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Feature-Based Attention and Conflict Monitoring in Criminal Offenders: Interactive Relations of Psychopathy with Anxiety and Externalizing

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Abstract

As predicted by the response modulation model, psychopathic offenders are insensitive to potentially important inhibitory information when it is peripheral to their primary focus of attention. To date, the clearest tests of this hypothesis have manipulated spatial attention to cue the location of goal-relevant versus inhibitory information. However, the theory predicts a more general abnormality in selective attention. In the current study male prisoners performed a conflict-monitoring task, which included a feature-based manipulation (i.e., color) that biased selective attention toward goal-relevant stimuli and away from inhibitory distracters on some trials but not others. Paralleling results for spatial cuing, feature-based cuing resulted in less distracter interference, particularly for participants with primary psychopathy (i.e., low anxiety). This study also investigated the moderating effect of externalizing on psychopathy. Participants high in psychopathy but low in externalizing performed similarly to primary psychopathic individuals. These results demonstrate that the abnormal selective attention associated with primary psychopathy is not limited to spatial attention but, instead, applies to diverse methods for establishing attentional focus. Furthermore, they demonstrate a novel method of investigating psychopathic subtypes using continuous analyses.

Keywords

psychopathy; response modulation; externalizing; self-regulation; attention

Psychopathy is a personality disorder comprised of interpersonal (lying, manipulative, glib/superficial), affective (lack of remorse and empathy), behavioral (irresponsible, impulsive), and antisocial (criminal versatility, revocation of conditional release) traits and behaviors (Hare, 2003). While some psychopathic traits and behaviors resemble those associated with broader constructs such as externalizing and general antisociality (e.g. crime, substance abuse, impulsivity), psychopathy reflects a more severe personality disorder and is more strongly associated with persistent and diverse criminality (Hare, 2003; Kosson, Lorenz & Newman, 2006). Furthermore, whereas externalizing appears to reflect a unitary etiological syndrome (Krueger, Hicks, Patrick, Carlson, Iacono, & McGue, 2002), clinical and experimental research on psychopathy highlights the presence of distinct psychopathic

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subtypes. Accurate characterization of these psychopathic subtypes represents a critical next step in understanding the core deficits that underlie psychopathy and will promote more accurate diagnosis and effective treatment of this syndrome (Skeem, Polacheck, Patrick, & Lilienfeld, 2011; Swogger & Kosson, 2007; Vassileva, Kosson, Abramowitz, & Conrod, 2005).

Clinically, the primary psychopathic subtype is marked by emotional hyporeactivity, a fundamental lack of anxiety, and distinct anomalies in cognitive and attentional functioning (Lykken, 1995). According to Cleckley's (1976) seminal description of psychopathy, the psychopath "appears almost as incapable of anxiety as of profound remorse" (p. 340). In contrast, secondary psychopathy, while related to similar traits and behaviors, is associated with emotional hyperreactivity and a tendency to over-respond to motivational stimuli. Moreover, Porter and colleagues (Porter, 1996; Porter & Woodworth, 2006) have hypothesized that failures in self-regulation associated with secondary psychopathy may be a consequence of chronic substance use and abuse or trauma in early childhood, as well as inherited traits. In research, identification of psychopathic subtypes has been implemented most commonly by dividing those who meet criteria for psychopathy into primary and secondary subgroups based on their level of self-reported neurotic anxiety (Brinkley, Newman, Widiger, & Lynam, 2004; Hiatt, Schmitt, & Newman, 2004; Koenigs, Kruepke, Zeier, & Newman, 2011; Newman & Brinkley, 1997; Newman, MacCoon, Vaughn, & Sadeh, 2005; Newman, Schmitt, & Voss, 1997; Skeem, Johansson, Andershed, Kerr, & Loudon, 2007; Zeier, Maxwell, & Newman, 2009).

Evaluation of psychopathic subtypes has proven critical to understanding the cognitive and attentional deficits in psychopathy, most notably the response modulation deficit. According to the response modulation model, psychopathic individuals are oblivious to inhibitory information that is peripheral to their current focus of attention and this obliviousness, in turn, is responsible for their profoundly deficient behavioral inhibition and self-regulation (Newman & Baskin-Sommers, 2011; Newman & Wallace, 1993; Patterson & Newman, 1993). In some cases, response modulation deficits, especially those involving peripheral emotion cues, apply to psychopathy broadly defined (e.g. Baskin-Sommers, Curtin, & Newman, 2011, 2013; Mitchell, Richell, Leonard, & Blair, 2006; Wolf, Carpenter, Warren, Zeier, Baskin-Sommers, & Newman, 2011). However, other deficits, especially those involving insensitivity to motivationally-neutral peripheral cues relate specifically to primary psychopathy (e.g., Newman et al., 1997; Zeier et al., 2009).

Using a flanker-type task in which participants were presented with two stimuli, one to the left and one to the right of fixation, Zeier et al. (2009) demonstrated that offenders with primary psychopathy are insensitive to peripheral distracter stimuli when their attention is allocated to a specific spatial location. Targets were always either letters or numbers, and participants were told to press one button for letters and another for numbers. When the distracter was incongruent (i.e. related to the opposite response as the target), interference (slower reaction time) occurred. To manipulate the focus of attention, visual cues foreshadowed either the ultimate location of the target (i.e., cued trials) or both spatial locations (i.e., uncued trials). When cued, interference scores for primary psychopathic individuals were significantly lower than those for anxiety-matched controls, while no differences were observed for uncued trials. These results supported the prediction that primary psychopathic individuals would be less influenced by inhibitory information that appeared outside of their immediate focus of attention and indicated that a pre-potent focus of spatial attention may be a necessary condition to observe the response modulation deficit in primary psychopathy (see also Hiatt et al., 2004; Newman et al., 1997; Zeier & Newman, 2011).

The purpose of the current study was to address two questions critical to understanding primary psychopathy and response modulation. The first question relates to identification of the conditions necessary to observe the response modulation deficit. The clinical literature on psychopathy suggests that psychopathic individuals are prone to overlook important contextual information (e.g., previous punishments) under a wide variety of circumstances (e.g., while planning to commit a crime). The pre-existing focus in such circumstances is not explicitly spatial, but is more accurately characterized as an attention set that causes certain features of a situation (e.g., a vacant house, signs of valuable contents) to occupy attention and organize perception. Thus, the contention that factors such as spatial attention represent a necessary component of this deficit (Hiatt et al., 2004; Mitchell et al., 2006) limits implications for most critical breakdowns of self-regulation in psychopathy. To address this limitation, the current study evaluated the generality of the abnormal selective attention demonstrated by primary psychopathic individuals using a cue that highlighted a relevant feature (the color) of the target stimulus. If, as in the spatial cuing task, primary psychopathy is associated with reduced interference in the presence of such cues, this would demonstrate that the engagement of attention, not the modality by which it is engaged, is a sufficient condition for observing the response modulation deficit.

The second major question addressed by the current study relates to the analytical approach to investigations of psychopathy and, in particular, psychopathic subtypes. The conventional way of discriminating primary and secondary psychopathy involves placing participants into low and high anxious groups based on responses to a self-report anxiety measure (Hiatt et al., 2004; Zeier et al., 2009; Zeier & Newman, 2011). However, it is not known whether this is the most precise or powerful approach to such analyses. Although empirical evidence supports the existence of two subtypes of psychopathic individuals distinguished by level of anxiety (Newman & Brinkley, 1997; Newman et al., 2005; Skeem et al., 2007), it has also been found that psychopathic subtypes may be identified using general personality traits. For instance, an emotionally stable psychopathic subtype exhibiting low stress reactivity and an aggressive subtype marked by a combination of high negative affect and low constraint have been identified (Hicks, Markon, Patrick, Krueger, & Newman, 2004). Notably, the aggressive subtype bears a strong resemblance to the externalizing dimension, which is also associated with antisociality, substance abuse, impulsivity, negative affect, hostile reactivity, and cognitive deficits typically associated with secondary psychopathy (Baskin-Sommers & Newman, 2013). Moreover, focusing on the interaction of externalizing and psychopathy dimensions represents a way to explore psychopathic subtypes which, unlike the traditional primary-secondary distinction or Hicks et al. (2004) groupings, retains the power of continuous analyses.

To evaluate the generality of the response modulation deficit to feature-based attention, the current study used cues that focused attention on features of the target stimulus instead of its spatial location. This method leads to preferential processing of stimuli associated with these focal features irrespective of spatial attention (Andersen, Muller, & Hillyard, 2009), thereby biasing processing at an early stage towards the target and away from the distracter (Desimone & Duncan, 1995). Using this manipulation, we can expand on the known parameters by which the response modulation deficit impacts information processing and, importantly, clarify the relevance of response modulation for self-regulation in the real world.

To facilitate comparisons with previous results involving spatial cuing, we evaluated feature-based attention using a modified version of the flanker-type task developed by Zeier and colleagues (2009), that cued the color of the target stimuli rather than their spatial location. On half of the trials, a pre-target cue was presented that informed the participant of the color of the target stimulus. This allowed the participant to form an attentional set for the

target color, thereby enhancing the ability to filter out incongruent distracters at an early stage of processing. Participants in this experiment were instructed to respond to a target stimulus by pressing a button to indicate if it was a letter or number. If the target and distracter were incongruent (e.g., the target was a number and the distracter was a letter), participants were expected to respond more slowly than if the distracter was not related to the task (i.e., an asterisk). The difference in reaction time between these two types of trials was the primary dependent measure in this task. For trials in which participants were cued to the color of the target stimulus, interference was expected to decrease because the color information aids selective processing of the target.

Also to facilitate comparisons with previous research (e.g. Hiatt et al., 2004; Newman et al., 1997, 2005; Zeier et al., 2009; Zeier & Newman, 2011), the primary analysis was conducted using the PCL-R (Hare, 2003) to identify psychopathic and non-psychopathic participants and Welsh (1956) anxiety scores to categorize participants into low vs. high anxious subgroups. Based on the response modulation hypothesis, we predicted that, while all participants would benefit from the color cue, interference scores would be significantly lower when cued for low-anxious (primary) psychopathic individuals compared to anxiety-matched controls. However, no differences were predicted between high-anxious (secondary) psychopathic inmates and anxiety-matched controls for cued trials, nor were differences predicted among any of the participant groups on uncued trials.

We also explored a novel approach to the investigation of psychopathic subtypes by performing additional analyses treating psychopathy and externalizing as continuous variables and evaluating their interaction as well as their main effects. This approach maintains the ability to study psychopathy as an etiologically diverse construct while retaining the statistical power of continuous analyses. Further, exploration of externalizing connects this study to empirical research on deficits, such as poor cognitive control, that have been related to externalizing as well as to similar constructs like general antisociality and secondary psychopathy (Hall, Bernat, & Patrick, 2007; Morgan & Lilienfeld, 2000; Ross, Benning, & Adams, 2007).

For these analyses, we predicted that psychopathy and externalizing would interact to predict interference for cued trials. We predicted that those high on psychopathy but low on externalizing would resemble emotionally stable “primary” psychopathic individuals, and thus display reduced interference on cued trials. Analogously, we expected that those high in both externalizing and psychopathy would correspond to the high-anxious secondary subtype, and thus display more interference. As with the group analyses, no other significant effects were predicted, although given prior research demonstrating a link between antisociality and poor cognitive control (Morgan & Lilienfeld, 2000; Zeier, Baskin-Sommers, Hiatt Racer, & Newman, 2011), we examined whether externalizing predicted greater interference, particularly on uncued trials.

Method

Participants

A total of 207 inmates from a medium-security prison in Wisconsin completed the modified flanker task. This included 161 Caucasian, 42 African American, three Hispanic, and one multiracial participant. While some research that has evaluated the generality of psychopathy has not found statistical moderation of results by ethnicity (Vachon, Lynam, Loeber, Stouthamer-Loeber, 2012), basic findings obtained with European-Americans typically have not been replicated in African-American participants (Baskin-Sommers, Newman, Sathasivam, & Curtin, 2010; Doninger & Kosson, 2001; Kosson, Smith, & Newman, 1990; Lorenz & Newman, 2002; Newman & Schmitt, 1998; Newman et al., 1997;

Thornquist & Zuckerman, 1995; Unikel & Blanchard, 1973; Vitale, Newman, Serin, & Bolt, 2005). Thus, we evaluated our performance-related hypotheses using European-American participants only.

Further, participants were excluded from the main analyses if they were younger than 18 or older than 45, scored less than 70 on the Shipley Institute of Living measure of intelligence (Zachary, 1986), were taking psychotropic medications, had a diagnosis indicating bipolar disorder or psychosis, or were color blind. Finally, participants with accuracy scores below 75% or who were more than 2 standard deviations from the group mean on the primary dependent measures (i.e., interference on cued and uncued trials, as well as reaction time for uncued control trials) were not included in analyses. After applying all exclusion criteria, the final test sample consisted of 120 participants. Notably, those excluded for poor task performance did not differ significantly from the remaining participants on psychopathy, anxiety, or externalizing scores. Participants were paid \$15 for completing the diagnostic interview and a battery of questionnaires.

Psychopathy—Psychopathy was assessed using Hare’s (2003) Psychopathy Checklist-Revised, the most commonly used and well-validated measure for the clinical assessment of psychopathy. Following a semi-structured interview with each offender, information from the interview and inmate’s institutional file was used to rate participants according to the PCL-R criteria. The PCL-R is scored by giving a rating of 0, 1, or 2 on 20 items to indicate the presence of traits and behaviors associated with psychopathy. Full scale scores on the PCL-R ranged from 5.0 to 36.0 ($M=22.78$, $SD=7.51$, $N=120$). Cronbach’s alpha for the full-scale score was .82 ($N=82$). Though interrater reliability was evaluated for only six of the current participants, the intraclass correlation was .99 and other assessments of interrater reliability in our lab are consistently above .90 (Zeier et al., 2009; Wolf et al., 2011).

For group analyses, participants were classified as non-psychopathic (PCL-R score of 20 or less, $n=50$), intermediate (PCL-R score greater than 20 but less than 30, $n=40$), or psychopathic (PCL-R score of 30 or more, $n=30$).

Anxiety—The Welsh Anxiety Scale (WAS; Welsh, 1956) consists of 39 true or false items—responses indicating greater neurotic anxiety are scored as “1”, while other responses are scored as “0.” For the current sample ($N=120$), scores ranged from 0 to 36 ($M=12.94$, $SD=9.03$). Reliability (Cronbach’s alpha) was .93 ($N=113$). As in prior research, participants were divided into low and high anxiety groups using a median (12) split on the WAS (Hiatt et al., 2004; Newman et al., 1997; Zeier et al., 2009). This resulted in 62 participants being classified as low-anxious and 58 participants classified as high-anxious.

Diagnostic Classification—Psychopathy and anxiety group classifications were used to place participants in one of four groups: low-anxious non-psychopathic ($n=30$), low-anxious (primary) psychopathic ($n=12$), high-anxious non-psychopathic ($n=20$), and high-anxious (secondary) psychopathic ($n=18$). Participants scoring in the intermediate range on the PCL-R were not included in group analyses. See Table 1 for descriptive statistics on the diagnostic subgroups.

Externalizing—Participants completed the brief form of the Multidimensional Personality Questionnaire (MPQ; Patrick, Curtin, & Tellegen, 2002), a 155-item personality questionnaire ($N=115$). This questionnaire consists of mostly “true” or “false” items, as well as questions asking participants to indicate which of two choices they would prefer. Items on these questionnaires can be combined to make up 12 subscales¹. Weighted combinations of these subscales are used to create three broad subscales: Positive Affect ($M=65.78$, $SD=16.07$), Negative Affect ($M=49.22$, $SD=20.81$), and Constraint ($M=72.43$, $SD=16.25$).

For the current study, the Negative Affect and Constraint scores were z-scored, then MPQ externalizing (EXT) scores were calculated by subtracting Constraint from Negative Affect, consistent with the operationalization of externalizing used in prior research (Baskin-Sommers, Wolf, Buckholtz, Warren, & Newman, 2012). This resulted in externalizing scores ranging from -3.21 to 4.29 ($M=0.00$, $SD=1.60$), with higher EXT scores indicating greater externalizing (higher negative affect and lower constraint). See Table 2 for correlates of the externalizing and psychopathy measures².

Task and Procedure

Each participant completed one testing session of 384 test trials. The experiment consisted of four blocks of 96 trials, with cue presence (“cued” or “uncued”) alternated by block. For each trial, a fixation point (+) appeared for 500 ms. After this, for cued trials, the fixation changed color (to either red or green); the color of the fixation matched the color of the upcoming target (i.e., if the fixation turned red, the target would be red and the distracter would be green) and remained on display for 500ms. For the uncued trials, the fixation either turned blue (to match the ‘alerting’ nature of the color change for cued trials) or else remained black.

Following this, the target appeared for 30 ms. The target display consisted of two stimuli, one appearing in the left visual field and one appearing in the right visual field (both equidistant from fixation), along with a black central arrow denoting which stimulus was the target. Visual angle from the center of the fixation point to the edge of either primary stimulus was 1.91 degrees (if visual angle was calculated from the edge of the arrow cue to the edge of the stimulus, it was 0.94 degrees).

The target stimulus in this task was always a 5, 8, G, or M and the distracter was always one of these stimuli or an asterisk. There were three types of trials: congruent (two letters or two numbers), incongruent (one letter and one number), and control (one letter or number in the target location and an asterisk in the distracter location). After each display, participants entered a response indicating whether the target was a letter or a number. For all trials, the target and distracter appeared in different colors (either red or green). This was followed by an intertrial interval of 1,500 ms before the next target appeared (see Figure 1 for an example of a trial). Before the participants began the first block of a cue type, they completed a short set of practice trials (12 trials for each of the two practice sets), which also had longer cue and target durations (all cues appeared for 1000 ms, and all targets appeared for 100 ms).

The primary dependent measure for this task was interference, the difference in mean reaction time between correct incongruent trials and correct control trials. This measure assessed the degree of conflict or interference created by response-incongruent distracters (relative to a baseline, in which the distracter is unrelated to any response). Trials in which participants took less than 100 ms or more than 1500 ms to respond were not included in the reaction time analyses. To reduce any variance due to overall reaction time, interference was calculated as (incongruent reaction time – control reaction time)/(incongruent reaction time + control reaction time) (see Hiatt Racer, Gilbert, Luu, Feller-Gant, Abdullaev, & Dishion,

¹To aid with interpretation of the current results, as well as past results of research using the Welsh Anxiety Scale (WAS), correlations between the WAS and each of the 12 subscales of the Multidimensional Personality Questionnaire (MPQ) are provided here ($N=115$): Wellbeing: $r=-.23$, $p=.02$; Social Potency: $r=-.04$, $p=.67$; Achievement: $r=-.14$, $p=.15$; Social Closeness: $r=-.32$, $p<.001$; Stress Reaction: $r=.73$, $p<.001$; Alienation: $r=.65$, $p<.001$; Aggression: $r=.39$, $p<.001$; Control: $r=-.37$, $p<.001$; Harm Avoidance: $r=-.18$, $p=.05$; Traditionalism: $r=-.14$, $p=.14$; Absorption: $r=.22$, $p=.02$; Unlikely Virtues $r=-.18^*$, $p=.05$.

²While we did not evaluate differences related to the psychopathy factors in this study, brief information regarding the factors is provided here. There was a significant correlation between the psychopathy factors, $r=.56$, $p<.001$. There was also a significant correlation of externalizing scores with PCL-R Factor 1 ($r=.30$, $p=.001$) and Factor 2 ($r=.40$, $p<.001$).

2011). Interference was calculated as (incongruent reaction time – control reaction time)/(incongruent reaction time + control reaction time) (see Hiatt Racer, Gilbert, Luu, Feller-Gant, Abdullaev, & Dishion, 2011). Interference was calculated separately for cued and uncued trials.

Results

Preliminary Analyses

Preliminary analyses were conducted to explore the effects of the task variables, independent of personality measures ($N=120$). To investigate the effect of the different experimental conditions on accuracy, we performed a 2 (cued or uncued) $\times$ 3 (incongruent, congruent, or control) Analysis of Variance (ANOVA). Mean overall accuracy was 94.53% ($SD=4.09\%$). There was no significant effect of cuing on accuracy, $F(1, 119)=0.41$, $p=.52$, $partial^2=.003$. There was a significant effect of trial type on accuracy, $F(2, 238)=28.41$, $p<.001$, $partial^2=.19$. We performed pairwise comparisons to explore this effect. As expected, accuracy was significantly lower in the incongruent condition ($M=93.19\%$, $SD=5.89\%$) than in the congruent ($M=94.73\%$, $SD=4.49\%$) and control ($M=95.46\%$, $SD=4.53\%$) conditions, both $p's<.001$. Accuracy was also significantly lower in the congruent condition than in the control condition, $p=.01$. There was no significant interaction of cue presence and trial type on accuracy, $F(2, 238)=0.35$, $p=.71$, $partial^2=.003$.

We repeated the same analysis to investigate the relationship of cue presence and trial type on reaction time (for correct trials). There was a significant effect of cuing on reaction time, $F(1, 119)=30.32$, $p<.001$, $partial^2=.20$. Participants responded faster in the cued condition ($M=720$ ms, $SD=96$ ms) than in the uncued condition ($M=741$ ms, $SD=91$ ms). There was also a significant effect of trial type on reaction time, $F(2, 238)=323.46$, $p<.001$, $partial^2=.73$. As predicted, pairwise comparisons revealed significantly slower response times for incongruent trials ($M=760$ ms, $SD=96$ ms) than for congruent ($M=725$ ms, $SD=94$ ms) or control trials ($M=706$ ms, $SD=96$ ms), both $p's<.001$. Reaction times for congruent trials were significantly slower than those for control trials, $p<.001$. Finally, there was a significant interaction of cue presence and trial type, $F(2, 238)=8.20$, $p<.001$, $partial^2=.06$. When cued, mean reaction time was fastest in the control condition ($M=699$ ms, $SD=92$ ms), followed by the congruent condition ($M=712$ ms, $SD=98$ ms), with reaction time being slowest in the incongruent condition ($M=748$ ms, $SD=100$ ms). This general pattern was also observed for uncued trials (control ($M=712$ ms, $SD=88$ ms); congruent ($M=737$ ms, $SD=94$ ms); incongruent ($M=772$ ms, $SD=97$ ms)). The significant interaction of cue presence and trial type reflected that participants produced less interference for cued trials than uncued trials.

Primary Analyses

Psychopathy Group Analyses—We performed a 2 (low-anxious or high-anxious) $\times$ 2 (control or psychopathic) $\times$ 2 (cued or uncued) mixed-design ANOVA, with interference as the dependent variable ($N=80$). As reported in the preliminary analyses, there was a significant effect of cue presence on interference, $F(1, 76)=8.17$, $p=.005$, $partial^2=.10$. There was no main effect of anxiety on interference, $F(1, 76)=0.001$, $p=.98$, $partial^2<.001$. There was a trend-level main effect of psychopathy on interference, $F(1, 76)=3.57$, $p=.06$, $partial^2=.05$; however, this effect was qualified by a significant psychopathy by anxiety interaction, $F(1, 76)=6.70$, $p=.01$, $partial^2=.08$. Follow-up analyses revealed that interference was significantly higher for low-anxious non-psychopathic participants ($M=0.042$, $SD=0.016$) than for low-anxious psychopathic participants ($M=0.027$, $SD=0.010$), $F(1, 40)=7.13$, $p=.01$, $partial^2=.15$, whereas high-anxious non-psychopathic

participants ($M=0.033$, $SD=0.013$) and high-anxious psychopathic participants ($M=0.035$, $SD=0.013$) displayed comparable levels of interference, $F(1, 36)=0.41$, $p=.53$, $partial^2=.01$. There was no interaction of cue presence with psychopathy, anxiety, or their interaction (all p 's $>.21$).

Planned comparisons were used to evaluate cued interference effects in low and high anxious participants, respectively. These analyses revealed a significant simple main effect of psychopathy on cued interference for low anxious participants, $F(1, 40)=8.56$, $p=.006$, $partial^2=.18$, with psychopathic individuals ($M=0.019$, $SD=0.014$) displaying significantly less interference than non-psychopaths ($M=0.038$, $SD=0.021$), as predicted. Conversely, high-anxious psychopathic ($M=0.033$, $SD=0.013$) and high-anxious non-psychopathic offenders ($M=0.031$, $SD=0.016$) displayed comparable interference on cued trials, $F(1, 36)=0.13$, $p=.73$, $partial^2=.003$ (see Figure 2). To explore the specificity of the cuing effect, we repeated the above analyses using interference on uncued trials as a covariate. Controlling for interference on uncued trials, the difference between low-anxious psychopathic and non-psychopathic individuals remained significantly significant ($p=.01$), whereas the difference between high-anxious psychopathic and nonpsychopathic continued to be non-significant ($p=.77$).

Psychopathy × Externalizing Analyses—To address the second goal of our study, we employed a General Linear Model that included both PCL-R total scores and EXT scores as continuous between-participant measures, cue presence (cued or uncued) as a within subjects factor, and interference as the dependent variable ($N=115$). As in the preliminary analyses, a significant main effect of cue presence was observed, $F(1, 111)=9.47$, $p=.003$, $partial^2=.08$. Neither the main effect of externalizing, $F(1, 111)=0.09$, $p=.76$, $partial^2=.001$ nor the externalizing by cue presence interaction, $F(1, 111)=1.61$, $p=.21$, $partial^2=.01$, approached statistical significance. Similarly, neither the main effect of psychopathy, $F(1, 111)=1.09$, $p=.30$, $partial^2=.01$ nor the psychopathy by cue presence interaction, $F(1, 111)=1.15$, $p=.29$, $partial^2=.01$ was significant. Finally, the interaction of externalizing and psychopathy achieved statistical significance, $F(1, 111)=4.71$, $p=.02$, $partial^2=.04$, although the three-way interaction of cue presence, psychopathy, and externalizing failed to achieve statistical significance, $F(1, 111)=1.93$, $p=.17$, $partial^2=.02$.

To evaluate the *a priori* prediction that externalizing and psychopathy would interact to predict interference for cued but not uncued trials, we performed separate follow-up analyses for cued and uncued trials. For cued trials, there was no significant main effect of externalizing, $F(1, 111)=1.12$, $p=.29$, $partial^2=.01$, and no main effect of psychopathy, $F(1, 111)=2.42$, $p=.12$, $partial^2=.02$. However, as predicted, there was a significant interaction of externalizing and psychopathy, $F(1, 111)=7.28$, $p=.008$, $partial^2=.06$ (see Figure 3). To unpack this interaction, analyses were rerun to evaluate the main effect of psychopathy at one standard deviation above (high EXT) and below the mean (low EXT) for externalizing. At low EXT, there was a significant main effect of psychopathy, $F(1, 111)=10.73$, $p=.001$, $partial^2=.09$, with higher psychopathy scores relating to reduced interference ($\beta=-.008$). Conversely, at high EXT, the main effect of psychopathy failed to approach significance, $F(1, 111)=0.63$, $p=.43$, $partial^2=.01$. There was no significant effect of externalizing, psychopathy, or their interaction for the uncued trials (all p 's $>.39$).

As with the primary analyses, we performed supplementary analyses to examine the relation of psychopathy and externalizing with the unique variance in interference for cued trials. Controlling for uncued interference, there was no main effect for externalizing, $F(1, 110)=1.53$, $p=.22$, $partial^2=.01$ or psychopathy ($F(1, 110)=2.42$, $p=.12$, $partial^2=.02$) on interference for cued trials. However, replicating the earlier analysis, we found a significant

psychopathy by externalizing effect on cued interference, $F(1, 110)=6.47$, $p=.01$, $partial^2=.06$).

Discussion

Prior research indicates that individuals with primary psychopathy have a deficit in response modulation, which makes them less responsive to information outside of their immediate focus of attention, and that this deficit undermines effective self-regulation (Patterson & Newman, 1993; Newman & Wallace, 1993; MacCoon, Wallace, & Newman, 2004). Research by Zeier and colleagues (2009) demonstrated this effect by manipulating spatial attention and noting that primary psychopathic individuals were insensitive to information that was peripheral to the cued spatial location. The current study demonstrates the generality of this selective attention abnormality by manipulating feature-based attention (i.e., target color) and observing that individuals with primary psychopathy are similarly insensitive to information that is incongruent with their featured-based focus of attention. Combined, the results of these studies demonstrate that individuals with primary psychopathy are prone to overlook potentially important peripheral information whenever their attention is engaged on a particular focus, regardless of the method by which attention is engaged.

Implications

This distinction helps clarify the clinical relevance of laboratory findings on the response modulation deficit because the major failures of self-regulation in psychopathy do not relate to spatial focus. More commonly, the “real-world” disinhibited behavior of psychopathic individuals reflects their failure to consider important inhibitory information (e.g., the possibility of getting arrested or injured) after adopting a specific attentional set (e.g., an immediate focus on stealing drugs or money from a gang member). The current task required participants to create a top-down set for the focal information, thereby engaging an attentional process more analogous to these real-life scenarios than a location cue. Thus, the reduced interference displayed by primary psychopathic offenders in the current study helps to bridge the gap between research on response modulation and real-world failures of self-regulation in psychopathy.

A second goal of the current study was to explore an alternative analytic strategy for investigating psychopathic subtypes. There is a well-developed and long-standing precedent of distinguishing psychopathic subtypes using category-based distinctions (Hicks et al., 2004; Lykken, 1957, 1995; Newman et al., 2005; Ross et al., 2007; Skeem et al., 2007, 2011). However, categorical approaches to subtyping have significant limitations, particularly in the domain of personality research (Trull & Durett, 2005; Widiger, 1992). Thus, this study employed continuous analyses of psychopathy, externalizing, and their interaction, thereby avoiding the limitations of categorical approaches. Moreover, by parsing the effects of psychopathy and externalizing, this strategy ties into a broader literature involving diverse pathways to antisocial behavior (Jones & Miller, 2012; Patrick, Hicks, Krueger, & Lang, 2005; Vaidyanathan, Hall, Patrick, & Bernat, 2010; Venables & Patrick, 2012). Furthermore, by evaluating the psychopathy by externalizing interaction explicitly, this approach addresses a critical limitation of the hierarchical model of antisocial behavior. By omitting interaction effects, the hierarchical model focuses exclusively on the common and unique variance of different syndromes, traits, and behaviors (Krueger et al., 2002; Patrick, Hicks, Nichol, & Krueger, 2007) and effectively adopts a unitary etiological model of these constructs. Thus, as typically applied, the hierarchical model would not detect potentially important interaction effects of the type identified in this study (see also Zeier & Newman, 2011).

By evaluating the psychopathy by externalizing interaction, we discovered that the behavioral expression of psychopathy may be moderated by a person's level of externalizing traits, suggesting one of two possibilities. The first highlights the potential heterogeneity of the psychopathy construct. In the present study, the response modulation deficit was specific to psychopathic individuals with low levels of externalizing, a subtype that appears to resemble the "primary psychopathy" subgroup highlighted in categorical analyses. Conversely, the performance of psychopathic individuals with high levels of externalizing suggests that they do not share the response modulation deficit with their low-externalizing counterparts, perhaps because they represent a distinct psychopathic subtype similar to secondary psychopathy or an extreme form of externalizing psychopathology like the "aggressive psychopathy" subtype identified by Hicks and colleagues (2004).

An alternative interpretation of these results is that, while psychopathy may be a homogeneous construct, externalizing moderates the behavioral expression of the disorder. In this case, deficits such as the executive dysfunction associated with externalizing may make it difficult to maintain the kind of focus necessary to make use of the color cues or maintain a top-down attentional set, particularly in a task containing only affectively neutral stimuli and no overt rewards or punishments. While the current study cannot distinguish between these two models, discovering the answer to this question represents a critical next step in psychopathy research.

Alternative Explanations

While the results of the current study support our predictions regarding response modulation and primary psychopathy, we recognize that aspects of these findings may seem surprising or unexpected. For one, if the self-regulation deficits related to psychopathy reflect a deficit in response modulation, then it might be expected that this deficit would be more pronounced in individuals high in both psychopathy and in anxiety or emotional reactivity (i.e. "secondary psychopaths"), as they would seem to have the most pronounced difficulties with self-regulation. In actuality, those who are high in psychopathy, be they "primary" or "secondary" psychopathic individuals, by definition have deficits in self-regulation and there is little or no evidence that the antisocial behavior associated with secondary psychopathy is more severe or frequent than that of primary psychopathy. In fact, previous research has found that primary psychopathy may be associated with more severe antisocial behavior than secondary psychopathy (Brinkley et al., 2004). This mischaracterization of primary and secondary psychopathy may relate to a conflation of these terms with Factor 1 and Factor 2 of psychopathy; however, these are distinct constructs, and those that are diagnostically psychopathic, be they primary or secondary psychopaths, possess elevated levels of both psychopathy factors.

Similarly, to the extent that response modulation represents a crucial aspect of self-regulation and both psychopathy and externalizing are associated with dysregulated behavior, it might be expected that both dimensions would be characterized by response modulation deficits. Thus, one might expect that those with elevated scores on both psychopathy and externalizing measures would have the most profound response modulation deficits. However, the response modulation deficits associated with psychopathy and externalizing appear to involve distinct psychobiological processes (Baskin-Sommers & Newman, 2013; Newman, 1997; Patterson & Newman, 1993). Whereas the dysregulated behavior of psychopathic individuals is associated with early attention problems (i.e., attention bottleneck) and reduced emotional reactivity (Baskin-Sommers, Curtin, Li, & Newman, 2011; Baskin-Sommers et al., 2011; Wolf et al., 2011), the dysregulated behavior of externalizing individuals entails exaggerated emotional reactivity and subsequent deficiencies in selective attention (i.e., Baskin-Sommers, Curtin, Larson, Stout, Kiehl, & Newman, 2012; Baskin-Sommers, Wolf, et al., 2012). Thus, individuals displaying a

combination of psychopathic and externalizing traits will not necessarily display a more extreme response modulation deficit. To the contrary, because the emotional hyper-reactivity and attention control problems associated with externalizing resemble those associated with high anxious individuals, it is not surprising that high externalizing scores also moderate the selective attention abnormalities associated with primary psychopathy. Finally, as with high-anxious psychopathic individuals, it is also possible that the psychopathic traits associated with high externalizing are secondary to the emotional reactivity associated with externalizing disorders (i.e., reflect the predisposition to externalizing primarily rather than combined predispositions to psychopathy and externalizing).

Another potential area of confusion regarding the current results relates to the fact that psychopathic individuals displayed superior performance in the cued condition of our task, yet we invoke this attention-related abnormality as a key factor underlying the psychopathic deficit in self-regulation. To reconcile this apparent contradiction, we offer a hypothetical analogy. Imagine a study that examines how pain stimuli interfere with cognitive task performance and, further, that some participants are impervious to pain. Owing to their lack of pain, such individuals would display less interference than other participants in the study. Despite their superior cognitive performance, however, this advantage is symptomatic of a larger deficit with profound negative real-world consequences. In general, pain serves a useful purpose in drawing attention away from engagement in other tasks. We propose that primary psychopathy is associated with a similar (but broader) deficit. Under circumstances in which obliviousness to context helps, primary psychopathic individuals will display superior performance. However, in the real world, their obliviousness to contextual stimuli is as maladaptive as being unable to experience pain in that it makes it difficult to recognize and adapt behavior in response to important information.

Limitations

Power and Design—Although the current results provided support for our *a priori* hypotheses, the specificity of the findings to cued trials was insufficient to yield significant three-way interactions (i.e., psychopathy $\times$ anxiety $\times$ cue presence, or psychopathy $\times$ externalizing $\times$ cue presence). It was expected that cuing would allow for superior focusing compared to uncued trials for the low-anxious (or low externalizing) psychopathic participants relative to other participants. The failure to observe a significant three-way interaction limits the ability to make this powerful statement. Nevertheless, there is evidence that the psychopathy-related effects are specifically associated with performance in the cued condition. In particular, the supplementary analyses that included interference on uncued trials as a covariate demonstrated a significant unique effect for the influence of primary (and low externalizing) psychopathy on cued interference.

A likely explanation for the failure to observe a three-way interaction in this study relates to the magnitude of the cuing effect, which was smaller than that observed in prior research. In the experiment by Zeier and colleagues (2009), which found significant interactions involving the cuing manipulation, the presence of a cue resulted in a 32-millisecond reduction in interference, whereas in the current study this difference was only 11 milliseconds. This smaller cuing effect resulted in greater difficulty in detecting significant effects due to the reduced variability of interference scores between the cued and uncued conditions. In future studies, additional feature cues (e.g. brightness, font, size) could be included in order to increase the competitive advantage of the target stimulus, with the goal of creating feature-based cues as robust as the spatial cues used in previous research.

While the current experiment focused on psychopathy and the potentially moderating effect of externalizing, it also allowed us to examine the association between externalizing and

executive functioning. Based on prior research (Morgan & Lilienfeld, 2000; Zeier & Newman, 2011), we expected that externalizing would relate to weaker cognitive control and more interference on the current task, but such results were not observed. In this regard, it may be that response inhibition problems associated with externalizing are most apparent when a dominant primary response must be inhibited (Baskin-Sommers & Newman, 2013; Young, Friedman, Miyake, Willcutt, Corley, Haberstick, & Hewitt, 2009). Although the Stroop and flanker tasks are often assumed to assess the same cognitive process, the presence of a primary dominant response may represent an important distinction between the two paradigms. In the Stroop task, participants are asked to inhibit a clearly prepotent response (word reading), while in the flanker task there are generally two categories of stimuli that appear with equal frequency and do not overtly differ in salience or automaticity of processing. Thus, if the current study used a Stroop task or was replicated with more salient distracters (highly emotional pictures or words, stimuli tied to real rewards, or perhaps even distracters that were larger or brighter than the target), it is likely that externalizing would have been associated with greater interference.

Generalizability and Scope—Another potential limitation of the current study concerns the specificity of the population studied. As the response modulation deficit is observed most reliably with male European American offenders (Lorenz & Newman, 2002; Newman et al., 1997), this group was selected for the current study. This is not to say that this deficit only exists in European Americans—rather, it is also possible that extant measures such as the Psychopathy Checklist-Revised and self-report measures like the WAS and MPQ-BF or laboratory tasks are less able to tap the psychopathic deficits associated with African American offenders. Such differences may lead to greater variability in an African-American sample, reducing the statistical power of analyses on these participants. Greater variability in performance among psychopathic African American offenders may also help to explain why apparent race differences in the expression of psychopathy seldom yield significant psychopathy $\times$ race interactions. Nonetheless, understanding psychopathy in diverse populations remains a critical issue, and clarifying the weaker psychopathy-related findings in African American samples will likely require more powerful studies.

In addition, further research examining the relationship of psychopathy and performance on this type of task in other groups (females, non-incarcerated individuals, and juveniles) is necessary to understand the generalizability of this deficit. In particular, exploration of these deficits in juveniles represents an important next step in understanding the development of the response modulation deficit, as well as to identifying and treating at-risk individuals. This appears promising, as evidence suggests that the response modulation deficit is present in adolescents with high levels of psychopathic characteristics and low levels of anxiety (Vitale, Newman, Bates, Goodnight, Dodge, & Petit, 2005) and supports the presence of primary and secondary psychopathic variants in juvenile samples (Kimonis, Skeem, Cauffman, & Dmitrieva, 2011; Vaughn, Edens, Howard, & Smith, 2009).

Summary

The current study provided evidence for a general deficit in sensitivity to peripheral inhibitory information in primary psychopathy while also examining psychopathy and externalizing as continuous measures. Using this approach and exploring the interaction of psychopathy and externalizing allowed for investigation of subsets of antisocial individuals while avoiding the inherent problems associated with categorical analyses. The results provided preliminary evidence for the moderating influence of externalizing on the psychopathy-related deficit in response modulation. Careful investigation of specific etiological deficits represents the next step towards developing a more precise understanding of and more effective treatments for chronically antisocial individuals.

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Figure 1.

Diagram of a sample trial from the current experiment. First, the fixation point appears. Second, the fixation changes color (cue), indicating the color of the upcoming target. Third, the test display presents a target and distracter printed in two different colors. This is followed by a 1500 ms inter-trial interval. Participants enter a response indicating if the target (i.e. the character that the central arrow points to) is a letter or number. Note that in the actual experiment color cues and stimuli are always green or red.

Figure 2.

The relationship of anxiety level and psychopathy group with interference (the difference in reaction time between incongruent and control trials, corrected for overall reaction time) for cued trials. Error bars represent standard error.

Figure 3.
Predicted values (point estimates) for corrected interference scores as a function of PCL-R and EXT scores.

Table 1
Descriptive Statistics for Diagnostic Groups

Scale	Low-Anxious	Low-Anxious	High-Anxious	High-Anxious
	Non-Psychopathic	Psychopathic	Non-psychopathic	Psychopathic
PCL-R	15.49 (4.32)	31.38 (1.26)	14.65 (3.73)	31.77 (1.93)
	30	12	20	18
WAS	4.90 (3.45)	7.58 (3.29)	19.30 (6.33)	20.78 (6.80)
	30	12	20	18
NA	31.97 (13.12)	43.42 (18.55)	58.37 (14.99)	60.69 (17.59)
	29	12	19	16
Constraint	83.10 (13.66)	70.83 (8.22)	73.79 (14.29)	60.81 (17.53)
	29	12	19	16
PA	67.52 (19.07)	68.67 (12.23)	64.32 (11.50)	60.38 (18.06)
	29	12	19	16
EXT	-1.49 (1.06)	-0.18 (0.67)	.36 (1.14)	1.27 (1.45)
	29	12	19	16

Note. Mean (SD) scores and number of participants for the main diagnostic groups on the main externalizing (EXT) and psychopathy (PCL-R) measures, as well as the component scales of the externalizing measure (Negative Affect (NA) and Constraint) and the Welsh Anxiety Scale (WAS).

Table 2
Correlation of Psychopathy and Externalizing Measures

Scale	1	2	3	4	5	6
1. PCL-R		0.18	.27**	-.38**	.01	.40**
2. WAS			.72**	-.34**	-.22*	.66**
3. NA				-.29**	-.06	.80**
4. Constraint					.20*	-.80**
5. PA						-.16
6. EXT						

Note. Zero-order correlations of the main externalizing (EXT) and psychopathy (PCL-R) scores, as well as the component scales of the externalizing measure (Negative Affect (NA) and Constraint) and the Welsh Anxiety Scale (WAS). For all correlations $N=115$ except for the correlation of PCL-R and WAS ($N=120$).