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Adult attachment and cortisol responses to discussions with a romantic partner

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Abstract

This study examines the effects of actor and partner attachment security on cortisol responses to discussions of personal and relationship concerns with a romantic partner. Dating couples ($N = 30$) completed two 20-min discussions and provided saliva samples at 4 time points before and after. Hierarchical linear modeling revealed that among women, higher levels of partner avoidance predicted greater cortisol reactivity to both discussions and among men, higher levels of actor anxiety predicted greater reactivity to the relationship concern discussion. These findings extend previous work by demonstrating that the effects of attachment on physiology vary by gender and by discussion context, which informs our understanding of how individual differences in attachment moderate the effects of romantic relationships on health.

The quality of close relationships has a powerful influence on physical health. Individuals in less distressed, higher quality marriages are in better health (Burman & Maroglin, 1992) and experience smaller declines in health as they age (Umberson, Williams, Powers, Liu, & Needham, 2006) than individuals in low-quality marriages. One pathway by which relationship quality may ultimately affect health involves activity in the hypothalamic–pituitary–adrenal (HPA) axis and production of the hormone cortisol. Short-term elevations in cortisol are considered adaptive, but repeated or prolonged cortisol elevation is harmful and can contribute to broader physiological dysregulation (McEwen & Seeman, 1999). Close relationships are like a double-edged sword because they can alter cortisol levels during interpersonal interactions for better or for worse; although supportive behavior from a partner can reduce perceptions of stress and dampen cortisol responding (Kirschbaum, Klauer, Filipp, & Hellhammer, 1995; Robles, Shaffer, Malarkey, & Kiecolt-Glaser, 2006), conflict with a partner can have the opposite effect (Kiecolt-Glaser, Glaser, Cacioppo, & Malarkey, 1998).

A frequently used paradigm to understand patterns of physiological activation that accompany interpersonal exchanges involves bringing couples into a laboratory and monitoring their physiological responses while they engage in a semistructured discussion, as the patterns of activation that accompany such laboratory discussions are thought to have long-term implications for health (Robles & Kiecolt-Glaser, 2003). The majority of these studies have focused on conflict, and in these studies the couple typically identifies

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areas of disagreement and spends a specified amount of time talking about these issues. The physiological correlates of other types of exchanges have received less attention despite the fact that most interactions between romantic partners are not overt conflicts (McGonage, Kessler, & Schilling, 1992). In particular, the patterns of physiological activation that accompany the disclosure of personal concerns may be relevant for understanding how the quality of romantic relationships ultimately influences physiology and health.

A second limitation of this literature is that the effects of partner-level characteristics are often neglected when explaining interindividual variability in physiological responding. The majority of work has examined characteristics of the individual, referred to here as *actor effects* (e.g., personality, trait affect), or characteristics of the couple (e.g., objectively coded relationship quality) as predictors of physiology, and have greatly advanced our understanding of which types of individuals in which types of relationships experience elevations or declines in cortisol while interacting with a partner. However, dyadic processes involve two individuals, each of whom has his or her own characteristic ways of feeling, thinking, and behaving in relational contexts. Couple-level variables such as relationship quality reflect some of this interdependence, but characteristics of a partner may contribute to physiology above and beyond couple-level variables. In order to fully understand the effects of relationships on physiology and health, it is essential to account for characteristics of the partner, referred to here as *partner effects.*

Adult attachment and HPA responses

Attachment theory (Bowlby, 1969), originally formulated to describe the behavioral system by which infants regulate proximity to caretakers, provides a useful framework for conceptualizing actor and partner effects on physiology. According to adult attachment theory (Bowlby, 1969; Fraley & Shaver, 2000), individuals vary along two independent dimensions—attachment anxiety and attachment avoidance (referred to here as *anxiety* and *avoidance*). Highly anxious individuals fear rejection and are preoccupied with maintaining proximity to their partner, and highly avoidant individuals are uncomfortable with intimacy and prefer to retain distance from their partner. Individuals who are low on both dimensions are considered *secure*, and individuals high on one or both dimensions are considered *insecure.* These dimensions were originally thought to reflect features of internal working models, but more recent conceptualizations view the dimensions as reflecting the organization of the attachment system dynamics more generally (Fraley & Shaver, 2000). According to Fraley and Shaver (2000), the anxiety dimension is primarily an appraisal-monitoring system that gauges the closeness of the attachment figure and monitors for threat-related cues, while the avoidance dimension regulates behavior toward or away from the attachment figure, especially during anxiety-provoking situations. The systems are thought to operate in parallel, to influence each other via reciprocal feedback, and to operate automatically.

Attachment theory is a particularly appropriate framework for understanding actor and partner effects on physiology because one of the central functions of an attachment relationship is to regulate physiology (Bowlby, 1969; Diamond, 2001). Infants rely on their caretakers to soothe physiological arousal during times of distress, and attachment theory suggests that these early experiences influence an individual's ability to self-regulate in adulthood, as well as his or her expectations about the availability of others to alleviate distress. Secure individuals are better able to regulate their own distress (for a review, see Mikulincer & Shaver, 2005) and to soothe their partner's distress (for a review, see Kane et al., 2007), both of which should have implications for stress-related physiology.

Despite theoretical reasons to expect attachment relationships to modulate physiological responding in adults, few studies have explicitly tested these predictions and fewer still have used naturalistic relational stressor paradigms. In studies using nonrelational laboratory stressors like public speaking, higher levels of attachment insecurity have been

associated with greater physiological responses in some (e.g., Feeney & Kirkpatrick, 1996; Maunder, Lancee, Nolan, Hunter, & Tannenbaum, 2006), but not all, studies (e.g., Ditzen et al., 2008). Although these studies suggest that insecure individuals show greater physiological reactivity to stress more generally, they tell us little about how attachment *relationships* influence physiology because they do not account for actor and partner effects and they do not utilize naturalistic dyadic situations. In addition, most of the work on attachment and physiology to date has focused on the autonomic nervous system, with few studies examining the HPA axis.

Individuals who are low on anxiety and avoidance should experience less frequent and/or smaller HPA activations during interactions with an attachment figure because they are better able to manage their own distress. Consistent with this premise, infants with anxious attachment styles and distress-prone temperaments showed heightened HPA reactivity to separation from an attachment figure (Gunnar, Brodersen, Nachmias, Buss, & Rigatuso, 1996; Nachimas, Gunnar, Mangelsdorf, Parritz, & Buss, 1996; Spangler & Grossman, 1993; Spangler & Schieche, 1998), although several studies did not find these effects (Gunnar, Mangelsdorf, Larson, & Hertsgaard, 1989; Hertsgaard, Gunnar, Erickson, & Nachmias, 1995). Only a handful of studies have examined actor attachment and HPA responses to relationship events in adults, but the results are consistent with the patterns observed in infants. For example, individuals with high levels of anxiety showed elevated daily cortisol production during a 4- to 7-day separation from their partner (Diamond, Hicks, & Otter-Henderson, 2008). To our knowledge, only one study has assessed the association between actor attachment and cortisol responses during a laboratory discussion. In this study, the authors measured cortisol responses to a 15-min conflict negotiation task (i.e., discussion of an ongoing disagreement) in 124 young adult dating couples and found that higher levels of avoidance and anxiety predicted greater cortisol reactivity in women and men, respectively (Powers, Pietromonaco, Gunlicks, & Sayer, 2006). These findings are intriguing and support basic predictions of attachment theory, but it is not clear whether these effects generalize to other types of interactions between partners and whether the observed gender differences are reliable.

In addition to the actor effects described above, individuals with secure *partners* should experience less HPA activation when they are interacting with that partner. Secure individuals are better able to alleviate their partner's distress because they are more responsive to the partner's needs (Feeney & Collins, 2001; Simpson, Rholes, & Nelligan, 1992). Anxious and avoidant individuals tend to be poor support providers, albeit for different reasons; the anxious individual's preoccupation with monitoring and appraising threat-related cues impairs his or her ability to provide support, and the avoidant partner may be a poor support provider because he or she wishes to avoid closeness and retain independence (for a review, see Mikulincer & Shaver, 2009). Therefore, individuals whose partners are high in anxiety or avoidance should experience greater and/or more frequent HPA activations when they are interacting with their partner, particularly in potentially stressful situations. In their study of dating couples, Powers and colleagues (2006) found that men with more anxious or avoidant partners exhibited greater cortisol reactivity, but this finding did not hold among women. The extent to which partner attachment influences cortisol responses in nonconflict scenarios has not been tested, despite the fact that most relationship events are not explicit conflicts.

Actor and partner anxiety and avoidance should be relevant when individuals are disclosing personal concerns because this is a potentially stressful context in which individuals may look to their partners for support, and attachment security influences both support seeking and provision. Not only are secure individuals better able to make use of interpersonal resources and ask for help, but they are more effective support providers because they are more responsive to their partner's needs. Individuals who have secure partners may experience greater benefits from

the presence of their partner under these circumstances compared to individuals with less secure partners.

The current study

The aim of this study is to investigate how an individual's attachment anxiety and avoidance, as well as that of his or her romantic partner, influences that individual's cortisol response to two types of discussions: a discussion of relationship concerns, similar to conflict tasks used in previous work (Powers et al., 2006), and a discussion of personal concerns, a situation in which individuals may exchange social support. We recruited dating couples to visit our laboratory and complete the discussions on two separate occasions, while we measured their salivary cortisol. We computed indices of reactivity and recovery to index the extent to which each individual's cortisol levels increased from baseline and decreased from peak level. We chose to examine these parameters separately, rather than using an integrated measure of cortisol production over the entire discussion, because they represent different aspects of HPA function. Although excessive reactivity and sluggish recovery from stressors are both considered harmful (McEwen & Seeman, 1999), they may have distinct psychosocial correlates (e.g., Burke, Davis, Otte, & Mohr, 2005). We used hierarchical linear modeling to test the effects of actor and partner attachment on cortisol, because this statistical procedure is suited to the unique structure of dyadic data.

On the basis of the theoretical role of attachment relationships in regulating physiology, behavioral evidence that actor and partner insecurity are associated with negative relational outcomes, and the findings observed by Powers and colleagues (2006), we expected that higher levels of actor or partner anxiety or avoidance would be associated with greater reactivity and slower recovery to both discussions.

There are theoretical reasons to believe that the two dimensions of security—anxiety and avoidance—have different implications for physiology, so we tested for distinct contributions of each dimension rather than creating a summary score of overall insecurity. However, given the inconsistency of previous work we did not advance specific predictions about the effects of each dimension.

Given the gender differences observed in prior work, we tested whether the effects of actor and partner attachment varied by sex. We also performed exploratory analyses to investigate whether subjective ratings of the discussions mediated the effects of actor or partner attachment on cortisol.

Method

Sample

Dating couples ages 19–34 were recruited through flyers and advertisements on the University of California, Los Angeles campus, in the surrounding community, and online. All females were nonpregnant and premenopausal. Individuals were excluded from the study if they had conditions which might alter the biological variables of interest, such as asthma, diabetes, or a skin disease, or if they took medications to treat any of the excluded medical conditions. In addition, disqualifying health behaviors included smoking, drinking more than 14 alcoholic drinks per week, drinking more than 8 caffeinated beverages per day, and using illegal drugs on a regular basis. In order to ensure that we recruited individuals in committed relationships (as opposed to casual dating relationships), we required couples to have been dating for at least 3 months and to spend at least four nights per week together overnight. Participants were required to be fluent in English.

A total of 34 couples participated in the study, but 1 couple did not complete the protocol and was excluded from our analyses. Two couples were excluded because they did not complete the attachment questionnaire, and 1 couple was excluded because they were missing cortisol data. The final sample ($N = 60$, mean age $= 23.35$, $SD = 3.99$) consisted of 30 couples who had been dating an average of 25.95 months ($SD = 20.91$, range $= 4–75$). The majority of the sample had completed at

least 1 year of college (53.5%) or had earned a bachelor's degree or higher (37.9%), and the remaining participants had completed less than 1 year of college (8.6%). The ethnic composition of the sample was representative of the community: 34.5% Asian, 32.8% Caucasian, 25.9% Latino, and 6.8% African American.

Procedure

Data for this study were collected as part of a larger study, which involved two 3.5 hr sessions completed on subsequent days and a 30-min follow-up session on a 3rd day. The basic procedure was similar on each of the first 2 days and involved the administration of self-report measures, collection of physiological indicators, and a discussion task (see below). On the 3rd day, couples were debriefed and received monetary compensation.

Arrival and adaptation period

All laboratory sessions were scheduled at 12:30 pm to minimize the influence of diurnal variations in cortisol. Participants were instructed not to eat or drink in the hour immediately preceding the session and to refrain from strenuous exercise. After arriving at the laboratory and providing informed consent, participants sat quietly in comfortable chairs for 30 min and completed a battery of demographic, personality, and relationship measures, including a measure of attachment. As part of a separate study, we collected measures of baseline cardiovascular function from one member of the couple and performed a noninvasive skin disruption procedure on both members of the couple. Further detail about the cardiovascular and skin procedures will not be provided here, but participants did not report experiencing them as stressful, and previous work (Robles, 2007) demonstrates that they do not significantly alter cortisol responding. Saliva samples were obtained at the beginning of the adaptation period, and approximately 1 hr later immediately before participants received instructions for the discussion task.

Discussion task

After getting acclimated to the laboratory and providing baseline psychological and physiological measures, participants were told, "During the next part of the session, you and your partner will have a discussion with each other." The topic of the discussion varied between the two sessions, such that during one session, the couple discussed things about themselves they wished to change (personal concern discussion) and during the other session, the couple discussed areas of disagreement in their relationship (conflict discussion). Order of administration was counterbalanced so that half of the couples completed the personal concern discussion on the first day, and order of administration did not influence any of the results.

Both discussion tasks were modeled on previous work with married couples (Gable, Reis, Impett, & Asher, 2004; Gottman, 1994; Karney & Bradbury, 1997; Pasch & Bradbury, 1998). Using questionnaires the participants had completed during the adaptation period, the interviewer helped each participant decide which conflict or personal concern he or she wanted to talk about. The most frequently selected conflict topics were uncertainty about the future of the relationship (30%), feeling like partner does not listen well (23%), problems with parents or family members (17%), partner is too critical or demanding (15%), and not spending enough time together (15%). The most frequently selected personal concern topics included wanting to exercise more (25%), improve time management (16%), perform better in school/work (11%), manage stress better (9%), and spend more time with friends (9%). The remaining percentage of participants selected miscellaneous topics such as making more money, maintaining a more regular spiritual or religious practice, getting a promotion, or improving relationships with family members.

The couple was then instructed to discuss the issues they had selected for 20 min total. One member of the couple was randomly chosen to talk about his or her issue for the first 10 min, at which point the couple was instructed to switch so that the partner

could talk about his or her issue. The experimenter explained that participants were "free to respond in any way you wish" when their partner was discussing his or her concerns. We deliberately did not instruct participants to respond in a particular way (i.e., to provide support) because we wished to create a naturalistic context which closely resembled the types of interactions couples have in daily life. The interviewer left the room while the participants completed the discussions, but the discussions were monitored via intercom to ensure that participants followed the instructions. All discussions were video- and audiotaped using hidden recording equipment.

Post discussion

Immediately after each discussion, participants completed a short questionnaire in which they rated their experience during the discussion (e.g., "How difficult was the discussion?") and rated how supportive their partner was during the discussion. For the remainder of the session, participants were permitted to sit quietly, study, or read magazines while additional physiological measures were obtained. Salivary cortisol samples were obtained 40 and 90 min after the discussion began.

Measures

Attachment anxiety and avoidance

The 36-item Experiences in Close Relationships–Revised (ECR–R) measure was used to assess individual differences in attachment (Brennan, Clark, & Shaver, 1998; Fraley, Waller, & Brennan, 2000). The ECR–R assesses two dimensions of attachment security: anxiety and avoidance. The anxiety dimension reflects the extent to which an individual is afraid of being rejected and abandoned, and is assessed with items like "I worry that romantic partners won't care about me as much as I care about them." The avoidance dimension reflects the extent to which an individual avoids closeness and intimacy, and is assessed with items like "I prefer not to show a partner how I feel deep down." Participants were instructed to think about how they generally experienced romantic relationships, not just the current relationship, and to respond to each statement by indicating how much they agreed or disagreed with it. Items were rated on a scale from 1 to 7, where 1 indicated *disagree strongly* and 7 indicated *agree strongly*. We computed anxiety ($\alpha = 0.92$, $M = 2.72$, $SD = 1.08$) and avoidance ($\alpha = 0.91$, $M = 2.34$, $SD = 0.90$) scores for each participant, and the means were comparable to normative data (Sibley, Fischer, & Liu, 2005).

Discussion ratings

Participants rated the discussion using eight items, each of which was scored from 1 (*not at all*) to 7 (*very much*). After inspecting the interitem correlations, we grouped the items into three theoretically distinct categories. *Stress* was measured with four items ($\alpha = 0.85$) that reflected perceptions that the discussion was stressful, difficult, challenging, and threatening, such as "How stressful was the discussion?" *Desire to quit* was measured with two items ($\alpha = 0.88$) that reflected reports of quitting or desire to quit during the discussion, such as "How much did you want to quit during the discussion?" *Satisfaction with the outcome* was measured with two items ($\alpha = 0.90$) that reflected perceptions that the discussion went well and that the individual had achieved his or her goals, such as "To what extent did you feel the discussion went well?"

Partner supportiveness

Participants rated the effectiveness of support provided by their partner using a modified form of the Social Support Effectiveness Scale (Rini, Schetter, Hobel, Glynn, & Sandman, 2006). This scale assesses the extent to which support provided by a partner meets an individual's needs and accounts for the potential costs of receiving support, such as feelings of indebtedness or unworthiness. We assessed supportiveness in terms of both emotional support (i.e., warmth and caring) and informational support (i.e., advice). Participants were told that emotional support involves having "someone to listen to and understand our

feelings or to show us affection and concern" and were asked questions like "If/when your partner attempted to give you emotional support during the discussion, how good was the match between the amount of support he/she provided and the amount you wanted?" For informational support, participants were asked questions like "If you needed advice or information from your partner during the discussion, how often was it easy to get?" Items were rated on a 5-point scale, where 1 indicated *not at all* and 5 indicated *extremely*. We combined the emotional ($\alpha = 0.92$) and informational ($\alpha = 0.88$) support subscales to create an index of overall partner supportiveness ($\alpha = 0.95$). The average partner supportiveness score was 3.94 ($SD = 0.90$), which corresponds to a rating of *good* or *quite a bit*.

Cortisol

Salivary cortisol was measured at four time points during each laboratory session: after the adaptation period, before receiving instructions for the discussion task and being told who would speak first, 40 min after the discussion began, and 90 min after the discussion began. From the time it is released in the bloodstream, cortisol takes approximately 20 min to appear in saliva, so these measures allowed us to determine the extent to which cortisol levels increased as the discussion began and the extent to which they decreased or remained elevated after the discussion ended. Saliva was collected using a Salivette (Sarstedt 1534; Sarstedt Inc., Newton, NC), consisting of a sterilized cotton swab, which the participant chewed in their mouth for 2 min and placed in a small beaker contained in a plastic tube. Cortisol samples were stored in a -20°C freezer until the study was completed. After data collection was complete, cortisol levels were determined by time-resolved immunoassay with fluorometric endpoint detection (Dressendörfer, Kirschbaum, Rohde, Stahl, & Strasburger, 1992) at the Biological Psychology laboratory directed by Dr. Clemens Kirschbaum at the Technical University of Dresden in Dresden, Germany.

As the novelty of arriving at the laboratory can elicit a cortisol response, the second saliva sample, obtained approximately 1 hr into the protocol, was used as a baseline measure. This sample was collected before couples received task instructions or were told who would be talking first, and thus was not influenced by experimental group or anticipation of the task. The remaining two samples were used as indicators of peak responding and recovery.

A small percentage of the cortisol samples (7%) were missing due to insufficient saliva. These data were not missing completely at random, meaning that simply deleting the missing cases would introduce substantial bias (Little & Rubin, 1987). To address this issue, we estimated the missing values using multiple linear regression and added a random component to each estimate by selecting randomly from the observed residuals of complete cases. Imputed cortisol values were then log transformed to correct for skew. Using log transformed and imputed data did not significantly alter the pattern of results.

We computed indices of reactivity for each discussion as the difference between peak and baseline levels, where higher values indicated greater reactivity. We computed recovery as the difference between the final cortisol measure and peak level, where smaller values indicated greater recovery.

Data analyses

Throughout the data analyses, SPSS 15.0 was used for all descriptive statistics, general linear models, and correlations. We ran analyses of variance (ANOVAs) to screen for effects of sex and order of administration on key variables. Interitem correlations were used to examine the relationships among attachment, cortisol, and subjective experience variables.

We used the Hierarchical Linear Modeling program (HLM, Version 6.0; Raudenbush, Bryk, & Congdon, 2004) to investigate the effects of actor and partner attachment on cortisol. Dyadic data present unique challenges because data for one member of a couple are related to data from his or her partner, violating the assumptions that underlie traditional analytic approaches, namely that errors are independently and identically distributed (Kenny, 1996). Hierarchical linear modeling

accounts for this nonindependence by estimating variance at both the level of the individual and the couple, and it has become a preferred method for analyzing dyadic data (Campbell & Kashy, 2002; Kenny & Cook, 1999). In addition, hierarchical linear modeling permits the estimation of actor and partner effects, as specified within the actor-partner interdependence model (APIM; Kashy & Kenny, 1999).

Results

Descriptive statistics

To screen for gender and order effects and to examine the effects of the discussion manipulation, we conducted a series of 2 (discussion type) × 2 (order of administration) × 2 (sex) ANOVAs with subjective experience and cortisol as dependent variables. We ran separate tests for each of the cortisol outcomes of interest (reactivity and recovery during both discussions) and each of the subjective experience indices (stress, satisfaction with outcome, desire to quit, and partner supportiveness). There were no effects of discussion type, order of administration, or gender on any subjective experience or cortisol variable (all $ps > .05$).

The discussions were designed to closely resemble the interactions participants had outside the laboratory. To test whether we achieved this aim, we asked participants how similar the discussions were to those they had in daily life, where 7 indicated *highly similar*. Participants rated both the personal concern ($M = 5.8$) and conflict ($M = 5.8$) discussions as very similar to interactions they had with their partner in daily life.

The correlations among actor and partner attachment variables are presented in Table 2. Within individuals, anxiety and avoidance were moderately positively skewed and were positively correlated ($r = 0.41$, $p < .001$). Attachment scores were also correlated between partners, such that individuals with higher levels of anxiety or avoidance tended to have partners with higher levels of anxiety or avoidance as well. There were no sex differences in anxiety or avoidance.

Preliminary analyses

Descriptive statistics and correlations among attachment and cortisol variables are presented in Tables 1 and 2.

Cortisol

Baseline cortisol was associated with reactivity to both discussions, such that individuals who arrived at the laboratory with higher baseline values showed less of an increase in response to the discussion. Peak cortisol (i.e., the cortisol measure obtained 40-min post-discussion onset) was correlated with recovery during the relationship concern discussion, such that individuals who exhibited higher peak levels had greater recovery. To account for these associations we included baseline and peak cortisol as predictors of reactivity and recovery, respectively, in our hierarchical linear models.

Cortisol levels did not change significantly from baseline to peak in either discussion, $F_{\text{conflict}}(1, 59) = 1.18$, $p = .28$; $F_{\text{personal}}(1, 59) = 0.78$, $p = .38$. However, these findings do not imply that the discussions had no effect on cortisol production; rather, because cortisol levels decline over the course of the day, acute activations of the HPA axis may reduce the slope of the decline without causing an increase per se (Robles et al., 2006). The average start time of the discussions was 1:30 pm, meaning that cortisol levels were continuing to decline over the remainder of the session.

Attachment

Descriptive statistics for anxiety and avoidance are presented in Table 1, and the correlations among attachment variables are presented in Table 2. Higher levels of partner avoidance were associated with higher baseline cortisol during both discussions, and higher levels of actor anxiety and partner anxiety were associated with higher baseline cortisol during the conflict discussion. The fact that anxiety and avoidance scores were correlated within individuals as well as within couples made it impossible to determine the unique contributions of each dimension and to

Table 1. *Demographics and descriptive statistics*

Variable	Men ($n = 29$) *M (SD)*	Female ($n = 31$) *M (SD)*	All ($N = 60$) *Min–Max*
Age	24.06 (4.28)	22.76 (3.56)	18.76–33.68
Relationship length (months)	25.07 (20.73)	26.27 (20.68)	4.00–75.00
Body mass index	24.24 (3.28)	23.04 (5.21)	17.92–44.00
Education (years)	15.03 (1.49)	14.92 (1.03)	12.00–19.00
Ethnicity (%)			
Caucasian	27.6	38.7	
Asian	37.9	29.0	
African American	13.8	—	
Latino	20.7	32.3	
Attachment anxiety (1–7)	2.77 (0.91)	2.66 (1.24)	1.06–6.67
Attachment avoidance (1–7)	2.36 (0.90)	2.30 (0.91)	1.00–5.06

	Discussion topic					
	Men *M (SD)*		Female *M (SD)*		All *Min–Max*	
	Conflict	Personal	Conflict	Personal	Conflict	Personal
Salivary cortisol (μg/dL)						
Baseline	6.06 (3.43)	4.90 (2.20)	6.18 (2.97)	6.01 (3.06)	2.11–17.25	0.79–12.90
Peak (40-min postdiscussion onset)	5.92 (4.73)	5.60 (3.70)	5.71 (2.87)	5.33 (3.32)	1.53–22.96	1.20–19.88
Final (90-min postdiscussion onset)	4.68 (2.23)	5.73 (3.26)	4.96 (2.35)	5.25 (3.61)	1.55–11.54	1.89–17.46
Reactivity	−0.14 (5.72)	0.70 (3.97)	−0.47 (2.25)	−0.68 (2.94)	−11.0–19.44	−8.35–15.25
Recovery	−1.24 (3.67)	0.13 (3.38)	−0.75 (2.14)	−0.08 (2.00)	−16.47–8.09	−9.62–7.45
Subjective experience (1–7)[a]						
Stress	2.77 (1.31)	2.31 (1.35)	2.59 (1.00)	2.10 (1.17)	1.00–6.75	1.00–5.50
Desire to quit	1.93 (1.26)	1.81 (1.37)	2.40 (1.71)	1.84 (1.11)	1.00–6.50	1.00–6.00
Satisfaction with outcome	4.76 (1.51)	5.07 (1.52)	4.93 (1.38)	5.38 (1.46)	1.00–7.00	1.00–7.00
Partner supportiveness (1–5)	3.56 (0.79)	3.84 (0.85)	3.66 (0.93)	4.02 (0.96)	1.50–5.00	1.50–5.00

[a]Female $n = 29$ for conflict discussion, $n = 28$ for personal concern discussion.

Table 2. *Interitem correlations among attachment and cortisol variables*

					Cortisol—conflict discussion			
	Actor anxiety	Actor avoidance	Partner anxiety	Partner avoidance	Baseline	Peak	Reactivity	Recovery
Actor anxiety	—				.29*	.30*	.03	−.16
Actor avoidance	.41**	—			.22†	.23†	.02	−.06
Partner anxiety	.64**	.36**	—		.27*	.20	−.05	−.12
Partner avoidance	.36**	.38**	.41**	—	.36**	.32*	−.02	−.13
Cortisol—personal concern discussion								
Baseline	.12	.17	.23†	.27*	—	.46**	−.46**	−.16
Peak	.23†	.19	.22†	.36*	.53**	—	.58**	−.55**
Reactivity	.16	.06	.05	.15	−.30*	.66**	—	−.41**
Recovery	−.25†	−.17	−.08	−.08	−.12	−.41**	−.35**	—

Note. Gray shaded area reflects correlations among cortisol values during relationship concern discussion.
† $p < .10$. * $p < .05$. ** $p < .01$.

distinguish between actor and partner effects, further highlighting the need for multilevel modeling.

Hierarchical linear modeling results

To test the effects of actor and partner attachment on cortisol reactivity and recovery during each discussion, we specified models of the form:

$$\begin{aligned} Y_{ij} &= \beta_{0j} + \beta_{1j}(\text{participant sex}) \\ &\quad + \beta_{2j}\ (\text{baseline OR peak cortisol}) \\ &\quad + \beta_{3j}\ (\text{actor anxiety}) \\ &\quad + \beta_{4j}\ (\text{partner anxiety}) \\ &\quad + \beta_{5j}\ (\text{actor avoidance}) \\ &\quad + \beta_{6j}\ (\text{partner avoidance}) + e_{ij} \end{aligned}$$

$$\begin{aligned} \beta_{0j} &= \gamma_{00} + u_{0j} \\ \beta_{1j} &= \gamma_{10}, \ldots, \beta_{6j} = \gamma_{60} \end{aligned}$$

where Y_{ij} was the cortisol outcome variable of interest (i.e., reactivity or recovery during conflict or personal concern discussion) of individual i in couple j. Baseline and peak cortisols were included as predictors of reactivity and recovery, respectively. We allowed the intercept to vary randomly and specified all other effects as fixed. In other words, we expected that couples would vary in their mean cortisol response, but that the effects of our predictors would not vary across couples. In accordance with prior recommendations (Campbell & Kashy, 2002; Kenny & Cook, 1999), we grand mean centered all variables before entering them into the model.

Results are presented in Table 3. All coefficients presented in the table and reported in the text are unstandardized. As predicted, baseline and peak cortisol predicted reactivity and recovery, respectively, during both discussions. Actor anxiety was a marginal predictor of recovery from the personal concern discussion, such that higher levels of anxiety were associated with less reactivity, $B = -0.049$, $t(53) = -1.73$, $p = .09$, but no other attachment variables were significant predictors.

To test whether the effects of attachment on cortisol varied by gender, we ran a second set of models which specified sex-specific parameters. These models took the following form:

$$\begin{aligned} Y_{ij} &= \beta_{m1j}\ (\text{male intercept}) \\ &\quad + \beta_{f2j}\ (\text{female intercept}) \\ &\quad + \beta_{m3j}\ (\text{male baseline OR peak}) \\ &\quad + \beta_{f4j}\ (\text{female baseline OR peak}) \end{aligned}$$

Table 3. *Estimation of predictors of cortisol reactivity and recovery*

	Conflict discussion				Personal concern discussion			
Reactivity: Fixed effects	*B*	*SE*	*t* (*df*)	*p*	*B*	*SE*	*t* (*df*)	*p*
Intercept	−0.03	0.03	−1.81 (29)	.25	−0.02	0.03	−0.89 (29)	.38
Sex	−0.00	0.03	−0.16 (53)	.87	−0.03	0.03	−1.14 (53)	.26
Baseline cortisol	−0.59**	0.14	−4.21 (53)	.00	−0.39*	0.15	−2.64 (53)	.01
Actor anxiety	0.01	0.03	1.07 (53)	.29	0.03	0.03	0.88 (53)	.38
Partner anxiety	−0.02	0.03	−0.50 (53)	.62	−0.01	0.03	−0.29 (53)	.78
Actor avoidance	0.01	0.03	0.37 (53)	.72	−0.00	0.03	−0.08 (53)	.94
Partner avoidance	0.03	0.03	0.96 (53)	.34	0.05	0.03	1.55 (53)	.13
Random effects	Variance component	*SD*	χ^2 (*df*)	*p*	Variance component	*SD*	χ^2 (*df*)	*p*
u_0	0.00	0.01	24.09 (29)	> .50	0.00	0.01	24.40 (29)	>.50
e_{ij}	0.04	0.20			0.04	0.21		
Recovery: Fixed effects	*B*	*SE*	*t* (*df*)	*p*	*B*	*SE*	*t* (*df*)	*p*
Intercept	−0.07**	0.21	−3.19 (29)	.00	−0.01	0.02	−0.58 (29)	.57
Sex	0.02	0.21	0.92 (53)	.36	−0.01	0.02	−0.28 (53)	.78
Peak cortisol	−0.49**	0.10	−4.71 (53)	.00	−0.34**	0.10	−3.43 (53)	.00
Actor anxiety	0.00	0.27	0.05 (53)	.96	−0.05†	0.03	−1.73 (53)	.09
Partner anxiety	−0.01	0.03	−0.40 (53)	.69	0.03	0.03	0.88 (53)	.38
Actor avoidance	0.02	0.03	0.60 (53)	.55	−0.02	0.03	−0.79 (53)	.43
Partner avoidance	0.01	0.03	0.34 (53)	.74	0.05	0.03	1.64 (53)	.11
Random effects	Variance component	*SD*	χ^2 (*df*)	*p*	Variance component	*SD*	χ^2 (*df*)	*p*
u_0	0.00	0.00	24.73 (29)	> .50	0.00	0.00	17.63 (29)	>.50
e_{ij}	0.03	0.16			0.03	0.17		

Note. Gender coded as 1 (*female*) and −1 (*male*). All cortisol variables were log transformed prior to analysis, and all predictors were grand mean centered. *B* = unstandardized least squares estimate of regression coefficient; *SE* = standard error of the regression coefficient.

† $p < .10$. ** $p < .01$. * $p < .05$.

$$
\begin{aligned}
&+ \beta_{m5j}\ \text{(male actor anxiety)}\\
&+ \beta_{f6j}\ \text{(female actor anxiety)}\\
&+ \beta_{m7j}\ \text{(male actor avoidance)}\\
&+ \beta_{f8j}\ \text{(female actor avoidance)}\\
&+ \beta_{m9j}\ \text{(male partner anxiety)}\\
&+ \beta_{f10j}\ \text{(female partner anxiety)}\\
&+ \beta_{m11j}\ \text{(male partner avoidance)}\\
&+ \beta_{f12j}\ \text{(female partner avoidance)}\\
&+ e_{ij}.
\end{aligned}
$$

$$\beta_{m1j} = \gamma_{10}, \ldots, \beta_{f12j} = \gamma_{12}$$

Results are presented in Table 4. For women, higher levels of partner avoidance predicted greater reactivity to both discussions, controlling for baseline cortisol, actor anxiety and avoidance, and partner anxiety, $B_{\text{conflict}} = 0.09,\ t(48) = 2.02,\ p < .05$; $B_{\text{personal}} = 0.13,\ t(48) = 2.44,\ p < .05$. In other words, women whose partners were high in avoidance showed attenuated declines in cortisol to both discussions, as compared to women whose partners were low in avoidance. Higher levels of male actor anxiety predicted greater reactivity to the conflict discussion, controlling for baseline cortisol, actor avoidance, and partner anxiety and avoidance, $B = 0.19,\ t(48) = 3.06,\ p < .01$. This finding indicates that men who were high in anxiety had greater reactivity to the conflict discussion than men who were low in anxiety. Actor and partner attachment did not predict recovery from either discussion among men or women. To illustrate these findings, predicted cortisol reactivity for women whose partners are high and low in avoidance (± 1 *SD*) are plotted in Figure 1. Predicted cortisol responses to the conflict discussion for men who are high and low in anxiety (± 1 *SD*) are presented in Figure 2.

Subjective experience as a potential mediator

To test whether subjective experience mediated the gender-specific effects of attachment on cortisol reactivity, we examined the correlations among attachment and discussion ratings. Among women, higher levels of actor anxiety were associated with marginally lower ratings of satisfaction during the personal concern discussion ($r = -.33$, $p = .08$) and higher levels of actor avoidance were associated with marginally greater desire to quit during the personal concern discussion ($r = .34,\ p = .08$). Higher levels of partner anxiety and avoidance were associated with greater ratings of stress ($r = .46$, $p < .05$) and desire to quit ($r = .43,\ p < .05$) during the personal concern discussion, and higher levels of partner avoidance were associated with marginally greater ratings of stress ($r = .32,\ p = .10$) and desire to quit ($r = .37,\ p = .06$). Interestingly, actor and partner attachment were not correlated with any ratings of the conflict discussion among women.

Among men, the most consistent associations were seen between actor anxiety and subjective experience, such that men who were higher on anxiety rated both discussions as more stressful ($r_{\text{personal}} = .55,\ p < .01$; $r_{\text{conflict}} = .47,\ p < .05$) and reported a marginally greater desire to quit during the personal concern discussion ($r = .32,\ p = .09$). Higher levels of actor avoidance were associated with greater ratings of stress ($r = .44,\ p < .05$) and marginally greater desire to quit ($r = .34,\ p = .07$) during the personal concern discussion. Finally, men whose partners were higher in avoidance rated the conflict discussion as more stressful ($r = .42$, $p < .05$).

Among women, partner avoidance was correlated with marginally greater ratings of stress and desire to quit during the personal concern discussion, but neither of these variables was related to cortisol reactivity ($r_{\text{stress}} = .18,\ p = .37$; $r_{\text{quit}} = .12,\ p = .54$). Among men, actor anxiety was correlated with greater ratings of stress during the conflict discussion, but stress was not correlated with cortisol reactivity ($r = .11,\ p = .42$). Given the lack of association between these potential mediators and cortisol outcomes, we did not conduct formal tests of mediation.

Discussion

This study examined the effects of actor and partner attachment on cortisol responses to discussions of personal and relationship concerns with a romantic partner. Hierarchical linear modeling revealed that among women,

Table 4. *Estimation of Level 1 predictors of cortisol reactivity and recovery in sex-specific models*

	Conflict discussion				Personal concern discussion			
Variable	*B*	*SE*	*t* (*df*)	*p*	*B*	*SE*	*t* (*df*)	*p*
Reactivity								
Male intercept	0.23*	0.10	2.22 (48)	.03	0.13	0.13	1.00 (48)	.31
Female intercept	−0.28*	0.10	−2.83 (48)	.01	−0.17	0.12	−1.44 (48)	.16
Male baseline cortisol	−0.93**	0.17	−5.33 (48)	.00	−0.54†	0.28	−1.92 (48)	.06
Female baseline cortisol	−0.24	0.19	−1.25 (48)	.22	−0.19	0.19	−1.02 (48)	.31
Male actor anxiety	0.19**	0.06	3.06 (48)	.00	0.07	0.07	0.99 (48)	.33
Female actor anxiety	0.01	0.04	0.32 (48)	.75	0.02	0.04	0.53 (48)	.60
Male actor avoidance	−0.04	0.05	−0.92 (48)	.36	−0.01	0.05	−0.12 (48)	.91
Female actor avoidance	0.02	0.04	0.43 (48)	.67	−0.28	0.05	−0.58 (48)	.57
Male partner anxiety	−0.05	0.04	−1.22 (48)	.23	−0.02	0.04	−0.51 (48)	.62
Female partner anxiety	−0.07	.06	−1.16 (48)	.25	−0.02	0.07	−0.24 (48)	.81
Male partner avoidance	−0.01	0.04	−0.32 (48)	.75	0.00	0.06	0.04 (48)	.97
Female partner avoidance	0.09*	0.05	2.02 (48)	.05	0.13*	0.05	2.44 (48)	.02
Recovery								
Male intercept	−0.04	0.09	−0.45 (48)	.65	0.10	0.08	1.25 (48)	.22
Female intercept	−0.09	0.08	−1.11 (48)	.28	−0.12	0.07	−1.59 (48)	.12
Male peak cortisol	−0.59**	0.15	−3.79 (48)	.00	−0.51**	0.15	−3.30 (48)	.00
Female peak cortisol	−0.45**	0.17	−2.67 (48)	.01	−0.20	0.13	−1.50 (48)	.14
Male actor anxiety	0.05	0.06	0.73 (48)	.47	−0.05	0.06	−0.80 (48)	.43
Female actor anxiety	0.01	0.03	0.17 (48)	.86	−0.03	0.04	−0.93 (48)	.36
Male actor avoidance	−0.04	0.04	−0.84 (48)	.40	−0.04	0.05	−0.91 (48)	.37
Female actor avoidance	0.05	0.04	1.44 (48)	.16	−0.00	0.04	−0.07 (48)	.94
Male partner anxiety	−0.02	0.04	−0.43 (48)	.67	0.04	0.04	1.10 (48)	.28
Female partner anxiety	−0.04	0.06	−0.77 (48)	.44	−0.03	0.06	−0.54 (48)	.59
Male partner avoidance	0.01	0.04	0.33 (48)	.74	0.06	0.04	1.53 (48)	.13
Female partner avoidance	0.00	0.05	0.18 (48)	.86	0.04	0.05	0.92 (48)	.36

Note. Gender coded as 1 (*female*) and −1 (*male*). All cortisol variables were log transformed prior to analysis, and all predictors were grand mean centered. *B* = Unstandardized least-squares estimate of regression coefficient, *SE* = standard error of the regression coefficient.
** $p < .01$. * $p < .05$. † $p < .10$.

higher levels of partner avoidance predicted greater reactivity to both discussions, and among men, higher levels of actor anxiety predicted greater reactivity to the conflict discussion. Although aspects of actor and partner attachment have been associated with cortisol responding during conflict in previous work (Powers et al., 2006), this study is the first to demonstrate that actor and partner attachment also influence cortisol responding during nonconflictual exchanges involving the exchange of social support.

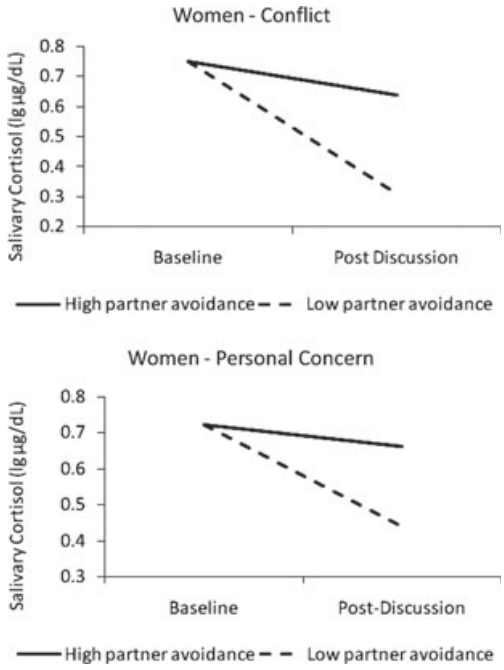

Figure 1. Predicted female cortisol responses to conflict and personal concern discussions, at ±1 *SD* partner avoidance.
Note. Postdiscussion values were obtained 40-min postdiscussion onset.

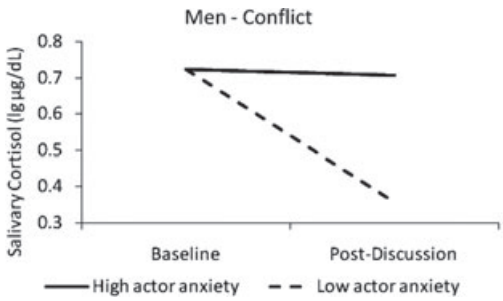

Figure 2. Predicted male cortisol responses to conflict discussion, at ±1 *SD* actor anxiety.
Note. Postdiscussion values were obtained 40 min postdiscussion onset.

Partner attachment and cortisol

Women with more avoidant partners had greater reactivity to both discussions, as compared to women with less avoidant partners, controlling for the woman's own levels of anxiety and avoidance and the partner's level of anxiety. The fact that we did not observe this effect among men is consistent with evidence that the association between physiological responding and a partner's negative behavior is stronger among women (Ewart, Taylor, Kraemer, & Agras, 1991; Smith, Gallo, Goble, Ngu, & Stark, 1998). However, these findings are inconsistent with those of Powers and colleagues (2006), who found no effect of partner attachment on cortisol among women. The discrepancy between studies could reflect our modest sample size, which may have hindered our ability to detect actor effects among women, methodological differences (i.e., our discussion task was 5 min longer), and differences in sample composition (i.e., our sample was older and considerably more diverse).

The fact that partner avoidance, but not anxiety, predicted cortisol reactivity among women suggests that the presence of an anxious partner may be less physiologically activating than the presence of an avoidant partner, even though people with anxious partners tend to be less satisfied with their relationships (Banse, 2004). As compared to anxious individuals, avoidant individuals may be more likely to exhibit negative behaviors in a laboratory discussion context. Consistent with this premise, avoidant partners showed more anger to a female partner undergoing a laboratory stressor (Simpson et al., 1992), behaved more negatively toward a partner while the partner waited to perform a stressful task (Campbell, Simpson, Kashy, & Rholes, 2001), were less supportive when separating from their partner at the airport (Fraley & Shaver, 1998) and when discussing stressful life events with their partner (Collins & Feeney, 2000), and were perceived as poorer caregivers (Kane et al., 2007), as compared to less avoidant individuals. In addition, it may be difficult to interact with an avoidant partner when he is discussing his personal or relationship concerns because the avoidant partner's extreme self-reliance makes him unlikely to ask for help (Collins & Feeney, 2000).

The detached and withdrawn behaviors of an avoidant partner may activate the HPA axis in part because they are perceived as uncontrollable and confer negative evaluation,

two key predictors of cortisol responding (Dickerson & Kemeny, 2004). There is evidence from laboratory studies that a partner's withdrawal behavior is associated with elevations in cortisol: In a study of newlyweds, Kiecolt-Glaser and colleagues (1996) found that greater likelihood of the husband's withdrawal in response to the wife's negative behavior was associated with elevated plasma cortisol for the remainder of the day among wives. Similarly, Heffner and colleagues (2006) found that older couples who reported wife demand/husband withdraw patterns in their marriage had greater cortisol responses to a conflict discussion. This pattern whereby one partner (typically the woman) communicates criticism, blame, and threats while the other partner (typically the male) withdraws from the interaction has been documented in the marital literature (Christensen, 1987; Christensen & Heavey, 1990) and may describe the interactions of couples in which one partner is avoidant.

Actor attachment and cortisol

Among men, higher levels of actor anxiety predicted greater cortisol reactivity to the conflict discussion, controlling for the man's level of avoidance and the woman's levels of anxiety and avoidance, but a woman's own levels of anxiety and avoidance did not predict any cortisol parameter in either discussion. These findings are consistent with Powers and colleagues (2006), who found that higher levels of actor anxiety predicted greater reactivity to a conflict discussion among men, but not women.

Anxious individuals experience relationship conflict as more distressing than secure individuals (Campbell, Simpson, Boldry, & Kashy, 2005). This may especially be the case for anxious men because the act of voicing relational concerns could violate gender normative expectations that men are less communal than women and are less attuned to close relationships (Eagley, 2009). Indeed, men are less likely than women to initiate conflict discussions in romantic relationships (Christensen & Heavey, 1990). Disclosing relationship concerns may be therefore more novel and threatening for men, particularly among those who are higher in attachment anxiety (Powers et al., 2006).

Subjective experience as a potential mediator

The effects of partner avoidance and actor anxiety on cortisol could not be accounted for by subjective experience, although our ability to detect mediation was limited by our sample size. Women with more avoidant partners rated the personal concern discussion as more stressful and reported a greater desire to quit, and more anxious men rated the conflict discussion as more stressful, but none of these ratings was related to cortisol reactivity or recovery and thus could not account for the effects. These findings are consistent with previous work, in which the correlation between subjective reports and physiology range from modest to nonexistent (Cacioppo, Gardner, & Bernston, 1999; Lang, 1994).

In general, ratings of the task were more closely related to partner attachment among women, and actor attachment among men. These findings suggest that women may be more closely attuned to their partner's behaviors than men during intimate conversations. However, it is interesting to note that women with more avoidant partners did not rate their partners as less supportive, although a body of work demonstrates that avoidant individuals are in fact less responsive to their partner's needs. Subjective appraisals of partner behavior may involve deliberate, controlled processing and may be heavily influenced by motivational factors such as a desire to see the partner positively. Thus, women with avoidant partners may have detected their partner's behavior as threatening, but this information may not be reflected in conscious awareness or self-report. In other work, high cortisol responses in naturalistic settings have not been accompanied by conscious perceptions of stress (e.g., Fischer, Calame, Dettling, Zeier, & Fanconi, 2000), a finding that may have implications for intimate relationships (Kiecolt-Glaser, Bane, Glaser, & Malarkey, 2003). Future work ought to address the mechanisms

by which partner avoidance influences physiological responding during interactions with the partner, perhaps by using behavioral coding, eye tracking, or other methods of behavioral assessment.

Limitations and future directions

An important limitation of this study is the modest sample size, which limited our ability to test for interactions between actor and partner attachment and may have prevented us from detecting additional effects. In addition, our sample was composed of dating couples who were relatively satisfied in their relationships and who were low on attachment avoidance and anxiety. It is possible that the effects of attachment would be stronger among highly anxious or avoidant individuals or in distressed couples. Future work ought to examine whether the effects of partner attachment on cortisol vary as a function of these factors.

Inconsistent with previous work (Powers et al., 2006), we found no effects of actor or partner attachment on recovery from either discussion, which may be due in part to the fact that our recovery indices were based on two time points. It may be necessary to measure salivary cortisol at more time points over a longer interval to sufficiently capture variability in recovery. In addition, the psychosocial antecedents of recovery are also not well understood, and thus far appear to involve similar situational antecendents (i.e., social evaluative threat, uncontrollability) as reactivity (Dickerson & Kemeny, 2004). An additional question for future research involves the health implications of individual differences in cortisol reactivity and recovery. Although theory suggests that both exaggerated reactivity and delayed recovery are deleterious because they lead to greater hormone exposure (McEwen & Seeman, 1999; Sapolsky, Romero, & Munck, 2000), the health relevance of these parameters is not clear.

The design of our study does not permit us to draw conclusions about the effects of disclosing concerns versus responding to a partner's concerns, as our cortisol measures reflect responses to the entire 20-min discussion, in which both partners discussed issues of personal importance. Although some studies have assigned one participant to a support recipient role and the other participant to a support provision role (e.g., Simpson et al., 1992), we did not structure our discussion this way because it would reduce our ability to make comparisons with the conflict discussion. Essentially, we sought to create a task that resembled the conflict discussion in form but not structure, which made it essential that both partners were allowed to speak freely and contribute their own concerns. In addition, laboratory studies in which one participant is assigned the support recipient role do not closely resemble the types of interactions couples have in daily life. Conversations are rarely one-sided, and by asking both partners to disclose concerns during the 20-min discussion, we sought to encourage a naturalistic exchange similar to the discussions couples have in daily life. The fact that participants rated the discussion as "highly similar" to the types of interactions they had in daily life is evidence for the external validity of the discussion task.

Our findings demonstrate that within dating couples, aspects of actor and partner attachment influence cortisol responses to a discussion with a partner, and these effects vary by gender and by the discussion context. These results highlight the need to account for the interdependence between romantic partners, as in some instances the effects of a partner variable can be stronger than the actor variable. This work has important implications for our understanding of basic questions about attachment and physiology, as well as our understanding of how relationships influence health. These findings help illuminate how relationships get under the skin, and how an individual's characteristic ways of thinking about and behaving in close relationships influence the ways that relationship gets under the skin.

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