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Gender Differences in the Negative Affective Priming of Aggressive Behavior

Edelyn Verona
University of Illinois at Urbana–Champaign

John J. Curtin
University of Wisconsin—Madison

The negative affective priming of aggression was examined across different aversive contexts (general stress exposure and frustration) with a laboratory aggression paradigm that measured the intensity of shocks participants delivered to a putative employee. Participants' emotional responses were gauged via startle eyeblink reactions and self-report mood ratings. Aside from gender differences in overall aggression, men but not women exposed to general stress showed significant increases in aggression across blocks. However, frustration produced increases in aggression in both genders. Although both genders showed robust startle increases during stress, startle activation was related to increases in aggression in men and decreases in aggression in women. These findings suggest that general stress and experiences of negative emotion trigger physical aggressive responses more strongly in men than in women.

Keywords: aggression, gender differences, stress, frustration, emotions, startle

A number of theoretical papers and some empirical evidence suggest that, in general, men tend to externalize their negative affect, including in aggressive forms, whereas women do not tend to respond to stress with aggression (Ogle, Maier-Katkin, & Bernard, 1995; Taylor et al., 2000). It is important to uncover potential situational and emotional factors that may relate to men's and women's differential behavioral responses to aversive contexts. The current report involves an analysis of the unique and interacting effects of general stress (physical stressor) and frustration (monetary goal-blocking) on gender differences in emotion and aggression. Additionally, we examine the moderating role of gender in relationships between negative affective activation, measured via the eyeblink startle response, and aggression.

Aversive Contexts and Aggression

According to Berkowitz (1990) in his cognitive neoassociationistic model of aggressive behavior, unpleasant events of all kinds (including interpersonal provocation, frustration, and physical discomfort) can prime the initiation of escape and attack behaviors. The elicitation of negative affect may result in aggressive behavior, because they are both connected to a common associative network involving adaptive mobilization for defensive action. On the basis of this view, the study of aggression should involve the assessment of different channels of activation, including subjective evaluations, physiological responses, and motor impulses following exposure to an aversive event to best gauge the individual's motivational state (cf. P. J. Lang, 1979). Another implication of this theory is that aversive stimulation does not necessarily have to involve an anger-specific event (i.e., provocation) to prime aggression.

A large empirical literature has examined the effects of aversive instigation (or priming) of laboratory aggressive behavior. In most existing studies (e.g., Bettencourt & Miller, 1996; Bushman & Baumeister, 1998), the aversive context has involved interpersonal provocation (i.e., direct insult or offense by another person). However, for decades, research has also been conducted on the effects of a frustrating context (or goal-blocking) on aggression (Dollard, Doob, Miller, Mowrer, & Sears, 1939), and empirical evidence has consistently supported the hypothesis that frustration leads to increased aggression (Gustafson, 1993; Thompson & Kolstoe, 1974). Although they are less explicit than direct provocation, interpersonal situations involving frustration (e.g., a motorist's car breaks down and causes a traffic jam) still allow one to identify the person responsible for one's negative affect and the likely target for the aggression (Dill & Anderson, 1995).

Conversely, Berkowitz (1990; Berkowitz & Harmon-Jones, 2004) has postulated that, despite prior suggestions that anger and aggression only arise when threat is attributed to a responsible agent (Ellsworth & Smith, 1988), seemingly impersonal stressors can result in hostility and aggression directed toward an innocent target. Indeed, hostile judgments of a stranger or delivery of electric shock to a confederate within a laboratory paradigm have been instigated by foul odors (Rotton, 1979), hot rooms (Bell & Baron, 1976), painful cold water immersion (Berkowitz, Cochran, & Embree, 1981), and exposure to an air blast stressor (Verona, Patrick, & Lang, 2002). Berkowitz (1989) explained the reason for these effects in his reformulation of the frustration–aggression

Edelyn Verona, Department of Psychology, University of Illinois at Urbana–Champaign; John J. Curtin, Department of Psychology, University of Wisconsin—Madison.

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Correspondence concerning this article should be addressed to Edelyn Verona, University of Illinois, Department of Psychology, 603 East Daniel Street, Champaign, IL 61820. E-mail: everona@cyrus.psych.uiuc.edu

hypothesis. He suggested that the resulting negative affect, not the aversive event per se, leads to likely increases in aggression, highlighting the importance of examining direct relationships between negative affective experiences and aggression following an aversive event.

Using Berkowitz's (1990) model as a framework, we extend prior work to examine (a) whether different cuing contexts (i.e., target is to blame or not to blame for one's distress) are associated with differential elicitation of negative affect and aggression in men and women and (b) whether gender moderates the negative affect–aggression association. In general, the most reliable instigation to aggression among men and women occurs during interpersonal provocation (Bettencourt & Miller, 1996), because of its explicitness (i.e., target is purposely trying to cause one distress). However, individual differences seem to play a greater role in contributing to aggressive responses under less explicit situations (Kogut, Langley, & O'Neal, 1992). For example, chronically aggressive youths are more likely than nonaggressive individuals to interpret ambiguous interpersonal situations (i.e., the intent of the instigator is unclear) with hostile intent, calling for anger and aggression (Dodge & Coie, 1987), but individual differences in hostility do not reliably predict aggressive intent in definite or less ambiguous interpersonal provocation (Homant & Kennedy, 2003).

A similar impact of the explicitness of the instigation has been reported in the gender–aggression literature. Knight, Guthrie, Page, and Fabes (2002) concluded from their meta-analysis that gender differences in aggression were smaller in interpersonal contexts that were rated as very low or very high in emotional evocativeness (no or extreme provocation, respectively), whereas gender differences were most robust under slightly or moderately evocative situations. Although Knight et al. did not discuss the issue, this last finding may relate to the fact that moderate levels of instigation allow for greater ambiguity in the likely behavioral response, and thus gender differences are most observable in such ambiguous contexts. In terms of the current study, although the target of the aggression was not purposely harming the participant in the frustration and general stress manipulations, frustration relative to general stress should represent a more explicit prime for aggression (i.e., the target is responsible for distress in the former but not the latter). Thus, we expect larger gender differences in aggression during general stress relative to frustration.

Gender, Negative Affect, and Aggression

In this article, we were interested in examining gender differences in the negative affect–aggression relationship across aversive contexts. We formulated hypotheses regarding gender differences according to the literature comparing men's and women's emotional and behavioral responses to aversive contexts. Women and men do not seem to reliably differ in terms of the magnitude (intensity, frequency) of self-reported experience of negative emotion (Kring & Gordon, 1998); however, they tend to differ in their self-reports of different types of negative emotions (Fischer, Mosquera, van Vianen, & Manstead, 2004). There is a tendency for women to report higher levels of fear and anxiety and for men to report higher levels of hostility, although effect size differences are not large (Watson & Clark, 1994). More robust gender differences are found in the *expression* of emotions, such as in greater facial reactivity when people view fearful pictures (Bradley, Codispoti, Sabatinelli, & Lang, 2001) or more self-reported crying behavior (Fischer et al., 2004) among women relative to men. Conversely, men are more likely to overtly express anger (Fabes & Eisenberg, 1992), and they react with antagonism (Fischer et al., 2004) more readily than female participants.

Despite these differences in self-report and expression of different emotions, gender differences in physiological responses are less consistent. Kring and Gordon (1998) found that women were more facially expressive than men, but men's and women's autonomic responses differed only slightly across different stimulus contents. Moreover, analyses failed to clearly reveal a gender difference in overall physiological reactivity to aversive stimuli. Bradley et al. (2001) reported more defensive activation, manifested by more concordant responding to aversive cues across different measures, in women than men, but direct comparisons between men and women on physiological responses to the aversive stimuli only revealed gender differences in facial electromyographic activity (more corrugator reactivity in women than men). In a classic aggression experiment, Frodi (1978) observed no gender differences in heart rate or skin conductance responses to interpersonal provocation, even though men reported more anger rumination and exhibited higher levels of aggression. In terms of the startle reflex used in this study, there is some evidence that women exhibit greater overall startle magnitudes (Bradley et al., 2001), although other studies have failed to find this effect (e.g., Ludewig et al., 2003). No studies have reported gender differences in startle potentiation (i.e., larger startle responses to aversive relative to neutral contexts), although there is evidence that women at high risk for depression or anxiety are more likely than high-risk men to show elevated startle responses under aversive conditions (Grillon et al., 2005).

On the basis of this prior work, we hypothesized that men and women would self-report different emotions in response to aversive contexts (i.e., more anger in men and more fear in women) but that gender differences in physiological (i.e., startle) responses to general stress or frustration would be minimal. Nonetheless, we were particularly interested in examining the moderating role of gender in the negative affect–aggression link postulated by Berkowitz (1989, 1990). Berkowitz has not elaborated on gender differences in regard to his theory. However, he has discussed the idea that negative affect can give rise to different types of behaviors, such as fight versus flight tendencies (attack vs. escape/avoid). He suggested that a variety of variables, including individual differences and situational factors, determine the relative strengths of these two tendencies in response to aversive events.

Only a few studies have actually reported gender differences in relationships between physiological reactivity and aggression, and, in actuality, these have involved the measurement of trait or state anger (an emotion) and not aggression (a behavior) per se. For example, studies have demonstrated that expressed anger and trait hostility in men but not women are linked to greater autonomic reactivity and sustained arousal (Burns, 1995; Burns & Katkin, 1993). In one study, sustained cardiovascular activity was actually related to decreased anger experiences and fewer expressions of hostility in women (Faber & Burns, 1996). It seems that women's and men's physiological responses to aversive contexts may result in different behav-

ioral outcomes; however, no studies have directly examined the moderating role of gender in the relationship between negative affect, measured physiologically, and behavioral indexes of aggression.

Present Study

In the current study, we assessed gender differences in negative affect (self-report and startle reactivity) and aggression in response to different aversive contexts (general stress vs. frustration) within a controlled laboratory aggression paradigm. We used the acoustic startle reflex to measure physiology because it specifically indexes the valence of emotional activation and is linked to action mobilization at a basic brain level (i.e., the amygdala; Davis, 1989). It is important to index this direct negative activation because Berkowitz (1990) stipulated that the associative connections between negative affect and aggression occur quite automatically. Only one prior study has examined relationships between acoustic startle responses and aggressive behavior in the laboratory. Verona et al. (2002) found that men who were high on trait negative emotionality responded with greater aggression to an air blast stressor and that the men's overall startle reactivity (relative to baseline; *startle sensitization*) was positively related to their level of aggression. This result is evidence of the potential concordance between physiological and behavioral responses to aversive contexts. No women were included in Verona et al. (2002); thus, the current study is meant to examine gender differences in the coherence of negative emotions and aggressive responses.

On the basis of this review of the literature, our predictions were as follows:

1. We expected that general stress and frustration manipulations would both produce increases in aggression, as per Berkowitz's (1990) model. We also examined the combined impact of these two cuing contexts to understand whether their effects are *additive* (i.e., higher aversive stimulation leads to more aggression; cf. Berkowitz & Harmon-Jones, 2004) or *interactive*. The type of interaction effect that we expected, on the basis of prior work (Ellsworth & Smith, 1988), was one in which the effects of stress exposure would only be evident when individuals could hold the target responsible for their distress, as when they were also being frustrated by the target.

2. On the basis of a review of the literature, we expected larger gender differences in aggression in response to general stress relative to frustration. The frustration manipulation represents a more explicit prime of aggression, and thus individual differences should play a smaller role in predicting aggressive responses in this context (Homant & Kennedy, 2003).

3. Likewise, we expected gender differences in participants' reports of their negative affective experience during aversive contexts. We expected women to self-report more fear and men to report more hostility (Watson & Clark, 1994).

4. Although we did not expect gender differences in physiology, we predicted that gender would moderate the relationship between startle responses and aggression. We hypothesized that the startle–aggression relationship would be stronger in men (Burns, 1995; Burns & Katkin, 1993) and that we might find a negative relationship in women (Faber & Burns, 1996).

Method

Participants

Participants were 117 undergraduate students (59 female, 58 male) recruited through introductory psychology classes and scheduled for participation via telephone. They received course credit and $10 compensation for their participation. The mean age of the participants was 21 years (SD = 5.5). Participants were mostly Caucasian Americans (n = 103; 88%), whereas 10% (n = 12) were African American and 2% (n = 2) reported another ethnicity. Because of equipment malfunction, 3 participants had no startle data and were not included in analyses involving startle.

Experimental Procedures

After signing an informed consent form, participants were introduced face to face to a same-sex student[1] (actually a confederate of the experimenter), and both were told that the study involved an investigation of the effects of distraction on supervisor and employee performance. The real participants were always assigned the role of supervisor. The supervisor (i.e., real participant) and employee (i.e., confederate) were then escorted to separate rooms.

Electrode hook-up and baseline startle assessment. Before the instructions were provided, the real participants were seated in a recliner positioned about 1 m from a 21-in. (53-cm) monitor, from which they could view the employee's responses later in the experiment. Participants in all conditions were fitted with electrodes to record startle responses. The eyeblink component of the reflex was recorded from the orbicularis oculi muscle beneath the left eye, via 4 mm electrodes (MED Associates, St. Albans, VT) filled with electrolyte paste. All participants were also fitted with earphones for the purpose of startle probe presentations. The startle response was elicited by a 50-ms presentation of a 105-dB burst of white noise (i.e., a startle probe) with an instantaneous rise time. Following this electrode hook-up, a pretest startle assessment was conducted. Nine noise probes were presented, separated by intervals of 11–13 s, to elicit baseline startle responses.

Instructions and cover story. The real participants were told that the employee was performing a digit memory task in the next room and that they would view the confederate's responses on the monitor positioned in front of them. They were to provide accuracy feedback to the employee via a *correct* button if the response was correct or one of 10 *shock* buttons if the employee's response was incorrect. Participants were told that, as supervisors, they would administer shocks to the employee to simulate criticism of job performance, as in a work situation, and they were free to choose and vary the level of shock to administer across the trials. This cover story was used to ensure that participants' shock responses could be interpreted as punishment for negative performance, not as helping behavior, as in the teacher–learner paradigm. The participants were led to believe that they were administering actual shocks to the employee; in actuality, no real shock was being delivered.

Stress and frustration conditions. Participants were randomly assigned to conditions, in a gender-balanced way, within a 2 (stress vs. no stress) × 2 (frustration vs. no frustration) design. This resulted in four groups each of men and women: no stress/no frustration (15 women and 14 men),

[1] Prior research has indicated that interactions between target and perpetrator gender in laboratory aggression paradigms mostly reflect the fact that men are less willing to aggress against a female target than a male target (see Frodi, 1978; Schnake, Ruscher, Gratz, & O'Neal, 1997) and that male on female aggression is considered especially prohibitive (Hilton, Harris, & Rice, 2003). Given this literature, which suggests a limited impact of this confound, we introduced participants to confederates of the same gender to optimally streamline analyses and presentation of results.

stress/no frustration (14 women and 14 men), no stress/frustration (15 women and 15 men), and stress/frustration (15 women and 15 men).

In keeping with the cover story instructions, participants were first informed of the stress condition to which they were assigned. As per the cover story, they were told that the study examined the impact of environmental distractions on participants' decision making and performance and that they would be randomly assigned to either receive a "distraction" (stress) or not receive a distraction (no stress). Those assigned to the stress condition, regardless of frustration, were told that they would receive brief, intermittent blasts of compressed air to the throat throughout the procedure (Grillon & Ameli, 1998). The air blasts were generated by a tank filled with compressed breathable air connected to a regulator that reduced the output to a constant flow pressure of 100 psi. A single tube extended from the regulator to a 17 × 7 mm reservoir cylinder that housed an outlet for the air blasts. The air blasts, which were 50 ms in duration, were delivered via a tube that was positioned through a harness placed around the participant's waist and chest and directed at the throat at the level of the larynx (Grillon & Ameli, 1998). The participants were assured that the employee was not at all responsible for these air blast administrations. Participants in the no-stress condition were not fitted with the harness. They were told that they were in the control condition and that they would not receive a distraction during the procedure.

Following stress condition instructions, all participants were encouraged to be fully invested in their tasks, to pay attention, and to be as accurate and quick as possible in their feedback. Participants assigned to the frustration condition, however, were told in addition that they would split $20 with the employee ($10 for the participant) if the employee performed the task effectively. They were told that the employee was encouraged to perform the task as accurately and quickly as possible. Real participants in the no-frustration condition were told that they would receive a monetary reward regardless of the confederate's performance. At the end of each block of trials, all participants received feedback on their monitor screen as to the number of incorrect responses made by the employee during that block. Across both frustration conditions, the experimenter manipulated the employee's responses so that he or she gradually made a large number of errors (29 total errors) across the experiment. This frustration manipulation has been used successfully in prior work (see Gustafson, 1993; Verona et al., 2002).

Experimental blocks. Before the beginning of the actual experimental blocks, participants completed an initial block of trials (practice block) so that they could get accustomed to the aggression paradigm. Participants provided feedback (shock or correct responses) to the confederate without the administration of air blasts (even if they were in the stress condition) during this practice block.

The actual experiment followed and consisted of a total of four experimental task blocks, with 10 trials per block. Main analyses focused on these four experimental blocks. Four startle probes were administered to all participants during each block. The serial positions of noise probe presentations were counterbalanced across incorrect/correct trial blocks. For participants in the stress condition, a total of 16 air blasts were delivered (4 within each block) during the procedure. An equal number of air blasts were presented during correct and incorrect response trials across all blocks. Startle probes and air blasts (for those in the stress condition) were never delivered simultaneously on the same trial.

Startle Sensitization Index

The raw electromyograph signal was obtained with Neuroscan (El Paso, TX) amplifiers, digitized at 2000 Hz and bandpass filtered, with frequencies below 0.15 Hz and above 500 Hz attenuated. Offline data processing included signal epoching (sample window included 50 ms preprobe to 250 ms postprobe presentation), rectification, smoothing (30-Hz lowpass filter, 24 db/octave), and baseline correction.

Startle responses were scored offline as peak magnitude of the eyeblink response for each probe presentation. Tonic startle reactivity during the test procedure was operationalized in terms of startle sensitization—that is, magnitude of the startle response during testing as a proportion of pretest scores (Grillon & Davis, 1997; Hamm & Stark, 1993). Participants' startle sensitization scores were calculated for each of the task blocks.

Self-Report

Participants completed a state version of the 60-item Positive and Negative Affect Schedule—Expanded Form (PANAS-X; Watson & Clark, 1994) at two time points, before the beginning of the experiment and at the end of the experimental blocks. To reduce unnecessary multiple testing, we planned analyses a priori on the basis of the literature on gender differences in self-reported negative affect. We conducted analyses first on the higher order Negative Affect (NA; 10 items) scale, and we conducted follow-up analyses on the Fear (6 items) and Hostility (6 items) lower order mood scales. Four of the 6 Fear items and 2 of the 6 Hostility items overlap with items on the NA scale. Internal consistency coefficients for the three mood scales during pre- and postmeasurement, respectively, were as follows: NA = .81 and .88, Fear = .89 and .89, and Hostility = .77 and .82.

Participants were also administered the Multidimensional Personality Questionnaire—Brief Form (MPQ–BF; Patrick, Curtin, & Tellegen, 2002), which is a 155-item version of Tellegen's (1982) MPQ. As a test of the validity of the aggression paradigm, we examined relationships between scores on the Aggression subscale of the MPQ–BF and participants' shock intensity behavior in the subsequent aggression task. We administered the entire instrument, not just the aggression items, to avoid priming participants to the true purpose of the study. Only 105 participants (54 women and 51 men) had usable MPQ–BF data.

Manipulation Checks and Debriefing

Following the experiment, participants completed a poststudy questionnaire (A. R. Lang, Goeckner, Adesso, & Marlatt, 1975; Verona et al., 2002) and were interviewed. We asked participants to rate their impressions of the employee (1 = *extremely unfavorable* and 10 = *extremely favorable*). Two other 10-point items assessed the extent to which participants felt they were motivated to increase shock intensities for instrumental reasons ("to encourage better performance in the employee") and for hostile reasons ("upset at the employee"). We used items on the poststudy questionnaire to examine the efficacy of the aggression paradigm. Additionally, we wanted to check that our frustration manipulation was associated with emotional aggression to confirm Berkowitz's (1989) suggestion that frustration results in aggression because of hostile motives evoked by the goal-blocking and not simply for instrumental reasons (i.e., to obtain a reward).

During the poststudy interviews, 6 participants expressed suspicions of the cover story and therefore were excluded from analyses (i.e., are not included in the sample size we have presented). They either were not convinced that they were actually shocking another participant or realized that we wanted to instigate their aggression. These participants did not differ on demographic variables from the participants who were kept in the sample. During scheduled debriefing sessions, participants were informed of the true purposes of the study and allowed to voice any concerns and ask questions.

Data Analytic Strategy

We analyzed both shock intensity and startle sensitization measures within a mixed model analysis of variance (ANOVA) with participants' gender (male vs. female), stress (stress vs. no stress), and frustration (frustration vs. no frustration) as between-subjects factors and trial block (Block 1–4) as a within-subject factor. We report Huynh–Feldt corrected p values for all within-subject effects involving the block variable to correct for possible violations of sphericity. We decomposed significant block effects into orthogonal polynomial contrasts (i.e., linear, quadratic,

and cubic components). In particular, the *linear* block effect (and interactions with this linear block effect) for shock intensity was a focus of our analyses because this effect would indicate increasing aggression over blocks, which has been emphasized in experimental aggression paradigms (Goldstein, Davis, & Herman, 1975).

We analyzed self-report negative mood scales (NA, Fear, and Hostility) within a between-subjects analysis of covariance (ANCOVA) with gender, stress, and frustration as between-subjects factors and associated preexperiment mood scores as covariates. For these latter analyses, we first systematically tested for interactions between the covariate (pretest mood scores) and any of the independent variables. We detected no significant interactions; thus, the ANCOVAs were appropriate. For all measures, we report partial eta-squared effect size estimates (i.e., equivalent to ΔR^2 from multiple regression models or the amount of variance in the dependent variable accounted for by the effect tested).

Results

Manipulation Check

Overall mean shock intensities delivered across aggression blocks were positively related to the Aggression subscale of the MPQ–BF ($r = .26$, $p \leq .01$); however, this relationship was slightly stronger but not significantly different for men than women (rs = .07 and .19, respectively). Shock intensity was also correlated with poststudy questionnaire ratings of lower impressions of the employee among male ($r = -.25$, $p \leq .06$) and female ($r = -.26$, $p \leq .05$) participants and with their self-reported instrumental and hostile motives for their aggression (men: rs = .60 and .54, respectively, ps $\leq .001$; women: rs = .45 and .50, respectively, ps $\leq .001$). These latter relationships did not differ between men and women. These results suggest adequate validity for the aggression paradigm.

To check that the frustration manipulation elicited emotional aggression associated with hostile motives, not just instrumental motives, we conducted two multiple regression analyses on shock intensity: one in which frustration condition, poststudy questionnaire ratings of instrumental motives, and their interaction were included as independent variables, and the second in which frustration, poststudy questionnaire ratings of hostile motives, and the interaction were included as independent variables. The first regression analysis revealed a significant effect of instrumental motives ($\beta = .53$, $p \leq .01$) but no significant interaction with frustration ($\beta = .05$, $p = .70$), in that participants' ratings of instrumental motives were associated with aggression to the same extent in the frustration ($r = .59$, $p \leq .01$) and the no-frustration ($r = .46$, $p < .01$) conditions. However, the second analysis revealed a significant interaction between hostile motives and frustration ($\beta = .23$, $p \leq .01$), in that hostile motives were more predictive of aggression in the frustration ($r = .76$, $p \leq .01$) than in the no-frustration ($r = .32$, $p \leq .01$) conditions. These results are consistent with conclusions by Bushman and Anderson (2001), who suggested that most acts of aggression involve mixed motives (hostile and instrumental), as well as with the findings of Berkowitz (1989), who suggested that hostile motives partly underlie increased aggression during frustration.

Shock Intensity

In accordance with the goals of the study, we analyzed shock intensity with a Gender × Stress × Frustration × Block mixed model ANOVA. We observed the expected significant gender main effect, $F(1, 108) = 17.65$, $p \leq .001$, $\eta^2 = .14$, with overall higher shock intensities selected by men ($M = 4.5$, $SD = 2.1$) than by women ($M = 2.9$, $SD = 2.1$). We observed a significant overall effect of block on shock intensity, $F(3, 324) = 6.13$, $p \leq .001$. Decomposition of the overall block effect into orthogonal polynomial contrasts revealed a significant linear block effect, $F(1, 108) = 11.21$, $p \leq .001$, $\eta^2 = .09$. This linear block effect suggests that aggressive responding, as indexed by shock intensity, increased in general over blocks, as expected. We also observed a smaller, significant *quadratic* block effect, $F(1, 108) = 4.34$, $p \leq .05$, $\eta^2 = .04$, which indicates that this increase in intensity over blocks was somewhat asymptotic.

The main effect of frustration was not significant. However, we observed a significant Frustration × Block interaction, $F(3, 324) = 5.51$, $p \leq .001$, $\eta^2 = .05$ (see Figure 1). Decomposition of this interaction into polynomial contrasts revealed a significant Frustration × Linear Block effect, $F(1, 108) = 12.46$, $p \leq .001$, $\eta^2 = .10$. This indicated that there was a linear increase in shock intensity over blocks during frustration ($\eta^2 = .23$, $p \leq .001$) but not during no frustration ($\eta^2 = .00$, $p = .861$). This suggests that prolonged frustration increased aggressive responding over time, as expected. Stress did not significantly moderate frustration effects (i.e., no significant Stress × Frustration or Stress × Frustration × Block effects). More important, gender did not significantly moderate frustration effects (i.e., no significant Gender × Frustration or Gender × Frustration × Block effects). This indicates that the increase in aggressive response over time due to the frustration manipulation was comparable across men and women. That is, we consistently observed this pattern of results (significant linear increase in shock intensity during frustration but not during no frustration) in men (ps = .01 and .67, respectively) and women (ps = .01 and .99, respectively).

Overall stress and Gender × Stress effects were not significant for shock intensity. However, we observed a significant Gender × Stress × Block interaction, $F(3, 324) = 3.02$, $p \leq .050$, $\eta^2 = .03$ (see Figure 2). Follow-up with polynomial contrasts again con-

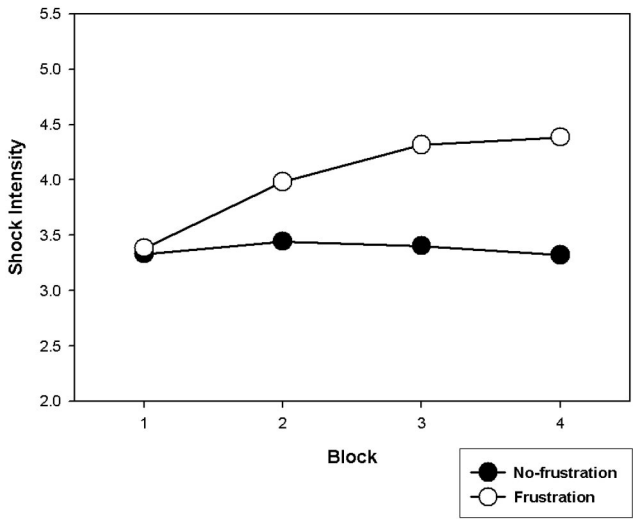

Figure 1. Mean shock intensity across blocks by frustration.

firmed that the linear component of the block effect (i.e., Gender × Stress × Linear Block) was significant within this interaction, $F(1, 108) = 3.90$, $p \leq .05$, $\eta^2 = .04$. This indicates that the magnitude of the linear increase in aggression over blocks varied across gender and stress conditions. Therefore, to further clarify how these increases in aggression varied, we examined simple linear block effects separately within gender and stress conditions (i.e., we tested each of the four lines, representing shock intensity over blocks, depicted in Figure 2 within the gender and stress conditions). Among men, we observed a significant linear block increase in shock intensity during stress ($\eta^2 = .16$, $p = .029$) but not during no stress ($\eta^2 = .05$, $p = .230$). In contrast, among women, we observed a significant linear block increase in shock intensity during no stress ($\eta^2 = .23$, $p = .008$) but not during stress ($\eta^2 = .00$, $p = .748$). Thus, men appeared to increase their aggressive responding over the experiment primarily in the stress condition, whereas women increased their aggression only during the no-stress condition.

Startle Sensitization

Equivalent analyses performed on startle sensitization revealed a significant overall effect of block, $F(3, 315) = 23.64$, $p = .001$. Decomposition of the block effect revealed significant linear, $F(1, 105) = 38.16$, $p = .001$, $\eta^2 = .27$, and quadratic block effects, $F(1, 105) = 9.20$, $p = .003$, $\eta^2 = .08$, with startle sensitization habituating (i.e., reducing) across blocks as expected for this measure but leveling off in later blocks (see Figure 3).

We also observed a significant main effect of stress for startle sensitization, $F(1, 105) = 30.99$, $p \leq .001$, with greater startle sensitization during stress ($M = 1.1$, $SD = 0.5$) than during no stress ($M = 0.6$, $SD = 0.5$), which confirms the successful priming of negative affect by the stress manipulation. There was also a significant Stress × Block interaction, $F(3, 315) = 6.82$, $p \leq .01$ (see Figure 3). However, follow-up simple effect tests of stress within each block revealed significant simple stress effects in all blocks (η^2s = .19, .15, .19, and .18, respectively, all ps $\leq .001$). More important, we found no gender main effect or Gender × Stress interaction for startle sensitization. Thus, men and women demonstrated equivalent direct negative emotional activation as a result of the stress manipulation. We observed no significant main effect or interactions involving frustration for startle sensitization.

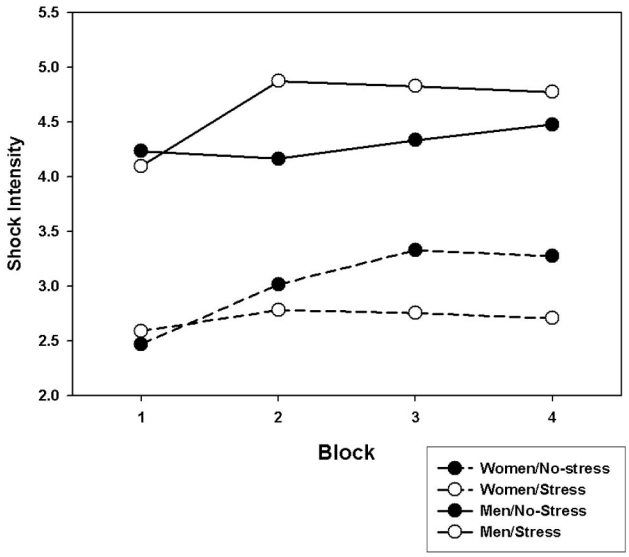

Figure 2. Mean shock intensity across blocks by gender and stress.

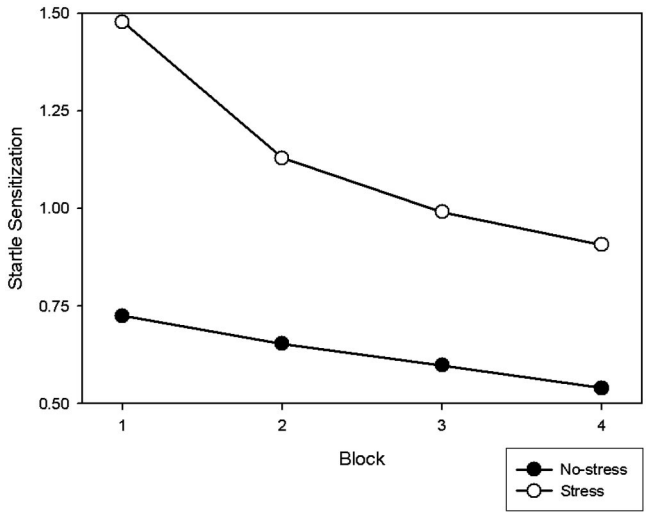

Figure 3. Mean startle sensitization across blocks by stress.

Gender Moderation of the Relationship Between Negative Affective Activation and Aggression

As per one of our goals, we conducted a multiple regression analysis to examine the relationship between negative affective activation and aggressive responding and the potential moderation of this affect–aggression relationship by gender. As we have reported, the linear block effect for shock intensity (i.e., increase in shock intensity across blocks) was a sensitive index of aggressive responding in this paradigm.[2] Therefore, we calculated linear shock intensity scores for each participant and regressed them (included as the dependent variable) on gender, overall startle sensitization, and their interaction. These analyses revealed a significant Gender × Startle Sensitization interaction, $F(1, 108) = 5.17$, $p \leq .05$, and the ΔR^2 value associated with the this interaction (i.e., variance in linear shock intensity accounted for by the interaction) was .044. This interaction indicated that the relationship between startle sensitization and linear shock intensity scores differed significantly by gender. That is, follow-up simple correlations within each gender revealed that the direction of this relationship differed between men and women, with increases in startle sensitization associated with increasing shock intensity over

[2] The shock intensity linear block polynomial contrast is calculated as (block4 × .75 + block3 × .25) − (block1 × .75 + block2 × .25). To increase power, we adjusted the shock intensity linear block effect and the overall startle sensitization scores to control for shock intensity and startle sensitization scores during the preexperiment practice block, respectively (i.e., we residualized these indexes by first regressing each on the practice block scores).

blocks for men ($r = .42$, $p < .05$) and with nonsignificant decreases over blocks for women ($r = -.09$).

Self-Report of Negative Affect

Preliminary analyses demonstrated no significant overall differences in the PANAS-X NA, Fear, or Hostility scales prior to the start of the experimental task across gender, stress, or frustration conditions (as expected given random assignment).[3] As per our a priori hypotheses, we examined postexperiment scores on these self-report mood measures to evaluate men's and women's reports of their subjective experiences of the stress and frustration manipulations. In particular, we analyzed postexperiment mood scores on each of these three measures in Gender × Stress × Frustration ANCOVAs, with PANAS-X preexperiment mood scores used as covariates to control for baseline individual differences.

Overall negative affect. We observed a significant main effect of stress for the NA scale, $F(1, 106) = 5.45$, $p = .022$, with higher overall negative affect reported in stress ($M = 16.6$) than in no-stress conditions ($M = 14.6$). Generally, we also observed higher mean levels of negative affect during frustration ($M = 16.4$) relative to no-frustration conditions ($M = 14.8$), $F(1, 106) = 3.68$, $p = .058$. However, we found no significant main effects or interactions for gender on overall negative affect. Thus, consistent with the results we have reported for startle sensitization, men and women reported comparable increases in overall negative affect as a result of the stress manipulation. Similarly, the effect of frustration on self-reported negative affect did not vary by gender. These results stand in contrast to results from analyses of the Fear and Hostility subscales, which we report next.

Fear. There was a significant main effect of stress for the Fear subscale, $F(1, 106) = 4.48$, $p \leq .05$, with higher fear reported in the stress ($M = 9.4$) than in the no-stress conditions ($M = 8.1$). However, this main effect was moderated by a Gender × Stress interaction, $F(1, 106) = 6.52$, $p \leq .01$. Decomposition of this interaction indicated that the stress effect on fear was significant among women ($\eta^2 = .17$, $p = .001$), with greater fear reported by women in the stress ($M = 10.4$) than in the no-stress conditions ($M = 7.7$). In contrast, the stress effect was not significant among men ($\eta^2 = .00$, $p = .813$), indicating comparable report of fear by men in the stress ($M = 8.0$) and no-stress conditions ($M = 8.9$).

Hostility. We observed a significant main effect of stress for the Hostility subscale, $F(1, 106) = 5.64$, $p \leq .05$, with increased self-report of hostility in the stress ($M = 10.6$) versus the no-stress conditions ($M = 8.9$). Similarly, there was a significant main effect of frustration, $F(1, 106) = 16.23$, $p < .001$, with increased self-report of hostility in the frustration ($M = 11.2$) versus the no-frustration conditions ($M = 8.3$). However, there was a trend toward a higher order Gender × Stress × Frustration interaction, $F(1, 106) = 2.95$, $p = .089$. We chose to examine this further given our a priori hypothesis regarding gender differences in reported hostility. Decomposition of this effect indicated that men reported significantly higher hostility ($\eta^2 = .20$, $p = .016$) in stress ($M = 15.3$) relative to no-stress ($M = 10.2$) conditions during frustration. We found no significant simple stress effect on hostility for men during no-frustration conditions (η^2s = .01, $p = .623$; Ms = 8.0 vs. 8.5 for stress and no-stress conditions, respectively) or women during frustration (η^2s = .03, $p = .372$; Ms = 10.3 vs. 9.1 for the stress and no-stress conditions, respectively) or no-frustration conditions (η^2s = .03; ps = .397; Ms = 8.8 vs. 7.7 for the stress and no-stress conditions, respectively).

Table 1
Partial Correlations Between Shock Intensity and Self-Report Mood by Gender

	Men		Women	
	Mean shock intensity	Linear shock increase	Mean shock intensity	Linear shock increase
Negative affect	0.45***	0.35**	0.14	0.19
Fear	0.34**	0.00	0.11	0.02
Hostility	0.46***	0.37**	0.19	0.22

Note. Table values are partial correlations between shock intensity scores and post-experiment Positive and Negative Affect Scales (Watson & Clark, 1994) self-report ratings of mood controlling for pre-experimental self-report ratings. Mean shock intensity is the average shock intensity administered across all 4 blocks. Linear shock increase represents the magnitude of the linear increase in shock intensity across the four task blocks. Correlations are separated by gender but collapsed across stress and frustration conditions.
** $p < .01$. *** $p < .001$.

In effect, although men and women reported higher negative affect in stress and frustration (relative to no-stress and no-frustration conditions), women reported higher fear in response to the stressor, whereas men did not. There was also marginal evidence that men experienced slightly more hostility during the stress condition, particularly if they were simultaneously frustrated.

Correlations between self-reported affect and aggression. Finally, we conducted partial correlations (controlling for preexperiment mood ratings) between shock intensity scores (both overall and linear increases) and self-report negative affect, fear, and hostility mood ratings for men and women separately to examine whether self-report negative affect was associated with aggression. As demonstrated in Table 1, negative affect, fear, and hostility ratings were significantly associated with overall shock intensity for men but not women. Linear increases in shock intensity were also significantly associated with overall negative affect and hostility in men but not women. However, tests of differences between correlations for men and women were not significant for any of these correlations. In summary, as with the startle–aggression results we have reported, there is some evidence that negative affect is more strongly related to aggression in men than in women.

[3] The following are the means for preexperiment mood ratings (negative affect, fear, and hostility, respectively) for each gender within stress and within frustration: men/stress = 14.38, 9.11, 7.96; men/no stress = 16.87, 10.62, 8.95; women/stress = 14.67, 9.68, 7.58; women/no stress = 14.80, 9.67, 7.63; men/frustration = 15.53, 9.70, 8.47; men/no frustration = 15.71, 10.03, 8.44; women/frustration = 14.67, 10.03, 7.63; women/no frustration = 14.77, 9.48, 7.59.

Discussion

Gender Differences in Aggressive Responses to General Stress

The current study provides compelling evidence that men and women differ in their aggressive responses to general stress exposure but not to frustration. As per our predictions, men's aggression was enhanced across time by general stress exposure (the intermittent air blast stressor), and men under general stress reported greater levels of hostility, particularly if they were simultaneously frustrated. Conversely, women did not show increases in aggression across time in response to general stress and instead reported slightly greater fear relative to women in the no-stress condition and to men in either stress condition. Thus, in regard to Berkowitz's (1990) neoassociationistic model of aggression, the general stressor triggered externalizing responses more strongly in men than in women.

This study also clarifies potential reasons for gender differences in aggression under aversive conditions. For example, Knight et al. (2002) suggested alternative hypotheses to explain why men tend to be more aggressive in moderately arousing contexts: either because they (a) become more emotionally aroused in these contexts or because they (b) are less able to regulate their behavioral responses to this emotional evocation relative to women. The results of the current study do not necessarily confirm the first hypothesis: Men and women did not differ in their reports of overall negative affect or in their startle reactions to general stress. Instead, the results suggest that men seem to be more likely to respond with increased aggression across time under general stress and that the relationship between negative affective activation and increased aggression was stronger in men than in women. Evidence for the latter is consistent across negative affect indexes (self-report and startle): Correlational analyses revealed significant and somewhat stronger positive relationships between aggressive behavior and both startle sensitization scores and self-reported negative affect in men relative to women.

The results from this study are consistent with those of Berkowitz (1990), who hypothesized that direct negative activation can evoke both escape and attack instigations in individuals. He suggested that the experience of fear results when the escape motivation is more strongly evoked, whereas hostile reactions are experienced when the attack instigation is more strongly evoked. The self-report, aggression, and physiological data from this study support the idea that attack motivations are more strongly activated in men than in women exposed to general stress. An alternative interpretation is that men, more than women, tended to experience the employee as more responsible for the distress and loss of money, which would facilitate more coherence between increases in negative affect and aggressive behavior in men but not women. Either way, our results are relevant to psychopathology research that indicates that men tend to experience more externalizing forms of psychopathology, such as antisocial behavior, aggression, and substance use (Weissman, Bruce, Leaf, Florio, & Holzer, 1991). In fact, some researchers have argued that aggressive behavior should be considered an index of "externalized distress," particularly among individuals who appraise situations as threatening and repress other emotional responses (Umberson, Williams, & Anderson, 2002).

Effects of Frustration Versus General Stress

Unlike the results for general stress, frustration did not interact with gender in the prediction of aggression. Instead, analyses revealed that both men and women in the frustration condition showed greater increases in aggression across time than did participants in the no-frustration group. As we suggested in the introduction to this article, the interpersonal frustration is a more explicit prime for aggression because the available target for the aggression is indeed responsible, albeit inadvertently, for the participant's distress in this situation (Dill & Anderson, 1995). However, the nonspecificity of the general stress condition (air blast stressor) relative to frustration allowed for the influence of gender differences in motivational tendencies (greater aggressive activation in men; Smith & Reise, 1998) as well as interpersonal attributions (greater externalizing attributions in men, as we have discussed; Zahn-Waxler, Cole, & Barrett, 1991) to affect behavior. The results cannot be attributed to the fact that general stress was not effective in producing negative affect in women, because both male and female participants showed increases in startle and reports of higher negative affect during stress relative to no stress. Our results may suggest that stressors that are not directly related to a target (e.g., physical illness, financial difficulties) will more likely produce aggression in men than in women, whereas interpersonal frustration (e.g., a child's temper tantrums) can instigate aggression in both genders.

The distinct pattern of results for the general stress and frustration manipulations may also suggest that aggression may be instigated via different pathways of activation. Anderson, Anderson, and Deuser (1996) tested a theory suggesting different routes to aggression and found that certain instigating contexts (hot rooms vs. exposure to guns) were differentially associated with affective and cognitive pathways to aggression instigation. The results from the current study may indicate that the effects of general stress on aggression may result from more direct negative affective priming, as indexed by increased startle under stress but not under frustration in men and women. Frustration, however, may increase aggression only partly through the affective route and partly via higher order cognitive–interpretative mechanisms (Berkowitz, 1989) that are not necessarily indexed in this study. In future work, researchers should measure participants' cognitive attributions about the situation to help understand gender differences in the influence of these distinct pathways on aggression—that is, why general stress leads to differential aggression in men and women, whereas frustration leads to similar increases in aggression for both genders. Additionally, future researchers should examine forms of frustration (e.g., achievement-related frustration) other than the one used in this study (involving monetary goal-blocking). It is possible that gender differences in aggression may be stronger when other types of frustration are used to manipulate participants' responses.

Limitations, Strengths, and Implications

Although the current study has produced interesting results, readers should take caution when interpreting some of the data. First, the laboratory context and manipulations represent novel situations that may not completely parallel the situations encountered or responses emitted by men and women in their everyday

life. For example, the magnitude of gender differences in self-reported mood and the actual mean fear ratings among the women in the stress condition were not large. Additionally, in future work researchers should also explore whether social desirability or impression management influences participants' reports of hostility and fear as well as their shock intensity responses. For example, men in the general stress condition only reported increases in hostility when they were also assigned to frustration, even though all men in the general stress condition exhibited increases in aggression. Perhaps the men who were frustrated felt justified in reporting hostility, whereas those who were not frustrated were hesitant to report hostility toward someone who was not causing them any direct distress.

Another important point is that we only measured overt aggression in this experiment, which may account for the fact that women did not show increases in aggression under general stress. We did note slightly lower correlations between self-reported aggression and shock intensity for women relative to men. In future work, it would be fruitful to index verbal aggression or more covert forms of aggression (including social manipulation) that are more commonly used by women (Bjorkqvist, Lagerspetz, & Kaukiainen, 1992). Finally, there is still some ambiguity as to the causal relationship between emotion and aggression in this study. For example, one could assert that participants' mood in the current study might have been affected by their shock behavior, not the other way around. Thus, the causal relationships between negative emotion and aggressive behavior in men and women require further empirical scrutiny.

There are also several strengths to the current study. One strength involves the use of a combination of self-report, behavioral, and physiological measures within a laboratory experiment. In the analysis of relatively complex situations, the use of multiple measures allows researchers to tap into different facets of participants' experiences as well as different channels of the defensive motivational system (P. J. Lang, 1979). Another strength of the study is that we used a tightly designed experimental procedure to causally examine the unique and interacting effects of general stress and frustration on affective and aggressive responses. For the most part, our results reliably indicate that general stress exposure resulted in aggressive activation and externalizing in men, whereas frustration produced similar effects for both genders.

In summary, the results provide preliminary evidence in the context of a laboratory aggression paradigm for differences in general stress responding and in the aggressive correlates of negative emotions between men and women. Continued work in this area can help inform our understanding of gender differences in different forms of psychopathology. This research can lead to the development of interventions tailored to help both men and women use more adaptive strategies for handling stress.

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