THE EFFECTS OF POSITIVE EMOTION, NEGATIVE EMOTION, FLOURISHING, AND LANGUISHING ON CARDIOVASCULAR RISK

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Positive psychology has led a movement that concentrates on positive characteristics. The current study examined the relationship between positive emotions, negative emotions, flourishing, languishing, and cardiovascular functioning. The study uses guided imagery to help participants recall a negative emotional event and positive emotional event in a counterbalanced order. The reverse order allowed us to examine the differential contributions of stress buffering versus facilitated recovery effects to higher levels of heart rate variability (HRV). The study also examined the relationship between mental health categories and known cardiovascular disease risk. Univariate analysis of variance revealed that positive emotions can serve as a stress buffer and dampen cardiovascular responses to a negative event. Also, analysis revealed a trend for the prediction that positive emotions can facilitate cardiovascular recovery following a negative event. Exploratory analysis did not reveal differences between a facilitated recovery group and a buffering group for cardiovascular measures. Future studies should include tighter control to help compare the differential influences of stress facilitation and stress buffering on cardiovascular functioning. The results from the study indicate that it is still too early to tell whether mental health buffers those individuals from developing CVD, and to answer whether languishing increases the risk of CVD. Longitudinal studies of young individuals without a prior history of any risk of CVD and who are flourishing or languishing might help provide answers to these questions.

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CHAPTER 1

INTRODUCTION

Over the last sixty years, psychology as a science has contributed an enormous amount of knowledge toward identifying and treating what is wrong with people (Seligman & Csikszentmihalyi, 2000). However, knowledge concerning what can go wrong has come at the cost of understanding what is right with people. Why has psychology focused so much on weakness rather than strengths? The current study proposes three reasons. First, guided by funding agencies, specifically the National Institutes of Mental Health and the Veterans Administration, psychology attracted researchers and clinicians who have added a significant amount of knowledge to in the understanding of the development and treatment of mental disorders (Seligman & Csikszentmihalyi, 2000). Psychology attempted to eliminate mental illness and in the process their research focused on negative characteristics rather than producing research that attempted to prevent mental illness. Keyes (2002) has argued that years of research has improved clinicians' ability to identify and treat people with mental illness, yet psychological research has not advanced to make it more possible to prevent people from acquiring mental illnesses.

A second reason for psychology's focus on trying to identify negative characteristics of the individual may stem from the nature and theories of psychological process. Humans automatically look for negative events to occur. Based upon evolutionary theory, negative events stand out in the environment, and therefore, are more recognizable than positive events (Cosmides & Tooby, 1992). As humans, it may be adaptive to have the ability to recognize potential dangers over positive rewards. Humans' ability to recognize potential threats may have had survival and reproductive consequences. For example, Cosmides and Tooby (1992) have demonstrated that people are better at detecting cheaters, or people that violate social contracts and benefit themselves without contributing to the group, than they are at recognizing altruists, or people that contribute to a group.

A third reason for psychology's focus on negativity is that negative information violates expectations (Olson, Roese, & Zanna, 1996). For example, positive events and positive interactions occur routinely and at a higher frequency than do negative events (Gable & Haidt, 2005). When asked to report over the last week how often they experienced positive social interactions compared to negative social interactions. Participants reported that positive interactions compared to negative interactions occurred at a rate of 3 to 1 (Gable & Haidt, 2005). It has been suggested that since positive events and processes occur at a higher rate, positive subject matter sometimes is ignored and takes longer to discover. For example, not until recently have researchers discovered that people who are happy and feel good tend to live longer healthier lives (Frederickson, 2003). Therefore, the movement towards positive psychology was a result of the recognition that positive events occur more often and studied with less frequency than negative events (Seligman & Csikszentmihalyi, 2000).

Positive Psychology

Positive psychology has been defined as the study of optimal functioning or flourishing that contributes to the well-being of people's lives (Keyes, 2002). Positive psychology under the leadership of Martin Seligman has not necessarily proposed to do away with research that examines mental illness, but rather to include research that exposes how positive events add to our knowledge of how to live a longer healthier life. Seligman and Csikszentmihalyi (2000) suggest that by limiting research to purely focus on disease and weakness, psychology will limit its ability to contribute to scientific progress. Yet, positive psychology, in only eight years of existence, has made great scientific progress and has contributed towards our understanding that most people are happy and that positive events have the ability to protect individuals from negative physical outcomes. Sheldon and King (2001) define positive psychology as the discipline that studies ordinary people. Sheldon and King (2001) also believe that what is typical is normally positive. For example, 9 out of 10 Americans report being happy and the majority of people around the world report having above-average life satisfaction (Myers, 2000; Diener & Diener, 1996). Positive psychology is also beginning to predict emotional and psychological well-being, physical health, and longevity by studying positive emotional expression in young adults. Looking for positive emotional content in the photos of young women, Harker and Keltner (2001) found that women who expressed more positive emotion had better psychological well-being and marital satisfaction. Danner, Snowdon, and Friesen (2001) with their groundbreaking research examined the autobiographical essays of young Catholic nuns. Their research revealed that nuns whose essays contained more positive emotional content lived longer than nuns whose essays lacked positive emotional content. Research is showing that people who think positively and feel good live longer lives. Additionally, these discoveries have lead to more questions in need of being answered. Specifically, how do positive characteristics and positive events protect us from stressful events and contribute to people living longer healthier lives? The purpose of the current study is an attempt to answer some of these questions.

Flourishing

Keyes (2007) has devised a system that makes it easier to identify people that are doing well and to measure the potential positive influences on health and well-being that optimal mental functioning may provide. According to Keyes (2002) to flourish means to have good mental health, and includes the presence of high levels of emotional, psychological, and social well-being. This definition of flourishing measures mental health as a complete state that consists of the presence of positive emotion and positive functioning rather than just the absence of mental illness (Keyes, 2004). A good sign that one is flourishing is having great emotional health, living positively in one's private life and social life, being productive, and missing fewer days of work. Specifically, flourishers score high on instruments that measure emotional, psychological, and social well-being (Keyes, 2002).

Emotional well-being is a state of positive feelings and the absence of negative feelings. Emotional well-being is a cluster of positive symptoms and, according to Keyes (2002) can be obtained by having individuals identify how much of the time over the last thirty days they felt the presence of positive emotion (e.g., cheerful, extremely happy) and the absence of negative emotion (e.g., hopeless). Psychological well-being is also included in the measurement of flourishing. Individuals who report high levels of psychological well-being are said to like most parts of their personality, have a good sense of the direction their life is taking, and to like the person into which they are developing into. A final component of flourishing includes a measure of social well-being, which includes the evaluation that one is doing well socially and that the individual sees themselves as contributing to society.

Where flourishing is characterized as the presence of mental health, the absence of mental health is described as languishing (Keyes, 2002). Languishing describes people who feel empty and who have low levels of emotional, psychological, and social-well being (Keyes, 2002; Keyes, 2005). Although languishing has a higher prevalence rate than depression, languishers are not mentally ill. According to a national survey about 18% of the American population are flourishing and 17% are languishing (Keyes, 2005). Comparable to people who are depressed, adults who are languishing have high emotional distress, limitations in their daily activities, and miss more work days (Keyes, 2004).

Research indicates that flourishing individuals are resilient, productive, and experience a high level of positive emotions (Keyes, 2002). Additional evidence suggests that flourishing individuals can cultivate and experience positive emotions to negative emotions at a ratio of about 3 to 1, which characterizes good mental health (Frederickson & Losada, 2005). Therefore, the experience of positive emotions emerges as an important promoter of individual flourishing. Positive emotions are said to have beneficial effects on physical health; however, few studies exists that explain the mechanism by which positive emotions promote physical health. The current study is an attempt to show that positive emotions can serve as a stress buffer and facilitate post-stress recovery of cardiovascular consequences that can benefit physical health.

Why Study Positive Emotions

Researchers have tended to focus on negative emotions because unlike positive emotions, they are said to be easier to define, observe, and measure (Krantz & McCeney, 2002). It was assumed that only negative emotions have specific-action tendencies with specific physiological responses (Frederickson, Mancuso, Branigan, & Tugade, 2000). For example, fear can result in fleeing, while anger can initiate attack and both emotions result in an increased heart rate and blood pressure (Frederickson et al., 2000). Meanwhile, there existed a consensus that positive emotions only have action tendencies that are vague and are accompanied by diffuse physiological responses (Frederickson & Levinson, 1998). Despite the preponderance of evidence suggesting that negative emotions influence physical health, hypotheses regarding positive emotions and the possible health benefits they may provide have emerged in the literature. Specifically, three hypotheses have been identified in the literature as possible mechanisms in which positive emotions can benefit physical health. First, positive emotions can buffer against the negative influence of negative emotions and stress. Second, in times of stress, positive emotions can be drawn upon to reduce negative cardiovascular responses. Additionally, positive emotions can be used to recover from negative cardiovascular responses.

Positive Emotions Can Act as Stress Buffers

Negative emotions such anxiety, sadness, depression, and anger have routinely been found to be predictive of poor health outcomes. The experience of negative emotions and stress has been known to cause recurrent or long-term activation of the cardiovascular system that can result in physiological responses that lead to arterial damage or myocardial deregulation. For example, the chronic experience of negative emotions has been predictive of ischemia in patients with cardiovascular disease (CVD; Pressman & Cohen, 2005). It is also known that individuals with the strongest physiological reactions to stress are at the highest risk for developing CVD (Treiber et al., 2003).

A review of the literature suggests that physiological reactions to stress can be influenced by negative emotional states. When compared to positive emotions, negative emotions such as anger and anxiety show higher increases in blood pressure and heart rate (Pressman & Cohen, 2005). Shapiro, Jamner, Goldstein, and Delfino (2001) using daily journal entries and 24-hour ambulatory blood pressure monitoring reported that individuals' daily accounts of negative emotion were associated with elevated changes in blood pressure. The researchers also found that the higher the reported intensity of the negative emotional state, the higher the increase in blood pressure and the longer the blood pressure took to return to normal (Shapiro et al., 2001). In a study on a facial manipulation task, participants were to express sadness, fear, anger, and happiness (Boiten, Frijda, & Wientjes, 1994). Anger, fear, and sadness were all associated with the highest increases in heart rate, while the expression of happiness had the smallest increase (Boiten et al., 1994). Therefore, negative emotions are linked to an increase in heart rate and longer cardiovascular recovery time. Taking into account the overwhelming evidence that negative emotions affect health, how might positive emotions be beneficial in moderating the influences of negative emotion and stress?

Psychological mechanisms that have the ability to dampen physiological reactivity and can mediate negative consequences to environmental challenges are referred as stress buffers (Pressman & Cohen, 2005). The capacity to produce and draw upon positive emotions during stressful events is one way that positive emotions can serve as stress buffers and influence physical health (Pressman & Cohen, 2005). It has been shown that some individuals have the ability to use positive coping strategies, such as positive appraisal and positive meaning-making while enduring hardship and failure (Folkman & Moskowitz, 2000). For instance, men who were able to create a positive meaning out of a situation that required long-term care and support for their partners with AIDS reported less stress associated with care giving (Folkman & Moskowitz, 2000). Women who used positive reappraisal reported greater well-being despite prolonged hospitalization from childbirth complications (Affleck & Tennen, 1996). These positive coping strategies are related to positive emotion and have been used to predict psychological and physical health (Affleck & Tennen, 1996). These results indicate that positive emotions contribute to an individual's ability to cope and thus enhance one's psychological and physical well-being.

Regardless of the previously mentioned findings the question remains: can positive emotions regulate harmful physiological effects of negative emotion in the midst of stress? Smith and Baum (2003) have suggested that positive emotions may encourage restorative activities such as sleep and relaxation. Smith and Baum (2003) believe that these restorative activities reduce the frequency in which people respond with negative emotions to environmental challenges. They also contend that positive emotions release endogenous opioids which diminish autonomic responses activated by negative emotional responses to stress. Despite these findings, to my knowledge no one has specifically examined the possible stress-buffering influences of positive emotions to limit or prevent harmful cardiovascular responses due to negative emotions in the midst of stress?

Positive Emotions Can Act as Cardiovascular Facilitators

In addition to serving as possible stress buffers, positive emotions may also facilitate cardiovascular recovery from stress related events and from the experience of negative emotions. Frederickson (1998) has devised a model of positive emotion that differs significantly from the framework of negative emotion and subsequent specific-action tendencies, the broaden-and-build theory of emotion. The broaden-and-build theory of positive emotion is a useful model in which to help explain how some individuals can utilize positive emotions when life is upsetting (Frederickson, 1998). The broaden-and-build theory of emotion infers that positive emotions can broaden an individual's thoughts and action, while simultaneously building long-lasting resources that an individual can utilize in the future (Frederickson, 1998). According to the broaden-and-build theory of emotions when an individual experiences joy, this positive emotion can guide an individual to broaden and expand their behaviors to include play, intellectual, or artistic activities (Fredrickson, 1998). Concurrently, joy can build social resources by means of playing with others, and also assist in the development of intellectual abilities by generating knowledge or even possibly artistic abilities (Frederickson et al., 2000).

Researchers have suggested that the broadening function of positive emotion can lessen the influence that negative emotion has on a person’s mind set (Frederickson, 1998). Therefore, positive emotions can undo the specific-action tendency, such as undo increases in heart rate or blood pressure as a result of negative emotions (Frederickson & Levinson, 1998). The narrowing of specific-action tendencies related to negative affect is followed by cardiovascular activity that mobilizes the body for action; while Frederickson and Levinson (1998) hypothesize that positive emotions broaden thought- action tendencies; and therefore, positive emotions should undo the lingering cardiovascular effects of negative emotions (Fredrickson & Levinson, 1998). To test the undoing hypothesis of positive emotions Frederickson and Levinson (1998) used a speech task to induce anxiety that would cause an increase in heart rate. The researchers then had participants’ watch a neutral film clip, a sad film clip, or positive-emotion film clip. The participants who watched the positive film clip had faster cardiovascular recovery as exhibited by heart rate returning to baseline quicker than the neutral and sad film clips, with sad clips showing the slowest return to baseline.

Might certain individuals therefore have the psychological resources to use their mental flexibility and apply positive emotions to their advantage in times of stress? Research suggests by way of the broaden-and-build theory that positive emotions produce health and well-being (Frederickson, 1998). By compounding over time, positive emotions therefore have the ability to make individuals’ lives healthy, resilient, and flourishing. Might it be possible then that some individuals may be better at using positive emotions to help them facilitate cardiovascular recovery in times of stress? Flourishing individuals, who are characterized as experiencing a higher degree of positive emotion to negative emotion, then may have a greater ability to facilitate cardiovascular recovery than others because they can manage their emotional lives better in times of stress (Keyes, 2002).

Cardiovascular Disease and Psychological Influences

According to the Centers for Disease Control and Prevention (CDC), current evidence indicates that multiple casual factors, including behavioral lead to cardiovascular disease (CDC, 2003). For example, depression has been shown to be a cause for the development of CVD (Ariyo et al., 2000; Feketich, Schwartzbaum, Frid, & Moeschberger, 2000). As well, the risk for cardiovascular mortality six months post myocardial infarction increases as depressive symptoms increase (Frasure-Smith, Lesperance, & Talajic, 1993). Physiological contributors to CVD include hypertension, elevated levels of total serum cholesterol, low-density lipoproteins (LDL), triglycerides, and low levels of high-density lipids (HDL) (Oloughlin et al., 1996; Wilson, 1989). However, not everyone who is depressed or stressed has CVD (Keyes, 2004); therefore, researchers are increasingly directing their attention towards behavioral factors that might act as stress buffers and have positive effects on health and well-being (Keyes, 2007).

Heart Rate Variability

Physiological researchers are increasingly emphasizing the importance of examining heart rate variability (HRV) as an index of CVD risk and illness. The primary system involved in physiological and cardiovascular responses is the autonomic nervous system (ANS; Harris & Matthews, 2004). The ANS is further divided into two branches: an excitatory sympathetic nervous system (SNS) and an inhibitory parasympathetic nervous system (PNS). The SNS and PNS often interact antagonistically in order to produce physiological responses to environmental changes (Guyton & Hall, 2000). HRV, then, depends upon the activity of both parasympathetic and sympathetic influences on the heart muscle (Task Force, 1996). In times of psychological stress, the SNS is the dominant branch and produces physiological responses to assist individuals in responding to environmental challenges (Guyton & Hall, 2000). An increased heart rate is one of many physiological responses of the SNS and is indicative of SNS arousal (Appelhans & Luecken, 2006). During the absence of psychological stress, the PNS predominantly operates, and as a result, a lower degree of physiological activity will result as evident by a lower heart rate (Appelhans & Luecken, 2006).

The heart is innervated with nerve branches of the SNS and PNS that can regulate the heart rate via the sinoatrial node (Guyton & Hall, 2000). The sinoatrial node produces multiple action potentials that cause the heart muscle to contract in an orchestrated manner, resulting in a heartbeat (Guyton & Hall, 2000). Sympathetic nerve fibers have an excitatory action and increase the firing rate of the sinoatrial node, which results in an increased heart rate (Guyton & Hall, 2000). Parasympathetic nerve firings result in an inhibitory action on the sinoatrial node and produce a decreased heart rate (Guyton & Hall, 2000). The parasympathetic and sympathetic nervous system modulate the time between consecutive heartbeats, or interbeat intervals, with a slower heart rate corresponding to longer interbeat intervals and increased HRV (Task Force, 1996). An increase in sympathetic activity with or without a decrease in parasympathetic activity or tone can lead to a decreased HRV (Task Force, 1996). Increased parasympathetic tone can also result in an increase in HRV due to increased parasympathetic activity relative to sympathetic activity (Task Force, 1996).

The parasympathetic and sympathetic nervous system have separate communication mechanisms. Parasympathetic influence on the heart is regulated by acetylcholine transmission and has a very short effect, with peak effects occurring at about 0.5 seconds, with a rapid return to baseline of 1 second (Bernston et al., 1997). SNS influence on heart rate is influenced by norephinephrine, and compared to PNS, this influence is relatively slow. The peak effect of SNS control happens in 4 seconds, returning to baseline in approximately 20 seconds (Bernston et al., 1997). The changes in heart rate responses produced by the parasympathetic and sympathetic nervous systems communication occur at varying speeds, or what has been termed frequencies (Task Force, 1996). Power spectral analysis is used to separate the Electrocardiogram (ECG) interbeat interval variance into a spectrum of frequencies. It is generally agreed that high-frequency (HF) HRV (0.15-0.40 Hz), analyzed using power spectral analysis is a measure of cardiac parasympathetic influences (Task Force, 1996). HF HRV can be influenced by respiration, which operates under the control of the parasympathetic nervous system. Therefore, it has been recommended to control for respiration because breathing may influence HRV measurements (Appelhans & Luecken, 2006). In addition, low-frequency (LF) HRV happens at the frequency between 0.04-0.15 Hz (Appelhans & Luecken, 2006). It has been reported that LF HRV is the degree to which the sympathetic nervous system activity dominates (Task Force, 1996).

The autonomic influence on heart rate can be modulated by brain areas known as the central autonomic network (CAN; Benarroch, 1993). The CAN includes cortical areas (prefrontal cortex), limbic areas (amygdala, hypothalamus), and brainstem areas (medulla; Benarroch, 1993). Benarroch (1993) indicates that the CAN is able to receive visceral afferent communication from sensory processing areas regarding the external environment. Benarroch

(1993) also suggests the CAN is then able to integrate the sensory information concerning the environment and respond by producing behavioral and emotional responses. In addition, the CAN has the ability to produce physiological responses via efferent SNS and PNS pathways that communicate to the sinoatrial node, and can directly influence heart rate (Benarroch, 1993). Therefore, HRV can reflect the moment-to-moment output of the CAN, as the CAN has the capacity to regulate and generate physiological responses in the context of emotional and behavioral expressions (Appelhans & Luecken, 2006).

An ANS that can produce and regulate physiological arousal rapidly in response to situational demands is referred to as a flexible ANS (Appelhans & Luecken, 2006). In contrast, autonomic rigidity is referred to the system's reduced capacity to change physiological responses to accord with environmental challenges (Guyton & Hall, 2000). Many researchers suggest that the inability to regulate emotions coupled with the inability to cope with stress can alter the long-term physiological responses to stress (Luecken, Rodriguez, & Appelhans, 2005). Therefore, HRV is a measure that can be used to examine the continuous relationship between parasympathetic and sympathetic activity on heart rate, and represents an investigative link between mental and emotional states and CVD (McCraty et al., 1995).

Uplifting Events, Negative Events, and Stress

The cognitive interpretation of an event has profound implications for the behavioral and subsequent physiological responses that follow. Individual differences of stress appraisal foster autonomic changes of the nervous system to mobilize the body's energy resources in order to take action (Fischer, Shaver, & Carnochan, 1990). One way the body prepares itself to move is by increasing cardiovascular responses in response to an environmental stressor. Research data suggests that the way an individual appraises stress, as challenge or threat, results in distinct heart rate, blood pressure, and total peripheral resistance responses (Fontana & McLaughlin, 1998.)

According to the transactional model of stress, the cognitive appraisal of an event determines whether or not a potential event will be perceived as being stressful (Lazarus & Folkman, 1984). Two kinds of cognitive appraisals have been identified: primary and secondary appraisals. In primary appraisal, the individual evaluates the environmental event and determines whether or not potential harm or benefits are present (Folkman et al., 1986). In secondary appraisal, the individual assesses whether or not he or she has the resources to cope with the current event (Folkman et al., 1986).

Under the umbrella of primary appraisals there exists the differentiation between threat and challenge appraisals. According to Lazarus and Folkman (1984) challenge appraisals are those events in which the perception of danger does not exceed the ability to cope. Challenge appraisals bring forth a facility to overcome and conquer obstacles and challenges (Lazarus, 1999). For example, an upcoming public presentation can be appraised as an opportunity to discuss one’s ideas and to realize that the people who are coming to see the presentation are interested in what one has to say. In addition, college students who believe that they are fully prepared for an upcoming exam feel challenged and eager to perform the task. Concurrently, research indicates that individuals who appraise situations as challenging tend to experience greater positive emotions and have decreases in total peripheral resistance (TPR) of the vasculature, which is associated with cardiovascular health and lower blood pressure (Maier, Waldstein, & Synowski, 2003). Threat appraisal, however, incorporates a component of a perception of loss and a potential for danger (Lazarus & Folkman, 1984). Threat appraisal is connected to a sense that one cannot adequately perform to a set standard that is personally acceptable (Lazarus, 1999). Threat appraisals have reflected a tendency to have succeeding negative emotional responses, such as fear and depression, and shown increases in TPR (Fischer et al., 1990). In addition, individuals who are susceptible to experience anxiety are prone to appraise stressors as threatening and show subsequent increases in heart rate (Schwebel & Suls, 1999).

This study uses an alternative to assessing cognitive appraisals of an event and uses a similar model to predict that imagery techniques to induce positive and negative emotions are sufficient. Thus, the use of imagery as an alternative to the use of films, creating a math task, reading a word list with emotional meaning, or staging an activity to create a stressful condition, has been shown to be a reliable means to induce positive and negative emotional states (Lang, 1995). As well, research on the induction of emotional states suggests that positive and negative emotions can alter physiological processes when participants recall personally relevant material. For example, Knapp et al. (1992) had participants recall either a negative or a pleasurable personal experience. Following the recall of the personal experience researchers took blood draws to investigate immunological changes. They reported a decrease in natural killer cells among participants who had recalled a negative experience.

Positive Emotion, Flourishing, and Cardiovascular Functioning

The current study examines the relationship between positive emotion, flourishing, and cardiovascular functioning. I used psychophysiological data, specifically HRV, to explore the cardiovascular components of flourishing and languishing to understand the role that positive emotions have in regulating cardiovascular responses associated to stress. The study predicts that positive emotions act as stress buffers and dampen cardiovascular reactivity to negative emotional events. I also predict that positive emotions assist flourishing individuals in regulating the physiological consequences produced by negative emotions.

Although no studies to my knowledge directly explore the relationship between psychological flourishing and HRV, mental health has been shown to have a demonstrable relationship to CVD. Specifically, depression has shown to be an independent risk factor for CVD (Ariyo et al., 2000; Ferketich, Schwartzbaum, Frid, & Moeschberger, 2000). Depression also predicts mortality six months post myocardial infarction (Frasure-Smith, Lesperance, & Talajic, 1993). Research identifying adults as being moderately mentally healthy found that such adults were 1.5 times more likely than flourishing adults to have CVD (Keyes, 2004). Languishing adults were 1.5 times more likely than flourishing adults to have CVD (Keyes, 2004). In addition, individuals who were identified as both languishing and depressed were 3.0 times more likely than flourishing adults to have CVD (Keyes, 2004).

Although relatively few studies have examined the possible relationship between flourishing, positive emotions, and HRV, there exists evidence that mental health and positive emotions have cardiovascular health benefits. For example, individuals who reported experiencing a higher ratio of positive emotions to negative emotions had lower rates of any CVD (Cohen & Pressman, 2006). Research on optimism, the experience of a positive outlook regarding the future, revealed improved recovery following coronary artery bypass surgery and at 6 month follow-up (Carver & Scheier, 2002). The experience of positive emotion has also been shown to benefit individuals with cardiovascular disease. Patients with cardiovascular disease who reported that they experienced frequent moments of positive emotions every day for

90 days after being released from the hospital had fewer return and readmission rates to the hospital (Middleton & Byrd, 1996).

There is evidence that individuals have differing HRV responses to negative emotional events. For instance, compared with non-anxious individuals, anxious individuals evidenced a reduction in HRV in response to a worry-inducing event (Thayer, Friedman, & Borkovec, 1996). Trait anxiety and social anxiety have also been associated with reduced HRV (Sgoifo et al., 2003). Several studies have been conducted that compare the results of depressive states and the effects on HRV. One study reported that bereaved individuals had lower resting HRV compared to non bereaved individuals (O'Connor, Allen, & Kaszniak, 2002). Similarly, Rechlin, Weis, Spitzer, and Kaschka (1994) found that patients with a major depression disorder also showed reduced resting HRV. It has also been shown that perceived stress throughout the day is predictive of a low HRV (Sloan et al., 1994). Changes in HRV have been reported among men and women who had reported enduring persistent stress over the last week (Dishman et al., 2000). Several studies have shown that individuals diagnosed with depression when given a psychological stressor show even more dramatic reductions in HRV, because of the incremental effects stress has on parasympathetic tone (Joynt, & O'Connor, 2005). The results of a study among mildly depressed patients who had cardiac disease during a stress task showed greater reductions in HRV than individuals with no depression.

In addition to benefiting physical health, positive emotions are related to mental health. Positive emotions may serve as a facilitator and buffer to the consequences of acute and chronic stress (Folkman & Moskowitz, 2000). Empirical support indicates that in times of chronic stress, positive emotions may interrupt the rumination cycle seen in clinical depression and therefore prevent depression (Gross & Munoz, 1995). Moskowitz, Acree, and Folkman (1998) found that men who experienced depression reported a higher level of negative emotion and had lower reports of experiencing positive emotion. Based upon the most recent data available, Folkman and Moskowitz (2000) conclude that individuals who do not experience positive emotions daily are more likely to become depressed if they experience a high level of negative emotion.

Previous research shows that cardiovascular changes are influenced by psychological differences. In addition, research indicates that positive emotions can have direct cardiovascular benefits by regulating the physiological consequences of negative emotions. Research has demonstrated that induced states of positive emotions can speed cardiovascular recovery from the influence of negative emotion (Fredrickson, Mancuso, Branigan, & Tugade, 2000). Previous research also suggests that positive emotion may dampen the influence of the SNS, and thus decrease arousal while facilitating cardiovascular recovery from stress related events (Cohen & Pressman, 2006).

The present study aimed to demonstrate that languishing individuals when compared to flourishing individuals would have negative cardiovascular activity in response to a stressful negative event as evidenced by a higher heart rate, increased LF/HF HRV ratio, and decreased HF HRV. In addition, I predict that flourishing individuals will show a lower heart rate, a decrease in the LF/HF HRV ratio, and greater HF HRV compared to languishing individuals when an induced positive event immediately follows an induced negative adverse event. This prediction is based upon the broaden-and-build theory of positive emotion. Because flourishing individuals are characterized as being free of depression as well as having the presence of positive emotion and positive functioning, the study hypothesizes that their experiences of positive emotion assist in their ability to regulate negative emotions and adapt to change.

The principal goal of the current study was to measure HRV continuously as each participant recalled a real-life uplifting or negative event. The study also used a self-report questionnaire that measures flourishing, moderate mental health, and languishing to examine the relationship between mental health and HRV. The specific questions the current study addressed are the following.

Hypotheses

Hypothesis 1: Flourisher versus languishers during a positive event and during uplifting imagery will exhibit better cardiovascular functioning.

Hypothesis 1a: The study predicts that flourishers during a positive emotional event would exhibit a decreased LF/HF ratio, decreased HR, and increased HF HRV compared to baseline and relative to languishers.

Hypothesis 1b: The study proposes that uplifting imagery alone will result in a better LF/HF ratio, HF, and HR than baseline imagery.

Hypothesis 2: Flourishers versus languishers when a positive event precedes a negative stressful event will exhibit a smaller increase in heart rate, a decreased LF/HF ratio, and smaller decrease in HF HRV.

Hypothesis 2a: I predict that flourishers relative to languishers will be able to benefit from the experience of positive emotions during the induced negative event; as a result flourishers will show smaller increases in heart rate, a decrease in LF/HF HRV ratio, and smaller decrease in HF HRV.

Hypothesis 2b: I predict that an induced positive emotional event will serve to dampen the cardiovascular influences of a subsequent negative emotional event.

Hypothesis 3: Flourishers versus languishers when a positive event follows a stressful event will exhibit a decreased LF/HF HRV ratio, increased HF HRV, and lower heart rate.

Hypothesis 3a: The study aims to demonstrate that quicker cardiovascular recovery from negative emotional arousal would be attributable to flourishing individuals being able to draw upon their experience of positive emotions. I predict that flourishing individuals are more likely than languishing individuals to incur cardiovascular benefits.

Hypothesis 3b: I predict that an induced positive emotional event will facilitate cardiovascular responses from a preceding negative emotional event.

Hypothesis 4: I will attempt to examine the effects of facilitated recovery versus stress buffers.

To my knowledge no prior study has examined recovery facilitators and cardiovascular buffers in the same study. Therefore, the current study will examine the differential effects of facilitated recovery from a negative event versus a positive-cardiovascular buffer in order to determine if the beneficial effect of one process exceeds that of the other.

Hypothesis 5: Flourishing versus languishing and emotional experience and recollection.

The study hypothesizes that flourishers will report a greater experience of positive emotions and has a greater recollection of the imagined uplifting event and report a lesser experience of negative emotions and a lower recollection of the imagined stressful event. The converse is expected for their languishing counter parts.

Hypothesis 6: Flourishing versus languishing and CVD.

Research continues to accumulate suggesting that psychological factors such as anger and depression are major risk factors for the development of CVD. Additionally, researchers are increasingly trying to identify mental health factors that promote positive influences on physical health. Recently, Keyes's (2004) identified languishing g adults to be 1.5 more likely than flourishing adults to have reported having CVD. However, Keyes (2004) did not specifically examine the relationship between flourishing and physiological predictors of CVD, specifically lipid profiles and blood pressure (BP). Therefore, additional research should help clarify the relationship among CVD risk and mental health measures of flourishing and languishing in order to promote positive mental health and reduce CVD. I hypothesize that flourishers will have reduced cardiovascular risk and languishers will have increased cardiovascular risk. I predict that flourishers will have significantly higher baseline HRV compared to languishers. I expect flourishers to have significantly lower LDL and Triglycerides, while having higher HDL compared to languishers who will have significantly higher LDL and Triglycerides, and lower HDL. I also predict that flourishing will be associated with lower diastolic and systolic BP, and languishing will be associated with higher diastolic and systolic (BP).

CHAPTER 2

METHOD

Participants

Students enrolled in introductory psychology courses and were recruited from the University of North Texas campus using class announcements. For students enrolled in the introductory psychology courses research credits were given to satisfy course requirements. Participations that were recruited through class announcements were given extra credit from their class professor. Participants were required to participate in two phases. Participants were undergraduates from the University of North Texas aged 18 to 55 (M = 21.39, SD = 4.78). The sample consisted of 505 participants for Phase I and 297 for Phase II. Due to missing data on demographic and physiological variables, the final sample consisted of 501 participants for Phase I, 265 participants for calculated low density lipids (LDL) and triglycerides, 297 participants for systolic blood pressure (SBP) and diastolic blood pressure (DBP), 276 participants for low frequency (LF) heart rate variability (HRV) and 274 participants for high frequency (HF) HRV. The sample size is reported when appropriate, due to differences in samples size depending on the analyses being conducted. The sample for both Phase I and Phase II consisted of 58% Caucasian, 19% African American, 12% Hispanic, and 11% of other or unspecified ethnic background.

Physiological Measures

Heart Rate Variability

Frequency domain methods are sensitive to immediate changes in HRV and are more susceptible to error over time; therefore, frequency domain methods are recommended for use with brief recordings of HRV (e.g., five minutes or less). Frequency domain methods involve calculating the power spectral density (or the distribution of signal power) to determine how the variance in R-R intervals is distributed as a function of time. R-R interval data is represented on a tachogram, with R-R intervals (seconds) plotted on the *y*-axis and total number of beats plotted on the *x*-axis. Fourier transformations are used to convert the tachogram into a power spectral display, in which power spectral density (s^2/Hz) is plotted on the *y*-axis and frequency (Hz) is plotted on the *x*-axis. The area under the curve represents the power of spectral components and is presented in absolute units (ms^2). The total power of a signal, integrated over all frequencies, is equal to the variance of the entire signal. Frequency domain methods can be parametric or nonparametric, yet there are some disadvantages to using the parametric analyses (Task Force, 1996).

Three components are calculated using the frequency domain method: very low frequency (VLF), LF, and HF. These measures are reported in frequency (Hz) or normalized units (nu). HF and LF represent the variation in changes in the autonomic modulations of heart period. It is suspected that HF is primarily a measure of parasympathetic or vagal activity (Task Force, 1996). LF has been supposed to be a measure of primarily sympathetic nervous activity with little vagal activity (Task Force, 1996). An LF/HF ratio represents a measure of sympathetic/parasympathetic balance or sympathovagal balance. Researchers dispute the physiological functioning that VLF represents and has not been clearly defined in the HRV literature, therefore the current study will not analyze VLF (Task Force, 1996).

Bio Graph Infiniti 4.0 (Thought Technology Computerized Biofeedback Systems) was installed and used as a computer-assisted electrocardiogram (ECG) that records and monitors HRV and heart rate. The ECG signal is measured in micro-volts (μV). Heart rate was measured in beats per minute (bpm) and interbeat interval (IBI) was measured in milliseconds (ms). A ProComp Infiniti 8 channel signal encoder was used to record HRV by connecting to the desktop PC via fiber optic cable. To record ECG on the ProComp Infiniti, I used a Triode ECG-Flex/Pro sensor. I placed the electrodes on the participant's forearms as it was determined too invasive for chest placement. The negative lead of the electrode was placed on the right forearm and the positive and ground leads were placed on the left forearm. I used an extender cable and Uni-Gel electrodes too enhance the quality of the ECG signal.

The ProComp Infiniti signal encoder was also used to collect respiration amplitude so I could better calculate the inter-beat-interval of the heart, a measure of HRV. The respiration sensor consisted of a long Velcro™ strap that was stretched around the participants' abdomen. The respiration signal received from the respiration sensor is a measure of chest expansion.

Respiration was also measured to account for errors in HRV measurement caused by breathing. Experimenters were asked to document environmental or behavioral factors that might cause error in HRV during recordings. These possible errors were checked with the raw data after all data had been collected. Respiration recordings were used to determine where errors had been made and to determine which portion of the recording needed to be deleted from further analysis. Each minute of electrocardiographic data was visually inspected for errors in respiration and signal detection. Two trained upper level doctoral students examined the raw ECG and respiration data for errors and conducted all data cleaning. The raw ECG data for each HRV variable that was more than one standard deviation above the mean was examined. The raw ECG data was then evaluated for irregularities as well as irregular patterns in respiration. Raw ECG data with a peak or drop greater than or equal to 50 µV were deleted. Once scanned and cleaned, HRV variables that had errors were re-calculated, re-entered, and re-checked for data entry errors by trained laboratory staff.

Blood Pressure (BP)

BP was obtained by taking consecutive readings from the left arm while the participant was seated. After the participant had rested for 5 minutes, two BP readings were obtained at 2-minute intervals. If the difference between the two readings was equal to or less than 5mm Hg, then the mean of the two readings was considered as the measurement. If the difference between the two readings was greater than 5mm Hg apart, a third measure was taken and a mean of the three scores was considered as the measurement. BP measurements following the guidelines referenced above were taken again following the completion of lipid profile measures and following a 20 minute paper-pencil survey.

Lipid Profile

Lipid samples were analyzed using the CardioChek PA System, Lipid Panel. Researchers collecting lipid samples were trained to use the equipment as well as prepared to handle participant difficulties, such as blood phobias or fainting. If fasting instructions were followed, the participants were allowed to participate in the fasting cholesterol screenings. If participants had not fasted, cholesterol samples were not collected. Experimenter used a new latex glove for each participant that was screened. The tip of the participant's index finger on the non-dominant hand was swabbed with alcohol and then pricked with a disposable One-step7 safety lancet. A disposable capillary tube and plunger was used to collect a droplet of blood and then deposit the droplet on a test strip, which was inserted into the CardioChek PA machine for analysis. The researcher immediately recorded the cholesterol reading following the analysis. Participants were provided with immediate feedback on resting BP and cholesterol readings and encouraged to contact the student health center if they had concerns.

Guided Imagery

Research has suggested that many of the mood or stress inducing methods that experimenters utilize to create emotional upsets or stress responses can be problematic and thus hide or represent physiological states that were not attended (Lang, 1995). For example, when trying to create a laboratory stressor that is intended to induce anger it may be difficult to measure the physiological anger response because some participants do not easily get upset. Additionally, some participants may embarrass easily and thus the physiological response may coincide with embarrassment rather than emotional upset you intended to measure (Witvliet, Ludwig, & Laan, 2001). Lang (1995) has argued that physiological responses can be created by the emotional valence of an event or through imagined responses. Two dimensions of emotion (positive and negative) have been identified to strongly influence physiological arousal. For example, negative imagery has been shown to cause cardiovascular reactivity, including increases in blood pressure and heart rate (Lang, 1995). The converse has been shown for positive imagery, quelling harmful cardiovascular responses (Lang, 1995). Thus, the current study employs guided imagery to recreate a real-life uplifting and negative event that the participant experiences in the here and now using the participants narrative recollection of the event.

Previous research suggests the study’s guided imagery technique is a valid and reliable technique to influence cardiovascular arousal. For example, Weerts and Roberts (1976) used the participant's experience of anger or fear to create a negative emotional response. The researchers instructed each participant to imagine the fearful or upsetting scene while monitoring changes in blood pressure. They found that the participants who recalled the angry or fearful experience and reported being upset had increases in blood pressure and heart rate. Additionally, McCraty et al. (1995) demonstrated by successfully inducing positive or negative emotional states individuals' HRV can significantly change. McCraty et al. (1995) had one half of the participants to choose either recall feeling appreciated by someone important or recall feeling positive towards a significant person. The researchers instructed the other half of the participants to recall a negative situation that would arouse negative feelings of frustration or anger. In response to feeling appreciated or feeling positive towards another person blood pressure decreased and HF HRV predominated, signifying increased parasympathetic activity. Furthermore, participants who recalled negative feelings of anger or frustration produced a dominantly LF HRV profile, suggesting decreased parasympathetic activity.

Psychological Measures

The Event Recollection Inventory (see Appendix A) was completed by the participant during Phase I of the current study. The Event Recollection Inventory was developed for the current study to gather data on three uplifting and three stressful events in the participant's life. Prior to Phase II of the study two experimenters attempted to match the uplifting and stressful event for emotional intensity. The two experimenters only chose one of the events from each category to be used during Phase II collection of HRV. The intensity of each event was on a scale of 1 to 3, 1 equaling mildly intense, and 2 equaling somewhat intense and 3 intense. The researchers attempted to choose an uplifting event that was rated one intensity level above the stressful event in order to counterbalance the stressful event because research has shown that we routinely experience positive events and because stressful events usually are recalled with more intensity and experience (Frederickson & Losada, 2005). The two experimenters were the only two assigned researchers that chose each event recollection in order to limit experimenter bias.

The Keyes Well-being Inventory (Keyes, 2007) was used to identify participants as flourishing or languishing (see Appendix B; reproduced with permission). The Keyes Well-being Inventory consists of 40 items which covers daily experiences that individuals have with various people and contexts in their life. The inventory estimates the well-being of participants in several areas: emotional, social, and psychological.

Emotional Well-Being

Participants indicated how much of the time during the past 30 days – all the time, most of the time, some of the time, a little of the time, none of the time – they felt six symptoms of positive emotion. The positive emotion symptoms are (a) cheerful, (b) in good spirits, (c) extremely happy, (d) calm and peaceful, (e) satisfied, (f) full of life. Reported internal reliability of emotional well-being scales is 0.91 (Keyes, 2004). Participants also reported their current life satisfaction using a scale from 0 to 10 where 0 means *the worst possible life overall* and 10 means *the best possible life overall*.

Psychological Well-Being

Psychological well-being is represented by six scales: (1) Self-acceptance, (2) Positive relations with others, (3) Personal growth, (4) Purpose in life, (5) Environmental mastery, and (6) Autonomy. The Psychological Well-Being scale is made up of 18 items, with each of the six scales consisting of three questions with a balance of positive and negative items. On a scale from 1 to 7, with 4 as *neither agree nor disagree*, participants reported whether they *agreed* or *disagreed strongly*, *somewhat*, or a *little* with a question that asked how they were functioning psychologically (i.e., I like most parts of my personality). The internal consistency of the Psychological Well-Being scale is 0.81 (Keyes, 2003).

Social Well-Being

Social well-being operationalizes how well people see themselves flourishing in their social lives. The Social Well-Being scale is represented by five scales: (1) Social – acceptance, (2) Social actualization, (3) Social contribution, (4) Social coherence, and (5) Social integration. The Social Well-Being scale is made up of 15 items, with each scale consisting of thee questions with a balance of positive and negative items. On a scale from 1 to 7, with 4 as *neither agree nor disagree*, participants indicated whether they *agreed* or *disagreed strongly*, *somewhat*, or a *little* with a question concerning their social functioning (i.e., I don't feel I belong to anything I'd call a community). The internal consistency of the Social Well-Being scale has been reported to be 0.81 (Keyes, 2003).

I followed Keyes (2003) methodology to identify individuals into two mental health categories, either flourishing or languishing in order to maintain validity and reliability. The scales of psychological, social, and emotional well-being were divided by the number of items, standardized, and tertiles were computed. Participants with scores in the upper tertiles of 1of the 2 emotional well-being scales and 6 of the 11 scales of the psychological and social well-being scales were classified as flourishing. Participants with scores in the lower tertiles of 1of the emotional well-being scales and 6 of the 11 scales of the psychological and social well-being scale were classified as languishing.

The Autobiographical Memory Questionnaire (AMQ) assesses for the quality of event recollection that each participant reported when asked to recall and write about a particular uplifting and stressful event from the past (Rubin, Schrauf, & Greenberg, 2003). The present study employed a revised version (see Appendix C; reproduced with permission) for which 10 of the items were suitable for assessing the quality of recollection during the imagery task. Participants responded to descriptions of their remembering using a seven-point descriptive anchored, rating scale (1 representing *not at all* to 7 representing *as clearly as if it were happening now*). Higher scores indicate a greater recollection of the imaged event. Participants evaluated the quality of their imagery immediately following the last imagery task.

Vividness of Imagery Questionnaire (VIQ; Marks, 1973) refers to the ability to visualize, or to form mental pictures (see Appendix D; permission to reproduce was not necessary). Marked individual differences have been found in the strength and clarity of reported visual imagery. The VIQ determines the vividness of the participant's visual imagery. The VIQ has 16 items which the subject completes while attempting to image descriptions with their eyes open and with their eyes closed. Subjects rate each item on a 5 point scale indicating greater vividness of imagery. Reported internal reliability of the VIQ has been reported to be .78 (Berry & Worthington, 2001).

Procedure

Phase I

Participant eligibility for Phase I of the study was 18 years of age or older and fluency in written and spoken English. During Phase I informed consent was obtained and participants were notified that they could withdraw their participation at any time without being penalized. Participants then completed a demographic questionnaire and psychological self-report measures, which included the Keyes Well-being Inventory and the Event Recollection Inventory. Prior to Phase II participation, participants were contacted in advance and reminded to fast overnight (no food and nothing but water to drink in the 12 hours before their appointment). In addition, participants were instructed to avoid alcohol, over-the-counter medications, or herbal remedies during the fasting period. Participants were instructed not to smoke for at least 2 hours before their appointment. Participants were also told to avoid exercising at least 30 minutes prior to their Phase II appointment. Phase II eligibility required that participants not be taking medication that would influence the cardiovascular system directly, which included hypertension and cholesterol lowering medication.

Phase II

Data collection occurred in the same building but in areas separate for Phase I and Phase II. At the onset of Phase II participants were assessed for adherence of Phase II fasting instructions and to determine eligibility. Informed consent was then obtained, and participants were instructed that they could withdraw from participation without penalty. Pre-gelled instruments were then placed on participants for collection of electrocardiograph signals. HRV was monitored through three trials lasting 5 minutes each. For each participant, trial one was the baseline measurement. For baseline measurements, participants were instructed to relax in a comfortable chair. Participants were instructed to clear their mind of thoughts and to help assist them with the task they were told to close their eyes and imagine a small blue dot. Following the baseline trial, participants received two guided imagery trials lasting five minutes each. For half of the participants the second trial consisted of imaging the stressful event and trial three involved imaging the uplifting event (b-s-u). The remaining half of the participants, the second and third trials was reversed, uplifting followed by stressful event (b-u-s). Guided imagery employed event narratives described by participants during phase one (see Appendix E for sample guided imagery scripts). After completion of the imagery tasks participants were assisted in removing the instrumentation and escorted by the experimenter to a room close by where a blood sample was taken and then they completed the AMQ followed by the VIQ. After completing the tasks, participants were given a copy of their highest blood pressure reading as well as cholesterol assays were then debriefed and excused.

Data Analysis

The sample was checked to be sure there was no significant bias on the basis of image facilitators or the gender of the facilitator and the gender of the participant. Additionally, comparisons were made between the two imagery conditions b-s-u and b-u-s to determine for a significant difference on vividness of imagery between the two groups. No imagery condition for vividness of imagery was significant; therefore, controlling for vividness of imagery differences was not necessary.

Hypothesis 1a

Flourishers versus languishers during a positive emotional event following baseline will exhibit a decreased LF/HF ratio and HR, as well as increased HF. The independent variables consisted of A = individual differences: flourishers (a1), languishers (a2) and B = imagery (repeated measures) baseline (b1), uplifting (b2). The dependent variables were LF/HF ratio, HF, and HR. I used a 2 X 2 MANOVA repeated measures on imagery variable and for dependent measures LF/HF ratio, HF, and HR. If the A X B interaction was significant I used simple effects to determine if (a1) X (b2) resulted in a decreased LF/HF ratio, increased HF, and decreased HR.

Hypothesis 1b: The study proposed that uplifting imagery alone (b2) will result in a better LF/HF ratio, HF, and HR than baseline imagery (b1).

Hypothesis 2a

I predict that flourishers compared to languishers during a negative stressful event preceded by a positive emotional event will exhibit higher HF HRV, lower LF/HF ratio, and a lower HR relative to baseline. The independent variables will consist of A = Individual differences: Flourishers (a1), Languishers (a2) and B = Imagery (repeated measures) Baseline (b1), Uplifting (b2), Negative (b3). Our dependent variables will be LF/HF ratio, HF, and HR. I will conduct a 2 (Mental Health) x 3 (Imagery) between-within MANOVA for cardiovascular measures. I predict an A X B interaction and will use simple effects to determine if Flourishing by Uplifting resulted in a decreased LF/HF ratio, increased HF, and decreased HR.

Hypothesis 2b: I propose that uplifting imagery alone (b2) will result in a better LF/HF ratio, HF, and HR than negative imagery (b3).

Hypothesis 3a

Flourishers versus languishers when a positive event follows a negative stressful event will exhibit a decreased LF/HF ratio, increased HF, and a lower heart rate compared to baseline. The independent variables will consist of A = Individual differences: Flourishers (a1), Languishers (a2) and B = Imagery (repeated measures) Baseline (b1), Negative (b2), Uplifting (b3). Our dependent variables will be LF/HF ratio, HF, and HR. I will employ a 2 X 3 MANOVA for repeated measures on imagery conditions for dependent measures LF/HF ratio, HF, and HR. I predict an A X B interaction and will use simple effects to determine if Flourishing by Uplifting resulted in a decreased LF/HF ratio, increased HF, and decreased HR.

Hypothesis 3b: I propose that uplifting imagery alone (b3) will result in a better LF/HF ratio, HF, and HR than negative imagery (b2).

Hypothesis 4

The current study will examine the differential effects of facilitated recovery from stress versus stress buffers. I will compare the differences of cardiovascular facilitation and buffer based on our belief that positive events will contribute to increase HRV. In addition, flourishing relative to languishing characteristics will impact both buffering and recovery processes. The independent variables will consist of A = Individual differences: Flourishers (a1), Languishers (a2) and B = Order of Imagery: Buffering (Uplifting > Negative) (b1), Recovery (Negative > Uplifting) (b2). The dependent variable for Buffering Group consists of the difference scores from baseline on trial 2 and trial 3 for LF/HF ratio, HF, & HR; and for Recovery Group consists of the difference scores from baseline on trial 2 and trial 3 for LF/HF ratio, HF, & HR. I will conduct separate 2 X 2 Analysis of Variance Latin Square Design for each cardiovascular measure.

Hypothesis 5

Flourishing versus languishing and emotional experience and recollection. I predict that flourishers will respond more favorably than their counterparts regardless of condition. The independent variables consist of A = Individual differences: Flourishers (a1), Languishers (a2). The dependent variables will consist of (1) AMQ scores on positive emotional event and (2) AMQ scores on negative emotional event. I will conduct a MANOVA for dependent variables one and two, with planned univariate analysis on each dependent variable.

Hypothesis 6

Flourishing versus languishing groups will differ on all measures of CVD risk. Independent variables will consist of A = Individual Differences: Flourishers (a1), Languishers (a2). Dependent variables will consist of HF HRV and LF/HF ratio during baseline for all participants, cardiovascular disease risk ratio, HDL, Systolic blood pressure, and diastolic blood pressure. I will conduct a MANOVA between (a1) and (a2) for cardiovascular measures.

CHAPTER 3

RESULTS

Preliminary Analyses

All analyses were performed using SPSS 17 (Chicago, IL, USA). All paper-pencil measures were entered by a trained research assistant. Two trained research assistants working together at the same time checked all entries and errors were corrected. Missing data were interpolated on The Keyes Well-being Inventory if 80% of scores were present for each participant by conducting a regression analysis and predicting the participant's score for the omitted item. The sample consisted of 505 participants for Phase I and 297 for Phase II. Due to missing data on demographic and physiological variables, the final sample consisted of 501 participants for Phase I. For phase II the study had 265 participants to calculate LDL and Triglycerides, 297 participants for SBP and DBP, 276 participants for LF HRV and 274 participants for HF HRV. Keyes (2004) reported 511 individuals classified as flourishing and 351 classified as languishing from a sample of 2,952. Compared to Keyes (2004) the current study had a small sample size with 115 flourishers and 87 languishers. The current study reported frequencies of 22% flourishing and 17% languishing, Keyes (2004) sample included frequencies of 17% flourishing and 12% languishing. Keyes (2004) was from a representative sample of U.S. adults aged 25 to 74 taken in 1995.

According to the Task Force (1996) both non-parametric and parametric analyses give equal results. The HRV variables chosen in the current study was guided by research in order to choose the best cardiovascular measures for analysis. I examined the LF/HF ratio as it is considered by most researchers as the most accurate measure of sympatho/vagal balance. Additionally, the LF/HF ratio is reported in many clinical studies that use HRV, therefore the current research will be able to compare our HRV results with previous research. I also looked at the HF component as it is considered to be the major contributor to parasympathetic activity (Task Force, 1996). Since many studies examine HR as a measure of cardiovascular reactivity I included HR in our analysis.

I conducted analysis to examine differences in demographic, psychological, and cardiovascular variables that were not tested by my hypotheses. Males (M = 73.60, SD = 12.79) had lower baseline HR ($t(269) = -2.33$, $p < .05$) than females (M = 77.24, SD = 10.92). Men (M = 12.55, SD = 30.54) also had a higher LF/HF ratio ($t(266) = 3.39$, $p < .01$) than females (M = 3.63, SD = 12.53). Males (M = 31.15, SD = 24.03) exhibited reduced HF HRV ($t(268) = -2.66$, $p < .01$) compared to females (M = 38.92, SD = 20.17). Regarding the stress condition, men (M = 29.56, SD = 17.08) exhibited lower HF HRV ($t(269) = -1.98$, $p < .05$) than females (M = 34.40, SD = 18.23). Men (M = 4.72, SD = 9.13) also exhibited a larger LF/HF ratio ($t(270) = 2.99$, $p < .01$) than females (M = 2.46, SD = 3.40). Concerning the uplift condition, men (M = 74.06, SD = 10.46) had a significantly lower HR ($t(265) = -2.11$, $p < .05$) than females (M = 77.16, SD = 10.64). Men (M = 29.61, SD = 18.08) showed reduced HF HRV in the uplift condition ($t(266) = -3.14$, $p < .01$) than females (M = 37.78, SD = 19.04). Men (M = 4.34, SD = 6.25) also exhibited a larger LF/HF ratio ($t(266) = 2.38$, $p < .05$) than females (M = 2.64, SD = 4.68). Men (M = 121.46, SD = 10.35) had higher SBP ($t(298) = 6.82$, $p < .01$) than females (M = 111.92, SD = 10.68). Men (M = 78.50, SD = 10.46) also had higher DBP ($t(298) = 5.25$, $p < .01$) than females (M = 71.58, SD = 9.86). Men (M = 5.07, SD = 1.99) also exhibited a higher cholesterol risk ratio ($t(192) = 3.67$, $p < .01$) than females (M = 4.00, SD = 1.60). Regarding mental health categories, there was no gender difference in measures of flourishing or languishing. Also, I conducted a multivariate analysis (MANOVA) to examine the possible facilitator effects on HR, HF, and

LF/HF ratio. The multivariate test was not significant by Pillai's Trace criterion, $F(18, 774) = .57$, $p < .92$. Univariate analysis also revealed no effect of Facilitator on each cardiovascular dependent variable (Table 1).

Table 1

Facilitator Univariate Analysis for Cardiovascular Measures

	Univariate HR			Univariate LF/HF			Univariate HF		
Source	*df*	MS	F	*df*	MS	F	*Df*	MS	F
Facilitator	6	32.05	.24	6	65.51	.17	6	584.37	1.32
Error	258	132.03		258	385.95		258	443.84	

To ensure that the two experimental groups were equivalent in terms of baseline cardiovascular functioning I conducted a MANOVA with the order of imagery (BSU, BUS) as the independent variable and cardiovascular measures (HR, LF/HF ratio, and HF HRV) during baseline as the dependent variables. Multivariate analysis was not significant by Pillai's Trace criterion, $F(3, 259) = .91$, $p < .44$. Univariate analysis revealed that the order of imagery were equivalent at baseline for each cardiovascular measure (Table 2).

Table 2

Imagery Univariate Analysis for Cardiovascular Measures

	Univariate HR			Univariate LF/HF			Univariate HF		
Source	*df*	MS	F	*df*	MS	F	*Df*	MS	F
Imagery	1	281.85	2.19	1	138.64	.36	1	42.40	.09
Error	261	128.80		261	382.32		261	451.94	

The intensity of each recalled event was rated by the participant on a scale from 1 to 3, with 1 equaling mildly intense, 2 equaling somewhat intense, and 3 intense. Research has shown that stressful events are recalled with more intensity than positive events. Therefore, the current study attempted to counterbalance the influence of the stressful event by choosing an uplifting event that was rated one intensity level above the stressful event. I also wanted to ensure that our two experimental groups were equivalent in terms of imagery intensity. Therefore, I conducted a 2 X 2 between-within ANOVA with the order of imagery (BSU, BUS) and event (uplift, negative) as the independent variables, and reported intensity of the event as the dependent variable. Results revealed no imagery condition by event interaction $F(1, 256) = .23$, $p < .63$ (Table 3). I also analyzed the main effects of the within-subject ANOVA to determine if the rating of intensity differed across our imagery condition. Findings revealed that participants in the positive imagery condition experienced a greater intensity of the imagined event ($M = 2.79$, $SD = .43$) compared with those in the negative imagery condition ($M = 2.35$, $SD = .56$), $F(1, 256) = 115.80$, $p < .01$ (Table 3). The result indicates that the researcher's attempt to counterbalance the negative event was successful.

Table 3

Imagery x Event Analysis of Variance for Intensity

Source		*df*	*MS*	*F*
Between Subjects	Imagery	1	.33	1.27
	Error	256	.26	
Within Subjects	Event	1	24.75	115.80**
	Event X Imagery	1	.05	.23
Error		256	.21	

**$p < .01$

The experimenters wanted to ensure that the intensity of the imagery was equivalent in terms of cardiovascular activity. I performed a one-way between subjects MANOVA to test whether cardiovascular functioning (HR, LF/HF ratio, and HF HRV) was different by ratings of positive imagery (intensity of imagery =1, 2, or 3). The multivariate test was not significant by Pillai's Trace criterion, $F(6, 492) = .62$, $p < .71$. Univariate findings also indicated that positive imagery intensity and cardiovascular activity were not significant (Table 4).

Table 4

Positive Imagery Univariate Analysis for Cardiovascular Measures

	Univariate HR			Univariate LF/HF			Univariate HF		
Source	*df*	MS	F	*df*	MS	F	*df*	MS	F
Imagery	2	39.99	.37	2	10.92	.41	2	38.33	.10
Error	247	109.64		247	26.46		247	369.07	

I also conducted a separate one-way between MANOVA to verify that cardiovascular (HR, LF/HF ratio, and HF HRV) activity was not different across ratings of negative imagery (intensity of imagery =1, 2, or 3). Results from the MANOVA indicated that the levels of negative imagery did not differ in cardiovascular activity by Pillai's Trace criterion, $F(6, 494) = .61$, $p < .72$. Univariate analysis also showed that negative imagery was not significant for each cardiovascular measure (Table 5).

Table 5

Negative Imagery Univariate Analysis for Cardiovascular Measures

	Univariate HR			Univariate LF/HF			Univariate HF		
Source	*df*	MS	F	*df*	MS	F	*df*	MS	F
Imagery	2	116.50	1.02	2	23.22	.66	2	231.27	.70
Error	248	114.70		248	35.25		248	329.11	

Hypothesis 1: Flourishers versus Languishers when a Positive Emotional Event follows Baseline and Cardiovascular Functioning

Hypothesis 1a: I predicted that flourishers compared to languishers during a positive emotional event following baseline would exhibit increased HF, decreased LF/HF ratio and a lowered HR. I conducted a 2 (Mental Health Categories) x 2 (Imagery) between-within subjects MANOVA for cardiovascular measures (HR, LF/HF ratio, and HF HRV). Table 6 provides the mean and standard deviation for our two imagery conditions b-s-u and b-u-s. MANOVA findings revealed no main effect for mental health categories, $F(3, 54) = .59$, $p < .63$, nor a imagery main effect, $F(3, 54) = .59$, $p < .62$. Additionally, multivariate results did not reveal a mental health by imagery interaction, $F(6, 50) = 1.01$, $p < .39$. Univariate analysis showed no mental health category main effect for any dependent measure (Table 7). Univariate results did not show an imagery main effect for cardiovascular measures (Table 7). Univariate analysis also showed that I did not have a significant mental health category by imagery interaction for each cardiovascular measure (Table 7).

Hypothesis 1b: I also wanted to determine whether our participant's positive emotional event successfully induced changes in cardiovascular functioning compared to baseline. To test the prediction we examined the main effect of imagery from our 2 (Mental Health Categories) x

2 (Imagery) between-within subjects MANOVA. As previously reported above, the multivariate test did not reveal a imagery main effect, $F(3, 54) = .59$, $p < .62$. Additionally, univariate analysis revealed that cardiovascular functioning during the positive emotional event was not significantly different from baseline for each of the three cardiovascular measures (See Table 7). Overall, these results did not reveal support for hypothesis one, indicating that cardiovascular functioning during baseline and during the positive emotional event did not differ by mental health categories. In addition, the positive emotional event was not successful in generating cardiovascular functioning that was different from baseline.

Table 6

Imagery Conditions Mean and Standard Deviation for Cardiovascular Measures

	Imagery Condition			
	BUS		BSU	
Variable	Mean	SD	Mean	SD
Baseline HR	77.13	9.30	75.39	11.33
Baseline LF/HF	4.57	17.80	5.88	17.13
Baseline HF	37.97	19.29	36.65	22.30
Stress HR	77.70	9.60	76.49	11.31
Stress LF/HF	2.76	3.71	3.27	5.41
Stress HF	33.13	17.69	32.07	17.52
Uplift HR	77.44	9.60	75.37	10.70
Uplift LF/HF	2.46	4.28	3.54	5.57
Uplift HF	37.28	18.17	33.75	19.45

Table 7

Mental Health Categories by Imagery Univariate Analysis for Cardiovascular Measures

	Univariate HR			Univariate LF/HF			Univariate HF		
Source	*df*	MS	F	*df*	MS	F	*df*	MS	F
				Between subjects					
Mental H	1	155.17	.95	1	12.95	.10	1	93.39	.16
Error	56	163.01		56	130.93		56	569.91	
				Within subjects					
Imagery	1	.30	.02	1	31.29	.26	1	117.33	.88
Imagery X Mental health	1	34.01	1.97	1	109.36	.91	1	.40	.01
Error	56	17.24		56	119.91		56	133.23	

Hypothesis 2: Mental Health, Psychological Buffers, and Cardiovascular Functioning

Hypothesis 2a: I predicted that flourishers compared to languishers during a negative stressful event preceded by a positive emotional event would exhibit higher HF HRV, lower LF/HF ratio, and a lower HR relative to baseline. I conducted a 2 (Mental Health) x 3 (Imagery) between-within MANOVA for cardiovascular measures (HR, LF/HF ratio, and HF HRV). Multivariate analysis revealed no main effect for mental health categories, $F(3, 53) = .30$, $p <$ .82, nor a imagery main effect, $F(6, 50) = 1.83$, $p < .11$. MANOVA findings did not reveal a mental health by imagery interaction, $F(6, 50) = 1.63$, $p < .16$.

Univariate analysis showed no mental health category main effect for any dependent measure (Table 8). Univariate analysis also did not reveal imagery by mental health category interaction for any cardiovascular measure (Table 8).

Hypothesis 2b: I also predicted that participants in the Positive Emotional Imagery that preceded a Negative Emotional Event would have better cardiovascular functioning relative to baseline. To test the prediction I evaluated the main effects of the imagery condition utilizing a 2 X 3 between-within MANOVA on mental health categories (flourishers versus languishers) and imagery-buffer (Trial 1-Baseline, Trial 2-Uplift, Trial 3-Negative emotional event). As reported above multivariate analysis did not reveal a imagery main effect, $F(6, 50) = 1.83$, $p < .11$. However, univariate analysis did show a imagery main effect for HF HRV, $F(2, 110) = 5.27$, $p < .01$ (See Table 8). Pairwise comparisons revealed that participants in trial 1 ($M = 38.69$, $SD = 2.55$) and trial 2 ($M = 36.28$, $SD = 2.51$) had higher HF HRV than participants in trial 3 ($M = 32.13$, $SD = 2.29$).

Table 8

Mental Health Categories by Imagery Univariate Analysis for Cardiovascular Measures

	Univariate HR			Univariate LF/HF			Univariate HF		
Source	*df*	MS	F	*Df*	MS	F	*df*	MS	F
Between subjects									
Mental H	1	108.76	.47	1	19.69	.19	1	55.49	.07
Error	55	232.91		55	102.15		55	750.21	

(*table continues*)

Table 8 *(continued)*.

Within subjects									
Imagery	2	1.09	.07	2	15.51	.19	2	685.79	5.27**
Source	*df*	MS	F	*Df*	MS	F	*df*	MS	F
Imagery X Mental health	2	29.04	1.84	2	54.59	.65	2	1.16	.01
Error	110	15.82		110	83.52		110	130.06	

**$p < .01$

Hypothesis 3: Mental Health, Psychological Faciliators, and Cardiovascular Functioning

I predicted that during the positive emotional event trial that followed a negative emotional event, participants that were flourishing would exhibit improved cardiovascular functioning compared with those who were languishing relative to baseline. For each participant and for each cardiovascular measure I determined mean levels over the five minute baseline, five minute negative emotional event, and over the five minute positive emotional event. To test the prediction I conducted a 2 X 3 between-within MANOVA on mental health categories (flourishers versus languishers) and imagery-recovery (Trial 1-Baseline, Trial 2-negative emotional event, Trial 3-positive emotional event) for cardiovascular measures. Multivariate findings revealed no main effect for mental health categories, $F(3, 44) = 1.04$, $p < .38$, nor a imagery main effect, $F(6, 41) = 1.49$, $p < .21$. MANOVA findings also did not reveal a mental health by imagery interaction, $F(6, 41) = .69$, $p < .66$. Univariate analysis showed no mental health category main effect for any dependent measure (Table 9). Univariate analysis also did not reveal imagery by mental health category interaction for any cardiovascular measure (Table 9).

Hypothesis 3b: I also predicted that participants in the Positive Emotional Imagery that followed a Negative Emotional Event would have improved cardiovascular functioning. In order to examine the prediction I evaluated the main effects of trial for each cardiovascular measure utilizing our 2 X 3 between-within MANOVA on mental health categories (flourishers versus languishers) and imagery-recovery (Trial 1-Baseline, Trial 2- Negative emotional event, Trial 3-Uplift). As reported above, Univariate results revealed a imagery main effect for HF HRV, $F(2, 92) = 3.67$, $p < .03$ (See Table 9). Pairwise comparisons revealed that participants in trial 1 (M = 38.46, SD = 3.76) had a higher HF HRV than participants in trial 2 (M = 30.69, SD = 2.76). Although not significant, pairwise comparison did reveal a trend of trial 2 (M = 30.69, SD = 2.76) having a lower HF HRV than trial 3 (M = 32.84, SD = 3.20).

Table 9

Mental Health Categories by Imagery Univariate Analysis for Cardiovascular Measures

	Univariate HR			Univariate LF/HF			Univariate HF		
Source	*df*	MS	F	*df*	MS	F	*df*	MS	F
				Between subjects					
Mental H	1	167.51	.40	1	.04	.00	1	1988.93	1.91
Error	46	422.58		46	210.82		46	1041.75	

(*table continues)*

Table 9 (*continued)*.

Within subjects									
Imagery	2	23.25	1.86	2	35.72	.39	2	724.79	3.67*
Source	*df*	MS	F	*df*	MS	F	*df*	MS	F
Imagery X Mental health	2	7.20	.58	2	91.22	1.01	2	301.26	1.53
Error	92	12.52		92	90.66		92	197.50	

*$p < .05$

Hypothesis 4: Cardiovascular Buffer versus Cardiovascular Facilitated Recovery

The current study examined the differential effects of facilitated recovery from stress versus stress buffers. I did not propose a direction of causality and the analysis conducted was for exploratory purposes. I evaluated the treatment effects (interaction) using the difference scores of the order of condition from baseline for each cardiovascular measure (HR, LF/HF ratio, and HF HRV). I utilized a 2 X 2 between-within ANOVA Latin Square Design on sequence (BUS, BSU) and order (Trial 2 & Trial3). Treatment effects for sequence by order for HR did not emerge $F(1, 258) = 3.20$, $p < .08$ (Table 10). Latin square analysis showed that there was no treatment effect for LF/HF ratio $F(1, 252) = .44$, $p < .51$ (Table 11). Latin square analysis also revealed that there was no treatment effect for HF $F(1, 251) = .74$, $p < .39$ (Table 12).

Table 10

2 X 2 Latin Square Analysis for HR

Source	*df*	MS	F
		Between subjects	
Sequence	1	5.29	.12
Error	258	44.22	
		Within subjects	
Order	1	89.19	10.49
Treatment	1	27.16	3.20
Error	258	8.50	

Table 11

2 X 2 Latin Square Analysis for LF/HF ratio

Source	*df*	MS	F
		Between subjects	
Sequence	1	10.59	.02
Error	252	550.73	
		Within subjects	
Order	1	1.54	.13
Treatment	1	5.28	.44
Error	252	12.05	

Table 12

2 X 2 Latin Square Analysis for HF

Source	*df*	MS	F
		Between subjects	
Sequence	1	176.16	.28
Error	251	624.08	
		Within subjects	
Order	1	882.24	6.74
Treatment	1	96.75	.74
Error	251	130.97	

Hypothesis 5: Flourishing Compared to Languishing and Emotional Experience and Recollection

To measure depth of positive and negative emotional experience the study examined the AMQ. We conducted a MANOVA with mental health categories as our independent variable and positive and negative scores on the AMQ as the dependent variables. Multivariate findings indicated a main effect for mental health categories, $F(2, 124) = 7.82$, $p < .01$. Univariate findings revealed a mental health categories main effect for positive imagery $F(1, 125) = 15.26$, $p < .001$, with flourishers reporting a greater recollection of the positive imaged event($M = 5.16$, $SD = .702$; Table 13) compared to languishers ($M = 4.61$, $SD = .891$). Flourishers also reported having a better recollection of the negative imaged event ($M = 4.95$, $SD = .822$) compared to languishers ($M = 4.61$, $SD = .947$), $F(1, 125) = 4.72$, $p < .03$ (Table 13).

Table 13

Mental Health Categories Univariate Analysis for AMQ Scores

	Univariate Positive			Univariate Negative		
Source	*df*	MS	F	*df*	MS	F
Mental H	1	9.55	15.26**	1	3.65	4.72*
Error	125	.63		125	.77	

*$p < .05$, **$p < .01$

Hypothesis 6: Flourishers Compared to Languishers Will Differ on Measures of CVD Risk

I predicted that participants who were flourishing would have less cardiovascular disease risk and better cardiovascular health overall compared to participants that were languishing. To test this hypothesis I conducted a MANOVA with mental health categories (flourishing, languishing) as the independent variable for cardiovascular measures (Lipid Risk Ratio, Systolic blood pressure mean across trial 1 and diastolic blood pressure mean across trial 1, HR, LF/HF ratio, and HF HRV). Multivariate findings revealed no main effect for mental health categories, $F(6, 62) = .79$, $p < .58$. Additionally, Univariate analysis did not reveal a mental health category effect for each cardiovascular measure (Table 14).

Table 14

Mental Health Categories Univariate Analysis for Cardiovascular Measures

	Univariate HR			Univariate LF/HF			Univariate HF		
Source	*df*	MS	F	*df*	MS	F	*df*	MS	F
Mental H	1	304.04	2.17	1	179.22	.81	1	230.26	.45

(table continues)

Table 14 *(continued)*.

Source	*df*	MS	F	*df*	MS	F	*df*	MS	F
Error	67	140.06		67	221.28		67	511.82	
	Univariate Systolic			Univariate Diastolic			Univariate TcHDL		
Source	*df*	MS	F	*df*	MS	F	*df*	MS	F
Mental H	1	101.02	.98	1	19.10	.27	1	2.10	.87
Error	67	103.53		67	70.96		67	2.41	

CHAPTER 4

DISCUSSION

The current study examined the relationship between positive emotion, negative emotion, flourishing, languishing, and cardiovascular functioning. To date, no studies to my knowledge have experimentally manipulated positive and negative emotion events while assessing the psychophysiological functioning associated with flourishing and languishing. Specifically, I utilized HRV to measure the cardiovascular functioning of flourishers and languishers in response to a personally meaning positive and negative emotional event. The current study attempted to expand the scientific knowledge of psychological faciliators and stress buffers that can promote cardiovascular health. The following predictions were examined and are discussed.

Hypothesis 1

Hypothesis 1a stated that flourishers compared to languishers when a positive emotional event followed baseline would exhibit a decreased LF/HF ratio, a reduced HR, and greater HF HRV. Contrary to expectation flourishers did not differ from languishers in cardiovascular functioning during the positive emotional event. To my knowledge no prior studies have examined the possible relationship between flourishing, positive emotions, and HRV. However, the finding is surprising since evidence links both flourishing and positive emotions to cardiovascular health. The regular experience of positive emotions, which describes flourishers, has been found to have many cardiovascular benefits. For example, Cohen and Pressman (2006) found that individuals who reported experiencing a higher ratio of positive emotions to negative emotions had lower rates of any CVD. The experience of positive emotion has also been shown to benefit individuals with cardiovascular disease. Ingjaldsson, Laberg, and Thayer (2003) reported that children who reported lower amounts of distress in their daily lives had higher HRV. In addition, (Ingjaldsson et. al., 2003) also reported a positive relationship between HRV and positive mood.

Hypothesis 1b: Regardless of mental health status I did not find a significant difference in cardiovascular functioning between baseline and the experimentally manipulated positive emotional event. A possible explanation for the results is that the baseline trial was also a positive emotional event, thus the two imagery conditions (baseline and positive emotional event) were both pleasurable. According to Fredrickson et al. (2000) relaxation therapies can be used as an intervention to produce positive emotions, and promote mental and physical health by reducing stress and blood pressure. The current study may have inadvertently produced a baseline condition that entailed a sense of calm and peace, and therefore, a relaxation response in the participants. For example, in our baseline imagery instructions I used words like “take a deep breath” and “try to relax and clear your mind of mental chatter.” The relaxation response may have created an uplifting experience, and therefore the HRV and HR analysis could not discriminate between the relaxation and uplifting states.

Hypothesis 2

Hypothesis 2a: I predicted that flourishers compared to languishers when a positive emotional event preceded a negative emotional event would exhibit a reduced heart rate, a smaller LF/HF ratio, and a higher HF HRV. I predicted that an induced positive emotional event could dampen the cardiovascular influences of a negative emotional event. I predicted that flourishers would be able to benefit from the experience of positive emotions during the induced negative event and demonstrate better cardiovascular functioning than languishers. Smith and

Baum (2003) have suggested that positive emotions can encourage restorative activities such as relaxation that reduces sympathetic nervous system activity.

Contrary to expectation flourishers did not differ from languishers in cardiovascular functioning during the positive and negative emotional events. To my knowledge, prior research has not explored the possible stress-buffering influences of flourishing to limit harmful cardiovascular responses due to a negative emotional event? Nevertheless, the results were unexpected due to prior research that has linked psychological mechanisms that can dampen physiological responses to challenging events (Pressman & Cohen, 2005). Because flourishing individuals are characterized as being free of depression as well as having the presence of positive emotion and positive functioning, Keyes (2002) I hypothesized that their experiences of positive emotion assist in their ability to regulate negative emotions and adapt to change.

Hypothesis 2b: Regardless of mental health status I also proposed that participants in the positive emotional event that preceded a negative emotional event would have better cardiovascular functioning. Frederickson and Levinson (1998) have shown that positive emotions by way of broadening thought-action tendencies can undo physiological influences of negative emotions and facilitate cardiovascular recovery. However, unlike Frederickson and Levinson (1998) to my knowledge this study was the first attempt to show induced positive emotions introduced before a negative emotional event could prevent harmful physiological responses. The findings that changes in HF HRV was the only significant cardiovascular measure as a function of the imagery, with both baseline and the positive emotional event significant from the negative emotional event, was not expected. However, the finding is consistent with the view that positive emotions can serve as a stress buffer and can be utilized during a negative event to dampen physiological responses. (Pressman & Cohen, 2005). I believe that our positive emotional event countered the cardiovascular effects of our negative emotional event. I would have expected that if the positive emotional group that came before the negative emotional group did not have a physiological influence that the negative emotional group may have had higher HRV and HR responses. I do take this conclusion with caution and feel that additional data of possible buffering influences of positive emotions should continue to be collected and analyzed.

Hypothesis 3

In addition to serving as possible stress buffers, positive emotions may also facilitate cardiovascular recovery from stress related events and from the experience of negative emotions (Frederickson, 1998). Flourishers compared to languishers experience a higher degree of positive emotion to negative emotion. Additionally, flourishers have the ability to manage their emotional lives better than languishers in a time of stress (Keyes, 2002). Therefore, I predicted that flourishers compared to languishers should have the ability to facilitate cardiovascular recovery. The present study attempted to demonstrate that flourishers would show a lower heart rate, decreased LF/HF HRV ratio, and greater HF HRV compared to languishers when an induced positive emotional event immediately followed a negative emotional event.

When the negative emotional event that followed the baseline condition was analyzed with mental health categories I did not observe a significant interaction. When a positive emotional event immediately followed a negative emotional event condition the results indicated that flourishers compared to languishers did not have significantly improved cardiovascular functioning. The findings did not support the idea that cognitive flexibility and the ability to control emotions during a negative event is related to higher HRV (Ingjaldsson et al., 2003).

Additionally, I did not find support for the hypothesis that flourishers compared to languishers would demonstrate facilitated cardiovascular recovery. The current results are surprising since evidence links negative emotional states such as depression to negative cardiovascular health. Although not always depressed, adults who are languishing report having a degree of emotional distress and limitations in their daily activities (Keyes, 2004). Reduced HRV has been reported in individuals with depression, generalized anxiety disorder, and panic disorder (Ingjaldsson et al., 2003). Hughes and Stoney (2000) also reported that individuals high in depressed mood, as indicated by the Beck Depression Inventory showed greater decreases in HF HRV to a speech task and cold presser task than participants who reported lower depressed mood.

One explanation for the finding may be that languishing in life may not have had time to negatively influence the cardiovascular system of college-aged students. Only one study has explored the relationship between flourishing, languishing, and CVD (Keyes, 2004). Keyes (2004) did not specifically examine CVD risks in college-aged students. The researchers also did not measure HRV or HR. Keyes' (2004) study was also based on a personal history of self-reported data and did not utilize an experimental design. I believe future studies are needed to clarify the relationship between flourishing, languishing, positive and negative emotions, cardiovascular facilitation and reactivity. Measures of HRV and HR should be included.

Frederickson and Levinson (1998) hypothesize that positive emotions broaden thought-action tendencies; and therefore, positive emotions should undo the lingering cardiovascular effects of negative emotions. Research has demonstrated that induced states of positive emotions can speed cardiovascular recovery from the influence of negative emotion (Fredrickson et al., 2000). Previous research also suggests that positive emotion may dampen the influence of the SNS, and thus decrease arousal while facilitating cardiovascular recovery from stress related events (Cohen & Pressman, 2006). Therefore, I predicted that participants in the positive emotional imagery that followed negative emotional imagery would have improved cardiovascular functioning. Although not significant, the direction of change in HF HRV for positive emotions is consistent with earlier studies. The experience of the positive emotion condition appears to have helped the participants in facilitating cardiovascular recovery from the negative emotional condition. The increase in HF HRV supports Frederickson's undoing hypothesis, which indicates that positive emotions may undo lingering cardiovascular influences of negative emotions (Frederickson & Levinson, 1998). Additionally, no studies to my knowledge have directly examined HRV measurements associated with Frederickson's undoing hypothesis of positive emotion and cardiovascular reactivity. The present study expands the research that positive emotions may have direct HRV benefits by regulating the physiological consequences of negative emotions. However, I believe additional data should be collected and analyzed for the possible recovering influences of positive emotions.

Hypothesis 4

To my knowledge no prior study has examined cardiovascular facilitators and cardiovascular buffers in the same study, making the current study's results difficult to compare. Therefore, the current study examined the differential effects of facilitated recovery from stress versus stress buffers on cardiovascular functioning. The current study did not find a significantly greater treatment effect for any cardiovascular measure. It appears from the data that buffering and recovery processes are not significantly different from one another in influencing cardiovascular functioning. Research suggests that positive emotions speed cardiovascular responses and improves cardiovascular functioning after a negative event (Frederickson &

Levinson, 1998). Results from the study also suggest that positive emotions that precede negative emotions may buffer against harmful physiological responses and therefore improve cardiovascular functioning. However, I believe further studies are still needed in order to identify the differential effects of buffering and recovery on cardiovascular functioning. Studies that include a control group and recovery group with no experimental manipulation are needed to identify whether stress buffering or facilitated effects have a stronger influence on cardiovascular functioning.

Hypothesis 5

The current study predicted that flourishers would respond more favorably than languishers regardless of positive or negative emotional condition. Flourishers report experiencing a high degree of positive emotional vitality and have reported processing positive emotions deeply (Keyes, 2002). As hypothesized, I found that flourishers reported a greater recollection of our positive emotional imagery. I also hypothesized that flourishers compared to languishers would report a lesser experience of negative emotions and a lower recollection of the negative event. Contrary to expectations, I found that flourishers also reported a better recollection of the negative imaged event compared to languishers.

One mechanism that flourishers may use to cope is they don't interpret negative events as stressful and therefore don't suppress new or challenging information. Therefore, flourishers may be able to recall an event they previously identified as stressful. According to the transactional model of stress, the cognitive appraisal of an event determines whether or not a potential event will be perceived as being negative or stressful, and positive or challenging

(Lazarus & Folkman, 1984). Challenge appraisals bring forth a facility to overcome and conquer obstacles and challenges (Lazarus, 1999).

A second reason for the finding that flourishers were better able to recall a negative emotional event is because of reappraising strategies. According to Demaree et al. (2004) reappraising strategies of an already experienced event are activated before an emotional response occurs. In the current study, flourishers may have reappraised the negative emotional event during the imagery process and reappraised and recalled the event as less threatening. Demaree et al. (2004) research has shown that individuals who have used reappraisal strategies report a less negative emotional response to already experienced event. Another possible reason that languishers did not recall negative emotional content as well as flourishers is that they may have used suppressive coping strategies. That is rather than reappraising or recalling the negative emotional event languishers may have coped by suppressing or downplaying the negative significance of the past negative emotional event (Demaree et al., 2004). Further studies could specifically examine the coping strategies that flourishers and languishers utilize in time of stress in order to help researchers better understand what behaviorally distinguishes flourishers from languishers.

Hypothesis 6

The current study predicted that individuals who were flourishing would exhibit fewer cardiovascular disease risks and better overall cardiovascular functioning compared to participants that were languishing. Flourishers were not significantly different from languishers in any measure of cardiovascular functioning. Although no studies to my knowledge directly explore the causal relationship between psychological flourishing and HRV, mental health categories has been shown to have a demonstrable relationship to CVD. Specifically, depression has shown to be an independent risk factor for CVD (Ariyo, et al., 2000; Ferketich et al., 2000). This result is surprising given the extensive literature connecting mental illness and cardiovascular disease risk. Like individuals who are depressed, adults who are languishing have high emotional distress. There also exists evidence that mental health and positive emotions have cardiovascular health benefits. For example, individuals who reported experiencing a higher ratio of positive emotions to negative emotions had lower rates of any CVD (Cohen & Pressman, 2006).

Only one prior study to my knowledge has researched mental health and cardiovascular disease risk (Keyes, 2004). Compared to Keyes (2004) the current study had a small sample size, 115 flourishers and 87 languishers. Keyes (2004) had 511 individuals classified as flourishing and 351 classified as languishing. The current study reported frequencies of 22% flourishing and 17% languishing, Keyes (2004) sample included frequencies of 17% flourishing and 12% languishing. A possible reason for Keyes (2004) finding that 12% of his sample of languishers were likely to have any risk of CVD and 1.5 more times likely than flourishers to have any CVD is that the study had a larger sample size. Keyes (2004) study was also based on archival data while the current study collected and analyzed physiological measures of individuals who were either languishing or flourishing. I believe from the results of our study that it is too early to say whether mental health categories such as flourishing buffer those individuals from developing CVD, and that languishing may increase the onset of CVD. I believe that a longitudinal study of young aged individuals without a prior history of any risk of CVD and who are flourishing or languishing might help provide answers to these questions.

Other Findings

Although I did not specifically set out to examine gender differences in cardiovascular disease risk, the results are not surprising. The results indicated that men had significantly higher SBP, DBP, cholesterol risk ratio, larger LF/HF ratio, and lower HF HRV. The findings are consistent with males being at an increased risk and having a higher incidence rate of CVD than age-matched premenopausal women (Maric, 2005). Therefore, the findings add to the importance that markers of cardiovascular risk be assessed routinely in young men.

The results from the current study did not reveal mental health categories or buffering and facilitating multivariate significance for cardiovascular measures. Additionally, univariate analysis did not reveal and significant finding for HR and LF/HF ratio. I would have expected an increase in heart rate and a increase in the LF/HF ratio during the negative-stressful event since increased heart rate and LF HRV is indicative of SNS arousal and psychological stress (Appelhans & Luecken, 2006). As well, I would have predicted during the positive event for the PNS to predominantly function, and as a result, a lower degree of physiological activity to result in a lower heart rate and a decreased LF/HF ratio. (Appelhans & Luecken, 2006). This result is surprising since Frederickson has repeatedly found a significant effect of the undoing hypothesis of positive emotions for HR. Additionally, McCraty et al. (1995) has demonstrated that by inducing positive or negative emotional states individuals’ LF/HF ratio can significantly decrease or increase. To my knowledge a recover period has not been implicated or suggested in order to get an accurate LF/HF reading. However, a possible explanation for the reason I did not find a change in the LF/HF ratio is that unlike McCraty et al. (1995) the current study did not implement a recovery period between the trials. Future studies should include a five-minute recovery period between trials, such as McCraty et al. (1995) in order to make better comparisons of the LF/HF ratio.

Limitations

Multivariate findings for hypothesis 1, 2, 3, & 4 were not significant and thus the significant findings were based upon univariate analysis. The current study was limited by the small sample size of flourishers and languishers in each experimental condition. The sample size of flourishers and languishers could have been expanded by surveying more participants. The sample also was a convenient sample of college-aged students enrolled in psychology courses for class credit. Because the sample represents young-aged students from a southwest University, the findings may not be generalized to the national population. Ideally, the number of participants would have been more evenly distributed across gender. The incidence of CVD occurs ten years earlier for men than women (Maric, 2005). Studies in the future should try to include an equal number of males and females. Future studies should also try to identify flourishers and languishers at an early age and examine the longitudinal role that mental health has on the development and incidence of cardiovascular disease. Additionally, the coping styles that flourishers and languishers implement in times of stress should be explored.

The current study also had limitations due to its methodological design. I believe a much stronger effect may have been found if participants would have had a five minute acclimation period. I also believe that a five minute baseline that did not include statements such as “try to relax” and “take a deep breath” would have been consistent with a true baseline condition. Therefore, the current study may have inadvertently produced a positive emotional state in the participants and as a result this influenced the statistical comparisons. I believe that if a true baseline condition was implemented that I could have found a stronger effect between baseline condition and trial 2. I believe that the current design would have been improved by a five-minute recovery period between trial 2 and trial 3 (the positive emotional event, followed by five-minute recovery, and then followed by the negative emotional event) or (negative emotional event followed by five-minute recovery, and followed by the positive emotional event). I also believe that a five-minute recovery period immediately following trial 3 would have provided clearer evidence of cardiovascular recovery, and I would have had been able to make better comparisons to past research.

Another possible improvement to the study could have been the addition of a control group. The control group could have been used to compare the effects of the positive and negative emotional event and to show that the two events had the desired change. I also believe that the use of a control group may have helped clarify alternative explanations of the findings. I feel that a control group would have specifically identified whether the nonsignificant finding was an indicator that I did have a true buffering effect of positive emotions. A control group and recovery group would also help future studies clarify the differential influences of stress facilitation versus stress buffering on cardiovascular functioning.

A final suggestion to improve the current study would have been to ask the participant to describe and identify the specific emotion they felt at the end of each emotional event. To my knowledge, no prior research has tried to identify specific emotions and markers of HRV. This information could have been useful in exploring the possibility that certain emotions produce specific HRV responses.

Conclusions

To my knowledge no studies have directly researched the cardiovascular responses related to flourishing and languishing, and buffering influences of positive emotions. Thus, the current study contributes to the literature on mental health, positive emotions, and cardiovascular functioning. In addition, to my knowledge the current study is the only study to research how positive emotions and flourishing buffer cardiovascular responses to a negative event using HRV. Although, flourishers did not differ from languishers in cardiovascular functioning during the positive and negative emotional events, I did find that positive emotions can serve as a stress buffer and dampen physiological responses to a negative event.

I did not find support for the hypothesis that flourishers compared to languishers would demonstrate facilitated cardiovascular recovery. Additional studies are needed to identify whether flourishing and languishing promote or inhibit cardiovascular facilitation and reactivity. The current study also adds to the research on the undoing influences of positive emotions (Frederickson & Levinson, 1998). Although not significant, a trend was present for the prediction that the experience of positive emotions can help individuals recover from the cardiovascular responses related to negative emotions.

The current study also explored the differential effects of facilitated recovery from stress versus stress buffers and cardiovascular activity. The analysis was exploratory in nature and I did not propose a direction of causality. I did not find that individuals in our stress facilitated group had differing cardiovascular responses compared to those in the buffering group. I believe further studies that include a control group are needed to identify the differential effects of buffering and recovery on cardiovascular functioning.

The current study found that flourishers reported a greater recollection of the positive emotional imagery. However, contrary to expectations the study also revealed that compared to languishers, flourishers reported having a better recollection of the negative imaged event. I propose that flourishers in the current study may have used reappraisal strategies to cope with the negative emotional event. Thus, flourishers may have reappraised the negative emotional event during the imagery process and reappraised and recalled the event as less threatening. Future studies are needed to specifically identify the coping strategies that flourishers and languishers utilize in time of stress in order to identify possible interventions and improve coping skills.

Only one study has examined the relationship among flourishers, languishers, and CVD (Keyes, 2004). In the current study, flourishers did not significantly differ from languishers in regard to any of the measures of cardiovascular functioning. I believe that the results from the study indicate that it is still too early to determine whether flourishing buffers those individuals from developing CVD, and to answer whether languishing increases the onset of CVD. I believe that longitudinal studies of young aged individuals without a prior history of any risk of CVD and who are flourishing or languishing might help provide answers to these questions.

APPENDIX A

THE EVENT RECOLLECTION INVENTORY

EVENT RECOLLECTION INVENTORY

During our lifetime, there are particular events that standout because they are stressful or uplifting. The next time you come, we will ask you to imagine a few of these events. The information you give us today will help us prompt your memory as you try to imagine the event.

In the space below, identify three events in your life that were unpleasant and stressful and three events that were positive and uplifting. Afterward, rate how intense you found each event; 1 = mildly intense, 2 = somewhat intense, 3 = intense

STRESSFUL EVENT #1	**UPLIFTING EVENT #1**
What happened? Where were you? Who was there besides you? How intense was it? Circle One: 1 2 3	What happened? Where were you? Who was there besides you? How intense was it? Circle One: 1 2 3
STRESSFUL EVENT #2	**UPLIFTING EVENT #2**
What happened? Where were you? Who was there besides you? How intense was it? Circle One: 1 2 3	What happened? Where were you? Who was there besides you? How intense was it? Circle One: 1 2 3
STRESSFUL EVENT #3	**UPLIFTING EVENT #3**
What happened? Where were you? Who was there besides you? How intense was it? Circle One: 1 2 3	What happened? Where were you? Who was there besides you? How intense was it? Circle One: 1 2 3

APPENDIX B

THE KEYES WELL-BEING INVENTORY

(Keyes, 2007)

Mental Health Continuum Long Form ©2007 Corey L. M. Keyes, Ph.D.

EWB1. During the past 30 days, how much of the time did you feel…

	ALL THE TIME	MOST OF THE TIME	SOME OF THE TIME	A LITTLE OF THE TIME	NONE OF THE TIME
a. …cheerful?	1	2	3	4	5
b. …in good spirits?	1	2	3	4	5
c. …extremely happy?	1	2	3	4	5
d. …calm and peaceful?	1	2	3	4	5
e. …satisfied?	1	2	3	4	5
f. …full of life?	1	2	3	4	5

EWB2. Using a scale from 0 to 10 where 0 means "the worst possible life overall" and 10 means "the best possible life overall," how would you rate your life overall these days?

WORST										BEST
0	1	2	3	4	5	6	7	8	9	10

PWB. Please indicate how strongly you agree or disagree with each of the following statements.

	AGREE				**DISAGREE**		
	STRONGLY	SOMEWHAT	A LITTLE	DON'T KNOW	A LITTLE	SOMEWHAT	STRONGLY
1. I like most parts of my personality	1	2	3	4	5	6	7
2. When I look at the story of my	1	2	3	4	5	6	7

life, I am pleased with how things have turned out so far.							
3. Some people wander aimlessly through life, but I am not one of them	1	2	3	4	5	6	7
4. The demands of everyday life often get me down	1	2	3	4	5	6	7
5. In many ways I feel disappointed about my achievements in life	1	2	3	4	5	6	7
6. Maintaining close relationships bas been difficult and frustrating for me	1	2	3	4	5	6	7
7. I live life one day at a time and don't really think about the future	1	2	3	4	5	6	7
8. In general, I feel I am in charge of the situation in which I life	1	2	3	4	5	6	7
9. I am good at managing the responsibilities of daily life	1	2	3	4	5	6	7
10. I sometimes feel as if I've done all there is to do in life.	1	2	3	4	5	6	7
11. For me, life has been a continuous process of learning, changing, and growth	1	2	3	4	5	6	7
12. I think it is important to have new experiences that challenge how I think about myself and the world	1	2	3	4	5	6	7
13. People would describe me as a giving person, willing to share my time with others.	1	2	3	4	5	6	7

(PWB continued)

	AGREE				DISAGREE		
	STRONGLY	SOMEWHAT	A LITTLE	DON'T KNOW	A LITTLE	SOMEWHAT	STRONGLY
14. I gave up trying to make big improvements or changes in my life a long time ago	1	2	3	4	5	6	7
15. I tend to be influenced by people with strong opinions	1	2	3	4	5	6	7
16. I have not experienced many warm and trusting relationships with others	1	2	3	4	5	6	7
17. I have confidence in my own opinions, even if they are different from the way most other people think	1	2	3	4	5	6	7
18. I judge myself by what I think is important, not by the values of what others think is important.	1	2	3	4	5	6	7

SWB. Please indicate how strongly you agree or disagree with each of the following statements.

	AGREE				DISAGREE		
	STRONGLY	SOMEWHAT	A LITTLE	DON'T KNOW	A LITTLE	SOMEWHAT	STRONGLY
1. The world is too complex for me.	1	2	3	4	5	6	7
2. I don't feel I belong to anything I'd call a community.	1	2	3	4	5	6	7
3. People who do a favor expect nothing in return.	1	2	3	4	5	6	7
4. I have something valuable to	1	2	3	4	5	6	7

give the world.							
5. The world is becoming a better place for everyone.	1	2	3	4	5	6	7
6. I feel close to other people in my community.	1	2	3	4	5	6	7
7. My daily activities do not create anything worthwhile for my community.	1	2	3	4	5	6	7
8. I cannot make sense of what's going on in the world.	1	2	3	4	5	6	7
9. Society has stopped making progress.	1	2	3	4	5	6	7
10. People do not care about other people's problems.	1	2	3	4	5	6	7
11. My community is a source of comfort.	1	2	3	4	5	6	7
12. I try to think about and understand what could happen next in our country.	1	2	3	4	5	6	7
13. Society isn't improving for people like me.	1	2	3	4	5	6	7
14. I believe that people are kind.	1	2	3	4	5	6	7
15. I have nothing important to contribute to society.	1	2	3	4	5	6	7

Emotional well-being:
Positive Affect scale = Reverse code items EWB1a through EWB1f, then sum items.
Psychological well-being (section PWB items):
(Reverse code the following items: 1, 2, 3, 8, 9, 11, 12, 13, 17, 18)
Self-Acceptance scale = sum items 1, 2, 5.
Purpose in Life scale = sum items 3, 7, 10.
Environmental Mastery scale = sum items 4, 8, 9.
Positive Relations with Others scale = sum items 6, 13, 16.
Personal Growth scale = sum items 11, 12, 14.
Autonomy scale = sum items 15, 17, 18.

Social well-being (section SWB items):
(Reverse code the following items: 3, 4, 5, 6, 11, 12, 14)
Social Coherence scale = sum items 1, 8, 12.
Social Integration scale = sum items 2, 6, 11.
Social Acceptance scale = sum items 3, 10, 14.
Social Contribution scale = sum items 4, 7, 15.
Social Actualization scale = sum items 5, 9, 13.

APPENDIX C

THE AUTOBIOGRAPHICAL MEMORY QUESTIONNAIRE

(Rubin, Schrauf, & Greenberg, 2003)

AMQ **Uplift**

Consider the items below in regard to your experience of the uplifting event you imagined during guided imagery. Please circle the rating that best describes your experience.

Item	1	2	3	4	5	6	7
1. While remembering the event, I feel as though I am reliving it.	1 not at all	2 vaguely	3	4 distinctly	5	6	7 as clearly as if it were happening now
2. While remembering the event, it comes to me in words or in pictures as a coherent story or episode and not as an isolated fact, observation, or scene.	1 not at all	2	3	4	5	6	7 completely
3. While remembering the event, I feel that I see it out of my own eyes rather than that of an outside observer.	1 not at all	2	3	4	5	6	7 completely
4. My memory comes in pieces with missing bits.	1 not at all	2	3	4	5	6	7 completely
5. While remembering the event, I feel the same particular emotions I felt at the time of the event.	1 completely different	2	3	4	5	6	7 identically the Same
6. While remembering the event, I feel the emotions as strongly as I did then.	1 not at all	2 vaguely	3	4 distinctly	5	6	7 as clearly as if it were happening now
7. While remembering the event, I can see it in my mind.	1 not at all	2 vaguely	3	4 distinctly	5	6	7 as clearly as if it were happening now
8. While remembering the event, I can hear it in my mind.	1 not at all	2 vaguely	3	4 distinctly	5	6	7 as clearly as if it were happening now
9. While remembering the event, I know the setting where it occurred.	1 not at all	2 vaguely	3	4 distinctly	5	6	7 as clearly as if it were happening now
10. While remembering the event, I feel that I travel back to the time when it happened.	1 not at all	2 vaguely	3	4 distinctly	5	6	7 completely

AMQ **Stressful Event**

Consider the items below in regard to your experience of the uplifting event you imagined during guided imagery. Please circle the rating that best describes your experience.

	1	2	3	4	5	6	7
1. While remembering the event, I feel as though I am reliving it.	not at all	vaguely		distinctly			as clearly as if it were happening now
2. While remembering the event, it comes to me in words or in pictures as a coherent story or episode and not as an isolated fact, observation, or scene.	not at all						completely
3. While remembering the event, I feel that I see it out of my own eyes rather than that of an outside observer.	not at all						completely
4. My memory comes in pieces with missing bits.	not at all						completely
5. While remembering the event, I feel the same particular emotions I felt at the time of the event.	completely different						identically the Same
6. While remembering the event, I feel the emotions as strongly as I did then.	not at all	vaguely		distinctly			as clearly as if it were happening now
7. While remembering the event, I can see it in my mind.	not at all	vaguely		distinctly			as clearly as if it were happening now
8. While remembering the event, I can hear it in my mind.	not at all	vaguely		distinctly			as clearly as if it were happening now
9. While remembering the event, I know the setting where it occurred.	not at all	vaguely		distinctly			as clearly as if it were happening now
10. While remembering the event, I feel that I travel back to the time when it happened.	not at all	vaguely		distinctly			completely

APPENDIX D

VIVIDNESS OF IMAGERY QUESTIONNAIRE

(Marks, 1977)

VIVIDNESS Scale

Occupation (if student, then give course of study and stage reached):

____

Visual imagery refers to the ability to visualize, that is, the ability to form mental pictures, or to see in the mind's eye. Marked individual differences have been found in the strength and clarity of reported visual imagery and these differences are of considerable psychological interest.

The aim of this test is to determine the vividness of your visual imagery. The items of the test will possibly bring certain images to your mind. You are asked to rate the vividness of each image by reference to the 5-point scale given below. For example, if your image is vague and dim then give it a rating of 4. After each item write the appropriate number in the box provided. The first box is for an image obtained with your eyes open and the second box is for an image obtained with your eyes closed. Before, you turn to the items on the next page, familiarize yourself with the different categories on the rating scales. Throughout the test, refer to the rating scale when judging the vividness of each image. Try to do each item separately, independent of how you may have done other items.

Complete all items for images obtained with the eyes open and then return to the beginning of the questionnaire and rate the image obtained for each item with your eyes closed. Try and give your eyes closed rating independently of the eyes open rating. The two ratings for a given item may not in all cases be the same.

Rating Scale

The image aroused by an item might be:

Perfectly clear and as vivid as normal vision	rating 1
Clear and reasonably vivid	rating 2
Moderately clear and vivid	rating 3
Vague and dim	rating 4
No image at all, you only "know" that you are Thinking of an object	rating 5

In answering items 1 to 4, think of some relative or friend whom you frequently see (but who is not with you at present) and consider carefully the picture that comes before your mind's eye. Please circle the number that best corresponds with your rating of vividness.

1 The exact contour of face, head, shoulders and body	1 2 3 4 5
2 Characteristic poses of head, attitudes of body etc.	1 2 3 4 5
3 The precise carriage, length of step, etc. in walking	1 2 3 4 5
4 The different colors worn in some familiar clothes	1 2 3 4 5

Visualize the rising sun. Consider carefully the picture that comes before your mind’s eye. Please circle the number that best corresponds with your rating of vividness.

5 The sun is rising above the horizon into a hazy sky	1 2 3 4 5
6 The sky clears and surrounds the sun with blueness	1 2 3 4 5
7 Clouds. A storm blows up, with flashes of lightening	1 2 3 4 5
8 A rainbow appears	1 2 3 4 5

Think of the front of a shop which you often go to. Consider the picture that comes before your mind’s eye. Please circle the number that best corresponds with your rating of vividness.

9 The overall appearance of the shop from the opposite side of the road	1 2 3 4 5
10 A window display including colors, shape, and details of individual items for sale	1 2 3 4 5
11 You are near the entrance. The color, shape, and details of the door	1 2 3 4 5
12 You enter the shop and go to the counter. The counter assistant serves you. Money changes hands	1 2 3 4 5

Finally, think of a country scene which involves trees, mountains on a lake. Consider the picture that comes before your mind’s eye. Please circle the number that best corresponds with your rating of vividness.

13 The contours of the landscape	1 2 3 4 5
14 The color and shape of the trees	1 2 3 4 5
15 The color and shape of the lake	1 2 3 4 5
16 A strong wind blows on the tree and on the lake causing waves	1 2 3 4 5

APPENDIX E

PHASE II SCRIPT INSTRUCTIONS

Phase TWO Script Instructions – ID # [ ]

1. Begin session with informed consent instructions for Phase Two.
2. If You Need More Information for guided imagery (Or Skip to Instruction # 3):
SAY: [Name] - Recently, you completed a questionnaire about uplifting and stressful experiences in your life. Before we begin, I need to ask you a few more questions about some of these events. This information will help me provide you with guidance in creating your imagery. (Ask Questions Now).
3. SAY: In a few minutes…. [Name] ………..I will hook you up to some sensors to measure your heart rate……I will record your heart rate while you are relaxed ……Then, I will ask you to imagine a(n) uplifting (stressful) event……I will use some of the words that you gave us …….Then I will ask you to recall a(n) stressful (uplifting) event……When you are thinking about each event, I would like you to really concentrate on the event….try to experience it again…..OK, are you ready? [Name] ………… do you have any questions? Then let's get started."
4. SAY: [Name]…… I need you to stand up. This belt will measure your breathing that affects heart rate. You wear this belt over your stomach. (demonstrate how to put the belt on). Here is the sensor in front. Now you put it on. Make it snug, but not too snug. (Let's try it again). Okay [Name] ……..let's have a seat.
5. SAY: I need you to hold your arms out in front like this (demonstrate)……I will wipe some places with alcohol swabs then place the electrodes.(Yellow/Negative on right arm, Blue/Positive on left arm, White/Ground on left arm above Blue/Positive electrode)
6. Session One: Baseline Imagery Instructions (LP=Long Pause=15 secs.)
SAY: [Name] …….. Please sit with both feet on the ground and your arms on the armrests…our instruments are very sensitive….try not to move your arms or body ..…movement interferes with our recording….Close you eyes…Get comfortable (LP)…Take a deep breath….Hold it..…
(YOU SILENTLY COUNT TO 10)……..
SAY: Now Exhale and Breath normally….(LP)
7. BEGIN RECORDING (Green Icon) after 5 minutes – Go to Biograph Instructions # 14

SAY:…..keep your eyes shut …Try to Relax …Clear your mind of mental chatter…Imagine a small blue dot. I will be recording for about 5 minutes (about Two minutes later) SAY: Remember…keep your eyes closed and imagine a blue dot (about 90 seconds later) SAY: Remember…keep your eyes closed and imagine a blue dot.

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