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The Effects of Core Affect, Emotion, and Self-Efficacy on Physiologic Response to Social Stressors

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APPROVED

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Abstract

Cardiovascular health is affected by many factors including biological aspects such as heredity and overall health, as well as by environmental factors. Social stress, socioeconomic status, family environment, and coping skills have all been shown to contribute increased risk for cardiovascular disease. In an effort to further elucidate past findings in this area, this study, conducted on 36 college-age students, examined the connection between physiological response (blood pressure, heart rate, and mean arterial pressure) to laboratory social stressors in correspondence to emotional, affective, and arousal levels, as measured by self-report. The results yielded a significant relationship between physiologic response to social stimuli and response measured by other factors, including emotion, affect, and arousal, during recovery baselines. This study implicates the great importance of possession of social coping skills among youth, to promote good health later in life.

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Preface

Throughout my college years I have entertained mutually intense interests in medicine and psychology, and fortunately these are two fields that overlap to a fair degree. In the beginning stages of the thesis project, I decided to try and incorporate these interests into a comprehensive reflection of my dedication to each. I sought an advisor whose work concerned health psychology, without a completely clear picture of what exactly what research I planned to do.

I became interested in Dr. Ewart's work after an initial meeting with him during my Junior year, and asked to work with him on Project Heart, a large-scale social stress inventory that correlated agonistic temperament (related to poor social skills) in high school students with long-term risk for hypertension and cardiovascular disease. He had completed studies in Baltimore and Washington D.C. on the subject matter, and had recently obtained a grant to run a similar study in Syracuse. I was interested in becoming involved at the beginning phase of such an all-encompassing project and began work with him promptly thereafter.

Project Heart is a massive undertaking which in phase one involves screening hundreds of students in the 9th grade at a local high school for height, weight, and blood pressure, as well as administration of a brief questionnaire which addresses such issues as social coping style, stresses encountered, and a multitude of other standardized indices. During phase 2, students whose blood pressure was higher than expected for their height, weight, and age are invited back to participate in a more intensive study of their physiologic and emotional

response to stress. Students are administered the SSCT protocol, and given an ambulatory blood pressure machine which can be programmed to take readings throughout a 24 hour period. These readings correspond to a digital survey held on a Palm Pilot, which students are expected to fill out after each reading, indicating what they have encountered in the past few minutes or hours, in terms of social interactions, academic and physical stressors, or any arousal effecting drugs (such as caffeine or cigarettes).

My thesis project's specific topic would not concern the entirety of Project Heart as it would run for four years, long after I had graduated, but it was unclear at the beginning what sub-topic my study would relate to. I started working with all aspects of the project, trying to get a feel for what interested me most. Before research assistants were hired, I helped to assess equipment left over from the previous studies and reviewed preexisting literature in the area, trying to absorb as much of it as I could, and when the local high school gave us permission to begin initial blood pressure screenings for the first phase of the project, I called dozens of students' parents to obtain consent for their children to participate in the project. Along with the research assistants, I conducted initial blood pressure screenings in the high school on mornings when I did not have class, and attended weekly project meetings to stay up to date on the overall direction of the project.

During the fall of 2004, we began to run a pilot study with Psychology 205 students, testing out the Standard Social Challenge Tasks protocol, along with the equipment we would be using with the high school students. I was trained to administer the protocol, and, with the research assistants' help, ran several of the participants through the experiment. It was at this point that we decided I would

write my thesis on the pilot study, as it seemed an appropriate size for the scope of the thesis project, and it became apparent that no real data could be collected at the high schools until the spring semester. I slowly lessened my work with the high school aspect of Project Heart and became more involved with the pilot study going on in the Psychology department.

The nature of a pilot study made my work somewhat limited in its scope, and because it was part of such a large study with such a radically different social group, it was intriguing to discover the different types of problems we would encounter when trying to generalize the pilot study feedback with the protocols we would be using in the high schools. The SSCT was geared towards high school students from the former studies, and although the purpose of the pilot was to test out the protocol for implementation in the schools, some of the social stress scenarios involved were inappropriate for college students, and had to be rewritten in the midst of the study. The questionnaires proved to be too long and tedious, so they were shortened and sections omitted after half the students had already completed them.

One severe limitation of the pilot study was the drastic differences between the populations at Syracuse University and the local inner-city high school. Students at S.U. were well educated, and the students that we interviewed seemed to be overwhelmingly white, Judeo-Christian, middle to upper class, with few social coping problems. Students we would be working with in the city were barely out of eighth grade, consisting of mostly black or other minority groups in the lower socioeconomic classes, and presented a high rate of social incompetence in response to the SSCT. While the S.U. students' biggest problems were getting

them to come in to the interview on time, the high school students' problems fell more along the lines of understanding words like "mugged" or showing up to school at all.

As the semester wore on, data started to collect and the specific nature of my project began to take shape. Over winter break I began to pull together the large amount of literature I had amassed on the topic and tried to sift through it for a comprehensive literature review, still unsure of the results of the study. When school commenced in January, I began working to interpret the statistics that resulted from the data collected by the study, and my real work on the paper began. After something like 8 or 10 drafts, it has finally become a work that is reflective of the time and energy I put into the project as a whole, and my respect for those who write research papers as part of their occupation has increased enormously.

A Note to Future Honors Students

Probably the most important lesson I learned from this experience is how absolutely absorbing research work can be. The amount of patience and attention to detail that is required in order to produce sound, significant results is astounding, and is in no way reflected in the brevity and succinctness of papers published in journals. For every hour I spent working on my paper (and there were many), I spent another two hours attending meetings, collecting data, and exchanging emails with the other members of the project, and they worked on their ends of the project upwards of 40 hours a week at times. Two full time research assistants worked specifically on Project Heart, and Dr. Ewart split his time between that and teaching courses. For every successful set of data collected,

there was no end of preparatory work before the participant ever arrived at the office.

The greatest advice I can give someone preparing to embark on this journey (because that's really what it is) is to choose an advisor that you feel comfortable pestering about every tiny detail of the project right up until the last minute. It's important that you enjoy working with him/her and that they have the time and dedication to your project that will allow you to produce the best possible product. If you were to choose a faculty member who is not interested in you or your topic, at least in an experimentally oriented study, it would be nearly impossible to complete. There is no way that I could have maintained the motivation and perspective I had during my experiences without the unwavering support of Dr. Ewart.

Secondly, it is imperative to realize exactly what the time commitment of this project is. I have spoken briefly about the number of hours I have put into the project, and it is absolutely true that my life has been consumed by the thesis project this past year, culminating in the past few weeks. I have submitted draft after draft to my advisor, second reader and the writing consultant, and every time am presented with another onslaught of new and corrected information and suggestions for the rewrite. This could be very discouraging if you were not prepared for it. Sitting at my computer rereading the same paper time and time again was not exactly what I had dreamt about when imagining the last few weeks of my senior year, but reflecting back on the knowledge and experience I have gained as a result of this study, I would say it was time well spent, which brings me to my last point.

The tediousness, discouragement, time commitment, and back pain from sitting at your desk for hours at a time are all made worthwhile by the feeling of handing in a finished thesis project. On the morning of the due date for this year's thesis project, I am polishing up the last corrections and pausing to reflect on the entire experience, and am filled with overwhelming satisfaction that this enormous project has finally come to a conclusion. This afternoon, when I hand in my year-long efforts, I will know that I have really produced a work that will showcase all that I have learned during my time here at Syracuse University.

Acknowledgments

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And most importantly, thank you to Dr. Craig Ewart, who dedicated countless hours to discussing, editing, and commenting on my research and paper, as well as for his willingness to involve an undergraduate student in his already daunting task of implementing Project Heart in a new city.

The Effects of Core Affect, Emotion, and Self-Efficacy on Physiologic Response to Social Stressors

Heart disease is the number one killer of Americans today. Millions of people die from some form of cardiovascular disease (CVD) every year, which has made research into its causes an ever-widening field (Cleveland Clinic, 2005). Studies have discovered many biological factors related to the development of poor heart health, including poor diet, age, gender, ethnicity, and genetic predisposition. However, these factors only account for approximately 50% of the diagnoses of CVD, leaving researchers a great number of other possible influences to investigate (Ewart, 1991). One of the more intriguing variables affecting risk for CVD is social stressors and their effect on physiologic reactivity. Quite a bit of work has been done in this area to prove a connection between social incompetence and poor heart health, which increases risk for CVD. As is the case with many diseases and disorders, the causes behind the many varieties of CVD appear to be both biologically and environmentally based.

Biological Factors

Heart disease develops as a result of many different types of risk factors. Two of the most common related problems are atherosclerosis (where fat and cholesterol accumulate in the arteries) and arteriosclerosis (where plaque builds up in the arteries, making arterial walls hard and brittle). Both of these cause blockage of the arteries and, as they become advanced, blood pressure increases to keep blood flow around these obstacles constant in order to supply the body with adequate oxygenated blood. If the artery becomes completely blocked, it can cause an arterial rupture, or if it supplies blood to the heart, a myocardial

infarction (heart attack). Generalized high blood pressure can itself overtax the heart, weakening arteries over time, eventually leading to a heart attack or arterial rupture (Cleveland Clinic, 2005). Highly stressful lifestyles or environments (such as those wrought with poor social interactions) can also cause a persistent high blood pressure.

As a person grows older, cholesterol and plaque naturally build up on arterial walls, increasing the risks of these two problems. However, poor diet can also increase the amount of blockage-inducing fat in the body, inadequate exercise allows them to continue circulating through the body. Males generally have greater chances of developing heart disease than women, simply because of their genetic predisposition, and African-Americans tend to have higher average blood pressure and heart rate than Caucasian-Americans, although it is unclear whether these findings are based on genetics or socio-economics (Ewart, 2004).

Extensive research indicates that risk for hypertension (dangerously long-term elevated blood pressure) can be inherited through the family (Larkin, Semenchuk, Frazer, Suchday & Taylor, 1998). In fact, studies have indicated that a parental history of hypertension is more indicative of child risk for hypertension than weight or other possible risk factors (Ewart, 1991). However, it has also been illustrated that these indicators are not related to genetics alone. Parental lifestyle choices (such as not eating healthfully or neglecting to exercise on a regular basis) are often mirrored by their children, who therefore can develop the same risks that the parent is vulnerable to (Ewart, 1991; Kamarck, Peterman, & Raynor, 1998).

Even the quality of interactions with parents can have a distinct impact on their progeny's risk for development of CVD. Parents who display inabilities to

effectively deal with social stressors and thus teach their children poor coping strategies are not giving the child appropriate tools to keep their overall social anxiety under control. Stress impacts are measured using several different techniques, including self-report, observation of behavior, and physiological reactivity. *Reactivity* is defined as the comparison of physiologic or reported arousal levels during the stressor with those of a baseline reading taken before the stress is induced. However, it is also important to note that return to baseline arousal levels after the stressor has been removed is an equally important indicator of risk for CVD (Ewart, 2004). As with a physical stress test (where the participant's heart rate and respiration rate in a healthy individual should return to a normal rhythm in a given amount of time), a social stress test given to a socially healthy participant should allow him/her to return to the baseline heart rate and blood pressure readings in a fairly short amount of time. If the person undergoing the social stress test does not return to baseline within a reasonable time period, that distinctly indicates that he/she may be at risk for CVD.

Environmental Factors

The influence of family environment (which is based not on genetics but rather on the environment that the family produces) has created several interesting avenues of approach for research (Ewart, 1991). Socioeconomic Status (SES) is a frequently implicated risk factor in adults, and the results are similar in the case of hypertension in children (Ewart, 2004). Other areas related to familial environment influence include arousal, affect, chronic anger, emotion, and social competence (Ewart, 2004; Repetti, Taylor, & Seeman, 2002). These factors are all influenced by stress. Stress, both good and bad, causes an increase in physiologic

response, and if a person is constantly stressed over a long period of time, their overall level of physical arousal increases; the added workload can be dangerous to heart health and increase the risk of CVD (Kamarck et al., 1998).

Socioeconomic Status

Low socioeconomic status can have a deleterious effect on general health as well as heart health, for many reasons (Ewart, 2004; Repetti et al. 2002; Ewart, 1991). First, people of lower SES usually have limited access to health care, as well as less knowledge about good health practices in general. Usually they have poorer diet and exercise habits, compounded with the fact that the majority (in the U.S.) are African American, who tend to display higher rates of hypertension already (Larson, 1998). However, these are only the outward (and more obvious) reasons that SES has such a profound impact upon risks to heart health.

There is a good deal of evidence to the effect that constant stress can cause hypertension and long-term elevated blood pressure. Social stressors fall into this category, and indeed, in environments where social stress in consistently high (such as dangerous neighborhoods or in a threatening family environment), elevated blood pressure is found on a regular basis (Ewart, 1991). People who are raised in such an environment report feeling unable to cope with social issues in a non-violent manner; as a result, they have been found to brood over problems they have difficulty solving. High levels of stress can cause “cognitive impairment [which] may include the inability to concentrate, repetitive obtrusive thoughts, reduced problem-solving capabilities, and impaired memory processes” (Larson, 1998).

In a study conducted on 114 women who worked full-time (greater than 35 hours per week), Gallo, Bogart, Vranceanu, and Matthews (2005) found that those in the lower SES bracket "reported less perceived control, more social strain, and less positive emotion when compared with their higher SES counterparts." The study also indicated that people with lower SES were more likely to encounter social conflict and experience low feelings of control on a regular basis than those of higher SES, and correlated this directly with the lack of supportive resources these women reported receiving (Gallo et al., 2005). Similarly, Kamarck et al. (1998) found that social relationships and support have a profound impact on CV health. On one hand, individuals who have strong personal support systems (like marriage or community involvement) "have a reduced risk for premature all-cause mortality" (Kamarck et al., 1998). On the other hand, when the social environment is highly stressful or the person is lacking in positive relationships, there is good evidence that they suffer physically as well (Repetti, et al., 2002). It seems apparent from this data that, because of the social and emotional environment this group lives with, they are less able to develop the ability to overcome internal arousal levels and return to a resting state after they have been engaged in social stressors.

Temperament

Temperament has been defined as "individual differences in reactivity and self-regulation assumed to have a relatively enduring biological basis [where biological means] a relatively enduring makeup of the organism, influenced over time by heredity, maturation, and experience" (Rothbart, Ahadi, & Evans 2000). Plainly stated, this means that temperament is a manner of approaching and

reacting to situations which has been influenced by both biology and environment, and which is generally retained by the individual over a long period of time, if not an entire lifespan. Consequently, a person's temperament is a key factor in determining how they will react to a given situation and how they will deal with emotions and persistent social stressors over time; it has been demonstrated that temperament occurs in nearly all humans and some primates and even other animals. Thus, specific individuals are more likely to react in a similar fashion to the same types of situations over time, based on their history and genetics. In the case of individuals who have been raised in an environment where reactions to social challenges are angry or inappropriate, therefore, it is more likely that the child will have reactions similar to their parents in a given situation (Ewart, 1991). Based on this, the child is more likely to develop hypertension and CVD risk in later life, because they are exhibiting constantly heightened blood pressure at such an early age, overtaxing the hear.

Core Affect

Core affect refers to the positive vs. negative affect a person is generally experiencing at a given time, in conjunction with their arousal level (Russell, 2003). *Affect* (also referred to as "hedonic tone") does not refer to a specific reaction to one particular incident or circumstance, and indeed, the causes for one's core affect may be inexplicable to the individual at any specific time. The core affect differs from temperament in that it changes more frequently and due to less influence from the environment; however, it is less changeable than emotion (Russell, 2003). Core affect would have a possible demonstrable effect on blood pressure levels over time – lower arousal would most likely predict lower blood

pressure, whereas either extreme (positive or negative) affect would most likely cause an increase in blood pressure (due to excitement or anger), whereas a more moderate report would likely predict lower physiological response.

Core affect may contribute to emotion either positively or negatively. Positive core affect will increase the likelihood of emotions such as happiness, satisfaction, or excitement, whereas negative affect will more often coincide with emotions like sadness, frustration, or anger. Following this logic, a person who has a more negative affect will be more likely to display anger, and is also more susceptible to rumination and dissatisfaction with performance in stress tasks.

Emotion

Emotion may be considered the most volatile predictor of physiological response on the hormonal level. *Emotions* are formally defined by Scherer (2000) as "episodes of coordinated changes in several components (including at least neurophysiological activation, motor expression, and subjective feeling but possibly also action tendencies and cognitive process) in response to external or internal events of major significance to the organism." They can cause increases or decreases in blood pressure readings, heart rate, respiration rate, perspiration, and many other factors (Scherer, 2000). Generally, an emotional state is short-lived and does not have any lasting effects on blood pressure that could be considered chronic or debilitative (Ewart, 1991). However, frequent fluctuation in emotion, such as a higher than average occurrence of fear (as might be experienced by someone concerned about dealing properly with social situations) can have negative effects on one's physical health by causing an increased workload for the heart when aroused. Some evidence indicates that emotional

state can have an effect on cognitive functioning (Gallo et al., 2005; Larson, 1998); accordingly, once one is aroused, the ability to calmly reflect on the situation and choose the best course of action is impaired, and thus the level of concern would increase, causing further physiological arousal (Scherer, 2000).

There are several factors that can influence an individual's ability to calm his/her body back to a resting state after being stressed; these include initial levels prior to the stressors, core affect, arousal, and emotions (Ewart, 2004). Emotions can be preexisting when the participant enters the lab, or may be affected by experiences, thoughts, and appraisals. In fact, some of the problems presented in the lab which the participant feels they have left unresolved can cause rumination about the incident as the participant wonders how they could have performed better or worries about whether they successfully solved the problem. This rumination can cause intrusive thoughts about the incident to interfere with thought processes in subsequent tasks, and this can increase arousal level (Larson, 1998). Angry emotions are also correlated very directly with CVD, and individuals who experience anger more often have demonstrated greater long term risk for poor heart health than individuals who exhibit lower levels of anger.

In a stressful situation, individuals who have difficulty coping with social problems become more aroused physiologically than those who are more effective, even if they report less feelings of arousal or anxiety. They are also more likely to dwell on the problem or stressor they have just experienced, causing a constant increase in physiological duress (Larson, 1998). It is theorized that this is due to the concern of the individual that they will be unable to solve their own problems, indicating a lack of self-efficacy.

Current Study

The current study seeks to expand upon research conducted previously in these areas, and to investigate possible correlations between them. Specifically, this study piloted in college students an emotional regulation assessment procedure to be used on a larger scale with high school students in the future. Based on past literature, the emotion of anger has been shown to create a marked change in physiological responses and may be indicative of heart disease risk, so the social scenarios were geared towards invoking an anger response (Davidson, MacGregor, Dixon, & MacLean, 2000). The present study sought to identify factors that contribute to sustained arousal following an anger-arousing event. Such factors include: physiological state, affect, and emotion (especially anger). The investigation also strove to identify indices of sustained arousal, such as post-stress arousal, self-efficacy, and outcome expectancy. It examined three questions in particular pertaining to physiological response to social stimuli. Waldstein, Neumann, Burn, & Maier (1998) showed that presenting hypothetical social scenarios in the lab and asking students to respond as they would in an environmental setting produced physiological and behavioral responses similar to those that actually occur in the normal environment. It is on this finding that we have based the research to answer the following questions:

1. Which variables measured during the tasks predict subjects' post-task arousal as indicated by core affect (arousal and hedonic tone)?
2. Which variables measured during the tasks predict :
    a. Problem-solving self-efficacy

b. Confidence that the problem solution will generate the desired outcome?

3. Which task variables predict post-stress rumination?

Methods

Participants

Thirty-six Syracuse University students participated in the study (avg. age 19.2, age range: 18-22 years, N Male: 12, N Female: 24). Students participated for credit in an entry-level psychology class, and 90% were Caucasian American, which fairly accurately represents the student body at the university. Students were recruited through announcements in the psychology class, and signed up for this project in the psychology department or online. Participants signed an informed consent agreement that explained the procedures of the experiment, any risks and benefits associated, and the general purpose of the experiment.

Materials

A Dinamap electronic automated blood pressure monitor was used to measure the participants' blood pressure throughout the session. A tape recorder was used to record verbal response data, and the blood pressure readings were recorded manually on a standardized data collection sheet. The protocol was administered following a standard script that included personal information probes, social scenarios, and several standardized scales of measurement (see Appendix B for actual forms). The protocol and all related measures and proceedings were reviewed and approved by the Syracuse University Institutional Review Board.

Measures

The variables being measured included several different techniques of stress response recording. CV reactivity was measured by using the Dinamap to record systolic and diastolic blood pressure readings, as well as heart rate (pulse) and mean arterial pressure (MAP). An initial baseline, consisting of 5 readings taken at 2-minute intervals, was taken to acquaint the participant with the procedures involved, and also to estimate resting (pre-stress) values. A second baseline was taken after the stress tasks in order to compare the ending physiological output with that taken during each of the stressors. CV reactivity was calculated by subtracting the mean measurements taken during the baselines from those obtained during stress tasks.

Other findings were recorded via self-report on scales and questionnaires. Students completed a 9-point Likert-type scale to assess core affect, which consisted of two items: (1) Arousal (1 = extreme sleepiness, 9 = extremely high arousal) and (2) Affect (1 = extremely unpleasant feelings, 9 = extremely pleasant feelings). Scales to assess emotions (Interested, Proud, Angry, Sad, Anxious) were also given on two different occasions during the testing, at the beginning and end of the tasks, and were also rated on 9-point Likert-type scales (1 = very slightly or not at all, 9 = extremely). Students were asked verbally as well as on paper to reflect on their tendency to ruminate, in a scale adapted from Larson (1998). Self-efficacy and outcome expectancy were both evaluated verbally on 10-point Likert-type scales (1 = not at all confident, 9 = very confident), where participants were asked to rate their abilities to solve a problem they were currently facing, and to rate their confidence that the outcome would be satisfactory. (See Appendix B for all scales and questionnaires.)

Environment

The study was conducted in a quiet room in the psychology department, while the participant was seated in a comfortable chair, and the lights in the room were dimmed in order to make the environment as calming as possible. The testing conditions for each subject were as similar as could reasonably be managed in order to create internal validity for the experiment. The environment was particularly important so that findings of blood pressure fluctuation could not be attributed to stimuli other than those intended to influence the experiment.

Procedures

When students first entered the room, they received a brief oral explanation of the procedure and equipment involved, as well as a consent form explaining the risks and benefits of participating in the experiment. While they received the explanations, they were attached to the Dinamap machine and microphone, and a baseline reading was taken, lasting 10 minutes Five readings were taken at two-minute intervals to familiarize the participants with the equipment and to allow them to relax as much as possible before the data collection began.

The Standard Social Challenge Task (SSCT) protocol was administered orally by a female graduate student, while an assistant programmed the Dinamap machine and recorded the blood pressure readings. The protocol was timed so that data would be recorded at uniform times during its administration to different individuals.

The protocol itself consisted of seven separate phases, which will be outlined and explained in the order they were presented to the participants (see

full protocol forms in Appendix B). The tasks consisted of a Self-Focus Task, Anger Experience, Anger Vignettes, Personal Memory, Future Projection, Emotion and Arousal Scales, and Biggest Problem/Rumination Scales.

After the 10-minute Baseline 1, subjects performed the first task, Self-Focus, which required participants to discuss for 3 minutes the kinds of activities they had recently been engaged in (over the past week and current day), as well as what their current relationships were like and what kinds of things they were concerned about. Next, they performed an Anger Experience task, which required them to recall an event in their lives when they were very angry, and then describe how they felt and how they had dealt with it. This lasted 3 minutes. After this, three Anger Vignettes were administered. The Anger Vignettes involved three scenarios that could feasibly happen to a college-age student which would generally produce an angry response. The participants listened to the scenario and then told the experimenter what they would typically do in response to such a situation. Each of the three tasks lasted 2 minutes. Blood pressure was recorded at 1 minute intervals during the vignettes. Following the Anger Vignettes, subjects performed a (3 minute) Autobiographical Memory task which asked the participant to recall an event or information about themselves which they might share with someone they wished to know more intimately, in order to explain something important about themselves to the person. The last task was a (3 minute) Future Projection exercise which asked the subjects to think about what their life would be like in the year following graduation from college, and what kinds of challenges they would encounter, as well as how they planned to

overcome them. Blood pressure was recorded at 1 minute intervals during these tasks.

The Affect and Arousal Scales (included in Appendix A) were administered at the outset of the experiment after the baseline physiological readings were taken, as an initial resting reading for the participant's affect and arousal levels before there was any influence by the various stages of the testing. The affect and arousal scales, along with the emotion scales, were also filled out after the Self-Focus task and again after the second Baseline at the end of the session. A rumination scale was also administered at the very end of the testing phase, along with some verbal and written questions about the largest problem the participant was currently facing, and how they planned to deal with it. The final blood pressure baseline was taken after the Future Projection, but before the Rumination scales were administered, and then the student was disconnected from the Dinamap machine (See Table 1).

Results

Study hypotheses were tested by correlating physiological response, affect, and emotion variables obtained during Baseline 1 and the stress tasks with the outcomes (post-stress): Affect Change, Arousal Change, Emotion, and Physiological Response. In order to evaluate the validity of the third hypothesis (which task variables predict post-stress rumination?) a correlational analysis among physiological measurements (systolic and diastolic blood pressure, mean arterial pressure, and pulse rate) and questionnaire items was run, including the ratings of arousal, affect, and emotion rating scales among other items. See Figure

1 and Table 2 for means of physiological response throughout the phases of the protocol.

Concurrent and Predictive Findings

The main findings and statistical data are summarized in Tables 3, 4 and 5 in Appendix A, and mainly related to change in affect, arousal, self-efficacy, and outcome expectancy ratings. Heart rate reactivity to the Self-Focus task increased post-stress, which indicates that the higher the reactivity during the Self-Focus task, the more arousal the subject will report at recovery. Diastolic blood pressure reactivity during Self-Focus negatively correlates with Affect change, meaning that higher DBP during Self-Focus predicts more negative Affect (see Table 3).

In regards to Self-Efficacy ratings, a number of significant correlations suggest relationships between heart rate, SBP, and stress tasks. A negative correlation was found with Baseline-1 Heart Rate, indicating that Baseline-1 resting Heart Rate predicts a lower post-stress recovery Self-Efficacy rating. Positive correlations existed between Self-Efficacy and Autobiographical memory reactivity in both systolic blood pressure and heart rate readings. This indicates that higher physiologic reactivity to the Autobiographical Memory task predicted greater ratings of Self-Efficacy following these social stress tasks. The last reactivity correlation is a positive correlation between systolic blood pressure reactivity during Future Projection task and Self-Efficacy (See Table 3).

Emotions ratings concerning the various phases of the social challenge task indicated a positive correlation between Outcome Expectancy ratings and Anxious ratings during the Anger Experience task. This indicates that greater feelings of anxiety during the Anger Experience task predicted a higher Outcome

Expectancy for the specific problem that the individual is asked to present solutions for at the end of the social challenge tasks. Interested ratings (during Autobiographical Memory task) showed a positive correlation with Self-Efficacy, thereby showing that a heightened interest during this phase of the social challenge task co-varied with greater Self-Efficacy rating (see Table 4).

When overall changes in emotion were correlated against physiologic response reactivity from baseline to baseline (see Table 5), a significant correlation with change in Anger was noted. Higher reactivity of both SBP and Heart Rate showed a positive correlation with change in Anger, indicating that a greater reported increase in feeling angry predicted a greater change in physiological arousal over the course of the social stressor tasks.

There were no significant findings regarding Intrusive Thoughts.

Discussion

It is evident from the statistical results that an overall increase in Anger is related to higher Heart Rate and SBP reactivity. As the participant becomes increasingly angry over the social stressor tasks, they experience an increase in SBP and heart rate. This is to be expected, as the entire effort of the social challenge task is to induce anger, however it is important to note that those who undergo greater physiologic reactivity tend to become more angered over the social challenge. This finding is significant in that it lends support to the idea that participants who are more reactive to the anger-inducing scenarios are less likely to be able to calm themselves back to a normal physiological state even much later, after the social stressors have stopped.

The positive change in arousal associated with Heart rate during Self-Focus task indicates a reaction to the procedure. This increase in arousal may correspond to an initial response to the change in proceedings. Since prior to this first task the students were sitting quietly with a general lack of stimulation, the commencement of the tasks would logically induce an increase in arousal in response. The lack of continued arousal in the subsequent tasks may demonstrate that participants have adjusted to the new stimulus and returned to a resting state level of arousal, on the cognitive level.

A relationship between Positive Affect and blood pressure responses was evident also. Positive affect during the Self-Focus task was negatively correlated with DBP. This could be explained by asserting that positive attitude and attention to the subject allow the participant to be more relaxed about their responses and become less agitated (excited) while engaging in the Self-Focus task.

Yet another finding relates to the resilience factors, specifically Self-Efficacy. Interestingly, the positive correlations occur mainly in correspondence with Future Projection Reactivity, and indicate that greater physiological response during the Future Projection task are associated with higher self-reports of Self-Efficacy. This may mean that those who worry most about the future (and therefore have a greater reaction to the task) have spent more time working out their strategies for dealing with current and future problems, and therefore feel more confident in their abilities to conquer the upcoming challenges.

In summary, anger experience and self-efficacy were found to correlate with increased cardiovascular activity, the former associated with a possible stress vulnerability and the latter a stress buffering effect.

Implications for Future Studies

This study was limited in scope due to time and resource limits, as well as the fact that it was intended to serve as a pilot study for a much larger effort at a local high school. In order to create real validity, it will be necessary to administer the tasks and take the measurements on a larger group of more varying ethnicity and socioeconomic background. A longer study could also endeavor to follow these students into adulthood and evaluate their problem-solving methods, emotion regulation, and cardiovascular health later on in life. Related research efforts could include problem-solving workshops for participants who indicate that their social stressor management skills are not very effective, and investigating whether these skills would assist the individuals in maintaining cardiovascular health.

In any case, the point is clear: social environment has an effect on how healthy people are, right down to their heart. It is important to train children not only in academic skills, but also in social skills, as it might give them a longer life. There is still a great deal of research to be done in this field, but through these research efforts and others, great progress is being made in the lives of people belonging to all social classes.

Sources Cited

Cleveland Clinic. (2005). Heart disease: Coronary artery disease. **Retrieved April 19, 2005 from http://my.webmd.com/content/pages/9/1675_57851.htm.**

Davidson, K., MacGregor, M.W., Stuhr, J., Dixon, K, & MacLean, D. (2000) Constructive anger verbal behavior predicts blood pressure in a population-based sample. *Health Psychology 19* (1), 55-64.

Ewart, C.K. (2004) Social environments, agonistic stress, and elevated blood pressure in youth. In R. J. Portman, J. M. Sorof, & J.R. Ingelfinger (Eds.), *Clinical Hypertension and Vascular Disease: Pediatric Hypertension* (pp. 335-349). Totowa, NJ: Humana Press Inc.

Ewart, C.K. (1991) Familial transmission of essential hypertension: Genes, environments, and chronic anger. *Annals of Behavioral Medicine 13* (1) 40-47.

Gallo, L. C., & Matthews, K. A. (2003). Understanding the association between socioeconomic status and physical health: Do negative emotions play a role? *Psychological Bulleting 129* (1), 10-15.

Kamarck, T.W., Peterman, A.H., & Raynor, D.A. (1998) The effects of the social environment on stress-related cardiovascular activation: Current findings, prospects, and implications. *Annals of Behavioral Medicine. (20)* 4. 247-256.

Larkin, K.T., Semenchuk, E.M., Frazer, N.L, Suchday, S, & Taylor, R.L. (1998), Cardiovascular and behavioral response to social confrontation: Measuring real-life stress in the laboratory. *Annals of Behavioral Medicine. (20)* 4. 294-301.

Larson, C.A. (1998) The effects of defensive coping on the reporting of intrusive thoughts by young adult females. Unpublished doctoral dissertation. Syracuse University, Syracuse, New York.

Repetti, R.L., Taylor, S.E., and Seeman, T.E. (2002) Risky families: Family social environments and the mental and physical health of offspring. *Psychological Bulletin. 128* (2), 330-366.

Rothbart, M.K., and Ahadi, S. A. (2000) Temperament and personality: Origins and outcomes. *Journal of Personality and Social Psychology. 78* (1), 122-135.

Russell, J.A. (2003) Core affect and the psychological construction of emotion. *Psychological Review 110* (1), 145-172.

Scherer, K.R. (2000) Chapter 6: Psychological models of emotion. *The Neuropsychology of Emotion.* Oxford, University Press, 137-162.

Waldstein, S.R., Neumann, S.A., Burns, H.O., & Maier, K.J. (1998). Role-played interpersonal interaction: Ecological validity and cardiovascular reactivity. *Annals of Behavioral Medicine (20)* 4. 302-309.

Appendix A: Tables and Figures

Table 1. Table showing the timeline of administration of tasks and questionnaires in SSCT protocol.

Phase of Session	**Duration (# of readings)**	**Questionnaires administered**
Baseline 1	10 min (5 readings)	Arousal, Affect
Self-Focus	5 min (3 readings in last 3 min)	Arousal, Affect, Emotion Scales
Anger Experience	5 min (3 readings in last 3 min)	
Anger Vignettes (3)	3 min x 3 (3 readings each)	
Autobiographical Memory	5 min (3 readings in last 3 min)	
Future Projection	5 min (3 readings in last 3 min)	
Baseline 2	5 min (5 readings)	Arousal, Affect, Emotion Scales
Post Baseline	None	Emotion Scales and difficulty ratings for tasks, Self-Efficacy and Outcome Expectancy Scales, Rumination Scales

Table 2. Table showing means and standard deviations of systolic and diastolic blood pressure, mean arterial pressure, and heart rate during each phase of the SSCT.

Phase of Session	Systolic BP (SD)	Diastolic BP	Pulse	MAP
Baseline 1	114 (13.2)	65 (6.4)	72 (14.7)	82 (7.5)
Self-Focus	122 (13.8)	70 (6.9)	79 (14.7)	90 (8.2)
Anger Experience	126 (15.6)	75 (7.9)	84 (17.4)	95 (9.3)
Autobiographical Mem.	120 (16.1)	69 (6.6)	79 (12.7)	89 (8.6)
Future Projection	121 (14.1)	68 (7.0)	79 (13.2)	88 (7.3)
Baseline 2	110 (12.7)	60 (6.3)	73 (11.9)	79 (7.4)

Table 3. Correlation coefficients showing relationships between cardiovascular reactivity, affective predictor variables and core affect (arousal, positive affect), intrusive thoughts, and resilience (self-efficacy, outcome expectancy) when compared to post-stress recovery baseline.

Predictor	Arousal Change	Positive Affect Change	Intrusive Thoughts	Resilience SE	Resilience OE
Baseline CV Measures					
Baseline-1 SBP	.07	-.12	.19	-.29	-.23
Baseline-1 DBP	-.19	.05	.15	-.24	.05
Baseline-1 MAP	.06	.17	.11	-.08	.00
Baseline-1 HR	-.14	-.60	.23	**-.40***	-.17
CV Reactivity					
Self-Focus SBP-R	.23	-.03	.09	.19	.12
Self-Focus DBP-R	.20	**-.34***	-.06	-.10	-.07
Self-Focus MAP-R	.01	.09	.03	.09	.19
Self-Focus HR-R	**.38***	-.17	.03	.11	-.09
Anger Recall SBP-R	.23	.10	.11	.10	-.01
Anger Recall DBP-R	.12	-.19	.25	-.21	-.16
Anger Recall MAP-R	.14	.08	.13	.17	.09
Anger Recall HR-R	.31	-.14	.27	-.07	-.32
Self-Memory SBP-R	.01	-.08	.07	**.34***	.27
Self-Memory DBP-R	-.04	-.19	-.02	.27	.18
Self-Memory MAP-R	.01	-.23	-.09	.12	.03
Self-Memory HR-R	.13	.01	.09	**.42***	.18
Future Proj. SBP-R	.18	.11	.01	**.37***	.19
Future Proj. DBP-R	.16	-.13	-.10	-.02	-.15
Future Proj. MAP-R	.00	-.11	.01	-.01	-.02
Future Proj. HR-R	.32	-.10	-.13	.25	-.03

Table 4. Correlation coefficients showing relationships between emotion predictor variables and core affect (arousal, positive affect), intrusive thoughts, and resilience (self-efficacy, outcome expectancy) during the post-stress recovery baseline.

Predictor	Intrusive Thoughts	Positive Resilience SE	Positive Resilience OE
Emotions During Stressors			
Anger Experience			
Proud	-.04	.16	.24
Interested	.16	.17	.04
Anxious	-.11	.24	**.35***
Angry	.10	-.04	-.00
Sad	-.10	.14	.09
Self-Memory			
Proud	.26	.19	.18
Interested	-.12	**.40***	.24
Anxious	.11	.21	.12
Angry	.17	.18	.09
Sad	.05	.01	.05
Future Projection			
Proud	-.02	.29	.16
Interested	.01	.28	-.08
Anxious	.01	.14	.01
Angry	.08	-.03	.01
Sad	.12	.03	.23

Table 5. Correlation coefficients showing relationships between emotion predictor variables and cardiovascular reactivity during the corresponding social stressor task.

Baseline 2 Phys. Readings	SBP-R	DBP-R	MAP-R	HR-R
Change in Emotions from Baseline 1 to Baseline 2				
Proud	-.09	.17	.07	.12
Interested	-.28	.12	.13	-.04
Anxious	.09	-.07	-.10	.04
Angry	**.53****	.16	.08	**.39***
Sad	-.22	-.01	.16	.18

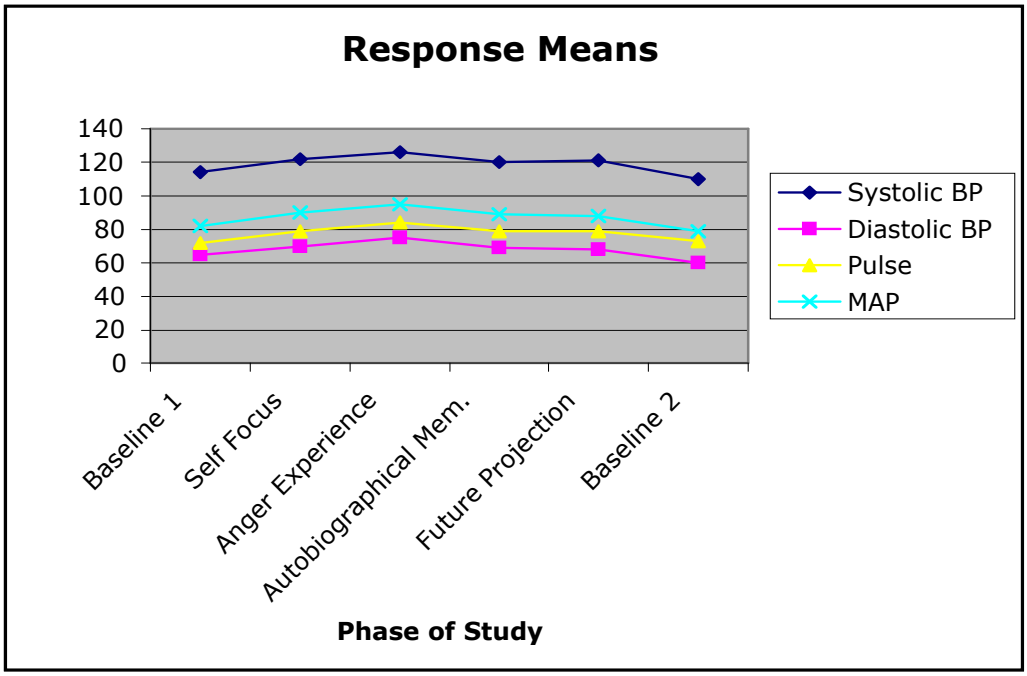

Figure 1. Graphical representation of the average response to the various phases of the SSCT.

Appendix B: Protocols and Ratings Scales Used During Experiment

Scale 1. Affect and Arousal Scales

FEELINGS AT PRESENT

By circling the appropriate number below, please indicate how you are feeling
at the present moment.

Extreme **sleepiness**								Extremely **high arousal**
1	2	3	4	5	6	7	8	9

Extremely **unpleasant** feelings								Extremely **pleasant** feelings
1	2	3	4	5	6	7	8	9

MENTAL EXERCISES

To understand your moods during the mental tasks, we would like to ask you how you felt when performing them.

Recalling a time when you felt very angry	*Not at all*						*Very much*
How difficult was this task?	1	2	3	4	5	6	7
How hard did you try?	1	2	3	4	5	6	7

How did you ***feel*** when doing this task?	*Very slightly or not at all*			*Moderately*			*Extremely*
Interested	1	2	3	4	5	6	7	8	9
Anxious	1	2	3	4	5	6	7	8	9
Angry	1	2	3	4	5	6	7	8	9
Proud	1	2	3	4	5	6	7	8	9
Sad	1	2	3	4	5	6	7	8	9

Sharing a Personal Memory	*Not at all*						*Very*
How difficult was this task?	1	2	3	4	5	6	7
How hard did you try?	1	2	3	4	5	6	7

How did you ***feel*** when doing this task?	*Very slightly or not at all*			*Moderately*			*Extremely*
Interested	1	2	3	4	5	6	7	8	9
Anxious	1	2	3	4	5	6	7	8	9
Angry	1	2	3	4	5	6	7	8	9
Proud	1	2	3	4	5	6	7	8	9
Sad	1	2	3	4	5	6	7	8	9

Imagining Your Future	*Not at all*	*Very*

How difficult was this task?	1	2	3	4	5	6	7
How hard did you try?	1	2	3	4	5	6	7

How did you ***feel*** when doing this task?	*Very slightly or not at all*				*Moderately*				*Extremely*
Interested	1	2	3	4	5	6	7	8	9
Anxious	1	2	3	4	5	6	7	8	9
Angry	1	2	3	4	5	6	7	8	9
Proud	1	2	3	4	5	6	7	8	9
Sad	1	2	3	4	5	6	7	8	9

PROBLEMS AND CHALLENGES

The mental tasks you have just performed involve dealing with potentially stressful problems or challenges. The final part of this experiment asks you to think about issues or situations you are dealing with now. As you think about your life right now, what is the greatest *problem or challenge* you face?

Consider any problem or challenge that confronts you *now,* including concerns about your academic work, living arrangements, relationships, job, transportation, money, career plans, family, health, or any other issues.

In the space below, indicate the most important problem or challenge that you face right now.

My *BIGGEST* problem or challenge right now is…

What thoughts come to mind when you think about this problem or challenge? Take a moment and describe in detail the problem and the typical thoughts that you have about it.

How often do you think about this issue during the course of a typical day?

Rarely or never		Infrequently		Sometimes		Frequently		All the time
1	2	3	4	5	6	7	8	9

By circling the appropriate number below, please indicate *how often* these comments are true about the problem or challenge you have described above.

	Not at all	Rarely	Sometimes	Often
I think about it when I don't mean to.	0	1	2	3
I avoid letting myself get upset when I think about it or am reminded of it.	0	1	2	3
I try to remove it from my memory.	0	1	2	3
I have trouble relaxing and closing my eyes, because thoughts about it come into my mind.	0	1	2	3
I have waves of strong feelings about it.	0	1	2	3
I have flashbacks about it.	0	1	2	3
I stay away from reminders of it.	0	1	2	3
I feel as if it isn't happening or isn't real.	0	1	2	3
I try not to talk about it.	0	1	2	3
Pictures of it pop into my mind.	0	1	2	3
Other things keep making me think about it.	0	1	2	3
I'm aware that I have a lot of feelings about it, but I don't deal with them.	0	1	2	3
I try not to think about it.	0	1	2	3
Any reminder brings back feelings about it.	0	1	2	3

My feelings about it are kind of numb. 0 1 2 3

FINAL QUESTIONS

The Experimenter asks the participant the following questions at the end of the experimental session. The questions should be asked while the audiotape recorder is still running, so as to capture the participant's verbal responses. The Experimenter collects the Post-Experiment questionnaire (SSCT_Post) and then says:

Thank you for completing all of these forms. Were any of the questionnaire items confusing, or did any cause problems?

Before we wrap this up, I'd like to ask you several questions. The questions are about the issue or situation you chose as the biggest problem or challenge you are facing now.

1. What problem or challenge did you write about?

2. What are some ways in which you could solve this problem?

3. What would be the most effective way to solve it?

4. What would you have to do to make this happen? What specific steps or actions would you have to take?

5. How *realistic* is this solution?

   On a scale of 1 to 10, with 1 = "Not at all realistic," and 10 = "Very realistic," please indicate how *realistic* this solution is.

6. How *confident* are you that you could take the actions (perform the steps) needed to implement this solution?

   On a scale of 1 to 10, with 1 = "Not at all confident," and 10 = "Very confident," please indicate how *confident* you are that you could take those steps.

7. If you took those steps, how *certain* are you that doing them would solve the problem?

   On a scale of 1 to 10, with 1 = "Not at all certain," and 10 = "Very certain," please indicate how *certain* you are that taking the steps you have described would solve the problem.