

13 RST and psychopathy: associations between psychopathy and the behavioral activation and inhibition systems

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We review the experimental evidence regarding information processing anomalies that have been observed in psychopaths, and conclude that the body of evidence is in substantially better accord with the revised RST, and, in particular, the current conceptualization of the BIS, than with the original version of RST. In addition, clear associations exist between psychopathy and self-report measures of the BAS and BIS constructs, and we discuss possible explanations for those associations that merit evaluation in future psychopathy research.

RST and psychopathy: associations between psychopathy and the BAS and BIS

Maladaptive behavior that is anti-social or impulsive in nature has been characterized as reflecting *disinhibition* – a decreased ability to regulate response inclinations in light of possible adverse consequences (e.g., Gorenstein and Newman 1980). Due to psychopaths' penchant for engaging in anti-social, maladaptive behavior, psychopathy is a prototypical example of the clinical syndromes that have disinhibited behavior as a prominent feature. For instance, although psychopaths make up only 1 per cent of the general population, they constitute 15 to 25 per cent of the prison population (Hare 1996), and psychopathic offenders are two to five times more likely to re-offend than are non-psychopaths (Hemphill, Hare and Wong 1998; Quinsey, Rice and Harris 1995; Serin 1996, Walters 2003).

As described by Cleckley (1976), who has played a major role in shaping the current conceptualization of psychopathy, the core features of the syndrome include poor judgement, the failure to learn from experience (especially from punishment or negative feedback), maladaptive behavior that often occurs in the context of relatively low levels of motivation

(i.e., on a whim), extreme egocentricity, lack of remorse and generally shallow or superficial emotional reactions (both positive and negative).

The original version of Gray's Reinforcement Sensitivity Theory (RST) (1975, 1987; Gray and Smith 1969) has figured prominently in attempts to explain the disinhibition of psychopaths. Briefly, the original RST postulated three interacting neurological systems. The Behavioral Activation System (BAS) was hypothesized to be reactive to conditioned appetitive stimuli or reward cues (i.e., stimuli associated with appetitive outcomes), and, as the level of BAS activity increases, the initiation of goal-directed behavior becomes more likely. Conversely, the Behavioral Inhibition System (BIS) was viewed as being reactive to conditioned aversive stimuli or punishment cues (i.e., stimuli associated with aversive outcomes), as well as to stimuli that are at odds with pre-existing expectancies. The BIS promotes the inhibition of ongoing or goal-directed behavior when potential threats or discrepant stimuli are detected, and causes attention to be directed or allocated to the processing of the threatening or discrepant stimulus. The third of Gray's three systems – the Fight-Flight System (FFS) – was considered to be reactive to unconditioned or innately aversive stimuli, and mediates the behavioral and affective reactions to those stimuli (e.g., rage).

Fowles (1980) proposed an initial explanation of psychopathy in terms of RST, noting that a number of psychophysiological findings that distinguished psychopaths from non-psychopathic controls (e.g., relatively small increases in skin conductance in anticipation of aversive stimuli) were consistent with the sorts of deficits that would be expected to occur in the presence of BIS dysfunction. Consequently, Fowles (1980) proposed that the BIS of psychopaths is relatively weak or hyporeactive, and that it is this defect that causes the observable features of the syndrome.

Whereas Fowles used laboratory findings and clinical observations to draw inferences about the relationships between psychopathy and RST, self-report measures of the BAS and BIS constructs recently have been used to examine those relationships. For instance, Book and Quinsey (2004) administered a measure of BAS and BIS activation to a group of psychopaths and to members of several control groups. Those researchers found that psychopaths were both higher in BAS activation and lower in BIS activation than controls; that is, their results indicated that psychopaths not only manifest a relatively weak BIS, but a relatively strong BAS as well.

RST also was utilized by Lykken (1995) in his conceptualization of psychopathy. However, he broadened his explanatory focus to reflect the distinction between primary and secondary psychopathy

(e.g., Blackburn 1979; Hare 1970). According to Cleckley (1976), primary or true psychopaths tend to experience lower levels of tension or anxiety than do most individuals. On the other hand, Cleckley viewed neurotic or secondary psychopaths as experiencing relatively high levels of negative affect (e.g., anxiety), with their anti-social behavior occurring mainly as a reaction to emotional conflicts or distress.

In accord with Cleckley's conceptualization, Lykken (1995) described primary psychopaths as manifesting fearlessness, relatively weak electrodermal responses in anticipation of punishment, and normal or below-normal levels of general emotional reactivity. However, he characterized secondary psychopaths as manifesting high levels of impulsivity and general emotional reactivity, but normal levels of fear and electrodermal activity in anticipation of punishment.

Based on his conceptualization of primary and secondary psychopathy, Lykken (1995) hypothesized that primary psychopathy is associated with a hyporeactive BIS, but normal or average levels of BAS reactivity, leading to maladaptive behavior via impaired processing of stimuli associated with potential threats or punishment. Conversely, he viewed secondary psychopathy as being associated with a hyperreactive BAS and average levels of BIS reactivity. Lykken proposed that the maladaptive behavior of the secondary psychopath reflects a stronger-than-normal response to reward cues, causing relatively inflexible BAS-mediated approach behavior. Nevertheless, he also suggested that those individuals tend to experience relatively high levels of negative affect due to the increased incidence of adverse outcomes that occur as a consequence of their inadequately-regulated approach behavior.

To assess Lykken's hypothesis that primary psychopaths manifest a weak BIS and normal BAS, whereas secondary psychopaths manifest a strong BAS and a normal BIS, two measures of the BAS and BIS constructs – the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) (Torrubia, Avila, Moltó and Caseras 2001) and the BIS/BAS scales (Carver and White 1994) – were administered to a sample of 517 male inmates in the Wisconsin prison system (Newman, MacCoon, Vaughn and Sadeh 2005). Participants were identified as psychopaths or non-psychopaths using the Psychopathy Checklist-Revised (Hare 2003). Measures of trait anxiety or negative affectivity traditionally have been used to distinguish between primary and secondary psychopaths, with primary psychopathy associated with lower levels of anxiety/negative affect and secondary psychopathy associated with higher anxiety/negative affect levels (for a review, see Newman and Brinkley 1997). In this study, the Welsh Anxiety Scale (Welsh 1956) was utilized for this purpose.

As predicted, primary psychopaths had significantly lower BIS scores than did other participants, with no group differences in BAS scores, based on both measures of the BIS and BAS constructs. In addition, the BAS scores of secondary psychopaths were significantly higher than those of other participants for both of the measures. However, the prediction that secondary psychopathy would be associated with average BIS scores received only partial support: The results from one measure (the BIS/BAS scales) were not indicative of differences in BIS reactivity, but those from the other (the SPSRQ) were indicative of greater BIS reactivity in the secondary psychopathy group. Hence, although the evidence was equivocal regarding the prediction of normal BIS functioning in secondary psychopaths, the results of this study were consistent with the suggestion that secondary psychopaths' BAS is unusually strong or reactive. In addition, the hypothesis that primary psychopaths are characterized by a weak BIS and a normal BAS received strong support.

Experimental evidence

Nevertheless, in our research we have *not* embraced the idea that primary psychopathy is caused by a weak or hyporeactive BIS (e.g., Fowles 1980; Lykken 1995) as the BIS was conceptualized in the original version of RST. In particular, primary psychopaths do not manifest a general or global hyporeactivity to punishment cues. Rather, psychopaths' insensitivity to punishment cues is unambiguously situation-specific.¹

One of the clearest illustrations of the situational specificity of psychopaths' deficit was provided by Newman and Kosson (1986). Participants in their experiment were asked to press a response button when numbers that had been designated as target stimuli were presented on a computer monitor, and not to press when numbers that had not been designated as targets were presented.

In addition, two incentive conditions were utilized. In one, participants won money for correct button press responses and lost money for incorrect responses (i.e., for pressing the response button when a non-target number was present). In the other, participants also lost money for pressing the button in the presence of a non-target number, but they

¹ Based on the work of Cleckley, who viewed true psychopaths as being low in trait anxiety or negative affectivity, the research of Newman and colleagues has focused on elucidating the information-processing deficits of primary psychopaths (see Schmitt, Brinkley and Newman 1999).

did *not* win money for responding correctly. Hence, the prepotent inclination or response set to press the button was less well established in the second condition than in the first, because no reward was obtained for doing so. Also note that, in both conditions, the non-target numbers clearly functioned as punishment cues (i.e., as inputs to the BIS): responding when they were present led to a loss of money.

In the first condition (in which a stronger set to press the button was established), primary psychopaths made more incorrect responses than did non-psychopaths. In other words, they manifested deficient behavioral inhibition in the presence of the punishment cues (non-target numbers). Conversely, psychopaths and non-psychopaths displayed comparable inhibition in the presence of the punishment cues in the second condition, in which the set to press the button was less well established.

We have concluded from these and similar results (e.g., Arnett, Howland, Smith and Newman 1993; Arnett, Smith and Newman 1997; Newman, Patterson, Howland and Nichols 1990; Newman, Patterson and Kosson 1987; Newman and Schmitt 1998; Schmitt, Brinkley and Newman 1999) that primary psychopaths do *not* suffer from either a general insensitivity to punishment cues or an inability to respond appropriately to stimuli associated with punishment (e.g., engage in behavioral inhibition). Rather, psychopaths manifest disinhibition (i.e., a decreased ability to regulate behavior to avoid adverse consequences) when the avoidance of an adverse outcome requires overriding a prepotent response inclination or modifying an established behavioral goal.

Furthermore, our view of psychopaths' deficit is not only more specific than the hypoactive BIS hypothesis (based on original conceptualization of the BIS), but it is also more general (Newman, Schmitt and Voss 1997). On the one hand, it is more specific in that psychopaths do *not* manifest a global insensitivity to punishment cues (i.e., their idiosyncratic responses to punishment are situation specific). On the other, it is more general in that situation-specific anomalies have been observed in the processing of stimuli that are not associated with punishment (i.e., that are affectively neutral), that is, psychopaths' information processing deficit is more pervasive than simply an idiosyncratic (albeit situation-specific) response to punishment cues.

To investigate 'whether psychopathic individuals are relatively unresponsive to contextual cues that are peripheral to their dominant response set (i.e., primary task) even though the cues are unrelated to punishment' (p. 554), Newman, Schmitt and Voss (1997) utilized a version of a task that had been developed by Gernsbacher and Faust (1991, Experiment 3). Participants were asked to determine whether

two sequentially-presented stimuli were conceptually related or unrelated. On half of the trials, two words were compared, and on the other half, two pictures were compared. For instance, on each picture trial, the first of the sequentially-presented stimuli consisted of a picture and a superimposed word, and the second stimulus consisted of a picture only. Participants were instructed to ignore the superimposed word (the distractor stimulus) in the initial display, and simply decide whether the two pictures (the comparison stimuli) were conceptually related (they won money based on the speed and accuracy of their responses). However, the to-be-ignored distractor stimulus (in this case, the superimposed word) was, on some trials, related to the second of the comparison stimuli. For example, the initial display might consist of a picture of a baseball player with the word *rain* superimposed, and the second stimulus might be a picture of an umbrella.

Gernsbacher and Faust (1991) observed that, when the two comparison stimuli were conceptually unrelated (e.g., a picture of a baseball player followed by a picture of an umbrella), but the distractor stimulus (e.g., the word *rain*) was conceptually related to the second picture, the presence of the distractor interfered with participants' ability to determine that the two comparison stimuli were unrelated (i.e., response latencies were longer than when the distractor stimulus was related to the second picture than when it was not).

Likewise, in the Newman, Schmitt and Voss (1997) experiment, members of the control group were slowed in their determination that the two comparison stimuli were unrelated during trials in which the distractor stimulus was related to the second comparison stimulus. Conversely, primary psychopaths did not manifest the normal interference effect: their response latencies did not differ regardless of whether the distractor was related or unrelated to the second comparison stimulus. Thus, psychopaths apparently did not process the distractor stimuli to the same extent as did non-psychopaths, even though the distractor was not associated with punishment (see also Hiatt, Schmitt and Newman 2004; Vitale, Brinkley, Hiatt and Newman, in press; Vitale *et al.* 2005).

A related set of results (Lorenz and Newman 2002) was obtained using a lexical decision task, in which participants determined whether a briefly-presented string of letters was a word or a non-word. Typically, participants show facilitation for emotion words; that is, they are able to make the lexical decision more rapidly for words having an emotional connotation or valence (e.g., *sunset*) than for words that are affectively neutral (e.g., *bowl*). In the Lorenz and Newman (2002) experiment, an equal number of positive and negative words were utilized, and, after

completing the lexical decision task, participants were asked to rate the stimulus words on a scale ranging from 0 (bad) to 7 (good).

As predicted, and replicating results first reported by Williamson, Harpur and Hare (1991), primary psychopaths manifested significantly less facilitation in their identification of emotion words than did controls, and this result was evident for positive as well as negative words. Nonetheless, psychopaths were equally adept at appraising or rating the affective valence of the stimulus words when that activity was the focus of their attentional set (i.e., when they were explicitly asked to do so at the conclusion of the experiment).

As was the case for the Newman and Kosson (1986) experiment, the results obtained by Newman, Schmitt and Voss (1997) and Lorenz and Newman (2002) do not appear to be consistent with an interpretation invoking dysfunction of the BIS (based on its original conceptualization). In the Newman, Schmitt and Voss (1997) study, psychopaths were less affected than controls by the distractor stimuli, even though the distractors were not associated with punishment. Likewise, in the lexical decision experiment, psychopaths showed less facilitation for *both* positive and negative words (i.e., their deficit was not specific to the processing of words having negative affective valence).

Our preferred interpretation of the information processing anomalies that have been observed in experimental task performance of primary psychopaths is that, for these individuals, selective attention is less likely to be re-allocated in a relatively automatic or effortless manner to the processing of information or stimuli that are extraneous to, or incongruent with, the current attentional focus (i.e., the current focus of selective attention) (e.g., MacCoon, Wallace and Newman 2004; Wallace, Schmitt, Vitale and Newman 2000). As we have observed elsewhere, 'psychopaths fail to allocate attention to non-dominant cues when their attention is allocated already to dominant cues. Whereas controls can use non-dominant cues automatically, psychopaths appear to have difficulty doing so' (MacCoon, Wallace and Newman 2004, p. 431).

It is important to note, however, that psychopaths perform as capably as do non-psychopaths when the relevant information is encompassed by their current attentional focus (i.e., when an automatic shift or re-allocation of attention is not required). Stated another way, 'psychopaths will perform normally when deliberately attending to relevant task dimensions but appear oblivious to incidental cues that rely on automatic shifts of attention' (Lorenz and Newman 2002, p. 99; see Newman and Lorenz 2003 for review).

We wish at this point to highlight the distinction between two conceptually distinct types of processes that are involved in the allocation or

direction of selective attention (see Most, Scholl, Clifford and Simons 2005). The first results from the activation of cognitive control mechanisms and processes (e.g., working memory; dual-task co-ordination) associated with the frontal and prefrontal cortices. As described by Lavie, Hirst, De Fockert and Viding (2004), 'frontal cognitive control functions serve to control selective attention in accordance with task-relevant information by actively maintaining the current stimulus-processing priorities' (p. 352). Furthermore, 'goal-directed behavior requires focusing attention on goal-relevant stimuli' (p. 339), and 'frontal processes of cognitive control seem crucial for maintaining task-processing priorities between relevant and irrelevant stimuli to guide behavior in accordance with current goals' (p. 352). In other words, frontally-mediated cognitive control subserves the maintenance of the current goal orientation by allocating selective attention to the processing of stimuli that are relevant to the current behavioral goal, while decreasing interference by (i.e., the processing of) stimuli that are extraneous to, or incongruent with, that goal.

In contrast, the second type of allocation process is associated primarily with subcortical structures such as the septo-hippocampal system, and involves the relatively effortless and automatic re-allocation of selective attention from the current attentional focus to the processing of stimuli or information that may be of potential relevance, but that are extraneous to the current response set or behavioral goal. As noted by Most *et al.* (2005), 'attention must be distractible; if potentially dangerous or relevant objects appear, they should divert cognitive resources' (p. 218). They designate this process *attention capture*, and state that it involves 'instances in which stimuli draw a person's attention without that person's volition' (p. 218). 'These kinds of attentional shifts have been referred to as *reflexive*, *involuntary*, and *automatic*' (p. 218).

In our view, it is a deficiency involving this second type of attentional process that is the essential feature underlying the disinhibition of psychopaths (i.e., their decreased ability to regulate immediate response inclinations in light of possible adverse consequences). That is, psychopaths' disinhibition results from difficulty utilizing information that is extraneous to their current goals or prepotent response inclinations to modify those inclinations and goals. Specifically, reduced efficacy of the subcortically-mediated reallocation of selective attention decreases the probability that information indicative of a potential problem with the current goal or response inclination will receive sufficient processing to cause the inhibition or modification of the prepotent response or the alteration of the current goal. Hence, the likelihood is increased of emitting maladaptive behavior and experiencing adverse consequences.

RST revisited

Taken together, the results that were referenced above are not consistent with the hypothesis that primary psychopathy is caused by a weak or hyporeactive BIS, at least as the BIS was described in the original RST. In particular, (a) psychopaths' idiosyncratic responses to punishment cues are situation-specific, rather than being ubiquitous (as would be expected to result from a hypoactive BIS), and (b) impairments are evident in the processing of stimuli that would not be expected to function as inputs to the original BIS (i.e., that are not punishment cues or stimuli of substantial novelty).

Nevertheless, although *experimental* evidence is not consistent with the association of primary psychopathy with BIS dysfunction, there are equally clear results based on the use of *self-report* measures that do, in fact, link primary psychopathy with the BIS (as well as secondary psychopathy with the BAS). Viewing the experimental results in light of recent revisions in RST (Gray and McNaughton 2000) may provide a way of resolving this discrepancy. In the revised RST, the BIS is associated primarily with the septo-hippocampal system (SHS) and amygdala, and becomes active when conflicts occur between concurrent goals. When the BIS is activated, ongoing or prepotent behaviors are inhibited, and information-processing activities to resolve the conflict are initiated. The prototypical conflict situation involves the activation of competing goals of approach and avoidance, but conflicts between two incompatible approach goals, or between two incompatible avoidance goals, also activate the BIS.

The reformulation of the BIS construct addresses the two objections to a weak BIS hypothesis that were described earlier. Specifically, the BIS is no longer considered to be reactive to punishment cues *per se*. Rather, the BIS becomes active in the presence of goal conflicts, which may or may not involve stimuli associated with punishment. Hence, the facts that psychopaths *do not* manifest a global insensitivity to punishment cues, and *do* manifest information-processing anomalies involving affectively-neutral stimuli, do not constitute objections to a model of psychopathy based on the current version of the BIS.

Indeed, Newman and colleagues (Newman *et al.*, in press) recently provided a comparison of psychopaths' deficits with the expected effects of SHS dysfunction, based largely on Gray and McNaughton's (2000) conceptualization of the functioning of the SHS. In brief, Gray and McNaughton (2000) characterized the SHS (which, as just noted, is a principal component of the BIS) as a comparator that detects conflicts among concurrently activated goals. Specifically, the hippocampus

'receives subcortical input which reflects the presence of important stimuli (potential goals). If the hippocampus does not at the same time receive a matching cortical input (i.e., the goals are novel), it determines the relative strength of the novel goal and of any prepotent goal and, if there is a significant conflict between these (i.e., neither is significantly greater than the other), then it produces an output which inhibits the prepotent goal and hence permits the orienting and exploratory programs to function properly' (Gray and McNaughton 2000, pp. 255–256).

In their review, Newman *et al.* (in press) discussed a number of features of SHS functioning that plausibly might be of relevance to the sorts of ill-conceived, maladaptive actions that are characteristic of psychopaths. For instance, a deficit in the processing of competing or conflicting goals might impair the ability to shift behavior strategies when the features of a situation suggest that the current response strategy is no longer adaptive or appropriate (e.g., when punishment is a more likely outcome than reward, or when an alternative strategy is more likely to achieve the desired end). In addition, those authors concluded that impairment of the functions attributed to the SHS might cause a number of the deficiencies in experimental task performance manifested by psychopaths. Hence, both clinical observations and experimental evidence are in substantially better accord with the revised RST and, in particular, the current conceptualization of the BIS, than with the original version.

Despite those consistencies, however, Newman *et al.* (in press) noted that psychopaths' hypothesized information-processing anomaly might have origins other than an impairment in the functioning of the SHS. For instance, psychopaths' deficient processing of stimuli that are extraneous to (or inconsistent with) the current goal might result from a dysfunction involving other neuroanatomical structures that affect the strength of the inputs that are received by the SHS, rather than from a problem in the processing of those inputs by the SHS. As one example, those authors noted that the CA3 comparator plays a crucial role in determining which stimuli will be gated in to the conflict detector: stimuli that are associated with higher levels of monoamine activity are passed on, whereas stimuli that are associated with sub-threshold levels of monoamine activity are gated out. Hence, a dysfunction that decreases the monoamine activity associated with potentially significant extraneous stimuli would be expected to have an adverse affect on the processing of those stimuli by the SHS, even in the absence of an impairment of the SHS itself.

In addition, a laterality component in the information-processing deficits of psychopaths repeatedly has been observed. In several

experiments, more pronounced performance deficits have been apparent when the task involves an increased demand for processing by the left cerebral hemisphere (e.g., Howland, Kosson, Patterson and Newman 1993; Kosson 1998). For instance, Bernstein, Newman, Wallace and Luh (2000) asked the participants in their experiment to memorize, and later recall, the serial order of eight words that were presented, one at a time, on a computer monitor. Each word appeared in one of the four corners of display. After viewing the words and then attempting to recall the words in serial order, participants were asked to recall the location in which each word appeared. Psychopaths were as able as control participants to recall the serial order of the words (replicating other results demonstrating that psychopaths do *not* manifest deficient performance when the task is the focus of their attention). However, while not differing in the recall of left spatial field locations, they recalled fewer locations from the right spatial field (visual information from the right spatial field is processed primarily by the left cerebral hemisphere). Similarly, in the Lorenz and Newman (2002) experiment described above, disparities between the performance of psychopaths and control participants were evident only when right-handed responses were required (which, presumably, utilized primarily left hemisphere processing resources).

Finally, in the lexical decision experiment (Lorenz and Newman 2002), in which participants determined whether briefly-presented strings of letters were words or non-words, psychopaths were less affected by the emotional connotation of the word stimuli, that is, they evidenced less facilitation in their identification of emotion words, suggesting that they were less affected by the emotional connotations of the words than were non-psychopaths. It is not clear, however, that processing the emotional connotation of the word stimuli constituted a goal conflict with respect to the manifest task of identifying the stimuli as being words or non-words. Consequently, this result may not fit as neatly within a weak BIS or an SHS dysfunction model of psychopathy as do other results that were discussed previously (e.g., Newman and Kosson 1986; Newman, Schmitt and Voss 1997).

Therefore, although we have attempted to achieve some specificity in our description of the information-processing deficit that underlies the disinhibition of psychopaths, we do not believe that, at this time, the evidence is sufficient to support a definitive statement regarding the anatomical locus (or loci) of that deficit. This stance follows from our view that psychopaths' deficit, although similar to that which might result from SHS (or BIS) dysfunction, also could be caused by impairments of other neuroanatomical pathways and structures. Evidence suggesting a

laterality component to psychopaths' information-processing deficit also requires accommodation within any neurological model of psychopathy.

Directions for future research

Although we do not, at least at present, endorse a weak BIS hypothesis of primary psychopathy, RST certainly will continue to play a major role in psychopathy research. This is because, without question, associations exist between psychopathy and self-report measures of the BAS and BIS constructs. Given the recent modifications of the BIS construct, those associations are in better accord with experimental results. In this section, we attempt to advance the theoretical development in the field by contrasting alternative hypotheses regarding the nature of the associations between psychopathy and the BAS and BIS.

One possibility is that evidence of both high BAS activation and low BIS activation within a sample of psychopaths reflects the presence of distinct sub-types among persons whose symptoms warrant a psychopathy diagnosis. That is, all psychopaths manifest disinhibition, but the disinhibition of one sub-set of psychopaths may result from the action of different psychological processes than the disinhibition of another sub-set. Consistent with this view, the BAS and BIS have been found to be differentially associated with the primary and secondary psychopathy sub-types. As described above, primary psychopaths score lower than controls on measures of BIS activation, whereas secondary psychopaths score higher on measures of BAS activation. This result might imply that some persons manifest psychopathic behavior due largely to the effects of a strong BAS (e.g., their attention is strongly attracted by reward cues, thus decreasing the attentional capacity that is available to process information indicative of a potential problem with a prepotent response). Others may merit the psychopathy diagnosis due largely to the effects of a weak BIS (e.g., impaired processing of information that is indicative of a conflict involving a current or prepotent goal).

A second possibility for understanding the associations of psychopathy with the BAS and BIS is derived from factor-analytic studies of the Psychopathy Checklist – Revised (PCL-R) (Hare 2003), which is the most widely used instrument for diagnosing psychopathy. The PCL-R encompasses two broad factors (e.g., Hare 2003), with psychopaths typically scoring above the mean on both (although for individual psychopaths, scores on one factor may be substantially higher than scores on the other). Based on experimental correlates of the PCL-R factors, Patrick and colleagues (e.g., Patrick 1994; Patrick, Bradley and Lang 1993) proposed that Factor 1 reflects the core features of the psychopathy

(e.g., hyposensitivity to anxiety), whereas Factor 2 reflects an externalizing dimension that is common to disinhibitory conditions such as conduct disorder, anti-social personality disorder and aggression (Patrick, Curtin and Kreuger, in press).

In a recent examination of the correlations between measures of the BAS and BIS constructs and the PCL-R factors, Newman (2006) found a robust association between responses to BIS scale items and Factor 1 (controlling for the effects of Factor 2), whereas BAS scale scores were predicted by the unique variance associated with Factor 2 (controlling for the contribution of Factor 1). These results suggest that psychopathy may represent an unfortunate combination of traits that jointly predispose affected individuals to the disinhibited expression of dominant response inclinations. In particular, psychopathy might be viewed as resulting from a combination of a weak or hypoactive BIS with a strong or hyperactive BAS. Note that this view differs from that associated with the primary and secondary psychopathy sub-types, in that the factorial position implies that both a strong BAS and a weak BIS are present to some extent in most psychopaths, whereas the sub-type view implies that some psychopaths predominantly manifest a weak BIS and other psychopaths manifest a strong BAS.

A second possibility that follows from the factorial view of psychopathy is that the information-processing deficit that is fundamental to psychopathy is reflected in the variance that is common to PCL-R Factor 1 and Factor 2. We discussed previously our view that this deficit entails an impairment that adversely affects the subcortical allocation of selective attention to the processing of stimuli or information that is extraneous to the current response inclination or goal. On the other hand, the unique variance associated with Factor 1 plausibly reflects the influence of a hypoactive BIS, with the unique variance associated with Factor 2 reflecting the influence of a strong or hyperactive BAS.

This perspective implies that BIS and BAS processes do not themselves constitute the fundamental psychopathy diathesis but, instead, serve to moderate its expression. Indeed, it may be that the cognitive deficit that is fundamental to psychopathy generally is not sufficient to produce the psychopathy syndrome. Rather, the presence of either a BIS that is weaker than average or a BAS that is stronger than average (or both) may be necessary to raise the level of disinhibited behavior above the threshold that is required to merit a psychopathy diagnosis.

Specifically, the presence of either a hypoactive BIS or a hyperactive BAS is, in and of itself, conducive to impaired self-regulation and increased disinhibition (e.g., Newman and Wallace 1993). Hence, when

the psychopathy diathesis is combined with either a strong BAS or a weak BIS, the presence of a dual predisposition to disinhibition creates a high probability that a person's level of disinhibited behavior will exceed the threshold that is required for producing the psychopathy syndrome. Extrapolating from this line of reasoning, it follows that the concurrent presence of both a weak BIS and a strong BAS (i.e., the individual attains PCL-R scores that are well above average on both Factor 1 and Factor 2) would create a particularly potent predisposition for expressing the psychopathy diathesis as behavioral disinhibition.

At this point, however, we do not believe that the evidence that is presently available clearly favors any one of the possible interpretations of the associations that exist between psychopathy and the BAS and BIS: proponents of any of the positions described above could cite favorable evidence. For example, the BAS and BIS constructs have been shown to be differentially associated *both* with the primary and secondary psychopathy sub-types and with PCL-R Factors 1 and 2. Consequently, we predict that attempts to elucidate the associations between psychopathy and RST will continue to play a pivotal role in psychopathy research.

Conclusion

We have proposed that predisposition to psychopathy consists of an information-processing deficit that entails a decreased efficacy of the subcortical allocation of selective attention to stimuli or information that are extraneous to, or incongruent with, the current goal or prepotent response inclination. This deficit becomes problematic (i.e., disinhibition results) when information indicating that the current response may not be well suited to the situation or stimulus context is not adequately processed.

In addition, psychopathy is associated with self-report measures of the BAS and BIS constructs. In the context of the original RST, those relationships appeared inconsistent with experimental results, whereas experimental and self-report data are in substantially better accord when viewed in light of the revised RST. Hence, the recent revision of RST, and in particular the increased specificity of the description of the BIS, have substantially enhanced the utility of RST for understanding the cognitive, affective and behavioral characteristics associated with psychopathy. We believe that the evaluation of alternative explanations for the associations between psychopathy and the BAS and BIS constructs (such as those described above) will significantly advance psychopathy research.

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