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Cardiovascular Reactivity During Positive and Negative Marital Interactions

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Abstract Marriage reduces risk of cardiovascular disease (CVD) but marital stress increases risk, perhaps through cardiovascular reactivity (CVR). However, previous studies have lacked controls necessary to conclude definitively that negative marital interactions evoke heightened CVR. To test the specific effects of marital stress on CVR, 114 couples engaged in positive, neutral, or negative interactions in which speaking and task involvement were controlled. Compared to positive and neutral conditions, negative discussions evoked larger increases in systolic blood pressure, heart rate, and cardiac output, and larger decreases in peripheral resistance and pre-ejection period—similarly for men and women. Hence, CVR could contribute to the effects of marital difficulties on CVD. Previous evidence of sex differences in this effect might reflect factors other than simple reactivity to negative interactions.

Keywords Cardiovascular reactivity · Marital interaction · Marital conflict · Interpersonal circumplex · Psychosocial risk · Impedance cardiography

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Introduction

Socially isolated individuals and those who report low levels of social support are more likely to develop cardiovascular disease (CVD) than are persons with more extensive and satisfying social networks (Berkman 1995; Uchino 2004). As a source of social integration and support, marriage reduces CVD risk, although apparently more so for men than women (Kiecolt-Glaser and Newton 2001). Yet, marriage may also be a source of stress, contributing to CVD risk. For example, marital strain and disruption have been associated with greater atherosclerosis, hypertensive complications, incidence of CVD and poor prognosis among persons with heart disease (Baker et al. 2000; Coyne et al. 2001; Gallo et al. 2003; Matthews and Gump 2002; Orth-Gomer et al. 2000).

Psychophysiological mechanisms may contribute to these effects. Increases in blood pressure (BP) and heart rate (HR) in response to stressors (i.e., cardiovascular reactivity; CVR) and related neuroendocrine responses are hypothesized to promote hypertension, atherosclerosis, stroke and coronary heart disease (CHD) (Kop 1999; Treiber et al. 2003). Individuals with higher levels of social support display attenuated physiological responses to laboratory stressors, and experimental manipulations of support similarly reduce these responses (Kamarck et al. 1998; Leopre 1998; Uchino et al. 1996). Through this mechanism, support in marriage could reduce CVD risk (Cohen et al. 1994).

Moreover, aversive social interactions—including marital conflict—heighten these psychophysiological responses (Robles and Kiecolt-Glaser 2003; Smith et al. 2003). In laboratory studies, marital conflicts evoke increases over baseline in HR, BP, and neuroendocrine variables (e.g., catecholamines; cortisol). These physiological changes are larger than those observed in control tasks such as simple speaking or neutral marital interaction tasks, and are also often positively correlated with negative affect and hostile behavior during conflict, and with reports of marital strain (e.g., Broadwell and Light 1999; Ewart et al. 1991; Kiecolt-Glaser et al. 1993, 1997; Mayne et al. 1997; Newton and Sanford 2003). Such findings are consistent with the hypothesis that marital stress could contribute to the development of CVD through the mechanism of CVR.

Potential Sources of CVR in Studies of Marital Conflict

Overall marital quality (e.g., satisfaction versus distress) consists of both positive aspects of the relationship (e.g., warmth, affection, support, etc.) and negative features—particularly conflict (Fincham and Linfield 1997; Mattson et al. 2007). Specific descriptions or definitions of marital conflict are varied and evolving (Fincham and Beach 1999), but commonly involve negative behaviors (e.g., criticism, blame, hostile control, withdrawal), related affect (e.g., anger, contempt, anxiety), and cognitive process (e.g., attributions of hostile intent), typically assessed when couples discuss an area or topic of disagreement or conflicting goals (Fincham and Beach 1999; Snyder et al. 2005). Methodological features of prior studies may limit the conclusion that marital conflict evokes CVR. In most of these studies, the marital interaction tasks are unstructured; after a resting baseline couples discuss, in a relatively natural manner, a topic that has been a source of conflict for them. This procedure has the advantage of increasing the likelihood that conflicts studied in the laboratory resemble naturally occurring conflicts. However, unstructured tasks also involve factors beyond the specific conceptualization of marital conflict that could also contribute to CVR. Hence, this complexity of naturalistic conflict tasks provides important mundane realism or ecological validity, but also creates the possibility that factors other than marital conflict contribute to CVR observed during these laboratory tasks.

For example, at the most basic level of possible confounding factors, speaking increases HR and BP, and the rate and loudness of speech are positively related to CVR (Siegman et al. 1992). The simple act of speaking during conflict could account for much of the observed increase in HR and BP over baseline levels. Hence, in some of these prior studies it is difficult to determine the extent to which CVR during marital conflict tasks reflects the construct of interest rather than the effects of speech. Marital conflict discussions might also evoke high levels of engagement in a personally relevant task or apprehension about evaluation by experimenters given the personal nature of the discussion. These factors could also contribute to the CVR during marital conflict (Smith et al. 1997; Wright and Kirby 2001). These potential influences on CVR are beyond the typical conceptualization of marital conflict, and could also covary with negative affect and hostile behavior observed during marital interaction. Therefore, associations of behavioral or affective indicators of negativity with CVR in such studies could reflect the influence of factors other than marital conflict, per se.

Studies that include comparisons with tasks that involve speaking (e.g., reading, neutral marital discussion) rather than comparisons only with resting baselines reduce the viability of some of these alternative explanations for CVR observed during discussions of conflict topics (e.g., Broadwell and Light 1999). However, even when speaking is controlled through appropriate comparison conditions, CVR during conflict could reflect generally emotional social interactions rather than specifically negative ones. For example, in a previous study we found that young women attempting to provide social support demonstrated increased CVR relative to a comparison condition involving a neutral interaction task, even though the support task was experienced as warm and friendly (Nealey et al. 2002). Some correlational evidence is inconsistent with the possibility that CVR during marital conflict reflects generally emotional rather than specifically negative aspects of the interaction. For example, CVR during marital interaction has been found to be associated with the level of negative behavior during the interaction but not positive behavior (e.g., Ewart et al. 1991). However, experimental manipulation of marital conflict with controls for the generally personal and emotional nature of the task and other alternative influences on CVR are required to support a more definitive conclusion that marital stress or conflict per se heightens these responses.

To summarize these concerns about the interpretive ambiguities of prior research, marital conflict discussions are typically engaging, personally revealing or involving, and often characterized by vigorous speech. However, not all marital interactions that have those characteristics also involve the negative affect, criticism and other negative behaviors, and perceptions of the spouse as unfriendly and perhaps domineering that is typical in marital conflict (Fincham and Beach 1999; Snyder et al. 2005). If marital conflict and strain contribute to subsequent cardiovascular health through the mechanism of CVR, then conflictual marital interactions should evoke greater CVR than marital interactions that are similar in levels of speech, task involvement, and personal content but otherwise lack these defining elements of conflictual or stressful interactions. The present study was designed to evaluate CVR during negative or conflictual marital interactions more specifically, by using a procedure that permitted more control over speaking, task involvement, and general affective engagement. It is important to note that greater experimental control over potentially extraneous factors during marital conflict tasks inherently involves more structure and as a result potentially less realistic or ecologically valid couple interactions. However, without such controls, the potential confounding factors described above are viable alternative interpretations of the causes of CVR observed during the typical unstructured tasks. Therefore, multiple studies using a variety of methods that vary along this continuum of precision and control versus mundane realism and ecological validity are required to identify the psychophysiological effects of marital conflict, and the present study was intended to address a relative lack of studies emphasizing more precise controls in this overall literature.

Sex Differences in CVR during Marital Conflict

This issue regarding potential confounding factors during typical marital conflict tasks and the value of related experimental controls is also relevant to conclusions regarding sex differences in CVR during marital conflict. In several studies the effects of marital conflict on physiological response are larger for women than men (Kiecolt-Glaser and Newton 2001). The greater health benefits of marriage for men than women may be due to such sex differences in the physiological effects of conflict—even in generally supportive relationships (Kiecolt-Glaser and Newton 2001). Problems in close relationships are common and generally more troubling to women than men (Davis et al. 1999), perhaps due to female gender roles that emphasize the importance of relationship quality (Cross and Madson 1997; Helgeson 1994). Hence, women may generally experience more "everyday" strain in marriage than men. The greater physiological effects of such normative relationship stress for women might undermine the health benefits of this source of social support (Kiecolt-Glaser and Newton 2001).

However, if men and women differ in task engagement or speech parameters during marital disagreement, then sex differences in CVR during conflict might reflect these factors rather than differential reactivity to marital stress. For example, during conflict wives often pursue a point of disagreement and request change while their husbands respond by limiting their involvement. This *demand-withdrawal* pattern (Christensen and Heavey 1990) might produce a sex difference in task engagement or speech parameters that could, in turn, account for women's greater CVR. That is, women's greater CVR during typical conflict discussions might not reflect the fact that they experience such events as more stressful or aversive than do men, but instead reflect the fact that women are more actively engaged in the task or simply speaking more or more vigorously. Some evidence supports this view; factors such as which spouse identifies the problem area to be discussed have been found to moderate sex differences in CVR during marital interaction (Denton et al. 2001; Newton and Stanford 2003).

If women display more CVR than men during realistic laboratory-based marital conflict discussions that resemble their actual interactions in daily life, it could be argued that the specific source of that greater response (e.g., greater task involvement or more speech versus experiencing conflict as more threatening or stressful) is unimportant. Their greater CVR is still a viable explanation of the sex difference in the health benefits of marriage. However, more precise understanding of the sources of any sex difference in CVR during marital interactions has clear implications for explicating such interpersonal effects on health, as well as the design of related risk-reducing interventions.

The Present Study

We attempted to provide a more definitive test of the specific effects of marital conflict on CVR and related sex differences. In a negative discussion condition intended to resemble marital conflicts, husbands and wives took turns describing traits that they disliked in their spouse, as criticism is a common component of marital conflict (Fincham and Beach 1999; Snyder et al. 2005). The turn-taking procedure generally equated husbands' and wives' speaking and task engagement. In a neutral condition, spouses described their partner's daily schedule. These two tasks differed in the level of conflict and negativity, but were similar in other influences on CVR (e.g., amount of speech). In a third similarly structured condition, spouses took turns describing characteristics they appreciated about each other. This provided a test of the specific effects of conflict through a comparison with a task that not only involved similar levels of speaking but also involved personal content and was emotionally engaging. Further, by examining the effect of these conditions while participants prepared silently for the tasks, listened silently to their spouse's comments, and while participants spoke, we could determine if the effects on marital conflict on CVR occurred generally or only during speech.

Recent models of sex differences in stress responses emphasize their quality rather than only their magnitude (Taylor et al. 2000). Therefore, we measured cardiac sympathetic and parasympathetic activity and other determinants of CVR, via impedance cardiography (Sherwood et al. 1990a). Cardiac pre-ejection period (PEP) and respiratory sinus arrhythmia (RSA) reflect sympathetic and parasympathetic influences on heart rate, respectively (Cacioppo et al. 1994). Further, blood pressure reactivity can reflect increases in cardiac output (CO) or total peripheral resistance (TPR). These determinants are influenced by distinct psychological processes (Smith et al. 2000; Tomaka et al. 1993) and may also differ for men and women (Allen et al. 1993; Girdler et al. 1990; Lawler et al. 1995). As manipulation checks we assessed affective responses and perceptions of the spouse's behavior. We expected that the neutral discussion would evoke cardiovascular activation over baseline and that the positive discussion would evoke some additional activation (Nealey et al. 2002). However, consistent with the hypothesis that negative marital interactions specifically pose a cardiovascular risk, we expected that the negative discussion would evoke even more activation. Finally, although prior studies suggest that women are more reactive to marital conflict than men, we anticipated that controls over speaking, task engagement and other influences on CVR might attenuate or even preclude such sex differences.

Method

Participants

Married couples were recruited through advertisements on the University of Utah campus, in the surrounding community, and in local newspapers. Couples were excluded if they were married for less than nine months, diagnosed with CVD, taking medication that affected CVR (e.g., beta-blockers), or were currently pregnant. Couples received $40 for participation. After screening for the exclusion criteria, 114 couples completed the protocol (i.e., 38 couples randomly assigned to each of three conditions). The mean age of the men was 30.1 years and 28.5 years for women. Most participants were married for 1–3 years (52.1%), were non-smoking (93.4%), employed full or part-time (80.9% of men, 63.7% of women), and enrolled in college or university classes full or part-time (64.1% of men, 43.8% of women). The majority were White (88%), with the remainder being Hispanic (5.3%) or Asian (3.5%).

Measures

State Affect and Perceptions of Spouse Behavior

Prior to the marital interaction task, participants completed questionnaires regarding demographic and health behavior information (e.g., length of marriage, medication use, smoking). Participants also completed a measure of state affect at the conclusion of the baseline period and after the discussion task. This 12-item measure of state anxiety and anger was derived from the State-Trait Personality Inventory (Spielberger 1980). An anxiety subscale score was calculated from four positively worded items (i.e., reflecting anxiety, nervousness, etc.) and two negatively worded items (i.e., reflecting relaxation). Similarly, an anger subscale was calculated from four of the original positively worded items (i.e., reflecting irritation, aggravation) and two negatively worded items not found on the original scale that we added in order to reduce floor effects (i.e., "I feel kind and warmhearted" and "I feel friendly"). Participants were asked to indicate how they felt during the most recently completed experimental period. In previous uses, these subscales have been reliable (Cronbach's alpha >.80) and sensitive to related experimental manipulations (Gallo et al. 2000; Nealey et al. 2002; Smith et al. 2004).

In an approach described elsewhere (Smith et al. 2003), we have developed the use of the Interpersonal Circumplex (IPC) (Wiggins 1996) to evaluate social context manipulations in psychophysiological studies (Gallo et al. 2000; Smith et al. 1996, 1998, 2004). In the IPC, interpersonal behavior varies along two dimensions—hostility versus friendliness (i.e., cold and quarrelsome versus warm and agreeable) and dominance versus submissiveness (i.e., controlling versus compliant) (Kiesler 1996). In the present study, at the conclusion of the task participants rated their spouses' behavior during the interaction using a circumplex version of the Impact Message Inventory (IMI-C; Kiesler et al. 1997). This 32-item measure consists of eight four-item subscales corresponding to dominance, submissiveness, friendliness, and hostility, as well as the four combinations of these characteristics (e.g., friendly-dominance; hostile-submissiveness). Overall scores for the two main IPC dimensions are created through weighted combinations of subscales. The IMI-C has the predicted circumplex structure, and the dimension scores are internally consistent and valid (Kiesler et al. 1997; Schmidt et al. 1999). The measure has also been found to be sensitive to experimental manipulations of social context (e.g., Nealey et al. 2002; Smith et al. 2004). Elsewhere (Traupman et al. 2007) we have demonstrated that reports of chronic marital conflict are associated with rating the spouse as unfriendly and controlling on this measure. In contrast, reports of greater marital satisfaction and support are associated with ratings of the spouse as warm.

Physiological Measures

Dinamap 8100 monitors (Critikon; Tampa, FL) assessed systolic and diastolic blood pressure (SBP, DBP). An occluding cuff was attached to the upper portion of the non-dominant arm. Blood pressure readings were taken at 1-min intervals during all experimental periods. Electrocardiogram (ECG), basal thorasic impedance (Zo), and the first derivative of the impedance signal (dZ/dt) were measured continuously using Minnesota Impedance Cardiographs (Model 304B, Surcom; Minneapolis, MN). This allows for the measurement of heart rate (HR), stroke volume (SV), and pre-ejection period (PEP), and the estimation of cardiac output (CO) and total peripheral resistance (TPR) (Sherwood et al. 1990a). Consistent with guidelines (Sherwood et al. 1990a), four band electrodes were placed in the tetrapolar configuration. Voltage bands were placed at the base of the neck and at the xiphisternal junction, and current electrodes were placed at least 3 cm distal to the voltage electrodes. A 4-mA AC current at 100 kHz was passed through the two current bands, and the Zo and dZ/dt signals were recorded from the voltage electrodes. The ECG, Zo, and dZ/dt signals were digitized at 500 Hz. We ensemble averaged these data in 1-min epochs and verified or edited the waveforms before conducting analyses. Using the Kubicek equation, SV was estimated and CO was calculated in l/min as HR × (SV/1000) (Sherwood et al. 1990a, b). On the basis of mean arterial pressure (MAP) and CO, TPR was calculated in resistance units (dynes s cm^{-5}) as TPR = MAP/CO × 80 (Sherwood et al. 1990a). PEP was calculated as the time interval in ms between the Q-point of the ECG and the B-point of the dZ/dt signal. In this manner, HR, PEP, CO and TPR vales were determined for each 1-min interval of all experimental periods.

RSA was calculated on the basis of the digitized interbeat intervals (IBI) from the ECG, initially checked and edited for artifacts using the detection algorithm of Berntson et al. (1990). A heart period time series was created from the IBI using the weighted beat algorithm described by Berntson et al. (1995). Sharp transitions in the heart period time series (e.g., arrhythmias) were detected and removed by smoothing (Berntson et al. 1990). A linear polynomial was fit to, and subtracted from, the heart period time series (Litvack et al. 1995). This linear detrending acted as a high pass filter, removing very large ultralow frequency trends (including the DC component) from the input signal. The heart period time series was then band-pass filtered from .12 to .40 Hz (Neuvo et al. 1984). The power spectrum of the heart period time series was calculated via a fast Fourier transformation and scaled to ms^2/Hz. RSA was calculated for each minute of all experimental periods as a natural log of the area under the heart period power spectrum within the corner frequencies of the band-pass filter (Litvack et al. 1995).

Procedure

Baseline Period

Sessions were conducted in a two-room suite. Participants were seated side by side in comfortable chairs approximately two feet apart in a sound attenuated chamber. They were seated so that they were able to easily look directly at each other by turning their heads slightly. A rationale was delivered by audiotape played over a speaker in the chamber, describing the study as examining physiological effects of speech and emotion. Specifically, participants were told we were examining the hypothesis that people's current emotional experiences are related to the magnitude of cardiovascular responses during speech, and that they would be asked to take part in different types of interactions with their spouse. The experimenter entered the room to answer any questions, and sensors were attached. A curtain was then drawn between the participants, and the experimenter left the chamber to begin a 10-min baseline period. An audiotape led participants through a 10-min minimally involving task or "vanilla baseline" (Jennings et al. 1992). Participants viewed a pair of outdoor photographs (e.g., landscapes from national parks) for 1 min and then indicated which picture they preferred before turning to the next pair (see Gallo et al. 2000; Smith et al. 2000). At the conclusion of this baseline task, participants completed a state affect questionnaire, indicating how they felt during the period.

Discussion Task

Participants listened to further recorded task instructions. In all three conditions, participants were asked to follow tape-recorded instructions which would ask them to alternate speaking and listening. They were told that the discussion would be monitored by the experimenter in the adjoining room. They were instructed to speak for the full time allotted and asked not to speak until it was their turn. Participants were given the option of responding to their spouses' remarks, but were asked to do so only after communicating the information requested in the task description. Couples in the positive discussion condition were given a list of 60 positive attributes (e.g., organized, sensitive, responsible, affectionate, adventurous) and asked to identify three that they appreciated in their spouse. During each of three 1-min speaking periods, they were asked to discuss the ways in which their spouse displayed one of these attributes. Couples in the negative discussion condition were given a list of 60 negative attributes (e.g., disorganized, insensitive, irresponsible, unaffectionate, reckless) and asked to identify three that described their spouse and that they did not appreciate. As in the positive discussion condition, they were asked to discuss one of these three attributes during each of the three speaking periods. In the neutral discussion condition, participants were given a form that prompted them to recall features of their spouse's typical daily schedule. They were asked to describe their spouse's typical morning, afternoon, and evening during the three 1-min speaking periods, respectively.

Participants were given 3 min to prepare silently for the task. The experimenter then entered the participant chamber, drew back the curtain separating the participants and indicated who would speak first. Speaking order was counterbalanced. After the experimenter left the room, tape-recorded instructions led participants through alternating speaking and listening periods. At the conclusion of the task the experimenter re-entered the participant chamber, drew the curtain between them and asked the couples to complete a second state affect questionnaire indicating how they felt during the task and the IMI-C asking them to describe their spouse's behavior during the task.[1]

Reduction of Physiological Measures and Overview of Analyses

Physiological measures from the last 3-min of the baseline period were averaged to form a baseline value for HR, SBP, DBP, PEP, RSA, CO, and TPR. Values from the 3-min preparation period and three speaking and listening periods were similarly averaged to form preparation, speaking and listening values. Change scores were calculated by subtracting average baseline values from each of the three average period values (Llabre et al. 1991). Similarly, baseline anxiety and anger scores were subtracted from their respective task period values.

In the primary analyses, discussion task condition was treated as a between subjects factors, whereas husbands' and wives' responses were treated as a repeated factor to avoid inflation of significance levels due to dependencies in their responses (Kenny 1995). For anxiety, anger, and perceptions of spouse friendliness and dominance, these analyses took the form of two-way mixed ANOVAs: 3 (discussion task condition: positive, neutral, negative) × (2) (spouses: wives, husbands). For analyses of physiological variables, an additional repeated factor (periods: preparation, speaking, listening) was added to form three-way mixed ANOVAs. Effect sizes are presented as eta-squared, interpreted as the proportion of variance in the dependent variable attributable to the group factor. Values of .04, .25, and .64 refer to small, medium, and large effects, respectively (Cohen 1992). Significant ANOVA effects for a-priori predictions were followed with directional mean comparisons using the appropriate error term from the ANOVA model (Bernhardsen 1975), with the test statistic distributed as *t*.

HR, SBP, and DBP were considered as primary measures of CVR, given that they are the most widely studied as predictors of CVD (Treiber et al. 2003). PEP, RSA, CO, and TPR were tested as secondary outcomes, to clarify mechanisms underlying effects on the primary measures. Specifically, PEP and RSA were examined in order to explicate effects on HR, whereas CO and TPR were examined to explicate effects on SBP and/or DBP. Because the rate and loudness of speech can alter physiological responses (Siegman et al. 1992), effects of the discussion condition on CVR could reflect the effects of this artifact, as could any differences between men and women. Therefore, even in the absence of interactions of the task period factor with the discussion condition or spouse factors, we followed significant effects for the spouse and discussion condition factors with analyses within each of the three task periods separately. In this way, we determined if a given effect occurred similarly when participants were speaking and when they were not. Sex main effects and the two-way (Sex × Conditions; Sex × Periods) and three-way interactions with Sex are not significant unless otherwise stated. Degrees of freedom vary in analyses reported below, due to missing data resulting from poor quality impedance cardiography data or equipment failure.

Results

Equivalence of Groups

A series of two-way mixed ANOVAs (Spouse × Condition) and Chi-square analyses tested differences among the groups on demographic and health variables (i.e., age, ethnicity, medication use, smoking, family history of CVD, body mass, weekly exercise amounts, years married). No differences between discussion conditions or Sex × Condition interactions emerged in these analyses. Women reported a higher number of prescription medications, $F(1,111) = 20.4$, $p < .001$, (1.04 for women, .45 for men). Women were significantly younger than men, $F(1,111) = 19.1$, $p < .001$, and they had a smaller body mass index (BMI), $F(1,111) = 13.2$, $p < .001$, (women = 24.1, men = 26.1). Baseline levels of anxiety, anger, SBP, DBP, HR, CO, TPR, PEP, and RSA were examined in similar two-way mixed ANOVAs. No effects involving the

[1] After participants completed questionnaires at the conclusion of the discussion task, they underwent a second 10-min baseline and participated in a second marital interaction task. Using the Couples Problem Inventory (Gottman et al. 1977), participants selected an issue that was currently contentious for both of them (e.g., money, children, in-laws). After a 3-min preparation period, participants took three 1-min turns speaking about the topic and three 1-min turns listening to their spouse in a structured interaction similar to the first task described above (speaking order was counterbalanced). They then continued to discuss the topic for an additional 4 min in an unstructured format. The physiological measures described above were recorded during these periods. Further, spouse ratings of friendliness and dominance, and self-reported anxiety and anger, were assessed as in the first task. This second task provided another opportunity to test sex differences in responses to marital conflict, again in a controlled task but one more closely resembling those used in prior research.

Table 1 Overall mean changes in reported anxiety and anger during the task and ratings of spouse friendliness and dominance for positive, neutral and negative discussion conditions

	Positive	Neutral	Negative
Anger change	$-.70_a$ (.33)	$-.40_a$ (.32)	1.38_b (.33)
Anxiety change	$.74_a$ (.41)	$.50_a$ (.41)	2.47_b (.41)
Spouse friendliness	5.16_a (.24)	3.89_b (.24)	2.83_c (.24)
Spouse dominance	$-.54_a$ (.13)	$-.20_b$ (.13)	$.16_c$ (.13)

Within rows, means with different subscripts differ at $p < .05$ (Bernhardson 1975). Standard errors in parentheses

Condition factor approached significance, but four significant sex differences emerged. Compared to women, men displayed higher levels of resting SBP, $F(1,111) = 119.2$, $p < .001$; DBP, $F(1,111) = 31.61$, $p < .001$; and CO, $F(1,111) = 4.45$, $p < .05$; and lower levels of RSA, $F(1,106) = 31.03$, $p < .001$. There were no effects on the other baseline measures.[2]

Manipulation Checks

In two-way mixed ANOVAs of anger change scores the Condition main effect was significant, $F(2,111) = 11.75$, $p < .001$, eta-squared = .177. As seen in Table 1, mean comparisons indicated that participants in the negative condition reported a larger increase in anger than did those in either the neutral, $t(111) = 3.85$, $p < .001$, or positive conditions, $t(111) = 4.48$, $p < .001$. The latter groups did not differ. Men and women reported similar changes in anger, and neither the Sex main effect or Sex × Condition interaction approached significance, both F values < 1.0. In a significant Condition main effect on changes in anxiety, $F(2,111) = 7.1$, $p < .002$, eta-squared = .113, (see Table 1) participants in the negative condition reported a larger increase in anxiety than did those in the neutral, $t(111) = 3.45$, $p < .001$, or positive conditions, $t(111) = 3.04$, $p < .005$. The latter groups did not differ. Again, men and women reported similar changes in anxiety, and neither the Sex main effect or the Sex × Condition interaction approached significance, both F-values < 1.0.

In analyses of IMI-C ratings of spouse behavior during the task, the expected main effect for Condition on the friendliness dimension, $F(2,111) = 23.58$, $p < .001$, eta-squared = .298, (see Table 1) indicated that participants in the positive condition rated their spouses as friendlier than did those in the neutral condition, $t(111) = 3.14$, $p < .005$, who in turn rated their spouses as friendlier than did those in the negative condition, $t(111) = 3.73$, $p < .001$. This pattern was similar for men and women; neither the Sex main effect or the Sex × Condition interaction approached significance, both F-values < 1.0. There was also a main effect for Condition on spouse ratings on the dominance dimension, $F(2,111) = 7.73$, $p < .002$, eta-squared = .122. Participants in the negative condition rated their spouses as more dominant than did those in the neutral condition, $t(111) = 2.04$, $p < .05$, who in turn rated their spouses as more dominant (or less submissive) than did those in the

Table 2 Overall and period mean cardiovascular reactivity in the positive, neutral, and negative discussion conditions

	Positive	Neutral	Negative
SBP (mmHg)			
Overall	7.1_a (.67)	4.2_b (.67)	8.9_c (.67)
Preparation	4.4_{ab} (.68)	2.5_a (.65)	6.7_b (.65)
Speaking	9.7_{ab} (.92)	6.3_a (.88)	11.4_b (.88)
Listening	7.3_a (.67)	3.5_b (.64)	8.0_a (.64)
DBP (mmHg)			
Overall	6.2_a (.54)	3.9_b (.54)	6.5_a (.54)
Preparation	4.5 (.61)	2.6 (.59)	4.6 (.59)
Speaking	9.2_a (.72)	5.8_b (.69)	9.5_a (.69)
Listening	4.7 (.66)	3.2 (.63)	4.1 (.63)
CO (l/min)			
Overall	$.29_a$ (.07)	$.21_a$ (.09)	$.68_b$ (.09)
Preparation	.07 (.08)	–.03 (.09)	.30 (.09)
Speaking	$.58_{ab}$ (.12)	$.52_a$ (.12)	1.03_b (.12)
Listening	$.22_a$ (.10)	$.14_b$ (.10)	$.72_c$ (.10)
TPR (dynes s cm^{-5})			
Overall	18.1_a (20.5)	16.2_a (21.1)	-44.4_b (20.8)
Preparation	30.7 (20.5)	46.5 (21.1)	10.0 (20.8)
Speaking	-8.0_a (28.1)	-15.8_a (28.9)	-75.5_b (28.5)
Listening	31.4_a (22.8)	17.9_a (23.4)	-67.8_b (23.1)
HR (bpm)			
Overall	2.9_a (.50)	2.2_a (.51)	4.9_b (.49)
Preparation	3.1 (.62)	2.3_a (.60)	3.4_b (.60)
Speaking	5.9_a (.86)	5.5_a (.83)	9.5_b (.83)
Listening	2.0 (.64)	1.4_a (.62)	3.0_b (.62)
PEP (ms)			
Overall	-3.0_a (.83)	-4.5_a (.85)	-9.0_b (.84)
Preparation	-1.8_a (.73)	-3.3_b (.75)	-6.0_c (.74)
Speaking	-4.3_a (1.0)	-5.5_a (1.0)	-11.3_b (1.0)
Listening	-2.8_a (.91)	-4.7_b (.94)	-9.7_c (.92)
RSA (log units)			
Overall	–.17 (.06)	–.13 (.06)	–.11 (.06)
Preparation	–.29 (.07)	–.30 (.07)	–.26 (.07)
Speaking	–.07 (.09)	.11 (.09)	–.02 (.09)
Listening	–.14 (.08)	–.21 (.08)	–.06 (.08)

SBP = systolic blood pressure; DBP = diastolic blood pressure; CO = cardiac output; TPR = total peripheral resistance; HR = heart rate; PEP = pre-ejection period; RSA = respiratory sinus arrhythmia. Within rows, means with different subscripts differ at $p < .05$ (Bernhardson 1975). Standard errors in parentheses

[2] Statistical control of baseline physiological values and BMI did not alter the results reported in the remaining analyses of CVR.

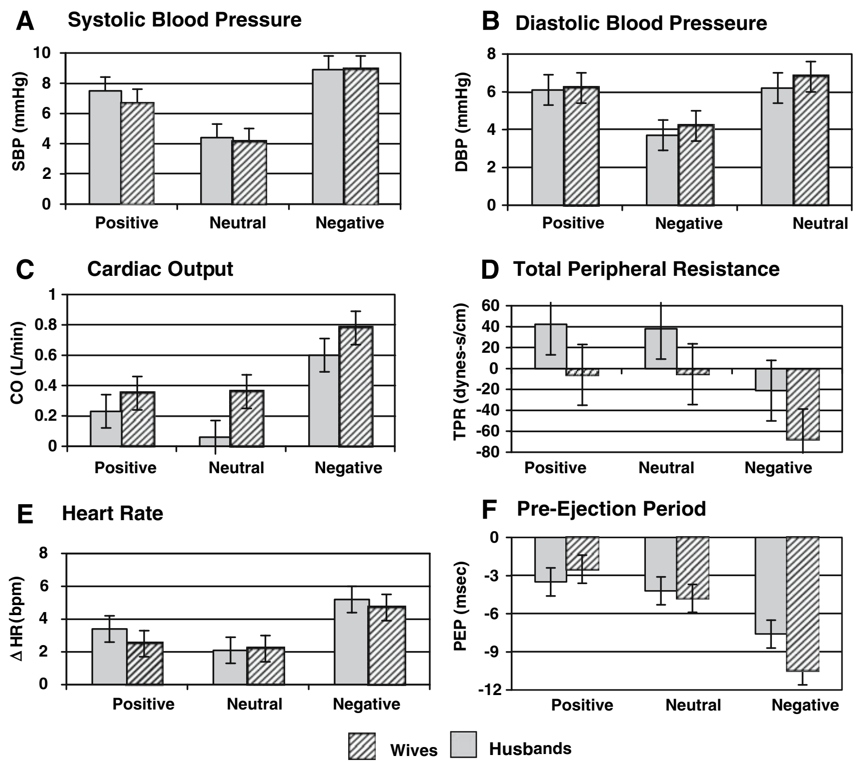

Fig. 1 Mean task values for CVR in positive, neutral and negative discussion tasks. Women's values in dark bars, men's values in open bars

positive condition (see Table 1). This pattern was also similar for men and women; the Sex main effect and Sex × Conditions interaction was not significant, both *F*-values < 1.0. Hence, compared to the neutral control condition, the negative task evoked expected increases in anger and anxiety, as well as perceptions of the spouse as unfriendly and controlling. These differences are consistent with both short-term and more enduring correlates of marital conflict and discord (Fincham and Beach 1999; Snyder et al. 2005; Traupman et al. 2007). Also as expected, compared to the neutral condition the positive task evoked perceptions of the spouse as warmer and less controlling.

Cardiovascular Reactivity

Blood Pressure Response and its Determinants

Three-way mixed ANOVA of SBP change scores revealed the expected Condition main effect, $F(2,111) = 12.63$, $p < .001$, eta-squared = .185. As seen in Table 2, participants in the negative condition displayed a larger average increase in SBP across the three periods than did those in the neutral condition, $t(111) = 4.99$, $p < .001$. Participants in the positive condition also displayed a larger increase in SBP than did those in the neutral condition, $t(111) = 3.07$, $p < .005$. Participants in the negative condition displayed a larger SBP response than did those in the positive condition, $t(111) = 1.91$, $p < .05$. As depicted in Panel A of Fig. 1, these effects were highly similar for men and women, as neither the Sex main effect or the Sex × Condition interaction approached significance, both *F* values < 1.0. A significant Periods main effect, $F(2,110) = 52.28$, $p < .001$, eta-squared = .487, indicated that overall SBP increases were largest when participants were speaking (9.18 mmHg, SE = .537), intermediate when listening (6.39 mmHg, SE = .38), and smallest during preparation (4.67 mmHg, SE = .40). Importantly, the conditions main effect was significant during each of these periods when considered separately, all *p*-values <.001 (see Table 2).

A parallel ANOVA of DBP change scores also revealed the expected main effect for Condition, $F(2,111) = 6.64$, $p < .002$, eta-squared = .107. As presented in Table 2, participants in the negative condition displayed a larger average increase in DBP across the three periods than did those in the neutral condition, $t(111) = 3.34$, $p < .005$. Participants in the positive condition also displayed a larger increase in DBP than did those in the neutral condition, $t(111) = 2.93$, $p < .005$. The negative and positive groups did not differ in DBP response, $t(111) < 1.0$. As depicted in Panel B of Fig. 1, these effects were highly similar for men and women; neither the Sex main effect or the

Sex × Condition interaction approached significance, both F-values <1.0. A significant Periods main effect, $F(2,110) = 97.49$, $p < .001$, eta-squared = .468, indicated that DBP increases were largest when participants were speaking (8.21 mmHg, SE = .41), and similar when participants were listening (4.27 mmHg, SE = .35) and during preparation (4.06 mmHg, SE = .33). The conditions main effect was significant during the preparation and speaking periods, both $p < .02$, but not during listening, $p > .20$ (see Table 2).

The three-way ANOVA of changes in CO revealed the expected main effect for Condition, $F(2,99) = 8.45$, $p < .001$, eta-squared = .146. As presented in Table 2, participants in the negative condition displayed a larger increase in CO than did those in the neutral condition, $t(99) = 3.86$, $p < .001$. Participants in the positive condition also displayed a smaller increase in CO than did those in the negative condition, $t(99) = 3.18$, $p < .005$, and the positive and neutral groups did not differ in CO response, $t(99) < 1.0$. As depicted in Panel C of Fig. 1, these effects were highly similar for men and women. Men did display a larger increase in CO than did women (.50 l/min vs. .29 l/min, SEs = .076, .060), $F(1,99) = 4.67$, $p < .004$, eta-squared = .045, but the Sex × Condition interaction did not approach significance, $F < 1.0$. A significant Periods main effect, $F(2,99) = 71.81$, $p < .001$, eta-squared = .42, indicated that CO increases were largest when participants were speaking (.71 l/min, SE = .067), intermediate when they were listening to spouses (.36 l/min, (SE = .056) and smallest when they were preparing for the discussion (.11 l/min, SE = .049). The conditions main effect described above was significant during each of these periods when considered separately, all p values <.02 (see Table 2).

In a three-way ANOVA of changes in TPR , the main effect for Condition approached significance, $F(2,99) = 2.92$, $p < .06$, eta-squared = .056. As presented in Table 2, participants in the negative condition displayed a decrease in TPR whereas those in the neutral condition displayed an increase, $t(99) = 2.05$, $p < .05$. Participants in the positive condition also displayed an increase in TPR that was significantly different from the negative condition, $t(99) = 2.12$, $p < .05$; the positive and neutral groups did not differ in TPR response, $t(99) < 1.0$. As depicted in Panel D of Fig. 1, these effects were similar for men and women. Men tended to displayed a decrease in TPR during the task (–26.42, SE = 16.61) whereas women displayed an increase (19.64, SE = 16.92), $F(1,99) = 3.89$, $p < .06$, eta-squared = .038, but the Sex × Condition interaction did not approach significance, $F < 1.0$. A significant Periods main effect, $F(2,99) = 12.21$, $p < .001$, eta-squared = .11, indicated that TPR decreased while participants spoke (–33.09, SE = 16.46), showed a small decrease while they listened (–6.14, SE = 13.34), and increased during preparation (29.07, SE = 12.01). The conditions main effect was significant during the listening period, $p < .005$, but not during preparation or speaking, both $p > .15$ (see Table 2).

Heart Rate and Determinants

The three-way ANOVA of changes in HR revealed the expected main effect for Condition, $F(2,105) = 8.18$, $p < .002$, eta-squared = .135. As presented in Table 2, participants in the negative condition displayed a larger average increase in HR compared to the neutral, $t(105) = 3.88$, $p < .001$, and positive conditions, $t(105) = 2.83$, $p < .01$. The positive and neutral groups did not differ in HR response, $t(99) = 1.04$. As depicted in Panel E of Fig. 1, these effects were highly similar for men and women. Neither the Sex main effect or the Sex × Condition interaction approached significance, both F values < 1.0. A significant Periods main effect, $F(2,105) = 94.35$, $p < .001$, eta-squared = .47, indicated that HR increased most while participants spoke (5.70 bpm, SE = .39), and showed smaller increases while they listened (1.87 bpm, SE = .32) and during preparation (2.46 bpm, SE = .29). The conditions main effect was similar during each of these periods separately, all p values <.05 (see Table 2).

As expected, the three-way ANOVA of changes in PEP revealed a significant main effect for Condition, $F(2,99) = 14.08$, $p < .001$, eta-squared = .221. Participants in the negative condition displayed a larger average decrease in PEP than those in the neutral (see Table 2), $t(99) = 3.81$, $p < .001$, and positive conditions, $t(99) = 5.08$, $p < .001$. The positive and neutral groups did not differ, $t(99) = 1.27$. As depicted in Panel F of Fig. 1, these effects were highly similar for men and women. Neither the Sex main effect or the Sex × Condition interaction approached significance, both F-values < 1.6. A significant Periods main effect, $F(2,99) = 52.40$, $p < .001$, eta-squared = .346, indicated that PEP decreased most while participants spoke (–7.05 ms, SE = .59), showed an intermediate decrease while they listened (–5.75 ms, SE = .53) and the smallest decrease during preparation (–3.72, SE = .43). The conditions main effect was similar during each of these periods when considered separately, all p values <.001 (see Table 2).

The three-way ANOVA of changes in RSA did not reveal a significant main effect for Condition, $F(2,105) = .19$. Neither the Sex main effect or the Sex × Condition interaction approached significance, both F values < 1.0. A significant Periods main effect, $F(2,105) = 16.71$, $p < .001$, eta-squared = .137, indicated that RSA decreased most during preparation (–.283, SE

= .039), showed a smaller decrease while they listened (–.134, SE = .045) and did not change while they spoke (.006, SE = .053).[3]

Discussion

Recent theory and research suggest that negative marital interactions evoke cardiovascular responses (i.e., CVR) that could contribute to the effects of marital stress on CVD. However, relatively unstructured discussion tasks used in prior research make it difficult to attribute these effects specifically to the negativity of interactions. Other influences on physiology, such as speaking and task engagement or the generally emotional and personal rather than specifically negative nature of these tasks could contribute to—if not account for—CVR observed during marital conflict discussions. Associations of negative marital behavior with concurrent CVR and the related sex differences in these effects demonstrated in some previous studies are similarly open to alternative interpretations.

We attempted to address such alternative explanations through structured discussions and two comparison conditions. A consistent pattern indicated that negative marital interactions evoked greater CVR than did neutral or positive interactions, and this occurred while participants silently prepared for the discussion, listened to their spouse and spoke to the spouse. Hence, the effects of marital stress on CVR were not due to differences in task engagement, speech parameters, or other artifacts. However, there was no evidence that the negative discussion evoked greater CVR from women than men.[4]

Specifically, compared to a neutral discussion with similar levels of speaking and other influences on CVR, negative interactions increased SBP, DBP, and HR. These effects were accompanied by increased CO and decreased TPR and PEP. Hence, the negative interaction apparently heightened CVR through sympathetically mediated cardiac activation, similar to tasks involving active—rather than passive—coping (Sherwood et al. 1990a, b; Smith et al. 2000). This pattern of CVR could also be seen as reflecting challenge rather than threat (Tomaka et al. 1993), though the negative task also evoked significantly greater negative affect—an emotional response that is not consistent with theoretical descriptions of the challenge response. With the exception of DBP, negative discussions evoked larger CV responses than did positive discussions, suggesting that the personal and emotionally involving nature of marital conflict tasks does not provide a complete explanation for their effects on CVR. However, the positive discussion did evoke greater increases in SBP and DBP than did the neutral discussion. Hence, some effects of marital conflict on CVR observed in other studies could be due to the generally emotional—rather than specifically aversive—nature of the interaction tasks in prior research.

These conclusions are strengthened by the fact that both the positive and negative tasks differed from the neutral task in participants' ratings of their spouses' warmth versus hostility and dominance versus submissiveness. Further, as expected the negative task evoked large increases in anger and smaller but still substantial increases in anxiety relative to the other two conditions. In addition to serving as simple manipulation checks, these psychological differences between the negative and neutral tasks support the negative task as an analogue of marital conflict; negative affect—especially anger—and perceptions of the spouse as quarrelsome, unfriendly and controlling are commonly observed as both short term responses during conflict discussions and correlates of more enduring experience of marital conflict (Fincham and Beach 1999; Snyder et al. 2005; Traupman et al. 2007)

Although there were some differences in responses of men and women (i.e., Sex main effects), in those effects men were more reactive (i.e., larger increases in CO, larger decreases in TPR). Importantly, women were not more reactive than men during negative discussions.

[3] Relative to baseline values, the second conflict discussion task evoked significant increases in self-reported anxiety and anger, SBP, DBP, CO, and HR, and significant decreases in TPR, PEP, and RSA. For the physiological variables, these changes were generally largest while participants spoke, smallest while they prepared for the task and listened to their spouse, and intermediate during the final unstructured discussion period. Men and women did not differ on changes in any of the physiological measures, all *p*-values >.20. However, women did report larger increases in anxiety (2.01 vs. 1.11, SE = .28, .35), $F(1,111) = 7.66$, $p < .01$, eta-squared = .065, and anger (1.74 vs. .87, SE = .36, .33), $F(1,111) = 6.59$, $p < .02$, eta-squared = .056) than did men. Further, women's changes in anxiety were significantly correlated with their SBP reactivity during the task, $r(113) = .32$, $p < .001$, and their DBP reactivity, $r(113) = .23$, $p < .02$; their changes in anger were correlated with their DBP reactivity, $r(113) = .23$, $p < .02$. None of the associations between men's reported change in affect and CVR during the second task approached significance. Hence, although the conflict discussion evoked expected increases in negative affect and CVR, as in the first task men and women did not differ in their cardiovascular responses. However, women did report larger increases in negative affect, and as in some prior research (Kiecolt-Glaser and Newton 2001) these affective changes were related to CVR for women but not men.

[4] Consistent with these findings, men and women did not differ in any cardiovascular response to the second conflict task (see footnote 3), even during a final unstructured portion of the task closely resembling commonly used marital interaction tasks. The fact that no sex differences emerged during that unstructured portion of the task is inconsistent with several prior studies (Kiecolt-Glaser and Newton 2001), but could reflect the fact that the preceding structured portion of the discussion made the task engagement of men and women more similar than they otherwise would have been if only an unstructured task was used.

Specifically, women were not more reactive when CVR to negative interaction was considered as an average across the experimental periods. That is, no Sex × Conditions interactions approached significance for any of the measures of CVR. Further, women did not demonstrate greater physiological response to the negative interaction during any of the specific activities of silent preparation, listening to their spouse, or speaking to their spouse (i.e., no Sex × Conditions × Periods interaction approached significance for any measure of CVR). Hence, in a procedure controlling speech parameters and task engagement, men and women did not differ in CVR to marital stress. The present lack of sex differences contrasts with several studies in which women were more reactive than men (see Kiecolt-Glaser and Newton 2001, for a review). However, as noted previously, the unstructured nature of the tasks used in most of those studies creates alternative interpretations, such as the possibility that differing levels of task engagement contribute to sex differences in physiological response. For example, women generally desire more change in their partners than do men (Margolin et al. 1983). Therefore, topics selected for discussion in psychophysiological studies of marital interaction may be more likely to involve issues in which women rather than men are requesting change.

In the present study, procedures that were intended to control these factors may have minimized sex differences observed elsewhere. A recent study suggests that sex differences in initiating change may be an important influence on CVR. Women displayed greater CVR than men only when the marital conflict topic under discussion was one in which women requested a change; when discussing a topic in which husbands requested a change, men and women did not differ in CVR (Newton and Sanford 2003). Hence, men and women might differ in simple reactivity to marital stress, but might also differ in interactional behaviors (e.g., identifying and pursuing relationship issues more actively) that influence their physiological responses during potentially stressful marital discussions. In our prior work (Smith et al. 1998), women responded to disagreement with greater CVR than men during marital discussions of topics outside of the relationship (e.g., current events). However, when highly involving marital topics are the focus of discussions—such as the perceived faults of the spouse in the present procedure—sex differences in responsiveness to less involving disagreements may be over-ridden.

When considered together, the present findings and others (Denton et al. 2001; Newton and Sanford 2003) suggest that previously observed physiological differences between men and women during marital conflict might not reflect simply greater reactivity to relationship stress. Women's greater involvement in effortful relationship-focused coping might also contribute to the effects. These coping processes may be sufficiently common as to promote more frequent and pronounced episodes of physiological activation among women. However, it is important to emphasize that this interpretation of sex differences in CVR during marital conflict was not directly tested—let alone supported—in the present study. Rather, it is a speculative attempt to account for the pattern of varying sex differences across studies of this issue.

It could be argued that as long as women respond to naturally occurring—and almost always unstructured—marital conflicts with greater CVR, it does not matter if this sex difference reflects the fact that they experience marital stressors as more aversive than do men or the fact that they are more involved in effortful relationship-focused coping. Their greater CVR—regardless of its source—could contribute to their reduced health benefits from marriage. However, these different explanations for sex differences in the psychophysiology of marital conflict could have implications for health-promoting marital interventions. Specifically, if both men and women respond to marital conflict with potentially unhealthy CVR, then both men and women would benefit from interventions that reduce exposure to this common stressor and/or attenuate physiological responses to it. Further, if women display additional CVR in accordance with their relatively greater involvement in effortful relationship coping, such interventions might also address processes through which spouses identify, prioritize, and pursue relationship problems.

Limitations and Qualifications

Several aspects of the present study render such conclusions tentative. For example, measurement of other responses (e.g., neuroendocrine) might have revealed sex differences. Further, generalization to other groups (e.g., older couples, lower SES populations, racial and ethnic minorities) should be made cautiously. Also, although the discussion procedure provided experimental control missing from prior research while maintaining at least some construct and external or ecological validity, the negative discussion task only resembles actual couple conflicts to some extent. Although the negative task evoked affective responses and perceptions of the spouse that are typical of naturally occurring marital conflict, the content and structure of this task render it less like actual marital disagreements than typical laboratory tasks in which couples discuss an area of relationship difficulty in an unstructured manner. Hence, while we feel experimental realism was high in that the manipulation evoked affective and cognitive responses quite similar to naturally occurring conflicts, the task could be seen as somewhat artificial or low in mundane realism or ecological validity. As a result, generalizations of our results to naturally occurring conflicts must also be made cautiously.[5] However, it is important to note again that the more realistic tasks contain potential influences on CVR that are beyond the conceptual definition of marital conflict and therefore pose interpretative ambiguities of their own.

As stated previously, it is unlikely that any individual study of marital interaction and CVR will strike an ideal balance between experimental precision and mundane realism. Rather, examination of the physiological effects of this interpersonal stressor across a range of study methodologies is likely to lead to a more complete understanding of the issues. Further, despite our efforts to create a high degree of experimental control, possible confounds remain. For example, although our intent was to manipulate the valence of the marital interaction, it is also likely that the conditions differed in the overall level of intensity of arousal independent of valence. That is, the negative condition may have been both more negative and more intense or arousing (i.e., independent of valence) than the positive and neutral conditions. Valence and intensity are separable characteristics of emotional experiences with potentially separate associations with physiological response (for a review, see Bradley and Lang 2007). Although it is therefore difficult to attribute the present results specifically to the negativity of marital conflict rather than its intensity, it is also possible that active engagement in marital conflict is inherently more intense than most realistic positive marital discussions, once again raising concerns about the inherent trade-off between experimental precision and mundane realism when studying the psychophysiology of close relationships.

Further, although the procedure designated specific periods in which participants prepared silently, listened while their spouse spoke and spoke to their spouse, this methodology does not provide complete control over speech and task engagement artifacts as potential influences on CVR. This procedure clearly provides greater control over these potential artifacts than is inherent in the previously used unstructured tasks, but we did not experimentally control—or measure and statistically control—the amount, volume or rate of speech. Therefore, we cannot rule out definitively these potential factors as possible sources of the apparent effects of marital conflict on CVR. However, the fact that the task differences are similar across these three very different activities—two of which involved no talking at all and one of which occurred before any talking—makes these artifacts less likely as explanations of the effects of marital conflict on CVR observed here. Finally, a growing body of evidence suggests that CVR could contribute to the development of CVD, but this association should be considered tentative. In fact, if CVR evoked in the negative condition reflected engagement in constructive problem solving, it is possible that this activation accompanies behaviors that could reduce subsequent exposure to marital stress. However, the concurrent arousal of anger and perceptions of the spouse as hostile and controlling make this interpretation less likely.

Conclusions and Future Directions

These qualifications notwithstanding, in the present study negative marital interactions clearly evoked sympathetically mediated CVR that could not be easily accounted for by speech artifacts, task engagement, or the generally emotional nature of the task. Further, marital conflict evoked CVR similarly for both men and women. To the extent that such cardiovascular responses contribute to the development of disease, CVR could be a mechanism through which marital difficulties heighten risk for CVD among both men and women (Baker et al. 2000; Coyne et al. 2001; Gallo et al. 2003; Matthews and Gump 2002; Orth-Gomer et al. 2000). These results also suggest that although prior studies have found that women typically display greater physiological reactions during marital conflict discussions than do men (Kiecolt-Glaser and

[5] Additional findings support the validity of the negative interaction task used here as an analogue for more realistic marital conflict. First, participants' ratings of their spouses' behavior during this task were significantly correlated with their ratings of the spouse during the second, more traditional marital conflict discussion described in footnotes 1 and 3; correlations ($n = 40$) for wives' and husbands' ratings of spouse friendliness and dominance ranged from .67 to .84, all p-values < .001. Further, as was the case for these ratings during the second and more traditional task, ratings of friendliness and dominance during the negative task were significantly correlated with participant's reports of general levels of marital conflict as assess by the Quality of Relationship Inventory-Conflict Scale (Pierce et al. 1991); correlations ($n = 40$) ranged from .42 (absolute value) to .78, all p-values <.01. Heart rate and blood pressure responses to the negative discussion and traditional conflict tasks were significantly correlated; correlations ($n = 40$) ranged from a low of .29, $p < .07$ (husbands' DBP) to a maximum value of .75, $p < .001$ (husbands' HR); wives' values were $r(40) = .46$ to .67. When comparing mean responses to these two tasks directly, compared to the traditional conflict task described in footnote 1 the negative discussion task evoked: similar increases in anger, $F(1,39) = .18$; larger increases in anxiety, $F(1,39) = 6.05$, $p < .02$; equal ratings of the spouses' dominance, $F(1,39) = 1.93$, $p > .17$; ratings of spouse as more hostile, $F(1,39) = 5.57$, $p < .03$; equal DBP reactivity, $F(1,39) = .04$; greater SBP response, $F(1,39) = 18.39$, $p < .001$; and greater HR reactivity, $F(1,39) = 39.72$, $p < .001$. Hence, although the smaller responses to the traditional task could reflect the fact that it was always presented second and hence participants may have habituated somewhat, it is clear that the negative task was not less stressful than the more commonly used and potentially more realistic conflict discussion. Further, perceptions of the spouse's level of warmth and dominance during the negative task were closely correlated with the couples' reports of general conflict in the marriage. Together, these findings provide additional evidence beyond the manipulation checks of the validity of the negative task as a manipulation of marital conflict.

Newton 2001), such effects might involve processes in addition to simple reactivity to relationship stress. For example, sex differences in the extent of active relationship-focused coping or the degree of engagement in the discussion could contribute to prior evidence of sex differences. Future research should include efforts to disentangle these potential sources of CVR during marital interaction (c.f., Denton et al. 2001; Newton and Stanford 2003), as well as examine their occurrence in a range of settings and with a range of methodologies from carefully controlled laboratory tasks to naturally occurring conflicts captured through ambulatory monitoring and experience sampling. Training in constructive marital problem solving techniques has been found to reduce CVR during marital conflict discussions (Ewart et al. 1984). Hence, research on the health consequences of marital stress and related studies of psychophysiological responses during marital interaction could contribute to the design of interventions for cardiovascular health promotion.

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