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Gender Differences in Threat Biases: Trauma Type Matters in Posttraumatic Stress Disorder

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Women are diagnosed with posttraumatic stress disorder (PTSD) at twice the rate of men. This gender difference may be related to differences in PTSD experiences (e.g., more hypervigilance in women) or types of trauma experienced (e.g., interpersonal trauma). We examined whether attentional threat biases were associated with gender, PTSD diagnosis, and/or trauma type. Participants were 70 civilians and veterans (38 women, 32 men; 41 with PTSD, 29 without PTSD) assessed with the Clinician Administered PTSD Scale for *DSM-IV* who completed a facial dot-probe attention bias task and self-report measures of psychiatric symptoms and trauma history. Factorial ANOVA and regression models examined associations between gender, PTSD diagnosis, index trauma type, lifetime traumatic experiences, and attentional threat biases. Results revealed that compared to women without PTSD and men both with and without PTSD, women with PTSD demonstrated attentional biases toward threatening facial expressions, $d = 1.19$, particularly fearful expressions, $d = 0.74$. Psychiatric symptoms or early/lifetime trauma did not account for these attentional biases. Biases were related to interpersonal assault index traumas, $\eta_p^2 = .13$, especially sexual assault, $d = 1.19$. Trauma type may be an important factor in the development of attentional threat biases, which theoretically interfere with trauma recovery. Women may be more likely to demonstrate attentional threat biases due to higher likelihood of interpersonal trauma victimization rather than due to gender-specific psychobiological pathways. Future research is necessary to clarify if sexual assault alone or in combination with gender puts individuals at higher risk of developing PTSD.

Posttraumatic stress disorder (PTSD) is a debilitating psychiatric diagnosis that is associated with significant personal and economic loss (Hidalgo & Davidson, 2000). Although most individuals experience a traumatic event during their lifetime, only 10%–15% of this population eventually meets PTSD diagnostic criteria (Kilpatrick et al., 2013). Women are affected by PTSD at twice the rate of men (American Psychiatric Association, 2013). It is unclear if this difference is due to gender-specific pathways in the underlying mechanisms of posttraumatic stress symptoms (Pineles, Arditte Hall, & Rasmusson, 2017) or to gender-relevant differences in rates of experiencing interpersonal physical and/or sexual violence (Krantz & Garcia-Moreno, 2005). In the present study, we sought to examine these intersecting explanations of why women have a higher risk of developing PTSD, in hopes of furthering our understanding of and informing treatments for PTSD, regardless of gender.

The underlying mechanisms of PTSD have been explored generally and, to a lesser extent, comparatively between genders. Evidence suggests that men and women experience similar PTSD symptom patterns (Chung & Breslau, 2008; but see Hourani, Williams, Bray, & Kandel, 2015). However, there are some gender-based differences. For instance, although both women and men ultimately benefit from trauma treatment, women tend to initially respond better, whereas men demonstrate continued symptom improvement over time (Wade et al., 2016). Further, men and women are likely to experience PTSD at different points in the lifespan, with women significantly more likely to experience PTSD at younger ages (Ditlevsen & Elklit, 2010). Women are also more likely to report experiencing childhood abuse than men, suggesting traumatic events experienced earlier in life may increase vulnerability to developing PTSD (Molnar, Buka, & Kessler, 2001).

Although PTSD symptom profiles do not differ between genders, evidence suggests gender-based differences in the social, emotional, and cognitive factors associated with PTSD. For

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example, women with PTSD have reported less tolerance for and greater impairment in goal-directed behaviors during negative emotions (Tripp, McDevitt-Murphy, Avery, & Bracken, 2015), whereas men with PTSD report more impulsivity and aggressive behaviors in response to negative emotions (Miles, Menefee, Wanner, Tharp, & Kent, 2016). Cognitively, it is well documented that women tend to ruminate more than men (see Johnson & Whisman, 2013, for meta-analytic review). Rumination has been associated with increased self-blame and trauma-relevant distorted beliefs in women compared with men (Mitchell, Contractor, Dranger, & Shea, 2016). However, cognitive processing differences are difficult to disentangle from the cultural forces which blame victims (Suarez & Gadalla, 2010). These cognitive and social differences may also be associated with neurological differences (see Bangasser & Valentino, 2014, for a review) likely secondary to hormonal differences, which may increase hyperarousal in females (Bangasser, Eck, & Ordones Sanchez, 2019).

Compared with other traumatic experiences, interpersonal trauma (IPT) is associated with an increased risk of developing PTSD (Badour, Resnick, & Kilpatrick, 2017). This risk differs by gender, with men more likely to develop PTSD after a sexual assault and women more likely to develop PTSD after experiencing combined physical and sexual assault (Tolin & Foa, 2006). Compared with other traumatic experiences, such as combat, accidents, or natural disasters, experiencing IPT also increases the likelihood of developing chronic PTSD (Smith, Summers, Dillon, & Cougle, 2016). This suggests that the type of trauma exposure is an important factor in the development of PTSD. In one study, the authors found increased rates of PTSD diagnosis and symptom severity when sexual assault was the reported index trauma, regardless of gender (Jakob, Lamp, Rauch, Smith, & Buchholz, 2017). Given the well-documented rate increase of IPT against women—particularly regarding sexual assault (Krantz & Garcia-Moreno, 2005)—it is possible that experiencing IPT, rather than gender alone, may increase vulnerability to the development of PTSD.

Cognitive processing bias is the tendency to prioritize and process environmental information in a particular manner. Biases are generally unconscious and serve to maintain emotional disorders by prioritizing information consistent with current emotional states (Elhers & Clark, 2000). Importantly, Ehlers and Clark (2000) expanded upon the emotion processing theory (Foa, Steketee, & Rothbaum, 1989) by noting that hyperarousal leads to "perceptual priming" for threatening information in the environment. Perceptual priming is the process by which sensory and perceptual information is brought to attention and assigned meaning. Arousal-based priming for threat cues triggers reexperiencing symptoms (Elhers & Clark, 2000). Perceptual priming feeds biased attentional processes, which are a tendency to notice or focus on specific types of information in the environment, such as trauma-relevant cues in PTSD. Biased memory processes reflect a tendency to recall specific types of information more easily, such as trauma memories in PTSD. Both attention and memory biases are associated with PTSD symptoms and diagnosis (reviewed in Bomyea, Johnson, & Lang, 2017). In a recent meta-analysis, the authors found that attentional threat biases for sexually threatening words (e.g., "rape or "force") in emotional Stroop paradigms was highest among sexually victimized individuals who had been diagnosed with PTSD, although never-victimized individuals also demonstrated a threat bias (Latack, Moyer, Simon, & Davila, 2017). Unfortunately, due to sample restrictions in the original studies, Latack and colleagues (2017) were unable to examine the gender effects.

Given evidence that cognitive biases reflect individualized experiences (Pergamin-Hight, Naim, Bakermans-Kranenburg, van IJzendoorn, & Bar-Haim, 2015), it is possible that the type of trauma exposure influences the nature of PTSD threat biases. Taken together, this suggests that examining trauma type in addition to relevant cognitive processes which underlie risk, such as attention biases, may further refine our understanding of PTSD incidence in women. To the best of our knowledge, gender effects on attention biases in PTSD have not been examined. Examination of threat biases using a dot-probe task that presents threatening and neutral stimuli paired together may provide some insight into gender differences in PTSD. Theoretically, hypervigilance for stimuli reminiscent of the traumatic event is associated with a higher risk of developing and maintaining PTSD (Elhers & Clark, 2000). It is possible that women are more hypervigilant regarding trauma-relevant stimuli compared to men due to biological differences that increase physiological arousal (Bangasser et al., 2019). Although there is some suggestion of gender-based differential symptom severity profiles in PTSD (Hourani et al., 2015), one study found that gender differences in PTSD symptoms were not observed when sexual assault was the index trauma (Sexton, Raggio, McSweeney, Authier, & Rauch, 2017). This indicates that the type of index traumatic event can overcome gender differences. The use of cognitive bias, particularly attention bias, measurement paradigms can provide an objective measure of vigilance for threat cues that are likely affected by both biological mechanisms and life experiences.

Previous experimental work using modified versions of the dot-probe task (MacLeod, Mathews, & Tata, 1986) has identified attentional threat biases across many anxiety disorders. In the dot-probe task, two stimuli are presented simultaneously for a short period of time (generally 500–1000 ms) before being replaced by a single probe stimulus. Participants are asked to make a decision about the probe (e.g., direction of an arrow). Participant reaction times regarding their decision about the probe are used to assess biases (for review of methodological issues and components of attention bias in PTSD, see Bomyea et al., 2017).

Relevant to the current study, individuals with PTSD, but not healthy control comparisons, have demonstrated an attentional bias toward threatening word stimuli, which correlated with amygdala reactivity and threat vigilance neurocircuitry (El Khoury-Malhame, Reynaud et al., 2011). This bias was absent after symptoms ameliorated with treatment

(El Khoury-Malhame, Lanteaume, et al., 2011). One study reported trauma-specific threat biases on a word stimulus–based dot-probe task among female IPT survivors with PTSD (Depierro, D'Andrea, & Pole, 2013), suggesting that IPT increases attention biases to IPT-relevant threat cues.

In the current study, we sought to examine whether attentional biases in PTSD, which theoretically maintain the disorder (Elhers & Clark, 2000), are associated with gender differences versus types of traumatic experiences. To address this question, we used a facial dot-probe task to assess threat biases in trauma-exposed men and women with and without PTSD to gain a better understanding of gender differences in information processing biases and how attentional biases may relate to PTSD. We tested two hypotheses to examine if gender or trauma type is more strongly associated with attentional threat biases in PTSD. First, we expected that threat biases would differ based on both PTSD diagnosis and gender. Specifically, we expected to observe biases only in individuals with PTSD, with women demonstrating larger attentional biases than men. Second, we expected that women would report IPT as the index trauma (i.e., the event that caused PTSD) more often than men and that experiencing IPT would be associated with larger attentional threat biases compared with other forms of trauma exposure.

Method

Participants and Procedure

Participants included both male and female U.S. veterans and civilians recruited from Veterans Affairs (VA) outpatient and community clinics as well as from local newspaper and Internet advertisements as part of two larger studies (Department of Veterans Affairs grants: CDA-2-037-07F and 1101CX000720-01A2); the study was approved by the University of California, San Francisco, institutional review board. To determine study eligibility, potential participants underwent a diagnostic interview, laboratory testing, and provided their medical history. Exclusion criteria included diagnoses of schizophrenia, bipolar disorder, substance dependence as defined by *DSM-IV* criteria, neurological disorder, moderate or severe head injury, or any other medical condition known to interfere with psychophysiological responses. All participants provided written informed consent to participate in study procedures, which included clinical interview, psychophysiology measures (reported in Inslicht et al., 2013), self-report measures, and a number of computer-administered cognitive tasks. For the present study, a subset of 70 participants (32 men and 38 women) were included in analyses based upon completion of the facial dot-probe task.

Chi-square and independent samples *t*-test analyses revealed that our sample did not differ by demographic factors. The age, ethnicity (missing for five individuals), and education level (missing for 12 individuals) of our sample did not differ by gender, $ps = .320–.630$, or veteran status, $ps = .338–.728$. Veteran status was not related to PTSD diagnostic status, $\chi^2(1, N = 70) = .214$, $p = .643$. Age and ethnicity did not differ by PTSD diagnostic status, $ps = .114–.879$; however, participants in the PTSD+ group were significantly less likely to have obtained a college degree than those in the PTSD- group, $\chi^2(3, N = 58) = 8.46$, $p = .037$. There were no significant differences on psychiatric symptom measures between genders, $ps = .590–.978$, or veteran status, $ps > .551–.961$. As expected, PTSD+ individuals reported significantly more depression, $t(55.53) = 5.542$, $p < .001$; trait anxiety, $t(56) = 3.95$, $p < .001$; as well as both self-, $t(55) = 5.81$, $p < .001$; and clinician-rated, $t(66.16) = 16.21$, $p < .001$, rated symptoms of PTSD. In summary, sample demographics did not differ based on gender or veteran status. Individuals with PTSD were less educated and endorsed more psychological distress than individuals without PTSD, regardless of gender. Table 1 provides participant demographic, diagnostic, and symptom information for women and men with and without PTSD.

Measures

Facial dot probe. The dot-probe task assessed attentional biases through comparison of participant reaction times to indicate which direction an arrow probe is pointing via a keypad response. After a fixation cross was presented on the screen for 500 ms, two images of the same actor making emotional (i.e., angry or fearful) and neutral facial expressions were presented simultaneously for 1000 ms, to be easily visible to participants. The images were then replaced with a single arrow probe pointing either left (i.e., <) or right (i.e., >). Participants were instructed to indicate which direction the probe arrow was pointing by pressing the corresponding arrow (< or >) button on an external keypad. Example trials are presented in Figure 1. There was a total of 16 pairs of stimuli from the Radboud face stimset (Langner et al., 2010), including eight female and eight male multiethnic actors. All stimulus pairs were presented in random order with the condition that all stimulus pairs were shown a total of four times so that each expression was presented in both positions (top and bottom) and was replaced by a probe in each position for a total of 64 trials. Participants were seated comfortably in a desk chair around 24 in. (arm's length) from the screen. The dot probe was presented using Inquisit (Version 4.09) software (Millisecond, 2015).

The facial dot-probe data were cleaned using SPSS (Version 25.0) 32-bit edition (IBM, 2017) at the sample level by excluding reaction times indicative of impulsive responding (< 200 ms) and attentional drift (> 3000 ms) and at the individual level by exclusion of trials more than 2 standard deviations from the individual participant's mean reaction time to each trial type (i.e., angry threat, fear threat, fear neutral, angry neutral) based on previously established cutoffs (Price et al., 2015). A total of 107 trials (4.14% of the total) were excluded as outliers. After cleaning, aggregated individual means for each condition were calculated. Bias scores were calculated by subtracting the mean reaction time for probes replacing threat facial expressions from mean reaction times for probes replacing neutral

Table 1
Participant Demographics, Symptom Presentations, and Index Trauma Type

	Women PTSD+ ($n = 24$)				Men PTSD+ ($n = 17$)				Women PTSD− ($n = 14$)				Men PTSD− ($n = 15$)			
Measure	*n*	%	*M*	*SD*	*n*	%	*M*	*SD*	*n*	%	*M*	*SD*	*n*	%	*M*	*SD*
Demographics[a]																
Caucasian	10	43.5			9	64.3			5	35.7			7	46.7		
Black	8	34.8			3	21.4			4	28.6			1	6.7		
Other	5	21.7			2	14.3			5	35.7			7	46.7		
Veteran	1	4.2			11	64.7			2	14.3			8	53.3		
Age (years)			36.08	12.47			9.40	35.94			34.86	10.69			37.87	8.09
Symptoms																
CAPS total score			48.75[a]	13.55			54.53[a]	15.23			5.07[b]	5.95			8.20[b]	10.28
Re-experiencing			14.63[a]	1.02			14.94[a]	1.21			1.36[b]	1.34			2.07[b]	1.29
Avoidance			18.54[a]	8.37			21.35[a]	9.15			1.93[b]	2.53			3.20[b]	5.00
Hyperarousal			15.58[a]	5.94			18.24[a]	6.93			1.79[b]	2.58			2.93[b]	4.17
BDI-II total			16.01[a]	9.97			18.91[a]	8.55			5.01[b]	5.67			5.67[b]	7.55
STAI-T total			46.95[a]	11.71			47.19[a]	11.50			35.92[b]	7.48			35.58[b]	12.10
PCL-4 total			49.13[a]	15.52			48.15[a]	9.97			28.73[b]	11.05			28.36[b]	12.27
Index Trauma Type																
Sexual assault	9	37.5[a]			1	9.1[b]			1	9.1[b]			0	0.0[b]		
Physical assault	17	70.8[a]			3	17.6[b]			6	42.9[a, b]			2	13.3[b]		
Combat	0	0.0[a]			9	52.9[b]			1	7.1[a]			2	13.3[a]		
Accident	1	4.2[a]			4	23.5[a, b]			3	21.4[a, b]			6	40.0[b]		
Disaster	0	0.0[a]			1	5.9[a]			1	7.1[a]			1	6.7[a]		
Lifetime traumatic experiences																
Life Stressor Checklist																
Sexual assault	12	50.0[a]			1	6.7[b]			3	21.4[b]			1	7.1[b]		
Physical assault	6	25.0[a]			5	33.3[a]			5	35.7[a]			4	28.6[a]		
War exposure	3	12.5[a]			9	60.0[b]			1	7.1[a]			2	14.3[a]		
Accident	7	29.2[a]			8	53.3[a]			5	35.7[a]			3	21.4[a]		
Disaster	4	16.7[a]			4	26.7[a]			4	28.6[a]			0	0.0[a]		

(*Continued*)

Table 1
Continued

Measure	Women PTSD+ (n = 24)				Men PTSD+ (n = 17)				Women PTSD− (n = 14)				Men PTSD− (n = 15)			
	n	%	*M*	*SD*	*n*	%	*M*	*SD*	*n*	%	*M*	*SD*	*n*	%	*M*	*SD*
Developmental events																
Childhood			1.29^{a}	1.97			1.07^{a}	1.39			0.86^{a}	1.03			0.50^{a}	0.85
Adolescence			3.67^{a}	2.39			2.93^{a}	1.91			2.57^{a}	2.06			1.86^{a}	1.75
Adulthood			2.00^{a}	1.67			1.33^{a}	0.98			1.36^{a}	0.93			1.00^{a}	0.88
Lifetime total			6.96^{a}	4.51			$5.33^{a,b}$	3.52			$4.79^{a,b}$	3.60			3.36^{b}	2.84

Note. Subscripts denote significant group differences at $p < .01$. All group differences for symptom measures and number of traumatic events are least significant difference–corrected post hoc comparisons (Tukey's test). Index trauma type and Life Stressor Checklist group are chi-square comparisons. PTSD = posttraumatic stress disorder; PTSD+ = PTSD diagnosis; PTSD− = no PTSD; CAPS = Clinician Administered PTSD Scale; BDI-2 = Beck Depression Inventory–Second Edition; STAI-T = State/Trait Anxiety Inventory – Trait; PCL-4 = PTSD checklist for *DSM-IV*.
[a]Demographic data missing for some participants.

facial expressions. Biases were calculated for difficulty disengaging from threat generally as well as for fear and anger expressions specifically. A positive bias score indicates threat engagement (i.e., the reaction time for probes replacing neutral facial expressions were slower than reaction times for probes replacing threat facial expressions), suggesting participants were looking at the threatening facial expressions when the probes appeared.

PTSD diagnosis and symptoms. Participants completed the Clinician-Administered PTSD Scale for *DSM-IV* (CAPS-IV; Blake et al., 1995; most participants completed the study prior to the availability of the CAPS for *DSM-5*), which is the gold standard in PTSD diagnosis (Blake et al., 1995). Masters-level clinicians trained and supervised by a doctoral-level psychologist administered and scored the CAPS-IV. The CAPS-IV provides information on the index traumatic event for current and lifetime PTSD symptoms with assessment of symptom frequency and intensity as well as diagnosis. Full PTSD diagnostic criteria for the *DSM-IV* or subsyndromal PTSD (i.e., a CAPS score higher than 30; meeting Criteria A, B, E, and F; and meeting either Criterion C or D) was determined by the CAPS-IV and must have been present for at least 3 months. Independent review of recorded interviews within our research group has achieved an ICC of .984 for CAPS severity scores. Index traumas were defined as the trauma exposure for which the CAPS-IV was completed and coded by each trauma type occurring during the event (e.g., physical assault, sexual assault, natural disaster, combat, etc.). Participants were not excluded based on the type of trauma they had experienced, which resulted in a range of traumatic events precipitating PTSD symptoms. Analyses examining the effect of index trauma type were conducted to compare individuals who reported IPT (i.e., physical and/or sexual assault) with individuals who reported all other types of trauma.

Participants also completed the PTSD Checklist–4 (PCL-4; Weathers et al., 1993; most participants completed the study before the PCL for *DSM-5* was available). The PCL-4 is a 17-item inventory on which participants rate the degree to which they have been bothered by a range of symptoms over the past month, scoring items on a scale of 1 (*not at all*) to 5 (*extremely*). Scores on the PCL-4 range from 17–85, with higher scores indicative of a higher level of symptom severity; a score of 44 is indicative of clinically significant PTSD symptoms in both civilians (Ruggiero, Del Ben, Scotti, & Rabalais, 2003) and veterans (VA National Center for PTSD, 2014). The PCL-4 lists symptoms consistent with *DSM-IV*-TR PTSD diagnostic criteria, which include *DSM-5* Criteria B, C, D, and F symptoms (Criteria E—negative alterations in cognitions and mood—is not specifically assessed by the PCL-4). In the current sample, the PCL-4 demonstrated good validity, Cronbach's $\alpha = .95$.

Depression and anxiety. Depression was assessed with the Beck Depression Inventory–II (BDI-II; Beck, Brown, and

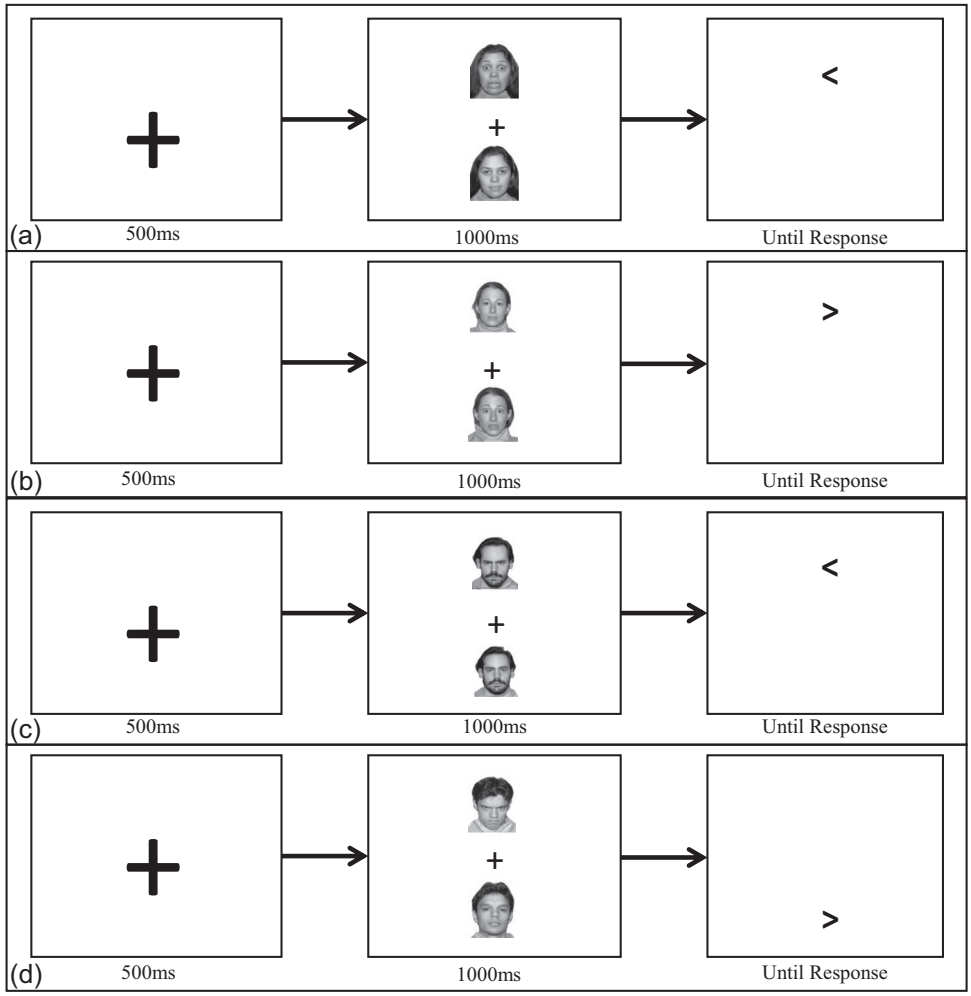

Figure 1. Example trials from the facial dot-probe task. Participants saw a fixation cross in the middle of the screen for 500 ms, followed by a pair of neutral and threat (fear or anger) facial expressions from the same actor for 1000 ms, followed by a probe arrow. Participants were instructed to indicate the direction of the arrow probe as quickly as possible via keypad button. Panel A shows the probe replacing a fearful face on a fear/neutral trial. Panel B shows the probe replacing a neutral face on a fear/neutral trial. Panel C shows the probe replacing an angry face on anger/neutral trial. Panel D shows the probe replacing an angry face on an anger/neutral trial.

Steer, 1996), a 21-item inventory of depressive symptoms. Respondents rate items on a scale of 0 to 3, and total scores range from 0–63. A score of 20 is indicative of moderate depressive symptoms in adults (Beck et al., 1996). In the current sample, the BDI-II demonstrated good validity, Cronbach's $\alpha = .93$.

Anxiety was assessed with the State-Trait Anxiety Inventory (STAI-T; Spielberger et al., 1983). The STAI-T assesses trait anxiety with 20 items relevant to general feelings of worry, nervousness, and apprehension. Participants rate items on a 4-point Likert-type scale ranging from 1 (*almost never*) to 4 (*almost always*), with some items reverse-coded. Scores range from 20 to 80, with higher scores indicating more trait anxiety; a score of 45 is associated with clinically significant anxiety (Spielberger et al., 1983). The BDI-II and STAI-T were included to provide further sample psychological symptom characteristics. In the current sample, the STAI-T demonstrated good validity, Cronbach's $\alpha = .94$.

Lifetime trauma exposure. The Early Trauma Inventory (ETI; Bremner et al., 2007) and a modified version of the Life Stressor Checklist–Revised (LSCR; Wolfe et al., 1997) were used to assess lifetime trauma exposure. Both the ETI and LSCR ask respondents to indicate if they have experienced general traumatic events (e.g., natural disaster) and physical, emotional, or sexual abuse during childhood (ages 0–13 years), early adolescence (ages 14–17 years), and/or adulthood (age 18 years and up). When participants reported having experienced a traumatic event or form of abuse during their lifetime, they indicated their age(s) at the time of the experience. The ETI functions to identify and count the types of trauma a person experienced during their early life, whereas the LSCR functions to provide the different types of traumatic events experienced during a person's entire lifetime. On the LSCR, participants were also asked to indicate whether they experienced "intense helplessness, fear, or horror" after the event

and whether the event was recurrent. For both the ETI and LSCR, participant ages were coded into yes or no variables for each trauma type experienced during each stage of development (i.e., childhood, adolescence, and adulthood). Lifetime IPT experience was calculated by summing the items indicative of interpersonal assault from the LSCR into a composite score, with specific assault types (i.e., physical vs. sexual) examined separately. Group means for all scales are presented in Table 1.

Data Analysis

Factorial analyses of variance (ANOVAs) were conducted using the generalized linear model functions in SPSS (Version 25; IBM, 2017). Follow-up analyses consisted of post hoc independent samples group *t*-test comparisons using a Tukey least significant difference correction to control for potential *p* value inflation. No facial dot-probe (see Procedure section for outlier removal process) or CAPS interview data were missing. Five participants were missing ethnicity identifiers, and three participants were missing the LSCR and were thus excluded from analyses involving this measure. Due to experimenter oversight, 11 individuals were missing the ETI, BDI-2, and STAI-T self-report measures. One additional person was missing both the BDI-2 and STAI-T but had data from the ETI. Additionally, 13 individuals were missing PCL-4 scores due to protocol changes after the release of the PCL-5. All analyses involving self-report measures excluded participants pairwise, resulting in reduced sample sizes.

Post hoc power analyses were conducted as the present study examined two separate data sets that were combined specifically for this secondary analysis. Post hoc power analyses were conducted using G*Power software (Faul, Edfelder, Lang, & Buchner, 2007) to calculate power with the current sample to detect population differences. Meta-analytic reviews indicate medium-to-large, as defined by Cohen (1988), effect size differences within studies of PTSD comparing symptomatic and healthy control groups, *d*s = 0.40–.92 (Latack et al., 2017). We are not aware of reported cognitive bias differences between genders and therefore defer to the PTSD effect size estimates. Post hoc power analyses indicated we were adequately powered to detect large effect size differences between groups—if $d = 0.70$, power with 70 subjects = 0.81.

Results

Threat Bias and PTSD Diagnosis

To examine if threat bias was related to PTSD diagnosis and gender, we conducted a 2 × 2 ANOVA examining effects of Gender (male vs. female) and PTSD (no PTSD vs. combined partial or full diagnostic PTSD) factors on dot-probe threat bias scores. The analysis revealed a significant Gender × PTSD interaction effect, $F(1, 66) = 5.06$, $p = .028$, $\eta_p^2 = .07$. Follow-up ANOVAs, which decompose the threat bias specifically for fearful or angry facial expressions, revealed the same Gender × PTSD interaction effect, $F(1, 66) = 4.37$, $p = .040$, $\eta_p^2 = .06$, in the fearful expression subcondition and no effects in the anger expression subcondition, $F(1, 66) = 1.04$, $p = .312$, $\eta_p^2 = .02$. There were no significant main effects nor were biases significantly different when examining independent *t* tests inspecting main effect differences. Figure 2 presents all means and standard errors for all threat bias conditions, by group.

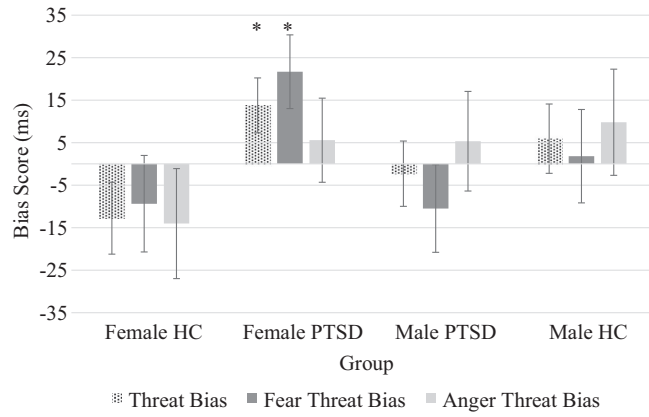

Figure 2. Group comparisons on threat bias scores across conditions. The bias score = mean reaction time for probes replacing neutral facial expressions – mean reaction times for probes replacing threatening facial expressions. Threat bias represents all trials combined. Fear threat bias represents the bias score from fear facial expression trials only. Anger threat bias represents the bias score from anger facial expression trials only. HC = healthy control; PTSD = posttraumatic stress disorder.
*$p < .05$ difference from all other groups.

To better understand this Gender × PTSD interaction effect, we first examined PTSD diagnostic status related threat bias differences within gender. Independent samples *t* tests conducted separately within genders revealed no significant differences within male participants regardless of PTSD diagnostic status, *p*s = .426–.833. However, PTSD+ women demonstrated a significantly higher threat bias compared to PTSD− women ($M = 13.75$ vs. $M = -12.76$) $t(1, 36) = -3.59$, $p = .001$, 95% CI[−41.48, −11.54], $d = 1.19$; with significant differences observed specifically in the fear expression subcondition ($M = 21.68$ vs. $M = -9.37$) $t(1, 36) = -2.29$, $p = .028$, 95% CI[−58.60, −3.51], $d = 0.74$; and no significant differences observed in the anger subcondition ($M = 5.58$ vs. $M = -14.03$), $t(1, 36) = -1.58$, $p = .124$, 95% CI[−44.84, 5.64], $d = 0.50$.

To further clarify the Gender × PTSD diagnostic status interaction effect with respect to threat biases, we examined gender differences within PTSD diagnostic status. For PTSD− participants, women had significantly less trouble disengaging from threatening expressions compared to men ($M = -12.76$ vs. $M = 5.93$), $t(1, 27) = 2.21$, $p = .036$, 95% CI [1.30, 36.07], $d = 0.82$. For PTSD+ participants, there were no significant differences on overall threat biases; however, women were significantly more biased toward fear expressions than men ($M = 21.68$ vs. $M = -10.49$), $t(1, 39) = -2.21$, $p = .033$, 95% CI

[−61.67, −2.68], $d = 0.67$. No other group differences were observed.

Threat Biases and Type of Traumatic Event

To examine the potential influence of the type of traumatic event experienced on threat biases, we conducted a 2 × 2 ANOVA examining effects of Gender (male vs. female) and experience of IPT as the index trauma (3: no violence vs. physical violence or sexual assault vs. both physical and sexual assault) factors on facial dot-probe threat bias scores. IPT experience was coded to maximize cell sizes for the initial analysis. This analysis revealed a significant main effect of IPT, $F(2, 65) = 4.66$, $p = .013$, $\eta_p^2 = .13$, modified by a Gender × IPT interaction effect, $F(1, 65) = 7.12$, $p = .010$, $\eta_p^2 = .10$. Tukey LSD corrected post hoc comparisons revealed a significant and large effect size threat bias mean difference between participants who experienced both physical and sexual assault and those who experienced one form of IPT, $M_{difference} = 34.51$, $p = .014$, 95%CI [7.13, 61.89], $g = 1.03$; a large effect size bias difference between participants who experienced both physical and sexual assault versus those who did not experience an assault, $M_{difference} = 24.17$, $p = .075$, 95%CI [−2.52, 50.87], $g = 0.83$; and no significant difference between having experienced one form of IPT and not having experienced IPT, $M_{difference} = 10.34$, $p = .183$, 95%CI [−5.02, 25.69], $g = 0.32$. Notably, only women ($n = 6$) reported experiencing both sexual and physical assault during the index traumatic event. Further, only two men, compared with 15 women, reported experiencing a sexual assault in their lifetime, with one man identifying combat rather than the sexual assault as his index trauma. Simplified *t*-test analyses examining the effect of experiencing sexual assault within the group of women who identified the assault as their index traumatic event revealed that women who experienced sexual assault were significantly more biased toward threat on the facial dot probe compared with women who did not report sexual assault ($M = 22.89$ vs. $M = −2.76$), $t(1, 36) = 3.05$, $p = .003$, 95% CI [8.62, 42.69], $d = 1.19$; particularly fearful facial expressions ($M = 34.37$ vs. $M = 1.62$), $t(1, 36) = −2.19$, $p = .035$, 95% CI [−63.08, −2.42], $d = 0.92$. Examination of physical assault as the index event revealed no significant differences in threat biases regardless of gender.

Importantly, lifetime experience of sexual assault did not account for the same level of threat bias differences, $F(2, 65) = 3.521$, $p = .065$, $\eta_p^2 = .05$, despite increasing the cell sizes. When examined among women only, as too few men reported sexual assault to examine, lifetime experience of sexual assault was less robustly associated with threat biases generally ($M = 14.51$ vs. $M = −2.88$), $t(1,36) = −2.18$, $p = .036$, 95% CI [−33.57, −1.20], $d = 0.74$ (compared to $d = 1.19$ for index traumatic event); and to fearful facial expressions specifically ($M = 26.09$ vs. $M = −0.10$) $t(1, 36) = −1.92$, $p = .063$, 95% CI [−53.90, 1.52], $d = 0.68$ (compared to $d = 0.92$ for index traumatic event). Notably, one man and five women reported lifetime experiences of sexual assault on the LCSR (4:6 during childhood) but did not identify the sexual assault as the index traumatic event. It appears that when sexual assault is not the identified index trauma, attentional biases are not observed with the same strength, even within individuals experiencing PTSD symptoms.

Potential Confound of Psychiatric Symptoms in Women

One potential confounding issue is whether women demonstrate threat biases due to a higher level of PTSD and other psychiatric symptoms. To examine this potential confound, we compared men and women with and without PTSD on several measures of PTSD, depression, and anxiety (see Table 1 for means, standards deviations, and comparison results). As expected, regardless of gender, PTSD+ participants endorsed significantly more symptoms of depression, anxiety, and PTSD compared to PTSD− participants, $ps < .001 – p = .014$ (see Table 1). Further, PTSD+ men and women did not differ in their endorsement of symptoms of depression, anxiety, or PTSD, nor did they differ specifically in their CAPS-rated symptoms of reexperiencing, avoidance, or hyperarousal, $ps = .141–.955$ (see Table 1). Additionally, PTSD− men and women did not differ in their reports of early life traumatic experiences (all means less than 1), $ps > .371 − .921$. However, PTSD+ women reported more traumatic experiences during early adolescence than PTSD+ men ($M = 1.23$ vs. $M = 0.33$) $t(1, 29.97) = −2.23$, $p = .033$, 95% CI [−171, −0.75], $d = 0.43$; particularly emotional abuse, which women experienced nearly 10 times more often than men ($M = 1.55$ vs. $M = 0.17$) $t(1, 24.02) = −3.25$, $p = .003$, 95% CI [−2.26, −0.50], $d = 1.00$. Regression analyses indicated self-reported symptom severity measures were not associated with threat biases, $ps = .364–.672$.

Discussion

Women are diagnosed with PTSD twice as often as men (*DSM-5*, 2013). It is unclear why this incidence difference occurs. One possibility is that women maintain PTSD symptoms through greater hypervigilance for threat, thus preventing recovery (Hourani et al., 2015). Another possibility is that the trauma experienced more often by women may increase the likelihood of developing PTSD (Smith et al., 2016). The present study used an objective measure of attentional threat biases to examine whether women with PTSD have larger attentional threat biases and if this was related specifically to gender alone or potentially to the trauma types women are more likely to experience (i.e., IPT). Consistent with our hypotheses, PTSD+ women demonstrated larger attentional biases for threatening facial expressions compared to PTSD+ men and trauma-exposed PTSD− controls of both genders. These biases were strongly related to IPT victimization and were not related to symptom severity. Rather, index trauma type was related to observing threat biases such that individuals who reported sexual assault as the index trauma for the CAPS, and

particularly women who experienced both sexual and physical assault during the index traumatic event, demonstrated larger threat biases on the facial dot-probe task. Of note, the biggest bias was toward fearful facial expressions, suggesting these women had the most sensitivity for fear triggers. When lifetime experience of sexual assault was examined, threat biases were less robust despite increased comparison of cell sizes. Although due to small sample sizes, it was not possible to directly compare individuals who reported an index trauma of sexual assault to those who did not, the decrease in effect sizes suggests threat biases, particularly for fearful expressions, are related to sexual assault as the index trauma rather than the experience of sexual assault during the lifetime.

The findings of the present study suggest that women who express more attentional threat biases were more likely to have experienced a sexual assault as their index traumatic event. However, compared to other individuals of both genders with PTSD, women who experienced sexual assault also did not report worse re-experiencing, avoidance, or hypervigilance symptoms in interviews or via self-report. It is possible that the present study represents a bias for fearful emotional expressions rather than a more generalized threat bias. Fearful facial expressions may trigger re-experiencing symptoms or provide a more salient anxiety/fear cue compared with other threat triggers. It is possible that women experience increased fear in the presence of fearful facial expressions due to emotional transfer. This is consistent with clinical experiences suggesting the emotion experienced during the event becomes a trauma cue (Foa et al., 1989). One could expect angry facial expressions would be reminder cues of perpetrators, although not all perpetrators attack out of anger (e.g., many victims report laughing perpetrators). We could be more confident in this interpretation of our results if we were able to examine whether women were reacting differently to male and female actor emotional depictions (i.e., potentially reacting to potential victims and perpetrators differently) or if other emotions (e.g., sadness, disgust, joy) were also presented. Unfortunately, we were unable to examine these possibilities.

Taken together, this study's results suggest attentional biases are most related to the trauma type the individual identified as distressing rather than specifically related to gender or types of traumatic events experienced over the lifetime. However, we were unable to make gender comparisons relevant to threat bias and sexual assault due to the low rate of sexual assault in the male comparison group in this study. This study limitation reflects the societal confound of women experiencing more violence compared to men (Krantz & Garcia-Moreno, 2005).

Several limitations of this study should be addressed through further research. It is possible there were differences in reactivity to gender-specific stimuli. Specifically, women may react similarly to both male and female fearful expressions (consistent with a general fear threat bias) or may be more reactive to female fearful expressions (consistent with re-experiencing of painful emotions threat bias). Unfortunately, the gender of the actors was not recorded at the trial level, limiting our ability to further isolate which stimuli were triggering threat biases. Future research should address this question by reporting actor gender in the stimulus sets. The present study was also unable to test if sexual assault specifically leads to the observed effects regardless of gender, as only one male participant reported sexual assault as the index trauma. Our sample included both veterans and civilians; however, we were underpowered to investigate differences based on veteran status. Inequality of veteran status across genders may have influenced our results due to military training and culture affecting motivation to fully engage in reaction time testing (Marx et al., 2009). It is difficult to parse the effects of gender and trauma type when a particular trauma type is more likely to occur in one gender versus another (e.g., men are more likely to report combat whereas women are more likely report sexual assault as index traumas). Future studies that recruit male and female participants based on trauma exposure history will be able to further disentangle these effects, potentially through oversampling of men who have been sexually assaulted. We note that veteran population samples provide a better chance of working with individuals of both genders who have experienced a range of trauma types. This will help to further clarify how trauma type impacts PTSD symptoms, functioning, and treatment outcomes. Finally, the majority of the present sample completed the study prior to updates to the PTSD criteria that were published in the *DSM-5*. Changes in diagnostic criteria can affect the similarity of clinical samples over time. Although the present sample endorsed symptoms consistent with the added criteria for negative alterations in cognitions and mood (assessed in the current study with the BDI-2), the present study should be replicated using a sample of participants who have been diagnosed using the updated criteria. Despite these limitations, the present study possesses a number of strengths, including a relatively more generalizable diverse clinical sample, both clinician-rated and self-report symptom measures, assessments of multiple types of index trauma events as well as early life traumatic experiences, and use of an objective measure of attentional threat bias with a multiethnic stimulus set.

The present study adds to the growing literature suggesting that the type of index trauma a person experiences is associated with factors theorized to maintain PTSD. Although there are specific neurological, physiological, and cognitive differences between men and women that can increase both risk and resilience for PTSD (Pineles et al., 2017), it is also apparent that experiencing an IPT, particularly sexual assault, increases the risk of developing psychopathology (Sexton et al., 2017). Women may have a higher risk of developing hyperarousal symptoms compared to men (Bangasser et al., 2019); however, increased arousal does not account for differences in attentional threat biases. Of note, our results suggest there is more attentional bias for reminders of the victim's traumatic emotional experience (i.e., fear) than for reminders of the perpetrator's emotional expression (i.e., anger). Future studies should work to parse out the association between biases for emotional

facial expressions using stimuli representing a full range of basic emotions and the gender of the actor pictured in the stimuli.

Becoming "unstuck" from emotional experience is a critical component of trauma recovery. The present study supports previous findings indicating that treatments that increase the ability to disengage from threatening emotional expressions and increase habituation to fear—such as prolonged exposure (PE) or cognitive processing therapy (CPT)—may be helpful in encouraging recovery from PTSD stemming from sexual assault. Given that many women have experienced sexual trauma (Krantz & Garcia-Moreno, 2005), they may be particularly vulnerable to fearful cues or fear transfer in their environment. Considering gender-specific threat triggers and creating safe contexts, such as assault survivor groups and spaces, may be key to providing sensitive care settings where stress, tension, and other individuals' emotional pain may be on display and trigger individuals struggling with PTSD. Clinicians may also consider incorporating therapeutic tools related to women's increased sensitivity to others' emotional expressions (e.g., distress tolerance skills, paced breathing) into treatment.

The use of the dot probe to assess attentional threat biases may provide an avenue to objectively assess what types of potentially threatening cues individuals may be struggling to move past (i.e., trouble disengaging), thereby inhibiting recovery. Integrating cognitive bias paradigms into clinical assessment procedures has the potential to help target treatments to the specific biases (i.e., "hot spots" in PE or "stuck points" in CPT) potentially maintaining symptoms. Further, cognitive bias modification has been shown to effectively treat anxiety disorders (Cristea, Kok, & Cuijpers, 2015) and may be a fruitful adjunct to evidence-based trauma-focused therapies. One potential use of the facial dot-probe paradigm could be as a form of exposure to fearful facial expressions, with a goal of reducing biases through repeated exposure and eventual habituation (MacLeod & Mathews, 2012).

The results of the present study indicate that PTSD+ women demonstrate larger attentional threat biases for fearful facial expressions during a dot-probe task compared with PTSD- women and men both with and without PTSD. This Gender × PTSD Diagnosis effect is not explained by differences in PTSD symptom severity, depression, or anxiety symptoms, nor by experience of childhood or lifetime sexual trauma. Rather, this attentional bias appears related to the experience of IPT, particularly experiencing both sexual and physical assault during the same index trauma. Given that women are more likely to experience IPT, it is possible that IPT experience is related to higher rates of PTSD diagnosis in women compared to men and is closely associated with attentional biases for fearful facial expressions.

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