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Exaggerated attention blink response in prisoners with externalizing

Arielle Baskin-Sommers [a,*], Richard Wolf [a], Joshua Buckholtz [b], Christopher Warren [c], Joseph Newman [a]

[a] University of Wisconsin-Madison, Madison WI 53706, USA
[b] Havard University, Cambridge MA 02138, USA
[c] University of Victoria, Victoria BC V8P 5C2, Canada

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ABSTRACT

The diverse phenotypic expressions of disinhibitory psychopathology are believed to reflect a common latent predisposing variable: externalizing. While deficiencies in executive functioning (i.e., cognitive/inhibitory control, working memory) and affective hyper-reactivity are commonly associated with externalizing, there is also evidence that externalizing is related to anomalous allocation of attention. In this study, we administered an attention blink task to a sample of male prisoners and assessed externalizing using the Impulsive–Antisociality scale (Benning, Patrick, Hicks, Blonigen, & Krueger, 2003). Individuals with high Impulsive–Antisociality displayed a significantly steeper attention blink (i.e., less accurate identification of a second target) than individuals with low Impulsive–Antisociality. Results provide new evidence that externalizers over-allocate attention to salient information and suggest a novel conceptualization of their disinhibitory psychopathology.

1. Introduction

Disinhibitory psychopathology encompasses a range of disorders, including substance use disorders, childhood oppositional defiance/conduct disorder, and adult antisocial personality disorder. Epidemiological studies indicate that these disorders are highly comorbid with one another, raising the possibility of shared etiology and pathophysiology (Krueger et al., 2002). Latent variable and twin analyses confirm that a genetically-influenced "externalizing" latent factor may be responsible for the observed comorbidity between these otherwise categorically distinct disorders (Buckholtz et al., 2010; Gorenstein & Newman, 1980; Krueger et al., 2002; Newman & Lorenz, 2003). This externalizing factor reflects a heritable dimension of personality traits, comprising low constraint, impulsivity, and negative emotionality that predisposes individuals to the expression of disinhibitory behaviors (e.g., excessive reward seeking and risk-taking, hostility, poor impulse control). Externalizing traits therefore represent a general risk factor for diverse forms of disinhibitory psychopathology. Thus, understanding the psychobiological processes that contribute to externalizing traits has far-reaching implications for understanding and preventing a variety of disinhibited behaviors and psychopathology.

Several prominent psychobiological models of externalizing emphasize deficient executive functioning (Buckholtz et al., 2010; Endres, Rickert, Bogg, Lucas, & Finn, 2011; Morgan & Lilienfeld, 2000; Ogilvie, Stewart, Chan, & Shum, 2011). However, executive function encompasses a broad range of processes, including response inhibition, cognitive control, sustained and selective attention, and working memory. While a number of studies highlight the importance of working memory and response inhibition deficits in externalizing individuals (Endres et al., 2011; Finn & Hall, 2004; Nigg, 2000), some studies suggest that anomalous allocation of attention may underlie or interact with externalizing traits to produce maladaptive, disinhibited behavior (Derryberry & Reed, 1994; Farmer, Whitehead, & Woolcok, 2007; Lubman, Allen, Peters, & Deakin, 2008; Wallace & Newman, 1997; Ávila & Parcet, 2001).

For instance, Ávila and Parcet (2001) proposed that individuals with externalizing traits are characterized by unusually strong reward expectations that bias them to prioritize and allocate attention rapidly and inflexibly to reward-related goal-relevant cues. However, potentially as a result of this strong attention response to reward cues, externalizing individuals have difficulty using controlled processing (e.g. response inhibition, cognitive control) to reallocate and deploy attention in the service of long-term endogenous goals, and ultimately regulate their affective and behavioral responses (see also Wallace & Newman, 1997). This attentional dysfunction has been implicated in the tendency for externalizing individuals to commit passive avoidance errors, display performance deficits in oddball paradigms, particularly in the presence of rewards, and to exhibit delay discounting deficits during gambling tasks (see Baskin-Sommers & Newman, in press, for review).

* Corresponding author. Address: University of Wisconsin-Madison, 1202 W. Johnson St., Madison WI 53706, USA. Fax: +1 608 262 4029.
E-mail address: baskinsommer@wisc.edu (A. Baskin-Sommers).

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While the anomalous allocation of attention in some externalizing individuals is associated with strong sensitivity to reward (Derryberry & Reed, 1994; Wallace & Newman, 1997; Ávila & Parcet, 2001), there is evidence that reward *per se* is not necessary to engender this form of dysregulated attention. Importantly, this dysfunction appears to be valence–neutral, as evidenced by the presence of dysfunctional attentional responses to both appetitive (e.g., money, drugs) and aversive (e.g., electric shock; stress cues) cues in individuals with externalizing (Baskin-Sommers et al., 2012; Blair, 2001; Carter & Tiffany, 1999; Tiffany & Conklin, 2000; Volkow & Li, 2004). Moreover, externalizing individuals appear to over-focus on goal-relevant stimuli and display disinhibited responding regardless of whether the goal-relevant stimuli are associated with rewards or punishments (e.g., Bachorowski & Newman, 1990). Such findings suggest that it is the prioritizing of attention (i.e., attentional response to salient stimuli) rather than the valance of the stimulus itself that generates the dysregulated attentional and behavioral responses of externalizing individuals.

Despite the importance of determining whether the attentional anomalies associated with externalizing individuals reflect the specific impact of anticipated rewards and punishments or, more broadly, the contribution of stimulus salience and potential goal-relevance, few studies have examined this attentional abnormality in the absence of explicit motivationally valenced cues (e.g., reward; see Ávila & Parcet (2001) for one example). Therefore, it remains unclear whether the abnormal attentional processes associated with externalizing are primarily a function of heightened affective responsiveness to valenced cues (e.g. threat or reward stimuli), or instead reflect an over-allocation of attentional resources to any salient, goal-relevant, environmental cue, regardless of its specific motivationally valenced value.

In this study, we examine the extent to which externalizing is associated with an exaggerated allocation of attention that over-prioritizes the processing of salient, goal-relevant information at the expense of subsequent information (i.e., attention dysfunction that is independent of magnified affective responses to reward, threat, or other valenced cues). Toward this end, we administered the attention blink (AB) paradigm to a sample of prison inmates and assessed externalizing using a measure of Impulsive–Antisociality (Benning et al., 2003). Impulsive–Antisociality taps the core trait-like features of externalizing, has been used in a variety of samples (e.g., undergraduate, correctional), and is positively related to delinquency, aggression, impulsivity, substance abuse, and other externalizing symptoms, traits, and disorders (Buckholtz et al., 2010; Edens, Poythress, Lilienfeld, & Patrick, 2008; Witt, Donnellan, Blonigen, Krueger, & Conger, 2009). Given its utility in measuring the deployment (i.e., allocation) of attentional resources (Dux & Marois, 2008), the AB paradigm is particularly well suited to assess the hypothesized attentional phenomenon.

More specifically, in the AB paradigm, participants are asked to identify two visual targets presented in rapid succession at various time intervals. While participants are typically good at identifying the first target (T1), they exhibit a deficit in reporting the second target (T2), specifically when it appears approximately within half a second of the first target. This deficit has been called the "attentional blink" (AB, Raymond, Shapiro, & Arnell, 1992). Virtually all theoretical explanations for the AB propose that attention prioritizes the identification of the first target at the expense of processing the second target (Olivers, 2007). Though the target stimuli used in most AB tasks (e.g., letters) lack intrinsic motivational salience (i.e., have neutral valence), motivational salience may reflect a variety of influences. For instance, Nieuwenhuis, Aston-Jones, and Cohen (2005) have shown that motivational salience can be conferred on a stimulus just by making the stimulus a target. Thus, to the extent that the attentional dysfunction in externalizing is more general than a specific reaction to reward or threat, it should be possible to tap that dysfunction with any stimulus that has been assigned target status by the experimenter (i.e., even if it is simply a letter). If as proposed, externalizing is related to a tendency to over-allocate attention to salient, goal-relevant stimuli it follows that externalizing individuals will over-prioritize and over-allocate attention to the first target (T1) in an AB task at the cost of reallocating attention to other potentially relevant stimuli. Based on these premises, we hypothesized that individuals with high levels of externalizing traits will display a more pronounced AB (i.e., less accurate identification of a second target, T2).

2. Methods

2.1. Participants

Forty-eight males from a prison in Southern Wisconsin were included in this study (see Table 1 for sample characteristics). Participants were excluded if they were age 45 or older; used prescribed psychotropic medication; had clinical diagnoses of schizophrenia, bipolar disorder, or psychosis not otherwise specified (NOS); scored below the fourth grade reading level; had estimated IQ scores of less than 70 (Zachary, 1986); or were less than 70% accurate in identifying T1 during trials in which T2 occurred at lag-6 or later (i.e., 70% accuracy or better under conditions of minimal interference).

The Shipley Institute of Living Scale (SILS; Zachary, 1986) is a brief measure of general IQ. It consists of a 40-item vocabulary test and a 20-item abstraction test, has good psychometric properties, and yields reliable estimates of Wechsler Adult Intelligence Scale—Revised scores (Zachary, 1986). In the present study, this measure was used to exclude participants with IQ of below 70 and insure differences in task performance were not due to differences in intelligence.

Table 1
Correlation between Impulsive–Antisociality and relevant descriptive and performance variables.

	r
Descriptive variables	
Age (years)	−.26
Shipley estimated IQ	−.17
Antisocial personality disorder symptoms	.41*
Behavioral activation system: total	.19
Behavioral inhibition system: total	.05
Self-report alcohol and drug use	.45*
Externalizing spectrum inventory	.66*
MPQ: positive affectivity	−.47*
MPQ: negative affectivity	.81*
MPQ: constraint	−.69*
Performance variables	
Lag 1 T2 accuracy	.01
Lag 2 T2 accuracy	−.10
Lag 3 T2 accuracy	−.12
Lag 4 T2 accuracy	.17
Lag 5 T2 accuracy	.21
Lag 6 T2 accuracy	.13
Lag 7 T2 accuracy	.17
Overall T2 accuracy	.09

Note: As noted in Footnote 1, antisocial personality disorder symptoms were assessed using interview and file information to rate all APD symptoms listed as Diagnostic Statistical Manual-IV. Other measures were a part of the battery of self-report questionnaires handed out to participants. Behavioral Activation System/Behavioral Inhibition System (Carver & White, 1994); Self-Report Alcohol/Drug Use: Michigan Assessment Screening Test for Alcohol and Drugs (Westermeyer, Yargic & Thuras, 2004); Externalizing Spectrum Inventory (Hall, Bernat & Patrick, 2007).

* Flagged cells indicate a significant ($p < .05$) zero-order correlation involving Impulsive–Antisociality.

Externalizing traits were assessed using the Multidimensional Personality Questionnaire-Brief Form (MPQ-B; Patrick, Curtin, & Tellegen, 2002). The MPQ-B has 155-items, each rated on a dichotomous, True/False, scale. Impulsive–Antisociality is calculated using five of the 11 primary MPQ scales (Benning et al., 2003). More specifically, Impulsive–Antisociality is characterized by high Aggression and Alienation, low Control and Traditionalism, and low Social Closeness. Impulsive–Antisociality was calculated as a linear combination of specific standardized (i.e., *z*-scored): $(0.16 * z\text{Aggression}) + (0.31 * z\text{Alienation}) + (-0.13\ \text{n} * \text{Traditionalism}) + (-0.29\ \text{n} * z\text{Control}) + (-0.15 * z\text{Social Closeness})$.

In addition to the IQ test and MPQ-B, participants are given a battery of self-report questionnaires that assess a variety of traits, behaviors, and symptoms. Table 1 reports the relationship between Impulsive–Antisociality and relevant characteristics (i.e., these measures are defined in the Table 1 note).

2.2. Procedure

Presentation of stimuli and recording of responses were controlled by Matlab (Version 7.10.0). The stimuli subtended on average 1.7° of visual angle horizontally. Participants' eyes were about 55 cm from the screen. Prior to beginning the experiment, participants read instructions and completed practice trials. At the end of the practice, participants received accuracy feedback. During the main task, participants also received accuracy feedback at the end of each block.

2.3. Task

In AB tasks, two targets are embedded within a rapid serial visual presentation (RSVP) of distracters. The targets are separated in time by varying numbers of distracters, such that the second target (T2) appears at different temporal "lags" in relation to the first (T1). When a second target (T2) is presented between 200 and 500 ms after the first target (T1), it often goes undetected. The window during which participants suffer reduced accuracy in detecting the second target is referred to as the AB (Raymond et al., 1992).

The present task consisted of eight 30-trial blocks (i.e., 240 trials) and took approximately 20 min to complete. On each trial, a fixation appeared at the center of the screen for 600 ms, followed immediately by an RSVP sequence of 26 characters. Each stimulus in the RSVP sequence appeared onscreen for 80 ms. Each sequence contained 24 distractor digits that were quasi-randomly selected from digits 2 to 9, inclusively. A digit never repeated consecutively within a trial. The targets consisted of two letters, randomly selected from 20 of the 26 letters of the English alphabet (B, I, O, Q, D, and S were excluded due to visual similarity to numbers). Importantly, the first target (T1) and the second target (T2) were never the same letters (Fig. 1). T1 appeared randomly at any location between the eighth and thirteenth stimulus slot, inclusively. T2 appeared anywhere between lag-1 and lag-10, inclusively. Therefore, T2 could never appear later than the 23rd stimulus slot, and was always followed by at least three distracter characters before the end of a trial. Within blocks, the appearance of T2 at a given lag was quasi-random, with the constraint that T2 appeared equally often at lags 1–10. Each stimulus in the RSVP sequence appeared onscreen for 80 ms such that lag-1 occurred at 80 ms, and subsequent lags appeared at 80 ms increments. [*Note*: Lag refers to the position of T2 after the presentation of T1. For example, in lag-1 T2 appears right after T1. In lag-5, T2 appears five stimuli after T1]. At the end of each trial, the computer prompted participants to type the letter of the first target (T1) and second target (T2) on the keyboard (see Warren et al., 2009 for more task details).

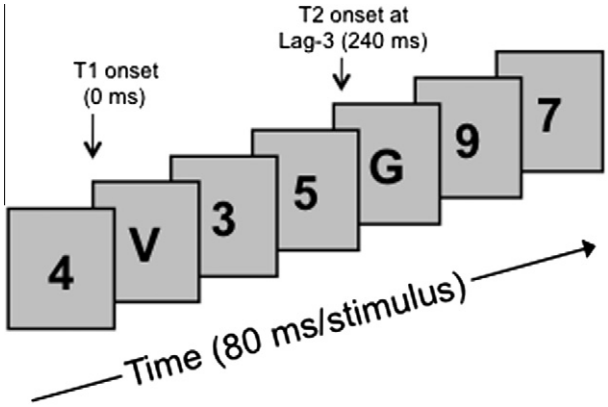

Fig. 1. *Critical portion of single trial.* Full trials started with a fixation cross (600 ms), subsequently 26 stimuli (24 distractors and 2 targets) were presented (80 ms each). T2 could appear at any lag between 1 and 10, and was always followed by at least one distracter.

3. Results

3.1. Preliminary results: T1 accuracy

To test whether level of externalizing was associated with the ability to identify a target in an RSVP sequence, we analyzed T1 accuracy (i.e., ability to identify the initial target) using two General Linear Model (GLM) models with seven repeated measures related to the proximity of T2 (i.e., for T2 presentation at lag-1 through lag-7), Impulsive–Antisociality (standardized) as a between-subject quantitative factor, and intelligence[1] as a covariate. There were no significant main effects ($p = .54$) or interactions involving Impulsive–Antisociality ($p = .42$). The lack of significant differences in T1 accuracy suggests that any differences in T2 accuracy during the AB interval (below) are not a function of overall ability to identify targets in an RSVP sequence.

3.2. Primary analyses: T2 accuracy

To test our hypothesis that externalizing (Impulsive–Antisociality) would be associated with a larger AB (i.e., less accurate identification of T2 during the blink interval), we used a GLM model with seven repeated measures (T2 accuracy for lag-1 through lag-7), Impulsive–Antisociality (standardized) as a between-subject quantitative factor, and intelligence as a covariate. Of note, in reporting T2 accuracy results it is common to analyze only the critical portion of the trial (lag-1 through lag-7), which represents the timeline of AB accuracy, from lag-1 sparing through recovery. In order to quantify the location (i.e., lag) of the AB difference, we employ follow-up Helmert interaction contrasts, which compare the current lag with the mean of subsequent lags. Due to a violation of sphericity, Greenhouse–Geisser corrections were used in analyses involving the lag variable.

The GLM analysis of T2 accuracy revealed a significant main effect for lag [$F(6, 4.34) = 50.74$, $p < .001$, $\eta_p^2 = .52$]. Consistent with previous research on AB, participants were less accurate in identifying the T2 targets when they were presented at lags 3–5 than when they were presented at lag-1 or after lag-5. The main effect for Impulsive–Antisociality ($p = .56$) did not approached statistical significance, indicating that externalizing was not consistently related to T2 accuracy.

[1] Initial examination of the data revealed a significant main effect of intelligence on accuracy, ($F(1, 47) = 5.87$, $p = .02$, $\eta^2 = .11$); therefore, for all analyses it is included as a covariate.

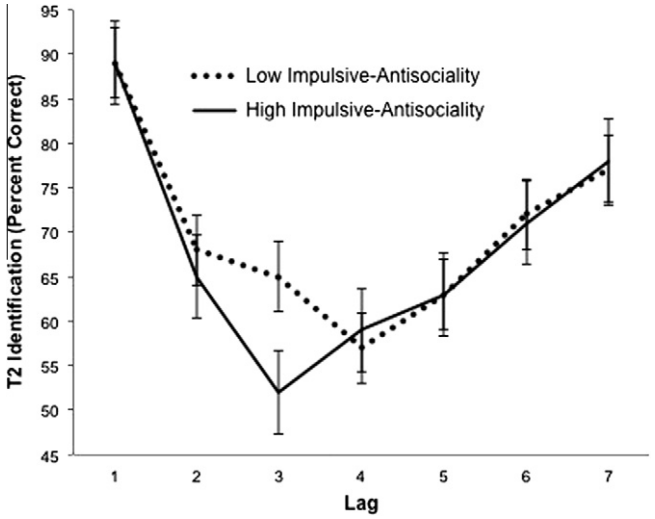

Fig. 2. *T2 Accuracy and Impulsive–Antisociality*. Figure displays accuracy at lags 1–7. Raw Impulsive–Antisociality scores, estimated from the MPQ-B, were standardized (*z*-scores). Inmates high on Impulsive–Antisociality displayed a pronounced AB (i.e., decline in T2 accuracy) following the first distractor compared to inmates low on Impulsive–Antisociality. High and low lines depict point estimates derived from the general linear model at 1 standard deviation above and below the measure mean, respectively. Error bars represent ±1 standard error for the point estimate.

Consistent with the experimental hypothesis, Impulsive–Antisociality[2] interacted significantly with T2 lag, F (4.36, 196.32) = 2.50, p = .039, η_p^2 = .05 (Fig. 2). Follow-up interaction (Helmert) contrasts yielded significant Impulsive–Antisociality *x* Lag interactions for lag-2 versus later lags [F (1, 45) = 4.25, p = .045, η_p^2 = .09] and lag-3 versus later lags [F (1, 45) = 8.38, p = .01, η_p^2 = .16]. These analyses indicate that relative to inmates with lower externalizing scores, inmates higher externalizing scores displayed a pronounced AB (i.e., decline in T2 accuracy) following the first distractor.

3.3. Secondary analyses: T2 accuracy as a function of Impulsive–Antisociality subscales

The primary goal of the present study is to examine the relationship between Impulsive–Antisociality scores, a measure of externalizing, and attention dysfunction as measured by performance in the AB task. However, given that the measure of Impulsive–Antisociality comprises 5 subscales, it is possible that the effects reported herein are attributable to one specific subscale rather than Impulsive–Antisociality *per se*. Therefore, we repeated the primary analysis, but instead of using Impulsive–Antisociality as the predictor, we entered the 5 subscales and their interaction in the GLM.

None of the individual scales interacted with T2 accuracy (Aggression: p = .33; Alienation: p = .65; Control: p = .12; Traditionalism: p = .31; Social Closeness: p = .19). Consistent with the effect reported above, there was a significant 5-way interaction among all of the scales and T2 lag, F (4.15, 170.06) = 2.90, p = .02, η_p^2 = .07. This pattern confirms our suggestion that this trait is selectively associated with abnormal AB performance.

4. Discussion

Using the AB paradigm, we evaluated the prediction that individuals scoring higher on our measure of externalizing (Impulsive–Antisociality) would over-allocate attentional resources to salient events (i.e., T1) at the expense of processing other important cues in the environment (i.e., T2). As hypothesized, individuals with high externalizing displayed a significantly greater AB than individuals with low externalizing. Although other studies have investigated individual differences in AB performance (Carr, Nigg, & Henderson, 2006; MacLean & Arnell, 2010; Martens & Valchev, 2009; Wolf et al., 2012), we believe ours is the first study to document an association between AB performance and the latent externalizing construct.

An especially important aspect of the present finding is that the association between externalizing and AB performance was observed in the absence of overt affectively valenced cues. Thus, salient goal-relevant cues may be sufficient to engender abnormal attention responses in externalizing individuals, regardless of their affective content. We note that the evidence for over-allocation of attentional resources in the present study is not incompatible with the link between externalizing and affective hyper-reactivity. It may be that externalizing individuals display hyper-reactivity to affective cues because their tendency to over-allocate attentional resources to intrinsically salient stimuli (e.g., drug, threat, and reward cues) disrupts controlled processing and compromises their ability to regulate behavior in the face of competing demands (Bishop, 2009; Ávila & Parcet, 2001). Notably, however, the present data suggest that the over-allocation of attentional resources need not be triggered by a salient stimulus with explicit affective content; any goal-relevant stimulus may be sufficient to initiate this dysfunction. While recognizing that the disinhibited behavior of some externalizing subtypes is associated with differential sensitivity to motivationally relevant cues (e.g., related to rewards, drugs, hostile aggression), we propose that such reactions reflect the interaction of a general predisposition to over-allocate attention with other, more specific, innate or acquired sensitivities.

Another notable aspect of the current findings relates to the specificity of the AB results. That is, while externalizing individuals displayed a significant deficit in performance, they recovered and did not display a deficit in reallocating attention. More specifically, individuals scoring high on our measure of externalizing displayed a very brief deficit in performance (i.e., the attentional blink centered around lag 2–lag 3), but they recovered quickly and displayed descriptively comparable or greater T2 accuracy than individuals low on externalizing during later lag times. One possibility is that the brevity of this deficit is a function of the AB paradigm. When the conflict between attending to T1 and subsequent distractors is most intense (i.e., at lag 2 and 3) the over-allocation of attention to T1 results in a performance deficit (i.e., larger AB). However, given externalizing individuals' predisposition to allocate attention very quickly and strongly to goal-relevant cues, they may be especially adept at reallocating attention to process a subsequent target (i.e., T2) as the time and number of distractors following T1 increases. Additionally, in contrast to overtly affective stimuli (e.g., reward or threat), it may be that the target stimuli in the AB paradigm do not hold attention for a sustained period of time. Finally, in contrast to tasks that require participants to reallocate attention away from goal-relevant stimuli to process unexpected stimuli or stimuli with substantially different

[2] Although this study was designed to examine the attentional abnormalities associated with externalizing traits, there is typically a strong association between externalizing traits and disorders. Thus, we re-ran the analyses using the externalizing spectrum diagnosis of Antisocial Personality Disorder (APD). APD was assessed using interview and file information to rate all APD symptoms listed as Diagnostic Statistical Manual-IV (DSM-IV) criteria and the number of symptoms was summed to yield an APD total score. Paralleling results for the Impulsive–Antisociality measure, the analyses involving APD total score revealed a significant APD × Lag interaction, F (4.53,203.84) = 2.29, p = .05, η_p^2 = .05. Additionally, the interaction contrasts yielded significant APD × Lag interactions for lag-2 versus later lags [F (1, 45) = 7.05, p = .01, η_p^2 = .94]. Together, the analyses of externalizing traits and disorder-related symptoms indicate that externalizing is associated with a pronounced AB.

characteristics, in the AB task, participants are required to reallocate attention to another conceptually related target (e.g., another letter). Thus, in the absence of a strong elicitor of attention or the need to revise an attentional set altogether, externalizing individuals may have relatively little difficulty reallocating attention in order to identify another expected target.

Despite not seeing a sustained deficit in performance, even a temporary deficit in reallocating attention to potentially significant environmental events may have important consequences for the regulation of behavior. Specifically, there is considerable evidence that externalizing individuals are less adept at suspending goal-directed behavior in response to negative feedback (i.e., punished errors) and that this failure to pause and reflect on negative feedback interferes with their ability to learn from experience and inhibit inappropriate responses in the future (e.g., Farmer & Rucklidge, 2006; Gremore, Chapman, & Farmer, 2005; Hartung, Milich, Lynam, & Martin, 2002; Patterson, Kosson, & Newman, 1987; Yechiam et al., 2006). In general, failure to reallocate attention in this manner interferes with a person's ability to update expectations concerning the present situation and learn from negative feedback (Patterson & Newman, 1993). Thus, their over-allocation of attention to salient environmental events may paradoxically undermine their ability to allocate attention in accord with goal-directed priorities.

Lastly, this pattern of over-allocation of attention to salient events in externalizing further distinguishes individuals on this spectrum from other disinhibited individuals, both in terms of AB performance and attention-related dysfunction more generally. The present results indicate that individuals high on externalizing over-allocated attention to goal-relevant targets, and that this over-allocation resulted in their temporary deficit in identifying T2 (i.e., larger AB). By contrast, using the same AB paradigm, Wolf et al. (2012) found that psychopathic offenders displayed a significantly smaller AB (i.e., less conflict and greater T2 accuracy) than non-psychopathic offenders. Such evidence is consistent with the belief that externalizing and psychopathy represent distinct pathways to disinhibitory psychopathology.

On the one hand, externalizing seems to be associated with a reactive dysfunction: When they are expecting motivationally salient stimuli, the reaction of externalizing individuals is to over-allocate attention to those stimuli, consequently decreasing the attention available for controlled processing and cognitive control (e.g., ignoring distracting stimuli; Ávila & Parcet, 2001). This characterization of externalizing is consistent with externalizers' dysfunction in identifying T2 stimuli in the present study, their exaggerated attentional orienting to salient cues (Ávila & Parcet, 2001), their difficulty classifying rare or unexpected stimuli in the oddball task (Bernat, Nelson, Steele, & Patrick, 2011; Costa et al., 2000), and their problems regulating attentional focus to inhibit drug craving and violent responses (Blair, 2001; Volkow & Li, 2004). On the other hand, the attention abnormality in psychopathy appears to involve dysfunction at an early stage of selective attention that distinguishes it from the attention abnormalities that potentiate disinhibited behavior in externalizing individuals. More specifically, Newman and colleagues propose that an early attention bottleneck blocks the processing of information that is not goal-relevant (i.e., distractors in AB paradigm). To the extent that the bottleneck filters information at an early stage of attention, the need for cognitive control to maintain a goal-directed focus is essentially circumvented. Although the attention bottleneck reduces the reactive over-allocation of attention that characterizes externalizing individuals, it nevertheless entails a rigid pre-potent focus of attention that effectively undermines response inhibition, conflict monitoring, affective processing, and self-regulation in psychopathic individuals (see Newman & Baskin-Sommers, 2011 for review). Thus, while the self-regulation of both groups is hampered by a tendency to overlook potentially important stimuli, their performance on the AB task indicates that different psychobiological mechanisms are responsible for this behavior.

Although the results provided good support for our experimental hypothesis, this study is not without its limitations. First, although the current sample size is comparable to those of other studies examining individual differences in AB performance (Arnell & Stubitz, 2010; Dux & Marois, 2008; Ávila and Parcet, 2001) and individual differences associated with the Impulsive–Antisociality scale (Buckholtz et al., 2010), it may be underpowered relative to some other domains of personality research [3]. Second, though the use of inmates may be favorable in that these individuals personify a range of externalizing-related disinhibition, it is important for future studies to test whether variation in performance on this AB paradigm is present in other, non-incarcerated externalizing samples. Lastly, despite the absence of immediate incentives in the present study, we cannot rule out the possibility that the larger AB displayed by high externalizing individuals is influenced by the magnitude of their affective reaction to experiencing conflict (e.g., between target and distractors). Given the preliminary nature of these findings, further research is needed to replicate these findings in other externalizing samples and to address the extent to which an attentional anomaly of this type exacerbates the hypersensitivity to reward cues and other executive functioning deficits associated with externalizing disorders (though see Footnote 2).

Externalizing is associated with a range of behavior problems that include drug and alcohol abuse, conduct disorder, and adult antisocial behavior. Previous research highlights the role of exaggerated responses to goal-relevant, motivationally valenced stimuli and associations with deficient working memory capacity and response inhibition. The present results provide preliminary evidence that externalizing is also associated with a distinctive profile on a basic measure of attention allocation in the absence of overt reward or punishment stimuli. If reliable, the findings would support a novel perspective regarding the additive and interactive influences of attention regulation, motivational sensitivities, and higher-order executive functioning on the impulsive antisocial lifestyle associated with externalizing disorders (see Baskin-Sommers & Newman, in press).

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[3] Power analysis conducted with the pwr package in R (R Development Core Team, 2009) indicated that the current sample size provided reasonable power, at 76% to detect moderate effect size ($f^2 = .15$; Cohen, 1992) for the 1 degree of freedom contrasts with a two-tailed alpha of .05

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