THE ROLE OF COGNITIVE APPRAISAL IN RECOVERY FROM STRESS

BY
LYNN P. HARRICK ©

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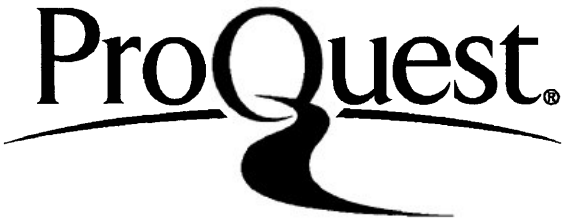
LAKEHEAD UNIVERSITY
THUNDER BAY, ONTARIO
CANADA



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Abstract

The present study examined the effects of cognitive appraisal on heart rate recovery from a psychological stressor. Forty introductory psychology students were randomly assigned to either a threat or challenge condition. Both groups performed the Stroop Colour-Word Conflict Task for one minute. Following this, subjects in the challenge condition received positive feedback concerning their performance and were encouraged to try for an even better score. In contrast, emphasis in the threat condition was on the difficulty of the task and the need to increase their speed and concentration in order to achieve a better score on their second try. The task was then performed again for a three minute period. Heart rate was monitored before, during, and after performance of the task. Results showed that the threat group displayed higher cardiovascular arousal during the task. However, contrary to expectations, the threat group exhibited significantly faster heart rate recovery than the challenge group.

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The Role of Cognitive Appraisal in Recovery from Stress

In recent years there has been increasing focus on stress as a major factor in various health issues. It has been estimated that as many as seventy-five percent of all medical complaints are stress-related (Charlesworth & Nathan, 1982). At present there is a growing awareness that cognitive processes play a vital and influential role in determining the magnitude of a stress response. As well, there is current recognition that unnecessarily prolonged responses to individual stressors are harmful since they exhaust adaptive coping resources and thus increase susceptibility to disease. As the role of cognitive appraisal becomes more apparent, so has the realization that unidimensional stress concepts, such as those focusing solely on physiological measures, are limited. To fully understand the underlying mechanisms comprising a stress response, one must integrate the disciplines of physiology and psychology. Despite this knowledge, there has been little research examining the role of cognitive factors in determining the speed of recovery from stress. The present study is designed to explore the relationship between these two processes.

The Stress Response

Over the past few decades, much has been written about the concept of stress from varying points of view. Perhaps the most widely used definition of stress is by Hans Selye who viewed stress as "the nonspecific response of the body to any demand made upon it" (Selye,1976,p.14). More simply stated, it is the rate of wear and tear on the body. There is general agreement that stress is manifested by changes in a variety of physiological indices. The underlying mechanisms of the stress response are associated primarily with the autonomic nervous system. The sympathetic branch of the autonomic nervous system is concerned with preparing the body for action. Thus, activation of this system is the first manifestation of the stress response, since it involves direct innervation of many organs and organ systems.

Changes in the body involve those appropriate for the support of muscular extension. Sources of energy are made available through increased glycogenolysis of the liver, increased release of free fatty acids, and increased plasma triglyceride and cholesterol metabolisis (Everly & Rosenfeld, 1981). Blood is diverted to the voluntary muscles, pupils dilate, and energy intended for digestion and salivation is diverted (Ramsey, 1982). Overall increases in activity are in turn supported by increased cardiac output and vasoconstriction. In general the neurotransmitter,

norepinephrine, is largely responsible for these changes of increased arousal (Charlesworth & Nathan, 1982).

A variety of psychophysiological indices can be used to detect this arousal response. Current research has generally focused on the cardiovascular system with heart rate being one of the most widely used physiological measures of a stress response. As Charlesworth and Nathan (1982) assert "heart rate is an excellent measure of how much stress a person is undergoing" (p.329). In addition to being a reliable and accurate measure, heart rate also has clinical relevance since the cardiovascular system manifests the most serious implications of prolonged stress (e.g., hypertension, strokes, and coronary heart disease).

Cognitive Appraisal

In recent years there has been a general recognition that the stressfulness of a situation depends on how the individual perceives the situation. Lazarus (1966) maintains that this perception or cognitive appraisal is an essential element in understanding an individual's personal response to stress.

According to Lazarus and Folkman (1984) cognitive appraisal is an evaluation process which determines why and to what extent a particular transaction between the person and the environment is stressful. Cognitive appraisal is comprised of two interdependent processes; primary and secondary appraisal.

Through primary appraisal one evaluates whether an encounter is irrelevant, benign-positive, or stressful. An irrelevant encounter carries no implication for a person's well-being and the person has no stake in its outcome. When the outcome of an encounter is construed as positive and enhances a person's well-being, it falls within the category of benign-positive. Stress appraisals include harm-loss, threat, and challenge.

Harm-loss refers to some damage that has already been sustained; threat concerns harms or losses that are anticipated; and challenge refers to the potential for growth, mastery, or gain. Therefore, according to this theoretical model by Lazarus, threat and challenge appraisals are both anticipatory, that is they are both comprised of evaluations that deal with an upcoming event. Thus, both appraisals demand the activation of coping responses. The main difference between these concepts is that challenge appraisals are associated with positive or pleasant emotions such as eagerness, confidence, and hope, whereas, threat appraisals are characterized by negative emotions such as worry, fear, and anxiety (Lazarus & Folkman, 1984).

Some of the most intriguing questions in stress research concern the possible adaptational consequences of different types of appraisals. A prevelant postulate is that the individual who is able to focus and respond to the potential for gain in a stressful situation and is challenged will probably fare better than the person who reacts to the potential for harm

or loss and thus is threatened. It is further surmised that an individual who feels challenged will adopt more efficient and persistent coping mechanisms and thereby experience less stress than the threatened individual.

Kobasa (1982) purports that challenge, in conjunction with committment, and control, comprise the personality trait of hardiness. The component of challenge is defined as the anticipation of change and thus individuals who possess this trait are well-adapted at responding to the unexpected. This predisposition, to be cognitively flexible, acts as a buffer to stress as it enables an individual to utilize all the coping resources available. It is assumed that these characteristics, even under highly stressful encounters, promote the health of the individual by decreasing the likelihood of disease. Research examining the relationship between this challenge factor and response to stress has yielded equivocal findings and thus perhaps there is value in studying challenge from a situational approach (manipulated) rather than a trait approach.

Current research has established the role of cognitive appraisal as a major determinant of psychological and physiological arousal. The first thorough investigation examining the role of cognitive mediation was undertaken by Lazarus and his colleagues. Through the use of motion picture films, chosen for their ability to elicit vicarious stress, the researchers manipulated appraisal using various methods. In all

of the experiments subjective distress and autonomic reactivity (heart rate and skin conductance) were measured.

One of the initial studies manipulated appraisal by having subjects receive one of four training procedures (relaxation, cognitive-rehearsal, desensitization, control) before exposure to a stressful film (Folkins, Lawson, Opton, & Lazarus, 1968). As expected, heart rate was highest in the control group with the relaxation and cognitive-rehearsal groups displaying the lowest heart rate. Studies such as this demonstrated that by influencing appraisal through coping techniques and statements, it was possible to affect stress response levels. In two subsequent studies, the effects of temporal factors on cognitive mediation were examined (Folkins, 1970; Nomikos, Opton, Averill, & Lazarus, 1968). The authors concluded that the amount of time the subject waited for the anticipated harm was related to the intensity of its stressful impact with the longer brief anticipation periods (20 and 26 seconds) resulting in a greater stress response. However, if sufficient time was alloted (3 and 5 minutes) for the subject to employ coping techniques, involving reappraising the situation, the stress response would considerably decrease. Breznitz (1971) concluded that the intensity of threat is not related so much to the length of anticipation time but more importantly to the individual's amount of involvement. Therefore, emphasis should be placed on whether the individual is given sufficient opportunity to develop self-assuring coping responses and thus

display a lower stress level.

In a related study, Rakover and Levita (1973) investigated the variables of anticipation time and arousal by substituting rewarding tasks for aversive stimuli. Findings from this study reported a linear relationship between anticipation time and heart rate. This result is contrary to the curvilinear relationship between anticipation time and arousal obtained when an aversive stimulus is employed (Folkins, 1970; Breznitz, 1971). These findings seem to suggest that challenge and threat appraisals have their own distinct coping patterns. Lazarus and Folkman (1984) state that threat appraisals elicit greater coping complexity since in addition to the manifestation of vigilant coping patterns that occur in challenge appraisals, threat appraisals are also comprised of defensive or avoidant strategies.

The role of individual differences on cognitive appraisal was manipulated by selecting subjects displaying varying cognitive styles in their ways of thinking and coping (Speisman, Lazarus, Mordkoff, & Davison, 1964). A subject was instructed to use either denial or intellectualization to mitigate the effects of the stressor. The results provided evidence that both coping strategies were effective in reducing the stress response only when it matched the mode of cognitive style characteristic of the individual (i.e. intellectualization was most effective with intellectualizers).

Extending earlier research on cognitive processes, Holmes

and his colleagues conducted series of experiments manipulating appraisal. In the initial study subjects were threatened with a series of electric shocks (Holmes & Houston, 1974). The experimental group was instructed to utilize cognitive coping strategies such as redefinition and isolation, whereas, the control group was not told to use the coping techniques. The authors reported that subjects who employed the coping strategies displayed smaller increases in stress response levels as measured by pulse rate, skin conductance, and self-reports of anxiety.

A related study by Bennett and Holmes (1975) confirmed that the coping strategy of redefinition was successful in lowering pulse rates when it preceded the threat but not when employed as a post-threat technique. This finding may be explained by the hypothesis that different coping strategies are necessary when one is regulating stress while anticipating a threatful event as opposed to regulating stress after an event has occurred.

Similarly, researchers found that attention diversion, involving instructing subjects threatened with shock to read an amusing story, was effective in reducing such autonomic measures as pulse rate, finger pulse volume, and skin resistance (Bloom, Houston, Holmes, & Burish, 1977).

Neufeld (1975) addressed the issue of whether cognitive appraisal simply changes the tendency to report stress or actually affects one's physiological and psychological stress level. Subjects ranked the aversiveness of photographs taken in

the morgue of victims of crime and of patients suffering from severe skin diseases. Two conditions were devised to manipulate cognitive appraisal. The first group of subjects listened to a threat-reducing intellectualization-denial tape prior to viewing the pictures, while the second group initially heard a neutral study habits tape. Results revealed that the first group experienced a decrease in "felt stress", however, the criterion for reporting the stress did not also increase. Therefore, subjects in this group were not denying the existence of the stress even though the cognitive manipulation was successful in decreasing their sensitivity to the disturbing properties of the stimuli. This manipulation successfully reduced the autonomic stress response of the first group without altering subsequent ratings of aversiveness to an assortment of new photos and some of the original ones. Therefore, Neufeld (1975) concludes that the actual appraisal of threat was changed rather than simply the propensity to report aversiveness.

The above series of experiments provide overwhelming evidence that cognitive appraisal plays a central role in mediating and shaping an individual's feelings, thoughts, and reactions to any encounter. It is thus not only logical but necessary to acknowledge the importance of cognitive appraisal if we seek to understand the variance of individuals' stress responses and their adaptational abilities.

Recovery from Stress

There is an emerging consensus that stress and disease are related and that certain events are regarded as stressful based on how they are perceived. Furthermore, increases in the intensity and duration of a stress response will serve to magnify the incidence of diseases of adaptation. Frankenhauser (1980) contends that "the speed with which a person "unwinds" after stressful transactions with his environment will influence the total wear and tear of the organism" (p.58). Similarly, "a number of investigators have hypothesized that if the stress response is evoked too often, or sustained too long, then disorders are likely to develop" (p.370). It has often been suggested that exaggerated cardiovascular reactivity leads to the development or progression of coronary heart disease.

Although it is a credible and widely accepted view that prolonged arousal is maladaptive and promotes disease, minimal research has focused on the recovery phase of the stress response. In an effort to ameliorate the incidence of stress-related illnesses, it is necessary to examine what factors diminish or sustain stress-induced psychological arousal.

Some investigators have examined the association between delayed recovery and cognitions. Jamieson and Kaszor (1986) demonstrated that impending social comparison in itself can delay heart rate recovery following a stressor. Such results

provide evidence to support the model of recovery which emphasizes the role of cognitions in mediating delayed recovery.

Further research illustrates the integral role of cognitions in the recovery process. Rumination or the tendency to think about stressful events has been found to be a factor which significantly predicted future onset of illness (Miller, Surtees, Kreitman, Ingham, & Sashidharan, 1985). In concordance with these findings, Cameron and Meichenbaum (1982) stated "it is conceivable that the habit of mentally rehearsing failures and concurrently engaging in self-denigrating thoughts might interfere with at least some dimensions of the unwinding process" (p.702).

The purpose of the present study was to examine the effects of different cognitive appraisals on recovery from stress. To examine these variables, the experiment employed tasks and instructions designed to elicit the pure and specific cognitive states of threat and challenge. Based on the assumptions that threat appraisals induce a more intense and longer stress response and require greater coping complexity than challenge appraisals, certain results were expected.

It is hypothesized that those individuals who perceive the stressful situation as a threat will display higher cardiovascular arousal during the task performance and will recover slower than individuals who react to the stressor in a challenged manner.

Method

Subjects

The subjects were 12 male and 28 female volunteers recruited from an introductory psychology course. All subjects received a one-point credit toward their final grade in the course for their participation. Due to time constraints and the exclusion of one colour-blind subject, only 19 subjects received the challenge instructions while 21 subjects received the threat instructions.

Apparatus

Heart rate was recorded via a photoplethysmographic transducer which was placed on the first phalanx of the left hand middle finger. The signal was recorded on a Gilson two-channel polygraph.

The task stimulus was a Stroop Colour-Word Conflict chart which consisted of 126 words printed on a 56cm x 81cm sheet of paper. The names of colours were printed in conflicting colours of ink (e.g., the word "red" might be printed in yellow ink).

A 14-item post-experimental questionnaire was used to measure cognitions during the Stroop task and during recovery (see Appendix A). The questionnaire consisted of seven emotions which were rated on a five- point Likert scale ranging from "not

at all" to "a great deal". Six of the seven emotions were chosen from those reported by Folkman and Lazarus (1985) as indicative of threat (worried, fearful, and anxious) and challenge (confident, hopeful, and eager) appraisals. In addition, the emotion of anger was also included for examination.

Procedure

Subjects were randomly assigned to either the threat or challenge condition. Upon entering the laboratory, subjects were seated and informed that the purpose of the investigation was to examine how heart rate changes are related to performance on an intellectual task. The photoplethysmographic transducer was attached and subjects were instructed to relax with their eyes closed for five minutes. At the end of the baseline period, the subjects were asked to open their eyes and to focus their attention upon the sample task stimuli. The Stroop Colour-Word Conflict Task was explained and the subjects were allowed a trial run to ensure it was understood that one must verbalize the colour of ink the word was printed in while ignoring the word content.

After the subjects became familiar with the sample task stimuli, the actual test was revealed and the following instructions were given:

This is the actual task. You are to read down

> each column. If you come to the end of the last column, go back to the beginning and start again. I will be recording your answers on a tape recorder to check that you have done it correctly. If you make a mistake correct it before you continue. Five words will be subtracted from your total for each error you do not correct. First, I want you to read as many words as you can in one minute. Try to go as quickly as you can without making mistakes. I will tell you when to stop. Any questions? Begin.

The subjects' responses were recorded and after one minute they were asked to stop.

Instructions following this initial task differed between the two experimental conditions. Subjects in the challenge condition received the following instructions:

> As you noticed this is a difficult task but you did very well. You seem to have mastered the technique. Now I want you to do it again for a three minute period. You did very well on the first attempt, let's see if you can do even better this second time. Try to go even faster and remember to correct any mistakes. Ready? Begin.

The instructions given to subjects in the threat conditions were as follows:

> As you noticed this is a difficult intellectual task which requires attention and concentration to do well. Now I want you to do it again for a three minute period to see if you can get a better score. In order to get a good score you will have to think quicker and really concentrate on the colours. It is important that you go as quickly as you can and try to get a good score. Ready? Begin.

The above instructions were devised to maximize the salient differences between the experimental conditions, without the use of

deception. The instructions to both groups do not contain false statements but rather emphasize different aspects. In the challenge condition the focus is on the subject to try harder by employing praise and encouragement, whereas, in the threat condition the focus shifts to motivate the subject to increase concentration and think faster to obtain a better score. The selection of these conditions were intended to differentially elicit either threat or challenge appraisals without raising any ethical implications.

Subjects then performed the Stroop task for a three minute period. At the conclusion of three minutes the subjects were instructed to close their eyes and rest for a few minutes. The length of the recovery period was five minutes. Upon conclusion of the recovery period, the subjects were asked "Can you tell me what thoughts and feelings you had during this last rest period?" The response was recorded on a tape recorder for later reference. The subjects were then asked to complete the 14-item self-report questionnaire. At the conclusion of the experiment all subjects were debriefed.

Heart rate was measured by counting the number of beats that occurred on the polygraph output in each minute, except for the first minute of the recovery period which was divided into four, fifteen second intervals. The last minute of the initial rest period was used as a measure of baseline heart rate.

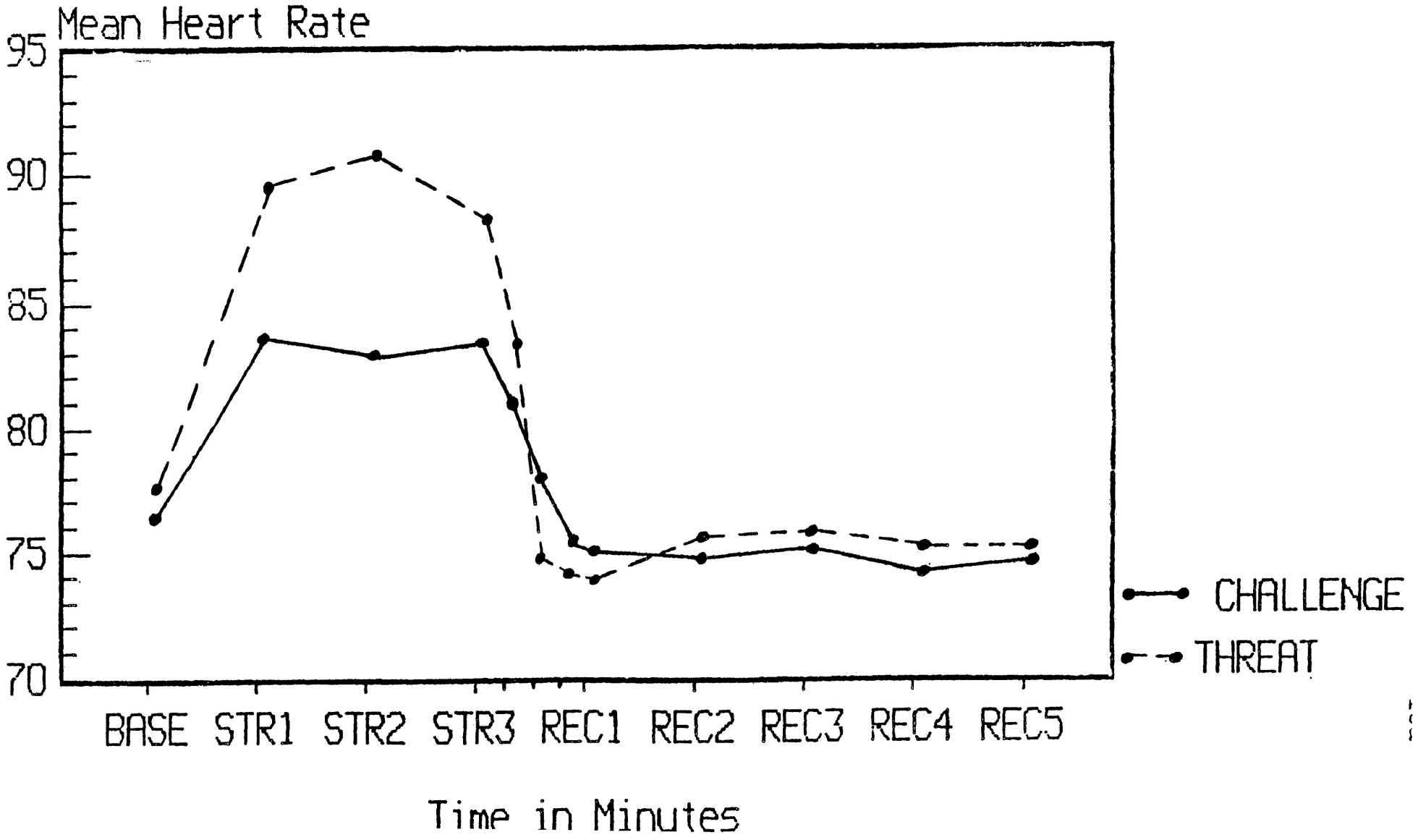
The tape recordings of subjects' verbal reports, depicting what they were thinking about during the recovery period, were transcribed. These transcriptions were read by two other individuals

who assessed the reports and consequently derived three categories into which most of the self-reports were best encompassed. These categories were 1) task related cognitions (e.g., "I was thinking about the task and how I could do better if you asked me to do it again."); 2) negative cognitions other than the task (e.g., "I thought about the test I wrote before coming in here and how did."); and 3) cognitions involving deliberate attempts to relax (e.g., "I was forcing myself to relax by thinking of really pleasant thoughts like the holiday we just had and lying on the beach."). Each transcription was then given a score for each of these three categories which reflected the degree to which each category was present. Thus, the value of "2" represented the highest degree factor could be present, the score of "1" indicated a moderate degree and the rating of "0" represented the absence of the respective factor.

Results

Mean heart rates for each group during baseline, the Stroop task, and the recovery period are presented in Figure 1. Both groups showed significant heart rate increases from rest to the first minute of the Stroop task. The mean increase for the threat group was 12.3 beats per minute ($t(20)=5.30, p<.001$) and the challenge group obtained a mean of 7.0 beats per minute ($t(18)= 3.79, p=.001$). During baseline there was no significant difference in heart rate between the threat and challenge

Figure 1. Heart Rate for the Threat and Challenge Groups during the Three Phases of the Experiment



groups, $t(39)=.37, p>.05$.

To evaluate whether threat and challenge produced different heart rate increases to the Stroop task, analyses of covariance controlling for resting heart rate were performed on heart rate for each of the three minutes of the Stroop task. These analyses revealed that the threat group displayed a significantly higher heart rate during the second minute of the stressor, $F(1,37)=4.33, p<.05$, although heart rate differences between the two groups did not reach significance during either the first ($F=3.25$) or third ($F=2.69$) minute of the stressor. Thus the threat instructions produced somewhat greater heart rate increases than the challenge instructions.

To examine group heart rate differences during the recovery period, an analysis of covariance was conducted which partialled out both resting heart rate and last minute of stress heart rate. Significant differences between the two groups were revealed at both the 30 and 45 second intervals of the initial minute of recovery, where $F(1,36)=12.68, p<.05$ and $F(1,36)=4.50, p<.05$, respectively. In each instance the threat group demonstrated faster recovery than the challenge group. The remaining intervals of 15 seconds ($F=1.43$) and 60 seconds ($F= 2.40$) were not significant. There were also no significant differences at two minutes ($F=1.11$) or longer intervals. These results are contrary to what was expected in that the threat group, which showed the highest heart rate increase to the task, also showed significantly faster recovery. This faster recovery

can be seen in Figure 1.

Table 1 presents the means and standard deviations of the two groups for each item on the post-experimental questionnaire. Discriminant analyses were performed on the seven emotions listed on the questionnaire for each of the task and recovery periods. The obtained results revealed that the differences between the two groups were significant for the emotions during the task (Chi Square(7)=24.02,p=.001), however, these differences were not significant for the emotions during the recovery period (Chi Square(7)=12.15,p.>.05). Each emotion was then analyzed separately, comparing the threat and challenge groups, but caution should be used in integrating the differences during recovery in view of the overall non-significance of the multivariate test. The threat group reported being significantly more fearful during both the task and recovery periods, $t(39)=4.59, p<.05$ and $t(39)=2.07, p<.05$, respectively. In addition, the threat group was significantly more anxious during both the task ($t(39)=4.59, p<.05.$) and during recovery ($t(39) =2.07, p<.05$). The threat group was also significantly more worried during the recovery period $t(39)=2.23, p<.05$. The challenge group reported feeling significantly more confident during both the task ($t(39)=2.61, p<.05$) and recovery ($t(39)=2.35, p<.05$). The groups did not significantly differ on the remaining cognitions. These differences generally confirm the effectiveness of the independent variable in affecting cognitions, with the threat

Table 1

Means and Standard Deviations on Self-Report Questionnaire for Threat and Challenge Conditions

	Condition				
Emotion	Threat		Challenge		
(During the task)	M	SD	M	SD	T-value
Worried	1.95	0.74	1.63	0.68	1.42
Confident	2.38	0.67	2.95	0.71	2.61*
Hopeful	2.43	0.98	2.32	0.89	0.38
Fearful	1.71	0.78	1.11	0.32	3.16*
Anxious	3.10	0.70	2.11	0.66	4.59*
Eager	2.76	0.83	2.68	0.82	0.30
Angry	1.33	0.73	1.11	0.32	1.26
(During recovery)					
Worried	1.67	0.73	1.21	0.54	2.23*
Confident	2.00	0.89	2.68	0.95	2.35*
Hopeful	2.19	0.87	2.16	1.02	0.11
Fearful	1.29	0.56	1.00	0.00	2.22*
Anxious	2.19	0.87	1.63	0.83	2.07*
Eager	1.90	0.89	2.00	0.88	0.34
Angry	1.23	0.54	1.00	0.00	1.92

n = 19 for challenge condition
n = 21 for threat condition
*$p < .05$.

group experiencing more fear, anxiety, worry, and less confidence than the challenge group.

To examine the relationship between reported cognitions during recovery and actual heart rate recovery, partial correlations were calculated. Both resting heart rate and the last minute of stress heart rate were partialled out to ensure that the remaining measure of recovery was independent of both resting heart rate levels and the magnitude of response to the stressor. Analyses of these data failed to reveal any significant correlations between reported cognitions during recovery and actual heart rate recovery (see Appendix B).

Analyses were conducted on the responses obtained from the open-ended question posed at the conclusion of the recovery period. T-tests were performed which compared the responses of the two groups to this question. The threat group reported significantly more task related cognitions, $t(39)=2.08, p<.05$. However, the groups did not significantly differ in their reports of negative cognitions, $t(39)=.50, p>.05$, or in their reports concerning deliberate attempts to relax, $t(39)=.03, p>.05$. In addition, Pearson correlation coefficients were calculated to determine the degree of inter-rater reliability for the categorical placement of these responses. It was found that the groupings comprised by the two raters were significantly correlated in all three categories. The correlations for each category were $r=+.973, p<.01$ (task-related cognitions), $r=+.863, p<.01$ (negative cognitions other than

task), and r=+.940,p<.01 (cognitions involving deliberate attempts to relax). Partial correlations obtained from this data did not yield any significant correlations between each of the three categories and actual heart rate recovery.

Discussion

The present study was designed to evaluate whether cognitive appraisal was related to recovery from stress. The results provide preliminary support for a relationship between cognitive appraisal and heart rate recovery from stress. As expected, results from the experiment revealed that individuals who felt threatened displayed greater cardiovascular arousal during task performance. However, this increased arousal did not persist during the recovery phase as these individuals exhibited faster cardiovascular recovery when compared to the challenge group. This is a contrary finding as it was expected that the increased arousal of the threat group would be apparent in both the task and recovery phases of the experiment.

A second purpose of this study was to examine the feasibility of manipulating threat and challenge appraisals without the use of deception. Instructions for manipulating each appraisal were composed without the use of deception so that they would be both ethically acceptable and more analagous to real-life stressors. Findings from the self-report

questionnaire revealed that the experimental procedure was successful in eliciting the cognitive appraisals of threat and challenge. Responses obtained from the questionnaire were in general accordance with findings by Folkman and Lazarus (1985) which showed that the appraisals of threat and challenge are each associated with specific emotions. Greater heart rate reactivity by the threat group, during the experimental task, lends further support to the successful manipulation of the cognitive appraisals.

A third purpose of the present research was to evaluate the efficacy of a post-experimental oral report. The transcribed reports were assessed by two individuals, who coded the responses according to three dimensions which they felt best categorized the responses. These dimensions were 1)task-related cognitions, 2) negative cognitions other than the task, and 3) cognitions involving deliberate attempts to relax. The ratings were conducted blind with respect to heart rate reactivity and treatment condition. A relationship was found between the self-reports and the experimental manipulation. Individuals in the threat group reported more task-related cognitions when asked to describe their thoughts during the recovery period. This finding is not surprising considering the negative emotions a threat appraisal evokes. During the recovery period, subjects experiencing such emotions as worry and anxiety would be more apt to engage in repetitive thoughts pertaining to the preceding stressor. However, it is surprising that the presence of these

task related cognitions was not accompanied by prolonged heart rate arousal.

In the present study, despite increased arousal during task performance, subjects in the threat group displayed faster heart rate recovery than those in the challenge group. This finding was quite unexpected, and should be replicated before strong conclusions are reached about the role of cognitive appraisal on recovery. However, having obtained this finding, it is appropriate to consider explanations for it.

One possible explanation may be that these findings are a result of group differences in physiological processes which comprise the cardiovascular response to stress. Grossman and Svebak (1987) studied the role of parasympathetic cardiac responses to stressor tasks. Following a resting baseline period, subjects received both the threat and no-threat conditions. In the threat treatment subjects were told that if they performed poorly on the task they would receive electric shock. Heart rate and respiratory sinus arrhythmia were measured throughout the experiment. Findings from their research showed that subjects who initially received the threat task displayed diminished parasympathetic control and both increased heart rate and sympathetic arousal, when compared to physiological measures taken during the no-threat task. The researchers note that the increased heart rate in the threat group could not be solely attributed to cardiac sympathetic influences but rather to a combination of parasympathetic

withdrawal and sympathetic overbalance. In contrast, the significant difference in heart rate from rest to task in the no-threat group was not apparent when parasympathetic influence was controlled for. The results of this study suggest that the absence or presence of parasympathetic influence may play a significant role in heart rate reactivity to a stressor and could contribute to prolonged cardiac responses. This interplay between sympathetic and parasympathetic systems may have contributed to some degree to the variation in recovery rates between the threat and challenge groups in the present study.

A limitation of the present study is that subjects in both groups required less than one minute to reach their pre-task heart rates. In contrast, Jamieson and Kaszor (1986) found that a recovery period of six minutes was insufficient for subjects awaiting feedback about their performance, to return to baseline heart rates. Thus it is apparent that in the absence of this waiting component, heart rate recovery can be quite rapid. In the present study, despite the presence of a threat and persisting related cognitions, the expected delayed recovery was not evident in the threat group. Also, self-reports of cognitions did not correlate with heart rate recovery in either of the groups.

A further limitation concerning this rapid recovery includes the difficulty in attempting to imitate a real-life stressor in the confines of a laboratory paradigm. Due to ethical considerations, it is difficult to expose subjects to

stressors that comprise the complexity and meaning which are evident in even a minor real-life stressor. In the present study, the laboratory stressor was perhaps void of the components present in a real-life stressor which may evoke a sustained reaction. Even when an experiment utilizes a good imitation of a real-life stressor, subjects are aware that they may terminate the stimulus at any time. In contrast, many real-life stressors are not associated with this degree of finality or controllability. Thus it is a precarious analogy between laboratory and real-life stressors which must be kept in mind when clinical implications of stress research are being considered. It is also necessary for future research to utilize stressors that will provoke and sustain cardiac elevations for an extended period of time before any clinical comparisons can be made that are reliable and valid.

The present study offers evidence for role of task-related cognitions in delaying the return of heart rate to baseline levels. The main finding of this study was an unexpected faster recovery in the threat condition. This result must be investigated further to clarify whether it reflects a parasympathetic influence or if it can be solely explained by the process of cognitive reappraisal. Perhaps how one interprets a stressful situation will affect not only the initial response to the stressor but also the affective and physiological arousal after termination of the stress provoking event.

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LIST OF APPENDICES

Appendix A

Please indicate the extent to which you felt each of the following emotions while performing the colour word task the second time.

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
WORRIED		2	3	4
CONFIDENT		2	3	4
HOPEFUL		2	3	4
FEARFUL		2	3	4
ANXIOUS		2	3	4
EAGER		2	3	4
ANGRY		2	3	4

Please indicate the extent to which you felt each of the following emotions during the rest period following the completion of the colour word task.

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
WORRIED		2	3	4
CONFIDENT		2	3	4
HOPEFUL		2	3	4
FEARFUL		2	3	4
ANXIOUS		2	3	4
EAGER		2	3	4
ANGRY		2	-	4

Appendix B

Partial correlations between heart rate recovery and reported cognitions during the first minute of recovery for the total sample

	Time Interval in Seconds			
Emotion	.25	.50	.75	1.00
Worried	.160	-.023	-.087	.068
Confident	.061	.097	.050	.157
Hopeful	.096	.147	.031	.232
Fearful	-.260	-.076	.105	.087
Anxious	.065	-.149	.059	.032
Eager	.193	.083	.287	.175
Angry	.083	-.165	-.142	-.060

Note. All of the above partial correlations were not significant.