478 - 72	2473 - 28	4356 x 23
2676 + 43	5578 x 65	1658 - 28	3367 - 85	3568 + 59	2894 + 38	8676 x 73
4567 x 65	1648 - 49	4980 + 76	5546 + 63	3938 x 65	4744 - 76	5587 x 46
7456 - 15	2623 - 89	3667 x 67	1446 + 36	7990 x 34	5564 + 63	
5350 x 35	7798 + 73	1468 - 43	2258 - 87	7235 + 64	5377 - 49	

1236 x 45	3557 x 54	4878 - 64	9345 x 57	6677 - 57	3478 - 62	3473 - 27
4266 x 43	7666 + 63	5778 x 58	3658 - 58	6867 - 46	7568 + 79	2432 + 23
5387 x 53	4647 x 45	6678 - 96	5980 + 36	7456 + 43	8698 x 45	3544 - 26
5345 + 76	4876 - 14	3623 - 69	3466 x 47	4456 + 36	7390 x 37	5464 + 33
7463 + 41	3890 x 56	7469 + 43	4768 - 46	3258 - 67	5235 + 67	
4366 x 21	5645 + 87	4163 + 67	3554 x 64	7646 x 34	2465 - 85	

APPENDIX B

UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES
4301 JONES BRIDGE ROAD
BETHESDA, MARYLAND 20814-4799

CONSENT FOR RESEARCH PARTICIPATION

Please read carefully

Title of Study: The effects of task performance on physiological functioning.
Protocol: TO-72AY

We are studying the effects of task performance on several psychological and physiological functions including coping, heart rate, blood pressure, and task performance. In order to do this we will have you answer a number of questions and participate in some tasks. We are asking you to help us by participating in one 2-hour session in our laboratory. We will pay you $25 for participating in this session.

We are interested in getting to know you and evaluating some of your attitudes, beliefs, and personal characteristics. In order to accomplish this, we will ask you a number of questions concerning your background. We will ask you questions about your health and well-being and administer some tasks measuring mental performance. We may ask you to complete any of the following simple tasks: playing a video game, listening to tapes of music, performing a proofreading task, watching films depicting surgery or disease, taking a simulated driving test, viewing scenes of unusual places, working on a color-word coordination task or a mental arithmetic task.

During the time you are in the laboratory we will be measuring your heart rate and blood pressure. In order to do this we will attach a cuff like the one used in your doctor's office to your dominant arm. This cuff is attached to a machine that will cause the cuff to inflate automatically at approximately 2-3 minute intervals at certain times throughout the session.

Possible inconvenience or discomfort from this study involves possible frustration during the tasks. If at any time during the study you should choose not to participate in some part of the study, you may do so without penalty. If you decide to participate, you may withdraw or discontinue participation at any time for any reason without prejudice. If you have any questions, we expect you to ask us.

This study does not entail any physical or mental risk beyond those described above. If, however you should become uncomfortable during the study, sufficiently uncomfortable that you would like to end the session, tell us. We do not expect this to occur, but if, for any reason, you feel that continuing would constitute a hardship, please tell us and we will end the session.

Research records of your participation in this study will be maintained by the principal investigtors Dr Singer, 301-295-3270, and Lorenzo Cohen, 301-295-3522. Confidentiality is protected to the best extent possible under law. Your identity will not be traceable by anyone other than the principal investigator. When you have completed the session and we have coded your data or you have withdrawn from the study, your name will be deleted from all records and no one will be able to trace your data. The data will be published in scientific journals but will not be published in any manner that can identify you.

If you believe that you have suffered any injury or illness as a result of participating in this research, please contact Research Administration, 301-295-3303, at the University. This office can review the matter with you and may be able to identify resources available to you. Information about possible judicial avenues of compensation is available from the University's Legal Counsel, 301-295-3028.

If you desire additional information about this experiment, either about the rationale for it or its findings, or about your rights as a participant, you may call the Department of Medical Psychology, 301-295-3270, to obtain information about it. In this way, you can make your participation in our research a more informative, educational experience. We welcome your comments and suggestions, and appreciate your willingness to help us.

YOU ARE MAKING A DECISION WHETHER OR NOT TO PARTICIPATE. YOUR SIGNATURE INDICATES THAT, HAVING READ THE ABOVE INFORMATION, YOU HAVE DECIDED TO PARTICIPATE.

_____
Date signed

_____
Signature of Subject

_____
Subject printed name

I was present during the explanation referred to above, as well as during the volunteer's opportunity to ask questions. I hereby witness the Volunteer's signature.

_____
Witness Signature

_____
Investigator or Designee signature

_____
Printed Name

_____
Printed Name

SUBJECT NUMBER_____

BACKGROUND INFORMATION

1. Date of birth?_____

2. Height?_____ Weight?_____

3. What is your marital status?

__Single

__Married How long?_____

__Separated How long?_____

__Divorced How long?_____

__Widowed How long?_____

4. What is your current family size?_____

5. Number of people living at your residence?_____

6. What is your highest educational level: ___Grammar School

___High School

___Some College

___College Degree

___Graduate Work

___Other (Specify)_____

7. What is your occupation?_____

8. What is your spouse's occupation?_____

9. What is your approximate annual income? ___Under 10,000/year

___$10,000 - $15,000/year

___$15,001 - $20,000/year

___$20,001 - $30,000/year

___$30,001 - $40,000/year

___$40,001 - $ 50,000/year

___over $50,000/year

On the following pages is a series of statements. They have been set up in a way which permits you to indicate the extent to which you agree or disagree with the ideas expressed.

1. Math doesn't scare me at all.

strongly agree				strongly disagree
1	2	3	4	5

2. It wouldn't bother me at all to take more math courses.

strongly agree				strongly disagree
1	2	3	4	5

3. I haven't usually worried about being able to solve math problems.

strongly agree				strongly disagree
1	2	3	4	5

4. I almost never have gotten shook up during a math test.

strongly agree				strongly disagree
1	2	3	4	5

5. I usually have been at ease during math tests.

strongly agree				strongly disagree
1	2	3	4	5

6. I usually have been at ease in math classes.

strongly agree				strongly disagree
1	2	3	4	5

7. Mathematics usually makes me feel uncomfortable and nervous.

strongly agree				strongly disagree
1	2	3	4	5

8. Mathematics makes me feel uncomfortable, restless, irritable, and impatient.

strongly agree — strongly disagree

1 2 3 4 5

9. I get a sinking feeling when I think of trying hard math problems.

strongly agree — strongly disagree

1 2 3 4 5

10. My mind goes blank and I am unable to think clearly when working mathematics.

strongly agree — strongly disagree

1 2 3 4 5

11. A math test would scare me.

strongly agree — strongly disagree

1 2 3 4 5

12. Mathematics makes me feel uneasy and confused.

strongly agree — strongly disagree

1 2 3 4 5

INSTRUCTIONS

Below is a list of feelings that people sometimes have. Fill in one of the spaces on the right with a check that best describes HOW YOU ARE FEELING AT THIS MOMENT. Make only one check mark for each item.

(0) = not at all
(1) = a little
(2) = moderately
(3) = quite a bit
(4) = extremely

	(0)	(1)	(2)	(3)	(4)
1. feeling nervous or shaky inside					
2. feeling calm					
3. feeling faintness or dizziness					
4. feeling relaxed					
5. feeling pains in heart or chest					
6. feeling low in energy or slowed down					
7. feeling energetic					
8. trembling					
9. feeling rested					
10. feeling of being trapped or caught					
11. feeling suddenly scared					
12. feeling worried					
13. feeling at ease					
14. feeling fearful					
15. heart pounding or racing					
16. nausea or upset stomach					
17. hot or cold spells					
18. feeling comfortable					

	(0)	(1)	(2)	(3)	(4)
19.feeling nervous					
20.feeling you have a lump in your throat					
21.feeling pleasant					
22.feeling tense or keyed up					
23.spells of terror or panic					
24.feeling so restless you can't sit still					
25.feeling self-confident					
26.feeling helpless					

STATE ASSESSMENT INVENTORY
INSTRUCTIONS

The following questionnaire is designed to measure your feelings about yourself and your situation at the present time.

There are twenty-one groups of statements, each group designated by a letter, A - U. In each group of statements you will be asked to make a check mark beside the one statement which most accurately reflects your feelings at the present time.

STATE ASSESSMENT INVENTORY

A

____ I do not feel sad
____ I feel blue or sad
____ I am blue or sad all the time and I can't snap out of it
____ I am so sad or unhappy that it is very painful
____ I am so sad or unhappy that I can't stand it

B

____ I am not particularly pessimistic or discouraged about the future
____ I feel discouraged about the future
____ I feel I have nothing to look forward to
____ I feel that I won't ever get over my troubles
____ I feel that the future is hopeless and that things cannot improve

C

____ I do not feel like a failure
____ I feel I have failed more than the average person
____ I feel I have accomplished very little that is worthwhile or that means anything
____ As I look back on my life all I can see is a lot of failures
____ I feel I am a complete failure as a person (parent, husband, wife)

D

____ I am not particularly dissatisfied
____ I feel bored most of the time
____ I don't enjoy things the way I used to
____ I don't get satisfaction out of anything any more
____ I am dissatisfied with everything

F

____ I don't feel particularly guilty
____ I feel bad or unworthy a good part of the time
____ I feel quite guilty
____ I feel bad or unworthy practically all the time now
____ I feel as though I am very bad or worthless

I

____ I don't feel I am being punished
____ I have a feeling that something bad may happen to me
____ I feel I am being punished or will be punished
____ I feel I deserve to be punished
____ I want to be punished

G

____ I don't feel disappointed in myself
____ I am disappointed in myself
____ I don't like myself
____ I am disgusted with myself
____ I hate myself

H

____ I don't feel I am any worse than anybody else
____ I am very critical of myself for my weaknesses or mistakes
____ I blame myself for everything that goes wrong
____ I feel I have many bad faults

I

____ I don't have any thoughts of harming myself
____ I have thoughts of harming myself but I would not carry them out
____ I feel I would be better off dead
____ I have definite plans about committing suicide
____ I feel my family would be better off if I were dead
____ I would kill myself if I could

J

____ I don't cry any more than usual
____ I cry more now than I used to
____ I cry all the time now. I can't stop it
____ I used to be able to cry but now I can't cry at all even though I want to

K

____ I am no more irritated now than I ever am
____ I get annoyed or irritated more easily than I used to
____ I feel irritated all the time
____ I don't get irritated at all at the things that used to irritate me

L

____ I have not lost interest in other people
____ I am less interested in other people now than I used to be
____ I have lost most of my interest in other people and have little feeling for them
____ I have lost all my interest in other people and don't care about them at all

M

____ I make dicisions about as well as ever
____ I am less sure of myself now and try to put off making decisions
____ I can't make decisions any more without help
____ I can't make any decisions at all any more

N

____ I don't feel I look any worse than I used to
____ I am worried that I am looking old or unattractive
____ I feel that there are permanent changes in my appearance and they make me look unattractive
____ I feel that I am ugly or repulsive looking

O

___ I can work about as well as before
___ It takes extra effort to get started at doing something
___ I don't work as well as I used to
___ I have to push myself very hard to do anything
___ I can't do any work at all

P

___ I can sleep as well as usual
___ I wake up more tired in the morning than I used to
___ 1 wake up 1-2 hours earlier than usual and find it hard to get back to sleep
___ I wake up early every day and can't get more than 5 hours sleep

Q

___ I don't get any more tired than usual
___ I get tired more easily than I used to
___ I get tired from doing anything
___ I get too tired to do anything

R

___ My appetite is no worse than usual
___ My appetite is not as good as it used to be
___ My appetite is much worse now
___ I have no appetite at all any more

S

___ I haven't lost much weight, if any, lately
___ I have lost more than 5 pounds
___ I have lost more than 10 pounds
___ I have lost more than 15 pounds

T

___ I am no more concerned about my health than usual
___ I am concerned about aches and pains or upset stomach or constipation or other unpleasant feelings in my body
___ I am so concerned with how I feel or what I feel that it's hard to think of much else
___ I am completely absorbed in what I feel

U

___ I have not noticed any recent change in my interest in sex
___ I am less interested in sex than I used to be
___ I am much less interested in sex now
___ I have lost interest in sex completely

Please circle the number which best describes how the task made you feel.

1. Tired:

1	2	3	4	5	6	7
not at all						a great deal

2. Bored:

1	2	3	4	5	6	7
not at all						a great deal

3. Tense:

1	2	3	4	5	6	7
not at all						a great deal

4. Uninterested:

1	2	3	4	5	6	7
not at all						a great deal

5. Stressed:

1	2	3	4	5	6	7
not at all						a great deal

6. Relaxed:

1	2	3	4	5	6	7
not at all						a great deal

INSTRUCTIONS
Below is a list of feelings that people sometimes have. Fill in one of the spaces on the right with a check that best describes HOW YOU FELT DURING THE TASK. Make only one check mark for each item.

(0) = not at all
(1) = a little
(2) = moderately
(3) = quite a bit
(4) = extremely

	(0)	(1)	(2)	(3)	(4)
1. feeling nervous or shaky inside					
2. feeling calm					
3. feeling faintness or dizziness					
4. feeling relaxed					
5. feeling pains in heart or chest					
6. feeling low in energy or slowed down					
7. feeling energetic					
8. trembling					
9. feeling rested					
10. feeling of being trapped or caught					
11. feeling suddenly scared					
12. feeling worried					
13. feeling at ease					
14. feeling fearful					
15. heart pounding or racing					
16. nausea or upset stomach					
17. hot or cold spells					
18. feeling comfortable					

	(0)	(1)	(2)	(3)	(4)
19. feeling nervous					
20. feeling you have a lump in your throat					
21. feeling pleasant					
22. feeling tense or keyed up					
23. spells of terror or panic					
24. feeling so restless you can't sit still					
25. feeling self-confident					
26. feeling helpless					

Please circle the number which best describes how the task made you feel.

1. Tired:

1 2 3 4 5 6 7
not at all a great deal

2. Bored:

1 2 3 4 5 6 7
not at all a great deal

3. Tense:

1 2 3 4 5 6 7
not at all a great deal

4. Uninterested:

1 2 3 4 5 6 7
not at all a great deal

5. Stressed:

1 2 3 4 5 6 7
not at all a great deal

6. Relaxed:

1 2 3 4 5 6 7
not at all a great deal

INSTRUCTIONS

Below is a list of feelings that people sometimes have. Fill in one of the spaces on the right with a check that best describes HOW YOU FELT DURING THE TASK. Make only one check mark for each item.

(0) = not at all
(1) = a little
(2) = moderately
(3) = quite a bit
(4) = extremely

	(0)	(1)	(2)	(3)	(4)
1. feeling nervous or shaky inside					
2. feeling calm					
3. feeling faintness or dizziness					
4. feeling relaxed					
5. feeling pains in heart or chest					
6. feeling low in energy or slowed down					
7. feeling energetic					
8. trembling					
9. feeling rested					
10. feeling of being trapped or caught					
11. feeling suddenly scared					
12. feeling worried					
13. feeling at ease					
14. feeling fearful					
15. heart pounding or racing					
16. nausea or upset stomach					
17. hot or cold spells					
18. feeling comfortable					

	(0)	(1)	(2)	(3)	(4)
19. feeling nervous					
20. feeling you have a lump in your throat					
21. feeling pleasant					
22. feeling tense or keyed up					
23. spells of terror or panic					
24. feeling so restless you can't sit still					
25. feeling self-confident					
26. feeling helpless					

Please circle the number which best describes how the task made you feel.

1. Tired:

1	2	3	4	5	6	7
not at all						a great deal

2. Bored:

1	2	3	4	5	6	7
not at all						a great deal

3. Tense:

1	2	3	4	5	6	7
not at all						a great deal

4. Uninterested:

1	2	3	4	5	6	7
not at all						a great deal

5. Stressed:

1	2	3	4	5	6	7
not at all						a great deal

6. Relaxed:

1	2	3	4	5	6	7
not at all						a great deal

INSTRUCTIONS
Below is a list of feelings that people sometimes have. Fill in one of the spaces on the right with a check that best describes HOW YOU FELT DURING THE TASK. Make only one check mark for each item.

(0) = not at all
(1) = a little
(2) = moderately
(3) = quite a bit
(4) = extremely

	(0)	(1)	(2)	(3)	(4)
1. feeling nervous or shaky inside					
2. feeling calm					
3. feeling faintness or dizziness					
4. feeling relaxed					
5. feeling pains in heart or chest					
6. feeling low in energy or slowed down					
7. feeling energetic					
8. trembling					
9. feeling rested					
10. feeling or being trapped or caught					
11. feeling suddenly scared					
12. feeling worried					
13. feeling at ease					
14. feeling fearful					
15. heart pounding or racing					
16. nausea or upset stomach					
17. hot or cold spells					
18. feeling comfortable					

	(0)	(1)	(2)	(3)	(4)
19. feeling nervous					
20. feeling you have a lump in your throat					
21. feeling pleasant					
22. feeling tense or keyed up					
23. spells of terror or panic					
24. feeling so restless you can't sit still					
25. feeling self-confident					
26. feeling helpless					

Please circle the number which describes how much you agree with the following statements.

1. I had a lot of control over the task.

1	2	3	4	5	6
not at all					a great deal

2. I was prepared for the task.

1	2	3	4	5	6
not at all					a great deal

3. I could stop the task whenever I wanted to.

1	2	3	4	5	6
not at all					a great deal

4. I felt overwhelmed and out of control throughout the task.

1	2	3	4	5	6
not at all					a great deal

5. The period prior to the task allowed me to prepare.

1	2	3	4	5	6
not at all					a great deal

6. Perparing for the task was helpful.

1	2	3	4	5	6
not at all					a great deal

7. In the future, preparing for the task would be helpful.

1	2	3	4	5	6
not at all					a great deal

8. Prior to the task I felt distracted.

1	2	3	4	5	6
not at all					a great deal

9. I could predict what the task was going to be.

1	2	3	4	5	6
not at all					a great deal

10. Prior to the task I concentrated my attention on what I would be doing.

1	2	3	4	5	6
not at all					a great deal

Subject #: _____ Date: __/__/__ 161

MILLER BEHAVIORAL STYLE SCALE

1. Vividly imagine that you are **afraid** of the dentist and have to get some dental work done. Which of the following would you do? Check **all** of the statements that might apply to you.

___ I would ask the dentist exactly what he was going to do.

___ I would take a tranquilizer or have a drink before going.

___ I would try to think about pleasant memories.

___ I would want the dentist to tell me when I would feel pain.

___ I would try to sleep.

___ I would watch all the dentist's movements and listen for the sound of the drill.

___ I would watch the flow of water from my mouth to see if it contained blood.

___ I would do mental puzzles in my mind.

2. Vividly imagine that you are being held hostage by a group of armed terrorists in a public building. Which of the following would you do? Check **all** of the statements that might apply to you.

___ I would sit by myself and have as many daydreams and fantasies as I could.

___ I would stay alert and try to keep myself from falling asleep.

___ I would exchange life stories with the other hostages.

___ If there was a radio present, I would stay near it and listen to the bulletins about what the police were doing.

___ I would watch every movement of my captors and keep an eye on their weapons.

___ I would try to sleep as much as possible.

___ I would think about how nice it's going to be when I get home.

___ I would make sure I knew where every possible exit was.

3. Vividly imagine that, due to a large drop in sales, it is rumored that several people in your department at work will be laid off. Your supervisor has turned in an evaluation of your work for the past year. The decision about lay-offs has been made and will be announced in several days. Check **all** of the statements that might apply to you.

___ I would talk to my fellow workers to see if they knew anything about what the supervisor's evaluation of me said.

___ I would review the list of duties for my present job and try to figure out if I had fulfilled them all.

___ I would go to the movies to take my mind off things.

___ I would try to remember any arguments or disagreements I might have had with the supervisor that would have lowered his opinion of me.

___ I would push all thoughts of being laid off out of my mind.

___ I would tell my spouse that I'd rather not discuss my chances of being laid off.

___ I would try to think which employees in my department the supervisor might have thought had done the worst job.

___ I would continue doing my work as if nothing special was happening.

4. Vividly imagine that you are on an airplane, thirty minutes from your destination, when the plane unexpectedly goes into a deep dive and then suddenly levels off. After a short time, the pilot announces that nothing is wrong, although the rest of the ride may be rough. You, however, are not convinced that all is well. Check **all** of the statements that might apply to you.

___ I would carefully read the information provided about safety features in the plane and make sure I knew were the emergency exits were.

___ I would make small talk with the passenger beside me.

___ I would watch the end of the movie, even if I had seen it before.

___ I would call for the stewardess and ask her exactly what the problem was.

___ I would order a drink or tranquilizer from the stewardess.

___ I would listen carefully to the engines for unusual noises and would watch the crew to see if their behavior was out of the ordinary.

___ I would talk to the passenger beside me about what might be wrong.

___ I would settle down and read a book or magazine or write a letter.

Below you will find a series of statements. Please read each statement carefully and respond to it by expressing the extent to which you believe the statement applies to you. For all items a response from 1 to 7 is required. Use the number that best reflects your belief when the scale is defined as follows.

1. The statement doesn't apply to me at all.
2. The statement usually doesn't apply to me.
3. Most often the statement does not apply.
4. I am unsure about whether or not the statement applies to me, or it applies to me about half the time.
5. The statement applies more often than not.
6. The statement usually applies to me.
7. The statement always applies to me.

It is important that you respond to all items.

1. I prefer a job where I have a lot of control over what I do and when I do it.

   1 2 3 4 5 6 7

2. I enjoy political participation because I want to have as much of a say in running government as possible.

   1 2 3 4 5 6 7

3. I try to avoid situations where someone else tells me what to do.

   1 2 3 4 5 6 7

4. I would prefer to be a leader rather than a follower.

   1 2 3 4 5 6 7

5. I enjoy being able to influence the actions of others.

   1 2 3 4 5 6 7

6. I am careful to check everything on an automobile before I leave for a long trip.

   1 2 3 4 5 6 7

7. Others usually know what is best for me.

   1 2 3 4 5 6 7

8 I enjoy making my own decisions.

   1 2 3 4 5 6 7

9. I enjoy having control over my own destiny.

   1 2 3 4 5 6 7

10. I would rather someone else took over the leadership role when I'm involved in a group project.

1 2 3 4 5 6 7

11. I consider myself to be generally more capable of handling situations than others are.

1 2 3 4 5 6 7

12. I'd rather run my own business and make my own mistakes than listen to someone else's orders.

1 2 3 4 5 6 7

13. I like to get a good idea of what a job is all about before I begin.

1 2 3 4 5 6 7

14. When I see a problem I prefer to do something about it rather than sit by and let it continue.

1 2 3 4 5 6 7

15. When it comes to orders, I would rather give them than receive them.

1 2 3 4 5 6 7

16. I wish I could push many of life's daily decisions off on someone else.

1 2 3 4 5 6 7

17. When driving, I try to avoid putting myself in a situation where I could be hurt by someone else's mistake.

1 2 3 4 5 6 7

18. I prefer to avoid situations where someone else has to tell me what it is I should be doing.

1 2 3 4 5 6 7

19. There are many situations in which I would prefer only one choice rather than having to make a decision.

1 2 3 4 5 6 7

20. I like to wait and see if someone else is going to solve a problem so that I don't have to be bothered by it.

1 2 3 4 5 6 7

21. When I go out with other people I usually make most of the arrangements.

1 2 3 4 5 6 7

22. I am comfortable lending my possessions (e.g., books and records) to my friends.

1 2 3 4 5 6 7

23. If I am going to an event (a lecture or movie) which I expect will be crowded, I try to arrive early.

1 2 3 4 5 6 7

24. I almost never get things done until the last minute.

1 2 3 4 5 6 7

25. I like to gamble and play games of chance.

1 2 3 4 5 6 7

26. I would rather play an individual sport such as tennis than a team sport such as basketball.

1 2 3 4 5 6 7

27. I would prefer to get on a subway or bus early and have a longer ride but a choice of where to sit than to have a shorter ride and less choice.

1 2 3 4 5 6 7

28. I don't mind other people scheduling my time.

1 2 3 4 5 6 7

29. I really get a kick out of driving a very responsive car.

1 2 3 4 5 6 7

30. I think it would be fun to be hypnotized.

1 2 3 4 5 6 7

31. I like to get high on alcohol or drugs.

1 2 3 4 5 6 7

32. I usually push an elevator button even if it is lighted indicating that someone has already pushed it.

1 2 3 4 5 6 7

PROOFREADING TASK

Your task will be to proöfread a passage and to circle any mistakes that you find. Below you will find examples of some common types of errors.

	Mistake	Correct
Misspellings	decreace	decrease
Typographical errors	ata	at a
Punctuation errors	Moreover; it is	Moreover, it is
Capitalization errors	eugene, oregon	Eugene, Oregon
Incorrect word	the dear ran	the deer ran
Verb error	the students takes	the students take

Your task will be to find the errors and circle them. Read the passage from left to right and do not skip any lines.

* *Here is an example of what your task is like:

When sufficient people begin to stay in a slum by choice, several other importantthings also begin to happens.

Please do not begin work until the experimenter gives you the signal.

THE CURSE OF BORDER VACUUMS

Massive single uses in cities have a quality in common with each other. They form borders, and borders in cities usually make destructive neighbors.

A border-the perameter of a single massive or stretched-out use of territory-forms the edge of an area of "ordinary city. Often borders are thought of as passive objects, or matter-of-factly just as edges. However, a border exerts an active influence.

Railroad tracks are teh classic examples of borders, so much so that they came to stand, long ago, for social borders too- "the other side of the tracks" - a connotation, incidentally, associated with small towns rather than with big cities. Here we shall be concerned not with the socail connotations of areas demarcated by borders, but rather with the physical adn functional effects of borders on their immediate city surroundings.

In the case of a railroad trak, the district lying to one side may do better or worse than the district lying to the other side. But the places that do worst of all, physicallly, are typically the zones directly beside the track, on both sides. Whatever lively and diverse growth occurs to either side, whatever replacement of the old or worn-out occurs, is likely to happen beyond these zones, inward, away from the tracks. The zones of low value and decay which we are

apt to find beside the tracks in our cities appear to afflict everything within the zones except the buildings that make direct, practical use of the track itself or it's sidings. This is curious, because we can often see, looking at the ingredients in the decline and de cay, that at one time some people did see fit to put new buildings, even ambitious buildings, in this zone of decline.)

The blight-proneness of zones along the tracks has usually been explained as a result of the noise, the soot of steam locomotive days, and the general undesirability of railroad tracks as an environment. However, I think thees disadvantages are only part of the cause, and perhaps a minorpart. Why did they not discourage development there in the first place?

Furthermore, we can see thatt the same sort of blight typically occurs along city waterfronts. Usually it is worse and there is more of it along the waterfronts than along the tracks. Yet waterfronts are not inherently noisy, dirty or disagreeable environments.

Itis curious, too, how frequently the immediate neighborhoods surrounding big-city university campuses, City Beautiful civic centers, large hospital grounds, and even large parks, are extraordinarily blight-prone, and how frequently: even when they are not smitten by physical decay, they are apt to be stagnant-a condition that procedes decay,

Yet if conventional Planning and land-use theory were true, and if quiet and cleanliness had as much positive effect as they are supposed to, exactly these disappointing zones should be outstandingly sucesful economically, and vital socially.

Different as railroad tracks, waterfronts campuses, expressways, large parking areas and large parks are from each other in most ways. they also have much in common with each other-so far as their tendency to exist amid moribund or declining surroundings is concerned. And if we look at the parts of cities most litterally attractive-i,e., those that literally attract people, in the flesh- we find that these fortunate localities are seldom in the zones immediately adjoining massive single uses.

The root trouble with borders, as city neighbors, is that they are apt to form dead ends for most users of city streets. They represent, for most people, most of the time, "barriers."

Consequently, the street that adjoins a boarder is a terminus of generalized use. If this street, which is the end of the line for people in the area of "ordinary" city, also get's little or no use from people inside the single-use border-forming territory, it is bound to be a deadened place, with scant users. This deadness can have farther repercussions. Because few people use the immediate border street, the side streets (and in some cases the paralell street) adjoining it are also less used as a reSult. They fail ot get a by-the-way circulations of people going beyond them in the direction of the border because few are going to that Beyond. If those adjoining streets, therefore, become too empty and therefore in turn are shunned, their adjoining streets may also be less used." And so it goes, until the forces of heavy use from an area of strong attraction come into counterplay

Borders can thus tend to form vacuums of use ajoining them.

Or to put it another way, by oversimplifying the use of the city at one place, on a large scale; they tend to simplify the use which people give to the adjoining territory too, and this simplification of use-meaning fewer users, with fewer different purposes and destinations at hand-feeds upon itself. The more unfertile the simplified territory becomes for economic enterprises, thestill fewer the users, and the still more infertile the territory. A kind of unbuilding, or running-down process is set in motion.)

This is serious, because literal and continuous mingling of people, present because of different pruposes, is the only device that keeps streets safe. It is the only device that cultivates secondary diver sity. It is the only device that encourages districts ot form in place of fragmented, self-isolated neighborhoods or backwaters.

Abstract or more indirect support among differing City uses (helpful though this may be at another plane) does not serve such purposes.

Sometimes visible evidence of the running-down process is almost as graphic asa diagram. This is the case in some parts of the Lower east Side of New York; it is especially striking at night. At the borders of the dark and empty grounds of the massive, low-income housing projects, the streets are dark and empty of people too. Stores, except for a few sustained by the project dwellers themselves, have gone out of business, and many quarter stand unused and empty. Street by street, as you move away from the project borders, a little more life is to be found, progressively a little more brightness, but it takes many streets before the gradual increase of economic activity and movement of people

become strong. And each year the vaccuum seems to eat a little farther in. Neighborhoods or streets caught between two such borders close together can be utterly deadened, border to border.

Sometimes a a newspaper account describes some vivid incident of the running-down process-for example, this account of an event in February 960 from the New York Post:

The slaying in Cohen's butcher shop at 164 E. 174th St. Monday Night was no isolated incident, but the culmination of a series of burglaries and holdups along the street...Ever since work started on the Cross-Bronx Expressway across the street some two years ago, a grocer said, trouble has plagued the area...Stores which once stayed open to 9 or 10 o'clock are shutting down at 7 P.M. Few shoppers dare venture out after dark, so storekeepers feel the little business they lose hardly justify the risk in remaining open late...The slaying had the greatest impact on the owner of a nearby drug store, which remains open to 10 P.M. "We're scared to death," he commented. We're the only store that stays open that late."

Sometimes we can infer the forma tion of such vacuums, as when a newspaper advertisement list's an amazing bargain-a tenroom brick house, recently rehabilitated, with new copper plumbing to be sold for $12,000-and the address pins down its location: between the borders of a huge project, and an expressway.

Sometimes the main effect is the gradual, progressive spread, from street-to-street, of simple sidewalk insecurity. Morningside Heights in New York contains a long, narrow strip of neighborhood

edged on one side by a campus and on the other side by a long waterfront park. This strip is further interrupted by the barriers of intervening institutions. Every place you go in this stripe brings you quickly to a border. The most shunned of these borders by evening, for decades, has been that of the park. But gradually and almost imperceptibly, the common consent that insecurity exists has affected more and more of the territory, until tuday there is only one side of one street that carries more than solitary footfalls at night. This one-sided street, a stretch of Broadway, is across from the deadened perimeter ofthe big campus; and even it dies off through much of the strip, where it becomes pre-empted by another border.

But in most cases, there is nothing dramatic in any way about a border vacuum. Rather, vitality just appears absent and the con dition is apt to be taken for granted. Here is a good characterization of a vacuum, in The Wapshot Chronicle, a novel by John Cheever: "North of the park you come into a neighborhood that seems blighted- not persecuted, but only un-popular, as if it suffered acne or bda breath, and it has a bad complexion-colorless and seamed and missing a feature here and there.

The exact reasons for scantness of use at a border vary.

Some borders damp down use by making travel across them a one-way affair. housing projects are examples of this. The project people cross back and forth across the border (usually, in any appreciable numbers, at only one side of the Project or at most two sides). The adjoining people, for the most part, stay strictly over on their side of the border and treat the line as a dead end of use.

Some borders halt cross-use from both sides. Open railroad tracks or expressways or water barriers are common exemples.

Some borders have cross use from both directions, but it is limited, in appreciable amounts, to daylight or it falls off drastisilly at certain times of year. Large parks are common examples.

Still other borders have scant use along them because the massive single elements that form them possess such a low intensity of land use, relative to the great perimeters they possess. Civic centers with large grounds are common examples.

Name _____

Date _____

THE HASSLES SCALE

Directions: Hassles are irritants that can range from minor annoyances to fairly major pressures, problems, or difficulties. They can occur few or many times.

Listed in the center of the following pages are a number of ways in which a person can feel hassled. First, circle the hassles that have happened to you in the past month. Then look at the numbers on the right of the items you circled. Indicate by circling a 1, 2, or 3 how SEVERE each of the circled hassles has been for you in the past month. If a hassle did not occur in the last month do NOT circle it.

HASSLES	SEVERITY 1. Somewhat severe 2. Moderately severe 3. Extremely severe		
(1) Misplacing or losing things	1	2	3
(2) Troublesome neighbors	1	2	3
(3) Social obligations	1	2	3
(4) Inconsiderate smokers	1	2	3
(5) Troubling thoughts about your future	1	2	3
(6) Thoughts about death	1	2	3
(7) Health of a family member	1	2	3
(8) Not enough money for clothing	1	2	3
(9) Not enough money for housing	1	2	3
(10) Concerns about owing money	1	2	3

HASSLES	SEVERITY 1. Somewhat severe 2. Moderately severe 3. Extremely severe		
(11) Concerns about getting credit	1	2	3
(12) Concerns about money for emergencies	1	2	3
(13) Someone owes you money	1	2	3
(14) Financial responsibility for someone who doesn't live with you	1	2	3
(15) Cutting down on electricity, water, etc.	1	2	3
(16) Smoking too much	1	2	3
(17) Use of alcohol	1	2	3
(18) Personal use of drugs	1	2	3
(19) Too many responsibilities	1	2	3
(20) Decisions about having children	1	2	3
(21) Non-family members living in your house	1	2	3
(22) Care for pet	1	2	3
(23) Planning meals	1	2	3
(24) Concerned about the meaning of life	1	2	3
(25) Trouble relaxing	1	2	3
(26) Trouble making decisions	1	2	3
(27) Problems getting along with fellow workers	1	2	3
(28) Customers or clients give you a hard time	1	2	3
(29) Home maintenance (inside)	1	2	3
(30) Concerns about job security	1	2	3
(31) Concerns about retirement	1	2	3
(32) Laid off or out of work	1	2	3

	HASSLES	SEVERITY 1. Somewhat severe	2. Moderately severe	3. Extremely severe
(33)	Don't like current work duties	1	2	3
(34)	Don't like fellow workers	1	2	3
(35)	Not enough money for basic necessities	1	2	3
(36)	Not enough money for food	1	2	3
(37)	Too many interruptions	1	2	3
(38)	Unexpected company	1	2	3
(39)	Too much time on hands	1	2	3
(40)	Having to wait	1	2	3
(41)	Concerns about accidents	1	2	3
(42)	Being lonely	1	2	3
(43)	Not enough money for health care	1	2	3
(44)	Fear of confrontation	1	2	3
(45)	Financial security	1	2	3
(46)	Silly practical mistakes	1	2	3
(47)	Inability to express yourself	1	2	3
(48)	Physical illness	1	2	3
(49)	Side effects of medication	1	2	3
(50)	Concerns about medical treatment	1	2	3
(51)	Physical appearance	1	2	3
(52)	Fear of rejection	1	2	3
(53)	Difficulties with getting pregnant	1	2	3
(54)	Sexual problems that result from physical problems	1	2	3

HASSLES	SEVERITY 1. Somewhat severe 2. Moderately severe 3. Extremely severe		
(55) Sexual problems other than those resulting from physical problems	1	2	3
(56) Concerns about health in general	1	2	3
(57) Not seeing enough people	1	2	3
(58) Friends or relatives too far away	1	2	3
(59) Preparing meals	1	2	3
(60) Wasting time	1	2	3
(61) Auto maintenance	1	2	3
(62) Filling out forms	1	2	3
(63) Neighborhood deterioration	1	2	3
(64) Financing children's education	1	2	3
(65) Problems with employees	1	2	3
(66) Problems on job due to being a woman or man	1	2	3
(67) Declining physical abilities	1	2	3
(68) Being exploited	1	2	3
(69) Concerns about bodily functions	1	2	3
(70) Rising prices of common goods	1	2	3
(71) Not getting enough rest	1	2	3
(72) Not getting enough sleep	1	2	3
(73) Problems with aging parents	1	2	3
(74) Problems with your children	1	2	3
(75) Problems with persons younger than yourself	1	2	3
(76) Problems with your lover	1	2	3

	HASSLES	SEVERITY 1. Somewhat severe 2. Moderately severe 3. Extremely severe		
(77)	Difficulties seeing or hearing	1	2	3
(78)	Overloaded with family responsibilities	1	2	3
(79)	Too many things to do	1	2	3
(80)	Unchallenging work	1	2	3
(81)	Concerns about meeting high standards	1	2	3
(82)	Financial dealings with friends or acquaintance.	1	2	3
(83)	Job dissatisfactions	1	2	3
(84)	Worries about decisions to change jobs	1	2	3
(85)	Trouble with reading, writing, or spelling abilities	1	2	3
(86)	Too many meetings	1	2	3
(87)	Problems with divorce or separation	1	2	3
(88)	Trouble with arithmetic skills	1	2	3
(89)	Gossip	1	2	3
(90)	Legal problems	1	2	3
(91)	Concerns about weight	1	2	3
(92)	Not enough time to do the things you need to do.	1	2	3
(93)	Television	1	2	3
(94)	Not enough personal energy	1	2	3
(95)	Concerns about inner conflicts	1	2	3
(96)	Feel conflicted over what to do	1	2	3
(97)	Regrets over past decisions	1	2	3
(98)	Menstrual (period) problems	1	2	3
(99)	The weather	1	2	3
(100)	Nightmares	1	2	3

	HASSLES	SEVERITY 1. Somewhat severe 2. Moderately severe 3. Extremely severe		
(101)	Concerns about getting ahead	1	2	3
(102)	Hassles from boss or supervisor	1	2	3
(103)	Difficulties with friends	1	2	3
(104)	Not enough time for family	1	2	3
(105)	Transportation problems	1	2	3
(106)	Not enough money for transportation	1	2	3
(107)	Not enough money for entertainment and recreation	1	2	3
(108)	Shopping	1	2	3
(109)	Prejudice and discrimination from others	1	2	3
(110)	Property, investments or taxes	1	2	3
(111)	Not enough time for entertainment and recreation	1	2	3
(112)	Yardwork or outside home maintenance	1	2	3
(113)	Concerns about news events	1	2	3
(114)	Noise	1	2	3
(115)	Crime	1	2	3
(116)	Traffic	1	2	3
(117)	Pollution	1	2	3
	HAVE WE MISSED ANY OF YOUR HASSLES? IF SO, WRITE THEM IN BELOW:			
(118)	_____	1	2	3

ONE MORE THING: HAS THERE BEEN A CHANGE IN YOUR LIFE THAT AFFECTED HOW YOU ANSWERED THIS SCALE? IF SO, TELL US WHAT IT WAS:

RECENT LIFE CHANGES QUESTIONNAIRE

I. Instructions for Marking Your Recent Life Changes

If the event in question has occurred to you within the past three months mark an "X" in the column to the right of the question. If the event has not occurred to you during the last three months, leave the column empty.

Now go through the questionnaire and mark your recent life changes. The column marked "Your Adjustment Score" will be explained at the end of the questionnaire.

A. HEALTH

within the time period listed, have you experienced:

	0-3 months ago	Your Adjustment Score
1. an illness or injury which:		
(a) kept you in bed a week or more, or took you to the hospital?	____	____
(b) was less serious than described above?	____	____
2. a major change in eating habits?	____	____
3. a major change in sleeping habits?	____	____
4. a change in your usual type and/or amount of recreation?	____	____
5. major dental work?	____	____

B. WORK

	0-3 months ago	Your Adjustment Score
6. changed to a new type of work?	____	____
7. changed your work hours or conditions?	____	____

B. WORK

within the time period listed, have you experienced:

	0-3 months ago	Your Adjustment Score
8. had a change in your responsibilities at work?	_____	_____
(a) more responsibilities?	_____	_____
(b) less responsibilities?	_____	_____
(c) promotion?	_____	_____
(d) demotion?	_____	_____
(e) transfer?	_____	_____
9. experienced troubles at work?	_____	_____
10. experienced a major business readjustment?	_____	_____
11. retired?	_____	_____
12. experienced being:		
(a) fired from work?	_____	_____
(b) laid off from work?	_____	_____
13. taken courses by mail or studied at home to help you in your work?	_____	_____

C. HOME AND FAMILY

within the time periods listed, have you experienced:

	0-3 months ago	Your Adjustment Score
14. a change in residence:		
(a) a move within the same town or city?	_____	_____
(b) a move to a different town, city, or state?	_____	_____
15. a change in family "get-togethers"?	_____	_____
16. a major change in the health or behavior of a family member (illnesses, accidents, drug or disciplinary problems, etc.)?	_____	_____

within the time periods listed, have you experienced:

	0-3 months ago	Your Adjustment Score
17. the death of a spouse?	____	____
18. the death of a:		
(a) child?	____	____
(b) brother or sister?	____	____
(c) parent?	____	____
(d) other close family member?	____	____
19. the death of a close friend?	____	____
20. a change in the marital status of your parents:		
(a) divorce?	____	____
(b) remarriage?	____	____

NOTE:
(Questions 21-32 concern marriage. For persons never married, go to item 34.)

within the time periods listed, have you experienced?

	0-3 months ago	Your Adjustment Score
21. marriage?	____	____
22. a change in arguments with your spouse?	____	____
23. in-law problems?	____	____
24. a separation from spouse:		
(a) due to work?	____	____
(b) due to marital problems?	____	____
25. a reconciliation with spouse?	____	____
26. a divorce?	____	____
27. a gain of a new family member:		
(a) birth of a child?	____	____
(b) adoption of a child?	____	____
(c) a relative moving in with you?	____	____
28. spouse beginning or ceasing work outside the home?	____	____

within the time periods listed, have you experienced:

	0-3 months ago	Your Adjustment Score
29. wife (or self) becoming pregnant?	____	____
30. a child leaving home:		
(a) due to marriage?	____	____
(b) to attend college?	____	____
(c) for other reasons?	____	____
31. wife or (self) having a miscarriage or an abortion?	____	____
32. birth of a grandchild?	____	____

D. PERSONAL AND SOCIAL

within the time periods listed, have you experienced:

33. a major personal achievement?	____	____
34. a change in your personal habits (your dress, friends life-style, etc.)?	____	____
35. sexual difficulties?	____	____
36. beginning or ceasing school or college?	____	____
37. a change of school or college?	____	____
38. a vacation?	____	____
39. a change in your religious beliefs?	____	____
40. a change in your social activities (clubs, movies, visiting)?	____	____
41. a minor violation of the law?	____	____
42. legal troubles resulting in your being held in jail?	____	____
43. a change in your political beliefs?	____	____
44. a new, close, personal relationship?	____	____
45. an engagement to marry?	____	____

within the time periods listed, have you experienced?

		0-3 months ago	Your Adjustment Score
46.	a "falling out" of a close personal relationship?	_____	_____
47.	girlfriend (or boyfriend) problems?	_____	_____
48.	a loss or damage of personal property?	_____	_____
49.	an accident?	_____	_____
50.	a major decision regarding your immediate future?	_____	_____

E. FINANCIAL

within the time periods listed, have you:

51.	taken on a moderate purchase, such as a T.V., car, freezer?	_____	_____
52.	taken on a major purchase or a mortgage loan, such as a home, business, property?	_____	_____
53.	experienced a foreclosure on a mortgage or loan?	_____	_____
54.	experienced a major change in finances:		
	(a) increased income?	_____	_____
	(b) decreased income?	_____	_____
	(c) credit rating difficulties?	_____	_____

INSTRUCTIONS FOR SCORING YOUR ADJUSTMENT TO
TO YOUR RECENT LIFE CHANGE

Persons adapt to their recent life changes in different ways. Some people find the adjustment to a residential move, for example, to be enormous, while others find very little life adjustment necessary. You are now requested to "score" each of the recent life changes that you marked with an "X" as to the amount of adjustment you needed to handle the event.

Your scores can range from 1 to 100 "points." If, for example, you experienced a recent residential move but felt it required very little life adjustment, you would choose a low number and place it in the blank to the right of the question's boxes. On the other hand, if you recently changed residence and felt it required a near maximal life adjustment, you would place a high number, toward 100, in the blank to the right of that question's boxes. For intermediate life adjustment scores you would choose intermediatge numbers between 1 and 100.

Please go back through your questionnaire and for each recent life change you indicated with an "X," choose your personal life change adjustment score (between 1 and 100) which reflects what you saw to be the amount of life adjustment necessary to cope with or handle the event. Use both your estimates of the intensity of the life change and its duration to arrive at your scores.

The following questions are about your menstrual cycle. Since the different phases of the menstrual cycle affect the physiological and hormonal measures we are taking please be as accurate as possible in answering these questions.

1. On the average, how long does your normal cycle last (specify the number of days from the first day of menstruation until the first day of your next menstruation)? _____

2. How regular is your cycle?

1	2	3	4	5	6	7
very regular					very irregular	

3. How many days does your normal menstrual period last?_____

4. When did your last menstrual period start (please give exact date)? _____/_____/_____

5. When did it end? _____/_____/_____

6. When do you expect your next period to start? _____/_____/_____

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Table 1: Methods Summary

	Instruction/ Preparation	Mental Arithmetic/ Distraction	Mental Arithmetic/ Rest	Stroop/ Rest	Rest/ Rest
Phase ONE	MA instruction	1 min MA	1 min MA	1 min Stroop	No stressor
Phase TWO (10 MIN)	MA preparation	MA distraction	nothing	nothing	nothing
Phase THREE	6 minutes MA	6 minutes MA	6 minutes MA	6 minutes MA	6 minutes MA
Phase FOUR RECOVERY	Proofreading Feather	Proofreading Feather	Proofreading Feather	Proofreading Feather	Proofreading Feather

GROUPS

Instruction/Preparation = Mental arithmetic Instructions/Perparation for task.

Mental Arithmetic/Distraction = Pre-exposure to mental arithmetic and distraction.

Mental Arithmetic/Rest = Pre-exposure to mental arithmetic and no intervention task.

Stroop/Rest = Pre-exposure to Stroop task and no intervention.

Rest/Rest = No pre-exposure to stressor and no intervention.

Questionnaires (see Appendix B)

Phase ONE: Background, math anxiety, Beck Depression Inventory, mood questionnaire.

After Task: Manipulation check, mood questionnaire.

Phase TWO: Manipulation check, mood questionnaire.

Phase THREE (after task): Manipulation check, mood questionnaire, preparation/ predictability/distraction/control.

Phase FOUR (after Proofreading and Feather): Desire for Control Scale, Miller Behavioral Style Questionnaire, Schedule of Recent Experiences, Daily Hassles.

Table 2 - Demogaphaphic and Background Data by Group

	Instruction/ Preparation (N = 15)	Mental Arithmetic/ Distraction (N = 15)	Mental Arithmetic/ Rest (N = 15)	Stroop/Rest (N = 15)	Rest/Rest (N = 15)	Average (range)
Age - yrs (SE)	30.1±1.9	31.5±1.9	29.7±1.5	31.7±2.1	32.3±1.8	31±0.8 (19-45)
Height - cm (SE)	175.1±2.8	173.7±1.9	170.7±2.8	171.5±2.5	171±2.1	172±1.1 (157-190)
Weight - Kg (SE)	75.1±4.9	68.9±2.3	75.7±4.3	82.7±5.0	69.1±2.6	74.5±1.8 (50-116)
Math Anx. (SE)	26.3±1.9	32.9±2.8	27.9±3.2	27.9±2.2	33.2±3.7	29.6±1.3 (12-59)
Beck (SE)	4.7±1.1	4.8±1.4	6.6±1.4	3.8±1.2	3.3±0.9	4.7±0.5 (0-16)
Daily Hass Number (SE)	38.1±8.6	29.4±4.8	33.7±7.3	24.7±5.9	23.4±3.8	29.9±2.8 (1-117)
Daily Hass Adjustment (SE)	57.3±14.1	44.1±8.5	54.0±10.9	39.9±11.2	40.5±9.6	47.2±9.6 (1-207)
RLE - Num (SE)	8.7±1.3	6.9±0.8	7.8±1.1	5.8±1.1	5.4±0.6	6.9±0.5 (1-20)
RLE - Adjustment (SE)	374.4±87.7	376.3±78.1	377.5±69.5	270.3±66.4	261.4±58.9	333.2±32.3 (20-1110)

(SE=Standard Error Term)

Table 3 - Baseline Cardiovascular Measures

	Baseline SBP mmHg (SE)	Baseline DBP mmHg (SE)	Baseline HR beats/min (SE)
Instruction/ Preparation	110.4±2.7	69.1±2.4	74.1±1.5
Mental Arithmetic/ Distraction	104.6±2.8	65.0±3.0	71.3±1.9
Mental Arithmetic/ Rest	102.1±3.9	62.2±2.8	71.4±2.5
Stroop/Rest	112.1±2.0	71.6±1.8	76.9±2.0
Rest/Rest	102.8±2.4	63.7±2.5	71.9±2.0
AVERAGE (range)	106.4±1.3 (66.7-130.7)	66.4±1.2 (46.3-88)	73.1±0.9 (52.0-91.3)

Table 4 - Performance on Mental Arithmetic

	Number of Errors (SE)	Number of Subtractions (SE)	Percentage Errors (SE)
Instruction/ Preparation	7.3±0.8	60.2±8.8	20.1±5.7
Mental Arithmetic/ Distraction	5.5±0.7	79.3±13.8	10.9±2.9
Mental Arithmetic/ Rest	8.3±0.9	67.1±7.3	15.4±2.5
Stroop/Rest	7.9±1.0	57.2±7.2	22.1±5.7
Rest/Rest	6.6±0.8	62.6±7.9	14.7±4.2
AVERAGE (range)	7.1±0.4 (1-15)	65.4±4.2 (9-240)	16.7±1.9 (1.2-80)

Table 5 - Manipulation Check Correlations - Two-tailed tests

	Tiredness	Boredom	Stress	Tension	Relaxation
Boredom	.32 p<.005	-----	-----	-----	-----
Stress	.21	.06	-----	-----	-----
Tension	.21	.05	.84 p<.00001	-----	-----
Relaxation	-.09	-0.3	-.54 p<.00001	-.48 p<.00001	-----

Table 6 - Mood Subscale Correlations - Two-tailed tests

	Energetic mood	Negative affect	Fearfulness	Nervousness
Negative affect	.29 p<.01	-----	-----	-----
Fearfulness	.31 p<.007	.38 p<.001	-----	-----
Nervousness	.34 p<.004	.60 p<.0001	.61 p<.00001	-----

Table 7 - Manipulation Check - 1 minute Task

	Distress (Stress, Tension, Relaxation)	Tiredness	Boredom
Instruction/ Preparation	2.6±0.3 b	1.8±0.3	2.6±0.5
Mental Arithmetic/ Distraction	5.8±0.3 a	2.6±0.4 a	1.8±0.4
Mental Arithmetic/ Rest	5.5±0.3 a	2.6±0.4 a	1.7±0.2
Stroop/Rest	3.5±0.3 b c	1.9±0.3	1.5±0.3
Rest/Rest	1.9±0.3 b d	1.1±0.1 b	1.6±0.2

a > b (p <.05), c > d (p <.05).

Table 8 - Changes from Baseline for Mood during 1 minute Task

	Negative Affect (SE)	Fearfulness (SE)	Nervousness (SE)	Energetic mood (SE)
Instruction/ Preparation	1.1±0.9 d	0.2±0.6 b	1.1±0.4 b	0.2±0.2
Mental Arithmetic/ Distraction	12.9±1.6 a c e	4.2±0.9 a	6.8±0.9 a c	-0.1±0.5
Mental Arithmetic/ Rest	10.2±1.0 a c	4.2±0.9 a	4.3±0.9 a	0.4±0.3
Stroop/Rest	6.0±1.5 a f	1.2±0.8	1.7±0.5 d	-0.5±0.3
Rest/Rest	-1.9±1.3 b	-0.13±0.2 b	0.1±0.2 b	-0.6±0.3

a > b (p <.05), c > d (p <.05), e > f (p <.05).

Table 9 - Changes from Baseline for Cardiovascular Measures During 1-Minute Task

	SBP - mmHg (SE)	DBP - mmHg (SE)	HR - beats/min (SE)
Instruction/ Preparation	2.1±2.1 b	6.4±1.7 b	-1.1±0.9 b d
Mental Arithmetic/ Distraction	23.4±3.4 a c	17.3±3.7 a e	16.7±3.0 a
Mental Arithmetic/ Rest	21.9±4.7 a c	16.6±2.6 a	16.6±3.0 a
Stroop/Rest	11.4±2.4 a d	7.3±1.8 c f	6.6±2.1 b c
Rest/Rest	-1.6±1.5 b	-2.3±1.6 b d	0.7±1.2 b

a > b (p <.05), c > d (p <.05), e > f (p <.05).

Table 10 - Correlations of the Manipulation Check for the Interventions - Two-tailed tests

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
Control	.46 p<.0001	.38 p<.001	-.25 p<.03	.23 p<.05	.20	.14	.0006	.10	.12
Preparation (A)	-----	.20	-.44 p<.0001	.40 p<.0001	.35 p<.002	-.02	-.07	.38 p<.001	.20
Ability to stop task (B)	-----	-----	-.23 p<.04	.13	.23 p<.05	-.10	-.03	.13	.07
Out of control (C)	-----	-----	———	-.20	-.24 p<.04	.007	.25 p<.03	-.08	-.03
Allowed to prepare (D)	-----	-----	-----	-----	.72 p<.0001	.30 p<.008	-.11	.42 p<.0001	.43 p<.0001
Intervention helpful (E)	-----	-----	-----	-----	-----	.43 p<.0001	-.10	.45 p<.0001	.43 p<.0001
Preparation helpful in future (F)	-----	-----	-----	-----	-----	-----	.19	.11	.14
Distraction (G)	-----	-----	-----	-----	-----	-----	-----	-.04	-.06
Predictability (H)	-----	-----	-----	-----	-----	-----	-----	-----	.39 p<.001
Attention (I)	-----	-----	-----	-----	-----	-----	-----	-----	-----

Table 11 - Manipulation Check for the Interventions

	Allowed to Prepare (SE)	Preparation Helpful (SE)	Distraction (SE)	Predictability (SE)	Concentration (SE)
Instruction/ Preparation	4.8±0.2 a	2.9±0.4 a	2.1±0.4 b	3.4±0.4 a	4.2±0.3 a c
Mental Arithmetic/ Distraction	2.5±0.3 b c	2.7±0.4 a	4.5±0.2 a	4.4±0.4 a	3.6±0.5 a
Mental Arithmetic/ Rest	2.7±0.3 b c	2.6±0.4 a	2.6±0.4 b c	4.0±0.4 a	2.6±0.3 d
Stroop/Rest	1.4±0.2 b d	1.8±0.3	1.7±0.2 b	1.2±0.1 b	2.1±0.4 b
Rest/Rest	1.1±0.1 b d	1.5±0.2 b	1.2±0.1 b d	1.5±0.3 b	1.7±0.4 b

a > b (p <.05), c > d (p <.05).

Table 12 - Energy Change from Baseline - Average of Groups

	Intervention (SE)	MA Task (SE)
Instruction/ Preparation	1.1±0.4	-0.4±0.6
Mental Arithmetic/ Distraction	0.5±0.3	0.3±0.6
Mental Arithmetic/ Rest	1.4±0.4	0.1±0.4
Stroop/Rest	0.3±0.4	-0.4±0.5
Rest/Rest	0.7±0.3	-1.3±0.5
AVERAGE	0.8±0.5	-0.2±0.5

Table 13 - Negative Affect Change from Baseline

	Intervention (SE)	MA Task (SE)
Instruction/ Preparation	0.5±1.2	7.4±1.2 b
Mental Arithmetic/ Distraction	1.2±1.3	10.9±2.0
Mental Arithmetic/ Rest	1.4±1.2	8.3±1.4 b
Stroop/Rest	0.9±1.0	11.1±1.3
Rest/Rest	-1.7±1.6	13.8±1.7 a
AVERAGE	0.5±1.5 d	10.4±1.8 c

a > b ($p < .05$), c > d ($p < .05$).

Figure 14 - Fearfulness Change from Baseline - Average of Groups

	Intervention (SE)	MA Task (SE)
Instruction/ Preparation	0.8±0.5	3.3±1.1
Mental Arithmetic/ Distraction	0.4±0.6	3.4±1.1
Mental Arithmetic/ Rest	1.1±0.4	2.4±0.9
Stroop/Rest	0.3±0.3	2.8±0.9
Rest/Rest	0.3±0.3	2.4±1.0
AVERAGE	0.6±0.4 b	2.8±1.1 a

a > b (p <.05).

Figure 15 - Nervousness Change from Baseline - Average of Groups

	Intervention (SE)	MA Task (SE)
Instruction/ Preparation	0.1±0.5	6.2±0.7
Mental Arithmetic/ Distraction	0.8±0.7	5.5±1.0
Mental Arithmetic/ Rest	0.6±0.4	4.0±1.2
Stroop/Rest	-0.6±0.4	5.7±1.1
Rest/Rest	-0.1±0.4	5.1±0.9
AVERAGE	0.2±0.4 b	5.2±1.0 a

a > b ($p < .05$).

Table 16 - Tiredness Levels - Average of Groups

	Intervention (SE)	MA Task (SE)
AVERAGE	2.62±0.2	2.56±0.2

Table 17 - Boredom Levels - Average of Groups

	Intervention (SE)	MA Task (SE)
AVERAGE	3.6±0.2 a	1.8±0.3 b

a > b ($p < .05$).

Table 18 - Relaxation Levels - Average of Groups

	Intervention (SE)	MA Task (SE)
AVERAGE	4.92±0.4 a	2.11±0.4 b

a > b (p <.05).

Table 19 - Tension Levels - Average of Groups

	Intervention (SE)	MA Task (SE)
AVERAGE	2.04±0.4 b	5.16±0.4 a

a > b (p <.05).

Table 20 - Stress Levels - Average of Groups

	Intervention (SE)	MA Task (SE)
AVERAGE	1.8±0.3 b	5.1±0.3

a > b (p <.05).

Table 21 - SBP Change from Baseline

	Intervention	Instructions	2 min	4 min	6 min	Recovery
Instruction/ Preparation	1.6±1.9	3.8±2.3 b	15.9±3.0	18.5±3.0	19.7±3.0	1.8±1.6
Mental Arithmetic/ Distraction	1.2±1.8	6.8±2.6	17.0±3.3	16.6±3.0	11.6±2.7	-2.3±1.1 b
Mental Arithmetic/ Rest	1.5±1.6	5.0±2.3	17.3±3.2	12.0±3.2 b	20.5±4.6	-1.8±1.8 b
Stroop/Rest	-1.2±1.5	11.8±2.4 a	19.3±3.4	20.9±3.1	18.4±2.6	6.4±1.7 a
Rest/Rest	-2.0±1.6	4.5±2.9	14.9±3.3	24.9±2.8 a	20.7±2.6	6.8±2.3 a

a > b (p <.05).

Table 22 - DBP Change from Baseline

	Intervention	Instruction	2 min	4 min	6 min	Recovery
Instruction/ Preparation	0.5±1.8	-0.7±1.1 b	13.4±1.9	16.3±2.2	17.1±2.1 a	-0.6±1.3
Mental Arithmetic/ Distraction	2.7±2.0	4.7±1.9 a	10.7±2.2	7.2±2.6 b	6.9±2.4 b	-2.9±1.4 b
Mental Arithmetic/ Rest	2.1±1.5	5.1±2.1 a	12.4±2.7	10.3±2.9	22.2±4.4 a	2.3±1.5 a
Stroop/Rest	-2.1±1.4	3.6±1.4	12.8±3.5	16.8±3.1 a	18.4±3.4 a	3.6±1.4 a
Rest/Rest	-1.1±1.3	4.5±2.0	15.1±2.3	15.6±3.2 a	15.1±2.3	1.8±1.6 a

a > b ($p < .05$).

Table 23 - HR Change from Baseline

	Intervention	Instruction	2 min	4 min	6 min	Recovery
Instruction/ Preparation	2.0±1.0	-1.7±1.2 b	12.6±3.2	7.0±1.8	8.4±1.8	-2.3±1.3 b
Mental Arithmetic/ Distraction	21.2±1.2	3.2±1.8	11.6±3.0	7.0±2.6	6.1±2.2 b	-4.0±1.1 b
Mental Arithmetic/ Rest	-1.7±0.7	6.2±2.0 a	16.4±1.8	9.6±1.3	9.6±1.6	2.0±0.9 a
Stroop/Rest	-0.1±0.8	2.8±1.9	11.2±2.0	10.2±2.0	8.1±2.1	2.4±1.1 a
Rest/Rest	-1.5±0.6	6.1±2.3 a	19.5±3.7	10.3±2.8	13.9±2.8 a	2.0±1.1 a

a > b ($p < .05$).

Table 24 - Proofreading

	Errors Found (SE)	Possible Number Errors (SE)	Percentage Errors Found (SE)
Instruction/ Preparation	7.1±0.7	9.0±0.8	79.4±4.2
Mental Arithmetic/ Distraction	7.6±1.1	9.9±1.4	75.6±3.6
Mental Arithmetic/ Rest	6.6±0.7	9.3±0.7	67.8±5.9
Stroop/Rest	7.6±0.7	9.9±1.0	78.1±6.0
Rest/Rest	9.3±0.9	13.9±2.6	76.8±4.8

Table 25 - Feather Task

	Number of Attempts Unsolvable (SE)	Number of Attempts Solvable (SE)
Instruction/ Preparation	2.0±0.3 b	1.3±0.2
Mental Arithmetic/ Distraction	8.5±2.5 a	2.2±0.5
Mental Arithmetic/ Rest	4.8±1.3	1.4±0.4
Stroop/Rest	7.6±2.4	1.8±0.3
Rest/Rest	3.3±0.8	1.3±0.2

a > b ($p < .05$)

Figure Captions

Figure 1: Energetic mood change from baseline for each group during the intervention and task exposure. Duncan post-hoc analyses indicated no group differences and no changes over time.

Figure 2: Negative affect change from baseline for each group during the intervention and task exposure. Duncan post-hoc analyses indicated no differences between groups during the intervention period. During task exposure the Instruction/Preparation and Mental Arithmetic/Rest groups had less of an increase from baseline in Negative affect than the Rest/Rest group. All groups exhibited an increased change from baseline in Negative affect from the intervention to the task.

Figure 3: Fearfulness change from baseline for each group during the intervention and task exposure. Duncan post-hoc analyses revealed no group differences. All groups exhibited an increased change from baseline in Fearfulness from the intervention to the task.

Figure 4: Nervousness change from baseline for each group during the intervention and task exposure. Duncan post-hoc analyses revealed no group differences. All groups

exhibited an increased change from baseline in Nervousness from the intervention to the task.

Figure 5: Tiredness levels averaged across groups during the intervention and task exposure. Analyses indicated no changes in Tiredness.

Figure 6: Boredom levels averaged across groups during the intervention and task exposure. Analyses indicated a decrease in Boredom over time.

Figure 7: Relaxation levels averaged across groups during the intervention and task exposure. Analyses indicated a decrease in Relaxation over time.

Figure 8: Tension levels averaged across groups during the intervention and task exposure. Analyses indicated an increase in Tension over time.

Figure 9: Stress levels averaged across groups during the intervention and task exposure. Analyses indicated an increase in Stress over time.

Figure 10: Change from baseline for systolic blood pressure levels during the intervention period, task instructions, 2,

4, and 6 minutes into the task, and during recovery. Scores were calculated by subtracting raw score from the average of the last three baseline measures recorded before the start of task pre-exposure. Duncan post-hoc analyses indicated that there were no group differences during the intervention period. During task instructions the Instruction/Preparation group had less of an increase than the Stroop/Rest group. During the first 2 minutes of the task there were no group differences. Four minutes into the task the Mental Arithmetic/Rest group had less of an increase than the Rest/Rest group. Six minutes into the task there were no differences between groups. During recovery both the Mental Arithmetic/Distraction and Mental Arithmetic/Rest groups had less of an increase than the Stroop/Rest and Rest/Rest groups.

Figure 11: Change from baseline for diastolic blood pressure level during the intervention period, task instructions, 2, 4, and 6 minutes into the task, and during recovery. Scores were calculated by subtracting raw score from the average of the last three baseline measures recorded before the start of task pre-exposure. Duncan post-hoc analyses indicated that there were no group differences during the intervention period. During task instructions the Instruction/Preparation group had less of an increase than

the Mental Arithmetic/Distraction and Mental Arithmetic/Rest groups. During the first 2 minutes of the task there were no group differences. Four minutes into the task the Mental Arithmetic/Distraction group had less of an increase than the Stroop/Rest and Rest/Rest groups. Six minutes into the task the Mental Arithmetic/Distraction group had less of an increase compared to the Instruction/Preparation, Mental Arithmetic/Rest, and Stroop/Rest groups. During recovery the Mental Arithmetic/Distraction group had less of an increase than the Mental Arithmetic/Rest, Stroop/Rest, and Rest/Rest groups.

Figure 12: Change from baseline for heart rate levels during the intervention period, task instructions, 2, 4, and 6 minutes into the task, and during recovery. Scores were calculated by subtracting raw score from the average of the last three baseline measures recorded before the start of task pre-exposure. Duncan post-hoc analyses indicated that there were no group differences during the intervention period. During task instructions the Instruction/Preparation group had less of an increase than the Mental Arithmetic/Rest and Rest/Rest groups. During the first 2 and 4 minutes of the task there were no group differences. Six minutes into the task the Mental Arithmetic/Distraction group had less of an increase compared to the Rest/Rest group. During recovery the Mental

Arithmetic/Distraction and Instruction/Preparation groups had less of an increase than the Mental Arithmetic/Rest, Stroop/Rest, and Rest/Rest groups.

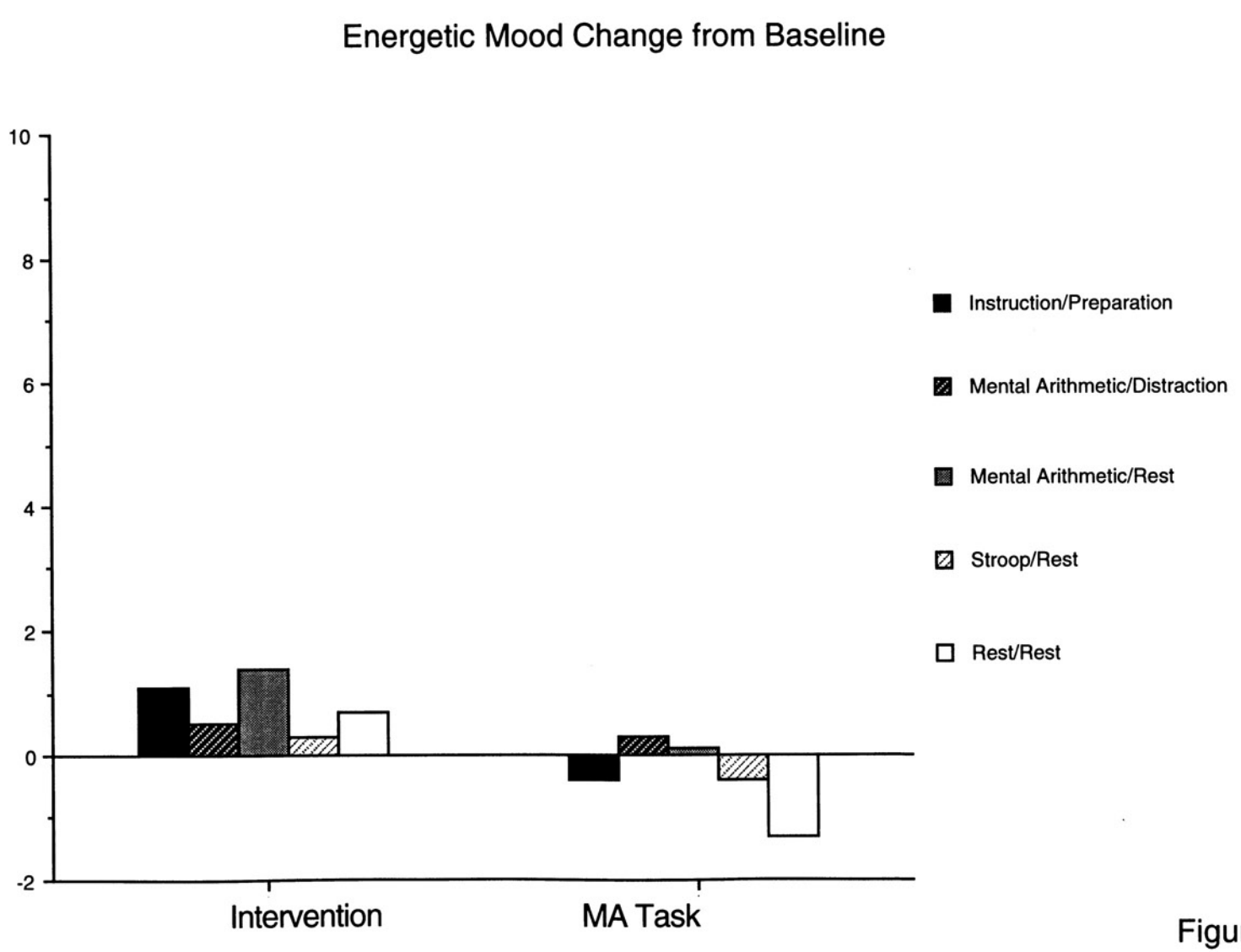
Energetic Mood Change from Baseline
10
8
6
4
2
0
-2
Intervention
MA Task
Instruction/Preparation
Mental Arithmetic/Distraction
Mental Arithmetic/Rest
Stroop/Rest
Rest/Rest

Figure 1

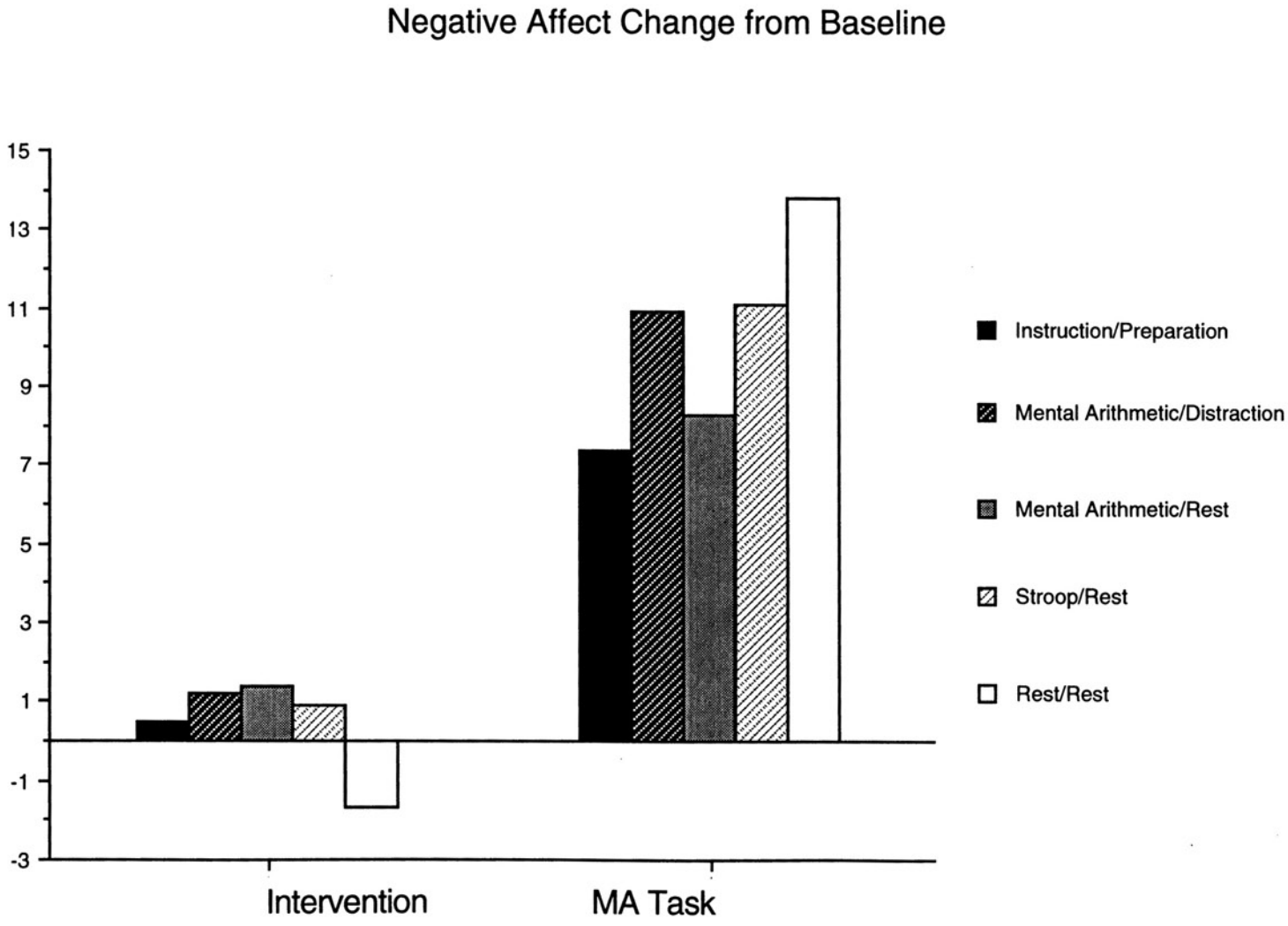
Negative Affect Change from Baseline
15
13
11
9
7
5
3
1
-1
-3
Intervention
MA Task
Instruction/Preparation
Mental Arithmetic/Distraction
Mental Arithmetic/Rest
Stroop/Rest
Rest/Rest

Figure 2

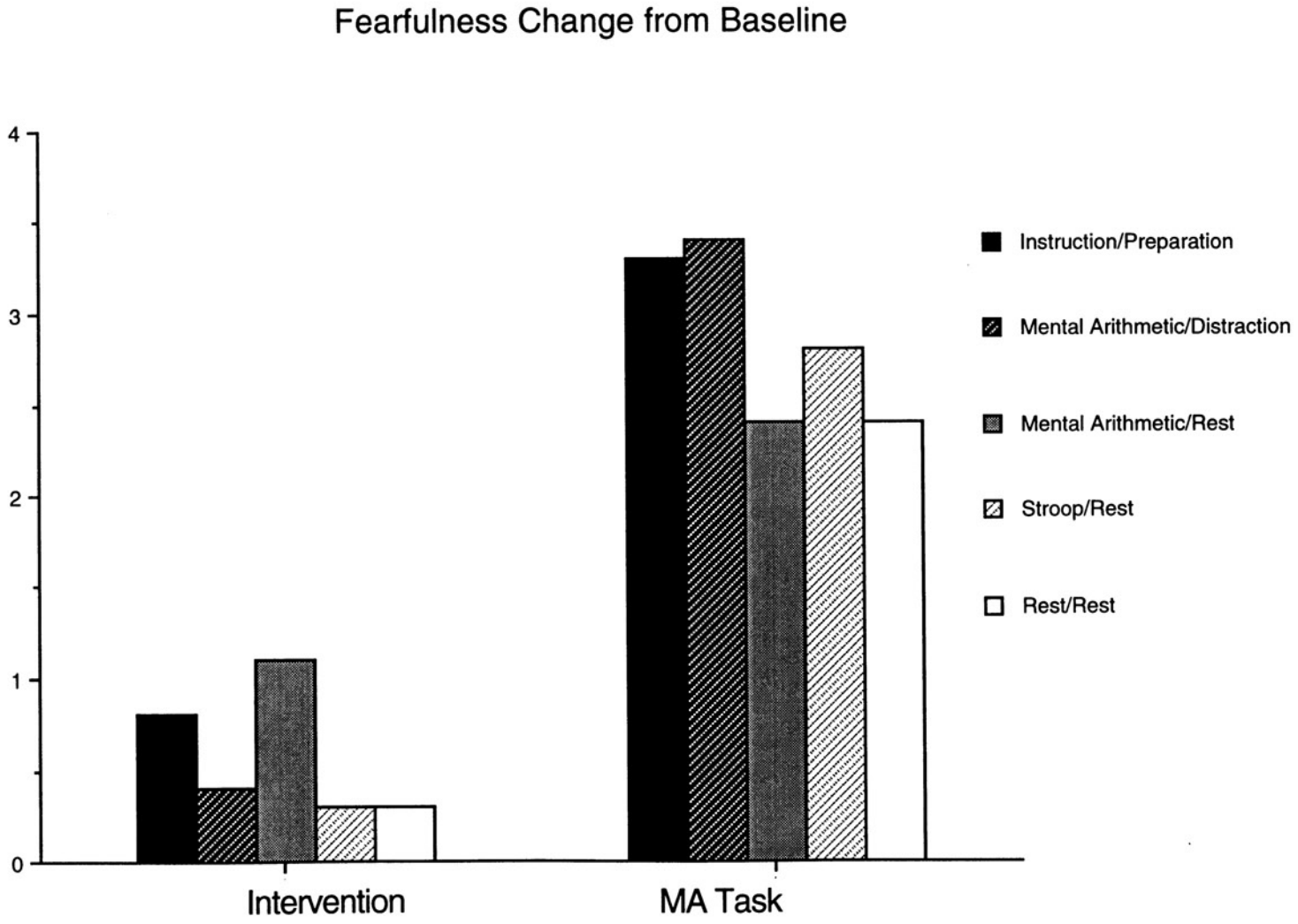
Fearfulness Change from Baseline
4
3
2
1
0
Intervention
MA Task
Instruction/Preparation
Mental Arithmetic/Distraction
Mental Arithmetic/Rest
Stroop/Rest
Rest/Rest

Figure 3

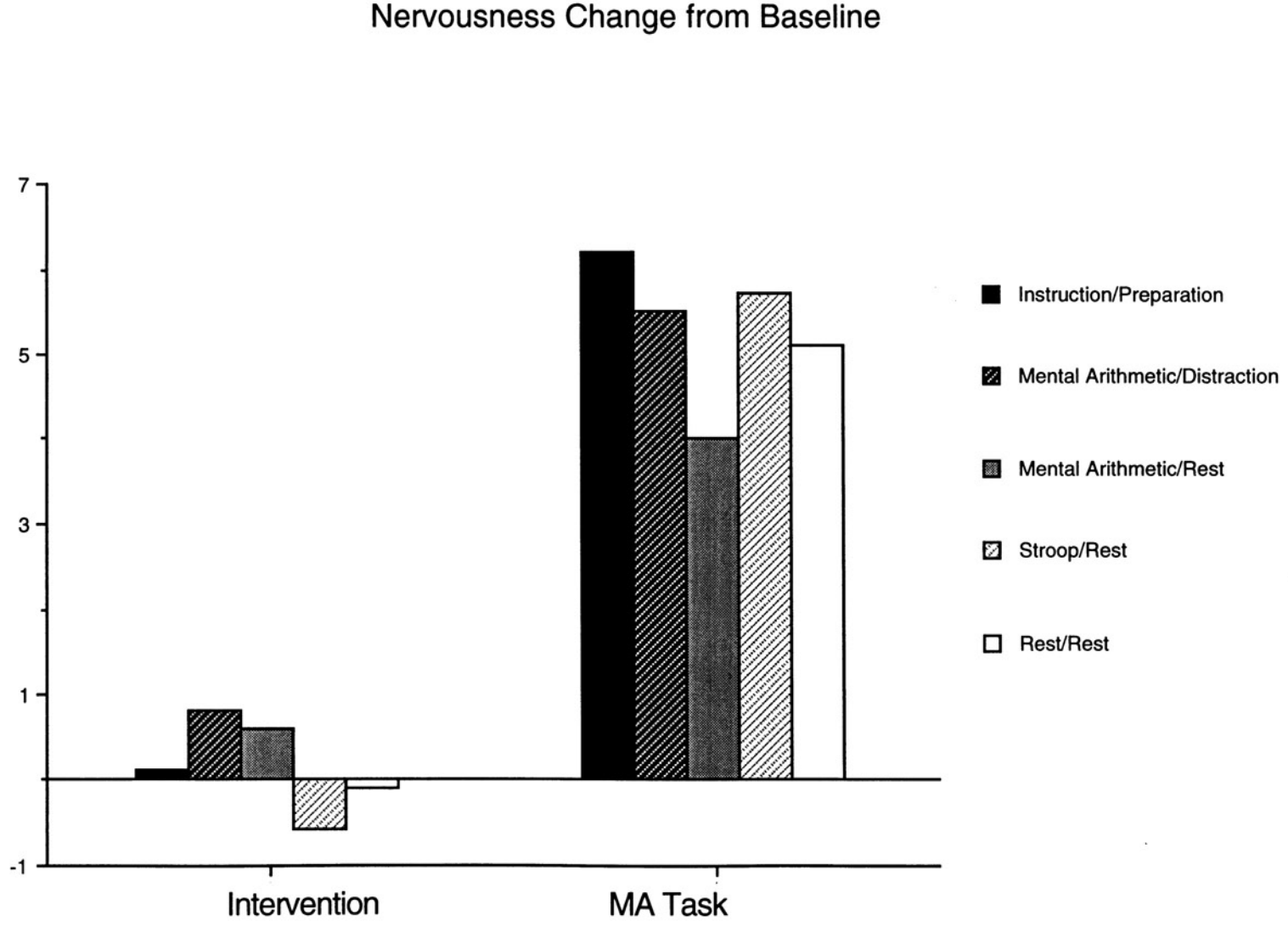
Nervousness Change from Baseline
7
5
3
1
-1
Intervention
MA Task
Instruction/Preparation
Mental Arithmetic/Distraction
Mental Arithmetic/Rest
Stroop/Rest
Rest/Rest

Figure 4

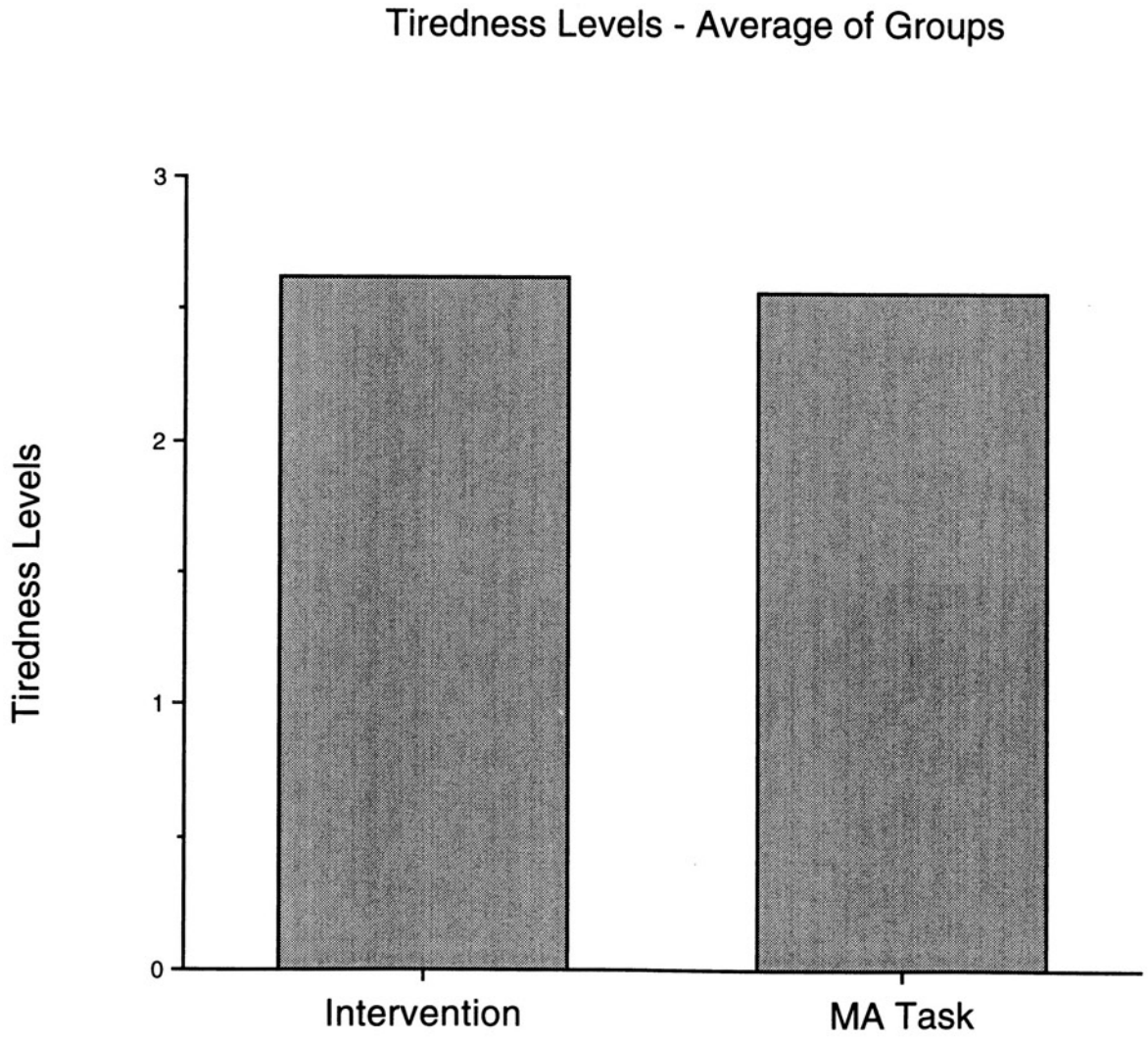
Tiredness Levels - Average of Groups
Tiredness Levels
3
2
1
0
Intervention
MA Task

Figure 5

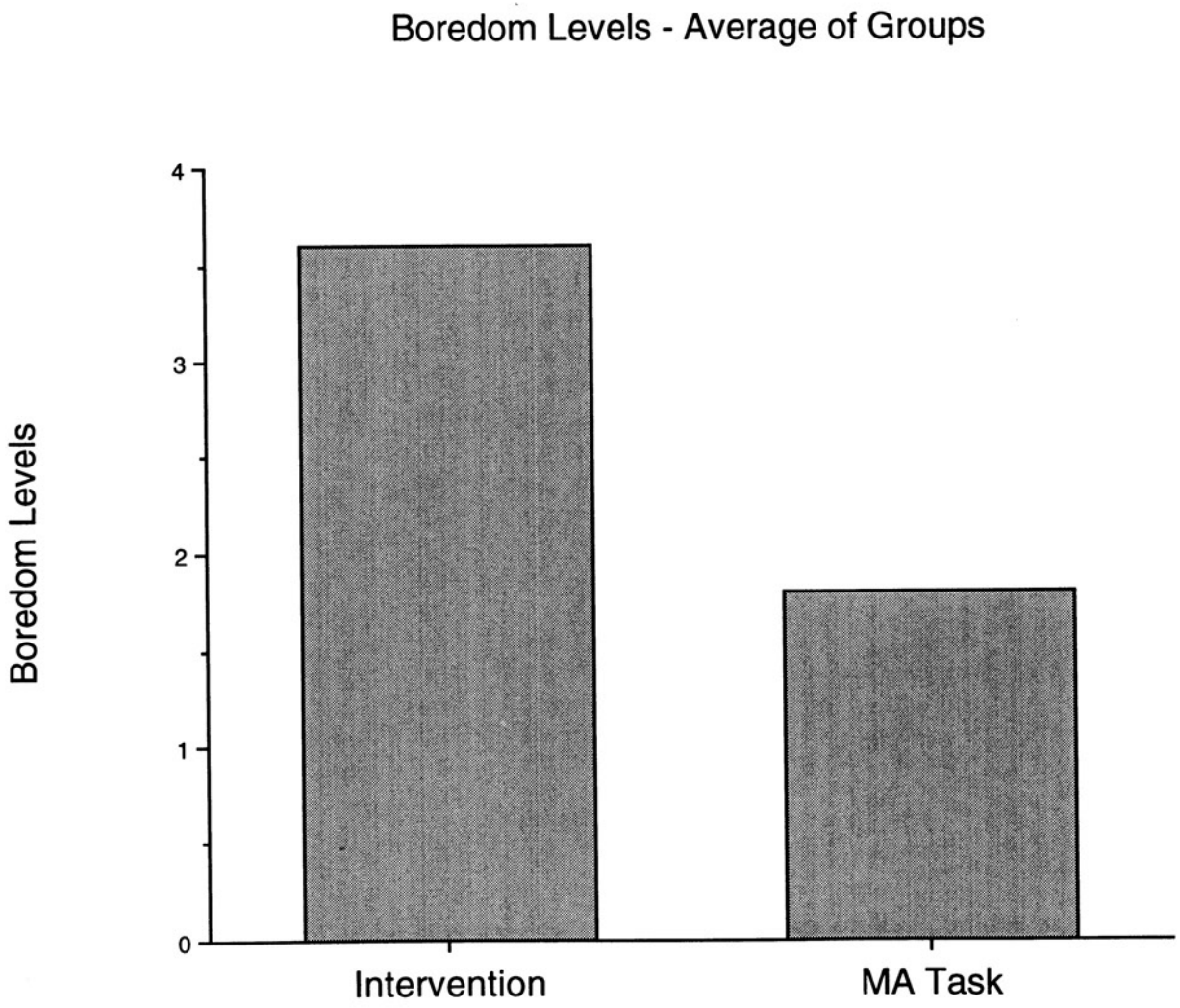
Boredom Levels - Average of Groups
Boredom Levels
4
3
2
1
0
Intervention
MA Task

Figure 6

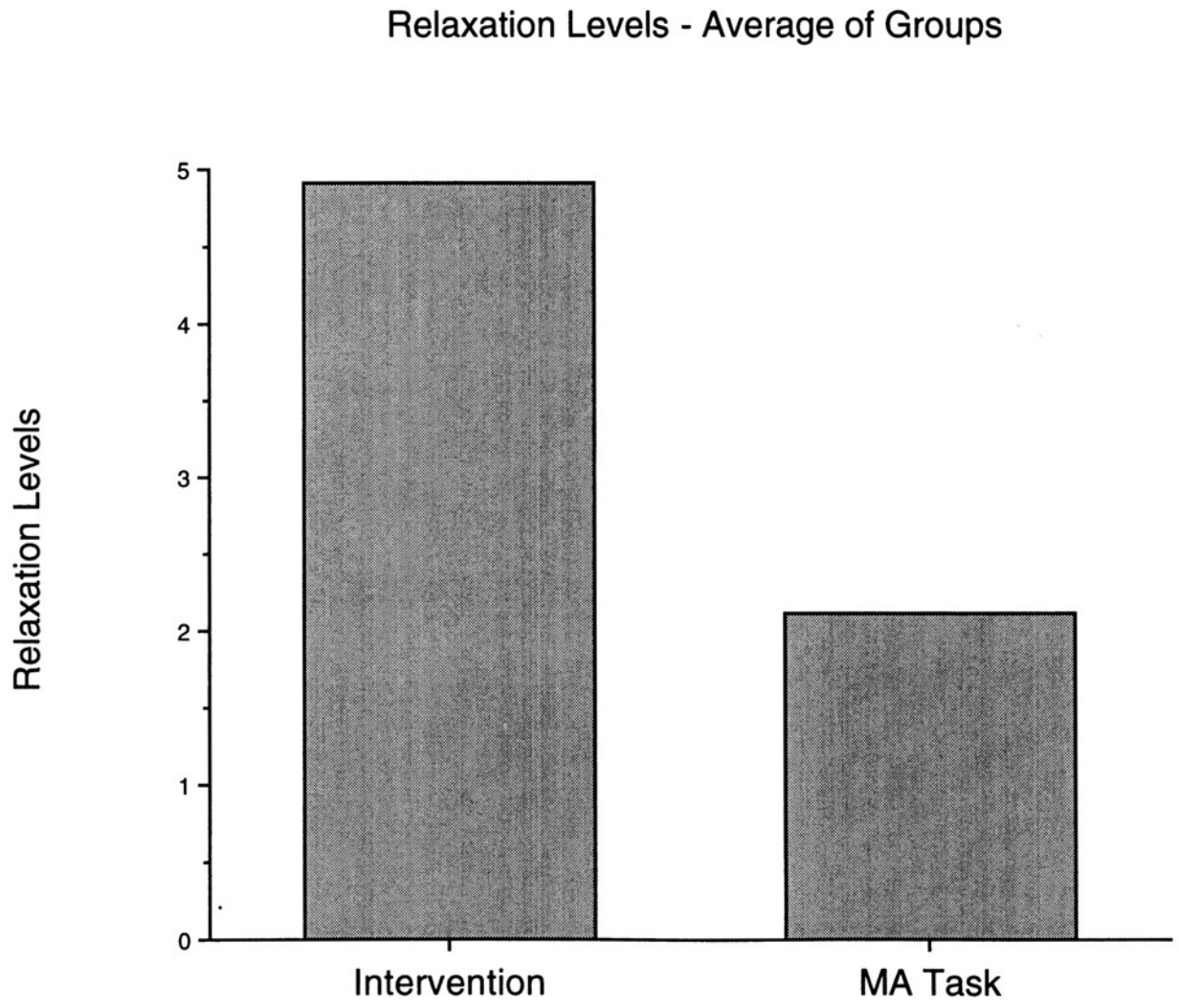
Relaxation Levels - Average of Groups
Relaxation Levels
5
4
3
2
1
0
Intervention
MA Task

Figure 7

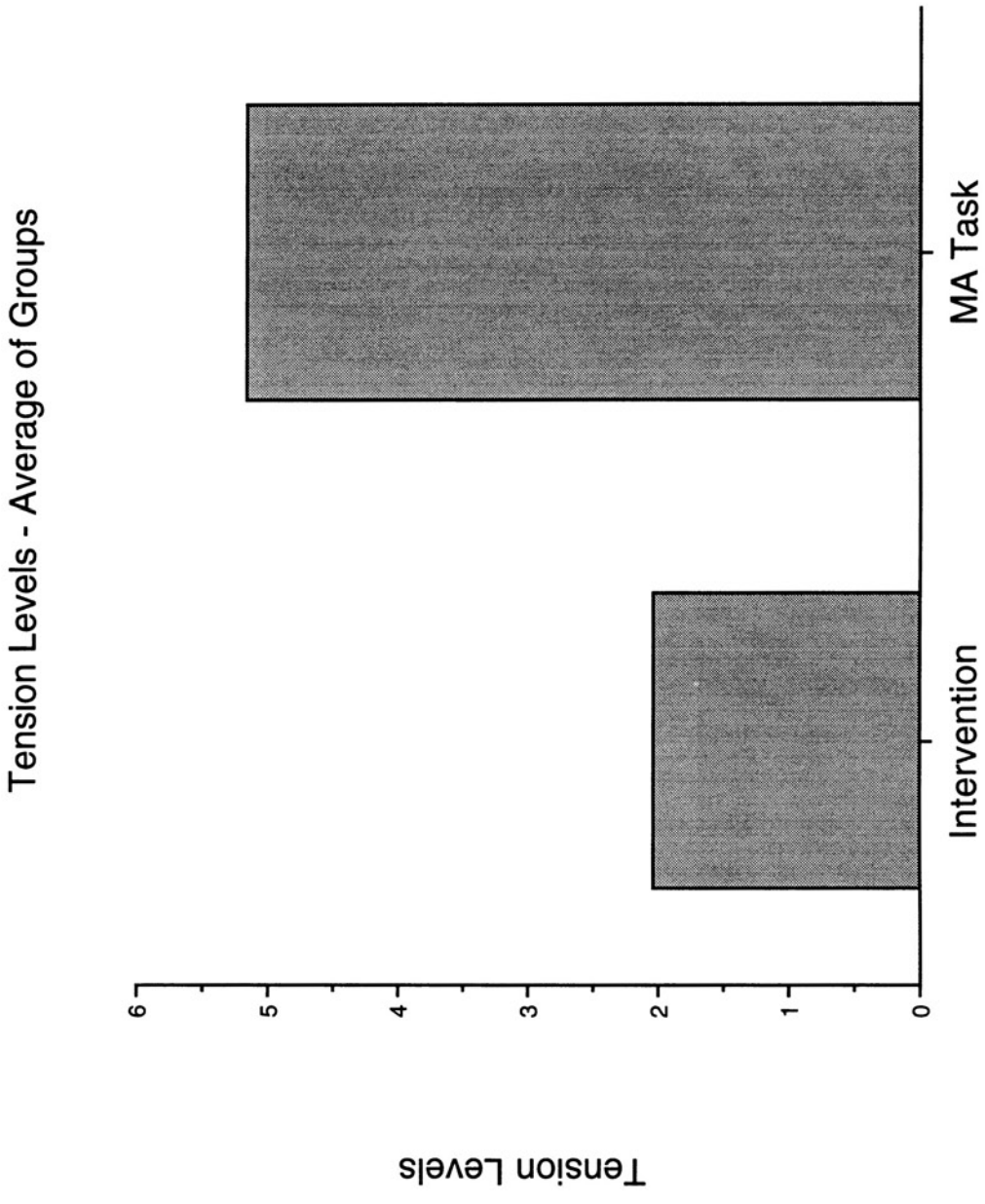
Tension Levels - Average of Groups
Tension Levels
0
1
2
3
4
5
6
Intervention
MA Task

Figure 8

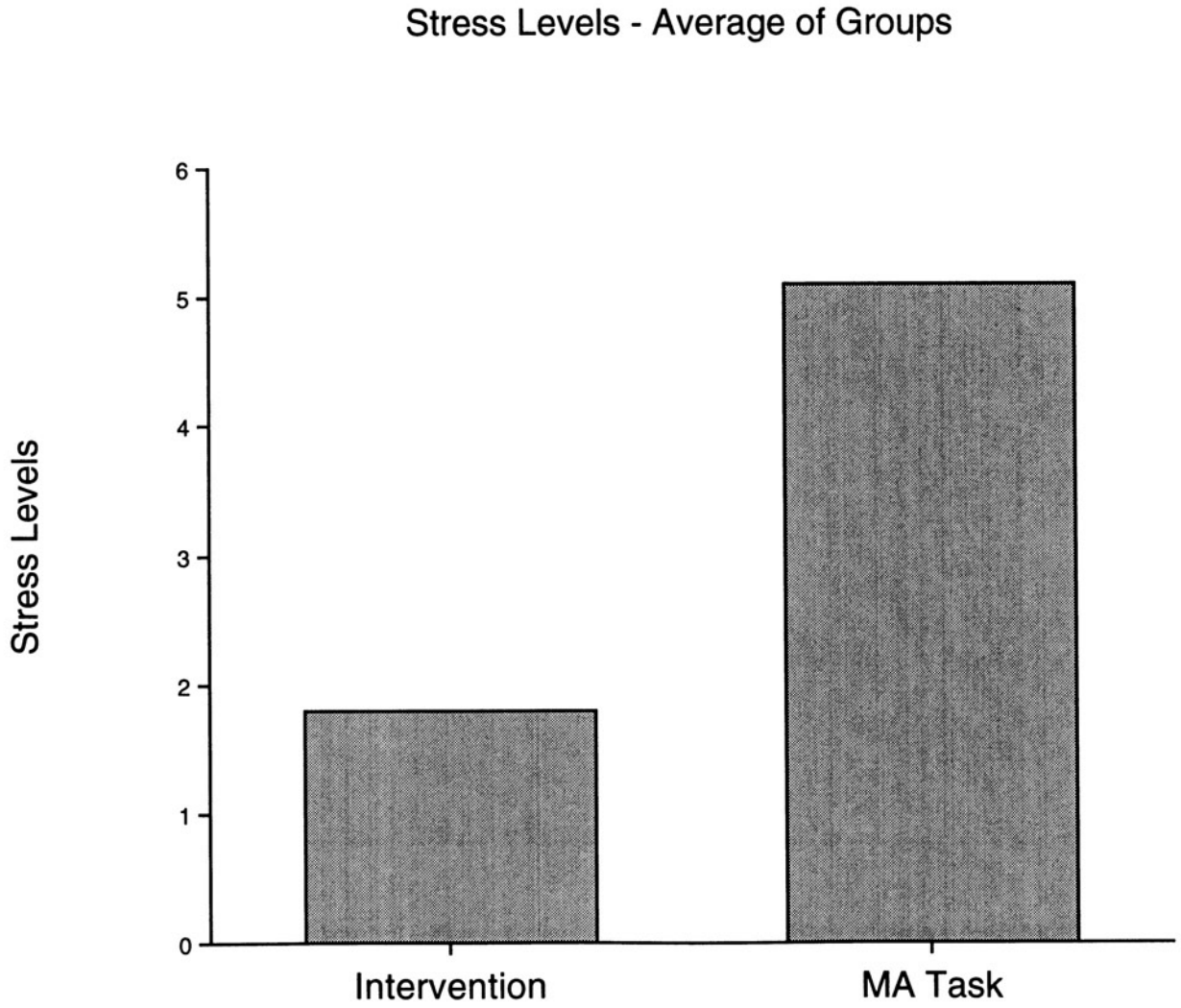
Stress Levels - Average of Groups
Stress Levels
6
5
4
3
2
1
0
Intervention
MA Task

Figure 9

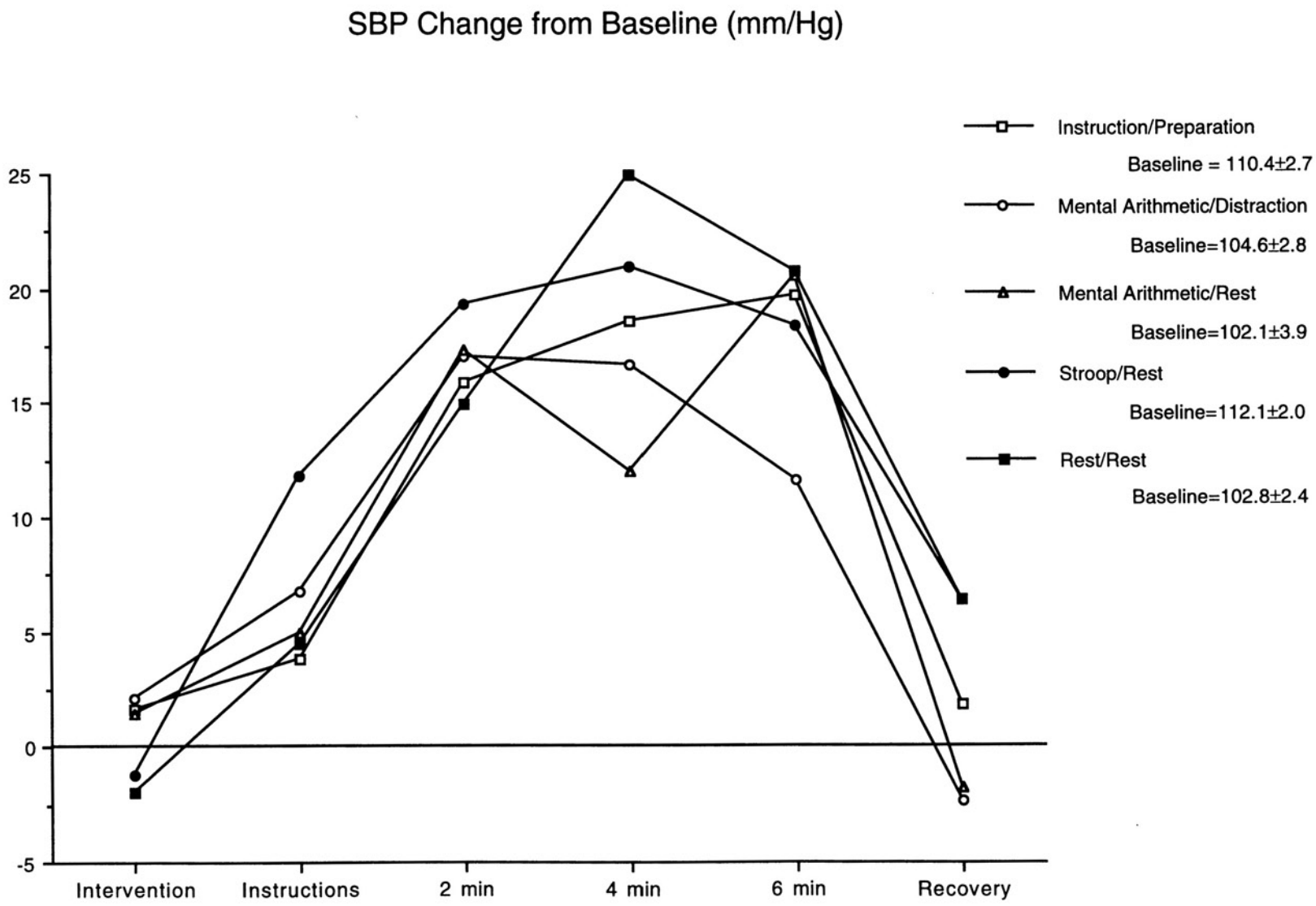
SBP Change from Baseline (mm/Hg)
25
20
15
10
5
0
-5
Intervention
Instructions
2 min
4 min
6 min
Recovery
Instruction/Preparation
Baseline = 110.4±2.7
Mental Arithmetic/Distraction
Baseline=104.6±2.8
Mental Arithmetic/Rest
Baseline=102.1±3.9
Stroop/Rest
Baseline=112.1±2.0
Rest/Rest
Baseline=102.8±2.4

Figure 10

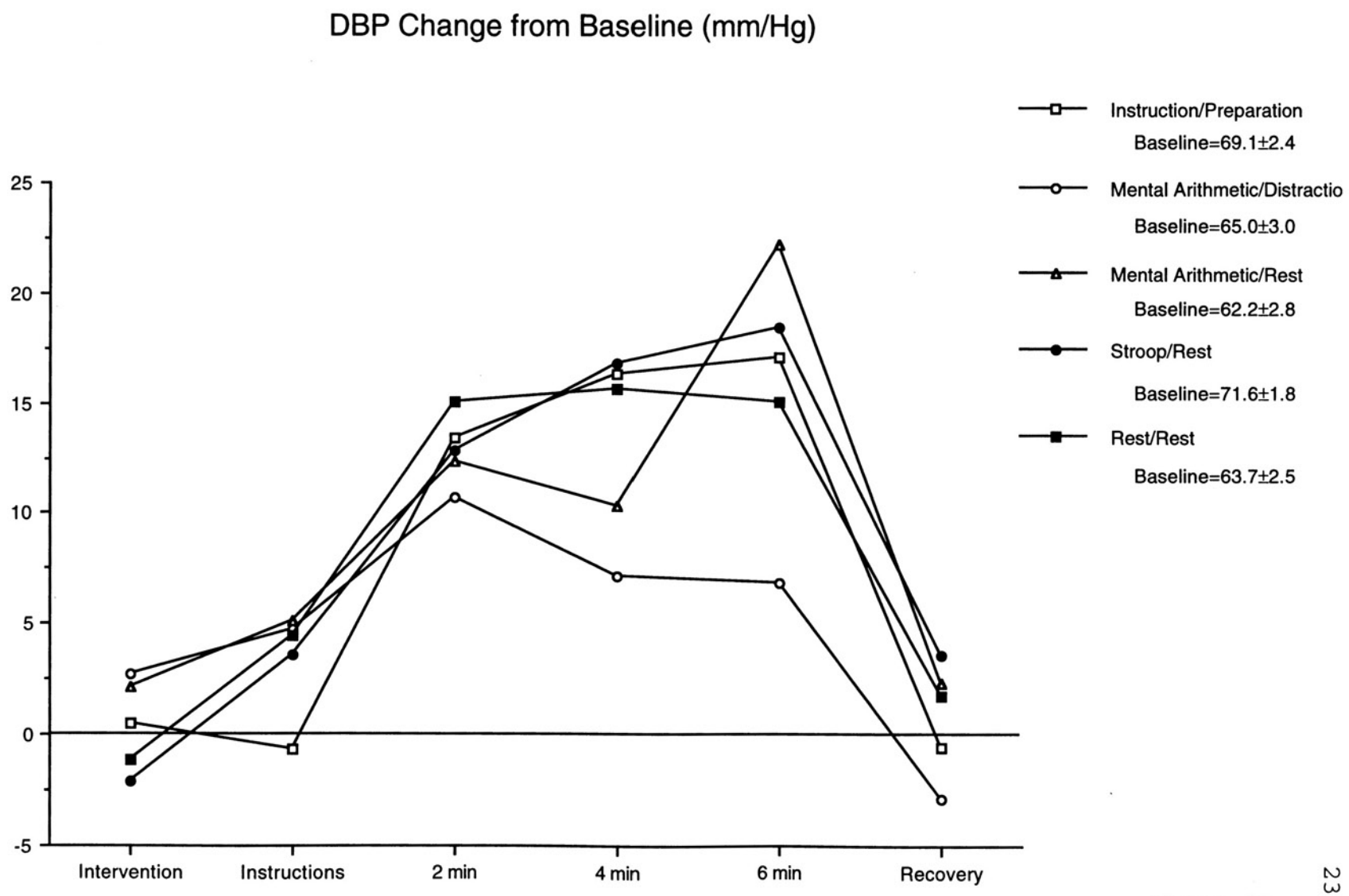
DBP Change from Baseline (mm/Hg)
Instruction/Preparation
Baseline=69.1±2.4
Mental Arithmetic/Distractio
Baseline=65.0±3.0
Mental Arithmetic/Rest
Baseline=62.2±2.8
Stroop/Rest
Baseline=71.6±1.8
Rest/Rest
Baseline=63.7±2.5
25
20
15
10
5
0
-5
Intervention
Instructions
2 min
4 min
6 min
Recovery

Figure 11

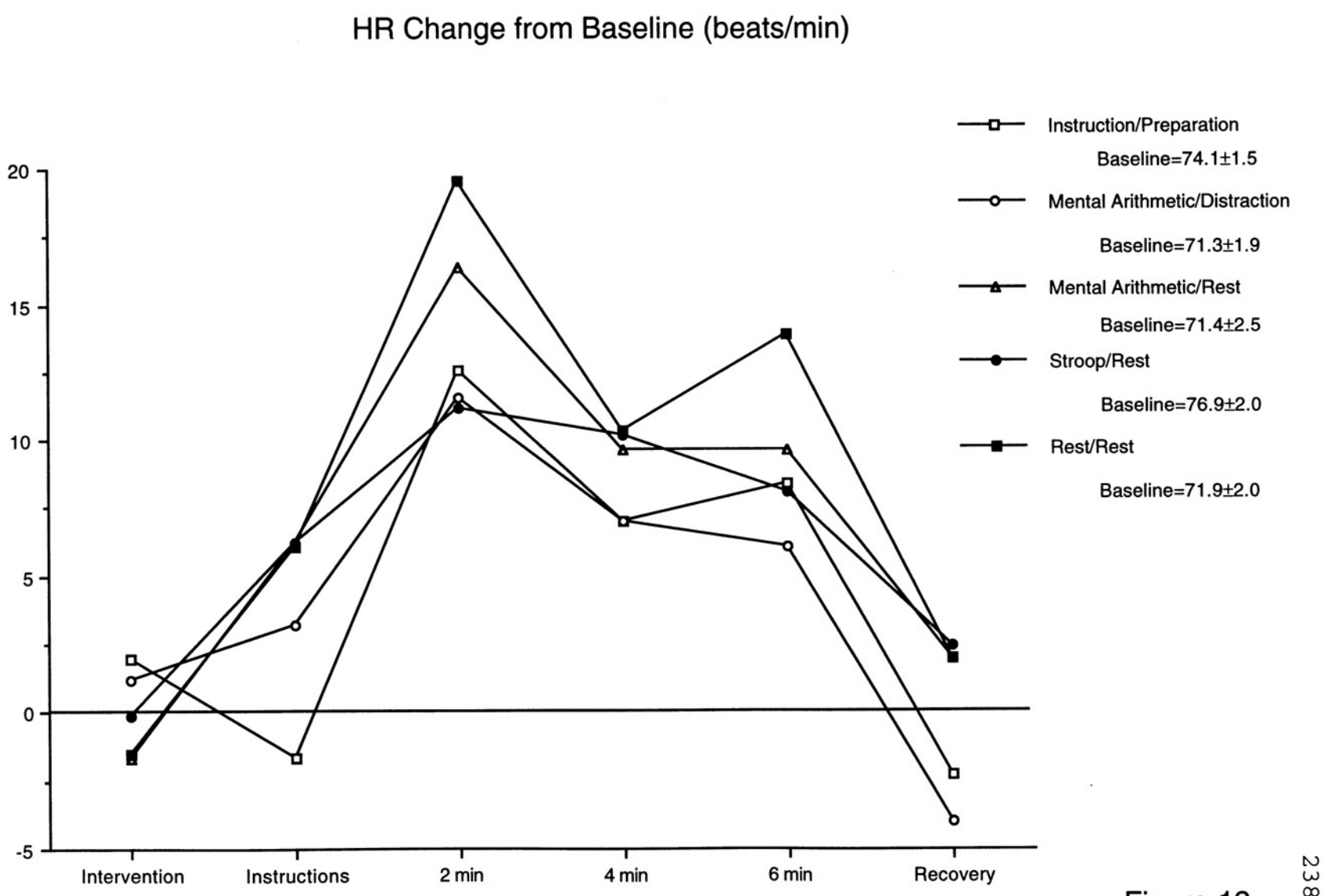
HR Change from Baseline (beats/min)
20
15
10
5
0
-5
Intervention
Instructions
2 min
4 min
6 min
Recovery
Instruction/Preparation
Baseline=74.1±1.5
Mental Arithmetic/Distraction
Baseline=71.3±1.9
Mental Arithmetic/Rest
Baseline=71.4±2.5
Stroop/Rest
Baseline=76.9±2.0
Rest/Rest
Baseline=71.9±2.0

Figure 12