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I Do...Do You? Dependence and Biological Sex Moderate Daters' Cortisol Responses When Accommodating a Partner's Thoughts about Marriage

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Abstract

We examined how daters' levels of relationship dependence interact with men's and women's degree of accommodation during a likelihood of marriage discussion to predict cortisol levels at the conclusion of the discussion. Upon arriving at the laboratory, couple members were separated and asked to graph their perceived likelihood of one day marrying each other. Couples were reunited and instructed to create a joint graph depicting their agreed-upon chance of marriage. For the majority of couples, negotiating their likelihood of marriage required one or both partners to accommodate each other's presumed likelihood of marriage. Multilevel analyses revealed a significant Dependence x Accommodation x Sex interaction. For women who increased their likelihood of marriage, feelings of dependence predicted heightened levels of cortisol relative to baseline; we suggest such a response is indicative of eustress. Among men, those who accommodated by decreasing their likelihood of marriage experienced significantly lower levels of cortisol to the extent they were less dependent on their partners. Discussion focuses on why men and women show different physiological reactions in response to seemingly favorable outcomes from a relationship discussion.

Keywords

accommodation; cortisol; dependence; sex; gender; relationship transitions; marriage; stress; interaction

1. Introduction

Relationship transitions are inherently stressful, as they require couple members to adapt to a newly negotiated relationship status (e.g., casually vs. exclusively dating; Loving et al., 2009b). These transitions are generally accompanied or preceded by some form of discussion in which the couple members clarify the status of their relationship. The import of such conversations is recognized to the point of warranting an initialism, "DTR," or a "define the relationship" talk. Through these conversations, partners negotiate not only their current relationship status, but also the likelihood of the relationship persisting in the future. One might imagine that how much somebody *needs* the relationship might affect how he or

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she reacts to the outcome of such conversations. The purpose of this study was to examine how depending on a relationship and accommodating a partner's thoughts about the future of the romance interact to predict men's and women's cortisol responses when talking about the likelihood of one day getting married.

1.1 Distress Versus Eustress

Negotiating the future status of a relationship is complicated by the fact that couple members oftentimes have competing interests. As Rusbult and Van Lange (2003) succinctly put it, "Situations with conflicting interests involve challenging problems of adaptation" (p. 362). Take, for instance, a situation in which a dating couple discusses the possibility of marriage. One partner may entertain thoughts of matrimony, whereas the other may view the relationship as a temporary arrangement. Discovering such discrepant relationship goals requires couple members to decide whether to pursue their own objectives or accommodate their partner's opposing preferences (e.g., Pruitt & Rubin, 1986; Van Lange et al., 1997). For either partner, transitioning from one's perceived relationship state (e.g., a temporary liaison) to their *partner's* desired relationship state (e.g., greater commitment) may be cause for distress, provided the resolution of the discrepancy is considered both important and undesirable (cf. Loving & Wright, 2012).

However, relationship discussions may also reveal information that both partners find overwhelmingly positive. For instance, an individual may choose to express a preference for greater commitment, only to find that his or her partner secretly harbors the same desire. In such a scenario, both partners possess a positive discrepancy between their current and desired relationship state (Edwards & Cooper, 1988)—a discrepancy that both partners should be pleased to discover and eager to accommodate. However, despite its positive valence, reconciling the discrepancy remains stressful, as couple members must adjust their perceptions, emotions, and behaviors in order to accommodate the redefined relationship (e.g., Aron et al., 1995; Kelley & Thibaut, 1978; Sbarra, 2006).

Such adjustments—regardless of whether they occur in response to a desired or undesired change in the relationship—activates the hypothalamic-pituitary-adrenal (HPA) axis, which produces a generalized stress response that results in the release of cortisol. Hans Selye, who developed the notion of physiological "stress" (Selye, 1975), differentiated between *distress* and *eustress* (or "bad" versus "good" stress, respectively). Within his conceptualization of stress, a negative discrepancy between one's current and desired relationship state may produce distress, whereas a positive discrepancy may result in eustress (Edwards & Cooper, 1988).

The bulk of research on health and stress has focused on distress (Loving & Wright, 2012; Nelson & Cooper, 2005), but eustress has received increasing attention in recent years, particularly among those studying early-stage passionate love. The process of falling passionately in love triggers a wide range of physiological responses, including elevated levels of circulating cortisol (Marazziti & Canale, 2004), heightened levels of the neurotrophin nerve growth factor (Emanuele, 2011; Emanuele et al., 2005), and activation of the anteromedial caudate and ventral tegmental regions of the brain, which are typically associated with the reward-motivation system (Aron et al., 2005; Fisher et al., 2005). Indeed, merely reflecting on one's partner and relationship produces heightened levels of cortisol in women who are passionately in love, particularly among those with a greater tendency to engage in relationship-focused thinking (Loving et al., 2009a). These findings suggest that, although falling passionately in love is an overwhelmingly positive experience (Reich & Zaurtra, 1981), it also extremely physiologically arousing.

Consistent with recent evidence suggesting increases in cortisol may result in positive outcomes (Leuner et al., 2010), Crockett, Wright, and Loving (2012) found that individuals in newly established, less sexually-active relationships experienced greater cortisol reactivity when they reflected on the experience of falling in love with their current partners. Although a low level of sexual frequency may frustrate individuals in new relationships (and thus elevated cortisol levels would indicate distress), it is also possible these individuals' heightened cortisol levels may reflect generalized arousal or a motivation to act on their restrained sexual impulses (i.e., eustress).

Of course, falling passionately in love is not the only event or transition that generates eustress in romantic relationships (Loving & Wright, 2012). In a prior study involving the current data, partners in established dating relationships who had not seriously considered the possibility of marrying one another experienced greater physiological reactivity when asked to discuss the likelihood of eventually marrying (Loving et al., 2009b). Importantly, regardless of the outcome of the discussion, couple members described the experience in largely positive terms. Taken together, these results suggest that the stress associated with relationship transitions may not universally reflect distress, but also eustress. Below, we describe how relationship transitions may affect certain individuals more strongly than others, specifically (a) those who are more dependent on their relationships and (b) women.

1.2 The Potential Moderating Role of Dependence

Although most individuals may find discussing the states of their relationships to be stressful, those who are more dependent on their relationships may be particularly sensitive to such discussions. Talking about the state of one's relationship can be threatening (e.g., individuals risk hurting their partner's feelings, embarrassing themselves, or undermining the relationship; Afifi & Burgoon, 1998). Thus, such conversations are generally avoided or deemed "taboo" (e.g., Afifi & Guerrero, 2000; Baxter & Wilmot, 1985; Knobloch & Carpenter-Theune, 2004). Dependent individuals are particularly vulnerable to the consequences of a conversation gone awry because they rely on their relationships to satisfy emotional needs (e.g., Rusbult & Agnew, 2010). This vulnerability is exaggerated the more dependence is unilateral and the more partners' interests conflict (Rusbult & Van Lange, 2003). Perhaps recognizing that the less dependent partner has more decision-making power (e.g., Tschann et al., 2002; Waller & Hill, 1938), dependent couple members tend to sacrifice their own interests, opting instead to accommodate their partner's desires (Attridge et al., 1995; Drigotas et al., 1999). The immediate outcome of such accommodations may not be desirable, but such behavior allows dependent individuals to protect their broader interest (i.e., the relationship's continuation; cf. La Guardia & Patrick, 2008; Rusbult & Van Lange, 2003).

Not only do dependent partners experience emotional stress when confronting a potential threat to their relationship, but the stress also manifests physiologically. Couple members who are more dependent experience elevated cortisol in response to conflict (Laurent & Powers, 2006; Loving et al., 2004). Relatedly, less dominant partners have elevated blood pressure when expressing conflicting opinions during marital interactions (Brown et al., 1998; Smith & Brown, 1991; see also Gramer & Berner, 2005). As further evidence that non-mutuality of dependence is tied to physiological consequences, a lack of power in one's relationship is associated with physical illness, suppressed immune function, and even death (Hibbard & Pope, 1993; cf. Kiecolt-Glaser et al., 1997; Tanner & Vlassoff, 1998; see Wanic & Kulik, 2011, for an overview).

Importantly, discovering that one's partner possesses similar relationship aspirations may be particularly delightful for dependent individuals, as they may not have felt confident pressing for their own relationship goals. Such a discovery would likely trigger many of the

physiological responses described above; however, given the positive valence of the inciting event, these reactions would best be characterized as eustress rather than distress. Indeed, Simmons and Nelson (2001) argued that merely interpreting a stressful event in a positive light qualifies its associated physiological responses as eustressful. Considered in tandem, these findings suggest that dependent individuals may show heightened physiological arousal in response to marriage discussions, but whether any arousal is characterized as distress or eustress will depend on the desirability of the outcome.

1.3 The Potential Moderating Role of Biological Sex

Individuals' physiological reactions to a marriage discussion may also be moderated by their biological sex. Compared to men, women think about their relationships more often (Acitelli & Young, 1996; Cate et al., 1995), are better able to recall relationship events (Ross & Holmberg, 1993), and are more likely to define themselves in terms of their relationships (Cross et al., 2002). Such tendencies predispose women to be more physiologically reactive to the emotional tenor of their romantic relationships (Kiecolt-Glaser & Newton, 2001). Indeed, although men generally show greater cortisol reactivity to achievement-based laboratory stressors than do women (e.g., Earle et al., 1999), women's reactions to relationship discussions are both more pronounced and persistent than are men's (Kiecolt-Glaser et al., 1996; Loving et al., 2004). Thus, it is possible that women may find discussing the possibility of marriage with their partner to be more stressful than men.

1.4 Hypotheses

Given that more dependent women appear to be particularly vulnerable to the physiological consequences of relationship discussions (Loving et al., 2004), we anticipate that dependence and accommodation will moderate women's stress responses during a marriage discussion. More specifically, we expect that women will experience heightened cortisol to the extent they are more dependent on their partner, particularly when the marriage discussion results in unfavorable outcomes (i.e., when dependent women decrease their perceived chance of marriage as a result of the conversation with their partners). We also anticipate *favorable* outcomes producing elevated cortisol levels (i.e., a eustressful response) among women who are more dependent on their relationships. However, we expect that dependent women will show a less pronounced physiological reaction in response to positive outcomes than negative outcomes resulting from the marriage discussion (cf. Delongis et al., 1982).

Although women often show stronger physiological reactions to relationship discussions (e.g., Kiecolt-Glaser et al., 1996; Loving et al., 2004), it is possible that men will also be affected by the laboratory task. For instance, Loving and colleagues (2009b) found that men and women show comparable cortisol reactions in response to discussing the state of their relationship. Given these mixed findings, we approach the analyses for men in an exploratory fashion.

2. Method

2.1 Participants

Self-report and endocrinological data were collected from 68 individuals (34 couples) over the course of a three-hour laboratory session. Participants were required to be in good mental and physical health (see below), and all couples had to be involved in an exclusive nonmarital relationship of at least one-year duration ($M = 29.96$, $Mdn = 28.20$, $SD = 15.82$, range 12.27–81.93 months). All couples were involved in a heterosexual romantic relationship, with the exception of one couple involved in a same-sex female relationship.¹ The majority of participants described themselves as non-Hispanic White (64.7%), although

a substantial minority of participants self-identified as Asian (22.1%) or Latino or Hispanic (10.3%; 1.5% Native Hawaiian or Other Pacific Islander; 1.5% Other). Participants ranged in age from 18 to 38 years ($M = 22.60$, $SD = 4.02$), and the average age of men and women did not differ, $t(59.01) = -1.27$, $p = .21$.

2.2. Procedure

2.2.1. Overview—Participants were recruited through newspaper or radio advertisements, as well as through flyers posted around a major University campus. Those interested in participating were directed to a secure website, where they obtained additional information about the study and completed an online screening form. Eligible participants were contacted and invited to participate in a three-hour laboratory session. Interested participants were instructed to not eat or drink for at least one hour prior to participation, and all study sessions were conducted between 2 p.m. and 5 p.m. to control for diurnal patterns in cortisol secretion (Kirschbaum & Hellhammer, 1994). At the completion of the study, all couples were debriefed and received US\$50 for their participation.

2.2.2. Screening Questionnaire—Those interested in participating completed an online screening form. Participants were excluded if their partners were not interested in participating or if a couple had been romantically involved for less than a year. The online interview also screened for a variety of factors that influence HPA-axis functioning, such as smoking; working night shifts; taking certain medications; having a history of anxiety, depression, or hormone problems; or being pregnant. Participants who reported one or more of these conditions were not invited to participate in the study. Although cortisol responses are generally affected by the use of hormonal contraceptives (Kirschbaum et al., 1999), couples were not excluded if the female reported taking a multiphasic or daily-dose form of birth control ($n = 16$). Because birth control is commonly used among unmarried women (Mosher et al., 2004), we believed that excluding these women would reduce the generalizability of our findings.

2.2.3. Laboratory Session—Upon arrival and after providing informed consent, couples were separated and each partner independently completed a battery of questionnaires and provided several practice saliva samples. Immediately prior to the individual graphing procedure (described below), participants provided their baseline saliva sample (approximately 30 min after arrival). Next, partners worked independently with a research assistant for 30 minutes to graph their perceived chance of marriage from the day their relationship began to the day of the study session (Loving et al., 2009b; Surra & Gray, 2000; Surra et al., 1999). We adopted a broad definition of marriage, so as to be applicable to all couples. Specifically, marriage was defined as “a relationship in which two individuals have made a public, lifelong commitment to each other,” and the research assistants stressed that such a commitment could “take different forms for different people.” When determining the likelihood of marriage, participants were asked to consider both their own *and* their partner’s feelings regarding the matter. First, participants were asked to indicate the likelihood of marrying their partner at the start of the relationship (0%–100%). Then they were asked to mark the next time they remember their perceived chance of marriage changed and to describe how the two points were connected (e.g., straight line, curvilinearly). With the help of the research assistant, this procedure was repeated until the trajectory of the perceived chance of marriage had been plotted from the start of the relationship to the day of the

¹The lesbian couple was dropped from the primary analysis because indistinguishable dyads (e.g., same-sex couples) require a different analytic strategy than distinguishable dyads (e.g., heterosexual couples; Kenny et al., 2006). However, additional analyses indicated that the inclusion of the lesbian couple did not substantively affect our findings; these results are available upon request.

laboratory visit. Following the completion of the individual graph, participants completed a series of additional measures for another 30 minutes.

Participants were next reunited with their partners and instructed to jointly construct a graph of their perceived chance of marriage. Specifically, participants were told to “create another graph of your relationship, similar to the one you just completed, but this time we’d like ... the two of you to create one graph.” Couples were provided with pencils, graphing paper, and a ruler, and were given 30 minutes to construct their graphs. Partners never had access to each other’s graphs. At the completion of the joint graphing procedure, couple members were again separated to complete additional questionnaires and to provide an additional saliva sample (collected 15 min after the conclusion of the joint graphing procedure).

2.3. Primary Measures

2.3.1. Accommodation—The final percentage marked on the individual and joint graphs reflects participants’ perceived likelihood of marrying their partners the day of the laboratory visit. For the independent graphs, the average chance of marriage was 76.84% ($SD = 22.24$, range 20–100%), with no significant differences between men and women, $t(66) = .87$, $p = .39$. The average chance of marriage was slightly higher for the joint graphs, at 79.24%. ($SD = 19.78$, range 30–100%). For men, the chance of marriage they negotiated with their partners was somewhat higher than the chance of marriage they selected independently, $t(32) = 1.93$, $p = .06$; for women, the difference between their individual chance of marriage and agreed-upon chance of marriage was not significant, $t(34) = -.18$, $p = .86$.

As evidenced by the change in the average likelihood of marriage, many couple members adjusted their perceived chance of marriage once they were in the company of their partners. We consider such adjustments to be a form of accommodation.² Accommodation scores were calculated for each partner by subtracting the individual’s final percent chance of marriage from the couple’s jointly indicated percent chance of marriage (i.e., Joint Graph – Individual Graph). Thus, participants who adjusted their likelihood of marriage downward received negative accommodation scores, whereas those who shifted upward received positive accommodation scores. The average amount of accommodation was 2.40 ($SD = 11.96$, range –22 to 50); men and women accommodated similarly, $t(56.68) = 1.50$, $p = .14$. When the absolute value of the accommodation scores is used (indicating the amount of accommodation that took place regardless of whether participants adjusted their likelihood of marriage upward or downward), the amount of accommodation for the final sample was 7.46 ($SD = 9.61$, range 0 – 50).

2.3.2. Dependence—Participants responded to five items that assessed the extent to which they rely on their partners to provide a variety of socioemotional needs (i.e., dependence; Agnew et al., 2003). Specifically, participants were asked to indicate who—either themselves or their partner—relies more on the relationship to fulfill their (a) intimacy needs, (b) companionship needs, (c) sexual needs, (d) security needs, and (e) needs for emotional involvement. Participants indicated who was more dependent on a scale ranging from 1 (“My partner”) to 7 (“Me”). We averaged the five items together to create a single composite score ($\alpha = .72$, $M = 3.90$, $Mdn = 4.00$, $SD = .81$, range = 1.60–5.80). Within-couples analysis revealed that couple members generally reported differing levels of

²According to Merriam-Webster, “accommodation” is defined as “adaptation, adjustment” or “a reconciliation of differences.” Similarly, Rusbult and colleagues (1991, 1996) defined accommodation as the tendency to respond constructively when one’s partner behaves in a way that may undermine the relationship. If partners discover they disagree about the likelihood of marriage, their relationship may be undermined unless one or both partners compromise or sacrifice their personal preferences. Thus, we use the term “accommodation” to describe shifts in individuals’ percent chance of marriage from the independent to the joint graphing procedure.

dependence ($r_T = -.58, p < .001$), with women being more dependent on their relationships compared to men, $t(66) = 4.38, p < .001$.

2.3.3. Salivary Cortisol—To assess circulating levels of free cortisol, all participants used Salivettes (Sarstedt, Germany) to provide a series of saliva samples. Although participants provided saliva samples at standard intervals (approximately every 15 min) throughout the laboratory visit, their “baseline” saliva sample (taken approximately 35 min into the laboratory session) and their “reactivity” sample (taken near the end of their visit, reflecting their cortisol levels at the completion of the joint graphing activity) are of primary interest to the current study. We chose to use participants’ third saliva sample as our baseline, as it was taken after participants had a chance to acclimate to the laboratory setting (see Diamond & Otter-Henderson, 2007, for a discussion of this point), and was the last sample taken prior to introducing the first stressor (i.e., the individual graphing activity).

Cortisol concentrations, reported in micrograms per deciliter, were determined using Salimetrics_{LLC} expanded range high sensitivity salivary cortisol enzyme immunoassay kit. As directed, we froze all samples at -20°C until assayed. Couple members’ samples were assayed in the same batch, along with high and low control samples provided by Salimetrics_{LLC} to ensure reliability. As is standard practice (e.g., Bower et al., 2005; Diamond et al., 2008; Smyth et al., 1997), cortisol values were subjected to a $\log_{10}$ transformation prior to analyses to normalize their distribution.

2.4. Analytic Strategy

We tested the significance of a number of potential covariates commonly known to affect cortisol levels, including alcohol consumption, cigarette smoking, weight, birth control use, and sleep quality. [Although we asked participants whether or not they smoke during the screening interview, we still asked about this behavior during the laboratory session. A small number of participants ($n = 4$) reported smoking at least one cigarette during the prior 24 hours.] Because individuals who have not previously engaged in much thought or conversation about marrying their partners show greater cortisol reactivity when discussing marriage with their partners (Loving et al., 2009b), we initially included individuals’ experience thinking or talking about marriage as a control variable. With the exception of cigarette smoking, none of these variables even marginally predicted participants’ cortisol levels during the graphing activity; thus, all but recent cigarette use were dropped from the analyses.³

To account for the lack of independence between partners, data were analyzed using a multilevel modeling framework (Bryk & Raudensbush, 1992). Thus, the model consisted of two levels: an individual (Level 1) and between-couple (Level 2) level. The individual level allowed for each partner’s cortisol reactivity to be modeled as a function of dependence, accommodative behaviors, and biological sex—and the interactions between these terms—while accounting for cigarette use and baseline cortisol levels. The equation was as follows:

$$Y_{ij} = \beta_{0i} + \beta_{1i}D_{ij} + \beta_{2i}A_{ij} + \beta_{3i}S_{ij} + \beta_{4i}C_{ij} + \beta_{5i}BC_{ij} + \beta_{8i}(D_{ij} \times A_{ij}) + \beta_{7i}(D_{ij} \times S_{ij}) + \beta_{6i}(A_{ij} \times S_{ij}) + \beta_{9i}(D_{ij} \times A_{ij} \times S_{ij}) + e_{ij}$$

³Because dependence may be related to other relationship factors that may influence how stressful daters’ considered the graphing activity to be, we also tested whether it would be appropriate to control for a variety of other relationship phenomena. To do this, we first identified a list of variables that could potentially overlap with partners’ feelings of dependence. Of these 20 variables, seven were at least marginally associated with dependence (e.g., attachment anxiety, attachment avoidance, neuroticism, and ambivalence). Because the inclusion of these variables did not affect the substantive results of our model, they were excluded from the analysis in order to increase power.

where Y_{ij} represented the cortisol level experienced by partner j in couple i in response to the graphing activity; D_{ij} reflects one's level of dependence; A_{ij} captures one's shift in the perceived chance of marriage; S_{ij} indicates one's biological sex; C_{ij} and BC_{ij} adjust for cigarette use and baseline cortisol levels, respectively; $D_{ij} \times A_{ij}$ is the interaction term for dependence and accommodation; $D_{ij} \times S_{ij}$ captures the interaction between dependence and sex; $A_{ij} \times S_{ij}$ is the interaction term for accommodation and biological sex; $D_{ij} \times A_{ij} \times S_{ij}$ represents the three-way interaction between dependence, accommodation, and sex, and the residual components are represented by e_{ij} . The coefficient β_{0i} is the average level of cortisol reactivity for couple i across men and women when no accommodation took place during the graphing procedure, the respondents reported smoking no cigarettes, and all other variables are at their projected average levels.

At the between-couple level of the analysis, each of the parameters in the Level 1 equation was treated as an outcome variable and determined by its fixed effect. The equation for the intercept also included an error term to capture variation in the intercepts. All analyses were conducted using SAS PROC MIXED, and the random effects were assumed to be uncorrelated with each other.

3. Results

Descriptive statistics and correlations for all study variables can be found in Table 1 (women above the diagonal, men below the diagonal). Not surprisingly, individuals' cortisol levels at baseline and at the completion of the graphing activity were moderately correlated. Otherwise, there was no systematic relationship between the variables of interest.

The primary goal of this study was to examine how men's and women's tendency to accommodate their partner during a marriage discussion interacts with their level of relationship dependence to predict cortisol levels at the conclusion of the marriage discussion. To accomplish this objective, we simultaneously entered the three predictors of interest (dependence, accommodation, and biological sex), two covariates (cigarette smoking and baseline cortisol), and four interaction terms (Dependence $\times$ Accommodation, Dependence $\times$ Sex, Accommodation $\times$ Sex, Dependence $\times$ Accommodation $\times$ Sex) into the model to predict cortisol levels at the end of the graphing activity. Biological sex was effect-coded (women = $-.5$, men = $.5$), which allowed the coefficient to be interpreted as the mean difference in cortisol reactivity across the sexes (Aiken & West, 1991). Baseline cortisol and dependence were grand-mean centered prior to analyses; accommodation, however, was not centered, as this variable had a meaningful zero value (specifically, a value of zero indicated that participants' negotiated chance of marriage and their chance of marriage determined independently of their partners were equivalent, and thus no accommodation took place during the marriage discussion; notably, our decision to leave accommodation uncentered did not affect our results or impact the reliability of our interaction terms).

Although there were no significant main effects or two-way interactions (see Table 2), there was a marginal main effect of dependence (such that more dependent individuals experienced somewhat greater physiological reactivity in response to the graphing procedure compared to those who were less dependent), as well as a marginal main effect of biological sex (controlling for baseline levels, women had somewhat higher cortisol levels in response to the graphing activity compared to men). Importantly, the three-way interaction between dependence, accommodation, and sex was significant. As predicted, men's and women's cortisol reactivity differed as a function of dependence and accommodation during the graphing procedure (see Figure 1).⁴

Most interpretations of three-way interactions focus on interpreting the simple slopes of the variable of interest (X) in relation to the outcome variable (Y) at different levels of the two

moderator variables (W and Z). Generally, three-way interactions are decomposed by first determining if the interaction between X and W is significant at different levels of Z and only interpreting the simple slopes if the overall two-way interaction is significant. However, such an approach overlooks other possible combinations of the moderator variables (as a presence of a three-way interaction indicates the association between X and Y depends not only on Z and W, but also on the interplay between Z and W; Dawson & Richter, 2006; Jaccard & Turrissi, 2003). In order to not overlook any potential associations between our three predictor variables of interest, we present the results for men and women in a single graph (see Figure 1), tested whether the individual simple slopes were significant, and examined whether the simple slopes were significantly different from *each other*. To do this, we followed the procedures outlined by Dawson and Richter (2006).

For women who accommodated by increasing their chance of marriage, their cortisol levels at the conclusion of the marriage discussion increased to the extent they were more dependent on their partner, $p = .01$; this association was reversed (but not significant) for women who accommodated by decreasing their chance of marriage, $p = .22$. Not surprisingly, the slope for women who increased their chance of marriage was significantly different from the slope for women who decreased their chance of marriage, $p = .02$.

Men, on the other hand, showed a different pattern of reactivity. Specifically, men who accommodated by decreasing their chance of marriage experienced lower levels of cortisol to the extent they were less dependent on their partner, $p = .02$. For men who accommodated by increasing their chance of marriage, their dependence was unrelated to their cortisol reactivity, $p = .68$. The difference between these two slopes was not significant, $p = .24$.

Although not directly relevant to our hypotheses, we also tested whether the link between dependence and cortisol reactivity varied significantly for men and women, depending on their accommodative behaviors. By and large, the sexes responded similarly to the graphing procedure, as this association did not significantly differ for men and women who increased their chance of marriage ($p = .15$), men who increased their chance of marriage and women who decreased their chance of marriage ($p = .30$), or men who decreased their chance of marriage and women who increased their chance of marriage ($p = .66$). However, men and women who decreased their chance of marriage showed contrasting endocrinological reactions to the marriage discussion, $p = .04$.

4. Discussion

Using a sample of dating couples, we examined whether daters' levels of relationship dependence interact with men's and women's degree of accommodation during a likelihood of marriage discussion to predict cortisol levels at the conclusion of the discussion. Contrary to expectations, women who accommodated by decreasing their likelihood of marriage did

⁴Given our relatively small sample size, it was important to ensure that the three-way interaction was not driven by a subset of individuals who reported unusually high or low values on our variables of interest. Tests for univariate outliers revealed three cases whose scores fell outside of ± 2.5 *SD* (two high accommodation scores and one low dependence score). We also tested for the presence of multivariate outliers using Mahalanobis distances (Stevens, 1984) and found one case with problematic influence, $D_i = 17.25$, $p = .0006$, based on $\chi^2(3, N = 64)$ at $p < .001$; this individual happened to be the same one who reported the unusually low dependence score. Although the three-way interaction was reduced to near-marginal significance when these cases were excluded from the sample, $\beta = -.01$, $t(41.2) = -1.98$, $p = .05$, we believe this decline in significance is largely a power issue. Indeed, when we substituted the high accommodation scores for a value of $+1$ *SD* above the mean (i.e., 14.84) and the low dependence score for a value of -1 *SD* below the mean (i.e., 3.07), the three-way interaction remained significant, $\beta = -.01$, $t(44.7) = -2.18$, $p = .03$. Further, when we adopted the more standard cutoff of ± 3 *SD* and eliminated the offending cases (one extreme accommodation score and the multivariate outlier), the three-way interaction remained significant, $\beta = -.01$, $t(42) = -2.13$, $p = .04$. Because the results were not substantively changed by their inclusion, and because the extreme scores fell within the range of possible responses (i.e., they were not the result of data entry errors), we chose to include these cases in subsequent analyses order to increase power and the generalizability of our results.

not show elevated cortisol levels to the extent they were more dependent on their partners. Rather, the reverse was true: Women who *increased* their likelihood of marriage experienced heightened levels of cortisol when they felt more dependent on their relationship. With respect to men, those who decreased their chance of marriage experienced less cortisol reactivity in response to the graphing activity at lower levels of dependence; notably, their female counterparts showed an opposing pattern of results. Overall, these results suggest that the physiological effects of “getting what you want” during a relationship discussion manifest differently for men and women and are contingent on levels of dependence.

Although discussing the possibility of marriage is likely stressful (Baxter & Wilmot, 1985), our results provide evidence that some relationship transitions may generate eustress as opposed to distress—at least for dependent women who discover their partners are more committed to their relationships than previously believed. As Loving and Wright (2012) suggest, any desirable change in relationship status may potentially generate a stress response. Learning that one’s partner is invested in the long-term potential of the relationship is likely to be appreciated, especially by those who depend on the relationship to satisfy their emotional needs. Further, women are expected to be more responsive than men to the positive aspects of relationship discussions (Cross & Madson, 1997; Kiecolt-Glaser & Newton, 2001). Indeed, our findings are consistent with prior research indicating that women who are particularly mindful of their romantic relationships experience heightened cortisol reactivity in response to positive relationship transitions (Loving et al., 2009a); such elevated levels of cortisol may function to promote social bonding (Diamond, 2001). More specifically, the activation of the HPA axis may inspire greater social interaction in the face of stressful or novel stimuli, or, alternatively, trigger the release of a variety of neuropeptides linked to the development of social bonds (for a discussion, see Carter & Keverne, 2002). It is also possible that acute stress activates a physiological response that promotes immune functioning (see Dhabhar & McEwen, 1996, 1997, 1999). For instance, Dhabhar and McEwen (1997) found that mice exposed to acute stress redistributed leukocytes from the blood to other organs, which the authors interpreted as an immuno-preparatory response designed to locate and fight off infection. While provocative, such implications are highly speculative and require further exploration in both animal and human models.

We also found that women’s average cortisol levels were somewhat higher than men’s, although this result is qualified by the presence of the hypothesized three-way interaction. This marginal difference in cortisol levels between the sexes comports with prior research indicating that women show stronger physiological reactions in response to relationship discussions (Kiecolt-Glaser & Newton, 2001; Loving et al., 2004) and interpersonal stressors (Stroud et al., 2002) compared to men. As discussed in the introduction, it is possible that women’s greater preoccupation with relationship dynamics (e.g., Cross & Madson, 1997) predisposes them to be more affected by relationship-based stressors than are men.

Unexpectedly, women who made downward accommodations did not show greater cortisol reactivity to the extent they were more dependent on their partners. It is possible these women underestimated the significance of decreasing their chance of marriage—specifically, such accommodations may point to the existence of underlying problems in the relationship. Dependent individuals downplay the significance of hypothetical relationship problems (Solomon & Samp, 1998); if dependent women did not equate the outcome of the graphing procedure with the existence of relationship problems, they may not have experienced a strong physiological reaction. It is important to acknowledge that participants universally considered the graphing procedure to be a positive experience, regardless of its outcome (based on participants’ open-ended feedback about the marriage discussion, provided at the conclusion of their laboratory visit; see Loving et al., 2009b). Simply gaining

additional insight into the status of their relationships may have buffered any disappointment dependent women may have experienced in response to decreasing their chance of marriage. Future research should explore such possibilities.

Men, on the other hand, responded differently to the graphing activity. Specifically, men who decreased their chance of marriage showed reduced HPA-axis activity when they reported lower levels of dependence; this pattern of reactivity differed substantially from that observed among less dependent women who made similar accommodations. These findings extend previous research by Loving and colleagues (2004) indicating that more powerful husbands demonstrate substantially lower levels of cortisol at the conclusion of a conflict discussion relative to baseline. Although this drop in cortisol may reflect a normal diurnal decline (Ice et al., 2004), it is also possible that less dependent men who are able to further reduce their commitment to the long-term potential of their relationship are better able to regulate their stress.

Why might women who are more dependent on their relationships show increased HPA-axis activation in response to a desirable outcome from the marriage discussion (i.e., increasing their chance of marriage), while less dependent men show decreased HPA reactivity in response to a similarly desirable outcome (i.e., decreasing their chance of marriage)? As noted above, women tend to be more physiologically reactive to interpersonal stressors than men (Kiecolt-Glaser & Newton, 2001), and these responses may be exacerbated when they do not have full control over their ability to achieve interpersonal goals (Dickerson & Kemeny, 2004). In the event of a positive outcome, women's generalized arousal would be characterized as eustress rather than distress (McGowan et al., 2006). Because men tend to be less affected physiologically by interpersonal stressors (Kiecolt-Glaser et al., 1996; Loving et al., 2004), the lower levels of cortisol observed among less dependent men who decreased their chance of marriage likely reflect the normal down-regulation of the HPA-axis that accompanies a reduction in external stress.

4.1. Limitations and Future Directions

Our findings should be interpreted in light of their limitations. First, our sample consisted of a small number of couples, which may cause some to question the reliability of our three-way interaction. However, we feel confident that our results are tapping a true effect and not a spurious one. Not only are spurious interaction effects uncommon in general (Aiken & West, 1991), but our study also avoided the biases that increase the likelihood of detecting such effects (specifically, the use of median splits, problems with multicollinearity, and the use of ordinal-level measures; see Kang & Waller, 2005). What's more, although significant interactions are oftentimes difficult to detect in small samples, low power does not *preclude* effects from being uncovered. Rather, our ability to detect a three-way interaction—despite limited power—suggests the presence of a strong effect (Aiken & West, 1991). Nevertheless, it would be ideal to replicate these findings using a larger, more diverse sample.

Additionally, by only soliciting participation from mentally and physically healthy couples, it is possible that the generalizability of our findings may be limited. However, these patterns may be more pronounced among less healthy individuals, who may rely on their partners for more than simply emotional fulfillment. For instance, Powers and colleagues (2006) found that women's trauma symptoms were tied to their own—and their partner's—cortisol reactivity to a conflict discussion. In our view, these results provide suggestive evidence that a history of psychological stress may place women in a vulnerable position and heighten their physiological reactivity to interpersonal stressors. Thus, it is conceivable that less-healthy women may also be particularly prone to eustressful reactions in response

to positive relationship events, particularly those who feel more dependent on their relationships.

Although it is unlikely that women who reported higher levels of dependence and who obtained a favorable outcome during the chance of marriage discussion interpreted the outcome in a less-than-positive way, it is possible that the increase in cortisol observed among these women reflects some other psychological process other than the positive emotions typical of eustress. For instance, it is possible that a woman who depends on her relationship may not necessarily want to marry her partner; in such a scenario, increasing one's chance of marriage may be *undesirable* and may cause these women to simultaneously feel dependent on *and* shackled to their relationship. Alternatively, dependent women who increased their perceived chance of marriage during the graphing activity may question whether their partner is truly committed to a higher chance of marriage; thus, their higher levels of cortisol may reflect a type of anxiety or uncertainty characteristic of *distress*. To explore such possibilities, we conducted additional analyses to see whether our variables of interest interacted to predict daters' self-reported positive and negative affect at the conclusion of the graphing activity. Consistent with other studies involving lab-based stressors (e.g., Het, Schoofs, Rohleder, & Wolf, 2012), individuals' positive affect and cortisol levels were not correlated ($r_s = .06$ and $.12$ for baseline and reactivity assessments, respectively, $p_s = .64$ and $.35$), nor did the results for positive affectivity parallel those for cortisol reactivity (i.e., the three-way interaction was not significant, $p = .36$). Although our analyses for negative affectivity produced a marginally significant three-way interaction, $t(48.9) = 1.92$, $p = .06$, follow-up analyses indicated that women who increased their chance of marriage did not experience a corresponding decrease in negative affect to the extent they were more dependent on their relationship.⁵ Although these findings lend credence to the notion that physiological reactions to stressful events do not signal or necessitate a specific psychological response (e.g., Lazarus, 1999), further research is needed to better understand the types of physiological and psychological arousal generated by positive stressors.

As we pointed out in the method section, we treated daters' third saliva sample as the baseline sample, as it was taken before they completed the individual graphing activity but after they had a chance to acclimate to the laboratory environment. Because the individual graphing task required participants to track the likelihood that their relationship may culminate in marriage from its inception to the present day—and describe the reasons for any upturns or downturns along the way—this task may have been anxiety-provoking for some participants. What's more, participants were instructed to take their *partner's* desire for marriage into account when assessing their chance of marriage, which required daters to consider the possibility *prior to constructing the joint graph* that their partner may harbor a lesser (or greater) desire for marriage than they do. Because the joint graphing activity concluded approximately an hour and 45 minutes after the start of the independent graphing activity, it is highly unlikely that the stress generated by the independent graphing activity would carry over into the joint graphing procedure, as cortisol responses generally peak about 21 to 40 minutes after the onset of an acute stressor (Dickerson & Kemeny, 2004). Thus, it is our strong belief that the cortisol levels observed at the conclusion of the joint graphing activity reflect (if not underestimate) participants' physiological reactions to the marriage discussion. Nevertheless, it would be useful for future studies to consider whether critically evaluating the chance of marriage independent of one's partner produces physiological reactions comparable to those observed in the current study.

⁵Closer inspection of this three-way interaction revealed that none of the simple slopes—nor any of the differences between pairs of slopes—were even marginally significant, suggesting that we likely did not have enough power to detect a significant effect.

Finally, our study involved the discussion of a highly significant relationship transition: marriage. The potential eustress response observed among women who made upward accommodations and who reported being more dependent on their relationship likely reflects the importance they ascribed to the subject matter; future studies should explore whether individuals experience eustressful reactions in the face of other desirable relationship transitions.

4.2. Conclusion

Overall, our findings both complement and extend prior work on the psychophysiology of relationships. This study is the first to suggest that men and women show distinct endocrinological reactions in response to presumably favorable outcomes during a discussion about marriage, contingent on their level of relationship dependence. What's more, by providing partners with the opportunity to discuss the possibility of marriage, we found suggestive evidence that, under certain conditions, women (but not men) may show eustress in response to relationship transitions. Ultimately, the potential health impact, if any, of such "positive" cortisol increases merits additional research.

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References

- Acitelli, LK.; Young, AM. Gender and thought in relationships. In: Fletcher, GJO.; Fitness, J., editors. *Knowledge Structures in Close Relationships: A Social Psychological Approach*. Erlbaum; Mahwah, NJ: 1996. p. 147-168.
- Afifi WA, Burgoon JK. "We never talk about that": A comparison of cross-sex friendships and dating relationships on uncertainty and topic avoidance. *Pers Relat*. 1998; 5:255-272.
- Afifi, WA.; Guerrero, LK. Motivations underlying topic avoidance in close relationships. In: Petronio, S., editor. *Balancing the Secrets of Private Disclosures*. Lawrence Erlbaum; Mahwah, NJ: 2000. p. 165-179.
- Agnew CR, Martz JM, Rusbult CA. Measuring interdependence in close relationships. 2003 Manuscript in preparation.
- Aiken, LS.; West, SG. *Multiple Regression: Testing and Interpreting Interactions*. Sage; Newbury Park, CA: 1991.
- Aron A, Fisher H, Mashek DJ, Strong G, Li H, Brown LL. Reward, motivation, and emotion systems associated with early-stage intense romantic love. *J Neurophys*. 2005; 94:327-337.
- Aron A, Paris M, Aron EN. Falling in love: Prospective studies of self-concept change. *J Pers Soc Psychol*. 1995; 69:1102-1112.
- Attridge M, Berscheid E, Simpson JA. Predicting relationship stability from both partners versus one. *J Personal Soc Psychol*. 1995; 69:254-268.
- Baxter LA, Wilmot WW. Taboo topics in close relationships. *J Soc Pers Relat*. 1985; 2:253-269.
- Bower JE, Ganz PA, Dickerson SS, Petersen L, Aziz N, Fahey JL. Diurnal cortisol rhythm and fatigue in breast cancer survivors. *Psychoneuroendocrinology*. 2005; 30:92-100. [PubMed: 15358446]
- Brown PC, Smith TW, Benjamin LS. Perceptions of spouse dominance predict blood pressure reactivity during marital interactions. *Ann Behav Med*. 1998; 20:286-293. [PubMed: 10234422]

- Bryk, AS.; Raudenbush, SW. Hierarchical Linear Models: Applications and Data Analysis Methods. Sage; Thousand Oaks, CA: 1992.
- Carter, CS.; Keverne, EB. The neurobiology of social affiliation and pair bonding. In: Pfaff, DW., editor. Hormones, Brain, and Behavior. Academic Press; San Diego, CA: 2002. p. 299-337.
- Cate RM, Koval JE, Lloyd SA, Wilson G. The assessment of relationship thinking in dating relationships. *Pers Relat.* 1995; 2:77–95.
- Crockett EE, Wright BL, Loving TJ. Sexual frequency moderates cortisol responses to a passionate love prime. 2012 Manuscript under review.
- Cross SE, Madson L. Models of the self: Self-construals and gender. *Psychol Bull.* 1997; 122:5–37. [PubMed: 9204777]
- Cross SE, Morris ML, Gore JS. Thinking about oneself and others: The relational-interdependent self-construal and social cognition. *J Pers Soc Psychol.* 2002; 82:399–418. [PubMed: 11902624]
- Dawson JF, Richter AW. Probing three-way interactions in moderated multiple regression: Development and application of a slope difference test. *J Appl Psych.* 2006; 91:917–926.
- Delongis A, Coyne JC, Dakof G, Folkman S, Lazarus RS. Relationship of daily hassles, uplifts, and major life events to health status. *Health Psych.* 1982; 1:119–136.
- Dhabhar FS, McEwen BS. Stress-induced enhancement of antigen-specific cell-mediated immunity. *J Immunology.* 1996; 156:2608–2615. [PubMed: 8786326]
- Dhabhar FS, McEwen BS. Acute stress enhances while chronic stress suppresses cell-mediated immunity *in vivo*: A potential role for leukocyte trafficking. *Brain, Beh, & Immun.* 1997; 11:286–306.
- Dhabhar FS, McEwen BS. Enhancing versus suppressive effects of stress hormones on skin immune function. *Proc Natl Acad Sci.* 1999; 96:1059–1064. [PubMed: 9927693]
- Diamond LM. Contributions of psychophysiology to research on adult attachment: Review and recommendations. *Pers Social Psychol Rev.* 2001; 5:276–295.
- Diamond LM, Hicks AM, Otter-Henderson KD. Every time you go away: Changes in affect, behavior, and physiology associated with travel-related separations from romantic partners. *J Pers Soc Psychol.* 2008; 95:385–403. [PubMed: 18665709]
- Diamond, L.; Otter-Henderson, KD. Physiological measures. In: Robins, R.; Fraley, CR.; Krueger, RF., editors. *Handbook of Research Methods in Personality Psychology*. The Guilford Press; New York, NY: 2007. p. 370-388.
- Dickerson SS, Kemeny ME. Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychol Bull.* 2004; 130:355–391. [PubMed: 15122924]
- Drigotas SM, Rusbult CE, Verette J. Level of commitment, mutuality of commitment, and couple well-being. *Pers Relat.* 1999; 6:389–409.
- Earle TL, Linden W, Weinberg J. Differential effects of harassment on cardiovascular and salivary cortisol stress reactivity and recovery in women and men. *J Psychosom Res.* 1999; 46:125–141. [PubMed: 10098822]
- Edwards JR, Cooper CL. The impacts of positive psychological states on physical health: A review and theoretical framework. *Soc Sci Med.* 1988; 27:1447–1459. [PubMed: 3070765]
- Emanuele E. NGF and romantic love. *Arch Ital Biol.* 2011; 149:265–268. [PubMed: 21701998]
- Emanuele E, Politi P, Bianchi M, Minoretti P, Bertona M, Geroldi D. Raised plasma nerve growth factor levels associated with early-stage romantic love. *Psychoneuroendocrinology.* 2005; 20:1–7.
- Fisher H, Aron A, Brown LL. Romantic love: an fMRI study of a neural mechanism for mate choice. *J Comp Neuro.* 2005; 493:58–62.
- Gramer M, Berner M. Effects of trait dominance on psychological and cardiovascular responses to social influence attempts: The role of gender and partner dominance. *Int J Psychophysiol.* 2005; 55:279–289. [PubMed: 15708641]
- Het S, Schoofs D, Rohleder N, Wolf OT. Stress-induced cortisol level elevations are associated with reduced negative affect after stress: Indications for a mood-buffering cortisol effect. *Psychosom Med.* 2012; 74:23–32. [PubMed: 22155939]
- Hibbard JH, Pope CR. The quality of social roles as predictors of morbidity and mortality. *Soc Sci Med.* 1993; 36:217–225. [PubMed: 8426965]

- Ice GH, Katz-Stein A, Himes J, Kane RL. Diurnal cycles of salivary cortisol in older adults. *Psychoneuroendocrinology*. 2004; 29:355–370. [PubMed: 14644066]
- Jaccard, J.; Turrise, R. Sage University Paper Series on Quantitative Applications in the Social Sciences. 2. Sage; Thousand Oaks, CA: 2003. Interaction effects in multiple regression.
- Kang S, Waller NG. Moderated multiple regression, spurious interaction effects, and IRT. *Appl Psychol Meas*. 2005; 29:87–105.
- Kelley, HH.; Thibaut, JW. *Interpersonal Relations: A Theory of Interdependence*. Wiley; New York, NY: 1978.
- Kenny, DA.; Kashy, DA.; Cook, WL. *Dyadic Data Analysis*. Guilford Press; New York, NY: 2006.
- Kiecolt-Glaser JK, Glaser R, Cacioppo JT, MacCallum RC, Snyder-Smith M, Kim C, et al. Marital conflict in older adults: Endocrinological and immunological correlates. *Psychosom Med*. 1997; 59:339–349. [PubMed: 9251151]
- Kiecolt-Glaser JK, Newton T. Marriage and health: His and hers. *Psychol Bull*. 2001; 127:472–503. [PubMed: 11439708]
- Kiecolt-Glaser JK, Newton T, Cacioppo JT, MacCullum RC, Glaser R, Maloney WB. Marital conflict and endocrine function: Are men really more physiologically affected than women? *J Consult Clin Psych*. 1996; 64:324–332.
- Kirschbaum C, Hellhammer DH. Salivary cortisol in psychoneuroendocrine research: Recent developments and applications. *Psychoneuroendocrinology*. 1994; 19:313–333. [PubMed: 8047637]
- Kirschbaum C, Kudielka BM, Gaab J, Schommer NC, Hellhammer DH. Impact of gender, menstrual cycle phase, and oral contraceptives on the activity of the hypothalamic-pituitary-adrenal axis. *Psychosom Med*. 1999; 61:154–162. [PubMed: 10204967]
- Knobloch LK, Carpenter-Theune KE. Topic avoidance in developing romantic relationships: Associations with intimacy and relational uncertainty. *Comm Res*. 2004; 31:173–205.
- La Guardia JG, Patrick H. Self-determination theory as a fundamental theory of close relationships. *Can Psych*. 2008; 49:201–209.
- Laurent HK, Powers SI. Social-cognitive predictors of hypothalamic-pituitary adrenal reactivity to interpersonal conflict in emerging adult couples. *J Soc Pers Relat*. 2006; 23:703–720.
- Lazarus, RS. *Stress, Appraising, and Coping*. Springer; New York, NY: 1999.
- Leuner B, Glasper E, Gould E. Sexual experience promotes adult neurogenesis in the hippocampus despite an initial elevation in stress hormones. *Plos One*. 2010; 5:e11597. [PubMed: 20644737]
- Loving TJ, Crockett EE, Paxson AA. Passionate love and relationship thinkers: Experimental evidence for acute cortisol elevations in women. *Psychoneuroendocrinology*. 2009a; 34:939–946. [PubMed: 19250753]
- Loving TJ, Gleason MEJ, Pope MT. Transition novelty moderates daters' cortisol responses when talking about marriage. *Pers Relat*. 2009b; 16:187–203.
- Loving TJ, Heffner KL, Kiecolt-Glaser JK, Glaser R, Malarkey WB. Stress hormone changes and marital conflict: Spouses' relative power makes a difference. *J Marr Fam*. 2004; 66:595–612.
- Loving, TJ.; Wright, BL. Eustress in romantic relationships. In: Campbell, L.; La Guardia, J.; Olson, JM.; Zanna, MP., editors. *The Science of the Couple: The Ontario Symposium*. Vol. 12. Psychology Press; London: 2012. p. 167–182.
- Marazziti D, Canale D. Hormonal changes when falling in love. *Psychoneuroendocrinology*. 2004; 29:931–936. [PubMed: 15177709]
- McGowan J, Gardner D, Fletcher R. Positive and negative affective outcomes of occupational stress. *New Zealand J Psych*. 2006; 35:92–98.
- Mosher WD, Martinez GM, Chandra A, Abma JC, Willson SJ. Use of contraception and use of family planning services in the United States: 1982–2002. *Adv Data*. 2004; 350:1–36. [PubMed: 15633582]
- Nelson DL, Cooper C. Stress and health: A positive direction. *Stress and Health*. 2005; 21:73–75.
- Powers SI, Gunlicks M, Laurent H, Balaban S, Bent E, Sayer A. Differential effects of subtypes of trauma symptoms on couples' hypothalamus-pituitary-adrenal (HPA) axis reactivity and recovery in response to interpersonal stress. *Ann NY Acad Sci*. 2006; 1071:430–433. [PubMed: 16891592]

- Pruitt, DG.; Rubin, JZ. Social Conflict: Escalation, Stalemate and Settlement. Random House; New York, NY: 1986.
- Reich JW, Zautra A. Life events and personal causation: Some relationships with satisfaction and distress. *J Pers Soc Psychol.* 1981; 41:1002–1012. [PubMed: 7299629]
- Ross MA, Holmberg D. Are wives' memories for events in relationships more vivid than their husbands' memories? *J Soc Pers Relat.* 1993; 9:585–604.
- Rusbult, CE.; Agnew, CR. Prosocial motivation and behavior in close relationships. In: Mikulincer, M.; Shaver, PR., editors. Prosocial Motives, Emotions, and Behavior: The Better Angels of our Nature. American Psychological Association; Washington, DC: 2010. p. 327-345.
- Rusbult CE, Van Lange PAM. Interdependence, interaction, and relationships. *Annu Rev Psych.* 2003; 54:351–375.
- Rusbult CE, Verette J, Whitney GA, Slovik LF, Lipkus I. Accommodation processes in close relationships: Theory and preliminary evidence. *J Pers Soc Psychol.* 1991; 60:53–78.
- Rusbult, CE.; Yovetich, NA.; Verette, J. An interdependence analysis of accommodation processes. In: Fletcher, GJO.; Fitness, J., editors. Knowledge Structures in Close Relationships: A Social Psychological Approach. Erlbaum; Mahwah, NJ: 1996. p. 91-120.
- Satterthwaite FW. An approximate distribution of estimates of variance components. *Biom Bull.* 1946; 2:110–114.
- Sbarra DA. Predicting the onset of emotional recovery following nonmarital relationship dissolution: Survival analyses of sadness and anger. *Pers Soc Psychol Bull.* 2006; 32:298–312. [PubMed: 16455858]
- Selye H. Confusion and controversy in the stress field. *J Hum Stress.* 1975; 1(2):37–44.
- Simmons BL, Nelson DL. Eustress at work: The relationship between hope and health in hospital nurses. *Health Care Man Rev.* 2001; 26(4):7–18.
- Smith TW, Brown PC. Cynical hostility, attempts to exert social control, and cardiovascular reactivity in married couples. *J Behav Med.* 1991; 14:581–592. [PubMed: 1791622]
- Smyth JM, Ockenfels MC, Gorin AA, Catley D, Porter LS, Kirschbaum C, et al. Individual differences in the diurnal cycle of cortisol. *Psychoneuroendocrinology.* 1997; 22:89–105. [PubMed: 9149331]
- Solomon DH, Samp JA. Power and problem appraisal: Perceptual foundations of the chilling effect in dating relationships. *J Soc Pers Relat.* 1998; 15:191–210.
- Stevens JP. Outliers and influential data points in regression analysis. *Psychol Bull.* 1984; 95:334–344.
- Stroud LR, Salovey P, Epel ES. Sex differences in stress responses: Social rejection versus achievement stress. *Biol Psychol.* 2002; 52:318–327.
- Surra, CA.; Gray, C. A typology of processes of commitment to marriage: Why do partners commit to problematic relationships?. In: Waite, LJ.; Bachrach, C.; Hindin, M.; Thomson, B.; Thornton, A., editors. Ties that Bind: Perspectives on Marriage and Cohabitation. Aldine de Gruyter; Hawthorne, NY: 2000. p. 253-280.
- Surra, CA.; Hughes, DK.; Jacquet, SE. The development of commitment to marriage: A phenomenological approach. In: Adams, JM.; Jones, WH., editors. Handbook of Interpersonal Commitment and Relationship Stability. Kluwer; Dordrecht, Netherlands: 1999. p. 125-148.
- Tanner M, Vlassoff C. Treatment-seeking behaviour for malaria: A typology based on endemicity and gender. *Soc Sci Med.* 1998; 46:523–532. [PubMed: 9460831]
- Tschann JM, Adler NE, Millstein SG, Gurvey JE, Ellen JM. Relative power between sexual partners and condom use among adolescents. *J Adol Health.* 2002; 31:17–25.
- Van Lange PAM, Rusbult CE, Drigotas SM, Arriaga XB, Witcher BS, Cox CL. Willingness to sacrifice in close relationships. *J Pers Soc Psychol.* 1997; 72:1373–1395. [PubMed: 9177022]
- Waller, W.; Hill, R. The Family: A Dynamic Interpretation. Dryden; New York, NY: 1938.
- Wanic R, Kulik J. Toward an understanding of gender differences in the impact of marital conflict on health. *Sex Roles.* 2011; 65:297–312.

Highlights

- Dependent women who raised their chance of marriage experienced increased cortisol
- The finding described above may be indicative of eustress
- Cortisol declined for less dependent men who decreased their chance of marriage
- Men and women responded differently to favorably resolving a relationship discussion

Figure 1.

Predicted means of cortisol levels at the conclusion of the joint graphing activity for men and women as a function of dependence and accommodation.

Table 1

Correlations and descriptive statistics for the major study variables (women above the diagonal, men below the diagonal)

Variables	1	2	3	4	5	n	M	SD
1. Accommodation	—	.08	-.10	-.17	.14	31	.48	10.01
2. Dependence	-.19	—	.08	.15	.13	31	4.29	.76
3. Cigarette smoking	.07	-.01	—	-.02	-.06	31	.03	.18
4. Baseline cortisol	-.18	.03	.08	—	.39*	31	-.86	.19
5. Cortisol at recovery	.17	.17	.31 [†]	.49**	—	31	-.92	.18
n	33	33	33	33	33	—		
M	4.64	3.51	.15	-.85	-1.00	—		
SD	13.83	.70	.57	.25	.18	—		

Note. The log-transformed values of cortisol at baseline and cortisol at the conclusion of the joint graphing activity were used when calculating the correlations. Variations in sample size are a result of missing data. Correlations and descriptive statistics describe those included in the final sample.

[†] $p < .10$.

* $p < .05$.

** $p < .01$.

Table 2

Results of the multilevel model assessing accommodation, dependence, and biological sex on cortisol levels at the conclusion of the marriage discussion

Predictor	Coefficient	SE	t	df	p
Intercept	−0.98	0.03	−38.69	34.5	<.001
Dependence	0.05	0.03	1.78	37.9	.08
Accommodation	0.00	0.00	1.62	43.1	.11
Biological Sex	−0.08	0.04	−1.96	32.3	.06
Cigarette smoking	0.08	0.05	1.79	49.0	.08
Baseline cortisol	0.38	0.10	3.94	52.7	.00
Dependence x Accommodation	0.00	0.00	1.00	54.0	.32
Dependence x Sex	0.04	0.06	0.75	52.7	.45
Accommodation x Sex	0.00	0.00	0.11	53.1	.92
Dependence x Accommodation x Sex	−0.01	0.00	−2.69	42.9	.01

Note. Dependence and baseline cortisol were centered at the mean. Degrees of freedom were determined using the Satterthwaite (1946) approximation, as recommended by Kenny and colleagues (2006).