Supplemental Information

Methods and Materials

Participants

In addition to the assessments described in the manuscript (1, 2), participants completed the Welsh Anxiety Scale (WAS; 3), a thirty-nine-item true/false scale derived from the Minnesota Multiphasic Personality Inventory that measures anxiety and negative affect more generally (see 4, 5). We also administered the Short Form of the Michigan Alcohol Screening Test (SMAST; 6). The SMAST is a questionnaire consisting of 34 yes-no items concerning the symptoms and consequences of alcohol abuse and dependence that correlates highly with both the full version of the Michigan Alcohol Screening Test and other self-report measures of alcohol abuse/dependence and has been shown to differentiate alcoholics from controls (7).

Procedure

Shock sensitivity evaluation

To control for individual differences in shock sensitivity, the intensity of shocks received during the experimental session were calibrated to the participants' individual subjective shock sensitivity. This procedure was conducted immediately prior to the start of the instructed fear-conditioning paradigm. Participants were administered a series of electric shocks of increasing intensity to the fingers of their left hand. Participants reported two intensity anchors: the first intensity that they considered uncomfortable and then the maximum intensity level that they could tolerate. The series was terminated when they reached their maximum intensity level. The shock intensity administered

during the experimental session was calibrated to the mid-point between their discomfort level and their maximum intensity level.

Experimental Task: Instructed Fear-Conditioning Paradigm

During the instructed fear-conditioning paradigm, participants viewed a series of letter cues. These stimuli were presented for 400ms with a variable inter-trial interval between 2 to 2.8 seconds. The letter cues were either upper- or lowercase and colored red or green. Participants were told that in all conditions, electric shocks might be administered on some trials following red letters (threat), but that no shocks would follow green letters (safety). Shocks were administered for 200ms to adjacent fingers on the participant's left hand at 1400 ms post- first stimulus onset on 20% of threat trials in each condition, for a total of 30 shocks (10 shocks per condition).

The focus of attention for the participant varied depending upon which of the three conditions they were performing. Trials were grouped into six blocks of 50 trials, two for each of the three conditions. Task instructions for these blocks varied across the three conditions. In the Threat-focused condition (TF), participants were instructed to attend to the color of the letter cue and press one of two buttons using their right hand according to whether the letters indicated threat (red) or safety (green). This condition was designed to focus participants on the feature of the letter cue (i.e., color) that connoted threat of shock. In Alternative-focus/Low load condition (AF/LL), participants had to determine if the letter cue was upper- or lowercase. The purpose of this condition was to make the threat information secondary or peripheral to the primary task. In the Alternative-focus/High load condition (AF/HL), participants performed a 2-back task (8), where they had to attend to the letter in a series and press one of the two buttons to

indicate if the current letter matched the letter presented 2 trials back in the series. As in the AF/LL condition, letter color (threat information) became peripheral and was not necessary to perform this 2-back task. Moreover, other research with this 2-back task has confirmed that it places substantial demand on working memory resources, requiring both maintenance and manipulation of information across trials (i.e., deletion, insertion, re-ordering and then maintenance of letter set on each trial).

As noted earlier, participants were instructed that electric shocks might be administered in all three conditions on some trials following letter cues colored in red, but that no shocks would follow green letters. Participants performed two consecutive blocks of each of these three tasks and task order was fully counterbalanced across participants. To further enhance the task-relevant feature set manipulation and to increase task motivation, participants were informed that speed and accuracy would influence the amount of shocks they received in the TF condition and the likelihood of receiving a reward (i.e., one of three prizes) based on task performance in the AF/LL and AF/HL conditions. However, the number of shocks participants actually received was not influenced by their behavioral performance.

These three task conditions were designed to provide discrete manipulations of attentional focus and working memory load. One of the conditions required the participant to focus on the threat information (TF) and the other two required a threat-irrelevant focus (AF/LL and AF/HL).

Results

Psychopathy analyses including important individual difference covariates

Hare (2) has provided substantial evidence that scores on his Psychopathy Checklist are generally independent of intelligence, anxiety, and most forms of psychopathology. Nevertheless, when conducting research with psychopathological populations, it is important to examine whether other potentially relevant individual difference variables are influencing the results. Toward this end, we repeated the principal analysis reported in the manuscript controlling statistically for the effects of age, education, intelligence (SILS), anxiety (WAS), alcohol problems (SMAST), and task order. The primary results remained essentially unchanged. The Psychopathy X Task condition interaction was significant ($p= .030$) and the Psychopathy X attentional focus interaction contrast was significant ($p= .042$). The inverse relationship between Psychopathy scores and FPS was significant in the Alternative focus conditions ($B= -4.9$, $p= .007$) and no significant relationship was observed between Psychopathy and FPS in the threat focused condition ($B= 0.8$, $p= .771$).

Psychopathy Groups Analysis of FPS

Many psychopathy researchers conceptualize psychopathy as a diagnostic category and thus analyze their data by contrasting extreme groups. In the United States, the standard cutoffs for dividing participants into psychopathic and nonpsychopathic control groups are $\geq$30 and $\leq$20 respectively. In addition, the Newman laboratory has historically subdivided psychopathic and nonpsychopathic offenders into low- and high-anxious subgroups to distinguish primary (low-anxious) and secondary (high-anxious) psychopathy.

To replicate this analysis strategy, we used the standard cut-offs to classify offenders as either psychopathic (n=28) or non-psychopathic (n=46). An additional 51 participants were excluded from these analyses due to their intermediate scores on the Psychopathy Checklist-Revised (i.e., Psychopathy total scores greater than 20 but less than 30). Next, we analyzed FPS in a 3-way mixed model factorial ANOVA with Condition (TF vs. AF/LL vs. AF/HL) as a within subjects factor and Psychopathy Group (Psychopath vs. Non-psychopath) and Anxiety (Low vs. High; median split) as between subject factors. Consistent with the analyses reported in the manuscript, the Psychopathy Group X Condition interaction was significant, $F(2,140)= 5.11$, $p= .010$. Similarly, follow-up tests of orthogonal interaction contrasts confirmed that Psychopathy Group also interacted with the focus of attention (i.e., Psychopathy Group X TF vs. AF), $F(1,70)= 5.17$, $p= .026$. Thus, the two primary results from the General Linear Model (GLM) analyses in the manuscript were replicated with this group approach to statistical analysis. This analysis revealed one additional novel effect that was not detected with the GLM approach. Specifically, the Psychopathy Group X Cognitive load interaction contrast (i.e., Psychopathy Group X AF/LL vs. AF/HL) was also significant, $F(1,70) = 5.02$, $p= .028$. This result provided some evidence that increasing cognitive demands further undermines the defensive responses of psychopathic offenders.

Analysis of task performance

Although this experiment was designed to examine the effects of higher order processes on FPS, participants were required to make a response on every trial in all three conditions of this experiment. Thus, analyses of response time provide an opportunity to confirm the success of our attentional focus and load manipulations. These analyses also

provide an alternative window through which to observe the impact of proposed attentional differences associated with psychopathy.

Response time was analyzed within a GLM with Condition (TF vs. AF/LL vs. AF/HL) and Cue type (Threat vs. Safety) as a within subject categorical factor and Psychopathy total score (standardized) as a between subject quantitative factor. Consistent with the increasing cognitive demands across conditions, a significant main effect of Condition was observed, $F(2,246) = 227.30$, $p < .001$, with response time increasing from Threat-focused (M= 425.3ms) to Alternative-focus/Low load (M= 538.0ms) to Alternative-focus/High load (M= 813.7ms). Similarly, response time was significantly slower during threat (M= 601.1ms) vs. safety cues (M= 583.6ms), $F(1,123) = 42.92$, $p < .001$. However, most importantly, the critical Psychopathy X focus of attention interaction contrast that was observed for fear-potentiated startle was also significant for response time, $F(1,123)= 5.06$, $p= .026$. This indicates that the relationship between Psychopathy total score and response time was significantly different during threat-focused (B= 3.5; i.e., response time increases by 3.5ms for every one standard deviation increase in Psychopathy total score) than during the alternative focus conditions (B= -17.4; response time decreases by 17.4ms for every one standard deviation increase in Psychopathy total score). Overall, then, the response time data are consistent with results reported in the main manuscript.

References

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