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# Perceived relational evaluation : biological, psychological, and physical health correlates

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PERCEIVED RELATIONAL EVALUATION: BIOLOGICAL, PSYCHOLOGICAL,  
AND PHYSICAL HEALTH CORRELATES

An Abstract of a Thesis  
Submitted  
in Partial Fulfillment  
of the Requirements for the Degree  
Master of Arts

Emily Christina Banitt  
University of Northern Iowa  
July 2015

## ABSTRACT

Humans have a fundamental need to belong, and being rejected or devalued elicits strong emotional reactions such as stress and anxiety (Leary, 2001). Low perceived relational evaluation (PRE), as a type of rejection, occurs when one person in a relationship believes his or her significant other does not regard his or her bond with the other person as valuable, close, or important (Leary, 2001). The goal of the research was to examine the interrelations among PRE, cortisol (biological stress), relationship quality, and physical and psychological within dating couples. Undergraduate female students ( $N = 109$ ) who were involved in dating relationships completed computer-based questionnaires assessing various aspects of their current relationship as well as measures of psychological and physical health symptoms. Immediately prior to and after completing the questionnaires, participants provided saliva samples that were subsequently analyzed for cortisol levels. PRE was expected to be positively correlated with satisfaction and commitment and negatively correlated with physical and psychological health. Relationship stress was expected to be positively correlated with physical health symptoms. Neuroticism was expected to be negatively correlated with cortisol and positively correlated with psychological health and physical health symptoms. Additionally, cortisol was expected to mediate the relationship between PRE and satisfaction, commitment, psychological health, and physical health symptoms. This mediational effect was further predicted to be moderated by neuroticism. PRE was positively correlated with satisfaction and commitment and negatively correlated with psychological distress. Contrary to expectations, PRE was not significantly correlated

with physical health symptoms. In addition, cortisol was not significantly related to any of the criterion variables. Therefore, neuroticism was examined as a moderator variable between PRE and the criterion variables. However, no moderation results were significant. Strengths of the research include assessing PRE for its influence on physical and psychological health and obtaining self-report and biological indicators of stress. However, the research was limited by a small sample size and small effect sizes. Future research may benefit from utilizing a longitudinal design as well as including a measure of self-esteem.

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This Study by: Emily Christina Banitt

Entitled: Perceived Relational Evaluation: Biological, Psychological, and Physical Health Correlates

has been approved as meeting the thesis requirement for the  
Degree of Master of Arts

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## TABLE OF CONTENTS

LIST OF TABLES .....	v
LIST OF FIGURES .....	vi
CHAPTER 1. INTRODUCTION .....	1
CHAPTER 2. METHOD .....	20
CHAPTER 3. RESULTS .....	32
CHAPTER 4. DISCUSSION .....	39
REFERENCES .....	53
APPENDIX A: DEMOGRAPHICS AND RELATED QUESTIONS .....	73
APPENDIX B: PERCEIVED RELATIONAL VALUE (PRV)-REVISED .....	78
APPENDIX C: RUSBULT (1998) RELATIONSHIP SATISFACTION SUBSCALE ...	79
APPENDIX D: RUSBULT (1998) RELATIONSHIP COMMITMENT SUBSCALE ....	81
APPENDIX E: BERGEN SOCIAL RELATIONSHIP SCALE-REVISED .....	82
APPENDIX F: BIG FIVE INVENTORY (BFI) .....	83
APPENDIX G: PHYSICAL HEALTH QUESTIONNAIRE-15 (PHQ-15).....	85
APPENDIX H: SYMPTOM CHECKLIST-90-REVISED (SCL-90-R) .....	86

## LIST OF TABLES

TABLE	PAGE
1 Participant Characteristics .....	66
2 Correlations between Cortisol and Related Covariates .....	67
3 Correlations between Predictor and Outcome Variables .....	68
4 Regression Analyses between Perceived Relational Evaluation, Neuroticism, and Outcome Variables .....	69

## LIST OF FIGURES

FIGURE	PAGE
1 The proposed moderated mediation between PRE, neuroticism, cortisol, satisfaction, commitment, physical health, and psychological distress with cortisol and neuroticism acting as a mediator and moderator, respectively.....	64
2 The proposed moderated mediation model diagramming the statistical pathways between PRE, cortisol, neuroticism, and the criterion variables. ....	65
3 The interaction between PRE, neuroticism, and relationship satisfaction which was not significant, $\Delta R^2 = .001$ , $\beta = 0.90$ , $t(108) = 0.46$ , $p = .65$ , 95% CI [-0.30, 0.48]. ....	70
4 The interaction between PRE, neuroticism, and relationship commitment which was not significant, $\Delta R^2 = .004$ , $\beta = .09$ , $t(107) = 0.72$ , $p = .48$ , [-0.33, 0.71]. ....	71
5 The interaction between PRE, neuroticism, and psychological distress which was not significant $\Delta R^2 = .001$ , $\beta = -.15$ , $t(106) = -0.36$ , $p = .72$ , [-0.94, 0.65].....	72
6 The interaction between PRE, neuroticism, and physical health which was not significant, $\Delta R^2 = .03$ , $\beta = -.62$ , $t(107) = -1.86$ , $p = .07$ [-1.28, 0.04]. ....	73

## CHAPTER 1

### INTRODUCTION

Relationships encompass a large part of everyday life and are particularly important due to their central role within various life domains. In fact, some argue that humans have a fundamental need for belonging (Baumeister & Leary, 1995). According to Baumeister and Leary (1995), people are driven to make and preserve a minimum number of quality interpersonal, lasting relationships. However, over the course of one's life, many people will experience instances where they will feel rejected, excluded, and/or ostracized by others, maybe even others whom they feel very close to such as spouses or significant others, family members, or close friends or colleagues. The current research was conducted to examine how one is impacted when her need for belonging is perceived to be thwarted by significant others. For purposes of this research, a significant other is defined as a person with whom someone has an established romantic or sexual relationship.

Research on how people respond to actual or perceived exclusion has been informative in several ways including, its effects on workplace productivity and close relationships. However, much of this research has tended to treat rejection and exclusion as a dichotomy, comparing people who are included to those who are excluded via some experimental manipulation (Leary, Twenge, & Quinlivan, 2006). In contrast to viewing inclusion versus rejection (or acceptance versus rejection) as a dichotomy, the current research focuses on one's perceptions of inclusionary status as resting on a continuum. In fact, some research indicates that one's perception of being rejected is just as important to

subsequent attitudes and behaviors as being actively and overtly rejected. Specifically, the current research focuses on the extent to which college women feel rejected by their significant other and how such experiences can impact can impact their physical and psychological health as well as relationship quality. This construct is referred to as Perceived Relational Evaluation (PRE), or “the extent to which people see others as valuing them” (Norman, Windell, Lynch, & Manchanda, 2012, p. 309).

To help develop the hypothesized relations between PRE and the proposed criterion variables, research on close personal relationships is broadly reviewed with a concentration on close interpersonal relationships. The focus is then narrowed to dating relationships, specifically. Second, the literature on relationship satisfaction and commitment is described with a focus on how instances of rejection and exclusion relate to satisfaction and commitment within both married and dating couples. As discussed in detail below, low levels of PRE are thought to elicit activation of one's biological stress response system. As such, a basic introduction to the inner workings of the stress response system are also described, as well as the effects of stressors (both physical and psychological) on physical and psychological health. Additionally, research on personality, specifically neuroticism, suggests this trait can impact the strength of the relation between PRE and one's biological stress response. Finally, a series of theoretical hypotheses are proposed culminating in a moderated mediation model that outlines how PRE might relate to neuroticism, cortisol, relationship quality, and physical and psychological health.

### Interpersonal Rejection

As mentioned above, humans have a strong aversion to being rejected. People are acutely aware of how others perceive of and evaluate them and are highly sensitive to indications of disinterest, disapproval, and dissociation (Leary, 2001). Social psychologists, especially those who study rejection, tend to talk about rejection and its opposite, acceptance, as a dichotomy (Leary, 2001) when clearly, shades of acceptance and rejection exist (Leary, 2001; Leary et al., 2006). For example, a woman who knows that her husband loves her dearly may nonetheless feel rejected, hurt, and angry when he ignores her on a particular occasion. Simply explaining rejection and acceptance as a dichotomy ignores the fact that there are degrees of acceptance and rejection that correspond to different psychological reactions. Specifically, people's emotional and behavioral responses to acceptance and rejection seem to depend on their perception of how much another person views the relationship as valuable or important (Leary, 2001; Leary et al., 2006). Leary (2001) suggests that acceptance and rejection may better be understood as points along a continuum of relational evaluation, or “the degree to which a person regards his or her relationship with another individual as valuable, important, or close” (Leary, 2001, p. 6). Given this definition, people tend to value their relationships with others to varying degrees. Some relationships are exceptionally valuable and important, others are moderately valued, and yet others hold little or no value (Leary, 2005).

Generally speaking, acceptance refers to a state of relatively high relational evaluation in which a person regards his or her bond with another person as valuable,

important, or close (Leary, 2001). For example, a girlfriend may seek out her boyfriend's company, treat him well, provide support, and generally do things to maintain the relationship. At the other end of the continuum, rejection involves a state of relatively low relational evaluation in which a person does not regard his or her bond with another person as close, important, or valuable (Leary, 2001). Such cases may be illustrated by the same girlfriend not seeking out her boyfriend for togetherness or treating him well.

Often, when people do feel rejected, they are not reacting to the objective degree to which others value their relationship, but rather to their perceptions of the degree to which they are valued by their significant other (Leary, 2001). Thus, people's behavioral and emotional responses to acceptance and rejection are a function of PRE. PRE is different from relational evaluation in that relational evaluation is the degree to which a person regards his or her relationship with another person as valuable, important, or close, not making inferences about how someone else feels about the relationship. Relational evaluation is simply how *you* feel about your relationship, whereas PRE is how you think another person feels about your relationship. As an example of relational evaluation, a woman may not text her friend back right away because that relationship is not as important, valuable, or close as other relationships in her life at that moment. As an example of PRE, a woman may perceive that her boyfriend does not value their relationship after he does not reply to her text for hours (Leary, 2001). Rejection-related experiences can be heavily subjective, especially in close relationships.

PRE is important to study because it has the potential to impact relationship quality and well-being. A few studies, especially those by Murray and colleagues (e.g.,

Murray, Bellavia, Rose, & Griffin, 2003; Murray, Holmes, & Griffin, 2000), have examined a similar construct to PRE called perceived regard (i.e., how participants think their partners see them) and how it affects relationship satisfaction and the longevity of the relationship. Murray et al. (2000) hypothesized that individuals would report greater relationship quality (both concurrently and longitudinally) when they felt more positively regarded in their partner's eyes. Consistent with their prediction and their dependency regulation model, dating and married couples were happier in their relationships the more positively regarded they felt. Feeling more positively regarded also predicted later relationship well-being (i.e., less conflict and ambivalence).

Researchers have also studied how self-esteem interacts with perceived regard and relationship satisfaction. Self-esteem, or feelings of self-worth, influence how individuals perceive themselves, their perceptions about how their dating partner views them, and their overall relationship quality (Sciangula & Morry, 2009). In general, low self-esteem individuals underestimate how optimistically their partner views them, and this underestimation is related to lower relationship well-being. In other words, low self-esteem individuals have more negative and conflicted views of themselves and may assume that their partners also see them negatively (Murray et al., 2000).

Feeling rejected (e.g., low PRE) can elicit behavioral, physiological, and emotional consequences. Thus, fMRI studies show that the same areas of the brain become stimulated when one experiences rejection as when one experiences physical pain (Eisenberger, Lieberman, & Williams, 2003). Interestingly, to test the hypothesis that rejection mimics physical pain, researchers gave some participants acetaminophen



(Tylenol) before asking them to recall a painful rejection experience. The participants who received Tylenol reported significantly less emotional pain than participants who took a sugar pill (Eisenberger, 2013). In addition, rejection threatens one's "need to belong" (Leary, 2001). When one gets rejected, this need becomes disrupted and the disconnection one feels adds to the emotional pain. Reconnecting with those who value and accept us has been found to soothe emotional pain after a rejection, but feeling alone and disconnected after a rejection creates surges of anger and aggression (Zadro, 2011). Last, rejection can even lower self-esteem. Short periods of in-person rejection and short periods of rejection over the internet (Cyberball) were enough to lower self-esteem in a study by Zadro, Williams, and Richardson (2004). Especially in romantic relationships, people often respond to romantic rejections by finding fault in themselves thus lowering self-esteem (Winch, 2013).

Physiologically, the biological systems that may be most sensitive to rejection and rejection-related experiences, such as social-evaluative threat, are the hypothalamic-pituitary-adrenal (HPA) axis (Rohleder, Beulen, Chen, Wolf, & Kirschbaum, 2007) and the immune system (Dickerson, Gruenewald, & Kemeny, 2009). Stress that poses a threat to the social self (i.e., psychological threat) has been associated with higher cortisol levels. One prospective explanation is that activation of the stress response system leads individuals to mobilize resources to preserve their social standing when it is threatened (Miller, Chen, & Zhou, 2007). Dickerson, Gruenewald, and Kimeny (2004) found support for this hypothesis by showing that cortisol secretion increases sharply when people are faced with social evaluative threats, that is, conditions that have the likelihood

to diminish one's standing in the eyes of others. Below, research examining women, stress, and relationship outcomes is reviewed.

### Women, Relationship Conflict, and Outcomes

Most of the previous research on relationship conflict and quality has focused on married couples and their physiological responses to conflict as a determinant of later relationship outcomes. For women, the correlation between physiological responses and the decline in relationship satisfaction and commitment may be more pronounced as compared to men (Gottman & Levenson, 1992). Women tend to have stronger physiological responses to conflict, and women's responses are more highly correlated with their relationship outcomes than to men's physiological responses (Gottman & Levenson, 1992). Three indicators of sympathetic nervous system (i.e., physiological) arousal on the part of the wife—that is, higher ACT (general somatic activity; amount of movement in any direction),  $r(16) = -.52$ ; shorter PTTs (pulse transmission time; the time interval (in ms) between the R wave of the electrocardiogram (EKG) and the upstroke of the peripheral pulse at the finger site),  $r(16) = .41$ ; and the interaction,  $r(16) = .54$  all significantly predicted decline in her marital satisfaction (Gottman & Levenson, 1985). Literature reviews conclude that the relationship between physiological change during conflict and negative behaviors is stronger for women than for men, and women's physiological changes, namely stress hormones, following marital conflict last longer than men's, even into the night and the next day (Kiecolt-Glaser, Bane, Glaser, & Malarkey, 2003). These gender differences may reveal that women are more sensitive to adverse marital interactions as well as other relationship events (Kiecolt-Glaser et al.,

2003). Women may be more sensitive to interpersonal stressors because of their interpersonal orientation, that is, a relatively enduring pattern of social interaction preferences over a wide range of situations (Smith & Ruiz, 2007). Women, because of their higher need for affiliation (Balswick & Avertt, 1977), may seek reassurance more so than men. This may result in more opportunities for rejection, or at least conflict in relationships, which then only feeds a woman's worries about the status of the relationship (Nolen-Hoeksema & Hilt, 2009). In other words, women may be more sensitive to interpersonal stressors.

Related to this, research also suggests that women may feel the effects of interpersonal stress and poor relationship quality more strongly than men, physically and psychologically. For example, women showed greater HPA reactivity to interpersonal stressors whereas men showed greater HPA reactivity to achievement stressors (Stroud, Salovey, & Epel, 2002). Negative health implications following interpersonal stress were stronger for women as compared to men (Orth-Gomer et al., 2000). For instance, women who had better quality relationships (defined in terms of influence, initiation, mutual disclosure, satisfaction, pleasantness, and intimacy) reported better physical health (i.e., fewer infections, blood or circulatory disorders, nervous system disorders, gastrointestinal disorders, and skin disorders) and fewer mental disorders compared to women who had poor quality relationships (Reis, Wheeler, Kernis, Spiegel, & Nezlek, 1985). Additionally, marital stress worsened the prognosis for women with coronary heart disease threefold. Among female patients with congestive heart failure, marital quality predicted 4-year survival as well as the patient's illness severity. Again, these

associations between survival and marital quality were stronger for women than men (Coyne et al., 2001). These findings underscore the idea that relationship quality has important implications for women's health.

Given that relationship stressors tend to be more impactful for women, the current research relied on this population for testing specific hypotheses. These effects are expected to carry over to women in dating couples such that women reporting more relationship stress will also report more physical health symptoms.

**H1:** Relationship stress is expected to be positively correlated with physical health symptoms.

### Dating Relationships, Relationship Quality, and Conflict

Dating relationships are important in their own right because they often serve as a stepping stone towards marriage and they offer insight into the initial processes of relationship quality and satisfaction (Gray, 2002). There is a tendency among researchers, especially longitudinal researchers, to view marriage as a beginning point. Subsequently, they start assessing couples on their wedding date rather than at the couples' first meeting or first date (Christensen, 1998). This is most likely because they are interested in the longevity of the marriage. But, many relationship problems surface during courtship and persist through early marriage. Thus, the beginning of marriage may not be the best time to start studying variables associated with marital outcomes (Christensen, 1998). Instead,

examining variables related to relationship outcomes when the couple is dating may help predict whether or not couples decide to get married.

Dating relationships are also important to study because of the influence of intimacy (or the lack thereof) with another can have on an individual (Stork-Hestad, 2010). For example, similar to other forms of close relationships, dating relationships have a strong potential to impact well-being, emotions, and physical health. In fact, the termination of dating relationships can be one of the most difficult times in a person's life in terms of psychological health (Stork-Hestad, 2010). In addition, college women reported significantly greater stress from social relationships (other than familial relationships) compared to college men. One main source of stress after a dating relationship has been started may stem from uncertainty over whether or not the relationship will last (Maestripieri, Klimczuk, Seneczko, Traficante, & Wilson, 2013).

The literature on the Investment Model adds to our understanding of romantic relationships by pinpointing a variety of elements that appear to be important in affecting relationship satisfaction, commitment, and dissolution. The model distinguishes between two important part of a relationship: satisfaction—positivity of affect about the relationship—and commitment—the tendency to maintain a relationship and to feel “psychologically attached to it” (Rusbult, 1983, p. 102). The model states that individuals should be more satisfied with their relationship if the relationship provides them high rewards and low costs and exceeds their generalized expectations. For example, if individuals share common interests with their partner (i.e., derive rewards), infrequently argue (i.e., experience little costs), and expect little (i.e., have a low comparison level),

then they should be relatively satisfied. Greater satisfaction should increase commitment. However, commitment depends on two additional variables: alternative quality and investment size. Commitment increases when individuals perceive they have only poor alternatives (e.g., solitude, no available attractive individuals). For example, if an individual is relatively dissatisfied with their relationship and really enjoys spending time on their own (i.e., have a good alternative), they should be less committed to maintaining their relationship. Last, the model states that satisfaction and commitment need not necessarily be strongly correlated. As such, according to the Investment Model, it is possible to be dissatisfied with a relationship and yet remain committed to it (Rusbult, 1983).

Part of being in a committed relationship is handling conflicts as they arise. Married couples have long been studied to determine how conflict relates to HPA axis stimulation, but few researchers have examined this relationship among dating couples. Even less research has been conducted on rejection-related experiences and cortisol using dating couples. Gunlicks-Stoessel and Powers (2009) explored the association between young adult college students' self-reported methods of coping with romantic relationship stress and their physiological reactivity to and recovery from negotiating conflict with their partners. Individuals' own use of active coping and their partners' use of active coping were expected to be associated with lower cortisol levels during the conflict conversation and quicker recovery afterwards. Romantic couples' need for social support predicted their HPA stress responses over the course of a conflict (Gunlicks-Stoessel & Powers, 2009). Receiving social support is argued to be one of the most important aspects

of couples' coping and has been shown to be positively correlated to relationship satisfaction (Julien & Markman, 1991), better mental health outcomes (Coyne & Downey, 1991), and better psychological adjustment to physical illness (Revenson, 1994). However, a significant relationship between need for social support and HPA reactivity was not found for women. This is consistent with previous work in which gender was found to moderate associations between social support and HPA stress responses (Kirschbaum, Klauer, Filipp, & Hellhammer, 1995).

In addition, attachment styles may moderate these relationships. Attachment relationships in humans are connected to physiological distress reactions such as heart rate and hormone activation. Further, HPA activation may be linked to attachment processes because it has been shown to be sensitive to interpersonal stressors. Powers, Pietromonaco, Gunlicks, and Sayer (2006) demonstrated that individuals' attachment styles predicted their HPA stress response and the nature of this association differed for men and women. Specifically, insecure attachment predicted greater HPA reactivity, and for women, greater attachment avoidance was associated with higher cortisol levels when they first entered the lab and during the conflict task (Powers et al., 2006). A more in-depth discussion of the HPA axis follows.

#### The Biological Mechanisms of Stress and its Outcomes

Low PRE can be a source of stress when one is assessing his or her relationship with another. This seems especially true within ongoing close interpersonal relationships, such as dating relationships. Certain types of psychosocial stressors have consistent effects on cortisol. Reviews of early studies in humans, rodents, and nonhuman primates

concluded that situations characterized by novelty, unpredictability, or low perceived control were most likely to activate the HPA axis (Nicolson, 2007). Cortisol, as a direct indicator of stress and activation of the HPA axis, has long been considered a potential mediator of the relationship between psychosocial factors and health (Lupien, 2013; Phillips, Carroll, Burns, & Drayson, 2005), but it has not been examined in the context of PRE.

In order to understand the biological underpinnings of a stress response, it is important to understand what happens within one's body under periods of stress. Stress responses usually consists of three phases: (1) basal activity, which reflects unstimulated, non-stressed activity, (2) a "stress reactivity" phase in which cortisol increases from baseline levels following a stressor, and (3) a stress recovery stage in which cortisol levels return to pre-stressor baseline levels (Burke, Davis, Otte, & Mohr, 2005). Generally speaking, cortisol release follows stimulation of the HPA axis (hypothalamic-pituitary-adrenal axis) and follows a diurnal rhythm which means that cortisol peaks in the morning immediately after awakening and slowly declines throughout the day (Chan & Debono, 2010). Activation of HPA-axis occurs when paraventricular neurons of the hypothalamus secrete corticotropin releasing hormone (CRH). This hormone then travels to the pituitary gland, which responds by releasing adrenocorticotropin hormone (ACTH). The ACTH is carried to the adrenal glands, which make and release cortisol. Cortisol is widely studied because of its regulatory influences on memory, learning, emotion, the central nervous system, the metabolic system where it regulates glucose storage and utilization, and the immune system where it regulates the strength and



duration of the inflammatory responses and the growth of lymphocytes, which fight against infections and other foreign substances (Nicolson, 2007).

Short-term increases in cortisol are beneficial in that they regulate normal circadian rhythm, prepare the organism to respond to external stimuli (fight or flight response), and facilitate recovery from disturbed homeostasis after stressful situations (Nicolson, 2007). However, prolonged heightened levels of cortisol are particularly damaging to the hippocampus (an area important for episodic memory) and chronically high levels of stress can increase one's chances of becoming ill and developing disease states such as cardiovascular disease, diabetes, and fatigue and pain syndromes (Nicolson, 2007). The official term used to describe chronically high levels of free activated cortisol is hypercortisolism. Hypercortisolism has been linked to tissue damage and ensuing dysregulation of biological systems such as the cardiovascular and endocrine systems (Goodyer, Park, Netherton, & Herbert, 2001; Groth, Fehm-Wolfsdorf, & Hahlweg, 2000; Miller et al., 2007; Rosal, King, Ma, & Reed, 2004; Tseng, Iosif & Seritan, 2011). Psychological distress and depressive symptomatology may be associated with hypercortisolism (Marchand, Durand, Juster, & Lupien, 2014). It is well-known that chronic stress increases cortisol output, but research has also discovered chronic stress can also blunt cortisol output (Miller et al., 2007). In times of stress, a blunted cortisol response is a flat, non-reactive cortisol metabolism. This exhaustion means that the hormone level stays relatively constant, rarely fluctuating at all (Stetler & Miller, 2005).

McEwen's (1998) theoretical model of allostatic load renders a helpful framework in understanding the relations between stress, mental health, and physical health. Under normal conditions, the body responds to stress by activating the HPA axis which is the body's main response to stress. In broader terms, exposure to stress triggers the allostatic mechanism, which brings about changes in the body's physiological systems, such as the neuroendocrine, cardiovascular, and immune systems, in order to defend the body from damage and return the body to baseline functioning (McEwen, 1998). Exposure to chronic psychosocial stress results in repeated demands for the body to adapt to stress, leading to allostatic load. Allostatic load refers to the wear and tear on the body that results from either too much stress or inefficient management of stress (McEwen, 1998). For example, it may be the consequence of failure to shut off production of stress-mediating hormones or it may be a result of the failure of the systems to generate an adequate response to stress, resulting in a blunted HPA stress response. Therefore, long term effects of continuous allostatic load may lead to mental and physical illnesses (Rollins, 2008). How one reacts to such chronic stressors can also depend on one's personality.

#### Personality as a Moderator

Personality factors contribute to how an individual responds to stressors (Rollins, 2008). One's personality, physiological predisposition, early childhood experiences, and social resources are responsible for the way a person "takes to" stressful life occurrences (Kobasa, 1979, p. 3). For example, neuroticism, defined as one's proneness to experiencing negative affective states, is related to an enhanced probability of perceiving

events as stressful, more participation in interpersonal conflicts, and greater sensitivity to the harmful mental and physical effects of stress (Rollins, 2008). It is one of the five personality dimensions that is relatively stable over the life span (McCrae & John, 2006). The six facets of neuroticism, as defined by Costa and McCrae (1992), relate to the extent to which individuals exhibit anxiety, depression, and hostility as well as feel self-conscious, act impulsively, and experience a sense of vulnerability. Individuals high in neuroticism tend to have difficulty accommodating aversive events. They also report more subjective stress, more somatic complaints, and recall more negative emotional information than their less neurotic counterparts. Highly neurotic individuals also have a tendency to interpret ambiguous stimuli in a threatening way, which may lead to biased interpretations in the domain of partner relationships and may explain how neuroticism affects relationship satisfaction. For example, a woman high in neuroticism will be less satisfied with her relationship because she tends to interpret the partner's ambiguous behaviors as mainly negative (Finn, Mitte, & Neyer, 2013).

A few studies have found no relationship between neuroticism and cortisol production (Kirschbaum, Bartussek, & Strasburger, 1992; Schommer, Kudielka, Hellhammer, & Kirschbaum, 1999; Verschoor & Markus, 2011; Wirtz et al., 2007), whereas many others have revealed that neuroticism is related to higher blood levels of cortisol (Miller, Cohen, Rabin, Skoner, & Doyle, 1999; Portella, Harmer, Flint, Cowen, & Goodwin, 2005; Vedhara, Tuinstra, Miles, Sanderman, & Ranchor, 2006; Williams et al., 1982; Zobel et al., 2004). It is expected that higher levels of trait neuroticism will be

associated with higher cortisol levels, psychological distress, and physical health symptoms.

**H2:** Neuroticism will be positively correlated with cortisol, psychological distress, and physical health symptoms.

### Research Hypotheses and the Theorized Moderated-Mediation Model

Given the importance of one's need for belonging to psychological and physical health, it is hypothesized that negative relations will emerge between PRE and psychological distress and physical health symptoms, which is consistent with previous research that shows that rejection (e.g. PRE) has a negative impact on psychological and physical health (Eisenberger et al., 2003; Leary, 2001). The more positively one feels her significant other values her relationship, the less distress and physical health symptoms will be reported. In contrast, PRE is expected to be positively related to relationship quality (including assessments of both relationship satisfaction and commitment) such that higher levels of PRE will be associated with higher levels of relationship quality, consistent with research by Murray et al. (2000).

It is further predicted that these relations will be mediated by cortisol, (consistent with previous research that has found cortisol to be related to these variables and a mediator between psychosocial issues and health), such that, after controlling for cortisol, a previously significant relation between PRE and each of the criterion measures is no longer significant.

Additionally, the ability of cortisol to mediate the relation between PRE and relationship quality, psychological distress, physical health symptoms is hypothesized to be dependent on one's level of neuroticism. Specifically, it is predicted that the mediating process will differ for individuals with high and low levels of neuroticism: the mediational effect of cortisol is expected to emerge only under conditions of low neuroticism, whereas, little to no mediation is expected to emerge for individuals reporting higher levels of neuroticism. This is consistent with previous research that states high levels of neuroticism are related to a less reactive cortisol profile and smaller cortisol stress reactions (Bibbey, Carroll, Roseboom, Phillips, & de Rooij, 2013; McCleery & Goodwin, 2001; Oswald et al., 2006; Phillips et al., 2005).

The final model to be tested represents a moderated mediation model. In moderated mediation “a variable mediates the effect of an independent variable on a dependent variable, and the mediated effect depends on the level of a moderator” (MacKinnon, Fairchild, & Fritz, 2007, p. 12). Figures 1 and 2 illustrate the conceptual and statistical moderated mediation models to be tested within the current research, respectively.

**H3:** It is expected that PRE will be negatively correlated with psychological distress and physical health symptoms.

**H4:** It is expected that PRE will be positively correlated with relationship satisfaction and commitment.

**H5:** It is expected that the relation between PRE and relationship satisfaction, commitment, psychological distress, and physical health symptoms will be mediated by cortisol, such that after controlling for cortisol a previously significant relation between PRE and each of the criterion measures will no longer be significant.

**H6:** It is expected that the ability of cortisol to mediate is dependent on one's level of neuroticism such that the mediational effect of cortisol is expected to emerge only under conditions of low neuroticism, whereas, little to no mediation is expected to emerge for individuals reporting higher levels of neuroticism.

## CHAPTER 2

### METHOD

#### Power Analysis

To determine an adequate sample size for testing for moderated mediation model described above, previous research including sample size simulation studies were consulted (Chu, 2012; Preacher, Rucker, & Hayes, 2007). It is generally accepted that researchers should strive for a power level of .80 or higher (Cohen, 1988). Power refers to the ability of a statistical test or model to detect an effect (or relation between variables) if one does, in fact, exist in the larger unmeasured population (Cohen, 1988). Chu (2012) conducted a simulation study specifically addressing the issue of power within moderated mediation models consistent with the one being tested within the current research. Empirical power estimates were obtained as a function of estimating expected effect sizes for the various model paths. For purposes of the current research, those paths most relevant for testing moderated mediation include the path from PRE (the focal predictor) to cortisol (the proposed mediator); ( $a_1$ ), the path from PRE x neuroticism (the moderator) to cortisol; ( $a_3$ ), and the path from cortisol to the criterion variables (psychological distress and physical health and relationship quality; ( $b_1$ ); (see Figure 2).

To compute the power estimates, Chu's (2012) research used a series of bootstrap simulations using different estimates for expected effect sizes and sample sizes. Bootstrapping is a nonparametric re-sampling technique that generates robust (strong) estimates of the parameter using the sample values. This technique uses the original data set as the population and involves taking the original data set, and, sampling from it to

form a new sample, usually called the bootstrap sample. The bootstrap sample is taken from the original using sampling with replacement, meaning the data is put back into the original data set. This process is repeated a large number of times (typically 5,000 or 10,000 times), and for each of these bootstrap samples a mean is computed. The standard error of the statistic is estimated as the standard deviation of the sampling distribution created from the bootstrap samples. From this, confidence intervals, regression coefficients, and significance tests can be computed (Field, 2013; Wright, London, & Field, 2011). Bootstrapping is usually used when you cannot assume normality about the underlying population distribution and want an estimate that is not affected by non-normality (Mooney & Duval, 1993).

However, bias can occur when using the bootstrapping method. Bias occurs when the bootstrap (sample) distribution and the original sample systematically disagree (Mooney & Duval, 1993). This merely means that although the bootstrap sample may be a good estimator, its expected or average value is not exactly equal to the population parameter. The difference between the estimator's average and the true parameter value is the degree of bias. When an estimator is known to be biased, it is sometimes possible, by other means, to estimate the bias and then modify the estimator by subtracting the estimated bias from the original estimate. This procedure is called bias correction. It is done with the intent of improving the estimate of the confidence intervals (Efron, 1987; Field, 2013). Based on a review of the existing literature, moderate (or medium) effect sizes were expected to emerge across all relevant paths within the model to be tested. Given medium effect sizes across the three paths, according to Chu (2012), 100



participants would be needed to achieve adequate power. The effect sizes mentioned above were expected based on the following:

#### Pathway a<sub>1</sub>

This pathway includes the relationship between PRE and cortisol. Because there is no specific research on PRE, similar variables such as rejection, social threat, and exclusion were used as proxies for PRE. Stressors with social-evaluative threat (in which others could negative judge the self) elicited greater cortisol responses than stressors without this component ( $d = .67$ ; Dickerson et al., 2004). A meta-analysis by Miller et al. (2007) found a medium effect size ( $d = .26, p < .01$ ) between social threat and afternoon/evening samples of cortisol.

#### Pathway a<sub>3</sub>

This pathway includes interaction between PRE and neuroticism. Rejection sensitivity was significantly associated with neuroticism ( $r = .35, p < .01$ ; Downey & Feldman, 1996). Participants with higher neuroticism scores were less accurate in making social evaluations than those with lower neuroticism scores ( $\eta^2 = .06, p < .001$ ; Gibson, 2006).

#### Pathway b<sub>1</sub>

This pathway includes the association between cortisol and physical and mental health and between cortisol and satisfaction and commitment. There is a large positive correlation ( $r = .89$ ) between intima media thickness (IMT; artery thickness) and cortisol reactivity in women (Eller, Netterstrøm, & Allerup, 2005) IMT can be used as a measure of atherosclerosis (plaque build-up in the arteries of the heart). IMT and atherosclerosis

are established predictors of heart disease (Iglesias del Sol et al., 2001). Although the current study is not measuring artery thickness, the physical health questionnaire taken by participants in the current study does measure chest pain would could be a sign of a heart problem. Last, there is a large correlation ( $r = .74, p < .01$ ) between cortisol levels and the severity of insomnia (Xia, Chen, Li, Juang, & Shen, 2013).

There have been many previous studies that have found a relationship between cortisol and psychological problems. For instance, a moderate effect size ( $d = .47, p < .01$ ) has been established between afternoon/evening cortisol and people who developed PTSD after stress exposure (Miller et al., 2007) in addition to a medium effect size ( $d = .45, p < .01$ ) between afternoon/evening cortisol and subjective distress (Miller et al., 2007). Last, several studies have found a significant relationship between cortisol and depression (e.g., Heaney, Phillips, & Carroll, 2010; Marchand et al., 2014; Muhtz, Zyriax, Klähn, Windler, & Otte, 2009).

### Participants

Participants included 109 female undergraduate students from a mid-sized Midwestern university in heterosexual, homosexual, or bisexual dating relationships. Participants were recruited through the introduction to psychology pool and were given course credit for participating. In order to qualify for the study, participants must have read through a description of the study that asked them to adhere to the following: (a) avoid alcohol for 12 hours prior to participating in the study, (b) refrain from eating a major meal for at least 60 minutes prior participating in the study, (c) avoid dairy products for at least 20 minutes prior to participation, and (d) avoid foods with high sugar

or high caffeine content immediately prior to participating because these may compromise saliva collection and increase bacterial growth.

The sample as a whole was relatively young—the average age of the students was 18.63 years ( $SD = .92$ ). Participants, on average, had been in a relationship 15.17 months ( $SD = 14.07$ ). Additional participant characteristics, such as race and sexual orientation, are displayed in Table 1.

### Measures

#### Perceived Relational Evaluation

PRE was assessed using the Perceived Relational Value (PRV) scale (Norman et al., 2012). The scale includes two parallel sub-scales—one referencing family and one referencing friends and acquaintances, but only the scale referencing friends and acquaintances was used for the purposes of this study. In addition, the wording was changed to focus on significant others. Originally, the scale included 24 questions, but an item about relationship closeness was added (e.g. “My significant other considers our relationship to be close”), per the definition of PRE. Participants answered 25 questions on a 7-point Likert scale (1 = *very strongly disagree* and 7 = *very strongly agree*). The PRE score is obtained by reverse scoring the ten negatively worded items, summing across all scale items, and then taking the average. Higher composite scores reflect higher PRE and thus a more positive perception of the relationship. Previous research indicate the scale has a Cronbach's alpha of .95. For the current research, the reliability alpha was calculated to be .94. The scale can be found in Appendix B.

### Relationship Satisfaction

Degree of relationship satisfaction was assessed with the satisfaction subscale of the Investment Model Scale (IMS; Rusbult, Martz, & Agnew, 1998). The sub-scale measures the degree to which the relationship fulfills the need for intimacy, sex, companionship, security, and emotional involvement. The scale consists of 10 statements: 5 facet items that are initially asked prior to 5 more global items. The facet items are concrete exemplars of each construct and are designed to prepare the respondent for the global items and are not included in the composite calculation. The facet items (e.g. “my partner fulfills my needs for intimacy”) have four possible responses (*do not agree at all, agree slightly, agree moderately, and agree completely*). In the five following global items (e.g. “I feel satisfied with our relationship”), respondents answered each item on a 9-point scale of agreement (0 = *do not agree at all* and 8= *agree completely*). The composite score is calculated by summing across the global items and then calculating the average. Higher composite values indicate higher levels of relationship satisfaction. The relationship satisfaction sub-scale has a reliability alpha of .92 (Rusbult et al., 1998). For the current research, the reliability alpha was also .92. The scale can be found in Appendix C.

### Relationship Commitment

Relationship commitment was assessed using the elaborated version of the commitment subscale from the Investment Model Scale (IMS; Rusbult, 1980). The sub-scale is a 15-item scale which measures three aspects of relationship commitment: intent to persist (e.g., “I am completely committed to maintaining our relationship.”),

attachment (e.g., “I feel completely attached to my significant other and our relationship.”), and long-term orientation (e.g., “I often talk to my significant other about what things will be like when we are very old.”). All item responses were obtained on a 9-point response scale (0 = *do not agree at all* and 8 = *completely agree*). The composite score is calculated by summing across scale items and then finding the average. In the composite score, higher values indicate higher levels of relationship commitment. Previous research suggests that all sub-scales are moderately inter-correlated and that the scale is reliable and valid with a reliability alpha of .91 (Rusbult et al., 1998). For this research, the Cronbach's reliability coefficient was calculated to be .96. The scale can be found in Appendix D.

### Stress

Interpersonal relationship stress was assessed using the Bergen Social Relationships Scale (BSRS; Bancila & Mittelmark, 2009). The BSRS was originally a 6-item scale that measures six chronic social stress constructs (i.e., helpless bystander, inept support, performance demand, role conflict, social conflict, and criticism). The scale was designed to measure interpersonal stress in close relationships (i.e., children, parents, siblings, spouse or significant other, neighbors, friends, colleagues, or others you know), but for the purpose of the current research, the statements were revised to focus on stress from a dating partner, specifically the participant's significant other (e.g. “My significant other makes my life difficult”). The original constructs were maintained in the new version, except for the first question, which was deleted, because it no longer applied after the wording was modified. All item responses are obtained on a 4-point response

scale (0 = *does not describe me at all* and 4 = *describes me very well*). The composite score is calculated by summing the scores for the five items and calculating the average. Higher values indicate higher levels of relationship stress. Previous research suggests the BSRS is valid and reliable (Bancila & Mittelmark, 2009) with an average Cronbach's alpha of .73. For this research, the reliability coefficient was calculated to be .76. The scale can be found in Appendix E.

Salivary Assays. Cortisol was also used as a measure of stress. Collecting salivary cortisol is minimally invasive, does not require medical personnel, and can be done in many different environments (Hellhammer, Wüst, & Kudielka, 2009). Unbound salivary cortisol levels in women are highly correlated with serum levels,  $r(47) = .91, p < .001$  (Salimetrics, Inc., n.d.) and represent a valid and reliable way to estimate serum cortisol levels (Dorn, Lucke, Loucks, & Berga, 2007; Gozansky, Lynn, Laudenslager, & Kohrt, 2005; Raff, Homar, & Skoner, 2003). Participants in the current research were instructed to salivate by passively drooling into a polypropylene funnel connected to a 2 mL cryovial. The sample was unstimulated and participants were allowed to express saliva without interruption until a sufficient sample was collected (~1mL). Samples were frozen at -80 degrees Celsius within five minutes of collection.

All samples were assayed for salivary cortisol in duplicate using a highly sensitive enzyme immunoassay kit (Salimetrics, Inc., n.d.). The test uses 25  $\mu$ l of saliva per determination, has a lower limit of sensitivity of 0.003  $\mu$ g/dl, and a standard curve range from 0.012 to 3.0  $\mu$ g/dl. Values from matched serum and saliva samples show the expected strong linear relationship,  $r(63) = 0.89, p < .001$ . Reliability was assessed by

examining the intra- and inter- assay coefficients of variability with acceptable levels being equal to or less than 10% and 15%, respectively (Salimetrics, Inc., n.d.). The intra-assay reliability coefficient was 6.67% and the inter-assay reliability coefficient was calculated to be 7.07%.

### Personality

Personality was assessed using the Big Five Inventory (BFI; John & Srivastava, 1999). The BFI is a 44-item scale which measures the Big Five traits of Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. The scale contains two 8-item scales measuring Neuroticism and Extraversion, two 9-item scales measuring Agreeableness and Conscientiousness, and one 10-item scale measuring Openness. All item responses were obtained on a 5-point Likert scale (1 = *disagree strongly* and 5 = *agree strongly*). Composite scores are calculated by reverse scoring the negatively phrased items and then summing and then averaging the items corresponding to the trait sub-scales. Higher values indicate higher levels of the trait. The Neuroticism subscale was the primary personality trait of interest for the current research. Previous research indicates the neuroticism subscale has a reliability coefficient of .84 (John & Srivastava, 1999). The reliability coefficient for the neuroticism scale was calculated to be .74 for this research. The scale can be found in Appendix F.

### Physical Health Symptoms

The Physical Health Questionnaire (PHQ-15) is a brief self-report somatic symptom subscale derived from the full PHQ. It inquires about 15 somatic symptoms or symptom clusters that account for more than 90% of the physical complaints (excluding

upper respiratory tract symptoms) reported in the outpatient settings. Participants rated the severity of each symptom (0 = *not bothered at all* and 2 = *bothered a lot*). The categories for scoring: minimal (score = 0–4), low (score = 5–9), medium (score = 10–14), and high (score = 15–30). The composite score is calculated by summing across all scale items and then calculating the average. Higher scores indicated more physical symptoms that are bothersome. Previous research specified convergent validity was established by showing a strong association between PHQ-15 scores and functional status, disability days, and symptom-related difficulty (Kroenke, Spitzer, & Williams, 2002). The internal reliability of the PHQ-15 is good, with a Cronbach's alpha of .80 (Kroenke et al., 2002). For this research, the reliability was found to be .79. The scale can be found in Appendix G.

### Psychological Distress

The SCL-90-R assessed participants' psychological distress (Derogatis, 1994). The SCL-90-R is a 90-item self-report symptom inventory. Participants rated a series of statements measuring various dimensions of psychological distress along five-point response scales (0 = *not at all* and 4 = *extremely*). Respondents also indicated how much a particular problem (e.g., headaches) distressed or bothered them during the past week. The SCL-90-R assesses nine primary symptom dimensions: Somatization (*SOM*; e.g., pains in heart or chest), Obsessive-Compulsive (*O-C*; e.g., Repeated unpleasant thoughts that won't leave your mind), Interpersonal Sensitivity (*I-S*; e.g., Feeling critical of others), Depression (*DEP*: Feeling hopeless about the future), Anxiety (*ANX*; e.g., Trembling), Hostility (*HOS*; e.g., Feeling easily annoyed or irritated), Phobic Anxiety



(*PHOB*; e.g., Feeling afraid in open spaces or on the streets), Paranoid Ideation (*PAR*; e.g., Feeling that most people cannot be trusted), and Psychoticism (*PSY*; e.g., The idea that someone else can control your thoughts).

The SCL-90-R assesses three global indices to provide summary psychological distress information: the Global Severity Index (GSI) provides a measure of general psychological distress, the Positive Symptom Distress Index provides a measure of symptom intensity, and the Positive Symptom Total (PST) provides a measure of the overall number of symptoms reported. Evidence suggests that these three global measures, while displaying moderate to high inter-correlations, assess distinct aspects of psychological distress important for clinical assessment, diagnosis, and treatment (Derogatis, Yevzeroff, & Wittelsberger, 1975). Even though participants completed the full SCL-90-R, the current research will focus on one global measure of psychological distress, the GSI. The Cronbach's alpha for the GSI was calculated to be .97. The full scale can be found in Appendix H.

### Procedure

Upon arrival, all participants were asked to read, sign, and date a written informed consent form. After completing the informed consent sheet, participants rinsed their mouth out with water for 15 seconds to flush out potential contaminants. Immediately after, participants completed a computer-based questionnaire. In addition to obtaining basic demographic information (e.g., age, gender, ethnicity), this questionnaire (Appendix A) asked participants several additional questions related to variables that have been found to impact circulating levels of cortisol (e.g., medications, medical

conditions, smoking, caffeine intake, and time since last meal; Nicolson, 2007; Hellhammer et al., 2009).

After completing the demographics questionnaire (~ 5 minutes), participants provided an initial saliva sample using a passive drool saliva collection protocol developed by Salimetrics, Inc. Given the novelty of the research situation and the potential for anticipatory cortisol reactivity that may emerge upon arriving for the study, the five minute delay in collecting the initial saliva sample served to help control for such anticipatory biological stress reactions and allow for a more precise measure of baseline cortisol level (Juster, Perna, Marin, Sindi, & Lupien, 2012). Participants were instructed to salivate into a polypropylene funnel connected to a 2 mL cryovial. They were allowed one minute increments to provide 2 ml of saliva and were allowed to salivate for a maximum of five minutes for each sample.

Afterward, participants completed the remainder of the questionnaire, with each scale being presented in a random order. After completing the final questionnaire, participants provided an additional saliva sample. The values for samples 1 and 2 were combined and averaged to provide a more stable baseline cortisol level to be used in data analyses. All samples were frozen within 5 minutes of collection at – 80 degrees Celsius (-112 Fahrenheit).

## CHAPTER 3

## RESULTS

Descriptive Statistics and Correlations

Before data analysis was conducted, data cleaning procedures were carried out. Frequency distributions and ranges were evaluated for “out of range” values for each variable. Each variable was also checked for normality: satisfaction (skewness = -1.43,  $SE = 0.23$ ;  $z = -6.22$ ,  $p < .001$ ; kurtosis = 1.45,  $SE = 0.46$ ;  $z = 3.15$ ,  $p < .001$ ), commitment (skewness = -0.77,  $SE = 0.23$ ;  $z = -3.35$ ,  $p < .001$ ; kurtosis = -0.28,  $SE = 0.46$ ;  $z = -0.61$ ,  $p = .27$ ), relationship stress (skewness = 1.92,  $SE = 0.23$ ;  $z = 8.34$ ,  $p < .001$ ; kurtosis = 5.10,  $SE = 0.46$ ;  $z = 11.09$ ,  $p < .001$ ), neuroticism (skewness = -0.08,  $SE = 0.23$ ;  $z = -0.35$ ,  $p = .36$ ; kurtosis = -0.17,  $SE = 0.46$ ;  $z = -0.37$ ,  $p = 0.36$ ), physical health symptoms (skewness = 0.56,  $SE = 0.23$ ;  $z = 2.43$ ,  $p = .008$ ; kurtosis = -0.29,  $SE = 0.46$ ;  $z = -0.63$ ,  $p < .26$ ), PRE (skewness = -2.98,  $SE = 0.23$ ;  $z = -12.96$ ,  $p < .001$ ; kurtosis = 14.88,  $SE = 0.46$ ;  $z = 32.35$ ,  $p < .001$ ), perceived stress (skewness = 0.14,  $SE = 0.23$ ;  $z = 0.61$ ,  $p = .73$ ; kurtosis = 6.31,  $SE = 0.46$ ;  $z = 13.72$ ,  $p < .001$ ), and psychological distress (GSI; skewness = 2.18,  $SE = 0.23$ ;  $z = 9.48$ ,  $p < .001$ ; kurtosis = 6.31,  $SE = 0.46$ ;  $z = 13.72$ ,  $p < .001$ ).

Based on these findings, variables found to have excessive skewness and/or kurtosis ( $p < .001$ ) were transformed. Based on recommendations by Tabachnick and Fidell (2013), psychological distress and relationship stress (positively skewed) were log transformed and satisfaction, PRE, and commitment (negatively skewed) were reflected and log transformed. After transformations, the data were re-examined. Transformations

substantially reduced the skewness and kurtosis estimates: psychological distress (GSI; skewness = -0.27,  $SE = 0.23$ ;  $z = -1.18$ ,  $p = .12$ ; kurtosis = -0.26,  $SE = 0.46$ ;  $z = -0.56$ ,  $p = .29$ ), PRE (skewness = 1.05,  $SE = 0.23$ ;  $z = 4.56$ ,  $p < .001$ ; kurtosis = 1.59,  $SE = 0.46$ ;  $z = 3.46$ ,  $p < .001$ ), relationship stress (skewness = 1.00,  $SE = .23$ ;  $z = 4.34$ ,  $p < .001$ ; kurtosis = 0.69,  $SE = 0.46$ ;  $z = 1.51$ ,  $p = .07$ ), satisfaction, (skewness = 0.50,  $SE = 0.23$ ,  $z = 2.09$ ,  $p = .02$ ; kurtosis = -0.66,  $SE = 0.46$ ;  $z = -1.43$ ,  $p = .08$ ), and commitment (skewness = 0.39,  $SE = .23$ ;  $z = .30$ ,  $p = .70$ ; kurtosis = -1.283,  $SE = .46$ ;  $z = -2.78$ ,  $p = .003$ ). Given this information, psychological distress, commitment, and satisfaction were brought to acceptable levels after transformation, however; PRE and relationship stress were not. Therefore, these composites were further examined for potential outliers. PRE and relationship stress both were found to have one outlier more than three standard deviations away from the mean, so they were removed. After removal, both of these variables' skewness and kurtosis were decreased: PRE (skewness = 0.568,  $SE = 0.23$ ;  $z = 2.43$ ,  $p = .02$ ; kurtosis = -0.532,  $SE = 0.46$ ;  $z = 1.15$ ,  $p = .25$ ) and relationship stress (skewness = 0.81,  $SE = 0.23$ ;  $z = 3.46$ ,  $p < .001$ ; kurtosis = -0.15,  $SE = 0.46$ ;  $z = -0.33$ ,  $p = .26$ ).

Cortisol at Time 1 and Time 2 were highly positively correlated,  $r(106) = .82$ ,  $p < .001$ . Because the two cortisol samples were highly correlated, they were combined to create a better baseline index and were checked for normality. Consistent with previous hormone research, it was discovered that the average cortisol measurement was skewed and kurtotic (skewness = 2.48,  $SE = 0.24$ ;  $z = 10.33$ ,  $p < .001$ ; kurtosis = 8.915,  $SE = 0.47$ ;  $z = 18.97$ ,  $p < .001$ ). To correct this, logarithmic data transformation was

conducted. This type of data transformation involves a logarithmic algorithm that yields more normally distributed data and is often used in research with cortisol (Seltzer et al., 2010). After transformation, skewness and kurtosis were substantially reduced (skewness = 0.61,  $SE = 0.24$ ;  $z = 2.54$ ,  $p = .006$ ; kurtosis = 0.15,  $SE = 0.47$ ;  $z = 0.32$ ,  $p = .63$ ).

Next, average cortisol was examined to determine if it correlated with variables that previous research has shown to impact salivary cortisol levels (including pre-study requirements; see Table 2). It was correlated with time since participants awoke (in minutes),  $r(106) = .47$ ,  $p < .001$ . As a result, in subsequent analyses, time since awakening was used as a covariate for all analyses including cortisol.

Upon examination of the pre-study requirements, 1 participant endorsed drinking alcohol less than 12 hours prior to the study, 3 endorsed eating a major meal less than 60 minutes prior, 1 endorsed consuming dairy less than 20 minutes prior, 1 endorsed consuming foods high in sugar immediately prior, 0 endorsed consuming foods high in acid, and 48 endorsed consuming caffeine immediately beforehand. These potential correlates were coded dichotomously such that 0 indicated that the participant followed instructions and 1 indicated the participant did not follow instructions. The point by serial correlation between the consumption of dairy and cortisol:  $r_{pb}(104) = -.03$ ,  $p = .75$ . The correlation between the consumption of sugary foods and cortisol:  $r_{pb}(104) = -.13$ ,  $p = .19$ . The correlation between the consumption of a major meal and cortisol:  $r_{pb}(104) = -.09$ ,  $p = .38$ . The correlations between alcohol consumption and caffeine (coffee) and cortisol can be found in Table 2. Because none of these variables were related to cortisol, these participants were not excluded from analyses given the already small sample size.

### Hypotheses Testing

First, a positive correlation was expected to emerge between relationship stress and physical health symptoms, but contrary to hypothesis 1, relationship stress was not associated with physical health symptoms,  $r(107) = .07, p = .46$ . Consistent with hypothesis 2, neuroticism was positively correlated with physical health symptoms,  $r(108) = .30, p = .002$ , and psychological distress,  $r(107) = .48, p < .001$ . However, contrary to hypothesis 2, neuroticism was not significantly positively correlated with cortisol  $r(101) = -.10, p = .32$  (see Table 3). These results suggest that higher levels of neuroticism (i.e., high anxiety and emotional instability) are related to more physical health symptoms and psychological distress.

Next, a negative correlation was expected to emerge such that higher PRE will be related to lower psychological distress and less physical health symptoms. In contrast, positive relations were expected to emerge between PRE and relationship satisfaction and commitment. Consistent with hypothesis 3, PRE was significantly negatively correlated with psychological distress  $r(106) = -.44, p < .001$ . Contrary to hypothesis 3, PRE was not significantly associated with physical health symptoms,  $r(107) = .10, p = .32$  (see Table 3). Consistent with hypothesis 4, PRE was positively correlated with satisfaction  $r(108) = .69, p < .001$  and positively correlated with commitment,  $r(107) = .35, p < .001$ . These results indicate that the more the participant perceives that her significant other values the relationship, the less psychological stress and the more satisfaction and commitment she has towards the relationship.

Next, moderated mediation predictions were tested using the statistical program PROCESS. PROCESS is a program developed by Hayes (2013) for the simultaneous examination of more complicated regression models (e.g., conditional process models) that include both moderators and mediators within a single analysis. One advantage of using PROCESS is its ability to use re-sampling strategies (i.e., bootstrapping) for estimating bias-corrected confidence intervals and testing hypotheses about indirect effects. Such an approach does not require a priori assumptions about the shape of sampling distributions (i.e., normal distributions; Preacher et al., 2007). PROCESS also allows for the inclusion of multiple covariates within a single model. As such, PROCESS is well-suited for testing the hypothesized moderated mediation model within a single step. However, one limitation is that only one criterion can be examined within a given model. As a result, separate models were computed for each of the criterion variables (i.e., psychological distress, physical health symptoms, satisfaction, and commitment). PROCESS was set to use 10,000 bootstrap re-samplings per each model in order to compute the bias corrected confidence intervals used to test each of the predicted relations.

It was further predicted that the relations between PRE and criterion measures would be mediated by cortisol levels such that, after controlling for cortisol, a previously significant relation between PRE and each of the criterion measures should no longer be significant. Given that the correlational analyses failed to indicate significant relationships between cortisol and the PRE or any of the other measures (see Table 2), hypothesis 5 failed to receive support and cortisol was dropped from all subsequent

analyses. The result of dropping cortisol resulted in testing a simplified *post hoc* moderation model with neuroticism moderating the relation between PRE and each of the criterion measures (i.e., physical health symptoms, satisfaction, commitment, and psychological distress; see Table 3). Neuroticism was negatively linked with PRE,  $r(108) = -.39, p < .001$  and satisfaction,  $r(109) = -.26, p = .007$  and significantly positively linked to relationship stress,  $r(108) = .39, p < .001$ . This indicates the participants who endorsed more neuroticism perceived more negativity from their significant other about the relationship and experienced less satisfaction and more relationship stress.

For relationship satisfaction, results of the moderated regression analyses indicate that the overall model was significant,  $R^2 = .48, F(3, 104) = 32.03, p < .001$ , with PRE as a significant predictor,  $\beta = 1.15, t(108) = 8.23, p < .001, 95\% \text{ CI } [0.87, 1.43]$ . However, neuroticism did not moderate the relation between PRE and satisfaction (see Table 4 for all regression results),  $\Delta R^2 = .001, \beta = 0.90, t(108) = 0.46, p = .65, [-0.30, 0.48]$  (see Figure 1).

For the second model, using commitment as the dependent variable, the overall model was significant,  $R^2 = .24, F(3, 103) = 10.67, p < .001$ , with neuroticism ( $\beta = -0.14, t(107) = -3.80, p < .001, [-0.21, -.07]$ ) and PRE ( $\beta = 0.88, t(107) = 4.69, p < .001, [0.51, 1.25]$ ) as predictors. However, neuroticism did not moderate the relation between PRE and commitment,  $\Delta R^2 = .004, \beta = .09, t(107) = 0.72, p = .48, [-0.33, 0.71]$  (see Figure 2).

Third, using psychological distress as the outcome variable, the overall model was significant,  $R^2 = .32, F(3, 102) = 15.69, p < .001$ , with neuroticism ( $\beta = 0.24, t(106) =$



4.29,  $p < .001$ , CI [0.13, 0.35]) and PRE ( $\beta = 0.91$ ,  $t(106) = 3.17$ ,  $p = .002$ , [0.34, 1.48]) as predictors. However, neuroticism did not moderate the relation between PRE and psychological distress,  $\Delta R^2 = .001$ ,  $\beta = -.15$ ,  $t(106) = -0.36$ ,  $p = .72$ , [-0.94, 0.65] (see Figure 3).

Last, moderator analyses were conducted to determine if neuroticism significantly moderated the relation between PRE and physical health symptoms. The overall model was significant,  $R^2 = .14$ ,  $F(3, 102) = 5.75$ ,  $p = .001$ , with neuroticism acting as a predictor,  $\beta = 0.16$ ,  $t(107) = 3.45$ ,  $p < .001$ , [0.07, 0.25]. However, neuroticism did not moderate this relationship,  $\Delta R^2 = .03$ ,  $\beta = -.62$ ,  $t(107) = -1.86$ ,  $p = .07$  [-1.28, 0.04] (see Figure 4).

## CHAPTER 4

### DISCUSSION

The current research was conducted to examine how Perceived Relational Evaluation (PRE; i.e., how one thinks another person feels about their relationship in terms of closeness, importance, and value; Leary, 2001) relates to relationship stress, neuroticism, psychological distress, physical health symptoms, and relationship satisfaction and commitment. Specifically, the current research examined the interrelations among PRE, cortisol (biological stress), relationship satisfaction and commitment, and physical and psychological health within a moderated mediation model utilizing undergraduate female college students in dating relationships.

Correlational analyses indicated that, as predicted, PRE was significantly negatively correlated with relationship stress, neuroticism, and psychological distress and significantly positively correlated with relationship satisfaction and commitment. Female participants who perceived that their partner valued their relationship and believed it to be close-knit, were more satisfied with and committed to their relationship. This is consistent with Investment Model (Rusbult, 1983) research that predicts relationship satisfaction is related to relationship commitment. It is also consistent with research by Murray et al. (2000) which states that dating and married couples report greater happiness (i.e., satisfaction) the more positively regarded (i.e., high PRE) they feel. High levels of relationship stress, neuroticism, and psychological distress were also associated with low levels of PRE. The results indicating that higher levels of neuroticism were related to lower levels of PRE is consistent with previous research which tends to state that

neuroticism is associated with rejection sensitivity and the higher likelihood of perceiving stimuli as negative (Finn et al., 2013). In addition, given previous research that indicates rejection has deleterious effects on emotions, physiology, and behavior (Eisenberger et al., 2003; Leary, 2001; Zadro, 2011), it is not surprising that low PRE was associated with more psychological distress and relationship stress. However, PRE was not significantly associated with physical health symptoms.

Also contrary to expectations, cortisol was not related to either PRE or any of the criterion variables in the current research. There are a few possible reasons for this. First, measures of emotional responses and physiological measures often are uncorrelated or, at best, weakly correlated. This discrepancy has been observed between self-report measures of stress and HPA reactivity (Dickerson & Kemeny, 2004). Second, it is possible that participants were not chronically stressed enough to show higher HPA-axis activation. For example, participants may not have been anxious, worried, or stressed about their relationships given that they were still involved in the relationship. This notion is corroborated by looking at the negative skewness in the PRE, relationship stress and commitment, and satisfaction measures. It seems as though most participants were generally satisfied, committed, and not stressed about their relationships. However, as the Investment Model (Rusbult, 1983) explains, an individual may be dissatisfied with a relationship yet remain committed to it and stay involved in it. This explains how even though a participant may not be satisfied they still could be committed and persist in the relationship. Perhaps the current study measured relationship variables at an inopportune time, that is, not at a stressful point. Attempting to study relationships that are “on the

rocks,” tense, or unregulated (couples who engage in more conflict and whining, are more defensive, more stubborn, more angry, more withdrawn as listeners, less affectionate, less interested in their partners, and who are less joyful) as Gottman and Levenson (1992) describe is challenging because researchers must endeavor to study the partners and the relationship at optimal times (i.e., when they are having difficulties). It might also be possible that those in more stressful relationships are less likely to want to participate in research that asks questions about their relationship (i.e., selection bias). Thus, the current research may not have obtained participants who were stressed about their relationships and thus cortisol production was not activated and consequently not associated with relevant covariates. In addition, the current research did not ask participants about a specific stressful event.

Because cortisol could not be tested as a mediator, the focus of subsequent analyses were limited to investigating neuroticism's role as moderating the relationship between PRE and the criterion variables. In the model with satisfaction as the dependent variable, the overall model was significant and PRE accounted for a significant amount of variance (i.e., it was a significant predictor). With commitment, the model was significant and neuroticism and PRE accounted for a significant proportion of the variance. In the model with psychological distress as the outcome variable, the overall model was significant, with PRE and neuroticism, again, accounting for a significant amount of the variance. Last, with physical health symptoms, the model was significant with neuroticism as a significant predictor. However, neuroticism did not moderate the relationship between PRE and any of the criterion variables at the  $p < .05$  level. But, there

was a trend towards significance in the regression testing the interaction between PRE and neuroticism's effects on physical health symptoms. These results provide some evidence that, coupled with low PRE, neuroticism could have a negative effect on physical health symptoms (i.e., increase them). Past research indicates that higher levels of neuroticism predict having a more severe physical condition later in life (Charles, Gatz, Kato, & Pedersen, 2008).

### Limitations

One reason for the lack of significant findings may be due to the overall small effect sizes in the current research. Based on a review of the existing literature, as described earlier, moderate (or medium) effect sizes were expected to emerge across all relevant paths within the model. However, one medium effect size and two small effect sizes emerged in the current research's model. In pathway  $a_1$  (between cortisol and PRE), there was a small effect size ( $r^2 = .01$ ). In pathway  $a_3$  (between PRE and neuroticism), there was a medium effect size ( $r^2 = .15$ ). In pathway  $b_1$  (between cortisol and the criterion variables), the effect sizes were very, very small (ranging from  $r^2 = .0009$  to  $.0049$ ). According to Chu (2012), using use small or very, very small effect sizes, one would need a sample size of 500 to achieve adequate power. Therefore, the current study was well underpowered given there were only 109 participants. Subsequently, if the research were to be replicated, obtaining a larger sample size would increase power to detect effects, if, in fact, such effects exist in the population.

In addition to the number of participants, the nature of participants is also a limitation. Because the study only used female participants, who were predominantly

Caucasian and heterosexual, results are not suitably generalizable to other populations. Further, the study was limited to participants who were relatively young and college students. Different results may be expected in older adults and in those who are not of Caucasian descent. Race-based and status-based rejection sensitivity has been studied in African American college students. Students high in race-based rejection sensitivity experienced greater discomfort during the college transition, decreased trust in the university, and relative declines in grades over a two to three year period (Mendoza-Denton, Downey, Purdie, Davis, & Pietrzak, 2002). However, no studies, to this writer's knowledge, have examined rejection in interpersonal relationships among African-American college students.

Related to the sample being relatively young, personality traits, like neuroticism, tend not to be crystallized until individuals are around 25 years old. "The greatest changes in core personality occur in childhood and from adolescence to early adulthood...after 25...character is set in plaster." (Goleman, 1987, p. 1). Because most of the sample was younger than 25 years old, it is possible that their personalities were not yet crystallized resulting in relatively low variability (i.e., range restriction) on the neuroticism scale. As evidence of this, the average neuroticism score was 3.06 with a standard deviation of 0.66. This is a limitation because low variability has the potential to reduce correlations. Variability is important to detect covariability, as low variability can decrease power to detect an effect. Given that neuroticism was an important variable in the model, range restriction could have contributed to the lack of significant findings.

Additionally, the study's cross-sectional design, where all measures were given at one time is also a limitation. Because of this, the current research was unable to detect a change in the focal construct levels, especially PRE, thus making it impossible to assess changes in cortisol over longer periods of time. Also, the study did not assess the discrepancy between desired and obtained levels of PRE, similar to the Investment Model's (Rusbult, 1983) generalized expectations or comparison level. Large discrepancies may be more impactful on participants in regards to levels of the criterion variables, especially satisfaction, because expectations about the relationship are not being met. In addition, the current research did not control for stress not related to relationship stress. Therefore, outcomes were based on stress from PRE only, meaning that other types of stress could have possibly confounded the results. Solutions to these potential limitations are discussed below.

#### Directions for Future Research

Future researchers in this area may want to better differentiate among different types of stressors. This would allow for confounding types of stress (e.g., academic or familial stress) to be controlled for. In other words, controlling for other types of stress, besides relationship stress, ensures that the focal stressor (PRE) is the only one having an effect on the criterion variables. This could be done effectively by including more comprehensive stress questionnaires that assess for academic, familial, and/or other types of stress.

Besides distinguishing between different sources of stress, there are additional considerations for future research. Leary (2001) discusses rejection related experiences as

falling on a continuum where there are different degrees of rejection and acceptance based on different forms of behavior, such as active or passive rejection-related behaviors. Leary (2001) proposes a “seven layer index of inclusionary status” ranging from maximal inclusion to maximal exclusion (p. 5). This index reflects differences in the degree to which people actively or deliberately seek out or reject an individual. For example, the index characterizes rejection as “passive” when we ignore other people but do not physically avoid or reject them, “active” when we avoid them (but tolerate their presence when necessary), or “maximal” when we eject them from social situations (Leary, 2001).

Because low PRE can be thought of as a type of rejection, one could assume that it would fall on the continuum as well. But, because PRE concentrates on the participants' perception of how their significant other feels about the relationship, placing PRE on the continuum is challenging as it is unlike other types of rejection. For example, it is different from not getting passed the ball or being ejected from a social situation (active and maximal rejection, respectively) because those experiences are caused by specific rejection behaviors that are easily detectable and measurable. PRE is a perception about what another person thinks without necessarily citing behavioral evidence behind the perception. In order to begin to think about where it would fall on the continuum, one would have to gather more information as to why participants indicated that they feel their partner does not value the relationship. In other words, one would need to obtain information specifically pertaining to the type of exclusion that is happening (i.e., specific behaviors) to determine if PRE is active, passive, or maximal so that researchers



would be able to better understand the mechanisms behind PRE and what specific behaviors, on the part of the significant other, contributed to the participants' specific perceptions. For example, it is possible that the significant other has been passively rejecting the participant after an argument by ignoring her and not initiating conversation. This, in turn, caused the participant to endorse low levels of PRE because she perceives that her partner thinks less of her and does not value the relationship as close-knit. Researchers would not know the reason behind the endorsement of low PRE by the participant unless they inquired about specific behaviors exhibited by the participant's significant other in the days, weeks, or even months preceding the study (i.e., the argument and the subsequent ignoring).

In addition to determining if any behaviors (whether a single impactful event or many smaller instances) exhibited by the significant other contributed to the participants' perceptions of low PRE, it would be helpful to also ascertain if participants perceive of their relationship issues as something about themselves or if it is truly only a function of their perception of how their significant other thinks. For example, one of the statements on the PRE scale is "my significant other finds me unattractive." Even though the significant other could have or has made it obvious to the participant that she is attractive (e.g., by being in the relationship in the first place), the participant may not believe this about herself, thus attributing the rejection, in part, on her own feelings of unattractiveness. If the participant sees herself as a major reason that her significant other does not value the relationship or think it is a close relationship, the rejection has the potential to be more impactful (i.e., hurtful) because the negative attribution is internal and not wholly

concentrated on her perception of what the significant other is thinking. As evidence of this, rejection by an in-group member, usually defined as a social group to which a person psychologically identifies with, is unlikely to be interpreted at a group level and is more likely to generate a person-level attribution (e.g., self-blame; Mendes, McCoy, Major & Blascovich, 2008). Applied to the current research, this suggests that rejection from a significant other as opposed to rejection from a stranger is more likely to cause the person to blame themselves for the rejection rather than place the blame on the significant other.

Additionally, specific personality characteristics may increase the likelihood of such personal attributions. Depression and low self-esteem place people at risk for dysphoria and self-devaluation following interpersonal rejection (Nezlek, Kowalski, Leary, Blevins, & Holgate, 1997). As such, it may prove useful in future research to add in a measure of self-esteem to determine if those who perceive low PRE could also have low self-esteem. For example, in a study by Swann, Hixon, and De La Ronde (1992), participants with positive self-esteem were more committed to their relationships if their spouses thought well of them, but participants with negative self-esteem were more committed if their spouses thought poorly of them. The authors explain that when people with negative self-views first receive favorable evaluations, they are infatuated with them. But, after they have time to compare these evaluations with their self-concept that a preference for self-verifying evaluations (i.e., evaluations that match how they think about themselves) emerges. Similarly, immediately after receiving unfavorable feedback,

people with low self-esteem report being distressed by it, yet shortly after they go on to seek additional unfavorable feedback (Swann et al., 1992).

In the current study, participants may perceive their partner is thinking negatively about the relationship but really their perception may be a function of their low self-esteem (i.e., thinking negatively about a certain aspect of themselves), which may superimpose their perception about how they think their significant other feels about the relationship or they may seek out unfavorable feedback. In other words, “behaving like naïve realists, dating and married individuals used their own self-images as templates in constructing impressions of their partners’ perceptions of them.” (Murray et al., 2000, p. 494). Measuring PRE without a measure of self-esteem, self-blame, or expectations about the relationship may not be portraying an accurate picture of the effect PRE may have on the criterion variables. Future research could address this by asking participants about self-esteem as a way to better understand how it factors into perceptions of rejection.

In addition, future research would also benefit from including a longitudinal design component to combat the limitations of a cross-sectional design and to determine whether changes in cortisol and PRE over time correspond to changes in stress, satisfaction, neuroticism, commitment, physical health symptoms, and psychological distress. Longitudinal research could provide additional evidence for the causal nature of the proposed relations and the opportunity to test for alternative theoretical models. For example, besides examining neuroticism, it may be useful to analyze whether other personality variables are related to cortisol and PRE. Perhaps individuals who are high in Agreeableness, (i.e., kind, sympathetic, cooperative, warm, and considerate) may report

higher levels of PRE and less cortisol reactivity because they are less stressed out about the relationship given that they generally have an optimistic view of human nature and get along well with others (John & Srivastava, 1999). A longitudinal design would allow for the assessment of changes over time.

Given that the current research only gathered information from primarily Caucasian females in heterosexual dating relationships, future research may also want to expand the target population to include the significant others of the participants, whether that be men or women, and participants of diverse races and ages. This would make conclusions about the research more generalizable to other populations. Further, attaining the partner's perspective on the relationship would allow for comparison of discrepancies between each partner's perceptions of the relationship. This would allow for examination of how differently (or similarly) each significant other thinks about the relationship and how this affects the criterion variables. This could also induce stress which could then be measured. Not only should future research examine the discrepancy (or lack thereof) between the significant others' perceptions of the closeness and value of the relationship (i.e., PRE), but it should also focus on the extent of the discrepancy between participants' desired and obtained PRE scores, as stated earlier. A larger discrepancy may be more impactful, and likely more hurtful for the participant because expectations of the relationship are not being met, which future research could also discern.

#### Strengths and Concluding Remarks

Despite a number of limitations of the current research, a strength of the current research is that PRE was assessed for its potential influence on physical and

psychological health correlates which adds to limited research in the area. In addition, the current study also obtained biological and self-report indicators of stress for a comprehensive evaluation of how stress affects physical and mental health. Overall, this study extends limited research on PRE as it relates to psychological health, physical health symptoms, and relationship quality. Although the current research did not find that cortisol and neuroticism acted as a mediator and moderator, respectively, the current research could facilitate future research to find evidence of cortisol acting as an internal biological monitoring system that is sensitive to interpersonal problems. As other research has done, namely research by Gottman and Levenson (1992), this could involve inducing relationship stress and then measuring cortisol levels.

The current research aided in the development of a scale that measures PRE in dating couples. More measures of specific variables in interpersonal relationships are needed because relationships are important for physical and mental health and occupy a large portion of human life. Specifically, it is important to study dating relationships as these relationships may end up in marriage. Studying dating couples could give insights into which couples are satisfied, committed, and mentally and physically and healthy before marriage. If researchers know what satisfied, committed, healthy couples look like, this may help us determine why certain married couples get divorced. Additionally, given that personality and stress trend toward impacting physical health symptoms, interventions addressing stress levels in relationships may prove helpful in keeping relationships healthy and inform clinicians who see couples in therapy. Thus not only researching happy couples, but also unhappy couples with high stress levels, low PRE,

low satisfaction, and low commitment may help reduce the divorce rate by helping to identify precursors to divorce.

Overall, the current study adds to previous research that has shown how feeling negatively regarded (and rejected) by a significant other has implications for relationship satisfaction and commitment. If an individual does not feel positively regarded by her partner or thinks that her partner does not value her or the relationship or think the relationship is close, this has consequences for her satisfaction and commitment towards the relationship. In other words, women's perceptions about what a significant other is thinking is important for her own feelings towards the relationship.

In addition, the current study adds to research on the negative relationship between PRE and neuroticism. Neuroticism is associated with heightened social pain sensitivity. More specifically, neuroticism correlates with interpersonal sensitivity which is the propensity to respond with undue sensitivity to the social behavior of others or the perceived or actual negative appraisal by others (Eisenberger & Lieberman, 2005). Although the current research did not measure interpersonal sensitivity, per se, it did measure PRE which could be a measure of interpersonal sensitivity in a romantic relationship. Studying neuroticism and PRE brings us closer to understanding how personality influences our perceptions.

Last, the current study found a negative correlation between PRE and psychological distress meaning the less one felt that their partner valued them the more distress one felt psychologically. Given that rejection has been found to be associated with negative emotions and behavior as well as psychological problems, it is not

surprising that rejection by a significant other with whom one is in a relationship negatively affects one's mental health. This demonstrates the importance of continued research on rejection (perceived and actual) and its impact on the human psyche.

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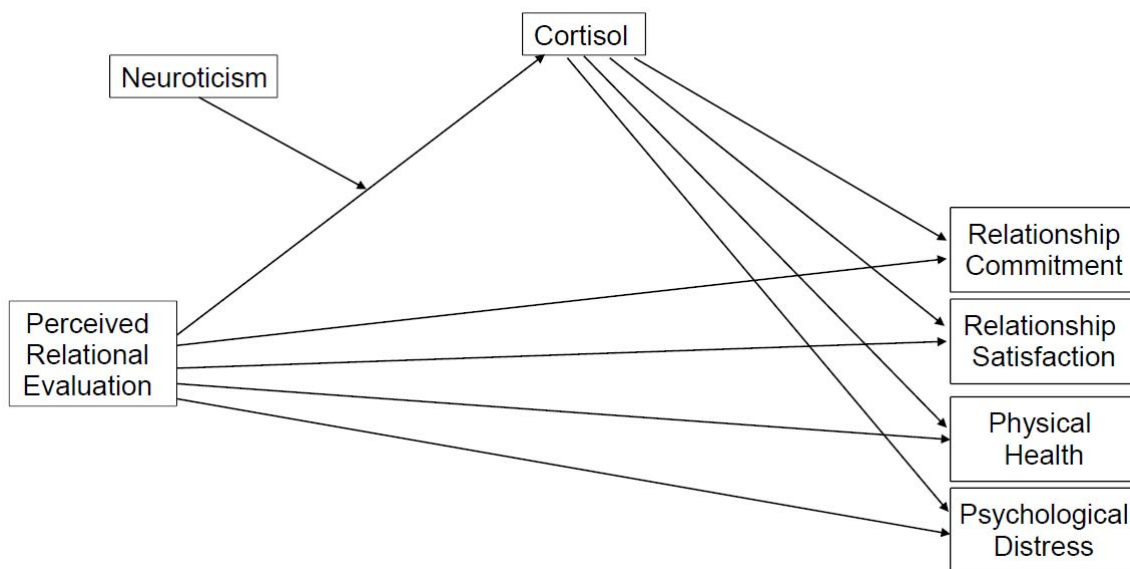
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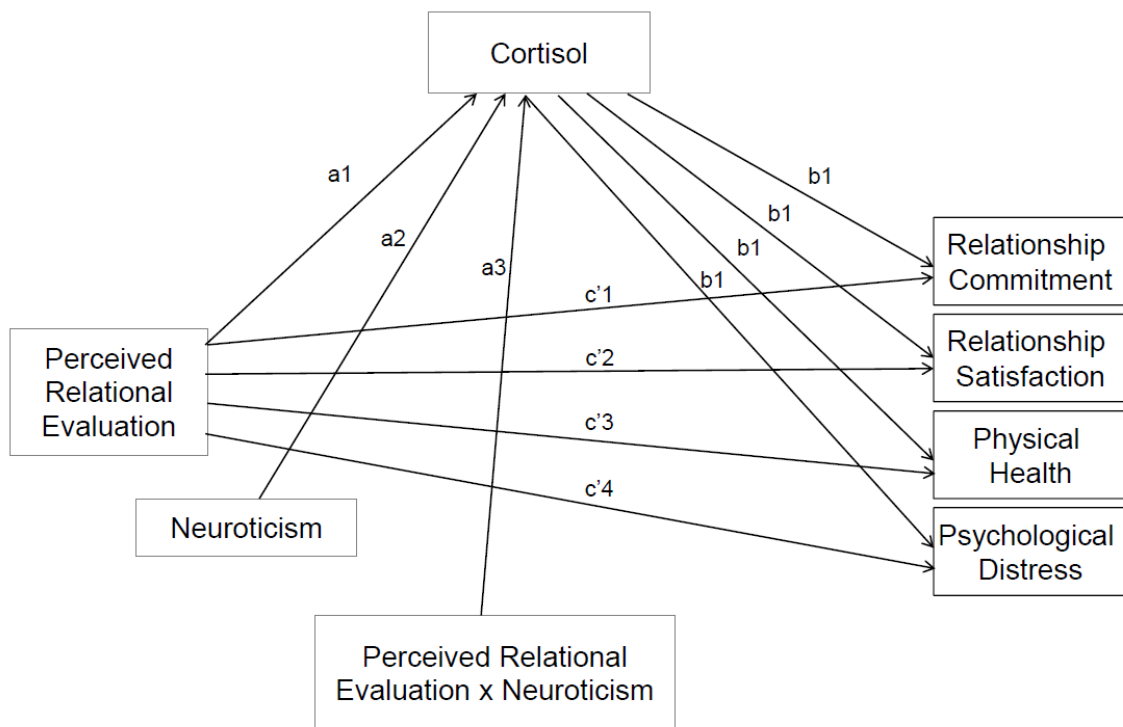


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*Figure 1.* The proposed moderated mediation between PRE, neuroticism, cortisol, satisfaction, commitment, physical health symptoms, and psychological distress with cortisol and neuroticism acting as a mediator and moderator, respectively.



*Figure 2.* The proposed moderated mediation model diagramming the statistical pathways between PRE, cortisol, neuroticism, and the criterion variables.

Table 1

*Participant Characteristics*

Variable	Total (N)	Percentage (%)
<b>Race</b>		
Caucasian/White	98	89.9
African American/Black	3	2.8
Latino/Latina/Hispanic	3	2.8
Asian/Pacific Islander	4	3.7
Other	1	0.9
Missing	0	0.0
<b>Age</b>		
18	59	55.7
19	36	34.0
20	5	4.7
21	3	2.8
22	3	2.8
Missing	2	0.9
<b>Relationship Status</b>		
Dating	107	98.2
Engaged	3	2.8
Married	0	0.0
Cohabiting	2	1.8
Missing	0	0.0
<b>Sexual Orientation</b>		
Heterosexual	100	92.6
Bisexual	5	4.6
Homosexual	3	2.8
Missing	1	0.5

Table 2

*Correlations between Cortisol and Related Covariates*

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Average Cortisol <sup>+</sup>	1	-.47**	-.03	-.18 <sup>++</sup>	.07	-.02	-.06 <sup>++</sup>	.21	-.08	.02	.05	-.06
2. Wake-up time		1	.01	-.16	-.02	.10	-.06	-.05	-.00	.06	.00	.10
3. Days Since Period			1	.14	-.14	.04	.02	-.01	.03	-.17	.01	.00
4. Alcohol				1	.11	-.11	-.11	.10	.09	.00	.08	.00
5. Birth Control					1	-.17	.07	.21*	.05	.16	-.20*	-.18
6. Smoking						1	.02	-.08	.12	-.06	.06	.13
7. Coffee							1	.13	-.04	-.14	-.01	.04
8. Medication								1	.10	.20*	.05	-.14
9. Physical Activity									1	-.12	-.01	-.11
10. Vaccinations										1	-.13	.03
11. Chronic Disease											1	-.09
12. Length of Rel.												1
Mean	-.61	252.59	19.61	1.61	1.39	1.98	1.56	1.75	78.60	1.86	1.18	15.17
SD	.23	128.51	18.51	.49	.49	.14	.50	.44	54.93	.35	.46	14.0

*Note.* Means and standard deviations for each variable are listed in the last two rows. <sup>+</sup> indicates partial correlations controlling for Wake-up time.

<sup>++</sup> indicates a point by serial correlation was used for these variables. Wake-up time = Time elapsed (in minutes) since participant awoke and when they took the demographics questionnaire. Length of Rel. = Duration of Relationship.

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

Table 3

*Correlations between Predictor and Outcome Variables*

Variable	1	2	3	4	5	6	7	8
1. PRE <sup>+</sup>	1	-.39**	.10	.69**	.35**	.10	.44**	.50**
2. Neuroticism		1	-.10	.26**	-.19*	.30**	.48**	.39**
3. Average Cortisol			1	.07	.07	-.03	-.04	-.16
4. Satisfaction <sup>+</sup>				1	.54**	.05	.33**	.54**
5. Commitment <sup>+</sup>					1	-.11	.06	.26**
6. Physical Health Symptoms						1	.50**	.07
7. Psychological Distress (GSI)							1	.43**
8. Relationship Stress (BSRS)								1
Mean	0.18	0.28	0.41	0.13	3.06	1.48	-0.41	-.61
SD	0.13	0.23	0.25	0.12	0.66	0.30	0.40	.23

Note. Means and standard deviations for each variable are listed in the last two rows. <sup>+</sup> designates that the variable was reflected and log transformed, meaning low scores indicate higher levels of the construct and high scores indicate lower levels of the construct. PRE = Perceived Relational Evaluation; BSRS = Bergen Social Relationship Scale; GSI = Global Severity Index.

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

Table 4

*Regression Analyses between Perceived Relational Evaluation, Neuroticism, and Outcome Variables*

Model	Beta	SE	<i>t</i>	<i>p</i>	<i>F</i>	<i>R</i>	<i>R</i> <sup>2</sup>	$\Delta R^2$
Physical Health Symptoms								
Neuroticism	.16	.05	3.45	< .001**		.38	.14	
PRE	.06	.24	0.25	.81				
PRE x Neuroticism	-.62	.33	-1.86	.07	3.48			.03
Commitment								
Neuroticism	-.14	.04	-3.80	< .001**		.49	.24	
PRE	.88	.19	4.69	< .001**				
PRE x Neuroticism	.19	.26	0.71	.48	0.51			.004
Psychological Distress								
Neuroticism	.24	.06	4.29	< .001**		.56	.32	
PRE	.91	.29	3.17	.002**				
PRE x Neuroticism	-.15	.40	-0.36	.72	0.13			.001
Satisfaction								
Neuroticism	.01	.03	0.36	.72		.69	.48	
PRE	1.15	.14	8.23	< .001**				
PRE x Neuroticism	.09	.20	0.46	.65	0.21			.001

*Note.* PRE = Perceived Relational Evaluation.

\**p* < .05. \*\**p* < .01



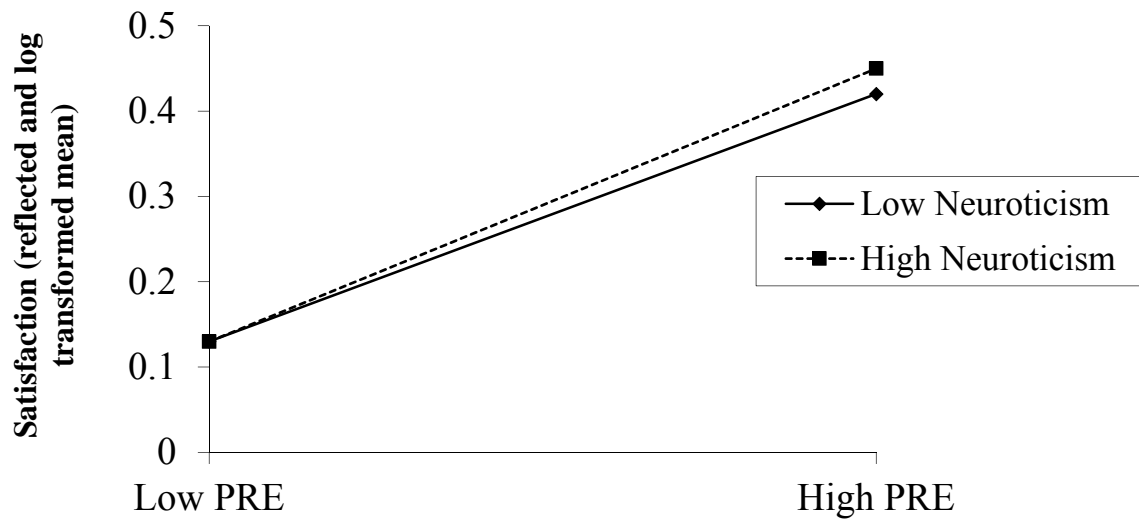
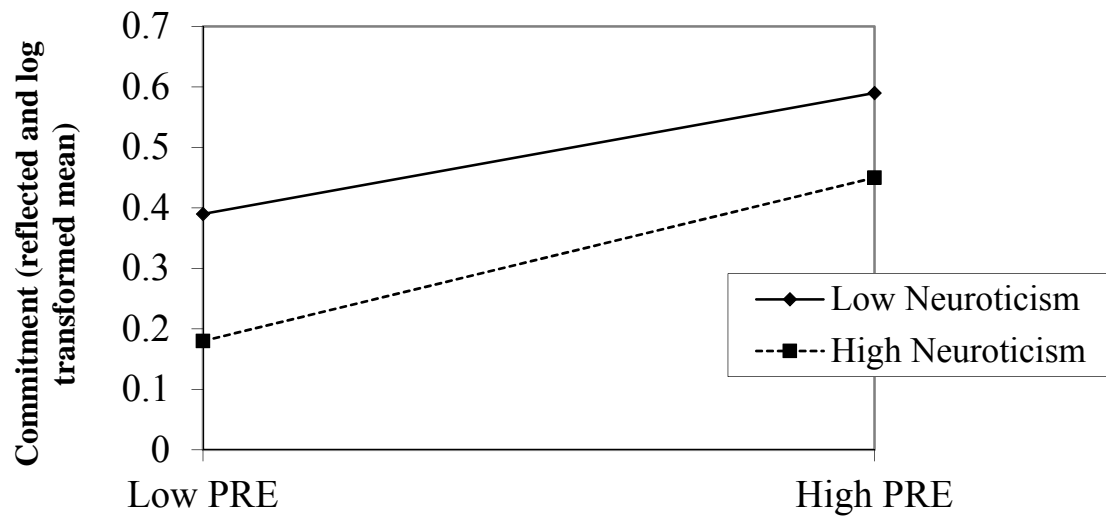


Figure 3. The interaction between PRE, neuroticism, and relationship satisfaction which was not significant,  $\Delta R^2 = .001$ ,  $\beta = 0.90$ ,  $t(108) = 0.46$ ,  $p = .65$ , 95% CI [-0.30, 0.48].



*Figure 4.* The interaction between PRE, neuroticism, and relationship commitment which was not significant,  $\Delta R^2 = .004$ ,  $\beta = .09$ ,  $t(107) = 0.72$ ,  $p = .48$ ,  $[-0.33, 0.71]$ .

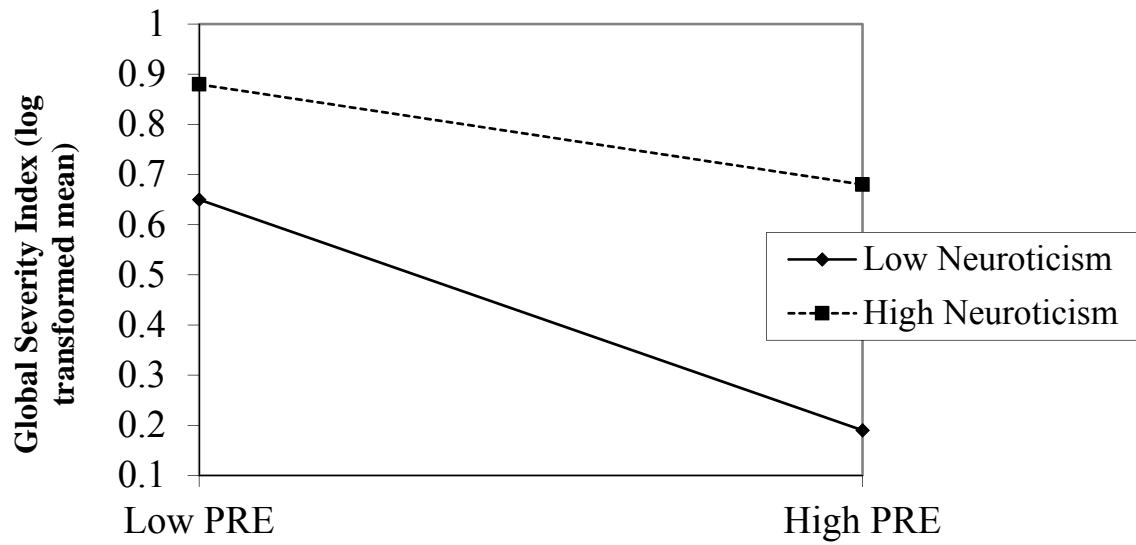


Figure 5. The interaction between PRE, neuroticism, and psychological distress which was not significant  $\Delta R^2 = .001$ ,  $\beta = -.15$ ,  $t(106) = -0.36$ ,  $p = .72$ ,  $[-0.94, 0.65]$ .

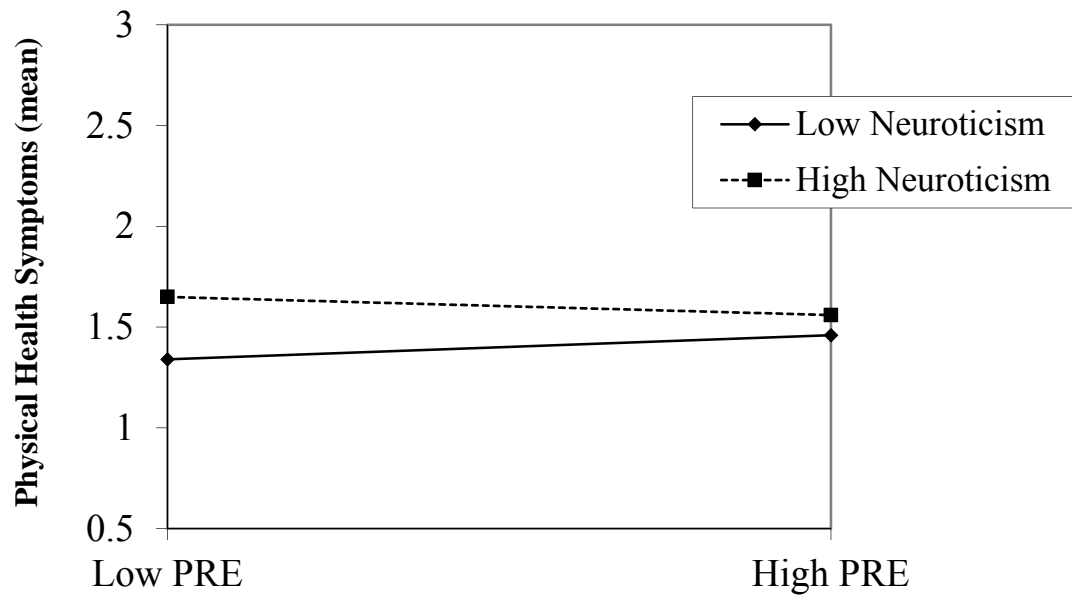


Figure 6. The interaction between PRE, neuroticism, and physical health symptoms which was not significant,  $\Delta R^2 = .03$ ,  $\beta = -.62$ ,  $t(107) = -1.86$ ,  $p = .07$  [-1.28, 0.04].

## APPENDIX A

## DEMOGRAPHICS AND RELATED QUESTIONS

The following short questionnaire several questions related to participant demographics. For most answers, check the boxes most applicable to you or fill in the blanks.

1. What is your age? Example: 21  
(Provide only one response)

2. Ethnic Background?  
(Select only one)  
Asian or Pacific Islander  
African American  
Caucasian (non-Hispanic)  
Hispanic/Latino/Latina  
American Indian

The following questions are important for the proper assessment of participant biological markers as measured via saliva. Please answer each question with as much detailed information as possible.

3. Are you currently on any form on contraceptive?  
(Select only one)  
Yes  
No

4. If you answered "yes" to previous question, please list which type and kind of birth control you are on. Example: Yasmin/pill

5. Sex steroids are prescribed for any number of reasons. However, such steroids can alter the baseline concentrations of various analytes in saliva. Are you currently receiving any form of sex steroids (e.g., testosterone, estrogen, etc.)?  
(Select only one)  
Yes  
No

6. If you answered "Yes" to the sex steroid question above, please list the sex steroids you are currently taking on a regular basis.

7. Do you currently smoke or take other nicotine containing products?  
(Select only one)  
Yes  
No

8. If you smoke cigarettes what brand and style do you smoke?
9. On average, how many cigarettes do you smoke each day?
10. If you use some other form of nicotine containing product, please list brand, type, and average use per day.
11. Do you drink coffee?  
(Select only one)  
Yes  
No
12. On average, how many 12 oz. cups of coffee do you drink each day?  
(Provide only one response)
13. Do you drink alcohol?  
(Select only one)  
Yes  
No
14. On average, how many drinks (e.g., 1 beer = 1 mixed drink: both contain, on average, 1 oz. of alcohol) do you consume in a week?  
(Provide only one response)
15. Are you aware of any family history related to alcohol dependence?  
(Select only one)  
Yes  
No
16. Do you regularly take vitamin supplements?  
(Select only one)  
Yes  
No
17. Please list what vitamins (or other herbal supplements) that you regularly take.
18. Are you currently taking any prescription medication?  
(Select only one)  
Yes  
No
19. Please list any medications you regularly take (on a daily basis).

20. Have you consumed alcohol within the previous 12 hours?

(Select only one)

Yes

No

21. Have you eaten a major meal within the previous 60 minutes?

(Select only one)

Yes

No

22. Have you consumed any dairy products within the past 20 minutes?

(Select only one)

Yes

No

23. Have you consumed any high sugar foods within the past 20 minutes?

(Select only one)

Yes

No

24. Have you consumed and foods high in acidity (e.g., lemons) within the past 20 minutes?

(Select only one)

Yes

No

25. Are you experiencing any oral diseases or problems?

(Select only one)

Yes

No

26. On average, how many minutes of physical activity do you engage in daily (walking, running, weight lifting, sports)?

(Provide only one response)

27. Have you had any vaccinations within the past 60 days?

(Select only one)

No

Yes, please list:

28. Do you have any of the following: Type I diabetes, an endocrine disorder, epilepsy, an autoimmune disorder, an adrenal disorder, or a severe psychiatric disorder (e.g. schizophrenia)?

(Select only one)

No

Yes, please name the disorder:

29. Are you feeling ill today? (ex. Cold and flu symptoms)

(Select only one)

No

Yes

30. What time did you wake up today?

(Provide only one response)

31. When did your last menstrual period begin? Give month and day. (Example: August 21)

(Provide only one response)

32. What is your sexual orientation?

(Select only one)

Homosexual

Heterosexual

Bisexual

33. What is the gender of your significant other?

(Select only one)

Male

Female

34. How would you categorize your status with your significant other?

(You may choose more than one)

Dating

Engaged

Married

Living Together

35. How long have you been in a relationship with your significant other? (in months)

Example: 3 months

(Provide only one response)

36. How old is your significant other? (in years) Example: 21 years



37. Please enter a four digit number you know you will remember (ex. Garage door code, last four digits of your Social Security Number, debit card pin). This number will be used to link your answers to your saliva samples and **WILL NOT BE USED FOR ANY OTHER PURPOSE**. In no way will your name be attached to your saliva samples or your answers on this and following questionnaires.

38. Would you mind if the researchers contacted you in 6-8 weeks to return to the lab for a follow-up session identical to the one you did today? (You would receive an additional 2 credits for participating in the follow-up study)

(Select only one)

No

Yes, here is my e-mail address:

## APPENDIX B

## PERCEIVED RELATIONAL VALUE (PRV)-REVISED

The statements in this questionnaire refer to your beliefs about how your significant other feels about you. We realize that sometimes it is difficult to judge other people's reactions to you, but would appreciate it if you would rate the extent to which you agree with each of the statements.

Very Strongly Disagree (1)    Strongly Disagree (2)    Disagree (3)    Neutral (4)  
 Agree (5)    Strongly Agree (6)    Very Strongly Agree (7)

1. My significant other considers me to be a nice person.
2. My significant other thinks I don't have much to offer.
3. My significant other likes talking to me.
4. My significant other makes me feel unimportant.
5. My significant other values my opinions.
6. My significant other doesn't think much of me.
7. My significant other doesn't like having me around.
8. My significant other thinks that I count.
9. I often disappoint my significant other.
10. My significant other likes me as I am.
11. My significant other generally ignores me.
12. My significant other would miss me if I was not around.
13. My significant other relies on me.
14. My significant other finds me to be attractive.
15. My significant other is happy to know me.
16. My significant other does not value their relationship with me.
17. My significant other respects my skills and talents.
18. My significant other is happy to know me.
19. My significant other does not enjoy my company.
20. My significant other does not consider me to be an important part of their life.
21. My significant other is ashamed of me.
22. My significant other makes me feel worthless.
23. My significant other enjoys spending time with me.
24. My significant other considers me to be important to them.
25. My significant other considers our relationship to be close.

## APPENDIX C

## RUSBULT (1998) RELATIONSHIP SATISFACTION SUBSCALE

Please indicate the degree to which you agree with each of the following statements regarding your current relationship.

1. My partner fulfills my needs for intimacy (sharing personal thoughts, secrets, etc.)

Don't Agree At All      Agree Slightly      Agree Moderately      Agree Completely

2. My partner fulfills my needs for companionship (doing things together, enjoying each other's company, etc.)

Don't Agree At All      Agree Slightly      Agree Moderately      Agree Completely

3. My partner fulfills my sexual needs (holding hands, kissing, etc.)

Don't Agree At All      Agree Slightly      Agree Moderately      Agree Completely

4. My partner fulfills my needs for security (feeling trusting, comfortable in a stable relationship, etc.)

Don't Agree At All      Agree Slightly      Agree Moderately      Agree Completely

5. My partner fulfills my needs for emotional involvement (feeling emotionally attached, feeling good when another feels good, etc.)

Don't Agree At All      Agree Slightly      Agree Moderately      Agree Completely

Rate the following statements using this scale:

1	2	3	4	5	6	7	8	9
Do Not Agree At All				Agree Somewhat			Agree Completely	

1. I feel satisfied with our relationship
2. My relationship is much better than others' relationships.
3. My relationship is close to ideal.
4. Our relationship makes me very happy.
5. Our relationship does a good job of fulfilling my needs for intimacy, companionship, etc.

## APPENDIX D

## RUSBULT (1998) RELATIONSHIP COMMITMENT SUBSCALE

To what extent does each of the following statements describe your feelings regarding your relationship? Please use the following scale to record an answer for each statement listed below.

0	1	2	3	4	5	6	7	8
Do Not Agree At All				Agree Somewhat			Agree Completely	

1. I will do everything I can to make our relationship last for the rest of our lives.
2. I feel completely attached to my partner and our relationship.
3. I often talk to my partner about what things will be like when we are very old.
4. I feel really awful when things are not going well in our relationship.
5. I am completely committed to maintaining our relationship.
6. I frequently imagine life with my partner in the distant future.
7. When I make plans about future events in life, I carefully consider the impact of my decisions on our relationship.
8. I spend a lot of time thinking about the future of our relationship.
9. I feel really terrible when things are not going well for my partner.
10. I want our relationship to last forever.
11. I am oriented toward the long-term future of our relationship (for example, I imagine life with my partner decades from now).
12. My partner is more important to me than anyone else in life – more important than my parents, friends, etc.
13. I intend to do everything humanly possible to make our relationship persist.
14. If our relationship were ever to end, I would feel that my life was destroyed.
15. There is no chance at all that I would ever become romantically involved with another person.

## APPENDIX E

## BERGEN SOCIAL RELATIONSHIPS SCALE-REVISED

Please respond to the following statements about your current significant other.

1	2	3	4
Does not describe me at all	Does not describe me very well	Describes me quite well	Describes me very well

1. When my significant other needs my help, I don't know what to do or how to help him.
2. My significant other often hurts my feelings.
3. When I'm around my significant other, he often irritates me.
4. My significant other makes my life difficult.
5. My significant other expects or has expected more of me than I can manage.

## APPENDIX F

## THE BIG FIVE INVENTORY (BFI)

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement.

1	2	3	4	5
Disagree Strongly	Disagree a Little	Neither Agree nor Disagree	Agree a Little	Agree Strongly

I see Myself as Someone Who...

- |   |   |
|---|---|
| <p>___ 1. Is talkative</p> <p>___ 2. Tends to find fault with others</p> <p>___ 3. Does a thorough job</p> <p>___ 4. Is depressed, blue</p> <p>___ 5. Is original, comes up with new ideas</p> <p>___ 6. Is reserved</p> <p>___ 7. Is helpful and unselfish with others</p> <p>___ 8. Can be somewhat careless</p> <p>___ 9. Is relaxed, handles stress well</p> <p>___ 10. Is curious about many different things</p> <p>___ 11. Is full of energy</p> <p>___ 12. Starts quarrels with others</p> <p>___ 13. Is a reliable worker</p> <p>___ 14. Can be tense</p> <p>___ 15. Is ingenious, a deep thinker</p> <p>___ 16. Generates a lot of enthusiasm</p> <p>___ 17. Has a forgiving nature</p> <p>___ 18. Tends to be disorganized</p> <p>___ 19. Worries a lot</p> <p>___ 20. Has an active imagination</p> | <p>___ 23. Tends to be lazy</p> <p>___ 24. Is emotionally stable, not easily upset</p> <p>___ 25. Is inventive</p> <p>___ 26. Has an assertive personality</p> <p>___ 27. Can be cold and aloof</p> <p>___ 28. Perseveres until the task is finished</p> <p>___ 29. Can be moody</p> <p>___ 30. Values artistic, aesthetic experiences</p> <p>___ 31. Is sometimes shy, inhibited</p> <p>___ 32. Is considerate and kind to almost everyone</p> <p>___ 33. Does things efficiently</p> <p>___ 34. Remains calm in tense situations</p> <p>___ 35. Prefers work that is routine</p> <p>___ 36. Is outgoing, sociable</p> <p>___ 37. Is sometimes rude to others</p> <p>___ 38. Makes plans and follows through with them</p> <p>___ 39. Gets nervous easily</p> <p>___ 40. Likes to reflect, play with ideas</p> <p>___ 41. Has few artistic interests</p> <p>___ 42. Likes to cooperate with other others</p> |
|---|---|

\_\_\_\_ 21. Tends to be quiet  
\_\_\_\_ 22. Is generally trusting

\_\_\_\_ 43. Is easily distracted  
\_\_\_\_ 44. Is sophisticated in art, music,  
or music

## APPENDIX G

## PHYSICAL HEALTH QUESTIONNAIRE-15 (PHQ-15)

During the past 4 weeks, how much have you been bothered by any of the following problems?

Not bothered at all (0)

Bothered a little (1)

Bothered a lot (2)

1. Stomach pain
2. Back pain
3. Pain in your arms, legs, or joints (knees, hips, etc.)
4. Menstrual cramps or other problems with your periods
5. Headaches
6. Chest pain
7. Dizziness
8. Fainting spells
9. Feeling your heart pound or race
10. Shortness of breath
11. Pain or problems during sexual intercourse
12. Constipation, loose bowels, or diarrhea
13. Nausea, gas, or indigestion
14. Feeling tired or having low energy
15. Trouble sleeping



## APPENDIX H

## SYMPTOM CHECKLIST-90-REVISED (SCL-90-R)

The following questionnaire contains a list of problems people sometimes have. Read each one carefully and choose the number that best describes how much that problem has distressed or bothered you during the past seven days.

Not At All (0)    A Little Bit (1)    Moderately (2)    Quite a Bit (3)    Extremely (4)

1. Headaches
2. Nervousness or shakiness inside
3. Repeated unpleasant thoughts that won't leave your mind
4. Faintness or dizziness
5. Loss of sexual interest or pleasure
6. Feeling critical of others
7. The idea that someone else can control your thoughts
8. Feeling others are to blame for most of your troubles
9. Trouble remembering things
10. Worried about sloppiness or carelessness
11. Feeling easily annoyed or irritated
12. Pains in heart of chest
13. Feeling afraid in open spaces or on the street
14. Feeling low in energy or slowed down
15. Thoughts of ending your life
16. Hearing voices that other people do not hear
17. Trembling
18. Feeling that most people cannot be trusted
19. Poor appetite
20. Crying easily
21. Feeling shy or uneasy with the opposite sex
22. Feeling of being trapped or caught
23. Suddenly scared for no reason
24. Temper outbursts that you could not control
25. Feeling afraid to go out of your house alone
26. Blaming yourself for things
27. Pains in lower back
28. Feeling blocked in getting things done
29. Feeling lonely
30. Feeling blue
31. Worrying too much about things
32. Feeling no interest in things
33. Feeling fearful
34. Your feelings being easily hurt

35. Other people being aware of your private thoughts
36. Feeling others do not understand you or are unsympathetic
37. Feeling that people are unfriendly or dislike you
38. Having to do things very slowly to ensure correctness
39. Heart pounding or racing
40. Nausea or upset stomach
41. Feeling inferior to others
42. Soreness of your muscles
43. Feeling that you are watched or talked about by others
44. Trouble falling asleep
45. Having to check and double check what you do
46. Difficulty making decisions
47. Feeling afraid to travel on buses, subways, or trains
48. Trouble getting your breath
49. Hot or cold spells
50. Having to avoid certain things, places, or activities because they frighten you
51. Your mind going blank
52. Numbness or tingling in parts of your body
53. A lump in your throat
54. Feeling hopeless about the future
55. Trouble concentrating
56. Feeling weak in parts of your body
57. Feeling tense or keyed up
58. Heavy feelings in your arms or legs
59. Thoughts of death or dying
60. Overeating
61. Feeling uneasy when people are watching or talking about you
62. Having thoughts that are not your own
63. Having urges to beat, injure, or harm someone
64. Awakening in the early morning
65. Having to repeat the same actions such as touching, counting, or washing
66. Sleep that is restless or disturbed
67. Having urges to break or smash things
68. Having ideas or beliefs that others do not share
69. Feeling very self-conscious with others
70. Feeling uneasy in crowds such as shopping or at a movie
71. Feeling everything is an effort
72. Spells of terror or panic
73. Feeling uncomfortable about eating or drinking in public
74. Getting into frequent arguments
75. Feeling nervous when you are left alone
76. Others not giving you proper credit for your achievements
77. Feeling lonely even when you are with people
78. Feeling so restless you couldn't sit still

79. Feeling of worthlessness
80. The feeling that something bad is going to happen to you
81. Shouting or throwing things
82. Feeling afraid you will faint in public
83. Feeling that people will take advantage of you if you let them
84. Having thoughts about sex that bother you a lot
85. The idea that you should be punished for your sins
86. Thoughts and images of a frightening nature
87. The idea that something serious is wrong with your body
88. Never feeling close to another person
89. Feelings of guilt
90. The idea that something is wrong with your mind