Psychophysiological Profiles of Batterers: Autonomic Emotional Reactivity as It Predicts the Antisocial Spectrum of Behavior Among Intimate Partner Abusers

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On the basis of studies finding heart rate deceleration among severely violent (SV) batterers (J. M. Gottman et al., 1995) and unsuccessful psychopaths (S. S. Ishikawa, A. Raine, T. Lencz, S. Bihrlhe, & L. Lacasse, 2001), this study compares the physiological reactivity of SV batterers (n = 35) with low-level violent (LLV) batterers (n = 37) and nonviolent men (n = 21) during 2 laboratory tasks. Men’s heart rate and skin conductance level were recorded during baseline, a conflict discussion, and a standardized anger induction. Results suggest that autonomic hyporeactivity is a risk marker for antisocial features among SV men, whereas autonomic hyperreactivity is a risk marker among LLV men. Psychophysiological responding appears to be a stronger correlate of general antisocial behavior than of intimate partner abuse.

Keywords: antisocial personality, intimate partner violence, psychophysiological reactivity, domestic violence, batterers

Research on the psychophysiological substrates of antisocial, psychopathic, and violent behavior has a long and venerable history (see Raine, 1993, for a review), but the methodologies have only recently been applied to men who are violent toward their intimate partner. Because intimate partner violence generally occurs in the context of intense interpersonal disputes, experiments that elicit emotions in interpersonal contexts may be the most informative as to how the physiological reactions of partner abusers might differ from those of nonviolent men. In the first study to examine psychophysiological responding of men who batter women, Gottman et al. (1995) found that heart rate hyporeactivity was correlated with abusiveness and psychopathology in a community sample of men who physically and psychologically abused their wives. On the basis of heart rate change, the partner-aggressive men were separated into two groups: Type I and Type II batterers. Type I batterers’ (n = 12) heart rates decreased from baseline to when they became engaged in a conflict discussion with their female partners, and Type II batterers (n = 48) showed the more expected pattern of increased heart rate during the beginning of a conflict interaction. Type II batterers were highly domineering during the observed conflict discussion. However, Type I batterers were more severely violent toward their wives, more likely to threaten their wives with a knife or gun, more emotionally abusive, and more likely to be violent outside the relationship than were Type II batterers. Type I batterers were also more likely to report antisocial personality features, problems with substance abuse, and criminal histories (Gottman et al., 1995; Jacobson, Gottman, & Shortt, 1995).

The findings of hyporeactivity among Type I batterers are in keeping with previous psychophysiological research on criminality and psychopathy (Raine, 1993). Low resting heart rate and low skin conductance (perspiration) during adolescence predict later criminality (Raine, Venables, & Williams, 1990), and adult criminals tend to have low arousal patterns (Eysenck, 1997). Psychopaths show diminished skin conductance reactivity in response to punishment cues (Hare, 1978; Newman, Wallace, Schmitt, & Arnett, 1997; Ogloff & Wong, 1990). Autonomic underarousal among psychopaths and criminals is not trivial, in that low arousal is predictive of continuation and escalation in criminal behavior (Brennan & Raine, 1997; Brennan et al., 1997). These physiological differences may be fundamental to the etiology and presentation of antisocial or psychopathic behavior. Eysenck (1964, 1977, 1997) theorized that lack of fear and low arousal lead to poor Pavlovian conditioning. Poor conditioning impairs the development of affective, cognitive, and behavioral responses thought to constitute the essential features of conscience, which in turn allows for the continued expression of aggressive or criminal behavior.

Hyporeactivity Predicts Psychopathy and Crime

Low skin conductance change (i.e., reactivity) and low resting heart rate (i.e., arousal) are relatively consistent markers of psychopathy (Brennan & Raine, 1997; Hare & Craig, 1974; House & Milligan, 1973). Although Gottman et al.’s (1995) findings
centered on heart rate change, there are inconsistencies in the research on heart rate reactivity as it relates to psychopathy and crime. In a meta-analysis of studies examining the relations between psychophysiological responding and the antisocial spectrum of behavior, Lorber (2004) found no consistent relations between heart rate reactivity and psychopathy in adults, as the relation appears to be moderated by many different variables. A recent study found that convicted psychopaths evidence reduced cardiovascular reactivity, whereas nonconvicted psychopaths show increased heart rate reactivity in response to a speech stressor (Ishikawa, Raine, Lencz, Bihrle, & Lacasse, 2001). Thus, the relations between psychopathy and physiological reactivity appear to be moderated by conviction status and perhaps by the severity of the crime.

Hyperreactivity Predicts Hostility

Although Gottman et al. (1995) found cardiac hygroactivity to be a risk marker among batterers, heart rate hyperreactivity may be a more consistent risk marker for the antisocial spectrum of behavior in adults (Lorber, 2004). Heart rate overarousal has been shown to be related to Type A personality and spouse-directed hostility (Brown & Smith, 1992; Smith & Brown, 1991). Research dismantling the Type A personality construct discovered that chronic anger and hostility were the variables most related to cardiovascular reactivity (Gottman, 2001; Siegman, 1994). Hostility is distinct from aggression in that hostility involves the primarily cognitive variables of cynicism, mistrust, and denigration, and aggression involves overt action (Miller, Smith, Turner, Guijarro, & Hallet, 1996). However, hostility and trait anger are consistent predictors of intimate partner aggression (Schumacher, Feldbau-Kohn, Slep, & Heyman, 2001).

Direction of Heart Rate May Be Moderated by Characteristics of the Population

Theoretically, both heart rate hyporeactivity and hyperreactivity could be biological markers for intimate partner abuse and antisocial behavior, depending on certain characteristics of the population. The reason that the relations between heart rate, skin conductance, and the antisocial spectrum of behavior are inconsistent may be because the relations are moderated by age of study participants (Lorber, 2004) as well as recruitment methods of the sample (Ishikawa et al., 2001). Although Gottman et al. (1995) found heart rate hyporeactivity to be a marker of a more antisocial subset of batterers, that study sampled only frequently and/or severely violent batterers. Severity of intimate partner violence is one of the dimensions commonly used in creating typologies of batterers (Holtzworth-Munroe & Stuart, 1994). Johnson (1995), in his theoretical review, argued that there are two distinct forms of couple violence: common couple violence and patriarchal terrorism. He asserted that there is a qualitative distinction between an occasional slap or push and systematic battering. Thus, severity of violence perpetrated appears to be an important distinction among men who batter women. The relation between autonomic reactivity and the antisocial spectrum of behavior may be moderated by severity of the batterers’ violence.


Subsequent attempts to replicate the Gottman et al. (1995) typology have failed (Babcock, Green, Webb, & Graham, 2004; Meehan, Holtzworth-Munroe, & Herron, 2001), perhaps as a result of some limitations of the original research design or peculiarities of the original sample. The current study revisits the notion that autonomic reactivity may be related to intimate partner violence and the antisocial spectrum of behavior. However, the first question to address is whether intimate partner violence is distinct from the antisocial spectrum of behavior. That is, is intimate partner abuse an empirically different construct than general antisocial traits, or is intimate partner abuse just another form of antisocial behavior that happens to be directed toward the partner? The second question is if intimate partner violence and general antisocial traits are separate constructs, do they both relate to autonomic reactivity? If so, does the same pattern of autonomic reactivity relate to partner violence and antisocial behavior for all men? The study compared nonviolent (NV), low-level violent (LLV), and severely violent (SV) men on measures of antisocial behavior, intimate partner abuse, and autonomic reactivity, retaining the continuous nature of the psychophysiological measures. A measurement model tests the shared variance between intimate partner violence and the antisocial spectrum of behavior to see whether they are unique constructs. Integrating the physiological findings of criminal psychopaths and Type A personality, we expected hygroactivity to be a risk marker for intimate partner abuse and general antisocial traits among only those men who resort to severe, life-threatening levels of intimate partner violence. Although some LLV and NV men may also show hygroactivity during emotionally arousing tasks, partner abuse and antisociality are expected to be related to hyperreactivity among LLV men. Specifically, we expected to find that some severely aggressive men are hyperactive in terms of heart rate and measures of skin conductance (as is found among criminal populations). Increased sympathetic response, on the other hand, may be a marker for intimate partner abuse and antisocial tendencies for the NV and LLV men (as often found in normal populations).

Finally, the study compares autonomic responding in two laboratory tasks, The Gottman et al. (1995) study was criticized for the use of a conflict discussion as the sole experimental task by which to measure physiological reactivity. The marital interaction paradigm, like naturalistic observation, is not tightly standardized and “does not carry the same valence for all participants” (Margolin, Gordis, Oliver, & Raine, 1995, p. 257). Differences in autonomic reactivity on this task may reflect differences in task engagement (Ornduff, Kelsey, & O’Leary, 1995), the argument topic, or the wives’ behavior. To control for these possible confounds, physiological patterns that emerge during a naturalistic conflict discussion are compared with those that emerge during a standardized anger induction task, by using an adapted Articulated Thoughts in Simulated Situations (ATSS) paradigm, which has been found to induce anger among intimate partner abusers (Eck-
hard, Barbour, & Davison, 1998). Again, we expected to find that low sympathetic (heart rate and skin conductance) reactivity would be related to the intimate partner violence and antisocial spectrum of behavior among SV men, whereas high reactivity would be a marker for aggressive tendencies of men who are typically NV or who engage in low-level violence. Although the patterns were expected to be similar, we expected the autonomic reactivity elicited by the imaginal exercise to be somewhat weaker than that elicited by the naturalistic conflict discussion.

**Method**

**Participants**

Participants were 110 couples who responded to local ads in free newspapers and flyers recruiting couples who were married or living together as if married for at least 6 months, 18 years of age, and able to speak and write English proficiently. The goal was to recruit an ethnically diverse sample of couples in which socioeconomic status did not vary across violence status. Flyers were posted in low-income African American and Hispanic neighborhoods, housing projects, and health clinics. Ads were placed in free newspapers near the employment section to attract the under- or unemployed. Female partners were contacted by phone by trained undergraduate interviewers who administered the Violence subscale of the Conflict Tactics Scales (Straus, 1979) to determine eligibility in the study. To meet preliminary screening for the domestic violence (DV) group, female partners had to report on the phone at least one incident of male-to-female aggression in the past year. To meet screening criteria for the NV group, women had to report no male-to-female violence in the past 5 years and no serious violence (beaten up, threatened with a knife or gun) ever in their relationship. Final group assignment was based on the woman’s report of her partner’s violence and then the man’s report of his own violence on the longer revised Conflict Tactics Scales (CTS2; Straus, Hamby, Boney-McCoy, & Sugarman, 1996) administered in the lab. Couples were considered NV if either partner reported no male-to-female violence on the CTS2 in the past year. Couples were defined as a male and female reported no male-to-female violence in the past 5 years and no serious violence ever in the history of their relationship. SV couples were defined as either the male or female reporting one or more acts of male-to-female severe violence in the past year, as defined by the CTS2 Severe Violence subscale (punched, slammed against a wall, kicked, used a knife or gun, choked, beaten up, and burned or scalped). LLV couples reported no severe items but one or more acts of male-to-female violence in the past year (e.g., pushing, slapping). Couples were paid $40 to $50 for their participation; an additional $10 was awarded if they came on time for their first scheduled appointment.

**Overview of Procedures**

Psychophysiological and questionnaire data were collected during one assessment period, which lasted approximately 3.5 hr. During the assessment, couples were separated to complete a series of questionnaires and then reunited to participate in a conflict discussion. Research assistants connected psychophysiological recording devices to both the husband and wife and then administered the Play-by-Play Interview (Hooven, Rushe, & Gottman, 1996) in order to clarify an actual conflict area in their relationship. Couples were then asked to sit quietly for a 4-min, eyes-open baseline, then to engage in a 15-min conflict discussion. Following the marital interaction, the female partner was administered a semistructured clinical interview about her relationship and violence history. Meanwhile, the male partner completed the anger induction procedure and a series of computer-based tasks while physiological measures were continuously recorded. Men’s reports of state anger were assessed prior to the experiment, following the conflict discussion, and again following the anger induction task. The debriefing procedures used by Gottman et al. (1995), which included an anger assessment, safety planning, referrals, and follow-up phone contacts, were adopted to ensure that the laboratory experience caused no harm.

**Questionnaire Measures**

**Intimate partner violence.** The CTS2 (Straus et al., 1996) was administered to both male and female participants independently. The CTS2 is a 78-item, widely used questionnaire that assesses the frequency of male-to-female and female-to-male physically, sexually, and psychologically abusive acts in the past year. The CTS2 contains 5 subscales: Negotiation, Psychological Aggression, Physical Assault (minor and severe), Sexual Coercion, and Injury. Preliminary internal consistencies of the CTS2 subscales range from .79 to .95 (Straus et al., 1996). Internal consistencies of the CTS2 ranged from .42 on Injury to .89 on Physical Assault in our data set.

**Psychopathy.** The Self-Report of Psychopathy—II (SRP–II; Hare, 2003) is a questionnaire measure consisting of 59 items based on the Psychopathy Checklist—Revised (PCL–R; Hare, 1991) interview. The SRP–II taps both the personality qualities associated with psychopathy (egocentrism, shallow affect, lack of remorse, narcissism, and lack of empathy; Factor 1) and the behavioral manifestations of psychopathy (criminal offenses, substance abuse, and violence; Factor 2). Unlike the PCL–R, the SRP–II does not require a long interview and archival data, such as criminal records. Preliminary validity statistics indicate that the measure correlates moderately with the PCL–R interview (r = .54) (Hare, 1991). In this data set, internal consistencies were acceptable for Factor 2 (α = .80) and for the total score (α = .85) but were inadequate for Factor 1 (α = .48). Because of this, only the total psychopathy score was analyzed.

**Antisocial personality.** Seventeen true–false items from the Antisocial subscale of the Millon Clinical Multiaxial Inventory—III (Millon, 1994) were administered to assess antisocial personality features. Individuals who score high on the Antisocial subscale tend to engage in duplicitious or illegal behavior and are irresponsible and impulsive (Millon, 1987, p. 29). Reliability of the Antisocial subscale items was .83.

**Hostility and anger.** The State–Trait Anger Expression Inventory (Spielberger, 1988) is a widely used 44-item scale analytically derived that assesses differences in the experience and expression of anger. This study used two subscales from the State–Trait Anger Expression Inventory. The Trait Anger subscale (10 items) assesses on a 4-point scale the frequency with which angry feelings are experienced (α = .88). The State Anger subscale (10 items) assesses on a 4-point scale the intensity of current angry feelings. Men completed a paper-and-pencil version of the state and trait anger items prior to the administration of the experimental tasks. They then completed a computerized version of the State Anger subscale items immediately following the couples’ interaction and again following the anger induction. In order to disguise the purpose of the repeated queries and to protect against response bias, we interspersed the State Anger subscale items with other adjectives and presented the State Anger subscale items in a randomized order. Reliabilities for the State Anger subscale were .84 for the pencil-and-paper version administered to men at baseline and an average of .82 for the computerized embedded subscale items administered following the conflict discussion and anger induction.

**Generality of violence.** Self-reports of men’s history of violence other than partner assault were assessed by using a project-designed questionnaire adapted from the General Violence Interview used by Gottman et al. (1995). Men were asked how many times since they were 18 years old they had been violent with family members, friends, coworkers or bosses, acquaintances, strangers, or police officers. Reliability on the general violence scale was .70.
Observational Measures of Affect

A team of four trained coders who were blind to participants’ violence severity coded the 15-min conflict discussion by using the Specific Affect Coding System (Gottman, McCoy, Cuan, & Collier, 1996). The Specific Affect Coding System categorizes 16 emotions on the basis of facial affect, vocal tone, body language, and content of speech. To be consistent with Gottman et al. (1995), aggressiveness was calculated as the sum of the number of onsets of contempt plus belligerence displayed during the interaction. Videotapes of the conflict discussion were coded on a second-by-second basis by using the Video Coding System (Long, 1998b). Twenty-five percent of the tapes were coded by a second coder to calculate reliability. Average kappas for contempt and belligerence were .78 and .70, respectively.

The standardized anger induction task used the ATSS (Davison, Robins, & Johnson, 1983), which comprises two audiotaped vignettes, shown previously to induce anger among maritally violent men (Eckhardt, Barbour, & Davison, 1998). Men were asked to sit quietly and listen to the tape while imagining that they were overhearing a conversation between their wives and someone else. In the overheard conversation scenario, the wife was complaining to another woman about her husband, who is characterized as “a loser” who “doesn’t make enough money.” In the jealousy scenario, the man hears his wife cooking dinner for, and subtly flirting with, a male companion. Men were asked to imagine that their wives were the protagonists in the scenarios. In the original ATSS task created by Eckhardt et al. (1998), participants listened to scenarios, interrupted every 30 s by 30-s articulation periods in which they expressed their thoughts and feelings about the scenarios aloud. For the current study, the paradigm was modified in an attempt to decrease disruption of the physiological data recordings. Participants sat quietly for a 2-min baseline, then listened to the 4-min scenarios without pause while using a rating dial to continuously indicate their level of anger (ranging from neutral to violently angry).

Following each scenario, men articulated aloud for 1 min about their feelings about the scenarios. For the current study, the paradigm was modified in an attempt to decrease disruption of the physiological data recordings. Participants sat quietly for a 2-min baseline, then listened to the 4-min scenarios without pause while using a rating dial to continuously indicate their level of anger (ranging from neutral to violently angry). Following each scenario, men articulated aloud for 1 min about their thoughts and feelings of the scenario. So that the demand characteristics were relatively consistent between the conflict discussion and standardized task (i.e., expectation for speech), physiology was averaged across the two 1-min articulation phases.1 Heart rate and skin conductance responses were averaged across the entire 4-min baseline, the first 5 min of the conflict discussion, and across the two anger-induction articulation periods.

Psychophysiological Measures

Psychophysiological measures were collected by using an integrated software and hardware package designed by James Long Company (Long, 1998a), including a 16-channel burst mode bioamplifier at the resolution of 1 ms, averaged over 1-s periods.

Heart rate was measured by placing three, pregelled, 30-mm square Unitrace, alligator-clip-type electrodes on the participant’s chest: two in a bipolar configuration on opposite sides of the chest and the third on the sternum as a ground. R-waves were automatically detected by using the interbeat interval (IBI) data analysis program (Long, 1998b). Electrocardiogram files were visually screened and R-waves of problematic files were manually marked by using the IBI edit program (Long, 1998b). Second-by-second heart rate (in beats per minute) was computed from the resultant IBI file. Heart rate arousal was measured by average resting heart rate. Heart rate reactivity was calculated as average task heart rate minus average resting heart rate. An increase in heart rate generally indicates increased arousal, caused by alpha- and beta-adrenergic activation or by parasympathetic (vagal) inhibition.

Skin conductance level was measured via two electrodes placed on the volar surfaces on the distal phalanges of the first and third fingers of the nondominant hand. James Long Company Ag/AgCl electrodes (1-cm diameter) were filled with an isotonic solution and attached with double-sided adhesive collars with 1-cm diameter holes and Velcro straps. Skin conductance reactivity, calculated from average task minus average base-line skin conductance (in microsiemens), assesses electrodermal activity, or changes in the secretion of sweat glands. These sweat levels are thought to change in response to emotional stimuli (as opposed to temperature) (Gottman et al., 1995). Skin conductance is a relatively pure index of sympathetic activation, as the sweat glands are innervated predominantly by the sympathetic nervous system.

Data Analyses

Three one-way multivariate analyses of variance were conducted to explore mean differences between NV, LLV, and SV men on demographics, psychophysiological responding, and the antisocial spectrum of behaviors (psychopathy, antisocial personality, trait anger, general violence, frequency of intimate partner assault, and observed aggression during the conflict discussion). Two planned comparisons were made of NV versus LLV men and of LLV versus SV men.

Confirmatory factor analyses were conducted to test the factor structure of the CTS2 and antisocial spectrum variables by using a structural equation modeling program (Mplus; Muthén & Muthén, 1998–2005) comparing one-factor and two-factor solutions. For data reduction purposes, factor scores were then entered into all subsequent analyses. Differential relations of heart rate and skin conductance with the Antisocial Personality and Intimate Partner Violence factors across the three groups were examined by using general linear modeling,2 controlling for demographic differences by group. This analysis provides a test of homogeneity of slopes across groups, akin to a test of the differences in the correlations between the antisocial variables and change in physiology between groups. To test which groups differ in terms of how physiological reactivity relates to the emergent factors, we used follow-up general linear models (GLMs), which provided planned contrasts by group, comparing NV versus LLV men and LLV versus SV men. A Bonferroni correction was applied to the planned comparisons to control for inflation of Type I error. Correlations were then conducted to clarify the direction of the relations between the antisocial factor and heart rate and skin conductance reactivity for each group.

Results

Of the 110 participant couples, 102 yielded usable psychophysiology data. Seven men were missing physiological data because of technical difficulties, and 1 man was excluded as an outlier on heart rate (i.e., resting heart rate above 110 beats per minute). These 8 cases were omitted from all subsequent analyses.

Men’s average age was 32 years (SD = 9.60). Median gross family income was approximately $45,000 per year (SD = 38,781). On the basis of U.S. poverty guidelines (Department of Health and Human Services, 2002), 7.2% of the sample was living below the poverty line. Fifteen percent of the men did not graduate from high school, and 32% were college graduates. Forty percent were African American, 19% were Hispanic, 33% were Caucasian, and 8% were from other racial or ethnic origins. Approximately 22% of the couples were interracial. The average length of the relationship was 4.89 years (SD = 4.07). Table 1 indicates that the three groups were successfully matched in terms of income. How-

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1 Similar findings emerge when examining physiological responses during the anger induction listening phases.

2 Like heart rate, severity of violence could also be analyzed as a continuous variable. However, CTS2 scores are not normally distributed, and the resultant three-way interactions would be difficult to interpret. Therefore, we opted to examine physiological responding, psychopathology, and so forth as continuous variables but to keep violence level as a trichotomous grouping variable.
ever, there were significant group differences on age, with violent couples being younger than NV couples (see Table 1). Despite the age differences, there were no significant differences on length of relationship. There were significant differences on relationship satisfaction, with SV couples being the most distressed, as expected.

**Mean Differences Between Groups**

**Frequency of violence.** Although the violent groups were defined by the presence of SV acts, the frequency of violent acts also differed significantly between the groups. There was little overlap between LLV and SV groups on frequency of use of violence in the past year, resulting in a bimodal distribution of CTS2 scores.

**Criminality.** SV men reported more extensive criminal histories for DV offenses (14% of SV men had been arrested on DV charges, as compared with 3% of LLV men and 0% of NV men), \( \chi^2(2, N = 102) = 7.02, p < .05 \), but not for nondomestic violence charges (46% of SV men had been arrested for non-DV charges, as compared with 29% of LLV men and 27% of NV men), \( \chi^2(2, N = 99) = 3.16, ns \). SV men were the most likely to report having spent time in jail or prison (43% of SV men, as compared with 15% of LLV and 20% of NV men), \( \chi^2(2, N = 98) = 7.64, p < .05 \).

**Questionnaire criterion measures.** There were significant group differences on all of the variables of interest except for psychopathy, with SV men scoring the highest compared with the other groups, omnibus \( F(16, 184) = 6.57, p < .001 \). However, after controlling for demographic differences, the differences between the groups on the antisocial behavior variables were no longer significant. Table 2 displays the group differences in the antisocial and male-to-female abuse variables, after controlling for age and marital satisfaction.

As a manipulation check, state anger was examined pre- and postanger induction (see Figure 1). SV men reported a significant increase in anger following the conflict discussion as compared with baseline, whereas the LLV and NV men did not. In all of the groups, men reported significant increases in state anger from baseline to following the anger induction, \( t(100) = 2.88, p < .01 \). There were no significant group differences in state anger following the anger induction. Similarly, on the continuous rating dial used during the listening phase of the anger induction, although there was a main effect as a result of time, \( F(3, 62) = 23.12, p < .001 \), there were no differences on mean ratings during the two scenarios by group, \( F(2, 64) = 1.51, ns \); no differences between the two scenarios, \( F(1, 64) = 0.58, ns \); and no Group \( \times \) Scenario interaction, \( F(2, 64) = 1.12, ns \). Thus, both scenarios appeared to induce anger over time equally in all men, not just the domestically violent men. In sum, only the SV men were angered by the conflict discussion, whereas all men were angered by the anger induction task.

**Measurement Model of Antisocial and Intimate Partner Abuse Variables**

The antisocial and intimate partner abuse variables were highly correlated (see Table 3). These nine manifest variables were entered into Mplus (Muthén & Muthén, 1998–2005). The one-factor solution yielded an inadequate fit of the data, \( \chi^2(27, N = 110) = 82.68, p < .001 \); comparative fit index = .95; root-mean-square error of approximation = 1.38; Akaike’s information criterion (AIC) = 136.68; Browne–Cudek criterion (BCC) = 142.17. However, a two-factor solution, in which the CTS2 variables load on one factor and the other measures load on a second factor, fit the data very well, \( \chi^2(25, N = 110) = 32.66, ns \); comparative fit
The ratio of the AIC and BCC between the two models suggests that the two-factor solution displayed in Figure 2 is a better model than a single-factor solution. For heart rate, there were significant group differences at baseline, $F(2, 99) = 3.97$, $p < .05$. SV partner-aggressive men had significantly lower resting heart rate than did the LLV men ($p < .025$). However, both age and antisocial personality have been shown to be related to resting heart rate. No group differences remained when age and the factor scores of the antisocial construct were entered as covariates, suggesting that baseline differences in heart rate were attributable to group differences in age and antisocial personality as opposed to severity of intimate partner violence. Table 4 displays the mean heart rate and skin conductance at baseline and means and change scores during the two experimental tasks, controlling for group differences in age and the antisocial composite measure. Only heart rate during the anger articulation remained significant when controlling for group differences in age and antisocial behavior, with SV men tending to display lower heart rates during the anger induction task than did LLV men ($p < .05$).

GLMs Predicting the Antisocial Spectrum of Behavior

We predicted that decreased heart rate and skin conductance from baseline to the marital interaction would be related to the Antisocial and Intimate Partner Abuse factor scores only for the SV men. The moderating effects of severity of violence on the relations between psychophysiological reactivity and antisocial personality and intimate partner abuse were examined by using separate GLMs for range-corrected heart rate and skin conduc-

3 The formula for calculated range-corrected heart rate (HR) scores is (mean HR during task - minimum HR)/(maximum HR - minimum HR).

We thank an anonymous reviewer for suggesting the use of the range-corrected HR scores.
tance. Table 5 shows the univariate effects of the antisocial and intimate partner abuse composite variables as they relate to the two physiological channels, interacting by group.

Heart rate reactivity. Range-corrected heart rate change from baseline to the marital interaction was unrelated to the antisocial personality and intimate partner abuse. That is, there were no significant main effects due to heart rate change. However, there were significant interactions between heart rate change and group for the antisocial personality construct (see Table 5), controlling for preexisting group differences. These findings were attributable to differences between the SV and LLV groups. Specifically, for the SV group, antisocial behavior was negatively correlated with range-corrected heart rate change (r = −.35, p < .05), consistent with the findings of Gottman et al. (1995). However, for the LLV group, antisocial behavior was positively correlated with heart rate change (r = .42, p < .01). The differences in the correlations between the SV and LLV groups were significant (t(94) = 3.09, p < .01). There was no significant prediction for the NV group (r = .06, ns). Low heart rate reactivity was related to antisocial behavior for the SV group, whereas high heart rate change was related to antisocial behavior for the LLV group. Figure 3 graphically displays this pattern of results for the composite antisocial variable. A similar interaction predicting Intimate Partner Abuse factor scores from heart rate reactivity was found, with the relation between heart rate change being negative for the SV men (r = −.26), positive for the LLV men (r = .33), and nonsignificant for the NV men (r = −.03).

Skin conductance reactivity. A similar GLM was conducted to test group differences in the relationship between the antisocial personality and intimate partner abuse with change in skin conductance from baseline to the marital interaction. Skin conductance change interacted with group to predict antisocial personality, after age and marital satisfaction were simultaneously entered as covariates (ps < .05). Specifically, antisocial behavior was negatively correlated with skin conductance change for the SV group (r = −.13) and for the NV group (r = −.31). However, for the LLV group, antisocial behavior was positively correlated with skin conductance reactivity (r = .37, p < .01). The correlations for the LLV group were significantly different than those for the SV men (t(94) = 2.17, p < .05) and the NV men (t(94) = 2.75, p < .01). Thus, high sympathetic reactivity was related to antisocial behavior for the LLV group only.

Do similar patterns emerge when physiological reactivity is based on the anger induction? Psychophysiological responding during both emotion-inducing tasks were highly correlated (r = .89, p < .001) for range-corrected heart rate change and for skin conductance change (r = .95, p < .001). There were no significant main effects due to heart rate change on the antisocial variables. A pattern similar to that found in the conflict discussion was found during the anger induction, with heart rate change interacting with group to predict the antisocial composite variable. Again, there was a significant interaction between group and range-corrected heart rate in the prediction of the antisocial construct, F(2, 94) = 3.21, p < .05. For LLV and NV men, heart rate acceleration during the anger induction was positively related to antisocial behavior (r = .23 and .14, respectively). For SV men, on the other hand, heart rate reactivity during the anger induction was negatively related to antisocial behavior (r = −.25). The correlations for SV men with heart rate were significantly different than for the LLV men (t(94) = 2.12, p < .05). Figure 4 visually displays the interaction between the antisocial behavior composite measure group and heart rate change during the anger induction. Comparing Figures 3 and 4, one can see a similar pattern in the relation between heart rate reactivity and the antisocial composite measure as moderated by group when heart rate reactivity is calculated from the conflict discussion (see Figure 3) and from the anger induction (see Figure 4). In both tasks, SV men who evidenced the largest decreases in heart rate reported the highest antisocial behavior.

Table 3

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<td>F. psych. abuse</td>
<td>.53**</td>
<td>.43***</td>
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<tr>
<td>M. psych. abuse</td>
<td>.28**</td>
<td>.62***</td>
<td>.49***</td>
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<tr>
<td>Observed aggression</td>
<td>.19</td>
<td>.18</td>
<td>.29**</td>
<td>.23*</td>
<td>—</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Antisocial</td>
<td>.19</td>
<td>.40***</td>
<td>.34***</td>
<td>.54***</td>
<td>.10</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Trait anger</td>
<td>.30**</td>
<td>.37***</td>
<td>.36***</td>
<td>.45***</td>
<td>.27**</td>
<td>.61***</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychopathy</td>
<td>.23*</td>
<td>.33**</td>
<td>.19</td>
<td>.39***</td>
<td>.29**</td>
<td>.57***</td>
<td>.36***</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>General violence</td>
<td>.25*</td>
<td>.35***</td>
<td>.23*</td>
<td>.30**</td>
<td>.17</td>
<td>.38***</td>
<td>.33**</td>
<td>.30**</td>
<td>—</td>
</tr>
</tbody>
</table>

Note. F. = female report of male-to-female abuse; M. = male report of his own abuse; psych. = psychological.

* Frequency of male-to-female abuse in the past year on the revised Conflict Tactics Scales (Straus, Hamby, Boney-McCoy, & Sugarman, 1996). * Contempt + belligerence displayed during conflict discussion.

4 To test whether differences in heart rate reactivity were attributable to parasympathetic activation or deactivation, we also entered respiratory sinus arrhythmia change into separate general linear models. No significant interactions between severity of violence and respiratory sinus arrhythmia were observed in the prediction of the antisocial behaviors.

5 This interaction is not attributable to group differences in amount of speech, as there were no group differences on word count during articulations by group, F(2, 82) = 1.29, ns.
behavior, whereas the NV and LLV men who evidenced the largest increases in heart rate reported the most antisocial features.

A separate GLM was conducted for electrodermal responding during the anger induction as it relates to the antisocial factor, this time revealing differential relations between antisocial behavior and skin conductance change by group (see Table 5). Only LLV men showed a positive correlation between skin conductance change during the anger induction and the antisocial composite variable \( r = .41, p = .01 \). There were no significant interactions between the intimate partner abuse construct, psychophysiological reactivity, and group during the anger induction task.

Additional GLMs were conducted to examine arrest status rather than severity of violence as the moderating variable. There were no moderating effects of arrest status on psychophysiological reactivity as it relates to the antisocial spectrum of behavior. In sum, autonomic reactivity as measured by heart rate and skin conductance during the conflict discussion was related to the antisocial spectrum of behavior, but the direction of this relationship differed on the basis of the severity of men’s violence. Lower autonomic reactivity during conflict was related to higher antisocial features for the SV men. However, high autonomic reactivity was related positively to the antisocial spectrum for the LLV men.

Discussion

This study extended the findings of Gottman et al. (1995) to examine patterns of psychophysiological responding during a conflict discussion with the spouse as well as during a standardized anger induction paradigm. It clarifies that general antisocial tendencies and intimate partner abuse are empirically distinct constructs and that low resting heart rate and psychophysiological reactivity are related more consistently to the general antisocial spectrum of behavior than to intimate partner abuse. Findings suggest that the relation between heart rate change and skin conductance with the antisocial spectrum of behavior is moderated by the severity of intimate partner violence. Similar patterns of results were found when comparing heart rate change from baseline with a naturalistic conflict discussion and with a standardized, imagery-based anger-induction protocol when predicting antisocial behavior.

In general, the current study supports some of the conclusions of the Gottman et al. (1995) study but does not support the typology per se. In a previous study using this same sample, Babcock et al. (2004), like Meehan et al. (2001), failed to replicate Gottman et al.’s (1995; Jacobson & Gottman, 1998) dichotomous distinction
between heart rate accelerators/Type II/pitbulls and decelerators/Type I/cobras by using their selection criteria. However, when the relations between the variables specified by Gottman et al. (1995) were explored in a broader sample by using more powerful statistical techniques, the pattern predicted by Gottman et al. (1995) emerged, but only among SV men. In the original typology, Gottman et al. (1995) included only maritally violent men whose wives reported either frequent or severe acts of violence in the past year. We found that distinguishing violent couples on the basis of perpetration of one or more severe acts captured distinct differences among most variables of interest. By examining a wider range of intimate partner violence, the current study found that men’s heart rate reactivity was negatively related to the antisocial spectrum of behavior, but only among SV men. Among the LLV group, the opposite was observed: Heart rate reactivity was positively related to the antisocial spectrum behavior. Among NV men, the relations emerged between physiological arousal and the antisocial spectrum only during the standardized anger induction. Under this condition, their heart rate reactivity correlated with antisocial traits in a pattern similar to that of LLV men, perhaps because they were angered only by the imaginal task.

Why would antisocial tendencies be related to increased arousal among LLV and NV men and decreased arousal among SV men? There are two venerable theories of aggression, psychopathology, and physiological responding (Gottman, 2001). One theory posits that underarousal is a biological mechanism of aggression among psychopaths and criminals (Eysenck, 1964; Lykken, 1957; Quay, 1965; Raine & Venables, 1981). The second, incorporating the literature on Type A personality, asserts that overarousal is functionally related to anger and hostility among noncriminal populations (Kaplan, Botchin, & Manuck, 1994; Smith & Brown, 1991). As Ishikawa et al. (2001) found, the direction of physiological

Table 4

<table>
<thead>
<tr>
<th>Physiological variable</th>
<th>NV</th>
<th>LLV</th>
<th>SV</th>
<th>F(2, 97)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart rate</td>
<td>76.28</td>
<td>9.99</td>
<td>75.54</td>
<td>11.58</td>
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<tr>
<td>Skin conductance</td>
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<td>4.92</td>
<td>14.13</td>
<td>6.47</td>
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<tr>
<td><strong>Conflict discussion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart rate</td>
<td>79.17</td>
<td>10.75</td>
<td>78.75</td>
<td>12.35</td>
</tr>
<tr>
<td>Heart rate change&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>0.09</td>
<td>0.07</td>
<td>0.08</td>
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<tr>
<td>Skin conductance</td>
<td>12.87</td>
<td>5.17</td>
<td>14.99</td>
<td>6.27</td>
</tr>
<tr>
<td>Skin conductance change</td>
<td>0.76</td>
<td>1.06</td>
<td>0.86</td>
<td>1.47</td>
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</tbody>
</table>

Note. Heart rate is calculated in beats per minute. Skin conductance is a raw conductance value in microsiemens. No planned contrasts were significant at <p>.05. NV = nonviolent; LLV = low-level violent; SV = severely violent.

<sup>a</sup> To be consistent with Gottman et al. (1995), psychophysiology means were calculated across the first 5 min of the conflict discussion. Means of the first 5 min were highly correlated to means across the entire interaction (rs range from .96 to 1.0) for both physiological measures. Results of the general linear models remained consistent whether reactivity during the first 5 min or across the 15 min was entered into the analyses.

<sup>b</sup> Range-corrected heart rate change scores were used in all analyses.

<sup>*</sup> p < .05.

Table 5

<table>
<thead>
<tr>
<th>Variable</th>
<th>Conflict discussion</th>
<th>Anger induction</th>
<th>Conflict discussion</th>
<th>Anger induction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antisocial behavior</td>
<td>5.40**</td>
<td>3.21**</td>
<td>5.24***</td>
<td>3.47**&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Intimate partner abuse</td>
<td>2.53</td>
<td>3.15**</td>
<td>1.93</td>
<td>1.67</td>
</tr>
</tbody>
</table>

Note. df<sub>s</sub> = 2, 94. There were no significant main effects due to range-corrected heart rate (HR) change or skin conductance change. SCL = skin conductance level; LLV = low-level violent; SV = severely violent; NV = nonviolent.

<sup>a</sup> LLV vs. SV contrast significant, p < .025  <sup>b</sup> NV vs. LLV contrast significant, p < .025  <sup>*</sup> p < .05.  ** p < .01.
reactivity as it relates to psychopathy can vary depending on whether the psychopath has been incarcerated. Thus, the direction of physiological reactivity as it relates to the antisocial spectrum appears to be moderated by the population under investigation.

The current findings also support Johnson’s (1995) notion that men who perpetrate severe intimate partner violence may be qualitatively different from those who engage in low levels of abuse. Although a dichotomous typology based on heart rate deceleration alone may be questionable, a categorical distinction based on having committed a life-threatening act may be appropriate when considering the psychophysiological correlates of intimate partner abuse. Antisocial men who perpetrate low levels of violence show the expected pattern of increased cardiovascular and electrodermal responding when angered, suggesting a failure to regulate physiological arousal when angered, or “flooding” (Gottman, 1994). The most antisocial of the SV men, however, evidence not only low resting heart rates but also decreases in cardiovascular and electrodermal responding when angered. This suggests a different process of regulating anger among the antisocial SV men. Whether this decrease in arousal is attributable to a focusing of attention or to the use of different coping strategies remains unknown. However, it does suggest that interventions teaching emotional regulation strategies to prevent flooding may not benefit the antisocial SV batterer.

The interaction between severity of violence and physiological reactivity may be explicable in terms of principles of reinforcement related to the escalation of crimes. Among high-risk adolescents (Raine et al., 1990) and adults (Brennan et al., 1997), increased arousal is predictive of desistance from crime. Raine (1997) proposed that those who will desist from crime have a more open attentional stance to the environment (p. 295), as opposed to the narrowly focused attention of recidivists and career criminals. Because of their attentional openness, they are more responsive to classical conditioning and are more fearful and conscientious (Eysenck, 1977; Hare, 1978), which inhibits the severity of violence perpetration. To apply this model to the current findings, severity of violence would best be viewed on a continuum. Increased heart rate reactivity may inhibit the severity of violence perpetration of men with aggressive tendencies. That is, men who report antisocial traits but are highly reactive may also be more anxious and fearful, which may serve as a protective factor against severely battering their mates. An alternative explanation is that severe battering may lead to autonomic hyporeactivity; that is, the batterer has become desensitized to interpersonal conflict. Although antisocial SV men may still report feeling anger, they may have learned how not to react physiologically in anger-inducing situations.

The standardized anger induction procedure shows promise as a tool to elicit psychophysiological responding. Patterns of heart rate reactivity as they predict the antisocial spectrum of behavior were consistent across both the anger induction and naturalistic conflict discussion. The standardized anger induction may be useful in clinical or research settings to assess the intimate partner abuser’s physiological reactions when angered in the context of intimate relations without jeopardizing the victim’s safety. In general, the relations between psychophysiological reactivity and aggressive tendencies and partner-directed abusive behavior were stronger for violent men in the couples’ interaction task than the anger induction, most likely because they experienced more true emotion during naturalistic conflict discussion with their partner than they did during the imagination task. However, the use of either the conflict discussion or the anger induction paradigm to categorize different types of intimate partner abusers is questionable, as the utility of dichotomizing partner-aggressive men into different types on the basis of their physiological reactivity has not been found to be reliable (Babcock et al., 2004; Meehan et al., 2001).

Across task and physiological channel, the current study found consistent patterns between psychophysiological reactivity and antisocial violence on the CTS2, thereby reducing variability of intimate partner abuse within group. Severity of violence may be one among many moderating variables in the relations between psychophysiological reactivity and intimate partner abuse. Although all men may show some degree of intimate partner abuse (i.e., psychological abuse and observed aggression), the weaker relations between autonomic reactivity and intimate partner abuse may be due to the fact that couples were grouped on severity of violence on the CTS2, thereby reducing variability of intimate partner abuse within group. Severity of violence may be one among many moderating variables in the relations between physiological reactivity and the antisocial spectrum of behaviors. Similar patterns may emerge when comparing community versus clinical samples of batterers. Socioeconomic variables, such as white-collar versus blue-collar workers or educational attainment, may also moderate the psychophysiological reactivity during emotional tasks as it predicts antisociality. Neuropsychological problems, such as frontal lobe deficits or head injuries, may underlie differences between the LLV and SV batterers. Future studies are
needed to explore other variables that may moderate the relations between psychophysiological responding and psychopathy and antisocial behavior for different populations.

In this laboratory protocol, the conflict discussion preceded the anger induction so that the protocol for the replication study was comparable to Gottman et al. (1995). However, the autonomic arousal from the conflict discussion could have contaminated the anger induction paradigm. Although the ATSS produced a comparable pattern of correlations between psychophysiology and self-report measures as the conflict discussion, the relations were less robust for the violent men but more robust for the NV men. One interpretation is that for the violent men, a naturalistic conflict discussion is simply more anger inducing than is an audiotaped anger induction staged by actors. Another possible interpretation, however, is that the anger induction was contaminated by the previous conflict discussion. However, this interpretation cannot explain the findings for the NV men, who reported more anger following the anger induction than following the conflict discussion. Although counterbalancing the two tasks is possible, the ethics of angering a batterer prior to a confrontation with his victim is questionable. Instead, future researchers may consider administering the tasks on separate days.

Other limitations include the self-report measures of men’s psychopathy. Formal diagnostic interviews of antisocial personality disorder (e.g., the Structured Clinical Interview for the Psychopathology. Formal diagnostic interviews of antisocial personality disorder (e.g., the Structured Clinical Interview for Psychopathology. Formal diagnostic interviews of antisocial personality disorder (e.g., the Structured Clinical Interview for Psychopathology. Formal diagnostic interviews of antisocial personality disorder (e.g., the Structured Clinical Interview for Psychopathology. Formal diagnostic interviews of antisocial personality disorder (e.g., the Structured Clinical Interview for Psychopathology. Formal diagnostic interviews of antisocial personality disorder (e.g., the Structured Clinical Interview for Psychopathology.

References


