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Dysregulation in High-Anxious Female Prisoners: Attentionally Mediated?

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Psychopathy is associated with specific information processing anomalies that hamper self-regulation (e.g., poor passive avoidance) in male offenders, but recent studies have found that anxiety—rather than psychopathy—appears to predict poor passive avoidance in female offenders. To clarify the association between attention and dysregulation in anxious offenders, this study used a computerized picture–word task to test 2 competing perspectives on how anxiety moderates attention to distracting cues in female inmates. The 3-pathway model (J. P. Newman & J. F. Wallace, 1993) hypothesizes that anxious individuals (identified as neurotic introverts) will show narrowed attention to relevant task cues and thus will show less interference due to irrelevant distractors. The second perspective, derived from substantial evidence that anxious individuals are vigilant to threat cues, suggests that neurotic introverts will show vigilance to irrelevant distractors only if they are threatening. Results suggest a synthesis between the two perspectives that clarifies both the attentional mechanisms involved in anxiety and their relation to dysregulation.

KEY WORDS: attention; regulation; anxiety; female; prisoners.

Effective regulation often requires the modification of ongoing behavior on the basis of information provided by environmental cues. If these cues are part of one's attentional focus, processing them is comparatively easy; however, if these cues are secondary or peripheral to an individual's current focus of attention, using the cues to modify behavior requires a shift of attention from ongoing behavior to process these secondary cues. The relatively automatic shift of attention from one's current (or primary) focus to secondary cues is known as response modulation (McCleary, 1966; Patterson & Newman, 1993; Wallace, Vitale, & Newman, Bachorowski, & Newman, 1991). Dysregulation involves behavior that is maladaptive or inappropriate for a specific context, particularly when information is available to suggest a more adaptive

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or appropriate response. Such dysregulation can occur when a secondary cue (1) contains valuable information for current behavior and (2) is not used to modify that behavior. Thus, effective regulation often requires effective response modulation.

For example, people focused on reaching a destination often drive above the speed limit. However, if traffic flow slows, people often switch attention from their original focus to adopt an alternative goal that involves regulating their speed to avoid a traffic ticket. Attending to and processing the likely presence of a police car requires response modulation: a switch of attention from primary cues directly relevant to current behavior (e.g., driving home as quickly as possible) to evaluate secondary cues that suggest a modification of this behavior (e.g., slowed traffic indicating the presence of a police car). Thus, dysregulation can occur when a maladaptive response is not corrected by processing and using secondary cues to help regulate this response.

Dysregulation can lead to costs for an individual (e.g., receiving a speeding ticket). However, there are large costs to society when a person's chronic dysregulation results in impulsive criminal behavior. Thus, understanding dysregulation in criminal populations has important implications. Newman and Wallace (1993) proposed three pathways to a response modulation problem: (1) psychopathy, (2) impulsivity, and (3) anxiety. Research in male offenders demonstrates the importance of response modulation problems in psychopathic individuals. For example, psychopathic individuals commit more passive avoidance errors than controls (e.g., Lykken, 1957; Newman & Kosson, 1986; Newman, Patterson, & Howland, 1990; Newman, Schmitt, & Voss, 1997; Newman, Widom, & Nathan, 1985; Siegel, 1978). However, in female inmates, anxiety—not psychopathy—appears to represent the most robust pathway to dysregulation as measured by passive avoidance deficits (MacCoon & Newman, 2003; Vitale, MacCoon, & Newman, 2003). Given the apparent importance of the anxiety pathway to disinhibition in female offenders, the current study attempts to expand our understanding of the anxiety pathway in the dysregulation of female inmates by applying predictions derived from the response modulation hypothesis to this population.

The three-pathway model is based on Gray's neuropsychological model (e.g., Gray, 1981, 1982, 1987; Gray & McNaughton, 2000) in which the behavioral activation system (BAS), the behavioral inhibition system (BIS), and the nonspecific arousal system (NAS) interact to determine behavior. The activity of the BAS increases in response to reward cues and is responsible for approach behavior. The activity of the BIS increases in response to novel or punishment (or other negative) cues and is responsible for inhibition of reward-seeking behavior (i.e., passive avoidance). The BIS functions in an automatic checking mode (Gray, 1987) and emits a "call for processing" when a mismatch occurs between expectations and actual events. This call is answered when limited-capacity attention is redirected from its primary focus to the eliciting stimulus (McCleary, 1966; Patterson & Newman, 1993; Wallace, Vitale, & Newman, 1999). Thus, a call will be answered to the extent that sufficient capacity is available to answer this call (MacCoon, Wallace, & Newman, in press). The nonspecific arousal of the NAS is at least partly described by increased activity of the locus coeruleus–noradenergic system that acts to increase signal-to-noise ratios (Usher, Cohen, Servan-Schreiber, Rajkowski, & Aston-Jones, 1999) by increasing attentional focus to motivationally relevant cues (Wallace & Newman, 1997).

That is, as nonspecific arousal increases, attentional capacity becomes increasingly dedicated to relevant cues, at the expense of processing irrelevant cues (see Lavie & Tsal, 1994). To the extent that more capacity is dedicated to processing one set of cues, there is less capacity available for other processing needs, including the ability to process cues necessary for effective regulation.

There is no standard way to assess the personality dimensions that arise from Gray's theory (Caseras, Avila, & Torrubia, 2003). However, many comparisons of BIS and BAS measures use Eysenck's (1967) extraversion (E) and neuroticism (N) dimensions as the default standard owing to Gray's original theorizing (Gray, 1981, 1987; Torrubia, Avila, Molto, & Caseras, 2001). The three-pathway model also uses Gray's original approach to define the groups that correspond to the impulsivity and anxiety pathways. According to this approach, E acts as an index for BIS-/BAS-sensitivity, with high levels of E being associated with BAS-sensitivity and low levels of E–introversion (I)—being associated with BIS-sensitivity. N indexes the NAS, with high levels of N being associated with greater NAS reactivity (but see Larsen & Ketelaar, 1989; Tellegen, 1985, for an alternative view). Thus, a neurotic individual is thought to respond more rapidly and forcefully to their bias (e.g., BAS or BIS) than their stable counterparts (see Gray, 1987; Wallace et al., 1991). Like Eysenck (1967; H. J. Eysenck & M. W. Eysenck, 1985), the three-pathway model associates anxiety with the combination of neuroticism and introversion and impulsivity with the combination of neuroticism and extraversion. Thus, in studying the anxiety pathway, we identify anxiety with neurotic introverts (NIs) and controls with stable extraverts (SEs).[3]

This approach to anxiety does not emphasize an end state reflecting a collection of symptoms including negative affect; instead, it emphasizes anxiety as a process with multiple contributing mechanisms of cue sensitivity and response bias, indexed by E, and emotional/attentional reactivity, indexed by N (Wallace et al., 1991), an approach with empirical validity (see, e.g., Bachorowski & Newman, 1990; Gray, 1981). According to the three-pathway model, an NI has a bias for processing BIS cues and is therefore more likely than an SE to orient attention to such a cue. By virtue of the increased reactivity of their arousal system (high NAS), an NI will direct more capacity to the processing of this cue than an SE. That is, relative to SEs, an NIs are more likely to experience a BIS-mediated increase in arousal that narrows their attention to primary cues. When this occurs, NIs are less able to suspend their current behavior, switch attention to assimilate feedback provided by less salient cues, and then modulate their current behavior on the basis of this feedback.

This theoretically derived prediction of narrowed attention appears at odds with a robust literature suggesting that anxious individuals are characterized by heightened vigilance. For example, in an attention deployment paradigm, MacLeod et al. (1986) found that anxious individuals responded more quickly to a probe when it replaced a threat word than a neutral word. The authors concluded that anxious

[3]Throughout the manuscript, we refer to NIs as anxious and SEs as controls. Although we believe this nomenclature accurately reflects some of the characteristics of NIs, we do not imply that these are the only—or even the best—ways to operationalize anxiety. We are not, for example, suggesting that symptom-based views of anxiety are not important or valid. However, there is good evidence for the construct validity of our measures (see, e.g., Bachorowski & Newman, 1990; Wallace et al., 1991) and they relate specifically to the model we are testing.

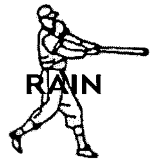
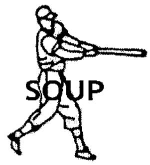
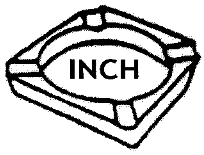
individuals exhibited an attentional bias toward threatening cues. Consistent with such a bias, Mathews and MacLeod (1985) found that anxious participants showed more interference in naming colors to threat words than controls in an emotion stroop paradigm. Similarly, Mathews and Klug (1993) found that anxious patients showed more interference than controls to anxiety-related words relative to unrelated or neutral emotional words. These and other studies (e.g., Ehlers, Margraf, Davies, & Roth, 1988; Martin, Williams, & Clark, 1991) suggest that anxious individuals preferentially attend to emotionally relevant cues. However, this perspective would predict no bias when task stimuli are neutral.

To test these competing predictions, we adopted a computerized picture–word (PW) task used by Newman et al. (1997), a modified version of a task used by Gernsbacher and Faust (1991, Experiment 3). Importantly, the task uses primary cues, irrelevant secondary cues, and uses only affectively neutral pictures and words. Each trial consists of three frames. Frame 1 indicates which cue is primary for the trial by indicating whether the participant should focus on the word or picture in the next frame. Frame 2, the context display, presents a picture with a word superimposed (see Fig. 1). On a picture trial, participants should focus on the picture because this is the primary cue and the word is the irrelevant secondary cue (and vice versa for word trials). Frame 3, the test display, presents either a picture (on picture trials) or a word (on word trials). The participant indicates whether this final frame is related to the primary cue in frame 2. The task is stroop-like in the sense that secondary cues can interfere with performance on the primary task. Figure 1 indicates an example of each type of trial. Illustrating an experimental trial, the picture of a baseball player is unrelated to the picture of an umbrella. However, the secondary cue (i.e., the word "RAIN") is related to the umbrella. For this reason, participants who process the irrelevant secondary cue "RAIN" are likely to take longer to respond "unrelated" or likely to make a mistake by responding "related" relative to responses to comparison trials in which the irrelevant secondary cue is not related to the test display.

On the basis of the three-pathway model, we expect the presence of negative feedback (i.e., "Wrong") and the nature of an evaluative laboratory task to increase arousal in NIs. According to Newman and Wallace (1993), higher NAS arousal will lead to narrowed attention to primary cues in NIs. Despite the arousing properties of the task situation, the pictures and words in this task are not intrinsically affective. That is, a picture of an umbrella and the word "RAIN" are not, in and of themselves, negative or threatening. Because the task is affectively neutral in this sense, we assume that secondary cues in the PW task are affectively neutral, and therefore that the primary task cues will be the primary focus of attention for anxious participants. This perspective predicts that, relative to controls, NIs will show less reaction time (RT) interference (RT on experimental-RT on comparison trials). Because they should not be as distracted as controls by secondary cues, this perspective also predicts that NIs will commit fewer errors on experimental trials that contain distracting secondary cues.

Alternatively, it is possible that the secondary cues of the PW task, while neutral in content, are threatening because of the role they play in the task. Specifically, secondary cues may be threatening because they cause response uncertainty and, in this way, can disrupt primary task performance. According to this perspec-

Picture Trial

Trial Type	Context Display	Test Display	Correct Answer
Experimental Trial			Unrelated
Comparison Trial			Unrelated
Filler Trial			Related

Word Trial

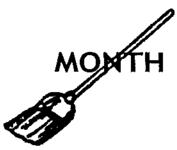
Trial Type	Context Display	Test Display	Correct Answer
Experimental Trial		SWEEP	Unrelated
Comparison Trial		SWEEP	Unrelated
Filler Trial		STREAM	Related

Fig. 1. Sample picture and word trials including experimental trials (i.e., related secondary cues) and comparison trials (i.e., unrelated secondary cues) that require an "unrelated" response, and filler tials (i.e., unrelated secondary cues) that require a "related" response. Note: Figure is a modified version of the figure that appeared in "The mechanism of suppression: A component of general comprehension skill." (Gernsbacher, M. A., & Faust, M. E. (1991), *Journal of Experimental Psychology: Learning, Memory, and Cognition* , *17*, 254. Used with permission).

tive, anxious offenders will show exaggerated vigilance to these cues because they are threatening (e.g., MacLeod et al., 1986). If anxious individuals do show vigilance to secondary cues because they are threatening, they will exhibit more, rather than less, interference than low-anxious controls. Because this assumption represents a new way of understanding threat, where the threatening aspects of a cue are based on their role in the task rather than their content (e.g., negative valence), it provides an opportunity to test a novel extension of the vigilance hypothesis. To the extent that secondary cues and response uncertainty are regarded as threatening, the vigilance hypothesis predicts that anxious participants will deploy more attention to secondary cues and display greater interference than low-anxious controls.

In short, the current experiment allows us to test two competing perspectives about the information processing of anxious participants. The three-pathway model predicts that NI offenders will narrow their attention to primary cues. Thus, this model predicts that relative to SEs, NI offenders will show (a) less RT interference and (b) better accuracy on experimental trials. If the emotionally neutral but task-disruptive secondary cues of the PW task act as threat cues (rather than neutral cues), the robust literature documenting an anxious individual's bias to such cues (i.e., vigilance) predicts that anxious offenders will show (a) more RT interference and (b) poorer accuracy on experimental trials. If the latter predictions are supported, it has interesting implications for how we define a threat cue for anxious individuals.

METHODS

Participants

The participants were 161 Caucasian female offenders from the Taycheedah Correctional Institution, a multilevel security prison in central Wisconsin. Participants were prescreened using prison files and all participants satisfying the inclusion criteria were invited to participate in the study. These criteria excluded participants who were 40 or more years old, had been diagnosed with a psychosis or bipolar disorder, were being prescribed antipsychotic medication, or had performed below the fourth-grade level on the prison's standardized measures of reading and math achievement. The elements of informed consent were presented both orally and in written form. We informed potential participants that their decision to participate or to refuse would not be a matter of record and would have no impact on their status within the prison system.

Individuals agreeing to participate were interviewed and, following a review of their file, rated on the Psychopathy Checklist—Revised (PCL-R; Hare, 1991). The PCL-R is a 20-item behavior checklist yielding scores that range from 0 to 40 that correspond to increasing similarity to the prototypical psychopath. Participants completed the Shipley Institute of Living Scale (SILS; Shipley, 1940), a short but reliable estimate of intelligence (Zachary, 1986) with vocabulary and abstraction subtests. The combined score from these subtests has shown good reliability (.78) and validity, with an average correlation with full WAIS-R scores of .80 (Zachary, 1986).

Participants also completed the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975), a scale that yields Extraversion (E) and Neuroticism (N) subscale scores that are used to form groups to test the anxiety pathway specified by the three-pathway model (Newman & Wallace, 1997). The EPQ has been validated extensively and used for general personality research as well as on tasks in our laboratory (e.g., Larstone, Jang, Livesley, Vernon, & Wolf, 2002; Newman et al., 1985, 1993; Nichols & Newman, 1986). The internal consistencies (Cronbach's alpha) of the extraversion and neuroticism subscales for females prisoners are .86 and .88, respectively (H. J. Eysenck & S. B. J. Eysenck, 1975). Test–retest reliabilities for the extraversion and neuroticism subscales for females are .87 and .80, respectively (H. J. Eysenck & S. B. J. Eysenck, 1975).

After excluding participants with low intelligence (estimated WAIS < 75), we used the EPQ to divide the remaining 133 participants into four groups along the dimensions of high- or low-neuroticism (above or below the median of 13) and high- or low extraversion (above or below the median of 14). The use of median splits to identify groups is consistent with previous research (e.g., Newman et al., 1997) and the actual median values are consistent with published norms for female prisoners (H. J. Eysenck & S. B. J. Eysenck, 1975). Following Newman et al. (1997), we also eliminated participants with poor task accuracy (less than 75% correct). Finally, participants scoring more than 2 SDs away from their group mean on interference RT (short interstimulus interval), accuracy, or RTs to experimental, filler, or comparison trials were eliminated as outliers. This resulted in the elimination of four stable extraverts (SEs). Thus, the final groups consisted of 28 Caucasian stable introverts (SIs), 36 NIs, 39 SEs, and 26 neurotic extraverts (NEs). However, our hypotheses and therefore our analyses are restricted to NIs and SEs.

Picture–Word (PW) Task

The PW task used in this study is a modified version of the task used by Gernsbacher and Faust (1991, Experiment 3) and identical to the one used by Newman et al. (1997). The task consists of 160 trials. Half of the trials involve comparing two words to determine if they are related, and the other half involve comparing two pictures to determine if they are related. Trials are initiated by a P on picture trials and a W on word trials. This 1000-ms warning stimulus alerts participants to focus on the picture or word component of the following display. Following the warning stimulus and a 1000-ms interstimulus interval, a combined display is presented for 700 ms, followed by a variable interval of either 50 or 1000 ms, and then the test display. The test display remains on screen until either the participant responds or 2000 ms elapses.

As shown in Fig. 1, each combined display contains a picture (a line drawing) and a superimposed word presented simultaneously. The drawing and word are always unrelated. On picture trials, participants must focus on the picture in the combined display (and ignore the word) and vice versa for word trials. On picture trials, the test display is simply another picture (without a superimposed word); on word trials, the test display is another word (without a picture). Participants are instructed to press one button with their left index finger if the stimuli are related and a second button with their right index finger if they are not related.

For example, in the combined display, participants might see a picture of a baseball player with the word “SOUP” superimposed. If the trial is a “picture” trial, the participant should focus on the picture of the hand, ignoring the word “SOUP.” The test display might contain a picture of an umbrella. Because the umbrella (from the test display) is not related to the picture of the baseball player (from the combined display), participants’ correct response would be “unrelated.”

Of the 160 trials in this task, there are 40 experimental, 40 comparison, and 80 filler trials. In experimental trials, the irrelevant secondary cue of the combined display is conceptually related to the test display, whereas the primary cue in the combined display is unrelated to the test display. For example, the test display might display a picture of an umbrella which is related to the irrelevant secondary cue (“RAIN”) but unrelated to the primary cue (the picture of a baseball player). Thus, the correct answer is unrelated, but participants will show slower RTs on these trials relative to neutral trials to the extent they process the irrelevant secondary cue (Gernsbacher & Faust, 1991).

Each set of experimental trials is matched by a set of comparison trials. The only difference between experimental and comparison trials is that the irrelevant secondary cue of the combined display is also unrelated to the test display (see Fig. 1). The comparison trials provide a means of assessing whether the meaning of the secondary cues is interfering with decision making on the experimental trials. For example, a comparison trial corresponding to the experimental trial just described might involve a picture of a baseball player with the word “SOUP” superimposed and the same test display. In both cases, the correct answer is unrelated, but associations elicited by “RAIN” have been shown to slow reaction times under these circumstances (Gernsbacher & Faust, 1991). In the 80 filler trials, the primary cue of the combined display is conceptually related to the test display, and the irrelevant secondary cue of the combined display is unrelated to the test display. These trials, which merit the related response, are included to ensure equal probabilities for related and unrelated responses.

In addition to varying the relation between the context and test displays, another variable concerns the time between the offset of the context display and the onset of the test display (i.e., interstimulus interval; ISI). A fixed but quasirandomized schedule of trials ensures that the ISI is 50 ms for one half of the trials and 1000 ms for the other half. Our primary RT dependent measure is an interference RT, calculated by subtracting participants’ RT to comparison trials from their RT on experimental trials. At the 50-ms ISI, interference is thought to reflect the relatively automatic influence of the to-be-ignored stimuli. Consistent with this view, Gernsbacher and Faust (1991) reported significant interference at the 50-ms ISI across groups despite providing participants with explicit instructions to ignore these stimuli. At the 1000-ms ISI, the “normal” participants displayed minimal interference and similar results were reported by Newman et al. (1997) for incarcerated males. Because of these previous findings, we focus on interference at the 50-ms ISI for our hypotheses. However, to ensure that the present task is comparable to the one used in male prisoners, we left the task unaltered and included trials with a 1000-ms ISI.

Throughout the experiment, a filled white (9×9 cm) square, bordered with a 2-mm blue line, occupies the center of the otherwise black computer screen. All displays are presented inside the blue border of the white square. After each trial, participants receive feedback: For correct responses, they receive the message "Correct" with a value $0.01–0.05 (centered below) indicating amount earned. To encourage rapid responding, higher amounts of money were earned with faster RTs. For incorrect responses, they receive the message "Wrong." Participants complete 23 practice trials (not analyzed) before performing the actual experiment.

Results

RT

As discussed in the *Methods* section, analyses were restricted to trials involving the short (50 ms) ISI. Analyses of RT trials involved only correct responses. Prior to testing our hypotheses, we examined possible group differences in RTs by conducting a Neuroticism (low, high) × Extraversion (low, high) × Trial Type (experimental, filler, comparison) mixed-model ANOVA with neuroticism and extraversion as between-participant factors and trial type as the within-participant factor. This analysis revealed a main effect for trial type, $F(1, 125) = 206.66$, $p < .001$, indicating that participants had the slowest RTs to experimental trials ($M = 846$ ms), faster RTs to comparison trials ($M = 808$ ms), and fastest RTs to filler trials ($M = 710$ ms). There were no other statistically significant results (see Table I for reaction time means and standard errors for each trial type for all groups).

To test our primary hypothesis, we conducted a Group (NI, SE) × Trial Type (experimental, comparison) mixed-model ANOVA with group as the between-participant factors and trial type as the within-participant factor. This analysis revealed a main effect for trial type, $F(1, 73) = 16.99$, $p < .001$, indicating that participants had the slowest RTs to experimental trials relative to comparison trials ($M = 853$ and 819 ms, respectively). As predicted, there was a significant Group × Trial Type interaction, $F(1, 73) = 6.59$, $p = .01$, indicating that NIs showed less interference to distracting cues than SEs (see Fig. 2). There were no other statistically significant effects.

To confirm that the form of the interaction conformed to prediction, we conducted t tests on experimental and comparison trials separately. Contrary to prediction, we found no difference between NIs and SEs on experimental trials,

Table I. Reaction Time Means and Standard Errors for All Groups for Each Trial Type

	Experimental trials		Filler trials		Comparison trials	
Group	M	SE	M	SE	M	SE
Stable extraverts	827	37.14	688	28.87	772	33.90
Neurotic introverts	878	38.65	734	30.04	865	35.29
Stable introverts	828	43.83	698	34.07	780	40.01
Neurotic extraverts	852	45.48	719	35.35	816	41.51

Note. M = mean, SE = standard error (in millisecond).

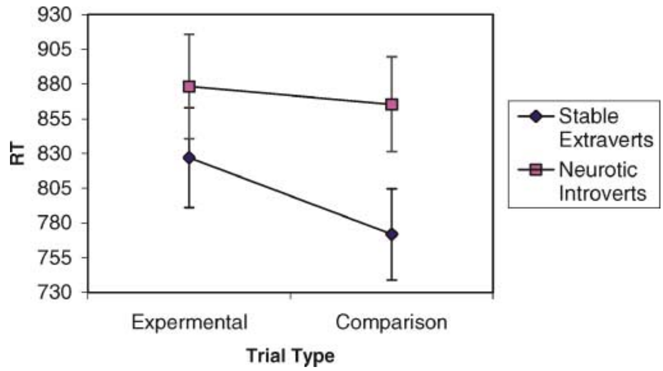


Fig. 2. Reaction time (in milliseconds) for stable extraverts and neurotic introverts on experimental and comparison trials. RT = reaction time.

$t(73) = -0.99$, ns. Instead, we found NIs were significantly slower than SEs on comparison trials, $t(73) = -1.98$, $p = .05$[4].

Accuracy

We conducted a similar ANOVA using error rates as the dependent measure. This analysis revealed a main effect for neuroticism, $F(1, 125) = 7.01$, $p = 0.009$, indicating that neurotic participants were less accurate ($M = 0.87$) than stable participants ($M = 0.90$) overall. There was also a main effect for trial type, $F(1, 125) = 157.20$, $p < 0.001$, indicating that participants were least accurate to experimental trials ($M = 0.82$), more accurate to filler trials ($M = 0.89$) and most accurate to comparison trials ($M = 0.95$). There were no other statistically significant effects (see Table II for means and standard errors for each trial type for all groups).

To examine interference in the two groups of interest, we conducted more specific analyses. We examined group differences in accuracy by conducting a Group (NI, SE) × Trial Type (experimental, comparison) mixed-model ANOVA with group as between-participant factor and trial type as the within-participant factor. This analysis revealed a main effect for trial type, $F(1, 73) = 117.97$, $p < .001$, indicating that participants were more accurate to comparison ($M = 0.96$) than to experimental trials ($M = 0.83$). There was also a main effect for group, $F(1, 73) = 5.29$, $p = .02$, but, contrary to prediction, the effect indicated that NIs were less accurate ($M = 0.87$) than SEs ($M = 0.91$). There were no other statistically significant effects.

Analyses conducted on experimental and comparison trials indicated that NIs and SEs did not differ in accuracy to comparison trials, $t(73) = 1.48$, ns, but that NIs were less accurate on experimental trials than SEs ($M = 0.80$ and $M = 0.85$ respectively), $t(73) = 2.16$, $p = .03$[5].

[4]An anonymous reviewer requested that we also report within-group t tests: when considered separately, SEs had slower RTs on experimental than comparison trials, $t(38) = 5.12$, $p < .001$, whereas NIs did not differ by trial type, $t(35) = 1.02$, *ns*.

[5]Within-group t tests show that SEs were less accurate on experimental than comparison trials, $t(38) = 6.84$, $p < .001$, as were NIs, $t(35) = 8.48$, $p < .001$.

Table II. Mean Percent Accuracy and Standard Errors for All Groups for Each Trial Type

Group	Experimental trials M	Experimental trials SE	Filler trials M	Filler trials SE	Comparison trials M	Comparison trials SE
Stable extraverts	0.85	0.02	0.91	0.01	0.97	0.01
Neurotic introverts	0.80	0.02	0.87	0.01	0.95	0.01
Stable introverts	0.84	0.02	0.90	0.01	0.95	0.01
Neurotic extraverts	0.79	0.02	0.88	0.02	0.93	0.01

Note. M = mean, SE = standard error.

DISCUSSION

The purpose of the current experiment was to contrast two theoretical perspectives on the processing biases of anxious individuals. The three-pathway model (Newman & Wallace, 1993) and a recent extension of this model (MacCoon et al., in press) predicts that relative to controls, NIs are particularly susceptible to performance concerns in the present task and, as a result, would experience greater arousal-mediated allocation of attention to task-relevant cues and thus less distraction due to irrelevant secondary cues. This contrasts with the vigilance hypothesis that predicts anxious individuals will demonstrate an attentional bias only to threatening cues. This perspective predicts no differences between controls and NIs because there are no affective cues present in the task.

This study suggests that neither perspective is correct. In support of the three-pathway model, NIs showed less interference than SEs to distracting secondary cues. However, contrary to prediction, NIs were less, not more, accurate than SEs on experimental trials. Furthermore, the reason NIs showed less interference was not that they responded faster on experimental trials than controls but that they responded more slowly on comparison trials (see Fig. 2). Thus, our results are inconsistent with the hypothesis that NIs are less distracted by secondary cues than SEs.

On the other hand, a strong version of the vigilance hypothesis also was not supported because NIs did respond differently to secondary cues despite the fact

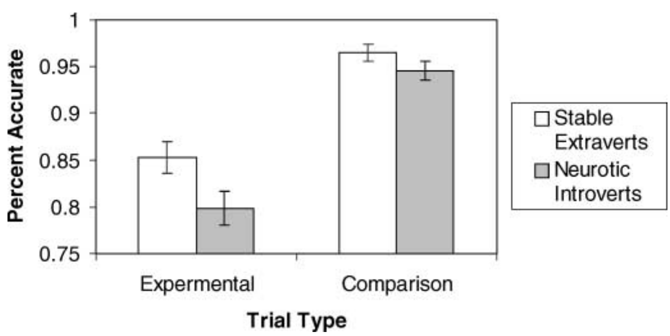


Fig. 3. Accuracy for stable extraverts and neurotic introverts on experimental and comparison trials.

that these cues were not inherently emotional. A different form of the vigilance hypothesis requires that we conceptualize secondary cues in the PW task as threatening (because they disrupt task performance). In this case, the vigilance hypothesis predicts that anxious offenders will show more interference to these cues than controls and as a result have poorer accuracy on experimental trials. Only the accuracy prediction received support. Thus, neither version of the vigilance hypothesis received full support.

In short, neither the narrowed attention hypothesis nor either form of the vigilance hypothesis received full support. Instead, the results suggest a third possibility representing a synthesis of the two hypotheses. We suggest that NIs do allocate more attention to relevant cues. However, the data suggests that secondary cues—rather than primary task cues—were most relevant to anxious offenders. There were no group differences in the processing of secondary cues when these cues were likely to cause errors (experimental trials), but there were group differences in the processing of these cues when they were not likely to cause errors (comparison trials; see Fig. 2). Controls demonstrate a phasic allocation of attention to secondary cues, slowing only to experimental trials. In contrast, NIs show a tonic allocation of attention to secondary cues, slowing to experimental and control trials: NIs attend to secondary cues even when these cues do not conflict with primary cues. Furthermore, this tonic attention to secondary cues regardless of actual threat is maladaptive—NIs were less accurate than controls.

If we assume that NIs are at least as motivated to perform well on the task as controls, why did they behave so maladaptively? The three-pathway model suggests the following explanation. The presence of punishment cues increased arousal in NIs relative to controls which, in turn, caused NIs to allocate more of their attention to secondary cues (because these cues were potentially threatening). With more capacity dedicated to the processing of irrelevant cues, NIs have less capacity available for effective task performance. Thus, NIs' performance suffers, a fact that suggests dysregulated behavior on the task.

In a recent event-related functional MRI study Carter et al. (2000) made a similar distinction between phasic and tonic allocation of attention. The authors administered a color–word Stroop under two conditions: 80% congruent trials and 80% incongruent trials. When each trial likely involved the threat of errors (the 80% incongruent condition), normal participants allocated more top–down processing resources to each trial as indicated by slower overall RTs and less dramatic slowing to incongruent trials. When the threat of errors was more phasic (the 80% congruent trials), normal participants appeared to allocate top–down resources only when needed for incongruent trials, as indicated by faster overall RTs and more dramatic slowing to incongruent trials. Our study parallels these results, with anxious participants showing a pattern consistent with tonic allocation of attention (i.e., slower overall RTs and less dramatic slowing to experimental trials relative to comparison trials) and controls showing the pattern more associated with phasic allocation of capacity (i.e., faster overall RTs and more dramatic slowing to experimental trials relative to comparison trials).

The fact that this study used a prison population raises the issue of whether our findings will generalize. There are three important ways that female prisoners are likely to differ from nonincarcerated females. First, female prisoners have lower IQs suggesting different baseline capacity differences. Second, incarcerated females have been convicted of antisocial behavior and such behavior should be more prepotent in a prison population than in a nonincarcerated sample. Finally, it is possible that prisoners are more habitually impulsive than nonprisoners; thus, an impulsive "go" response may be more easily activated in this population. Although these variables are likely to differ between incarcerated and nonincarcerated samples, we do not expect the self-regulatory process itself to differ meaningfully. For example, the lower IQ of incarcerated females may lead to more dysregulated behavior but would involve the same process as a nonincarcerated female who lacks the capacity necessary to regulate a response.

In any case, it is important to study the regulatory process in multiple populations. Because of the higher rates of antisocial behavior in a prison population, for example, the consequences to society of dysregulation in a group of high-anxious incarcerated women should be higher than in a group of nonincarcerated women.

A potential limitation of our explanation for the current results relates to the problem of baseline RT. If we view comparison trials as a baseline condition, the slower RTs of anxious participants on these trials may indicate that anxious offenders simply have a slower baseline RT than controls.[6] If anxious and control inmates are equated on comparison trials, this would shift the locus of the effect from comparison to experimental trials—anxious offenders would appear faster to experimental trials than controls. According to this account, the poorer accuracy of high-anxious inmates on experimental (and filler) trials would be due to their faster RTs to these trials relative to controls. Our results cannot rule out this explanation. Of course, faster RTs to experimental trials is precisely what we predicted a priori on the basis of three-pathway model (Newman & Wallace, 1993).

Notwithstanding the limitations just discussed, our attentional explanation has important implications for anxiety. First, our explanation further specifies the situations under which we can expect an attentional bias in anxious female offenders. Specifically, it suggests that anxious individuals effortfully attend to cues (in this case, secondary cues) that have the potential to disturb performance. According to this view, anxious individuals may attend preferentially to threat cues (e.g., MacLeod et al., 1986) because these cues warn about potential errors on a task. Furthermore, cues with negative emotional valence would be preferentially attended to (e.g., Ehlers et al., 1988; Martin et al., 1991; Mathews & Klug, 1993; Mathews & MacLeod, 1985)

[6]The problem of choosing a good baseline RT is complicated. Ideally, we would want to measure RTs when participants are engaged in a very similar—but entirely separate—task that presents stimuli that are neutral in terms of both content and their role in the task. For example, we have argued that secondary cues of neutral content (e.g., a picture of an umbrella) can be interpreted as threatening because of their role in the task (e.g., when the umbrella causes the participant to choose the wrong answer no experimental trials). If this is true, it highlights the role that context plays on the assumed neutrality of particular stimuli and poses a challenge to the creation of within-task baseline conditions. It also suggests that empirical work relying on difference scores should report and consider RTs for their neutral condition. In following our own advice, we have effectively eliminated our baseline condition. Unfortunately, we do not have another source of baseline RT information in this study, a deficit that future research should avoid by including a block of trials for the express purpose of gathering relevant baseline RT information.

because they have been associated with mistakes, failures, or unsatisfactory experiences in the past. Thus, each of these cues can be understood in the greater context of stimuli that suggest the potential of making a mistake or causing response uncertainty. Future research might explore how broad or inclusive this attentional bias is.

The results suggest that one priority of anxious female prisoners is to avoid making errors and they attempt to do this by allocating effortful attention to cues (i.e., vigilance) that may cause such errors. To the extent that effortful attention is focused on these secondary cues, it is not available to regulate performance on the primary task (see also Wallace & Newman, 1997). Thus, for the PW task, the dominant set of an NI is maladaptive, leading to slower response times on comparison trials and poorer accuracy on experimental trials.

However, it is interesting to note that this attentional bias is not necessarily maladaptive under all conditions. For example, a task could be designed such that effortful attention to secondary cues actually improves task performance. In addition to situational influences that may enhance the adaptiveness of this attentional bias, allocating effortful attention to secondary cues may also interact with other individual difference variables to enhance information processing and behavioral regulation. Specifically, the idea that anxious individuals may have an attentional set that focuses on secondary cues has clear and exciting implications for understanding a possible moderating influence of anxiety on psychopathy. If psychopaths are characterized by an inability to use secondary cues automatically to modulate ongoing behavior on a primary task (as suggested by the response modulation hypothesis; Patterson & Newman, 1993), and anxiety is characterized by effortfully attending to secondary cues, then the combination of the two (i.e., a high-anxious psychopath) could result in a psychopath whose attentional set includes secondary cues. This could explain the fact that unlike low-anxious psychopaths, high-anxious psychopaths often appear normal on information processing tasks that require the use of secondary cues to moderate ongoing behavior (Newman et al., 1997; Newman & Schmitt, 1998).

In conclusion, we have proposed that when confronted with cues that may disrupt task performance or cause response conflict, anxious female inmates allocate more attention to these cues than controls. This study is consistent with the idea that such an attentional response leaves less capacity available for the processing of primary task cues. It appears that anxious offenders allocated attention in this way despite the fact that this bias leads to poorer task performance. In this way, this study suggests an attentional mechanism for the emotional or behavioral dysregulation that leads this subset of the prison population to commit their crimes. Specifically, this perspective predicts that anxious individuals with a history of antisocial behavior will narrow their attention to threatening environmental cues in an attempt to regulate their emotion or behavior. Unfortunately, this response may divert controlled processing resources (i.e., selective attention) needed for the consideration of less prepotent behavioral alternatives and thus result in a dysregulated response. Such a viewpoint has been explored more carefully by MacCoon et al. (2002) and is consistent with cognitive control theories (e.g., Miller & Cohen, 2001) that emphasize the critical role of effortful attention in resolving response conflict in favor of a nonprepotent response.

This perspective also builds a bridge between the three-pathway model (Newman & Wallace, 1993) and vigilance theories of anxiety by suggesting that the threatening aspect of a stimulus can be determined either by its content (e.g., cancer) or by the role the cue plays in the task (e.g., disrupting task performance by causing response uncertainty). Once threat cues become the focus of selective attention (i.e., become primary), the three-pathway model suggests that fewer limited capacity resources are available to attend to other cues or support the regulation of a habitual response. Research in progress is currently testing the capacity aspects of the model more explicitly.

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