STRESS:
CONCEPTUALIZATION, FRAMING, AND INDUCTION

by
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Author's Declaration

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Stress: Conceptualization, Framing, and Induction

Master of Arts in Psychology 2015

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Abstract

Past research has often conceptualized stress from a deficit-oriented approach. This approach is unbalanced, often associating stress with negative events and outcomes. The current study examined stress from the Transactional Model, and proposed alternative ways to conceptualize stress. In addition, both psychosocial and physiological stressors were utilized to induce stress. Study aims were threefold: (1) to examine beliefs about stress and effects of framing on changes to perceptions of stress, (2) to examine the comparative effects of two different stress-induction methods, and (3) to explore the interactive effects of framing and stress-induction on subjective perceptions of stress and measures of stress reactivity. Results confirmed a deficit-orientation of stress within the sampled population. Comparative effects of both stressors highlighted differential stress responses based on task demands and appraisal. Finally, interactive effects of framing and stress-induction provided support for alternative conceptualizations of stress in adaptive coping.

Key Words: *Stress, appraisal, framing, Triers Social Stress Test, CO₂*

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“We could never learn to be brave and patient if there were only joy in the world”

— Helen Keller

1. Introduction

The experience of stress has been known to diminish health, adjustment and well-being. The General Adaptation Syndrome (GAS) is a model of chronic stress reactions as suggested by Hans Selye (1956). In this model, an individual experiences three stages of stress: the alarm stage, the resistance stage, and the exhaustion stage. As stress persists during each stage, an individual's resources continue to become taxed, a process known as the allostatic load (Sterling & Eyer, 1988). At the alarm stage, one encounters stress, and the stress response quickly ensues. If stress persists, the body goes into a resistance stage, coping with the ongoing stress by mobilizing the body's energy and resources. Finally, if the stress continues, the body is depleted of its resources, and hence enters the final stage of exhaustion.

Physiologically, the body's primary stress systems include the Hypothalamic-Pituitary-Adrenal (HPA) axis and the Sympathetic-Adrenal-Medullary (SAM) system. Upon experiencing stress, the hypothalamus influences additional systems, such as the pituitary gland to secrete adrenocorticotrophic hormone (ACTH), stimulating the adrenal cortex to release various chemicals associated with the stress response. However, the stress systems and its responses extend beyond the physiological activation of various mechanisms within the body.

The psychological stress response, initially triggered in the hypothalamus, is also a key part of the stress response. This psychological stress response is highlighted in Lazarus' Transactional Model of Stress, which identifies stress as anything an individual perceives to be a taxation on one's resources beyond his or her own abilities to cope (Lazarus, 1966; Lazarus & Folkman, 1984). Although out-dated, this definition highlights the strong psychological

component involved in the stress response. Under stress, an individual may experience subjective changes in mood, such as increased levels of anxiety or distress (McRae et al., 2006).

Borrowing from the Transactional model, stress is recognized to be an interactive process between cognition and physiology. Therefore, stress can be defined, in the context of the current thesis, as stimuli, events, or situations that require adaptation, and pose challenges to the existing equilibrium, whether psychologically or physically. As such, a stressful event can provoke both a psychological as well as a physiological response in various systems within an individual.

Deregulation of these respective stress systems as a result of on-going stress and subsequent maladjustment has been linked to psychopathology and poor health outcomes as one's own resources become depleted due to continued ineffective coping (Stratakis & Chrousos, 1995; Wolkowitz & Rothschild, 2003). For example, individuals with Post Traumatic Stress Disorder, a clinical disorder often triggered by exposure to a traumatic stressor or event, tend to regard stress as uncontrollable and unpredictable, while viewing themselves as having inadequate coping resources (Olf, Langeland, & Gersons, 2005).

To date, a primary focus of stress research has been the need to 'remedy' stress, examining ways in which an individual can recover from a stressful occurrence that is typically assumed to be detrimental to one's well-being (Keller et al., 2012). Indeed, many researchers use the word stress synonymously with a negative event. These examples serve to illustrate the predominantly deficit-oriented approach in which stress has often been conceptualized. However, this represents an unbalanced conceptualization of stress.

Individuals require an optimal level of physiological arousal in order to survive, adapt, and function. This principle is reflected in the Yerkes-Dodson Law of optimal arousal and performance, and can be demonstrated through an inverse U-curve (Epel, McEwen, & Ickovics,

1998; Harrington, 2013). The Yerkes-Dodson Law stipulates that performance is optimized when there is a moderate amount of arousal. In this case, stress may be the trigger for the arousal system, acting as a motivator (Harrington, 2013). Following this reasoning, and applying the same arousal mechanisms to health, the experience of moderate stress that does not post as threats, but rather requires adaptive functions have been proposed to have positive effects on health and functioning (McEwan, 2013).

Aldwin (1994) speculated that coping with stress can either lead to a return to homeostatic function/status-quo, or it can be transformational, leading to positive or negative changes. The above speculations are consistent with Antonovsky's (1979) Salutogenic Model of health conceptualization. Within this model, an individual's health and functioning are maintained on a continuum over the course of his or her lifetime. By extension, an individual's response to stress could move him or her along the continuum of both positive and negative health outcomes over time (Harrington, 2013). Thus, successful coping with everyday stress could serve as a mechanism with which to motivate achievement, personal growth, self-confidence and coping self-efficacy. However, it is worth noting that biased conceptualizations of stress that highlight only the positive or negative may impede adaptive coping, as supported by findings in the pain literature (e.g., Flink, Boersma, & Linton, 2013). Rather, a balanced portrayal of both the positive and negative outcomes of stress could be hypothesized to be more informative and thereby resulting in more adaptive coping for the individual.

1.1 Purpose and Study Aims

The current study sought to address three main issues: (1) assessment of the effects of reframing stress on individual beliefs regarding stress, (2) evaluation of the efficacy of a psychosocial versus physiological stress-induction on individual responses to stress, and (3)

exploration of the interaction between stress framing and stress-induction on psychological and physiological stress response. The novelty of the current study is its examination of the effects of re-framing stress in a systemic and balanced manner prior to the introduction of a stressor. This approach departs from the typical deficit-oriented conceptualization of stress, which regards stress as a negative event that impairs functioning, and therefore paints an unbalanced and incomplete picture of the outcomes of stress. Furthermore, although several studies (see Maruyama et al., 2012) have previously compared reactivity to different stressors, little work has been done in this research to examine multiple measures of stress reactivity (e.g., subjective self-reported levels of stress and objective physiological indicators of stress.) Finally, no researchers have, to my knowledge, examined perceptions of stress using different framing conditions and how they interact with different types of stressors in subsequent coping.

1.2 Background and Theoretical Framework of Stress

Many of the seminal studies in stress research highlight the importance of individual beliefs in coping with stress, as shaped by one's past experiences and attributions. The Transactional Model (Lazarus & Folkman, 1984) describes the relationship between stress and coping as a marriage of cognition and emotion. In this model, an individual uses primary appraisal when he or she first encounters a stressor in order to assess whether the stressor is a threat or not. Upon identifying the stressor to be a threat, secondary appraisal by the individual then determines whether he or she has enough resources to cope with this stressor. Through the appraisal processes, an individual uses his or her resources and past experiences in determining the appropriate stress response and coping strategies. In this regard, a relational meaning would be assigned to the stressor based on the appraisal outcomes, which would ultimately dictate the

coping strategies used (i.e., is the stressor threatening or exciting?). Figure one below illustrates a simplified version of the Transactional Model of stress and Coping (Lazarus & Folkman, 1986).

Figure 1. *Transactional Model of Stress and Coping*

Lazarus' theoretical proposition was also hypothesized by Ray and Zald (2012), who suggested a cyclic feedback loop between the prefrontal cortex and the amygdala. These assertions were further supported by van Reekum et al. (2007) using functional magnetic resonance imaging (fMRI). Van Reekum et al. (2007) examined individual differences in prefrontal and amygdala activation as related to personal well-being. They found a relationship between the degrees of activation in the prefrontal cortex, specifically, ventral anterior cingulate cortex, and the amygdala, confirming the merging of cognition and emotions during the appraisal process of incoming stimuli. In a review of the stress literature, Lazarus later referred to the individual's construction of relational meaning as the 'bottom line' to his conceptual model (Lazarus, 2000, p. 665). Within this model the individual, in any stressful situation, would respond to a stressor in a way that is consistent with the assigned meaning he/she has given it.

In line with the above meaning-construction approaches to the stress experience, it naturally follows to question the extent to which individuals are able to manipulate the construction of the meaning of stress. Altering the ways in which stress is presented could, affect

the way individuals respond to stress. Past researchers (e.g., Jamieson, Mendes, & Nock, 2013; Jamieson, Nock & Mendes, 2013; Keller et al., 2012) have indeed established a link between how people interpret the acute stress response with how stress is presented. Utilizing methods of reappraisal, participants are taught to reinterpret their physiological arousal not as experiences of threat, but rather as experiences of motivation, challenge, and readiness to cope with stress. The findings from these studies suggest that individuals' thoughts on stress and how they view stress clearly impact the stress coping processes.

Lazarus and Folkman (1984) advanced a Transactional Model, in which they posit that stress reactivity is the result of multiple factors converging, including relational meaning of the stressor, biological factors, psychological strengths, and external resources. Yet, the study of stress reactivity is often complicated by the various components that measure it. Depending on the operationalization of stress, stress responsivity could be measured in a variety of ways. For example, the stress response can encompass elements of appraisal, which may or may not be based on prior experiences or levels of stress experienced; physiological arousal, including heart rate and blood pressure; biological indicators, as measured by cortisol and other chemicals released during the stress response; and finally, psychological factors, such as efficacy and coping styles. Campbell and Ehlert (2012) reviewed 358 studies using variations of a well-known social psychological stress-induction method, and examined the correlations across various indicators of stress. Specifically, Campbell and Ehlert (2012) found that convergence rates between biological parameters, such as cortisol, and emotional parameters, such as emotionally perceived stress were only significantly correlated in approximately 25% of studies, indicating that these multi-systems of stress may be more divergent in nature. As emphasized in the Transactional Model of Stress and Coping, the stress response may consist of a variety of

activations in various systems. The lack of correlation between biological and psychological indicators of stress may be indicative of the multiple pathways of stress, further mediated by factors such as interpretation, physiological and biological differences, and coping within an individual.

2. Rationale for Current Study

2.1 Rationale for Current Study – Stress Appraisal

Keller et al. (2012) conducted a longitudinal study examining the relationships among stress, health, and mortality. Controlling for other variables, such as social economic status, the study found a link between stress and all-cause mortality in that high amounts of stress, as measured by events or stressors, were associated with poor health. However, they noted that individuals experiencing a high stress and who also *perceived* stress to be aversive had an increased risk of mortality. Thus, the impact of stress may be mediated by a person's appraisal of the stress, rather than a linear relationship between stress and health.

Moreover, a series of studies all indicate improvements in acute stress responses through reappraisal (Jamieson et al., 2010; 2012; 2013). Approaching stress from a biopsychosocial model, the stress response is seen as the outcome of an interaction of internal factors (i.e., appraisal of arousal) and external factors (i.e., environment). In a series of studies, Jamieson et al. sought to alter the physiological response to stress through reappraisal of arousal in multiple contexts, including a stimulated GRE test (Jamieson et al., 2010), general physiological response to an upcoming stressor (Jamieson, Nock, & Mendes, 2012), and social anxiety and social evaluation (Jamieson, Nock, & Mendes, 2013). Participants in the above experiments were taught to anticipate arousal and stress in their specific upcoming tasks, whether writing the GRE or giving a speech, and then to reinterpret the physiological signs of arousal as beneficial for their performances. Although some events are deemed universally stressful, researchers have found success in reappraising selective events in order to enhance stress reactivity. The findings across multiple studies indicated improvements in physiological responses to stress, self-report of appraisal of resources, and attention across the reappraisal conditions.

These experiments support the notion that whether an event or stimulus is a stressor or not is sometimes in the eye of the beholder, and that reinterpreting physiological arousal during some events can enhance subsequent performance. However, the reappraisal conditions in Jamieson et al. (2010, 2012, 2013) work were assigned task-specific information, including instructions that encouraged the participants to anticipate stress from the upcoming task, and to reinterpret all ensuing arousal within the task as beneficial. Stress researchers have long speculated on the role cognition plays in controlling the stress responses (Carver, 1990; Schachter & Singer, 1962). Research by Jamieson et al. (2010, 2012, 2013) was key in highlighting the integral role cognition plays, and ultimately, the malleability of stress response (Keller et al., 2012). However, it is still uncertain whether a global re-framing of stress in a more balanced manner will achieve similar beneficial effects on subsequent responses to stress, as did task-specific instructions on subsequent arousals.

Going one step further than past studies, if it can be established that the meaning of stress as a construct can be changed through a manipulation in the way it is presented, this result will facilitate a deeper understanding regarding individual responses to similar stressors. Not only will it shed light on the utility of reframing stress in more adaptive ways, it will also highlight the malleability of individuals' perceptions of stress. In addition, rather than a task-specific instruction requesting participants to re-interpret their specific physiological arousal as beneficial, this thesis seeks to study the effects of a systemic framing of stress that departs from the deficit-oriented approach. Instead, participants will be exposed to different conceptualizations of stress, highlighting positive, negative, and a neutral, balanced combination of both the positive and negative outcomes. It is possible then that if stress were reframed to

include different outcomes, then it may ultimately be left to the individual to control his or her subsequent coping style and perceptions of stress overall.

Researchers studying anxiety have utilized similar interventions designed to alleviate symptoms of anxiety through 90-minute single-session Anxiety Sensitivity Amelioration Training (ASAT; Schmidt et al., 2007). ASAT training is a similarly neutral intervention combining psycho-education and interoceptive exposure (IE) in order to reduce instances of anxiety in clinical populations. The psycho-education element of the ASAT intervention highlights the benign effects of anxiety from a neutral perspective, explaining the symptoms associated with physiological arousal. Although ASAT appears to be effective in clinical populations, the intervention is specific to symptoms of anxiety and appears to target sensations rather than conceptualizations of anxiety as a construct overall.

In slightly different contexts, a two-hour, single-session stress management program focused on skilled coping from the Transactional Model of stress has also been shown to improve coping self-efficacy at times of stress (Shimazu, Umanodan, & Schaufeli, 2006). However, similar to ASAT training, the stress management program focused on specific skills rather than targeting the construct of stress.

The innovation of the current study is to frame stress from multiple, systemic conceptualizations *prior* to the introduction of a stressor. These conditions of conceptualization, including a negative, positive, and balanced perspective of stress not only contributes to existing bodies of literature that seeks to improve acute stress reactivity through reappraisal, but also address a novel inquiry of targeting individual participants' overall perceptions regarding stress as a general construct. The ultimate goal of this study is to improve stress response and coping, and challenge existing perceptions of stress.

There is no way to eliminate stress completely, nor would it be in our best interest to do so. In the past, research has indicated that moderate exposure to adversity can result in increased resilience when facing stress relative to histories of no adversity and severe adversity (Seery et al., 2013). Thus, it is important to shift the conceptualization of stress from the current unbalanced, deficit-oriented approach in order to bring about adaptive responsivity to stress (Dolbier, Jaggars, & Steinhardt, 2010). If a simple reappraisal of physiological arousal can be sustained over time (Jamieson, Mendes, & Nock, 2013), then it is even more important to study how a systemic shift in appraising stress may promote adaptive responses to stress and resilience.

2.2 Rationale for Current Study – Alternative Trajectories in Stress

Positive Psychology is a branch of psychology dedicated to promoting positive human functioning (Seligman & Csikszentmihalyi, 2000). The strategies promoted in positive psychological interventions amplify personal strengths and thus fit in ideally with the enhancement of resilience in stress. Specifically, Positive Psychology examines the inner strengths and internal resources already possessed by the individual; this focus also emphasizes personal growth (Hadad, 2013).

Currently, the deficit-oriented approach to understanding stress does not conceptualize stress in both its positive and negative outcomes. Researchers have, however, speculated that stress can positively influence the trajectory of personal growth in building coping efficacy, self-confidence, and effective stress management skills (e.g. Carver, 1998). In addition, traumatic events or stressors have been studied in the related construct of post-traumatic growth, or stress-related growth (Tedeschi & Calhoun, 2004). Post-traumatic growth is conceptualized as a potential trajectory of trauma. The experience of trauma could have neutral outcomes (i.e., no change in one's life), negative outcomes (i.e., development of post-traumatic stress disorder

(PTSD) or other aversive health outcomes), or positive outcomes (i.e., the experience of growth arising out of trauma). In this sense, the ‘growth’ comes from a deeper understanding and meaning in life.

The concept of post-traumatic growth has traditionally been studied in the aftermath of traumatic stress, without accounting for the coping behaviour of individuals in everyday stress leading up to the trauma. Because the ‘growth’ in this context is contingent on a prior trauma, few studies have examined growth prior to the experience of trauma. The lack of research may imply that the trajectory of growth is dependent on the experience of trauma. However, this may not be the case. LeBlanc et al. (2011) found that individuals experiencing PTSD, participants’ acute response to everyday stress did not differ fundamentally from those who did not experience a prior trauma. This finding is indicative of two parallel but distinct constructs in stress conceptualization and response. Continuing with this line of reasoning, it could be speculated that although the appraisal of stress is partially affected by past experiences, there may be a distinction in the processing of a traumatic versus non-traumatic stressor. Thus, the experience of trauma may not affect individual responses to everyday, non-traumatic stress.

Researchers have not yet explored the trajectory of growth (if any) associated with daily stressors. Therefore, it is important to study the acute stress response to *non-traumatic* stress. Specifically, there is a need to examine both how the stress has been framed, as well as the individuals’ beliefs about stress before and after the stressor has been presented, in order to understand whether the introduction of a balanced framing of stress can facilitate alternative stress responses. These alternatives may include personal growth in relation to coping, self-efficacy, and well-being, along with increased knowledge about stress. If a balanced conceptualization can be effective in disseminating knowledge while promoting adaptive stress

responses, then everyday encounters with stress could potentially contribute to a dynamic process of development, growth, and positive adjustments (Tedeschi & Kilmer, 2005), a conceptualized growth that very much differs from post-traumatic growth resulting from the experience of trauma. Thus, systemically shifted beliefs regarding stress can enhance adaptive coping, and could potentially promote a process of personal growth, development, and resilience.

2.3 Rationale for Current Study – Methods of Stress Induction

Working within the Transactional model of stress and coping, the form and method of stress induction may also play an important role in the appraisal of stress and subsequent coping behaviour. This may be partly due to the cognitive underpinnings of the appraisal process as influenced by emotions and experiences.

In research, there is a lack of consensus in the use of a single stress-induction method. The goal of stress-induction methods is to simply provoke a response, whether physiological, biological, emotional, or psychosocial. To date, variable stress-induction methods have been used interchangeably to provoke stress in a laboratory setting. These methods range from physiological methods of induction, such as inhalation of a single vital-capacity breath of 35% carbon dioxide (CO₂; Kaye et al., 2004), and the Cold Pressor Test (Hines & Brown, 1937; Deuter et al., 2012), to more psychosocial methods including the Trier Social Stress Test (TSST; Kirschbaum, Pirke, & Hellhammer, 1993) and the Mannheim Multicomponent Stress Test (Maruyama et al., 2012). Multi-methods of stress-induction have been used to validate new types of stress-induction methods (see Reinhardt, Schmahl, Wust, & Bohus, 2012), or in combination with one another to provoke a strengthened stress response, as indicated by biological markers (see Allen, Blascovich, & Mendes, 2002; Maruyama et al., 2012). However, few researchers appear to have specifically examined variations in subjective responses to

different methods of stress-induction, and the impact of a stressor on subsequent coping (Giles et al., 2014; Maruyama et al., 2012) Furthermore, no researchers have specifically examined the degree of differences in stress reactivity across multiple indicators of stress, including self-reported stress levels and physiological markers of arousal.

The comparable use of these methods of stress-induction carries an underlying assumption that all methods of stress-induction are analogous, and share the same end result. Although this assumption may very well be true, empirical research is needed to test its accuracy. Notably this assumption is inconsistent with the Transactional Model of Stress and Coping, whereby the appraisal of different stressors plays a fundamental role in determining the coping strategies used and the response that follows.

In addition, stress induction methods vary in their known effects; the CO₂ stress test consists of breathing in air enriched with CO₂, which promotes an acute activation of the parasympathetic, sympathetic, and hypothalamic-pituitary-adrenal systems while decreasing heart rate (Kaye et al., 2004; Vickers et al., 2012); on the other hand, the TSST is a multi-component psychosocial stressor that consists of an anticipatory period, a task period (usually delivery of speech), and a mental arithmetic performance followed by critique from the experimenter(s) (Kirschbaum, Pirke, & Hellhammer, 1993). The TSST is known to produce longer-lasting activation within the HPA-Axis compared to the CO₂ stress test, as well as significant elevations of heart rate (Kirschbaum, Pirke, & Hellhammer, 1993). The proposed study addresses the comparable use of stress-induction methodology in stress research by comparing the effects of two laboratory stressors – the CO₂ stress test and the Trier Social Stress Test.

It is important to examine the above methods of inducing stress along with the individual reactions to these different stress-induction methods in a single study. Given that meaning is assigned to the stressor as part of a coping strategy, it would be important to understand if there is a difference in the way participants will interpret and respond to different methods of stress-induction in a controlled, laboratory setting.

2.4 Experimental Hypothesis

In order to assess the effects of both experimental manipulations of stress framing and of stress-induction, and the overall interaction effects, between-group differences will be investigated.

The first question to be addressed in this thesis examined the effects of framing conditions in order to determine whether balanced or unbalanced conceptualizations of stress affected individuals' opinions of stress. It is hypothesized that the participants receiving any unbalanced conceptualization of stress in the framing conditions may show fewer changes pre- and post-framing in their opinions of stress. It may be that unbalanced conceptualizations do little to better inform participants' views on stress. In addition, the balanced conceptualization of stress framing condition may show a significant change pre- and post-framing by having lower scores on stress perception, thus indicative of more perceived interpersonal control of stress and beliefs regarding stress post-framing.

In accordance with Lazarus and Folkman's Transactional Model of Stress and Coping, it can be speculated that an individual's propensity to appraise and respond to stress (i.e., stress reactivity) would be heavily based on the significance of the relational meaning of a stressor. The second research question of focus observed the differential effects of a psychosocial stressor (TSST), versus a physiological stressor (CO₂). It is hypothesized that the TSST would provoke a

more intense psychological stress response, and heightened physiological reactivity via measures of heart rate and blood pressure, as compared to the CO₂ inhalation. Based on the emphasis on meaning and appraisal in the Transactional Model of Stress, the TSST's procedures would place more demands on the individual as he or she is observed and critiqued by the researcher, thereby eliciting a more intense stress response in part attributed to the significance of the social evaluative component. In contrast, the CO₂ challenge likely contains less social-evaluative threat in comparison.

The third research focus explored the interactive effects in stress reactivity resulting from differences in framing and stress-induction. Further analyses examining the interactive effects of framing and stress-induction are predicted to reveal differential effects across experimental groups. Specifically, it may be speculated that the positively reframed stress condition would result in especially improved stress reactivity for the TSST, as compared to CO₂ inhalation, based on the possibility of reinterpreting a social-psychological stressor as compared to a purely physiological one. To further elaborate, a brief re-framing of stress in a balanced manner that highlights both positive and negative outcomes may enhance coping self-efficacy, and increase an individual's perceived ability to manage and deal with the stress at hand. If the stressor is then presented as a multi-component social psychological stress, an individual may find more opportunities to reinterpret what may have been previously threatening as something that can be controlled. Thus, the participants in the balanced framing condition who received the TSST may ultimately benefit most from the reconceptualization of stress as compared to the unbalanced framing conditions, as well as the balanced framing condition receiving the CO₂ stressor.

Due to the moderate relationship between components of stress reactivity (Campbell & Ehler, 2012), the current study utilized both objective physiological indicators of stress,

including heart rate and blood pressure, as well as subjective ratings of stress, including a Likert-type rating of stress in order to attempt to capture the diverse responses to stress.

2.5 Theoretical Implications

In a review of stress and coping research over the past decade, Lazarus (2000) urged researchers to look past individual differences in stress and coping. Instead, he advised researchers to extend the research of stress to other factors and criteria, such as behavioural or objective variables that may or may not affect coping efficacy systemically (Lazarus, 2000). Based on past research, it is clear that our current cultural beliefs of stress tend to be somewhat negative, and therefore, imbalanced (Keller et al., 2012). Thus, if cultural perception of stress tends to lead to an avoidant approach in responding to stress, then this may systemically impede coping efficacy and personal growth. The current study focused on the systemic barriers to coping with everyday stress by examining the effects of framing on stress. This study hoped to address the existing limitations in the stress literature regarding the inconsistent uses of various stress-induction measures.

Fundamentally, if shifting one's beliefs towards stress in a more balanced and comprehensive regard can change stress response, the results of this study could suggest potential education reform in the way stress is presented and taught. In addition, if a reframing can alter the meaning of stress and subsequent coping, perhaps this will facilitate a deeper understanding of the individual responses to stress, and offer new shifts in the existing models of stress and coping.

3. Methods

3.1 Participants

3.11 Sampling Procedure

Participants were enlisted through an Introductory Psychology Student Pool, where the study was advertised as a study of methods of stress-induction. After screening for any health-related conditions that served as exclusionary criteria, participants were randomly placed into one of the six conditions ($n = 9$ each), plus a confirmatory group condition, which will be discussed later ($n = 5$). Participants included undergraduate students of both sexes. Exclusion criteria focused on known health conditions, as outlined in the *Medical Health Questionnaire* below. In addition, to ensure an even distribution of the level of stress in the sample, a screening measure--the *Perceived Stress Scale* (PSS)--was put in place to select only those whose current PSS scores range between 10-30.

Eligible participants were randomly assigned to either: (a) the balanced framing condition, (b) the unbalanced, negative framing condition, or (c) the unbalanced, positive framing condition. Participants were also then randomly assigned to receive either (i) a psychosocial stress-induction via TSST, or (ii) a physiological stress-induction via CO₂ challenge. This ultimately resulted in six experimental groupings: (1) balanced framing of stress, and stress-induction via Triers Social Stress Test; (2) balanced framing, and stress-induction via CO₂ inhalation; (3) unbalanced, negative framing, and stress-induction via Triers Social Stress Test; (4) unbalanced, negative framing, and stress-induction via CO₂ inhalation; (5) unbalanced, positive framing of stress, and stress-induction via Triers Social Stress Test; and (6) unbalanced, positive framing of stress, and stress induction via CO₂ inhalation.

3.12 Participant Characteristics

A total of 59 participants successfully completed the study. The final sample size for all subsequent analysis was reduced to 49 participants in total following data reduction, which included the removal of outliers, missing data, and equipment control conditions. A post hoc power analysis for a mixed ANOVA design with an alpha of .05, and an effect size of 0.4, was found to have predictive power of 0.89 for subsequent statistical analyses. The sampled population had a mean age of 21 ($SD=4.53$). Out of the 49 participants, 18 (37%) were males and 31 (63%) were females. Thirty-five percent of the sampled population self-identified as Caucasian, while 22% identified as East Asian, and 28% identified as South Asian. For detailed demographics information, please refer to Table 2.

3.2 *Materials and Apparatus*

3.21 Equipment

The Biopac Continuous Non-invasive Arterial Pressure (CNAP)® NIBP100D blood pressure system was used to record heart rate and blood pressure during the course of the experiment. The NIBP100D is a monitoring system that records continuous blood pressure and heart rate, using a double finger cuff, a lower armband, and an upper arm inflatable cuff. After initial calibration, the system then outputs data onto a monitor interface (MP150), which is an acquisition monitor displaying the values and waveforms for heart rate, systolic and diastolic blood pressure. These values are then recorded using Acknowledge® software on a laptop. The system is turned on during and secured onto participants following their consent to the study, and taken off at the end of the study prior to debriefing participants.

The CO₂ gas used for this study is provided by Air Liquide® in a gas tank. The gas is first emptied into a gasbag on a session-by-session basis, which is connected to ADInstrument's

PowerLab® system. The PowerLab is a data-acquisition hardware that outputs the tidal volume, blood oxygen concentration, and heart rate onto the LabChart Reader, software installed onto a computer to monitor the continuous outputs.

3.22 Framing of Stress

Participants received one of three conditions in the framing video of stress: balanced, negative, or positive. The framing videos were approximately five minutes in length, featuring a graduate student playing the role of a leading stress researcher. In the unbalanced, negative condition, the actor discussed the effects of stress from the typical, unbalanced perspective taken by popular textbooks and taught in class. Information presented focused largely on the negative effects that stress, particularly chronic stress, has on the body. This video was written to represent the traditional, deficit-oriented approach in selectively highlighting only the detrimental effects of chronic stress, and it advised viewers to engage in stress management as to avoid the negative effects of stress.

In the balanced framing of stress video, a comprehensive approach to conceptualizing stress was taken. Specifically, stress and both its negative and positive consequences were discussed. In addition, the video introduced the terms "resiliency" and "personal growth", and highlighted the individual's autonomy in perceiving stress and reacting to stress. Ultimately, the goal of the balanced conceptualization of stress was to highlight an individual's control of his or her own appraisal of stress, and subsequent abilities to cope with stress. The message of the video was intended to highlight the learning opportunities from past experiences of stress, and to develop effective stress management skills in order to adaptively cope with stress in the future.

The unbalanced, positive framing stress video focused selectively on the potential positive effects of exposure to stress. Specifically, positive outcomes, such as increased

motivation, vigilance, and efficient stress response times were highlighted. Stress was presented as having exclusively positive effects on the mind and the body. Ultimately, the goal of this positive conceptualization of stress was to ensure that the framing manipulations explore all potential conceptualizations of stress.

The script for the framing video skits can be found in Appendix XII.

3.23 Methods of Stress Induction

The CO₂ test was developed as a model of panic disorder, and has been used in the past to incite anxiety-like symptoms in anxiety-prone participants. In healthy participants, CO₂ inhalation is known to have a stress-like HPA-axis activation (Kaye et al., 2004; Vickers et al., 2012). The CO₂ protocol for this experiment followed the Research Ethics Board (REB) approved protocols used in previous studies conducted in the Psychophysiology Lab at Ryerson University. Prior to the actual method of induction, the experimenter walked through the steps of stress induction with the participant, and detailed every aspect of the stress induction, including expected outcomes and physiological outcomes, lasting up to 10 minutes. During this briefing, the participants were told that there may be some discomfort associated with this task, and that there would be a 10-minute recovery period afterwards. Following the briefing, participants underwent the CO₂ test, which consisted of a single vital-capacity breath containing 35% CO₂ and 65% oxygen. Specifically, after two practice breaths, the participant took a single breath of carbon dioxide-enriched air through a mouthpiece while wearing a nose clip and then continued to hold this breath for 4 seconds. The mouthpiece was attached to a valve linked directly to a gas canister containing carbon dioxide-enriched air at the specified concentration. It is important to note that to date, no adverse effect has been reported following the inhalation of carbon dioxide-enriched air across all populations.

The psychosocial method of stress induction consisted of a modified version of the induction protocol of the Triers Social Stress Test, a widely known and used test to induce stress in both clinical and healthy participants (Kirschbaum, Pirke, & Hellhammer, 1993). The TSST traditionally consists of an anticipation period, a speech period, and a task period, each lasting fifteen minutes in duration (Kirschbaum, Pirke, & Hellhammer, 1993). During the anticipatory period, participants were told of the upcoming tasks and asked to mentally prepare, while waiting alone in an empty room. The modified version of this period was shortened from fifteen minutes to three minutes each, including three minutes of quietness alone with the experimenter. Although the traditional TSST has participants deliver a speech to a panel to stimulate a mock interview, the modified version of the TSST in this study used three minutes of speech (on the participants' role at Ryerson University and their future with Ryerson University) that was delivered in front of a camera and the experimenter. Finally, the final task period consisted of three minutes of mental arithmetic exercise of backwards subtraction from a random number.

As part of the psychosocial stress-induction, participants were instructed that their session would be filmed for educational purposes. In addition, the experimenter provided neutral, non-committal feedback during the filmed speech, while insistently urging the participant to speed up during the mental arithmetic task. If a mistake was made during the mental arithmetic task, the experimenter instructed the participant to start again from the beginning.

As a precautionary measure, participants were told that the methods of stress-induction could be stopped at any time and that they could withdraw their consent to participate at any point throughout the course of the experiment with no consequences to the course credit. In addition, safety protocols stipulated that the session would immediately terminate following an unusual blood pressure trajectory (as defined below). All participants who began the study were

able to complete it and no participant withdrew their participation. Additionally, no participant had an unusual blood pressure trajectory, as defined by any of these criteria: (1) participant's systolic blood pressure reaches 170 or above; (2) participant's diastolic blood pressure reaches 110 or above; (3) participant's systolic blood pressure reaches 90 or below, (4) participant's diastolic blood pressure reaches 60 or below; (5) participant's systolic blood pressure experiences a fall of 20mmHg or more during a 1-minute period, or over a 3-minute period; or (7) participant's diastolic blood pressure experiences a fall of 10mmHg or more during a 1-minute period, or over a 3-minute period. As noted, none of the above criteria occurred during the course of this study.

3.3 Measures

3.31 Screening Measure

Participants were assessed for eligibility by completing a *Medical History Questionnaire* (see Appendix XI). The Research Ethics Board of Ryerson University approved the questionnaire for ongoing studies within Dr. Vickers' Psychophysiology Lab using CO₂. The questionnaire assessed prior health and medical conditions, which may serve as risk factors to the CO₂ challenge. Participants were asked whether they themselves or their immediate family members have ever had a history of health concerns or illnesses, including heart disease and asthma. Exclusion criteria for this study included participants with any medical illnesses or concerns, and also those that have not had a medical check-up within the last year. Specifically, responses in the format of 'yes' or 'not sure' on questions 1, 2, 3, 4, and 7 deemed the participant ineligible for CO₂ inhalation. The questionnaire was first administered online as a screening tool via the SONA database, followed by an in-person assessment once again to confirm true eligibility.

In addition, to ensure that the sample population's current stress levels were comparable across groups, the Perceived Stress Scale (PSS) was used to assess participants' current levels of stress. The PSS is a 10-item scale developed by Cohen (1983; Cohen & Williamson, 1988) that measures the participant's level of perceived stress he or she experienced over the past month, and is scored based on a 5-point Likert-type scale of 0-4. This scale has an overall internal reliability of $\alpha = 0.78$ (Cohen & Williamson, 1988). Higher scores correspond to greater perception of stress in one's life. For the purpose of this experiment, moderate levels of stress are ideal as too little or too much stress may affect the outcome of one or both experimental manipulations. Therefore, those that scored below 10 (too little stress) or above 30 (too much stress) were ineligible.

3.32 Pre-Test Measures

The *demographics questionnaire* was constructed for the purposes of this study. It contains basic questions such as participant ID number, sex, age, ethnicity, number of years in Canada, and year of study. These demographic questions served as basic identifiers of the study population. An additional free-words association question on stress was also included. This question was presented as "When thinking of stress, please identify up to four words that comes to mind" and served to garner qualitative data to gauge the general opinions about stress in the sample.

3.33 Covariate Measures

The *Positive Affect Negative Affect Scale – PANAS* is a 20-item scale assessing the current affective mood and emotion of the individual, with 10 items dedicated to positive affect (e.g., alert, inspired), and 10 to negative affect (e.g., distressed, upset) (Watson, Clark, & Tellegan, 1988). Test-retest stability for Positive Affect is .68, and .71 for Negative Affect

(Watson, Clark, & Tellegen, 1988). Lazarus (2000) speculated that coping processes that are sustained in the long term may involve some aspects of meaning as a result of positive affect. Currently, a major deficit in existing research on stress is the failure to examine the role of positive emotions. In incorporating this measure as a potential covariate, this study sought to examine whether positive emotions (or negative emotions) are associated with stress appraisal and responsivity.

The Personal Growth Initiative Scale is a 9-item measure scored on a 6-point Likert-type scale that assesses an individual's willingness to endorse statements pertaining to areas of personal growth, change, and self-development across various domain (Robitschek, 1998). A sample statement from the questionnaire includes: "*I know how to change specific things that I want to change in my life*". Internal consistency for the scale ranges from .78 to .90, with a test-retest reliability of .74 after 8 weeks (Robitschek, 1999). Due to the nature of the framing in this study, it was important to examine whether the motivation for change and growth affects how an individual would then respond to different framing conditions.

The Discomfort Intolerance Scale (DIS) is a 5-item self-report measure scored on a Likert-type scale ranging from 0-6 (Schmidt, Richey, & Fitzpatrick, 2006). The DIS asks participants' to rate their willingness to tolerate physical sensations that are deemed uncomfortable to most individuals (Schmidt, Richey, & Fitzpatrick, 2006). The DIS is a sound measure of an individual's tolerance to uncomfortable physical sensations (e.g., "I can tolerate a great deal of physical discomfort"). Factor analysis indicates two factors, one identifying ability to tolerate discomfort and pain, with a Cronbach's $\alpha = .91$, while the other measures avoidance to physical discomfort, with a Cronbach's $\alpha = .72$.

The *Perceived Social Support Scale* is developed by Zimet, Dahlem, Zimet and Farlye (1988). This 12-item questionnaire measures the participant's level of perceived social support that he or she experiences in everyday life from family, friends, and a significant other. It is scored based on a 7-point Likert-type scale of 1-7. The overall internal reliability of this scale is estimated to be at $\alpha = 0.93$ (Zimet et al., 1990). Social support has been widely known to buffer the experience of stress. Thus, this degree of social support an individual has may act as a mediator for stress responsivity.

The Spheres of Control Scale (Paulhus, 1983) is a 30-item scale that measures three aspects of locus of control, the extent to which an individual believes he or she is in control of the events, including intrapersonal, interpersonal, as well as socio-political perception of control. Participants rate responses on a Likert-type scale of 1-7. This scale has an internal reliability score of $\alpha = 0.75-0.80$, and a test-retest correlation of $r = 0.90$ at four weeks, and $r = 0.70$ at six months (Paulus, 1983). For the purpose of this study, only the subscales of intrapersonal and interpersonal control were used as these qualities may directly affect an individual's appraisal of and subsequent coping with stress.

The individual measures can be found in the Appendix.

3.4 Outcome Measures

3.41 Perception of Stress

Central to this study's aims was the examination of the perception of stress. To this end, measures were developed to test the extent to which the sample conforms to the deficit-oriented approach to stress. These measures were intended to examine the sample's views of stress, and whether those beliefs are consistent with the existing deficit-oriented approach to conceptualizing stress that pervades both research and public domains. To indicate participants'

stress perception, a free association task was used in which participants were asked to write down up to four words associated with the word ‘stress’.

3.42 Framing Effect

The dependent measure used for framing effect in this study consisted of a single visual analog scale (VAS) question, asking participants to indicate the extent to which they worry about stress, and consider stress to be uncontrollable. Prior to the framing video, participants were asked to indicate this on a scale 0 to 100, where 0 indicated ‘not worried, and likely controllable’, while 100 represented ‘highly worrisome, and very uncontrollable’. Participants were given this scale three times: during baseline questionnaires period, after the framing video, and after the stress-induction task. Additionally, participants also indicated whether their opinions of stress were changed from the framing video by selecting yes or no to the question “*did the video influence your opinion of stress*” at the end of the study.

3.43 Stress Responsivity

Physiological stress response. Objective indications of stress responsivity consisted of heart rate and blood pressure from the Biopac CNAP blood pressure system, a non-invasive measure of heart rate and blood pressure using a two-finger finger press, paired with an upper arm calibration. The measures of heart rate and blood pressure were taken at one-minute intervals, and the output exported directly to a computer via a software program.

Psychosocial stress response. Participants in both stress-induction conditions were asked to introspect and reflect on the extent of actual stress they had just experienced following the laboratory stress-induction. Participants were asked to indicate on a visual analog scale from zero to 100 the degree to which they felt stressed during the stress-induction task.

3.5 Procedure

Those eligible for the study were invited for a 60-minute session to the Psychophysiology Lab at Ryerson University. Testing for participants occurred between 9am to 5pm on weekdays. Participants completed the study in a single, individual session. Upon arrival at the Psychophysiology Lab, participants were briefed on the nature of the study by filling out a consent form indicating the nature of the study, including the purpose, risks, benefits, confidentiality, time commitment, and contact information.

Following the briefing, each participant was connected to the Biopac Continuous Non-invasive Arterial Pressure (CNAP)[®] NIBP100Dblood pressure system, where his or her non-dominant arm was used for incremental measures of blood pressure and heart rate throughout the experiment via a finger clip transducer for pulse. During the CO₂ inhalation, participants breathed through a tube connected to an air filter, which was connected to a computer monitor displaying continuous lung volume and frequency rate of breathing. The CNAP was connected to participants at the beginning of the experiment to ensure maximum habituation time, in case participants experience unintended stress as a result of this machine. During the initial habituation period, participants were asked to complete a set of pre-test measures, all of which were detailed in the *Measures* section.

The recording of blood pressure and heart rate was continuous during the course of the experiment, including during the stress-induction, and continued for five minutes following the induction. In order to ensure that the actual measurement of blood pressure and heart rate did not itself exacerbate stress, each group receiving stress-induction via TSST also consisted of an additional, sub-group of confirmatory group participants ($n = 5$, total) that were *not* connected to

the CNAP system. This confirmatory group received stress-induction through TSST without the physiological measures of stress response.

In order to examine the current attitudes towards stress, participants were asked for their opinions of stress in several ways. First, participants were asked to free associate four words with the word 'stress'. Participants were then asked to indicate their opinion of stress on the VAS.

Upon completion of the pre-test measures, participants watched a 5-minute video describing stress via balanced framing; unbalanced, negative framing of stress; or unbalanced, positive framing. After the video, participants were asked again to indicate, on a VAS, how much they perceived stress to be worrisome and uncontrollable. Zero was considered 'not worrisome, and likely controllable', while 100 meant 'highly worrisome, and very uncontrollable'.

Next, participants underwent a controlled method of stress-induction. Depending on the random assignment, participants received either a social method of stress induction (TSST), or a physiological method of stress induction (CO₂ inhalation). The section on stress-induction methodology (below) gives a detailed description of the procedures.

Immediately after the completion of the stress-induction task, participants were once again asked to indicate, on the same VAS, their perceptions of stress. Then, individuals entered a rest period, during which they were asked to indicate how stressful they found the stress-induction to be, on a visual analog scale of 0-100, where 0 is not at all stressful and 100 is extremely stressful. Finally, participants were asked to reflect on their overall experience by providing answers to the following question: *"Did the video influence your opinion of stress? Yes or no, and how?"* Upon the conclusion of the experiment, participants were debriefed on the nature of the study, disconnected from the CNAP machine, and given a course credit on SONA

for their study completion. Please refer to Figure two below for a break-down of the study design.

Figure 2. *Study Design*

3.6 Statistical Analysis

This study aimed to examine the current perceptions of stress and also answer three specific research questions: (1) whether differences in framing had any effects on opinions of stress, (2) whether individual responses to lab-induced stress differed in a psychosocial stressor versus a physiological method of stress-induction, and (3) whether there were group differences in the interactions between stress presentation, stress induction, and stress response. Additionally, a primary goal of this thesis was to determine whether deficit-orientation in stress were persistent in the studied population.

In order to determine whether the studied population's indeed perceived stress negatively, Two independent raters blind to the purpose of the study were recruited to code the qualitative data on the free-association task and open-ended responses into numerical codes. For the free-association task, raters coded the words as either positive (+1), negative (-1), or neutral (0). On

the open-ended responses, raters freely categorized the responses into themes. These data were then manually entered into Excel in numerical form, and transferred to the general datasheet for analysis. All quantitative analyses were then conducted using IBM's Statistical Package for the Social Sciences (SPSS) Software®, version 21.0.

To examine changes to perceptions of stress over time, a mixed ANOVA was used to explore the time and framing condition interactions, while a Chi-Square was used to examine the changes in opinions of stress. To compare the effects of different stressors, a one-way ANOVA and T-tests were used to compare group means. Finally, the interactive effects of framing and stress-induction were assessed via mixed-ANOVA, with specific emphasis on trend analysis.

4. Results

4.1 Data Reduction and Preparation for Analysis

A total of 59 eligible university students recruited via an online Introductory Psychology Pool served as participants.

4.11 Missing Data and Outlier Removal

Missing data were rare, and physiological data were recorded throughout the session and therefore none were missing. However, one subject had over 20% missing data on questionnaires, and was thus removed. No other data were missing in other participants' test scores.

Outliers were determined based on scores beyond three standard deviations from the norm. All scores were standardized and four participants were identified as outliers and removed from analysis. Thus, the final sample consisted of 54 participants since five were removed, one on the basis of missing data noted above, and four based on outliers.)

4.12 Controlling for Equipment Stress

In order to ascertain whether the use of the BioPac physiological equipment causes stress for those in TSST conditions, five participants were subjected to a control condition in which the BioPac was not utilized. Independent T-Tests were then used to compare the data on all subjective responses to stress between those using the BioPac and those not wired to the equipment. The results from these analyses were not significant (see Table 1), confirming that the BioPac did not produce a differential subjective stress response or affect opinions of stress on the subjective measures.

4.13 Physiological Data

Physiological data were obtained through the Biopac CNAP® blood pressure system. Data were time-period marked for five time-points, including baseline one (T1; questionnaire period, approximately five to ten minutes in length), framing (T2; video period, five minutes in length), baseline two (T3; post-video questionnaire period, approximately three minutes), stressor (T4; during either TSST or CO₂ task period, both approximately 15 minutes), and post-stressor (T5; recovery and questionnaire period, approximately five to ten minutes). Unexpected events in the form of loss of signal in the physiological data were cleaned using a transformative function that connected the last time points in the AcqKnowledge (ACK100W) software, version 4.2. Post-data cleaning, the averages for each time period were extracted using the Mean function under the ACK100W software.

The data averages scored across different time points were compared to the reported ranges published in previous papers. Data averages on the CO₂ stress task were comparable to findings previously published (see Kaye et al. 2004; Vedhara et al. 2010). Data averages on the TSST task were also comparable to findings previously published (see Andrews, D'Aguiar, & Pruessner, 2012; Childs, Vicini, & De Wit, 2006; Kirschbaum, Pirke, & Hellhammer 1993).

4.2 Preliminary Analyses

First, all variables were plotted to ensure a linear relationship with one another. Following, variables were entered into a total correlations table (see Appendix XIII, Table 3). Using two-tailed Pearson's correlations analyses, the subjective outcome measures of stress were found to share significant moderate to high correlations with one another, while not significantly correlated with physiological measures of stress. Likewise, physiological indicators of stress

shared significant moderate to high correlations with one another, while sharing statistically insignificant correlations with subjective indicators of stress.

Potential covariates were determined based on the close relationship they share with outcomes of stress (see previous section 3.33). All measures were graphed initially to establish a linear relationship. Then, correlational analyses were performed to determine the significant relationships, if any, between the outcome variables of stress responsivity on subjective and objective measures, and the proposed covariate measures. Significant Pearson's correlations were found between various outcome measures and the PGIS (Robitschek, 1998), SCS Intrapersonal (Paulhus, 1983), and the DIS –Avoidance (Schmidt et al., 2006).

The PGIS was significantly negatively correlated with the subjective VAS measure of stress reactivity, indicating that higher self-endorsed thoughts of growth may relate to less perceived stress. The Intrapersonal subscale of the SCS was significantly negatively correlated with measures of heart rate and systolic blood pressure, indicating that higher perceived intrapersonal control is related to lowered heart rate and systolic blood pressure during the course of the experiment. Finally, the avoidance subscale of the DIS was significantly negatively correlated with the baseline VAS measure of perception of stress, indicating that those high in avoiding uncomfortable physical sensations rated their perceptions of stress to be more distressing and uncontrollable. Table 3 details the complete correlational findings between these variables and outcome variables.

4.3 Primary Analysis: Examining the Deficit-Oriented of Stress

As speculated in this thesis, research and knowledge dissemination in stress has taken a deficit-oriented approach (Liu & Vickers, 2015). In order to confirm this speculation and gauge the sample's existing opinions of stress prior to the study, participants were asked to freely

associate up to four words when thinking about stress. Out of the 49 participants, 194 responses were collected. Two independent raters, one male and one female, were asked to categorize each response as positive (1), negative (-1), or neutral (0). The inter-rater reliability was 84.26% overall.

Looking at the rated responses, 59% (115/194 words) were rated as negative, while 32.5% (63/194) were rated as neutral, and only 8.5% (16/194) were rated as positive. Interestingly, a larger percentage (69%) of participants rated the first word associated with stress as negative. The rating scores across each participant were then added, and the mean score across all participant was -2, while the median was -3 across the rated responses of the word-association task. Figure three below illustrates the frequency distribution of total ratings of stress within the sampled population.

Figure 3. *Frequency distribution of ratings of opinions of stress on the word-association task*

4.4 Research Question One: Framing's Effects on Perception of Stress

The first research question of this thesis focused on the effects, if any, from the framing videos on opinions of stress.

4.41 Changes in Perceptions of Stress During Experiment

In order to examine whether the framing manipulations affected perception of stress, data were analyzed using a mixed ANOVA with a within-subjects factor of time (pre-framing condition, post-framing video, post stress-induction), and a between-subjects factor of framing condition (positive, $n = 16$; negative, $n = 16$; balanced, $n = 17$). Mauchly's test indicated that the assumption of sphericity had been violated ($\chi^2(2) = 12.157, p = .002$); therefore, degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity ($\epsilon = 0.809$).

Results indicate that there was a significant effect of time on perception of stress, $F(1.617, 74.389) = 6.475, p = .005, \eta^2 = .123$. More specifically, pair-wise comparison showed a significant mean difference of 3.82 between Time One (pre-framing condition), and Time Two (post-framing video), $p = .007, SE = 1.363, d = 2.80$, indicating that on average, participants rated their perception of stress as less uncontrollable and threatening after the framing video ($M = 34.71, SD = 3.168$) compared to before the framing video ($M = 38.53, SD = 3.494$), regardless of condition.

Additionally, pair-wise comparison indicated a significant mean difference of -6.78 between Time Two (post-framing video), and Time Three (post-stressor), $p = .002, SE = 2.05, d = 3.31$. Regardless of condition, participants rated their perception of stress to be more threatening after the stress-induction methods ($M = 41.5, SD = 3.566$) as compared to after viewing the video ($M = 34.71, SD = 3.168$).

However, contrary to the hypothesized results, there was no significant interaction effect of time with the between-subject factor of framing on perception of stress, $F(3.234, 74.389) = .550, p = .663, \eta^2 = .023$. Figure 4 compares the changes in perception of stress over time between various framing groups.

Figure 4. *Comparison of Framing Conditions in Changes in Perception of Stress Over Time*

Covariates were considered in a follow-up analysis. Upon entering the scores from the Personal Growth Initiative Scale (PGIS), a covariate as determined by its significant correlation with the outcome variable of Subjective Perceptions of Stress (SPSS), the effect of time was no longer significant, $F(1.639, 73.772) = 2.458, p = .103, \eta^2 = .052$. However, between-subjects ANOVA indicated that PGIS did not have a significant effect on the perception of stress, $F(1, 45) = 3.396, p = .0172, \eta^2 = .07$. Results of the above analyses are illustrated in Table 4.

4.42 Efficacy of Framing Video to Affect Changes to Opinions of Stress

To further explore the effects of framing on opinions of stress, changes to participants' opinions of stress based on the framing video alone were assessed. In order to assess this question, a chi-square analysis examined participants' responses to the question "*Did the video change your opinion of stress? Yes or No*", and examined the response rates across different experimental conceptualizations of stress (positive, negative, or balanced).

Overall, the chi-square analysis was not significant when comparing framing conditions $X^2 (2, N=49)=3.378, p=.185, V=.263$. However, based on the *a priori* hypothesis that the negative framing condition would significantly differ from the positive framing condition based on the extremes in opinion, an additional chi-square was computed comparing only the frequencies of changes in opinion between those receiving the negative framing ($n=16$) and those receiving the positive framing ($n=16$). Results of this analysis revealed that participants receiving the positive framing of stress were more likely to change their opinions of stress (proportion changed =56%) as compared to those receiving the negative framing condition of stress (proportion changed =25%), $X^2 (1, N=32)=3.239, p=.036, V=.318$, one-sided. Figure 5 below illustrates group differences in proportions of changes in opinions, broken down by framing conditions.

Figure 5. *Framing Group Differences in Response to Changes in Opinion to Stress*

4.43 Qualitative Analysis of Changes to Opinions of Stress

A content analysis examining participants' open-ended response to whether the video changed their perception of stress ("if yes, why?") resulted in 21 responses overall. Two independent blind raters were asked to read each statement, and identify freely, without instructions, up to four themes present in each statement. Out of the completed ratings, inter-rater reliability was calculated to be 71.4% for the first two categories.

Overall, the two raters identified four themes present in the open-ended statements. The majority of the statements' themes were identified and categorized as "educational," with many of the statements simultaneously also identified as "positive shifts in opinions of stress." Additionally, two statements' themes were identified as relaxing or anxiety-reducing, while one statement was identified as having the theme of the general adaptation syndrome. These

categories will provide anecdotal evidence for the efficacy of the framing videos. For a detailed breakdown of the themes, including select statements, see Table 5.

4.5 Research Question Two: Differences in Reactivity Based on Stress-Induction

The second research question central to this thesis focused on differences in stress responsivity based on the types of stressors utilized. In order to determine whether there were differences in stress responsivity, both self-assessment and physiological indicators of arousal in response to different stressors were examined. Although a MANOVA can be performed in this instance to examine the differences across various output measures, due to the high correlations between outcome measures (see Table 3), separate univariate analyses were performed instead. This univariate approach also has the advantage of protecting against the loss of degrees of freedom from MANOVA (French et al., 2008).

4.51 Subjective Indicator of Stress Reactivity

Subjective measures of stress reactivity on the self-report visual analog scale (SUSS: Subjective Units of Stress Scale) were analyzed using analysis of variance (ANOVA), with the between-subject factor as stress-induction (CO₂, $n=27$; vs. TSST, $n=22$). Due to the unequal variances in the two groups, scores of the SUSS were first transformed using Log transformation (Log₁₀). As some of the scores on the SUSS were zero, a constant of one was added to all scores prior to transformation in order to anchor the data set (Osborne, 2002).

An ANOVA using the transformed data indicated a significant group effect on scores on the SUSS $F(1, 47) = 7.846, p=.007, \eta^2 = .143$. Specifically, participants who underwent the TSST indicated higher levels of subjective stress reactivity post-stressor ($M=51.23, SD=27.61$; untransformed values reported), as compared to participants that had the CO₂ inhalation

($M=19.78$, $SD=17.45$). Figure 6 below shows these group differences in the subjective reactivity to each stressor.

Figure 6. *Group Differences in Subjective Response to Stress*

Secondary analyses incorporated previously established covariates to control their levels of variance. Based on the findings from Pearson's correlations (see Table 3), personal growth initiative, as determined by the PGIS, and locus of control, as determined by the SCS-Intrapersonal, were entered into the analysis. Results indicated that locus of control did not have a significant effect on subjective responses to stress-induction $F(1, 45) = 1.091$, $p=.302$, $\eta^2=.024$. On the other hand, personal growth initiative did have a significant effect on the subjective responses to stress-induction, $F(1, 45) = 5.036$, $p=.030$, $\eta^2=.101$. After controlling for covariates,

stress-induction condition still significantly affected subjective stress response, $F(1, 45) = 8.291$, $p=.006$, $\eta^2=.156$. Additional results are available on Table 6.

4.52 Objective Indicators of Stress Reactivity

Objective measures of stress reactivity (physiological measures of heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were analyzed using independent t-tests, with the between-subject factor as stress-induction method (CO₂, $n=27$; or TSST, $n=22$). Specifically, the individual mean values on the above measures during the stress-induction task were compared across groups. As t-test statistics can be adjusted for heterogeneity of variances, raw data scores were used in the analyses.

One-tailed t-tests revealed no significant differences between groups on systolic and diastolic blood pressure during stressor. However, participants who underwent the TSST test had significantly higher heart rate ($M=99.12$, $SD=19.03$) as compared to those that underwent the CO₂ ($M=90.27$, $SD=10.06$, $t(30.382) = -1.949$, $p=.035$, $d=0.575$). It is worth noting that these differences are examined during the course of the stressor, rather than during the recovery period post-stressor, and that the effects of various methods of stress-induction differ, including the timeline of arousal. Additional information is available in Table 7.

4.6 Research Question Three: Interactive Effects of Both Experimental Manipulations

The tertiary research focus of this thesis involved the interaction of the framing manipulation and method of stress-induction, and this research question will be answered in the following sections.

4.61 Effects of Experimental Manipulations on Perceptions of Stress

In order to examine the overall effects of both experimental manipulations on subjective perceptions of stress over the course of the experiment, a repeated measures analysis of variance was used. Specifically, the current analysis used both framing condition (Negative, $n=16$, Balanced, $n=17$; Positive, $n=16$) and stress-induction condition (TSST, $n=22$; CO₂, $n=27$) as between-subjects factor while time was the within-subjects factor. A significant Mauchly's test indicated the assumption of sphericity was violated ($\chi^2(2) = 7.132, p = .028$); therefore, degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity ($\epsilon = 0.865$). Table 8a and 8b provide summaries of these findings.

Tests of within-subjects effects found a significant effect of time: $F(1.73, 74.38) = 9.507, p < .0001, \eta^2 = .181$. Participants' endorsement of the perception of stress as uncontrollable and threatening decreased significantly after the framing video ($M=35.20, SE=3.20$) compared to baseline ($M=39.14, SE=3.47$), $p=.006, d=2.896$. Moreover, participants' endorsement of the perception of stress as uncontrollable and threatening increased significantly after the stressor ($M=42.74, SE=3.28$), $p < .000, d=-4.147$.

A significant two-way interaction of time and stress-induction also occurred: $F(1.73, 74.38) = 6.767, p=.003, \eta^2=.136$. Finally, there was also a significant three-way interaction of time, stress-induction, and framing condition: $F(3.46, 74.38) = 3.17, p=.024, \eta^2=.129$. Figure 7 below illustrates group differences in opinions of stress over time, across framing and stress-induction conditions. Visual inspection of the plotted means across groups indicated that participants in the positive and negative framing conditions who underwent the TSST experienced the most significant increase in their perceptions of stress as uncontrollable and threatening, compared to other groups. Meanwhile, participants in the negative framing condition

who underwent CO₂ experienced decreases in their perceptions of stress as uncontrollable and threatening during the course of the experiment.

Figure 7. *Group Differences in Changes to Opinions of Stress Over Time*

4.62 Effects of Experimental Manipulations on Subjective Stress Outcome

To compare group differences based on the effects of framing and stress-induction manipulation, a one-way analysis of variance was conducted on the previously transformed data for ratings of self-reported levels of stress post stressor. No significant interactions emerged, and

only a main effect of stress induction was found. Results are consistent with findings from section 4.51, and can be found in table 9 in the appendix.

Figure 8 below illustrates group differences in subjective responses to stress, broken down by both the framing and stress-induction manipulation groups. Data represents participants' average, untransformed scores on the subjective ratings of stress via the visual analog scale SUSS after the stress-induction.

Figure 8. *Subjective Ratings of Stress-Response Post-Stressor Across Experimental Groups*

4.63 Effects of Experimental Manipulations on Objective Stress Outcomes

In order to further examine differences in physiological stress parameters across experimental groupings, a five-by-three mixed-measures ANOVA was used to examine the effects of time (t1 - t5) on different measures of stress (heart rate, systolic blood pressure, diastolic blood pressure). The two between-subjects factors for this ANOVA were framing

condition (Negative, $n=16$, Balanced, $n=17$; Positive, $n=16$) and stress-induction condition (TSST, $n=22$; CO₂, $n=27$). All physiological data were Log transformed (Log_{10}) prior to analyses.

Mauchly's test indicated that the assumption of sphericity had been violated for all three physiological stress parameters: heart rate ($\chi^2(9) = 43.398, p < .001$), systolic blood pressure ($\chi^2(9) = 41.781, p < .001$), and diastolic blood pressure ($\chi^2(9) = 59.254, p < .001$); therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\epsilon = 0.658$ for heart rate; $\epsilon = 0.708$ for systolic blood pressure; $\epsilon = 0.602$ for diastolic blood pressure).

After adjusting for degrees of freedom, results from the mixed-ANOVA indicated a significant effect of time on heart rate, $F(2.634, 113.26) = 10.386, p < .001, \eta^2 = .195$. Within-subjects contrasts also revealed significant trends. As determined by the largest effect size, a significant cubic trend was observed in several factors, including the within-subjects time factor, framing condition, and stress induction for heart rate, $F(2, 43) = 3.65, p = .034, \eta^2 = .145$. Participants' heart rate decreased from baseline to video, increased again during the course of the stressor, and decreased again during the recovery period. Figure 9 below illustrates group differences in heart rate over time using untransformed data. Upon visual inspection of the data, it appears that all groups' heart rate experience a slight decline from baseline to the framing video (t1-t3). However, during the stressor (t4) and recovery (t5), time, framing condition, and stress induction interactions are evident.

While all other groups experience elevations in heart rate during stressor, the balanced framing condition that underwent CO₂ induction experienced a decline in heart rate. Meanwhile, during the recovery period, all groups experience decreases in heart rate while the participants in

the positive framing condition that underwent CO₂ induction continued to experience elevations in heart rate.

N=Negative Framing
B=Balanced Framing
P=Positive Framing

Figure 9. *Group Differences in Changes in Heart Rate Over Time*

Results from the repeated measures ANOVA did not detect any significant effects on participants' systolic blood pressure. Likewise, within-subjects contrasts also did not detect any

significant trends. Figure 10 below illustrates changes in systolic blood pressure over time using untransformed data.

N=Negative Framing
B=Balanced Framing
P=Positive Framing

Figure 10. *Group Differences in Changes in Systolic Blood Pressure Over Time*

Lastly, results from the repeated measures ANOVA indicated a significant effect of time on diastolic blood pressure, $F(2.406, 113.26) = 17.943, p < .001, \eta^2 = .293$. Within-subjects contrasts also revealed significant trends. As determined by the largest effect size, a significant

cubic trend between time, framing condition, and stress induction was observed for diastolic blood pressure, $F(2, 43) = 3.419, p = .042, \eta^2 = .137$. Participants' diastolic blood pressure decreased from baseline to video, increased again during the course of the stressor, and decreased again during the recovery period. Figure 11 below illustrates group differences in diastolic blood pressure over time using untransformed data. Upon visual inspection of the data, it appears that all groups' diastolic blood pressure experience a slight decline from baseline to the framing video (t1-t3). However, during the stressor (t4) and recovery (t5), time, framing condition, and stress induction interactions are evident.

While all other groups experience elevations in heart rate during stressor, the balanced framing condition that underwent CO₂ induction experienced a decline in diastolic blood pressure. Meanwhile, during the recovery period, all groups experience decreases in diastolic blood pressure, while the participants in the positive framing condition that underwent CO₂ induction's diastolic blood pressure continued to have elevated diastolic blood pressure. Finally, it is important to note that trends illustrated in Figure 11 below share visual similarities with trends in heart rate, illustrated in Figure 9 above.

Table 10 in the appendix details findings from the within-subject contrasts discussed in this section.

N=Negative Framing
 B=Balanced Framing
 P=Positive Framing

Figure 11. *Group Differences in Changes in Diastolic Blood Pressure Over Time*

5. Discussion

The current study's aims were three-folds: 1) to assess the effects, if any, of different conceptualizations of stress on individual perceptions of stress, (2) to evaluate the efficacy of a psychosocial versus physiological stress-induction on individual reactivity to a stressor using different measures of stress, and (3) to examine the interaction(s) between stress re-framing and stress responsivity. Based on reviewed evidence suggesting a deficit-orientation of stress in both the research literature and public perception (Liu & Vickers, 2015), the current research also assumed that a deficit-orientation of stress would be normative in the sample. As such, the study hypothesized that those that received the balanced reframing would experience more changes to their opinions of stress over other framing conditions, largely because the negative framing of stress would not significantly differ from most participants' existing opinions of stress while the positive framing may be unrealistic in comparison. In addition, the study also expected higher stress reactivity, as indicated on both measures of physiology and subjective self-reports in groups undergoing the TSST compared to the CO₂ stressor. Finally, considering the possibility of an interaction between different framing and stress-induction conditions, it was suggested that individuals in the balanced framing and TSST condition would have the least reactivity. Conversely, those in the unbalanced framing conditions were hypothesized to have the most stress reactivity, and fewer changes to their perceptions of stress during the course of the experiment. However, given the expectation of deficit-orientation in the studied population, it can further be hypothesized that those in the unbalanced, negative framing condition may experience fewer changes in their perceptions of stress.

5.1 Deficit-Orientation of Stress in Sampled Population

Participants' opinions of stress on both qualitative and quantitative measures were highly consistent with the study's hypothesis. Indeed, results indicated that the majority of the sample perceived stress from a deficit-oriented approach. Qualitatively, participants of this study freely-associated the term 'stress' with words such as pressure, anxiety, frustration, and fear. These words further paint a picture of stress as a construct that poses physiological, psychological, and emotional threats to one's self. Moreover, these words highlight individual concerns and inadequacies, and suggest that stress may further provoke these thoughts and symptoms.

Much of the mental health movement has been pre-occupied with negative outcomes, and thus has emphasized deficit-orientation in the approach (Seligman & Csikszentmihalyi, 2001). Similarly, the current findings suggest that the view of stress in the layperson is also a deficit-orientation. The negativity bias is a notion that has been heavily studied in cognition and perception (Kanouse & Hanson, 1972). Persistent preoccupation with negative events, thoughts and feelings are prevalent in individuals, and stress is no exception. Along these lines, Hobfoll (2004) discussed our culture's preoccupation with stress; whether a marital discord or violent trauma, it would seem stress has become an umbrella term easily encompassing various negativities in life.

Furthermore, research in stress has often been conducted through the quantification of events or traumas, including the examination of stress impacts and exploration of coping strategies (Chun, Moos, & Cronkite, 2006; Clonan et al., 2004). The wide-spanning umbrella term 'stress', along with negative biases emphasizing its deleterious consequences, may result in a society consumed with stress. Moreover, perceived physiological and psychological stress can serve to further exacerbate or trigger many health conditions, and negative conceptualizations of

stress have been linked to negative life events and higher instances of depression (Lunsky & Bramston, 2006) and mortality (Keller et al., 2012). Although anticipating and preparing for stress may be helpful in alerting individuals of threats, preoccupation with stress may also result in fear, catastrophizing, and avoidance altogether. Thus, the current approach to understanding stress may be ineffective in increasing individual coping efficacy and adaptability under instances of stress as they place heavy emphasis on prevention, rather than the acceptance of stress as part of everyday life.

5.2 The Effects of Framing and Changes to Participants' Opinions of Stress

The current study found that regardless of framing condition, all participants' perceptions of stress became less negative after viewing the framing video. The current study conceptualized stress in three ways: a negative framing condition in which only the detrimental effects of stress were discussed, a balanced framing condition exploring both the positive and negative effects of stress, and a positive framing condition in which stress was presented as beneficial and adaptive. The use of these framing manipulations was intended to explore the malleability of individuals' perceptions of stress. It was hypothesized that those in the balanced framing conditions would view stress more favourably in comparison to both of the unbalanced framing conditions, and experience more changes in opinions of stress throughout the course of the experiment.

Interestingly, these manipulations in stress conceptualization did not produce differential changes in perception across groups when exploring the effects of time and framing conditions alone. Rather, all groups, regardless of framing conditions, perceived stress to be less threatening and uncontrollable after exposure to the framing information. Although this finding is unexpected, it could act to further support the deficit-orientation of stress. It may be that because stress is so rampant in our society, there is an increased need for knowledge dissemination about

stress. In this sense, perhaps any type of psycho-educational initiative targeting stress can be beneficial and works to attenuates negative psychological and physiological arousal. On the other hand, simply being present during a stress experiment may also result in accidental placebo effects, such that participants view themselves as having benefited from their participation.

However, the attenuation analogy may be more likely in this instance, as it is further supported by the response rates of those participants that endorsed the efficacy of the framing video in changing their opinions of stress. Of those participants who indicated a change to their opinions of stress as a direct result of the framing video, the answers on the open-ended responses provided insights that seem to also underscore the educational component in attenuating psychological, physical, or emotional arousal. Specifically, the majority of the responses given as to why a participant's opinions have changed highlight the utility in learning about stress from viewing the framing video (see Table 5). These statements also provide anecdotal support for the need to better educate individuals on different conceptualizations of stress in order to improve stress reactivity.

The response rate to participants' changes in their opinions of stress further supports the notion of deficit-orientation in stress. Indeed, it was predicted that participants in the negative framing group would be unlikely to change their opinions of stress as compared to others. This idea was confirmed by the results of the two-sampled z-test; compared to the positive framing group, the negative framing group indicated significantly fewer changes to their existing opinions of stress. Thus, with the majority of participants having negative perceptions of stress, it then follows that those with negative perceptions of stress would be unlikely to change their opinions of stress after seeing the negative stress video, as their opinions of stress would be supported and even reinforced rather than challenged by the framing video. On the other hand,

the positive framing group (and balanced framing group) indicated more frequent changes to opinions of stress, as these different conceptualizations challenged participants' existing opinions of stress, rather than presenting the normative deficit-orientation of stress conceptualization. This finding is similarly supported by the open-ended responses, as the second-largest categories of statements were found to focus on shifting existing opinions of stress in more positive ways (see Table 5 for sample statements).

These results also serve to indicate the success of the framing manipulations and its importance in two ways. First, the findings contribute to a growing body of literature establishing the efficacy of short, re-appraisal-based interventions that are targeted to improve stress reactivity (see Beltzer et al., 2014; Cohen et al., 2006; Jamieson et al., 2010; 2012; 2013; Schmidt et al., 2007). Second, this particular re-framing manipulation was novel in that it successfully targets the deficit-orientation in conceptualizations of stress, and systemically introduced alternative conceptualizations that challenged this deficit-orientation, which often results in negative perceptions of stress. A critique of previous reappraisal videos by Jamieson, Nock, and Mendes (2013) is the lack of generalizability across various stress conditions. The aim of the framing manipulation in the current thesis was to re-frame stress systemically, thereby challenging individuals' comprehensive opinions of stress rather than inviting them to merely reinterpret symptoms of physiological arousal. This marks an important step forward in determining the effects of reappraisal to be more than symptoms-specific, but rather, that it can be applied to an entire construct.

5.3 Differential Responses to Methods of Stress Induction

Subjective responses on self-report measures as well as objective data from physiological assessment both support the differential effects of the TSST and CO₂ stress-induction tasks (see

Kaye et al., 2004; Kirschbaum et al., 1993). The results from this study confirm the *a priori* hypothesis that the Triers Social Stress Test mounts a more intense psychological and physiological stress response as compared to CO₂ stress-induction challenge.

According to the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), the mounting of both psychological and physiological stress response would depend on the appraisal of the stressor. Following this logic, two very different stressors would thus result in very different appraisal patterns based on the demands placed upon the individual in order to respond to the stressor. The Transactional Model focuses on the appraisal process modified over time (Lazarus & Folkman, 1984). In the context of this experiment, participants' primary appraisal process would immediately follow upon hearing about the upcoming stressor; individuals would determine whether the anticipated event is threatening or not. Following, individual would engage in secondary appraisal, during which the resources to cope are evaluated against the demands of the upcoming tasks.

Focusing on the primary appraisal process, it can be speculated that the CO₂ challenge may not have provoked a very intense stress reaction, perhaps because it was not interpreted by some of the participants as a stressor. Although previous research has established that the CO₂ challenge provokes HPA Axis activation in healthy individuals (e.g., van Duinen et al., 2005), studies have also documented a lack of reactivity in healthy individuals, subsequently categorized as 'non-responders' to the CO₂ challenge (Wetherell et al., 2006). In this present study, the significant differences in self-reported stress levels following the stress-induction challenges could be attributed to some individuals failing to respond to the CO₂ challenge. However, a limitation of the current study was the single assessment of self-reported stress levels. Without a baseline confirmation, it is unknown whether the lower averages on the CO₂

challenge are indicative of a lack of reactivity post CO₂, or simply diminished levels of stress reactivity when directly compared to the responses triggered by the TSST.

Quantitatively speaking, the secondary appraisal process would largely depend on number of tasks, and difficulty levels of the tasks at hand. The TSST's multi-component tasks require many more resources to cope as compared to the CO₂ challenge. Some of the skills and demands placed upon participants in the TSST condition included public speaking, performing under pressure, performing in front of an audience, coping with social evaluation, and performing a mental arithmetic task (Kirschbaum et al., 1993). On the other hand, the tasks involved in the CO₂ challenge are less demanding, and includes listening to instructions and breathing when prompted (Kaye et al., 2004). In comparing the two methods of stress-induction, it could be that the resources required to cope with TSST are more strenuous, thereby prompting more intense psychological and physiological responses. A synthesized review examining the physiological activations of various stressors found similar results (Dickerson & Kemeny, 2014). The degree of physiological activation was directly related to the degree to which a stressor was uncontrollable as well as socially evaluative, both factors directly attributed to the Triers Social Stress Test (Dickerson & Kemeny, 2014; Kirschbaum et al., 1993).

Another explanation for the variations in response across stressors may be the physiological symptoms resulting from each stress-induction method. Past research has identified physiological activations that are distinctive to a specific stressor (see Kaye et al., 2004; Kirschbaum et al., 1993; Maruyaa et al., 2012). For example, research utilizing the CO₂ challenge often documents decreases in heart rate during the experiment (see Kaye et al., 2004; van Duinen et al., 2005), while a well-established effect of the TSST is the steady increase of heart rate (Foley & Kirchbaum, 2010; Kirchbaum et al., 1993). Thus, it makes sense that these

stressors would then elicit different physiological effects. Perhaps, the significant differences in stress reactivity can be attributed to the different methods of either stress-induction, thereby following diverging courses of physiological arousal, which could also lead to differences in psychological appraisal of each stressor during the appraisal and reappraisal processes (Gangestad & Snyder, 2000). These differential effects of each stressors could also explain the findings of higher heart rate in participants who underwent the TSST versus the CO₂ challenge, as the effects of TSST are known to increase heart rate, while the CO₂ induction is known to decrease heart rate in comparison (see Kaye et al. 2004; Kirschbaum, Pirke, & Hellhammer 1993).

In examining group differences in stress reactivity, individual differences also play a key role. Past research has documented differences in reactivity based on personal characteristics (Choi, Vickers, & Tassone, 2014; Forsythe et al., 2011). More importantly, some of these individual differences have been shown to be accounted for largely by inter-personal characteristics, such as the construct of locus of control, the extent to which an individual believes he or she is able to control the situation or event (Weinstein & Quigley, 2006). Similar justifications were considered in the current study when using the variables Spheres of Control, Intrapersonal Subscale and Personal Growth Initiative Scale as covariates, as both constructs are supported by robust findings indicating a mediating role in stress reactivity (see section 3.52 and 3.53). In addition, both measures were significantly correlated with the stress outcome measures, suggestive of a relationship between these factors and the dependent variables. By controlling for the variance accounted by these interpersonal characteristics, it thus makes sense that the differential effects of subjective response to both stressors became more evident.

5.4 Interaction Effects of Framing and Stress-Induction on Stress Reactivity Profiles

Findings looking at the interactive effects of both experimental manipulations provide mixed support for the *a priori* hypotheses of this study. Although the directionality of the hypotheses was generally supported by the data, the hypotheses were unable to predict the complexity of the findings. The initial hypotheses were too simplistic in expecting the interactive effects of stress framing and induction. The results, however, highlight the multidimensional nature of the stress response, which was not predicted initially.

A primary interest of the current study was the changes in perceptions of stress over the course of the experiment; specifically, how participants' changes in perceptions of stress may be different based on the framing condition and stress-induction method employed. The results indicated a significant three-way interaction between time (throughout the course of the experiment), framing condition, and stressor. Contrary to the hypothesis, findings indicate that participants in the negative and positive framing conditions that underwent TSST experienced increases in perceiving stress to be uncontrollable and threatening following the experience of an acute stressor. It could be that the experience of TSST, coupled with unbalanced conceptualizations of stress, regardless of positive or negative, resulted in inadequate psychological preparations to cope with the stressor at hand, thus overwhelming both groups to perceive stress as much more threatening and uncontrollable.

As speculated previously, unbalanced conceptualizations of stress present the individual with incomplete information and expectations regarding the experience of stress. Upon encountering a stressor, an individual may then find it difficult to cope, which would ultimately reinforce negative perceptions of stress. A goal central to this thesis is to challenge the unbalanced conceptualizations of stress, and examine the impact of these conceptualizations. The

findings from the current study support the notion that balanced conceptualizations of stress would best equip individuals in coping with stressors, as individuals are more knowledgeable and thus can exert more control and autonomy in stressful context. This notion was supported in cross-cultural stress studies using Anglo-Americans and native Japanese participants (Kawanishi, 1995). In Eastern cultures, where interdependency is emphasized and praised, individual control is less important, whereas in Western cultures, the intrinsic need to feel in control of a situation is vital in perceiving what may or may not be stressful (Kawanishi, 1995). In the balanced framing conditions, participants of the current study were thus given important information regarding stress without enforcing deficit-oriented or surplus-oriented, biased views regarding what stress may be. This approach potentially allowed the individual to perceive stress as within his or her own control, thereby remaining autonomous when handling a subsequently stressful situation.

The notion of expectation is also very important in stress. According to the Transactional model of stress and coping (Lazarus & Folkman, 1984), a stressful encounter entails continuous appraisal and reappraisal. Yet, central to the process of appraisal is expectation. Whether it is expectations regarding whether an event is stressful or not, or the expectations of whether one can successfully cope with the anticipated stressor using the available resources, the process of appraisal is heavily influenced by one's attitudes and beliefs regarding his or her personal abilities and the situation at hand. Therefore, it can be expected that the framing manipulations may play a key role in influencing these expectations, especially coupled with the type of stressor subsequently encountered.

If the information given in a framing condition set forth specific expectations regarding stress, and those expectations were violated or became incongruent upon facing a particularly

stressor, then the violation of expectations could potentially augment distress for the participant. Telch and Telch (1985) documented similar findings in an educational approach to mitigate cancer patients' symptoms and prognosis. Although the educational therapy helped the prognosis of certain cancer patients, the same therapy given to those with previously optimistic outlooks despite facing their cancer diagnoses served to reduce their optimism, ultimately violating their expectations, and resulting in symptom deterioration post-therapy (Telch & Telch, 1985). In a subsequent study by Telch et al. (2011), the researchers experimentally induced unexpected arousal versus expected arousal, and again found the violation of expectations further contributed to increased vulnerability and reactivity to the CO₂ challenge. Gruber (2011) also discussed the downside of positive emotions in his research. Although studied in a clinical, bi-polar population, the implications of his findings indicated that positivity experienced in the wrong context could potentially negate any benefits from feeling positive, and potentiate dysfunction (Gruber, 2011). In this sense, findings from the studies above identify the mismatch between expectation and reality, and its contributions to increased vulnerability and reactivity in the individual. This analogy could explain the high levels of subjective stress reported by participants in the positive framing condition that have received the TSST, and continued arousal of participants in the positive framing condition that underwent the CO₂ challenge.

Perhaps, the positive framing set forth expectations that stress is easy to cope with. This, coupled with the demands of the TSST, could overwhelm the participants as reality violated the expectations set by the framing video. Similarly, physiological data indicate that while all groups experienced decreases in arousal during recovery, participants in the positive framing condition that underwent the CO₂ challenge continued to experience elevated arousal. Once again, the expectation that stress is easy to cope with set forth by the framing video could detrimentally

affect the subsequent coping by violating the expectations. In a model of cognitive appraisal proposed by So, Kuag, and Cho (2015), the researchers found that perceived susceptibility was a higher predictor of subsequent arousal than the experience itself. In violating one's perceptions and/or having unrealistic expectations regarding an event's outcome (e.g., unrealistic optimism), the result could lead to exacerbated arousal or worsening of outcomes (Hadad, 2013).

The incongruence between expectation and reality can also work in the opposite direction. Participants in the negative framing group receiving the CO₂ challenge perceived stress to in more favourable ways over the course of the experiment. Perhaps, the expectations of stress set forth by the negative framing video were violated once again, but in the opposite direction, and that the demands of the CO₂ challenge made stress seem much more controllable and less negative, thereby resulting in seeing stress in more positive ways towards the end of the experiment.

As expected, participants in the balanced framing conditions had better stress reactivity as compared to participants in other groups. Specifically, the balanced framing condition that underwent the TSST experienced the most efficient and dramatic decline in physiological arousal following the stressor, a sign of cardiac efficiency and resilience (see Jamieson et al., 2012), while participants that received the balanced framing and CO₂ challenge experienced minimal arousal during stress and throughout the remaining course of the experiment. It is possible that a participant in the balanced framing conditions may feel more self-efficacious relative to the negative or positive conceptualizations, as he or she may hold beliefs in one's capabilities to control stress reactivity, and cope with the stressor at hand. In addition, the balanced conceptualization does not set up unrealistic or biased expectations regarding stress and its outcomes, and therefore would not violate individual beliefs in stress and coping. Lastly, the

balanced framing would ultimately emphasize individual differences in coping with stress, and the on-going efforts needed to practice stress management. This would allow individuals to form and develop their own perceptions of stress in an open-minded manner.

A review of the literature highlighted both the efficacy and sustainability of interventions that depart from the deficit-oriented approach (Bogenschneider & Olson, 1998). These approaches have been shown to be ineffective, and at times, result in deterioration of behaviour (Bogenschneider & Olson, 1998). The current study highlighted the potential for more efficient and adaptive stress responses, as well as improvements in beliefs about stress, by utilizing an approach that departs dramatically from the typical, deficit-orientation in stress. Although a five-minute framing video may be inadequate in changing perceptions of stress over time, the current framing manipulation was effective in altering individuals' perceptions of stress during the course of the experiment, as well as having an interactive effect on individual's stress physiology and coping.

5.5 The Convergence and Divergence of Different Measures of Stress

Past research has documented that behavioural profiles may not always match the physiological and psychological stress reactions that ensue (Campbell & Ehlert, 2012; Tottenham et al., 2010). Similarly, the same stressor may also elicit different stress reactions in different stress systems (Maruyama et al., 2012). Interestingly, results of the current study show some levels of consistency across both subjective and objective indexes of stress reactivity. More specifically, while stress profiles of groups receiving TSST versus CO₂ challenge were different in many ways, similar profiles of arousal were seen in participants receiving the same stressors. The TSST seemed to have elicited the most reactivity while the CO₂ challenge elicited less reactivity in comparison, and at times, even decreased physiological arousal. Furthermore,

participants of the balanced framing condition that underwent the CO₂ challenge consistently reported, and showcased, the least stress reactivity as compared to other groups.

The current study's mixed findings between subjective and objective measures of stress could be partially attributed to the nature of the measurements used. In highlighting stress and its conceptualization in the framing videos, participants may have heightened awareness of their own perceptions of stress and stress reactivity, thereby interpreting their arousals carefully in accordance with the information they received in the framing manipulations. In addition, objective measures of stress reactivity focused exclusively on the sympathetic adrenal medullary (SAM) axis. The SAM activity is a general physiological indication of engagement and arousal (Bradley et al., 2008). As the study emphasized the role of self-appraisal in stress reactivity, participants' heightened awareness psychologically could result in the close monitoring of their physiological symptoms. According to research lead by Matthews et al. (2002), an individual's state of stress could be attributed to many factors, including engagement, distress, and/or worry. As such, the significant findings may be attributed to a single or combination of the above factors. Finally, as the TSST and CO₂ are both distinct stressors, it may be that the measures utilized in this study were more adept at capturing the reactivity of only one of the stressors or partial stress responses of either stressor.

5.6 Study Limitations

This study has four main limitations: (1) sample size, (2) individual characteristics not assessed or controlled for, (3), equipment use during study, and (4) baseline control for experimental design.

The study's sample size is relatively small. Initial power analysis determined that a predictive power of .99 required 135 participants in total. The current study sample consists of

only 49 participants. As such, it can be expected that the sample size and statistical tests employed did not have sufficient power in detecting findings of smaller effect sizes (Ferguson, 2009). However, according to Lakens (2013), observed effect sizes within the current study can differ from the *a priori* determined effect sizes via initial power analysis. As such, overestimations in initial power analysis are common in research (Lakens, 2013). Furthermore, the current study's statistically significant findings were interpreted to indicated small to medium effect sizes (Ferguson, 2009), suggesting that despite the small sample sizes, findings were relatively robust and interpretations were conservative.

An additional limitation that can be directly attributed to the small sample size is the heterogeneity of variance within the sampled population. As a result, several outcome variables had to be transformed during the course of the statistical analyses as the small sample sizes emphasized the heterogeneity of variances from one participant to the next. Thus, findings as a result of the transformed data may not be consistent with the untransformed data. However, similar results were found in analyses using the untransformed data, and as such, with a larger sample size, the heterogeneity of variance may be less of an issue.

The second limitation consists of failure in study design to assess for individual characteristics that may otherwise influence participants' stress reactivity. Past reviews have highlighted the substantive role individual factors may play in the outcome of encountering stress (Segerstrom & Miller, 2004). Although the study controlled for medical history and stress levels of the participant prior to their arrival at the laboratory, at times, participants' responses during the in-lab assessment of the pre-screen measure departed from those done prior to the study. Due to practical constraints, participants were still kept; those that met the exclusion criteria of CO₂ upon arriving at the laboratory were then placed in the TSST condition, which

had far fewer health-related exclusionary criteria than that of the CO₂ challenge. Although this occurred in less than five cases, these participants were excluded from the CO₂ challenge despite being randomized into that condition. However, the majority of the participants were randomly placed in their respective conditions. Furthermore, given the limited scope and practicality of the experiment, many demographics variables were not analyzed. Past studies have supported demographic differences that could contribute to differential stress effects to stressful stimuli (e.g., Kudielka et al., 2004; Taylor et al., 2014). With a larger sample size, these demographic variables may have shed light on the differential responses to stressors.

In addition, although the study tested for significantly correlated individual characteristics such as personal growth initiative and spheres of control, many factors were never assessed as part of the study design. In analyses of variance, the intercept indicated a large portion of the variance was unaccounted for by the current study design. For example, the TSST is a social-psychological stressor, with one of the primary threats being social evaluation (Kirschbaum et al., 1993). Therefore, it would have been useful to assess for social anxiety in the current study population. Although participants in the TSST condition with social anxiety may result in increased stress reactivity, similar results may also be expected from participants that have undergone the CO₂ challenge. Although the TSST may involve elements of social evaluation, the CO₂ challenge arguably also requires individuals to follow social cues and interact with the experimenter in a social context (but to a far lesser extent and for a shorter time period). That noted, past research has controlled for social anxiety in a psychosocial stress-induction paradigm, and has found no differences in stress reactivity as a function of social anxiety (Jamieson et al., 2013b).

Another limitation of the current study is the equipment used to measure stress reactivity. Firstly, the BioPac system utilized in this study is relatively new. As such, occasional technical errors during the experiment occurred, such as problems in signalling, resulting in the loss of signal or alterations to signals. All of these may otherwise influence results or cause inappropriate stress reactions in participants. However, as part of the study design, a control group of participants ($n = 5$) completed the experiment without the use of BioPac, thereby controlling for equipment stress. As indicated in the results section, independent mean comparisons found no significant differences in subjective self-reported stress across the two groups. Similarly, as part of the CO₂ challenge protocol, participants are instructed to breathe through a tube connected to the machine. It is difficult to ascertain whether the stress response is entirely attributed to the increase of CO₂, or through the stresses associated with following instructions and/or restrictions in normal breathing patterns.

Finally, the last limitation of the current study is the lack of experimental control for experimental manipulations. The current thesis did not have a baseline measure of subjective self-reported levels of stress prior to stress-induction. Although baseline measures of perceptions of stress are recorded, and pre-screen measures ensured that the participants were experiencing moderate levels of stress over the past month, there was no measure to indicate participants' levels of stress upon arriving at the laboratory. As such, it would be difficult to gauge the participants' true levels of stress as a direct result of the stressors, and the extent to which each stressor induced individual subjective stress responses. Furthermore, to further gauge the extent to which framing affects opinions of stress and stress reactivity, a control condition where participants were not exposed to any framing conditions would be beneficial.

5.7 Study Strengths

Despite limitations, the current study also has unique strengths. Although previous research has highlighted the deficit-orientation in stress conceptualization, this was the first study to directly challenge the different conceptualizations of stress using a framing video manipulation. Past research has often conceptualized stress by highlighting its aversive effects. Yet, individual variations in perceptions of stress are often not accounted for. Research indicates that even maladaptive coping strategies could contribute to adaptive coping in different contexts (Ottaviani et al., 2014). Ultimately, stress and coping likely depend on individual beliefs regarding stress and the flexibility to adapt to different stressors. Thus, biased conceptualizations of stress would not contribute to the flexibility needed in order to adapt to stress and promote resilience. With Lazarus' (2000) urging for researchers to examine systemic factors that contribute to efficient coping, as well as past research highlighting a deficit-orientation in approaches to research (for review, see Liu & Vickers, 2015), this study was successful in underscoring the importance of stress conceptualization in subsequent coping with stressors.

Another strength of the study despite its small sample size is the significant differences between two methods of stress-induction. To date, few studies have examined differences in reactivity between different methods of stress-induction (see Giles et al., 2014; Maruyama et al., 2012). More importantly, no study to date has specifically addressed the use of different stressors in psychological research by using both subjective and objective indicators of stress reactivity. While research has begun to look at the effects of different stressors (Giles et al., 2014), few utilize different systems measures and none have explored the convergence of these measures with self-reported levels of stress. Thus, an important strength of the current study is prominently

featuring the very different stress responsivity profiles, and the magnitude of those differences through both subjective self-report and objective physiological indexes.

5.8 Conclusion and Future Directions

A goal central to this thesis is to challenge the unbalanced conceptualizations of stress, and examine the impact of these conceptualizations. Prior to this study, previous findings have speculated on the role of cultural conceptualizations of stress in shaping our knowledge and coping with stressors (Hobfoll, 2001). Going one step beyond past research that has utilized reappraisal to improve stress and coping, the current study set out to introduce different conceptualizations of stress in order to gain better understanding of *how* our thoughts regarding stress may influence future coping with stressors. Despite the small sample size, the findings of the current study highlight the complexity of the relationship between how we think of stress, and ultimately how we choose to cope with stressors.

A critique of the appraisal-based models of stress has been that it does not highlight the role of culture and is an egocentric model of stress and coping (Hobfoll, 2001). Yet, the current research underscores the importance of culture in shaping individual perceptions of stress. The Transactional Model of Stress and Coping (Lazarus & Folkman, 1984) and the key role of appraisal continues to be relevant in understanding stress reactivity, as well as an individual's perceptions of stress today. However, research in this area continues to be sparse. Although researchers have emphasized the role of reappraisal in stress and coping, the interventions utilized are diverse in nature, and often reframe stress from unbalanced perspectives, highlighting only the bad or good, and focusing on only immediate effects of reframing. The aim of the current study was to challenge the effects of reappraisal interventions in delivering only unbalanced knowledge of stress. Future research is needed to validate the current study's

findings, as well as to examine the lasting effects, if any, of conceptualizing stress from different perspectives.

Researchers have often speculated on the effects of different stressors, and use procedures previously employed without contemplating the theoretical and practical implications of the methods chosen and the potential effects on the participants. Although the current study differentiated between the effects of two very different stressors using self-reported and physiological measures of stress reactivity, the results may only represent the tip of the iceberg. There are many different types of stressors still widely used in psychological research today, ranging from physiological in nature (e.g., cold pressor; Hines & Brown, 1936), to cognitive (e.g., Paced Auditory Serial Addition Test [PASAT]; Gronwall, 1977), to psychological (virtual reality; Hartanto et al., 2014), and to multi-systems (multitasking; Wetherell et al., 2012). Giles et al. (2014) highlighted the differential physiological effects of the stressors, suggesting that researchers should carefully choose the stress-induction method(s) when designing their studies. The current study further contributed to this knowledge, by also examining the psychological, as well as physiological, reactivity to different stressors. Future research in psychology would greatly benefit from a more in-depth understanding of the psychological profiles of each of these stressors and their comparative use as a laboratory stress-induction method. This would better inform future research designs with research goals in mind. For example, despite the TSST's intense physiological and psychological arousal, methods such as CO₂ may still be useful in study designs that are aimed to explore the appraisal processes, or those that are interested in physiological symptoms of stress. More knowledge in the relevance of each stress-induction method would enable researchers to conduct more purposeful research.

Furthermore, heart rate, systolic blood pressure, and diastolic blood pressure are all indicators of the acute, fast-acting SAM system (Piazza et al., 2010). While the SAM system is a system of stress activation, it is not the only stress system within the body. McEwen (2013) advocated the use of a variety of stress reactivity measures from various systems of the body in order to gain a comprehensive understanding of the stress profile. Moreover, as previously noted, it is uncertain whether heart rate, systolic blood pressure and diastolic blood pressure are truly indicative of a stress response, or whether they are markers of engagement and arousal (Bradley et al., 2008).

Ultimately, this study effectively addressed existing gaps in the stress literature, tapping into conceptualizations of stress as well as methodologies employed to study stress. The field of stress is complex, and much is still yet unanswered. However, this study unravelled some of the common conceptions of stress, and identified areas where future exploration is needed. Although attempts to reduce stress should never be overlooked by an individual or the healthcare system, when stress inevitably occurs, a more balanced understanding, a strengthened coping efficacy, diverse stress management skills and enhanced resilience may be useful for individuals in approaching non-traumatic stress as a challenge, and potentially experience growth and resiliency from these beliefs.

5.9 Recommendations

Based on findings from the current study, several specific recommendations can be made. Firstly, the unexpected findings resulting from the effects of the positive framing (possibly as a result of the violation of expectations) provide support for the need to examine overtly positive messages of stress and coping. Although previous research has highlighted the success of reappraisal interventions that use similar language as the current thesis' positive framing script

(e.g., Jamieson et al., 2010; 2012; 2013), it is worth noting that these studies did not provide alternative conceptualizations of stress. Thus, the current thesis' findings provide compelling support for the importance of providing realistic messages regarding stress and its outcomes to better educate the individual and further improve stress responsivity.

The success of the framing manipulations in the current thesis lends support for future applications for alternative conceptualizations of stress exploring various trajectories of stress outcomes. Future research could explore the longitudinal effects in shifting conceptualizations of stress. Although reviews have identified various facets of stress, such as the adaptive effects of stress in the short-term (Dhabhar, 2014; McEwen & Sapolsky, 1995; Segerstrom & Miller, 2004), as well as the utility of stress for resilience-building in the long term (Seery et al., 2013), much is left to be studied in understanding the role of individual, subjective appraisals of stress in determining the outcomes of stressful experiences. Knowledge in this area would further contribute to a better understanding of resilience and personal growth over the course of an individual's life, and has been identified as a key area of further study by prominent researchers (see Epel & Lithgow, 2014). Lastly, educational initiatives could benefit from incorporating alternative conceptualizations when discussing stress-related outcomes.

Appendix I – Demographics Questionnaire

Participant Number _____

1. Sex (circle one): M F

2. Age: _____

3. Ethnicity: _____

4. Year(s) in Canada: _____

5. Year of Study (circle one): 1 2 3 4 5 6 7 8

6. When thinking of stress, please identify up to four words that comes to mind.

1. _____ 2. _____ 3. _____ 4. _____

Appendix II – DIS¹

0 – Not at all like me	1 – Moderately not like me	2 – A little not like me	3 – Neutral	4 – A little like me	5 – Moderately like me	6 – Extremely like me
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1. I can tolerate a great deal of physical discomfort (r)	0	1	2	3	4	5	6
2. I have a high pain threshold (r)	0	1	2	3	4	5	6
3. I take extreme measures to avoid feeling physically uncomfortable	0	1	2	3	4	5	6
4. When I begin to feel physically uncomfortable, I quickly take steps to relieve the discomfort	0	1	2	3	4	5	6
5. I am more sensitive to feeling discomfort compared to most persons	0	1	2	3	4	5	6

¹ This is the participant version of the Discomfort Intolerance Scale (Schmidt, Richey, & Fitzpatrick, 2006). For the purposes of controlling for the influence a scale name may pose on participant responses, actual names of the measures were not shown.

Appendix III – PANAS²

PANAS Questionnaire

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. Indicate to what extent you feel this way right now, that is, at the present moment *OR* indicate the extent you have felt this way over the past week (circle the instructions you followed when taking this measure)

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely

_____ 1. Interested	_____ 11. Irritable
_____ 2. Distressed	_____ 12. Alert
_____ 3. Excited	_____ 13. Ashamed
_____ 4. Upset	_____ 14. Inspired
_____ 5. Strong	_____ 15. Nervous
_____ 6. Guilty	_____ 16. Determined
_____ 7. Scared	_____ 17. Attentive
_____ 8. Hostile	_____ 18. Jittery
_____ 9. Enthusiastic	_____ 19. Active
_____ 10. Proud	_____ 20. Afraid

² Positive Affect Negative Affect Scale (Watson, Clark, & Tellegan, 1988).

Appendix IV – PGIS³

1 – Definitely Disagree	2 – Mostly Disagree	3 – Somewhat Disagree	4 – Somewhat Agree	5 – Mostly Agree	6 – Definitely Agree
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1. I know how to change specific things that I want to change in my life.	1	2	3	4	5	6
2. I have a good sense of where I am headed in my life.	1	2	3	4	5	6
3. If I want to change something in my life, I initiate the transition process.	1	2	3	4	5	6
4. I can choose the role that I want to have in a group.	1	2	3	4	5	6
5. I know what I need to do to get started toward reaching my goals.	1	2	3	4	5	6
6. I have a specific action plan to help me reach my goals.	1	2	3	4	5	6
7. I take charge of my life.	1	2	3	4	5	6
8. I know what my unique contribution to the world might be.	1	2	3	4	5	6
9. I have a plan for making my life more balanced.	1	2	3	4	5	6

³ Personal Growth Initiative Scale (Robitschek, 1998).

Appendix VI – PSSS⁴

1 – Very Strongly Disagree	2 – Strongly Disagree	3 – Mildly Disagree	4 – Neutral	5 – Mildly Agree	6 – Strongly Agree	7 – Very Strongly Agree
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1.	There is a special person who is around when I am in need.	1	2	3	4	5	6	7
2.	There is a special person with whom I can share my joys and sorrows.	1	2	3	4	5	6	7
3.	My family really tries to help me.	1	2	3	4	5	6	7
4.	I get the emotional help and support I need from my family.	1	2	3	4	5	6	7
5.	I have a special person who is a real source of comfort to me.	1	2	3	4	5	6	7
6.	My friends really try to help me.	1	2	3	4	5	6	7
7.	I can count on my friends when things go wrong.	1	2	3	4	5	6	7
8.	I can talk about my problems with my family.	1	2	3	4	5	6	7
9.	I have friends with whom I can share my joys and sorrows.	1	2	3	4	5	6	7
10.	There is a special person in my life who cares about my feelings.	1	2	3	4	5	6	7
11.	My family is willing to help me make decisions.	1	2	3	4	5	6	7
12.	I can talk about my problems with my friends.	1	2	3	4	5	6	7

⁴ Perceived Social Support Scale (Dimet, Dahlem, Zimet & Farlye, 1988).

Appendix VII – SCS⁵

1 – Very Strongly Disagree	2 – Strongly Disagree	3 – Mildly Disagree	4 – Neutral	5 – Mildly Agree	6 – Strongly Agree	7 – Very Strongly Agree
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1.	When I get what I want it's usually because I worked hard for it.	1	2	3	4	5	6	7
2.	When I make plans I am almost certain to make them work.	1	2	3	4	5	6	7
3.	I prefer games involving some luck over games requiring pure skill.	1	2	3	4	5	6	7
4.	I can learn almost anything if I set my mind to it.	1	2	3	4	5	6	7
5.	My major accomplishments are entirely due to my hard work and ability.	1	2	3	4	5	6	7
6.	I usually don't set goals because I have a hard time following through on them.	1	2	3	4	5	6	7
7.	Competition discourages excellence.	1	2	3	4	5	6	7
8.	Often people get ahead just by being lucky.	1	2	3	4	5	6	7
9.	On any sort of exam or competition I like to know how well I do relative to everyone else.	1	2	3	4	5	6	7
10.	It is pointless to keep working on something that's too difficult for me.	1	2	3	4	5	6	7
11.	Even when I'm feeling self-confident about most things, I still seem to lack the ability to control social situations.	1	2	3	4	5	6	7
12.	I have no trouble making and keeping friends.	1	2	3	4	5	6	7
13.	I'm not good at guiding the course of a conversation with several others.	1	2	3	4	5	6	7
14.	I can usually establish a close personal relationship with someone I find attractive.	1	2	3	4	5	6	7
15.	When being interviewed I can usually steer the interviewer toward the topics I want to talk about and away from those I wish to avoid.	1	2	3	4	5	6	7
16.	If I need help in carrying off a plan of mine, it's usually difficult to get	1	2	3	4	5	6	7

⁵ Spheres of Control Scale (Paulhus, 1983).

others to help.							
17. If there's someone I want to meet I can usually arrange it.	1	2	3	4	5	6	7
18. I often find it hard to get my point of view across to others.	1	2	3	4	5	6	7
19. In attempting to smooth over a disagreement I usually make it worse.	1	2	3	4	5	6	7
20. I find it easy to play an important part in most group situations.	1	2	3	4	5	6	7

Appendix VIII – Informed Consent Form

Participant Informed Consent Form

You are being asked to participate in a research study. Before you give your consent, it is important that you read the following information and ask as many questions as necessary to be sure you understand what you will be asked to do.

Title of Study: Stress: Methods of Experimental Induction.

Purpose: The purpose of this study is to examine the methods of stress-induction in a laboratory setting. The primary investigator is Jenny Liu and she is supervised by her faculty advisors Dr. Marilyn Hadad and Dr. Kristin Vickers, Department of Psychology, Ryerson University.

Procedure: If you agree to be in this study, you will be asked to do the following:

1. Fill out a series of questionnaires (~25 minutes)
2. Watch a brief video detailing the effects of stress. (5 minutes)
3. Undergo an experimental induction of stress. (~25 minutes)
4. Be debriefed. (5 minutes)

The total time required to complete the study should be approximately 60 minutes.

Benefits/Risks to Participant: During the course of this study, you may be asked about certain thoughts, emotions, attitudes, or beliefs that you hold as well as experiences that you may have had in your life. Reflecting on these experiences may involve a minimal risk of any discomfort or psychological distress. In addition, the experimental induction of stress may involve some minimal risk of physiological and psychological distress as it is intended to mimic physiological and psychological stress. Please note that these measures have been widely used in psychological research, and have been reviewed and approved by the Research Ethics Board at Ryerson University. Through your participation, you may gain knowledge regarding stress and psychological research. In addition, you will be compensated for your time and participation by receiving 1% credit towards your PSY course, in accordance with the Department of Psychology's guidelines. You will receive this credit by "walking through" the study even if you decide not to participate.

Voluntary Nature of the Study/Confidentiality: The nature of this study is entirely voluntary. Your participation is much appreciated and you may refuse to complete this study at any time during the course of this research, or refuse answers to any question you feel uncomfortable about. If you choose to drop out during the research, your credit for PSY will not be affected. If at any point you feel unclear or confused regarding the nature of this study, you should feel free to ask the researcher any questions you may have. All your responses will be confidential and your individual responses will not be identified or connected to you. All data collected will be pooled and published in aggregate, and locked away in a secured cabinet only the primary investigator Jenny Liu, her faculty advisors and research assistant will have access to.

Contacts and Questions: If you have any questions regarding this study, please feel free to contact the primary investigator Jenny Liu at jenny.liu@psych.ryerson.ca. Alternatively, you may contact her

supervisors Dr. Marilyn Hadad at mhadad@psych.ryerson.ca or Dr. Kristin Vickers at kvickers@psych.ryerson.ca.

This study has been approved by the Ryerson Research Ethics Board. If you have questions regarding your rights as a human subject and participant in this study, you may contact the Ryerson University Research Ethics Board for information.

Research Ethics Board
c/o Office of the Vice President, Research and Innovation
Ryerson University
350 Victoria Street
Toronto, ON M5B 2K3
416-979-5042

Participant Agreement: Your signature below indicates that you have read the information in this agreement and have had a chance to ask any questions you have about the study. Your signature also indicates that you agree to be in the study and have been told that you can change your mind and withdraw your consent to participate at any time. You have been given a copy of this agreement.

You have been told that by signing this consent agreement you are not giving up any of your legal rights.

Name of Participant (please print)

Signature of Participant Date

Signature of Investigator Date

Thanks for your participation!

Appendix IX – Debrief Form

RYERSON UNIVERSITY

DEBRIEFING SCRIPT

Re-Branding Stress: Implications for the Future of Stress

Thank you for participating in this study. Your contributions to this research are extremely valuable. The purpose of this research aims to study the effects of framing on stress.

Non-traumatic stress, encompassing stresses we typically encounter on a daily basis, has often been associated with negative outcomes in health and well-being. The cultural beliefs regarding stress tend to be unbalanced, in that it focuses exclusively on the negative outcomes. In turn, individuals typically regard stress as something to avoid if possible. Unfortunately, we cannot eliminate stress altogether. Although we should never overlook efforts to reduce stress in our daily lives, when stress inevitably occurs, such as when a car accident happens on your daily commute resulting in being late for a meeting, or when deadlines pile up, a strengthened coping self-efficacy, diverse stress management skills, and a sense of control may enhance your resilience and be useful for managing stress effectively.

For this study, we first attempted to conceptualize stress in different ways in an attempt to shift individuals' beliefs regarding stress, and looked at the effects on stress responses across different groups. In addition, we also tested different methods of stress-induction often used in stress research to examine whether any differences in stress response occurred between these methods, and across groups. In this study, you were asked to respond to several questionnaires, all commonly associated with resilience, and watched a video documenting stress. This video was, in fact, a part of the experimental manipulation to examine cultural perceptions of stress and potentially shifting those beliefs. The video was filmed here on campus, and the actress in the video was a graduate student. Following the video, you provided us with both objective measures of your stress response (e.g., heart rate and blood pressure) and subjective measures of your stress response (e.g., question regarding how stressed you may have felt, and whether you believed if you were in control of your response). These results will provide us with deep insights into the conceptualization of stress. Fundamentally, if a shift in the beliefs regarding stress can affect how individuals may respond to stress, we can then conceptualize stress in more adaptive ways. This area of research is relatively novel, and the data you have provided will begin to point us in the right direction for investigation.

Your questionnaires are coded by number, not name, to ensure anonymity, and the questionnaires will be stored in a locked filing cabinet in the Psychophysiology Lab at Ryerson University. Any personal information about you will remain completely confidential. All electronic information will be stored in an encrypted USB drive. Only those directly involved with the study will have access to both the cabinet and the electronic data, including the primary investigator Jenny Liu, her faculty advisors Dr. Hadad and Dr. Vickers, and any research assistant helping with this study.

If you would like to speak to someone about your experiences, or about the nature of this study, or are interested in finding out the outcomes of this study, you may contact any of the following:

Dr. Marilyn Hadad (Faculty Supervisor)

Phone: 416-979-5000 x7109

Email: mhadad@psych.ryerson.ca

Dr. Kristin Vickers (Faculty Supervisor)

Phone: 416-979-5000 x7727

Email: kvickers@psych.ryerson.ca

Jenny Liu (Primary Investigator)

Email: jenny.liu@psych.ryerson.ca

Thanks for your participation!

Appendix X– Medical Health Questionnaire (pre-screen)

ID # _____

Medical History Questionnaire

1. Have you ever been diagnosed by a physician as having any of the following? If you are NOT SURE, please explain.

CONDITION	NO	NOT SURE (IF NOT SURE, PLEASE EXPLAIN)	YES
Head Injury			
Brain Tumor			
Cerebral Aneurysm			
Cerebral Hemorrhage			
Stroke			
Transient Ischemic Attack			
Heart Attack			
Heart Disease			
Coronary Artery Disease			
Congestive Heart Failure			
Mitral Valve Prolapse			
Diabetes			
Vasovagal syncope (fainting episodes)			

2. Have you ever been diagnosed by a physician as having any of the following? If you are NOT SURE, please explain.

CONDITION	NO	NOT SURE (IF NOT SURE, PLEASE EXPLAIN)	YES
Heart Murmur			
Cardiac Arrhythmia			
Respiratory Disease			
Lung Disease			
Basilar Artery Migraine			
Asthma			
Epilepsy			
Hemiplegic Migraine			
Seizures			
Liver Disease			
Kidney Disease			
Ophthalmoplegic Migraine			
Hypertension (High Blood Pressure)			
Cerebrovascular Accident			
Renal Problems (Kidney Problems)			

3. Has any family member (first degree relative) ever been diagnosed with any of the following?

CONDITION	NO	NOT SURE (IF NOT SURE, PLEASE EXPLAIN)	YES
Cerebral Aneurysm			
Cerebral Hemorrhage			
Hemiplegic Migraine			

4. Please check YES, NO, or NOT SURE for each of the questions below: If you are NOT SURE, please explain:

QUESTION	NO	NOT SURE (IF NOT SURE, PLEASE EXPLAIN)	YES
Are you currently pregnant?			
Do you have a history of fainting?			
Are you taking any medication that affects your heart rate? Examples include: beta-blockers, calcium channel blockers, and tricyclic antidepressants.			
Are you in poor physical health?			
Have you been told to limit physical activity?			
Have you ever been dizzy or passed out during or after exercise?			
Are there any restrictions on your daily behavior due to a medical condition?			

5. Have you ever been diagnosed by a physician with any of the following? If YES, please explain the type.

CONDITION	NO	YES	IF YES, PLEASE EXPLAIN THE TYPE
Allergies			
Cancer			
Psychological Disorder			

- 6a. Have you ever been diagnosed by a physician as having a condition that has not been asked about on this questionnaire?

YES

NO

- 6b. If you answered NO to question 6a above, please skip to question 7 (next page). If you answered YES to question 6a above, please list the condition/s and explain below in the table:

CONDITION	PLEASE EXPLAIN

7a. Do you get headaches?

YES

NO

If you answered NO to question 7a above, please skip to question 8 (on page 6). If you answered YES to question 7a above, please answer the questions in the HEADACHE SYMPTOMS table below (question 7b).

7b. Please answer each question in the HEADACHE SYMPTOMS table below with respect to the headaches you have had. Please consider each question as it relates to symptoms you may have had during your headache, after your headache has passed, or before your headache has started.

HEADACHE SYMPTOMS

QUESTION	NO	NOT SURE (IF NOT SURE, PLEASE EXPLAIN)	YES
Did paralysis of one side of your body ever occur?			
Did two (or more) of the following occur?: feeling that the world was revolving or like you were revolving in space; tingling sensations on both sides of your body; double vision; ringing in your ears; paralysis of both sides of your body; difficulty speaking; visual symptoms in both eyes' visual fields near your nose and ears; decreased hearing; decreased level of consciousness; lack of coordination?			

Did paralysis of the nerves needed for eye movement occur, leading to a drooping eyelid, double vision, or excessive dilation of the pupil of your eye?			
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8. Please list previous hospitalizations for past medical problems:

DIAGNOSIS	DATES	TREATMENT

9a. Are you currently taking prescription medications? **YES** **NO**

9b. If you answered YES to question 9a above, please list the prescription medications you are taking and the condition each is treating.

PRESCRIPTION MEDICATION	FOR WHAT CONDITION?

10. When did you have your most recent physical exam?

MONTH and YEAR:

11. Did this most recent physical exam indicate that you are in good physical health? YES
NO DON'T KNOW

12a. Are you currently taking non-prescription medications? **YES** **NO**

12b. If you answered YES to question 12a above, please list the non-prescription medications you are taking and the condition each is treating or the purpose of the non-prescription medication.

NON-PRESCRIPTION MEDICATION	FOR WHAT CONDITION OR PURPOSE?

13a. Are you currently taking vitamins, minerals or herbal supplements? **YES** **NO**

13b. If you answered YES to question 13a above, please list the vitamins, minerals, or herbal supplements you are taking and the purpose of each. Herbal supplements include weight loss preparations such as ephedra (ma huang) and yohimbine.

VITAMIN, MINERAL, OR HERBAL SUPPLEMENT	FOR WHAT PURPOSE?

14a. Are you currently trying to become pregnant? **YES** **NO**

14b. Have you experienced a miscarriage or abortion in the past month? **YES** **NO**

14c. Please list the date of your most recent pregnancy:

NEVER BEEN PREGNANT or DATE: _____

15a. Are you currently taking birth control pills or using other hormonal means of contraception? **YES**
NO

15b. If YES, please specify what type of hormonal contraception:

TYPE:_____

16a. Do you smoke cigarettes?

YES

NO

16b. If YES, please specify number of cigarettes per day:

NUMBER OF CIGARETTES DAILY:_____

The next questions below (#17 & #18) are optional and you may choose NOT to answer either or both of them. These questions are for the purposes of data collection only.

17a. Do you drink alcohol?

YES

NO

17b. If YES, please specify number of drinks per week:

NUMBER OF DRINKS PER

WEEK:_____

18a. Do you use substances other than nicotine or alcohol?

YES

NO

18b. If YES, please specify the type of substance:

TYPE OF SUBSTANCE _____

We greatly appreciate you giving us this information. All information will be kept confidential. It is important that this form be accurate. Please print your id number below if you have answered these questions to the best of your knowledge.

"I have read the questions on this form carefully and have answered each as accurately as possible."

(print ID number)

(date)

Appendix XI – PSS⁶

0 - Never	1 – Almost Never	2 - Sometimes	3 – Fairly Often	4 – Very Often
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1. In the last month, how often have you been upset because of something that happened unexpectedly	0	1	2	3	4
2. In the last month, how often have you felt that you were unable to control the important things in your life	0	1	2	3	4
3. In the last month, how often have you felt nervous and “stressed”	0	1	2	3	4
4. In the last month, how often have you felt confident about your ability to handle your personal problems	0	1	2	3	4
5. In the last month, how often have you felt that things were going your way	0	1	2	3	4
6. In the last month, how often have you found that you could not cope with all the things that you had to do	0	1	2	3	4
7. In the last month, how often have you been able to control irritations in your life	0	1	2	3	4
8. In the last month, how often have you felt that you were on top of things	0	1	2	3	4
9. In the last month, how often have you been angered because of things that were outside of your control	0	1	2	3	4
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them	0	1	2	3	4

⁶ Perceived Stress Scale (Cohen, 1983).

Appendix XII – Framing Script

Unbalanced Negative Framing Skit:

People are concerned with stress because it permeates so many aspects of our lives. This is even more so in our modern world. We have more and more reasons to be worried and stressed out. And there are just cause to be worried about the stresses we all bear, because dealing with this stress can have detrimental effects on our bodies and our minds.

Hans Selye, one of the original stress researchers in psychology proposed a three-stage model, called the General Adaptation Syndrome to explain how we react to stress.

At the alarm stage, we first encounter what we find to be stressful – something that threatens our wellbeing, and our bodies' balance, that is, our homeostatic functions. Now, 'stress' doesn't have to be just one thing or event. In fact, stress is additive. This is especially true in today's world, where we are often dealing with ongoing stress that continues for long periods of time. So fast forward days, months, or years of constantly dealing with things that we find stressful, or threatening, such as pressures of graduating school, finding a job, and the continuing stresses of financial insecurities, bad relationships, health concerns etc that many people experiences, and our bodies then enter the next stage, the resistance stage. During this time, our bodies are using up all of our resources to continue to fuel us in what we are doing to 'cope' with these stressors. Finally, as the stresses persist, our bodies' resources are depleted, and there is no relief from stress in sight. This is the third and last stage, known as the exhaustion stage. At this point, we are out of fuel, and exhausted.

Biologically, the stress response is a complex physiological process. Stress affects the cardiovascular system, increasing our heart rate and blood pressure. It tenses up our muscles, it slows down our digestion, increases our oxygen intake, cools down our skin, dilates our pupils and makes our hearing more acute, and produces many other chemicals, such as cortisol. In short, our bodies really take a beating from stress!

Now, we see the problem. If many of our everyday stresses are ongoing, our bodies are bound to run out of resources eventually. And, once our bodies are depleted of its resources as a result of chronic stress we so often experience today, our immune systems are compromised, our energies are down, and this is where we are vulnerable to physical maladies, from cold or flus (which are popular co-occurrences during the final exam period), or heart attacks.

So it's easy to see why when we are stressed, we sometimes experience tensions in our muscles, dry throat and mouth, trembling, cold hands and feet, weakness, fatigue, and other feelings that might negatively impair our performance. And this, could stress us out even more. Research on stress has linked the experience of stress to many mental and physical illnesses, including bipolar disorder, depression, post-traumatic stress disorder, coronary heart disease, diabetes, and arthritis. And to make matters worse, when we are stressed, we tend to engage in adverse health behaviors, such as smoking, drinking, or eating, which are also disruptive to our abilities to cope with stress and maintain health. In this sense, stress can act as both triggers to new health issues, or worsen existing health conditions. Therefore, it is important to promote a healthy lifestyle that coincidentally also acts as a strategy for reducing stress. This includes plenty of exercise, restful sleep, good nutrition, and taking breaks to recharge and refuel the mind and the body.

Balanced Framing Skit:

People are concerned with stress because it permeates so many aspects of our lives. We are told all the time that stress is bad for our health, both physically and psychologically. And there is some truth to this.

Hans Selye, one of the original stress researchers in psychology proposed a three-stage model, called the General Adaptation Syndrome to explain how we react to stress.

At the alarm stage, we first encounter what we find to be stressful – something that threatens our wellbeing, and our bodies' balance, that is, our homeostatic functions. Now, 'stress' doesn't have to be just one thing or event. In fact, stress is additive. This is especially true in today's world, where we are often dealing with ongoing stress that continues for long periods of time. So fast forward days, months, or years of constantly dealing with things that we find stressful, or threatening, such as pressures of graduating school, finding a job, and the continuing stresses of financial insecurities, bad relationships, health concerns etc. that many people experiences, and our bodies then enter the next stage, the resistance stage. During this time, our bodies are using up all of our resources to continue to fuel us in what we are doing to 'cope' with these stressors. Finally, as the stresses persist, our bodies' resources are depleted, and there is no relief from stress in sight. This is the third and last stage, known as the exhaustion stage. At this point, we are out of fuel, and exhausted.

While all this may be true. It paints a very unbalanced picture of what stress can do for us! Stress is not always a bad thing. In fact, it can be motivating. When we experience all these physiological signs, we often think our bodies are stressed out. in a sense, it is, but this also indicates our bodies are ready for action, to deal with what's stressing us out! To truly understand stress, we need to consider both the good and the bad. Obviously, if we have too much stress, we will get anxious and won't perform well. However, if we have too little stress, we'd just fall asleep and not perform at all!

A fellow researcher at Harvard found that by simply having people reinterpret their bodies' responses at times of stress, their stress response looked a lot closer to rising up to a challenge. It's not that they no longer reacted to stress, it's that their reaction changed to something that's not to threatening.

We often hear of the phrase 'mind over matter'. We know that stress is bad for the health. However, a study found that, yes, stress is related to mortality, but *only* within those that *believe* stress is bad for health. Therefore, how we think of stress matters. In fact, people who successfully cope with stress (big or small), can even experience enhanced self-confidence and resilience!

Now, the question is, how can we use stress in a positive way? Coping with stress is like playing a videogame. The more your practice, the better you get, and the better you get, the higher the level you climb to, until finally, you have a chance at beating the game! And so to with stress.

Unbalanced Positive Skit:

People are concerned with stress because it permeates so many aspects of our lives. We are told all the time that stress is bad for our health, both physically and psychologically.

While all this may be true. It paints a very unbalanced picture of what stress can do **for** us! Stress is not always a bad thing. In fact, it can be motivating. When we experience physiological signs of stress, such as sweating, heart palpitations, we often think our bodies are stressed out. In a sense, it is, but this also indicates our bodies are ready for action, to deal with what's stressing us out!

In fact, our bodies need stress in order to survive. Obviously, if we have too much stress, we will get anxious and won't perform well. However, if we have too little stress, we'd just fall asleep and not perform at all! Therefore, stress is *adaptive*.

A fellow researcher at Harvard found that by simply having people reinterpret their bodies' responses at times of stress, their stress response looked a lot closer to rising up to a challenge. It's not that they no longer reacted to stress, it's that their reaction changed to something that's not to threatening.

This research found that people can rethink stress in order to reap the benefit of the positive effects of stress! Think of your heart rate quickening as preparation for you to make quicker decisions; when you're increasing your oxygen intake, it's readying you for action. Your pupils dilate because you can see better, your ears can hear better – all of these are indications that your body is preparing your internal resources to cope with the anticipated stress!

We often hear of the phrase 'mind over matter'. We know that stress is bad for the health. However, a study found that, yes, stress is related to mortality, but *only* within those that *believe* stress is bad for health. Therefore, how we think of stress matters. In fact, people who successfully cope with stress (big or small), can even experience enhanced self-confidence, personal growth, and resilience! In this sense, coping stress is like a muscle, and needs to be exercised constantly in order to keep it in top shape!

Of course, it's impossible to rid our lives of stress entirely. Therefore, instead of thinking of stress as a threat, it's time to think of it as a challenge! Next time you feel stress coming on, you can begin to think of all the great things that it can do for you, and all the great skills you can gain as a result of your experiences.

Now, the question is, how can we use stress in a positive way and continue to reap only the benefits of stress? Coping with stress is like playing a videogame. The more your practice, the better you get, and the better you get, the higher the level you climb to, until finally, you have a chance at beating the game! And so to with stress.

Appendix XIII – Statistical Tables

Table 1. *Independent T-Tests Controlling for Equipment Stress*

		Sample Size (N)	Mean	T-Test Ratio (<i>t</i>)	Degrees of Freedom (df)	Significance (two-tailed)
SPSS1						
	With BioPac	54	39.31	.097	57	.923
	Without BioPac (Control)	5	40.40			
SPSS2						
	With BioPac	54	35.81	-.540	57	.591
	Without BioPac (Control)	5	30.00			
SPSS3						
	With BioPac	54	42.48	.353	57	.726
	Without BioPac (Control)	5	46.60			
SUSS						
	With BioPac	54	35.54	-.059	57	.954
	Without BioPac (Control)	5	34.80			

SPSS: Subjective Perception of Stress Scale
 SUSS: Subjective Units of Stress Scale

Table 2. *Demographic characteristics of sampled population.*

		Sample size (N)	Sample Distribution (%)
Sex	Female	12	62.7%
	Male	18	32.3%
Age	Under 20	27	55.1%
	20-25	15	30.6%
	25+	6	12.3%
	Missing	1	2%
Ethnicity	East Asian	11	22.4%
	South Asian	14	28.6%
	Caucasian	17	34.7%
	Others/Unidentified	7	14.3%
Year of Study	1	30	61.2%
	2	8	16.3%
	3	3	6.1%
	4	3	6.1%
	4+	5	10.2%
Total sample N=49			

Table 3. *Bivariate correlations among outcome variables and possible covariates*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. SPSS Baseline	-																					
2. SPSS Video	.920**	-																				
3. SPSS Recovery	.812**	.823**	-																			
4. SUSS	.525**	.466**	.759**	-																		
5. HR Baseline	-.128	-.036	-.049	-.015	-																	
6. HR Video	-.133	-.066	-.065	-.024	.947**	-																
7. HR Baseline2	-.172	-.105	-.074	-.007	.907**	.960**	-															
8. HR Stressor	-.148	-.109	-.085	.008	.873**	.906**	.928**	-														
9. HR Recovery	-.176	-.156	-.119	-.093	.837**	.872**	.894**	.918**	-													
10. SBP Baseline	-.159	-.088	-.072	.047	.843**	.822**	.759**	.738**	.677**	-												
11. SBP Video	-.132	-.075	-.073	.069	.739**	.810**	.742**	.695**	.621**	.945**	-											
12. SBP Baseline2	-.172	-.119	-.159	-.083	.738**	.810**	.821**	.756**	.690**	.878**	.928**	-										
13. SBP Stressor	-.209	-.149	-.192	-.056	.735**	.776**	.760**	.846**	.726**	.841**	.841**	.870**	-									
14. SBP Recovery	-.226	-.205	-.225	-.165	.738**	.738**	.719**	.760**	.769**	.851**	.812**	.824**	.868**	-								
15. DBP Baseline	-.105	-.003	-.064	-.106	.924**	.867**	.841**	.807**	.805**	.669**	.566**	.588**	.588**	.633**	-							
16. DBP Video	-.130	-.059	-.081	-.048	.879**	.919**	.895**	.855**	.852**	.666**	.640**	.659**	.650**	.646**	.946**	-						
17. DBP Baseline2	-.161	-.099	-.047	-.006	.792**	.851**	.890**	.815**	.804**	.599**	.595**	.624**	.588**	.551**	.851**	.931**	-					
18. DBP Stressor	-.098	-.062	-.051	.004	.763**	.811**	.849**	.920**	.863**	.563**	.541**	.600**	.681**	.574**	.800**	.875**	.896**	-				
19. DBP Recovery	-.174	-.124	-.093	-.080	.689**	.742**	.768**	.789**	.901**	.495**	.471**	.520**	.561**	.545**	.743**	.821**	.830**	.882**	-			
20. PGIS	-.217	-.248	-.346**	-.347**	.058	.073	.134	.164	.189	-.019	-.006	.116	.090	.085	.135	.145	.110	.217	.206	-		
21. DIS – Avoidance	-.296*	-.214	-.097	.024	.112	.168	.190	.249	.173	.145	.186	.132	.274	.143	.137	.215	.261	.241	.232	.085	-	
22. SCS – Intrapersonal	-.217	-.240	-.211	-.287*	-.282*	-.340*	-.257	-.185	-.092	-.317*	-.365**	-.273	-.215	-.180	-.155	-.213	-.189	-.081	-.006	.547**	.063	-

SPSS: Subjective Perceptions of Stress Scale

SUSS: Subjective Units of Stress Scale

BP: Blood Pressure; (SPB: Systolic BP; DBP: Diastolic BP)

PGIS: Personal Growth Initiative Scale

DIS: Discomfort Intolerance Scale

SCS: Spheres of Control Scale

* $p < .05$

** $p < .01$

Table 4. *Mixed ANOVA assessing the Effects of Framing on Perceptions of Stress*

	<i>F</i> -Ratio	Degrees of Freedom (<i>df</i>)	Significance (* <i>p</i> <.05)	Partial Eta Squared (η^2)
Time (within-subjects repeated factor)	6.475	1.617, 74.389	.005*	.123
Framing (between-subjects factor)	.517	2, 46	.599	.022
Time (across 3 samples) x Framing Effects	.550	3.234, 74.389	.663	.023
PGIS	3.396	1, 45	.072	.070
Time (after controlling for PGIS)	2.458	1.639, 73.772	.103	.052

PGIS: Personal Growth Initiative Scale

Table 5. *Themes Extracted from Open-Ended Statements*

Theme Category	Sample Statements
Educational	<ol style="list-style-type: none"> 1. "I learned that to be active to cope with stress is beneficial for me." 2. "i didnt knw [sic] there was so much to learn about stress" 3. "by knowing what things can happen when you're constantly stressed really opened up my view of it and changed a bit of my opinion" 4. "Helping me realize stress can be a beneficial thing"
Positive Shifts in Perspective/Learning about Good in Stress/Enhancing Stress	<ol style="list-style-type: none"> 1. "Helping me realize stress can be a beneficial thing" 2. "That stress can be used to motivate" 3. "it made me feel that stress isnt [sic] always bad." 4. "it allowed me to view stress in a positive sense, instead of negative. I now view stress as a challenge, where I am able to overcome the challenge and learn something important." 5. "it was like a reminder that stress can be good and it is somewhat motivating" 6. "it made me think of stress in more of a positive way, instead of a set back or something from keeping me doing well in my everyday life."
Helped to Relax/Calm/Reduce Anxiety	<ol style="list-style-type: none"> 1. "helped me to get my mind off school a little and calm me down" 2. "The video made me better informed of stress. Learning that it is manageable, I feel less worried about the stress that I regularly experience."
General Adaptation Syndrome	<ol style="list-style-type: none"> 1. "I went to 3 stages of general adaption syndrome."

Table 6. *Participants' Subjective Ratings of Stress Reactivity by Stress-Induction Group*

	CO ₂ Untransformed (N = 27)		TSST Untransformed (N = 22)		F-Ratio (1, 47)	Sig	(η^2)
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
SUSS	19.78	17.45	51.23	27.61	7.846	.007**	.143
SCS- Intrapersonal	--	--	--	--	1.091	.302	.024
PGIS	--	--	--	--	5.036	.030*	.101
SUSS (after covariates)	--	--	--	--	8.291	.006**	.156

SUSS: Subjective Units of Stress Scale

PGIS: Personal Growth Initiative Scale

SCS: Spheres of Control

* $p < .05$

** $p < .01$

Table 7. *Participants' Objective Measures of Stress Reactivity by Stress-Induction Group*

	CO ₂ Untransformed (N = 27)		TSST Untransformed (N = 22)		T-Test Value	Sig (one-tail)	Cohen's <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
HR	90.37	10.06	99.12	19.02	-1.946	.035*	.575
SBP	125.62	18.38	131.34	27.62	-.833	.205	.24
DBP	73.23	9.88	79.15	14.51	-1.627	.056	.476

HR: Heart Rate

SBP: Systolic Blood Pressure

DBP: Diastolic Blood Pressure

* $p < .05$

Table 8a. *Interactive Effects of Experimental Manipulations on Perceptions of Stress*

	Greenhouse- Geisser Adjusted df	F	Sig.	Partial Eta Squared	Observed Power
Time	1.730	9.507	.000**	.181	.961
Time x Framing	3.460	.983	.414	.044	.276
Time x Stress Induction	1.730	6.767	.003**	.136	.876
Time x Framing x Stress Induction	3.460	3.170	.024*	.129	.756
Error	74.383				

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

Table 8b. *Group Means Of Subjective Self-Reported Perceptions of Stress Overtime*

	Framing	Stress Induction	Mean	Std. Deviation	N
SPSS1	Negative	CO ₂	38.44	28.183	9
		TSST	40.71	29.686	7
		Total	39.44	27.883	16
	Balanced	CO ₂	29.78	27.694	9
		TSST	41.63	14.725	8
		Total	35.35	22.704	17
	Positive	CO ₂	31.56	21.378	9
		TSST	52.71	18.989	7
		Total	40.81	22.483	16
SPSS2	Negative	CO ₂	34.78	25.820	9
		TSST	40.71	26.812	7
		Total	37.37	25.542	16
	Balanced	CO ₂	25.67	22.946	9
		TSST	36.38	12.750	8
		Total	30.71	19.098	17
	Positive	CO ₂	30.56	22.040	9
		TSST	43.14	20.268	7
		Total	36.06	21.564	16
SPSS3	Negative	CO ₂	32.56	23.373	9
		TSST	59.71	27.281	7
		Total	44.44	27.976	16
	Balanced	CO ₂	29.89	23.111	9
		TSST	40.50	19.064	8
		Total	34.88	21.351	17
	Positive	CO ₂	33.33	22.405	9
		TSST	60.43	21.196	7
		Total	45.19	25.301	16

SPSS: Subjective Perceptions of Stress Scale

TSST: Triers Social Stress Test

CO₂: Carbon Dioxide Inhalation

Table 9. *Interactive Effects of Experimental Manipulations on Subjective Response to Stressor*

	df	F	Sig.	Partial Eta Squared	Observed Power
Corrected Model	5	2.304	.061	.211	.685
Intercept	1	271.035	.000**	.863	1.000
Framing	2	.616	.545	.028	.146
Stress Induction	1	8.191	.006**	.160	.799
Framing x Stress Induction	2	1.349	.270	.059	.275
Error	43				

** $p < .01$

Table 10. *Interactive Effects of Experimental Manipulations on Participants' Physiology*

	Measure	Time	df	F	Sig.	Partial Eta Squared	Observed Power
Time	HR	Linear	1	6.553	.014*	.132	.706
		Quadratic	1	4.614	.037*	.097	.556
		Cubic	1	35.258	.000**	.451	1.000
		Order 4	1	10.306	.003**	.193	.881
	SBP	Linear	1	.395	.533	.009	.094
		Quadratic	1	2.803	.101	.061	.373
		Cubic	1	1.551	.220	.035	.230
		Order 4	1	.003	.956	.000	.050
	DBP	Linear	1	18.222	.000**	.298	.987
		Quadratic	1	3.313	.076	.072	.428
		Cubic	1	46.201	.000**	.518	1.000
		Order 4	1	13.972	.001**	.245	.955
Time x Framing x Stress Induction	HR	Linear	2	.520	.598	.024	.130
		Quadratic	2	1.611	.211	.070	.322
		Cubic	2	3.650	.034*	.145	.642
		Order 4	2	1.795	.178	.077	.355
	SBP	Linear	2	.411	.665	.019	.112
		Quadratic	2	2.001	.148	.085	.391
		Cubic	2	1.219	.306	.054	.252
		Order 4	2	.260	.772	.012	.088
	DBP	Linear	2	1.393	.259	.061	.283
		Quadratic	2	1.522	.230	.066	.306
		Cubic	2	3.419	.042*	.137	.612
		Order 4	2	2.217	.121	.093	.428

* $p < .05$

** $p < .01$

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