Physiological and Subjective Responses to Social and Academic Stress

Undergraduate Honors Thesis

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Abstract

Experimental research has revealed common activation in various brain regions during experiences of physical pain and social stress (e.g., DeCharms et al., 2005; Lieberman & Eisenberger, 2006). Scientists propose that due to the adaptive nature of mammalian social connections, the social attachment system has evolved to overlap with the physical pain processing system (Eisenberger et al., 2003). The current study examined differences in physiological arousal and subsequent verbal descriptions of two forms of stress (i.e., social stress and academic stress). Participants completed two-semi structured interviews where they recounted each type of stressor. Heart rate and skin conductance were recorded to assess physiological reactivity. Additionally, the frequency and intensity of language used to express pain and negative affect while describing both forms of stress were calculated. We expected that participants would exhibit heightened physiological stress responses, use more negative affect and pain language, and use more severe negative affect and pain language when discussing a social stressor as compared to an academic stressor. We also expected gender differences, such that the greater reactivity to the social stressor would be present in both males and females, although more pronounced in females, and males would display higher reactivity to academic stress than females. While findings did not support original hypotheses regarding differences in physiological stress reactivity according to interview type, participants used more negative affect words in the academic interview than the social interview and used pain language exclusively in the social interview. Additionally, results indicated that males used more negative affect words than females.

Physiological and Subjective Responses to Social and Academic Stress

Research suggests social relationships are essential to our wellbeing (MacDonald & Leary, 2005). The need to belong is a fundamental concept that has a long history of research in the field of psychology. This phenomenon is often described as a persistent human desire to develop and preserve long-term, significant relationships with other individuals in a community (Baumeister & Leary, 1995). The inability to fulfill this need is linked with a variety of negative consequences including declines in health, increased feelings of sadness, and maladjustment (Baumeister & Leary, 1995). However, negative social interactions are often considered common and unavoidable aspects of the human experience (DeWall et al., 2010). In fact, researchers have suggested that social stress is one of the most persistent forms of stress in mammals and other social animals (Schmidt et al., 2010). Therefore, common experiences of social stress could potentially pose a threat to the fulfillment of an individual's need to belong.

Experimental research has revealed common activation in various brain regions during experiences of physical pain and social stress, which is commonly defined as the perception of threatened or lost social connections (DeCharms et al., 2005; Eisenberger, Gable & Lieberman, 2007; Eisenberger, Lieberman, & Williams, 2003; Lieberman & Eisenberger, 2006; MacDonald, 2007). Scientists have proposed that the social attachment system has evolved to overlap with the physical pain processing system in order to increase chances of mammalian survival (Eisenberger et al., 2003). In other words, social stressors may be interpreted and experienced as a form of pain due to neural substrates that are shared with physical pain. In fact, some researchers have used the term

"social pain" to describe social stress due to its association with pain affect (MacDonald, 2007; MacDonald & Leary, 2005).

Social pain is often described as a specific emotional reaction to the perception of exclusion, rejection, forced separation, relational devaluation, or the death of a loved one (MacDonald & Leary, 2005). Research on social pain often primarily focuses on instances of exclusion, rejection and relational devaluation because they occur in higher frequency than alternative forms of social stress. In other words, individuals are likely to be familiar with these experiences because they tend to be more routine in everyday settings. Social exclusion occurs when an individual is actively prevented from participating in peer activities, whereas rejection describes a lack of acceptance in a peer group (Buhs, Ladd & Herald, 2006). Relational devaluation is defined as the perception by individuals that they are not as close, valuable and important to another person as they would like to be (Leary, Springer, Negel, Ansell & Evans, 1998). Each of these constructs represents a form of social stress that may threaten feelings of acceptance and therefore interfere with the fulfillment of the need to belong.

Although scientists have found evidence of common neurological activation during social stress and physical pain processing, there is minimal research examining differences in physiological arousal and subjective experiences of social stress in relation to alternative stressors (i.e., those lacking a social or physical basis). Therefore, the goal of this study is to examine differences in physiological responses and subjective experiences of socially stressful events and non-physical, non-social stressors. Additionally, gender differences in these associations will be analyzed. Specifically, I propose that social stress will yield higher physiological responses and that participants

will use more frequent and intense pain language and negative affect words while describing a socially stressful event rather than an alternative stressor that is commonly experienced by college students (i.e., an academic stressor). I also predict that women will have higher physiological reactivity and use of negative affect and pain language during social stress than men.

Discovery and Examination of Neurological Overlap in Physical Pain and Social Stress Systems

The first evidence for a relationship between social stress and physical pain was provided in 1978 by Panksepp and his colleagues (as cited in Lieberman & Eisenberger, 2006). While experimenting with the effects of opiates on the development of analgesia in dogs, they realized the drugs also appeared to reduce the number of cries generated by their subjects in isolation (Lieberman & Eisenberger, 2006). This discovery generated the hypothesis that the physical pain and social stress systems were both mediated by the opiate-receptor system. Scientists involved with this study quickly began searching for explanations for this connection between social stress and pain processing.

Studies examining the neurological overlap of the physical pain and social stress processing systems emphasize the importance of social connections in mammals while providing possible explanations for their results. MacLean (1993) suggests that especially during infancy, a mammal's social relationships determine his or her access to nourishment, shelter, protection from predators and numerous other significant requirements for survival (MacDonald & Leary, 2005). In other words, threats made towards an animal's social connections appear to pose a basic threat to his or her survival. Scientists propose that due to the adaptive nature of mammalian social connections, the

social attachment system may have "piggybacked" onto the physical pain system to increase chances of survival (Eisenberger et al., 2003).

Numerous studies have found similar activation in the anterior cingulate cortex (ACC) and the right ventral prefrontal cortex (RVPFC) during experiences of physical pain and social stress. The ACC is generally thought to be involved in regulating autonomic and endocrine functions (Devinsky, Morrell & Vogt, 1995). Additionally, there is evidence that it contributes to emotional learning, expression of internal states through vocalizations, assessing emotional valence of stimuli, and evaluating motivational content (Devinsky et al., 1995). In regards to motivation, researchers have suggested that the ACC uses a choice-outcome history (i.e., rewarded or nonrewarded outcomes) in order to guide future decisions (Kennerley, Walton, Behrens, Buckley & Rushworth, 2006). The RVPFC is believed to contribute to the regulation of the ACC and of pain distress in general (Eisenberger et al., 2003). Additionally, researchers suggest that a network of cortical areas described as the pain matrix are involved in pain perception. Specifically, this area is thought to include areas such as the anterior insula and the periacqueductal gray. Scientists also believe these regions are involved in pain anticipation, processing, and modulation (DeCharm et al., 2005). These brain areas have also recently been linked to the processing and regulation of both physical pain and social distress in humans (Eisenberger et al., 2003; Eisenberger, Gable & Lieberman, 2007; Lieberman & Eisenberger, 2006). Research examining these common neural substrates is significant because these studies may suggest that social and physical threats are fundamentally similar in terms of neurological activation and severity of reaction beginning at the initial assessment of these stressors.

Animal models are commonly used to study the neural activity in the ACC, RVPFC, anterior insula and periacqueductal grey due to the similar value of social bonds for survival across mammalian species. Invasive procedures performed on animals are valuable because they allow a closer look into the brain substrates involved in pain processing. For instance, research has found that damaging the cingulate cortex in hamster mothers disrupts the maternal instinct to keep pups close (Eisenberger et al., 2003). In other words, destruction of the cingulate cortex appears to be associated with a decrease in expected behavioral responses to social stress in the form of separation between mother and pup. Damage to this area also appears to affect the production of separation vocalizations in squirrel monkeys (Eisenberger et al., 2003). In a similar fashion, the electrical stimulation of these brain regions produces separation distress cries even when social isolation is not a factor (Lieberman & Eisenberger, 2006). These two findings suggest the ACC, RVPFC and the pain matrix are directly involved in the emotional and behavioral reactions associated with social distress in mammals.

While these studies have provided groundbreaking information concerning the social stress and physical pain systems in mammals, the use of animal models limits the ability of researchers to study the subjective experiences that accompany these socially stressful events. Therefore, additional research involving human subjects is important in order to assess emotional reactivity and negative psychological effects of experiences that evoke social distress. Additionally, conclusions must be carefully formed due to the differences in neural substrates of various species. However, by utilizing human participants' perceptions of pain and social stress, similar findings have been generalized tentatively to humans. Using this knowledge of common neural circuitry, DeWall and his

colleagues (2010) discovered that acetaminophen reduced neural activity in areas of the brain that are commonly associated with processing social stress, such as the dorsal anterior cingulate cortex (dACC) and the anterior insula. They also found that daily doses of acetaminophen decreased the number of reported incidents of social stress experienced by participants taking the drug (DeWall et al., 2010). Therefore, it appears that physical pain suppressants are associated with reduced frequency of self-reported, socially stressful events. It is likely that participants are still encountering these events with the same frequency, but they appear to be experiencing them as less distressing while under the influence of acetaminophen. This provides further evidence of the neurological overlap between physical pain and social stress processing and suggests that humans may actually subjectively interpret social stress as similar to physical pain. Furthermore, this study may suggest that social stress is privileged in triggering physiological and subjective stress responses when compared to alternative stressors lacking a physical or social basis.

While many events experienced throughout a lifetime can cause stress reactions, social and physical pain pose a significant threat to a mammal's survival (MacDonald & Leary, 2005). Therefore, social and physical pain processing may differ from the processing of alternative stressors that are associated with less hazardous evolutionary outcomes such as academic stressors. In theory, this knowledge might suggest that an academic stressor would produce less activation of the physical pain pathway than social stress or physical pain. Consequently, the neurological and physiological reaction to academic stress may affect an individual's subjective experience of this stressor.

Specifically, academic stress may be interpreted as less threatening or potentially harmful to an individual's wellbeing than physical pain or social stress.

Physiological Reactivity to Physical and Social Stressors

The brain is often considered the primary organ involved with stress response because it is involved in identifying threats, interpreting them as stressful, and prompting physiological and behavioral responses (McEwen, 2007). Due to the previously discussed literature and the neurological basis of physiological reactivity, social stress may produce physiological responses that are similar to the physiological reactivity observed following physical pain. The human stress response activates the autonomic nervous system, particularly the sympathetic branch that regulates the "fight-or-flight" response, and the hypothalamus-pituitary-adrenal (HPA) axis, which serve as the major physiological stress response systems in the human body (McEwen, 2007). The HPA axis controls stress hormone responses that function to extend phases of elevated activity in order to increase chances of survival when we are confronted with a challenge (McEwen, 2007).

Scientists examining physiological reactions to physical pain found that functional laboratory tests intended to induce pain have evoked responses associated with sympathetic arousal such as respiration, skin conductance, and heart rate (Kalezic, Åsell, Kerschbaumer & Lyskov, 2007; Loggia, Juneau, & Bushnell, 2011). Heart rate and skin conductance are commonly used to examine physiological arousal because they provide reliable information regarding activation of the sympathetic and parasympathetic nervous systems (Loggia et al., 2011; Sijtsema, Shoulberg, Murray-Close, 2011). Skin conductance is a more direct measure of activation of the sympathetic nervous system, a branch of the autonomic nervous system that often prepares the body for the fight or

flight response (Sijtsema, Shoulberg, Murray-Close, 2011). Heart rate indicates activity in both the parasympathetic nervous system, which serves to relax the body and direct one's energy to "rest and digest" operations, and the sympathetic nervous system (Sijtsema et al., 2011).

Researchers have found that physiological reactivity following instances of social stress resembles physiological responses to physical pain (Hellhammer & Schubert, 2012). In this field of research, protocols such as the Trier Social Stress Test (TSST) are often used to induce socially stressful experiences. This task involves the completion of an interview and a mental arithmetic task with an audience of three interview panel members (Hellhammer & Schubert, 2012). Although this protocol includes an academic task, this segment of the TSST is used to provoke awareness of social-evaluative threat and is therefore related to social stress (Dickerson & Kemeny, 2004). A variety of physiological reactions may be measured during this task including heart rate and levels of the stress hormone cortisol. This method has been shown to produce significant physiological responses via the autonomic nervous system and is associated with increased activity of the hypothalamus-pituitary-adrenal axis (Kudielka & Wüst, 2012; Hellhammer & Schubert, 2012).

It appears that in cases involving both physical pain and social stress, physiological arousal functions to direct our attention toward an immediate threat in order to increase our chances of survival as mammals. One potential implication of these data is that social stress may produce higher physiological reactivity than non-social and non-physical stressors due to the adaptive nature of maintaining social bonds and the need to belong.

Although there is limited research comparing severity of these reactions between academic and social tasks, Chen and colleagues (2002) discovered that students who valued acceptance and affiliation displayed increased heart rate, increased blood pressure and less heart rate variability (i.e., variations of instantaneous heart rate) (Task Force of the European Society of Cardiology, and the North American Society of Pacing and Electrophysiology, 1996) during social stress as compared to nonsocial tasks. These findings are consistent with the possibility that although nonsocial stress responses may elicit somewhat similar stress reactions as social stress, social stress may produce more extreme reactions due to the evolutionary importance of maintaining social connections.

Furthermore, one study found an association between psychological stress responses (i.e., perceived stress, anxiety and emotional security) and these physiological stress responses during the TSST (Hellhammer & Schubert, 2012). In other words, physiological stress responses appear to fluctuate according to perceived stress and anxiety and reflect the severity of the stressor. Therefore, social stress might yield higher subjective experiences of stress (i.e. higher perceived anxiety, stress severity) than alternative stressors (e.g., academic) due to the higher physiological reactivity resulting from the overlap between social stress and physical pain systems.

Social Pain and Hurt Feelings

In accordance with the theory that people experience social stress as painful, there could be overlap in the descriptions used to express pain and social stress. In fact, research suggests people occasionally describe their negative emotional states in response to social stress through the use of physical pain language (Lieberman & Eisenberger, 2006). While it may appear that this is simply a phenomenological technicality, research

suggests that having "hurt feelings" is a distinctive emotional state (Leary & Springer, 2001). Furthermore, some researchers use the term "social pain" to describe instances of social stress due to the previously described overlap between social stress and physical pain (Lieberman & Eisenberger, 2006, DeWall et al., 2010). Researchers propose that the concept of "hurt feelings" directly relates to social pain, and more specifically, relational devaluation (Leary & Springer, 2001). In fact, one study asked participants to describe a situation in which their feelings were hurt or when they had hurt another person's feelings. After answering a series of questionnaires, researchers found that hurt feelings were associated with events that indicated relational devaluation (Leary et al., 1998). Additionally, the reported distress from victims of hurt feelings was highly correlated (.63) with feelings of rejection (Leary et al., 1998). Because relational devaluation and rejection are both aspects of the construct of social stress, this finding may also be relevant to alternate forms of social stress such as exclusion (MacDonald & Leary, 2005). For example, the concept of "hurt feelings" and the use of pain language may extend into alternative forms of social stress (e.g., exclusion, forced separation, loss of a loved one).

Researchers often examine language used by participants in order to understand the subjective experience of social stress or pain (Ashworth, Giorgi & de Koning, 1986; Pfefferbaum et al., 2007; Hall, Everett & Hamilton-Mason, 2012). These studies frequently use structured or semi-structured interviews to examine the language used while describing specific events. Using this methodology, researchers are able to focus on the language and details concerning certain experiences in order to develop a refined understanding of their significance (Ashworth et al., 1986). Common coding schemes often highlight information such as setting, definitions of a situation, perspective,

behavior, strategies used to accomplish goals, and social structure (Bogdan & Biklen, 1998). Based on the evidence for neurological overlap, social stress may be subjectively experienced as painful in a way that is similar to physical pain. Thus, people may use physical pain words to describe experiences of social stress.

Research methods that focus on language are common in studies examining emotion and stress (Hall et al., 2012; Pfefferbaum et al., 2007). For example, one study seeking to examine workplace stress in African-American women used multiple investigators to identify and label important concepts and evaluate narrative data from focus group discussions (Hall et al. 2012). Additionally, a separate study examining children's reactions to the World Trade Center attacks used a similar process in order to obtain data that could be used to assist clinicians and contribute to future investigations (Pfefferbaum et al., 2007). These studies suggest that analyzing language can help researchers better understand the subjective experiences of distress that accompany stress. These methods allow participants to speak directly and without advance preparation, which may provide more ecologically valid information than alternative techniques such as questionnaires. Therefore, the present study aims to analyze language used by participants while describing socially and academically stressful events in order to develop a more clear understanding of their personal experience.

There is evidence that alternative emotions may accompany the emotional state of hurt feelings (Dua, 1993). For example, self-reported negative affect has been shown to be related to higher levels of stress, depression, poor psychological and physical wellbeing, and lower self-esteem (Dua, 1993). Research suggests that some of these constructs may be related to the concept of hurt feelings and there is some evidence

suggesting an association between the use of pain language and general negative affect (Leary et al., 1998). Specifically, Leary and his team (1998) found that hurt feelings were linked with undifferentiated negative affect, anxiety and hostility. This suggests that the constructs of hurt feelings, social stress, and negative affect may be associated.

However, more research is needed in order to determine whether there is specificity in greater use of pain words or negative affect words depending on the described stressor. The current study seeks to examine whether language used to describe a stressful event is dependent on the classification of the stressor (i.e. social or academic). On the one hand, it is possible that that social stress may be uniquely related to pain, but not negative affect, words. Alternatively, social stress may be related to both more negative affect and pain language. We hypothesize that participants will use more pain and negative affect language in social, as compared to academic, interviews. Specifically, we expect that social stress will yield higher frequency and intensity of negative affect and pain language due to the importance of social connections in promoting mammalian survival. Common neurological substrates between social stress and physical pain are hypothesized to lead to higher physiological reactivity to social stress than to alternative stressors (i.e. academic) and potentially be interpreted as painful. Additionally, we anticipate that higher pain experience will lead to more frequent and intense expressions of negative affect due to the finding that perceived stress is moderately correlated (.44) with individual differences in negative affect (Watson, 1988).

Although many studies examining emotion and stress employ qualitative methods, the current study seeks to perform quantitative research due to the use of pre-chosen constructs of interest (i.e. pain language and negative affect). Quantitative

approaches have been used in various studies, including some examining expressed emotion (Dickerson, 2012; Benson, Daley, Karlof & Robison, 2010; Leff and Vaughn, 1985; Magana et al., 1986). Expressed emotion is a quantitative measure of one individual's attitude and feelings toward another person (Benson et al., 2010). These studies have yielded valuable information through their use of quantitative methods and suggest that pre-chosen coding schemes can be appropriate when examining narrative data for previously defined constructs of interest. For example, one study by Benson and colleagues (2010) examined the reliability and validity of the *Autism-Specific Five Minute Speech Sample (AFMSS)*, an adapted expressed emotion coding system derived from the *Five Minute Speech Sample*. The researchers coded speech samples from participants using predetermined components of expressed emotion in order to assess whether the AFMSS was a useful method of assessing constructs of interest (Benson et al., 2010). Specifically, this study coded for four global scales including initial statement and relationship, which were rated as positive, neutral or negative (Benson et al., 2010). Warmth and emotional over-involvement were rated as high, moderate or low (Benson et al., 2010). Additionally, they performed frequency counts for critical comments and positive comments (Benson et al., 2010). These findings provide valuable insight into this field of research, suggesting quantitative coding methods can be helpful and informative when examining previously defined constructs of interest.

Therefore, the current study will use similar methods to perform a quantitative analysis of narrative data using the previously selected constructs of pain language and negative affect. In addition to examining the frequency of this language, coders will rate the severity of each word or phrase. This study will use the subjective opinions of the

interview coders to measure the severity of the words or phrases because measures of language intensity have not been formally developed for pain and negative affect language. Multiple coders will be used to assess inter-rater reliability.

Gender Differences in Reactions to Social and Academic Stress

Research suggests that certain characteristics may influence an individual's reaction to socially stressful stimuli. Some studies have suggested that girls place more emphasis on the importance of social relationships than boys. For example, one study found that adolescent females rate social goals (e.g., having friends) as more valuable than nonsocial goals (e.g., academic success) (Ford, 1982). Additional research has found that girls are generally more perceptive of changes in interpersonal relationships (Leadbeater, Kuperminc, Blatt, & Hertzog, 1999). The concentration girls tend to place on social relationships may lead to worries about the status of their friendships, abandonment and peer acceptance (Rose & Rudolph, 2006). Because girls appear to be more concerned about their social relationships than boys are, they may interpret threats to these relationships as more stressful. In fact, several studies have found that girls tend to describe instances of social tension to be more stressful and hurtful in comparison to boys (Crick, 1995; Rudolph, 2002). Therefore, girls may have higher physiological responses to and more intensely negative subjective experiences of socially stressful events than boys. Furthermore, Smith and Gallo (1999) found that boys tend to focus on issues and threats concerning status, control and achievement. Accordingly, the current study seeks to examine whether there are gender differences in reactivity to social or academic stress based on the previously observed gender differences in goals.

In fact, some previous literature does suggest there are sex differences in physiological reactivity in response to different forms of stress. It has been suggested that females tend to have greater cardiovascular activity following social stress, while males have greater cardiovascular activity following threats to status and achievement (Murray-Close & Crick, 2007; Light, Turner, Hinderliter, & Sherwood, 1993). Specifically, men tend to have greater acute HPA and autonomic responses in response to performance-related stress such as arithmetic tasks or public speaking (Kajantie & Phillips, 2006; Kudielka & Kirschbaum, 2005). However, despite these suggestions, not all evidence indicates that females are more physiologically reactive to social stress; in fact, one study found that some acute social stressors lead to lower reactivity in the HPAA and autonomic nervous system for women than men (Kajantie & Phillips, 2006). These apparent discrepancies could be investigated with additional research in order to provide more information regarding variables that impact the stress response. Because socially stressful events are common in our society, it would be useful to have more information concerning how gender impacts physiological reactivity and subjective experience following different stressors.

Hypotheses

The three hypotheses of the study are: 1) participants will exhibit heightened physiological stress responses (i.e., increases in skin conductance and heart rate) when discussing a social stressor as compared to an academic stressor; 2) participants will more frequently use negative affect and pain words and the words that they use will be rated as more severe when discussing the social as compared to the academic stressor; and 3) the greater reactivity to the social stressor will be present in both males and females,

although more pronounced in females, and males will display higher reactivity (i.e., physiological reactivity and use of a greater number and more severe pain and negative affect words) to academic stress than females due to their higher achievement goals. This study will allow us to examine whether there are differences in physiological responses and subjective experiences of socially painful stimuli and academic stressors, and whether there are significant differences between genders.

Method

Participants

Fifty college students aged 18-22 years (M = 18.85, SD = .99) were recruited through the University of Vermont Psychology website and introductory psychology courses at the University of Vermont. The participants were part of a larger study that examined factors that underlie academic, social and psychological adjustment in emerging adulthood. The sample included 30 female students and 20 male students. Ninety-eight percent of the sample was Caucasian and 2 percent was Asian-American. Participants in psychology classes received extra credit in exchange for their participation in the study.

Procedure

The data being used in this study were drawn from a larger, IRB approved study being performed by Dr. Dianna Murray-Close. Consenting participants completed a two-hour protocol in the Social Development Laboratory. Following consent procedures and a tour of the laboratory, height and weight measurements were taken for each participant.

In order to assess physiological reactivity to stress, measurements of physiological arousal were made while recounting two types of stressors (i.e., social and academic). Participants performed two semi-structured interviews, each lasting

approximately twelve minutes. The order in which the interviews were completed was counterbalanced in order to reduce order effects. These interviews included the Social Competence Interview (SCI) and the Academic Competence Interview. Both interviews were audio-recorded and later transcribed for coding purposes. Following the first interview, the participants completed a five-minute distracter task where they read from a Vermont tourism guide. This task was followed by a second baseline measurement. Next, the participant completed the second interview. Finally, participants were provided with a series of self-report measures including a demographics questionnaire and various surveys that will not be discussed in the present study.

Measures

Demographics Questionnaire. Participants were asked to report their sex, age, race, romantic relationship status, and sexual orientation.

Social Competence Interview. This interview was adapted from a procedure by Ewart and colleagues (Ewart et al., 2002). The updated version of this interview focused on relational stressors (e.g. you get left out of something), whereas the original SCI allows the participant to recount a variety of stressful events (Ewart & Kolodner, 1991). This adaptation has been used in previous studies and appears to be effective at eliciting stress arousal (Murray-Close & Crick, 2007). This interview asks participants to describe a recurring social challenge, consider goals and strategies for achieving a desired end result in the described situation, evaluate their skills, and re-live their thoughts and feelings during this event (Ewart & Kolodner, 1991).

Academic Competence Interview. The Academic Competence Interview (ACI) was adapted from the Social Competence Interview and developed for the purposes of the

present study. This interview asks the participant to answer a similar series of questions regarding a recent academic stressor (e.g., technological difficulty prevents you from completing an assignment). A team of research assistants in the UVM Social Development Laboratory developed a list of potential stressors for this interview by forming a list of potentially stressful academic situations and eliminating examples that were also relational in nature (e.g., not being called on by a professor in class could reflect academic or social challenges). This allowed us to assess reactivity specifically related to academic stress.

Physiology. During the baselines and stress tasks, measures of heart rate and skin conductance were recorded to assess physiological reactivity. Stress reactivity was examined using a customized data acquisition system from James Long Company (Shoulberg, Sijtsema & Murray-Close, 2011). Skin conductance was measured using a bioamplifier and two physiological sensors attached to middle phalanges of the second and fourth fingers on the non-dominant hand. Isotonic citrate salt electrode gel was applied on the electrodes to increase conduction. The standard unit of measurement for skin conductance is microsiemens (μ*S*). Heart rate was examined using electrodes and an electrocardiogram. Heart rate is generally expressed as heartbeats per minute (bpm). Two electrodes were attached in a bipolar configuration on opposite sides of the participant's rib cage and a third electrode was placed on the sternum (Shoulberg, Sijtsema & Murray-Close, 2011). Heart rate was calculated using the following standard formula: HR = (1/IBI) x 60,000 ms (Murray-Close & Crick, 2007).

Skin conductance and heart rate were collected continuously throughout the study. Psychophysiological equipment was attached to the participant and he/she was

given a brief accommodation period in order to become accustomed to each device. Once the physiological equipment was attached and tested for functionality and accuracy, participants sat quietly while the researcher left the room in order to acquire a preliminary baseline reading.

A six-minute baseline measurement preceded each interview. Averaged baseline measurements for heart rate and skin conductance were compared with averaged measurements of these variables during two different stress tasks (i.e. social stress, academic stress). Specifically, to calculate physiological reactivity to the SCI, the average arousal during the 6-minute baseline prior to the SCI was subtracted from the average arousal during the SCI. Similarly, the average arousal during the 6-minute baseline prior to the ACI was subtracted from the average arousal during the ACI. Reactivity was calculated separately for each index of physiological arousal (i.e., we calculated heart rate reactivity and skin conductance reactivity separately).

Coding. Following completion of this study, interviews were transcribed for coding. The frequency and intensity of language used to express pain and negative affect while describing both forms of stress were calculated. Frequency described how many times physical pain and negative affect words were used throughout the interview, while intensity was determined using a scale describing how much pain (1= a little painful, 2= painful, 3= very painful) or negative affect (1= a little negative affect, 2= negative affect, 3= a lot of negative affect) each word that had been identified as pain or negative affect generally signifies in the English language. Coders were provided with a list of examples for each group of words and asked to use their own judgment regarding which of the participant's words were classified as pain or negative affect language and how much

intensity they represented. The intensity ratings for pain language and negative affect language were averaged separately for each interview and participant. Thus, intensity ratings were only available for participants who spontaneously used pain or negative affect words during their interviews. These averaged scores for the social and academic interviews were compared in order to determine differences in the use of language for each participant. Thus, there were four primary indices of language for each interview: frequency of pain words, frequency of negative affect words, severity of pain words, and severity of negative affect words.

Results

Preliminary Analyses

Pearson correlations among all variables of interest are presented in Table 1. The results showed that there were small to moderate correlations between several variables. The negative affect severity rating in the academic interview was positively associated with the number of negative affect words used in the academic interview (see Table 1). This indicates that participants who used more negative affect words in the academic interview also tended to use more severe negative affect words in the academic interview. Additionally, the number of negative affect words used in the academic interview was associated with gender (coded as male = 1, female = 2), suggesting that males used more negative affect words than females during the academic interview (see Table 1).

The number of negative affect words used during the social interview was positively correlated with the average negative affect severity rating in the social interview (see Table 1). This finding suggests that participants who used more negative affect words in the social interview were also inclined to use more severe negative affect

words in the social interview. The average pain rating in the social interview was positively correlated with the number of negative affect words used during the social interview (see Table 1), suggesting that participants who used more severe pain language in the social interview also tended to use more negative affect words in the social interview. The number of negative affect words used in the social interview was also associated with gender, suggesting that males used more negative affect words than females in the social interview (see Table 1). Additionally, the average negative affect rating in the social interview was positively correlated with the average pain rating in the social interview (see Table 1). This finding suggests that participants who used more severe negative affect words in the social interview were likely to use more severe pain language in the social interview.

The number of negative affect words used in the academic interview was positively associated with the number of negative affect words used in the social interview (see Table 1), meaning participants who used high numbers of negative affect words in the academic interview were more likely to use high numbers of negative affect words in the social interview. Participants who used more negative affect words in the academic interview also used more pain words the social interview (see Table 1). There was a moderate positive correlation between the average negative affect rating in the academic interview and the average negative affect rating in the social interview (see Table 1). This finding indicates that participants who used more severe negative affect words during the academic interview were also more likely to use more severe negative affect words during the social interview. Additionally, the average negative affect rating in the academic interview was positively associated with the average pain rating in the

social interview (see Table 1), suggesting that participants who used more severe negative affect words during the academic interview also tended to use more severe pain language in the social interview. Finally, heart rate reactivity during the academic interview was positively correlated with heart rate reactivity during the social interview (see Table 1), which indicates that participants who had high heart rate reactivity during the academic interview were likely to have high heart rate reactivity during the social interview.

Physiological Reactivity to Social and Academic Stress

The first goal of the present study was to examine whether participants experienced heightened physiological stress responses (i.e., increases in skin conductance and heart rate) when describing a social stressor as compared to an academic stressor. We predicted that physiological reactivity would be higher when discussing social stressors rather than academic stressors. Moreover, we predicted that although higher physiological reactivity to social stress would be present in both males and females, it would be more pronounced in females. Additionally, we hypothesized that males would have higher physiological reactivity in response to academic stress than females. To assess whether physiological reactivity differed according to the type of stressor and gender, two 2 (gender) x 2 (interview type: social versus academic) mixed analysis of variance (ANOVAs) with interview type as the repeated measure were performed on physiological reactivity (i.e. heart rate and skin conductance, respectively) to social and academic stress. Physiological data was missing for one male participant due to experimenter error or equipment malfunction. Means and standard deviations for physiological arousal are presented in Table 2. The results indicated that skin

conductance reactivity did not vary according to interview type (see Table 2), $F(1,47) = .25$, $p = .62$, and there were no gender differences in skin conductance reactivity (see Table 2), $F(1,47) = .29$, $p = .60$. There was also no significant interaction between interview type and gender, $F(1,47) = .01$, $p = .91$.

Results for heart rate reactivity indicated that heart rate reactivity did not vary according to interview type (see Table 2), $F(1,47) = .03$, $p = .87$, and there were no gender differences in heart rate reactivity (see Table 2), $F(1,47) = .75$, $p = .39$. There was also no significant interaction between interview type and gender in the prediction of heart rate reactivity, $F(1,47) = .36$, $p = .55$. Overall, physiological stress response did not vary according to interview type and there were no significant gender differences in physiological reactivity to either the social or the academic interview.

Negative Affect and Pain Language for Social and Academic Stress

The second goal of this study was to examine whether expressed negative affect and pain language varied in frequency and severity according to interview type and gender. We hypothesized that participants would more frequently use pain and negative affect words and that these words would be rated as more severe when discussing social stress rather than academic stress. Additionally, we predicted that males would use more frequent and more severe expressions of negative affect and pain language than females during the academic interview due to higher achievement goals, whereas females would use more frequent and more severe expressions of negative affect and pain language during the social interview due to higher concentration on social relationships. Intraclass correlations between coders ranged from marginal to high for each category of language

coding (see Table 3), indicating that the coding scheme for number and severity of pain and negative affect words was modestly reliable.

To assess whether expressed negative affect and pain language varied according to the type of stressor and gender of the participant, four 2 (gender) x 2 (interview type) mixed ANOVAs with interview type as the repeated measure were performed. Separate analyses we run for number of pain words, severity of pain words, number of negative affect words, and severity of negative affect words. The results for the number of negative affect words ANOVA indicated that participants used more negative affect words when describing academic stress than social stress (see Table 2), $F(1,48) = 20.08$, $p < .01$. Figure 1 illustrates students' tendency to use more negative affect words while recounting experiences of academic stress than while describing experiences of social stress. In addition, males used more negative affect words than their female peers across interviews (see Table 2), $F(1,48) = 7.05$, $p < .05$. Figure 1 illustrates the tendency for male students to use more negative affect words while recounting experiences of academic and social stress in comparison to their female counterparts. There was no significant interaction between interview type and gender, $F(1,48) = .13$, $p = .72$.

In the number of pain words analysis, results indicated that participants were more likely to use pain language when describing social stress rather than academic stress (see Table 2), $F(1,48) = 10.90$, $p = .002$. Figure 2 illustrates students' inclination to use more pain words while describing experiences of social stress than while describing academically stressful situations. The gender effect for the number of pain words used was not significant, $F(1,48) = .004$, $p = .95$. There was also no significant interaction between gender and interview type, $F(1,48) = .004$, $p = .95$.

For severity of negative affect words, results indicated that there were no significant differences in the ratings of negative affect words between academic interviews and social interviews (see Table 2), $F(1,48) = .50$, $p = .48$. Additionally, there were also no significant differences between males and females in severity of negative affect words (see Table 2), $F(1,48) = .59$, $p = .45$. There was also no significant interaction between rating of negative affect words and gender, $F(1,48) = .55$, $p = .46$. We were unable to statistically examine whether the severity of pain words varied according to interview type due to the lack of any pain words being used during the academic interviews.

Discussion

Prior research has suggested that the social attachment system evolved to coincide with the physical pain system in order to effectively signal a social threat and promote mammalian survival (Eisenberger et al., 2003; MacDonald, 2007; MacDonald & Leary, 2005). Therefore, the current study endeavored to discover whether this neurological overlap impacts physiological and subjective responses to social stress and alternative stressors (i.e. academic). Specifically, we examined differences in physiological reactivity through measuring heart rate and skin conductance, and subjective experience by assessing frequency and intensity of expressed negative affect and pain language. We hypothesized that the neurological overlap between social stress and physical pain would lead to the interpretation of a negative social event as more stressful than an alternatively distressing event. Therefore, social stress was expected to yield higher physiological reactivity and a more negative subjective experience than academic stress. We hypothesized that 1) participants would exhibit heightened physiological stress responses

(i.e., increases in skin conductance and heart rate) when discussing a social stressor as compared to an academic stressor; 2) participants would more frequently use pain words and the pain words that they used would be rated as more severe when discussing the social as compared to the academic stressor; and 3) the greater reactivity to the social stressor would be present in both males and females, although more pronounced in females. In addition, males were expected to display higher reactivity (i.e., physiological reactivity and use of more and more severe pain and negative affect words) to academic stress than females due to their higher achievement goals.

The first objective of this study was to examine whether there were higher physiological stress responses (i.e., increases in skin conductance and heart rate) when describing social stressors as compared to academic stressors. The results of this study indicated that there were no significant differences in heart rate or skin conductance reactivity for social stress as compared to academic stress. In other words, social stress did not yield higher physiological reactivity than academic stress. Literature on emotion has previously suggested that physiological reactivity is not emotion-specific (Rickard, 2004; Schachter & Singer, 1962). For instance, Schachter's cognitive theory suggests that physiological reactivity is associated with the strength of an emotion, whereas context or cognitive information is related to the type of emotion experienced (Schachter & Singer, 1962). Similarly, there is evidence that activation of the sympathetic nervous system can be prompted by several different emotions (Murray-Close, 2013; Hubbard et al., 2002; Bollmer, Harris & Milich, 2006). This research suggests we could theoretically expect similar physiological reactivity following a variety of different emotional experiences. Therefore, the finding that social stress and academic stress did not yield significant

differences in heart rate or skin conductance reactivity may reflect these previous findings. In other words, it is possible that participants may be experiencing similar severity of emotions across interviews, but that the type of emotion differs depending on the type of stressor. In the current study, negative emotional states may have initiated similar physiological stress responses regardless of the type of negative emotionality (i.e., hurt feelings, anger, sadness) in each interview. This finding could suggest that both interviews lead to negative emotional states, but that the specific type of emotion differs across interviews. For instance, the theoretical perspective adopted by the current study might suggest that emotions such as hurt feelings are more commonly linked with social experiences, whereas academic stressors are more likely to lead to experiences of anxiety or nervousness.

Our preliminary analyses revealed a moderate correlation between heart rate reactivity during the academic interview and heart rate reactivity during the social interview. Specifically, we found that participants displaying high heart rate reactivity during the academic interview were likely to have high heart rate reactivity during the social interview. This finding is significant because it supports the idea that physiological stress reactivity is not entirely context-specific. In other words, individuals may have similar patterns of reactivity across types of stressors. However, correlations were moderate in size, indicating some specificity in stress responses across stressors. A variety of individual differences may impact physiological functioning and subjective experiences of different events. In the future, it may be beneficial to examine how specific traits, values, and goals affect physiological reactivity across different forms of stress.

The second objective of this study was to explore differences in individuals' subjective experiences of social stress and academic stress. Consistent with our predictions, participants used more pain language in the social interview rather than the academic interview. This supports the idea that neurological overlap of social stress and physical pain processing systems may contribute to people experiencing social stressors as painful (DeWall et al., 2010; Eisenberger et al., 2003; Lieberman & Eisenberger, 2006; MacDonald & Leary, 2005). Pain language, in contrast, was never used while describing academic stress. Additionally, results indicated that participants used more negative affect words during the academic interview than during the social interview. Although we originally hypothesized that social stress would yield higher levels of both pain language and negative affect, this finding might be related to the sample used in the study. A college student population values academic achievement and therefore, the academic interview may have been a salient stress task for this sample (DeBerard, Spielmans & Julka, 2004). However, although students conveyed their distress during the academic interview, the lack of pain language supports our original hypothesis that pain language is specifically associated with social stress. This finding may suggest that the construct of subjective pain is somewhat distinct from negative affect. However, these concepts do not appear to be mutually exclusive emotional expressions. Our preliminary analyses found that participants who used more severe pain language in the social interview also tended to use more negative affect words in the social interview, suggesting that there is some overlap between negative affect and pain language. Additional research concerning the relationship between these concepts would be particularly beneficial in order to develop a stronger understanding of the subjective experience of social stress.

Interestingly, the results of this study also suggested that males tended to use more negative affect words than females when describing both socially and academically stressful events. While these findings support our hypothesis regarding the academic stress task, we did not expect males to use more negative affect words than females during the social interview due to the emphasis females tend to place on social relationships (Ford, 1982; Crick, 1995; Rudolph, 2002). However, this finding could be explained due to males' focus on issues and threats concerning status, control, and achievement (Smith & Gallo, 1999). In other words, these findings could suggest that males perceive academic stress and social stress as threats to their status and achievement goals. Therefore, they may consider these events to be more stressful than their female counterparts and express these feelings accordingly. For example, some social stress prompts (i.e. someone tries to flirt with or seduce your romantic partner, you don't get invited to something) pose a more direct threat to status and achievement than alternate prompt choices (i.e. someone gives you the silent treatment). These options may have led to stronger feelings of negative affect and pain in males due to the interpretation of this threat as more salient to their primary goals. In future research, it would be beneficial to categorize social stressors according to whether they pose threats to status or alternative goals. This structure would allow researchers to identify whether males tend to select stressors that threaten status, achievement, or control more than females and/or whether males exhibit more negative emotions in the context of these types of stressors.

Although the findings of the present study provide important information regarding physiological and subjective experiences of social and academic stress, some limitations must be acknowledged. Firstly, the sample used in this population was

somewhat small and mainly included Caucasian students. Therefore, these findings may not generalize to other ethnicities and age cohorts. Cultural emphasis on the importance of academic achievement and social relationships may vary according to ethnicity and generation. For example, cultures that value group solidarity and collectivism may place more emphasis on the importance of social relationships than cultures that value autonomy and independence (Schwartz, 1999). Additionally, autonomous cultures tend to value individual engagement with personal ideas and intellectual directions, suggesting academic achievement may be more salient in these cultures than for collectivistic cultures (Schwartz, 1999). Perception of the importance of academia and social connections are in part learned and will therefore reflect the values of the individual's culture. Thus, individual responses to each of these forms of stress may be more severe if individuals perceive one of these domains as more fundamentally important than other domains.

Additionally, the current study used semi-structured interviews. Although these interviews allow participants to describe personal events and tend to generate a large amount of detail, there are a number of disadvantages associated with this method. First, we cannot guarantee that the responses provided by participants are honest or authentic. There is a chance that participants included false information or altered information in order to present themselves favorably. Additionally, the flexibility allowed by a semi-structured interview may make data difficult to compare across participants due to the variability in follow-up questions and opportunities to expand and provide more detail. Lengths of interviews were not limited and may have allowed some participants to provide more information than other participants. Therefore, participants with longer

interview times may have elaborated on their experience and potentially used a larger number and more severe pain and negative affect words. Longer interviews may also lead to higher physiological reactivity because the participant is more likely to effectively relive the stressful experience and react more intensely. The semi-structured interviews used in this study may have also allowed participants to discuss stressors of varying degrees of severity. Therefore, some participants may have discussed stressors that they considered to be very intense, while others could have described minor instances of stress. In future research, it would be beneficial to control for stress provocation level in order to more effectively compare differences in the variables of interest across social and academic interviews. For example, participant ratings of how upset or mad they were during the stressful event could be controlled in order to ensure comparable stress levels during both interviews. Additionally, the use of standardized stressors could help increase reliability by ensuring that participants are exposed to similar levels of stress. Finally, due to the use of spontaneous descriptions of stressors, our findings may reflect individual differences in the propensity to experience negative emotions or describe them in detail. This limitation is evidenced by similar frequency and severity of pain and negative affect words used across interviews. However, by using within-person comparisons, the current study partially controls for these individual differences.

In terms of interrater reliability, some data had only moderate intraclass correlations between coders, suggesting that some data used in analyses may not have high reliability. In other words, the coders involved in this study did not always have high consensus in their ratings of the number and severity of pain and negative affect words. Because the constructs of negative affect and pain language were well-established and

defined, this finding may suggest that more training is required to ensure consistent findings between raters. Specifically, future research could utilize comprehensive lists of possible negative affect and pain language and lengthen initial training sessions. Additionally, it might be helpful to re-train coders throughout the coding process to ensure continued understanding of constructs.

The theory that the social and physical pain processing systems are related has tremendous implications for science and for our communities. While autonomy and independence are considered desirable traits in western society, biological research suggests social relationships are essential to our wellbeing (MacDonald & Leary, 2005). Today, people are generally becoming increasingly geographically distant, technologically isolated, and overall secluded from others. Therefore, social pain may occur in higher frequencies and may eventually become detrimental to our wellbeing.

Additionally, social rejection and exclusion occur often for many individuals on a day-to-day basis (DeWall, 2010). Some people experience such episodes at a higher than usual rate and may suffer tremendously, particularly if they have specific personality traits that amplify the negative outcomes of social rejection (DeWall, 2010). Furthermore, rejection is associated with increased aggressive and antisocial behavior (DeWall, 2010). These behaviors may produce additional obstacles for those living with the negative consequences of social rejection (DeWall et al., 2010). Therefore, research regarding reactivity following social stress is required to gain a better understanding of how these events are experienced and potentially create interventions to improve long-term outcomes for individuals experiencing high rates of social stress.

Particularly, future research could focus on neurological activation and subjective experiences of individuals during various stress tasks. It would be particularly beneficial to use fMRI research to expand our understanding of neurological activation during various stressors. While there is evidence that the pain matrix is activated during physical pain and social stress, it would be beneficial to know whether these areas are also involved in processing academic stress or alternative forms of stress. These findings would allow researchers to examine whether nonsocial and nonphysical stressors share a common neurological basis with social and physical stress. This knowledge could help researchers understand whether social stress is privileged or whether alternative stressors lead to similar neurological activation. These studies could help examine gender differences in values and goals and their relation to physiological and subjective stress responses.

Moreover, knowledge of common neural circuitry suggests that scientists may be able to interfere with the subjective experience of social pain in the future (DeWall et al., 2010). Specifically, some research has suggested that acetaminophen can reduce neurological activation in brain areas associated with social stress and decrease the number of reported social stressors experienced by individuals taking this drug (DeWall et al., 2010). Therefore, negative emotional experiences often associated with social stress could potentially be blunted through medical interventions. This may be particularly beneficial for individuals who experience socially painful events at a higher than usual rate and suffer tremendously due to specific personality traits (i.e. rejection sensitivity) and disorders (i.e. Borderline Personality Disorder). Therefore, it may be

beneficial to examine the possibilities of medical intervention for social pain in order to buffer the negative effects of rejection and exclusion in some populations.

Overall, academic stress and social stress produced similar heart rate and skin conductance reactivity. However, there were a number of significant findings related to the subjective experience of social and academic stress. Specifically, we found that participants used more negative affect words during the academic interview than the social interview, and that males used more negative affect language than females overall. Additionally, pain language use was limited to the social interviews and was never used while describing academic stress. Furthermore, heart rate and skin conductance were not significantly associated with frequency or severity of negative affect and pain words. Therefore, physiological reactivity does not appear to be associated with the subjective experience of these stressors. In other words, our findings did not cohere across methods (i.e. physiological and self-reports). However, it is important to recognize the implications of the exclusive association of social stress to pain language. This finding suggests that social stress may be interpreted as painful, whereas academic stress is not described as painful. It does not appear to be the case that participants were unconcerned about academic stress; in fact, these stressors seemed to frequently lead to the experience of negative emotions. Additional research will be critical in developing a greater understanding of how different forms of stress relate to physiological reactivity and subjective responses, especially in relation to the concept of social pain.

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Tables and Figures

Table 1. Correlations among variables in analysis

	# NA Words in ACI	# NA Words in SCI	# Pain Words in SCI	NA Rating in ACI	NA Rating in SCI	Pain Rating in SCI	HR in ACI	HR in SCI	SC in ACI	SC in SCI	Gender
# NA Words in ACI	1										
# NA Words in SCI	.294*	1									
# Pain Words in SCI	.282*	.123	1								
NA Rating in ACI	.400**	.272	.107	1							
NA Rating in SCI	-.007	.441**	-.091	.506**	1						
Pain Rating in SCI	.131	.764**	-.021	.594*	.669*	1					
HR in ACI	.118	.231	.070	.075	.061	.152	1				
HR in SCI	.043	.122	.027	.230	.234	.202	.540**	1			
SC in ACI	.011	.228	-.047	.146	.215	.057	-.231	-.222	1		
SC in SCI	.080	.169	.067	.115	.026	.258	.004	.161	-.112	1	
Gender	-.288*	-.290*	.009	.039	.164	.270	.081	.132	-.048	-.056	1

Note. *$p < .05$. **$p < .01$.
Number and severity of pain words in the ACI were omitted, since no participants used pain words during this interview.
ACI = Academic Competence Interview, SCI = Social Competence Interview, NA = Negative Affect, HR = Heart Rate, SC = Skin Conductance

Table 2. Means and Standard Deviations (SD) for variables in analyses

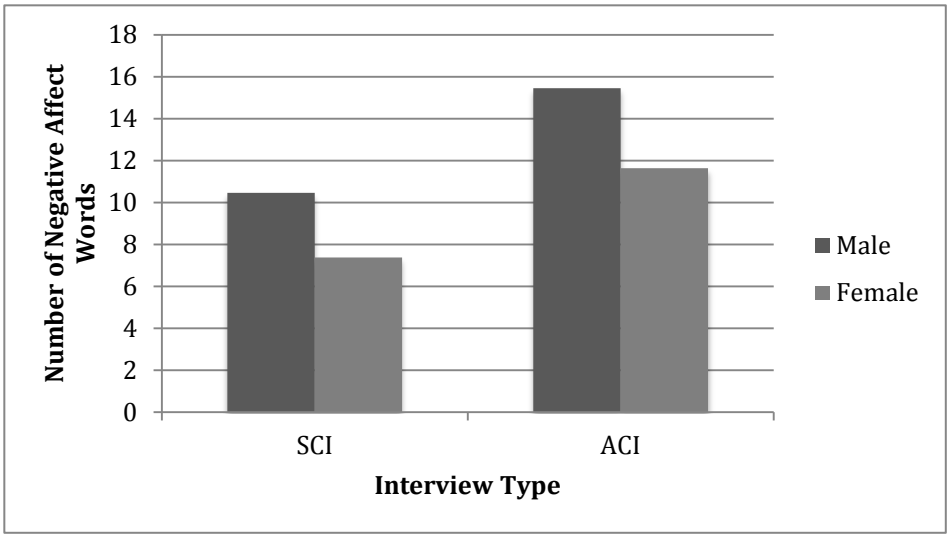
		Academic Interview		Social Interview	
Group	N	Mean	SD	Mean	SD
Male HR	19	2.83	4.85	2.51	5.35
Female HR	30	3.53	3.91	4.11	6.36
Male SC	19	2.00	1.84	2.25	2.62
Female SC	30	1.85	1.34	2.01	1.74
Male # NA Words	20	15.45	7.45	10.45	6.49
Female # NA Words	30	11.63	5.51	7.37	3.89
Male NA Rating	20	1.88	0.46	1.88	0.30
Female NA Rating	30	1.91	0.35	1.98	0.34
Male # Pain Words	20	0.00	0.00	0.45	0.76
Female # Pain Words	30	0.00	0.00	0.47	1.07
Male Pain Rating	20			2.00	0.00
Female Pain Rating	30			2.00	0.89

Note. HR = Heart Rate Reactivity, SC = Skin Conductance Reactivity, NA = Negative Affect
Severity of pain words in the ACI was omitted, since no participants used pain words during this interview.

Table 3. Intraclass correlations between findings for primary coder and reliability coder.

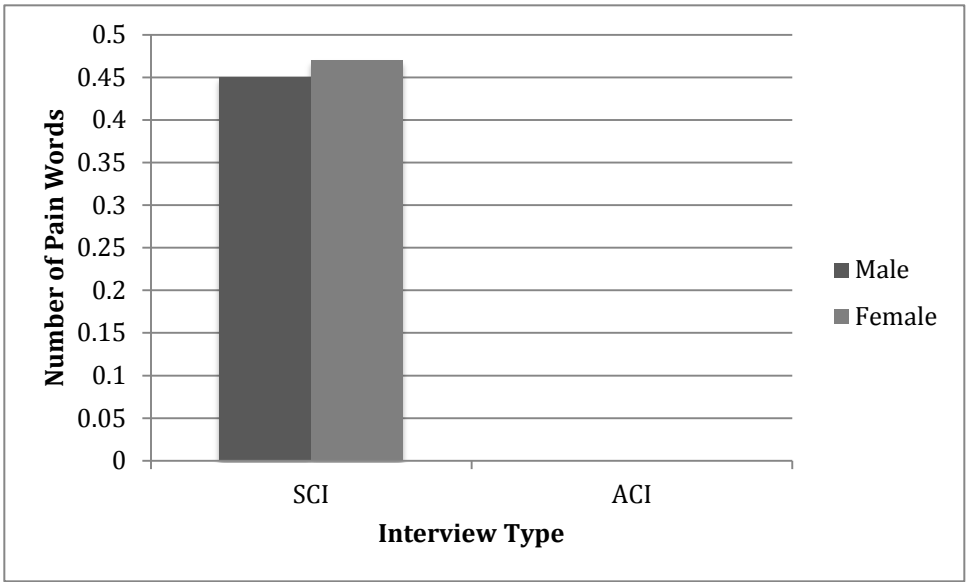
Variables of Interest	Correlation
Total Number of NA Words in Academic Interview	.662**
Total Number of NA Words in Social Interview	.787**
Total Number of Pain Words in Social Interview	.644**
Rating of NA Words in Academic Interview	.645**
Rating of NA Words in Social Interview	.828**
Rating of Pain Words in Social Interview	.915**

Note. **$p < .01$.



Note. SCI = Social Competence Interview, ACI = Academic Competence Interview

Figure 1. Frequency of negative affect words used by males and females while recounting experiences of social and academic stress.



Note. SCI = Social Competence Interview, ACI = Academic Competence Interview

Figure 2. Frequency of pain words used by males and females while describing experiences of social and academic stress.

Appendix B

Examples of Language Expressing Pain

Hurt Feelings	Damaged	Torture
Feeling Hurt	Agonizing	Heartache
Broken Heart	Excruciating	Suffering
Feeling Crushed	Stabbing	Paralyzing
Painful	Throbbing	Sickening
Scarred	Torn	