



## Reinforcement Sensitivity Theory and emotion regulation difficulties: A multimodal investigation

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### ABSTRACT

This study examined associations between BIS–FFFS, BAS dimensions, and emotion regulation (ER) assessed across self-report and behavioral domains among 101 adults. Findings revealed significant associations among the various ER assessments, as well as between ER and BIS–FFFS and BAS dimensions. As expected, BIS–FFFS was positively associated with self-reported ER difficulties, and, among women, BIS–FFFS was negatively associated with a behavioral measure of ER assessing the willingness to experience distress in order to pursue goal-directed behavior. BAS had a more complex association with ER, with certain BAS dimensions (e.g., Drive among women, Fun-Seeking) demonstrating unique positive associations with adaptive ER and other dimensions demonstrating negative associations with adaptive ER. Findings suggest the relevance of individual variations in BIS–FFFS and BAS to ER difficulties, as well as potential pathways through which sensitivity to punishment and reward may contribute to psychopathology.

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### 1. Introduction

Reinforcement Sensitivity Theory (RST; [Corr, 2004, 2008](#); [Gray & McNaughton, 2000](#)) is a neurobiologically-based theory of personality that asserts that three major brain subsystems known as the Behavioral Approach System (BAS), Behavioral Inhibition System (BIS), and Fight–Flight–Freeze System (FFFS) underlie many of the individual differences observed in personality, psychopathology, and reinforcement sensitivity. The BAS is theorized to be an appetitive system underlying approach behavior in response to conditioned and unconditioned cues of reward ([Corr, 2008](#)). Individuals high on BAS are proposed to be impulsive and extraverted ([Gray, 1991](#)). In contrast, the FFFS is proposed to be a defensive avoidance system that motivates avoidance and escape behaviors in response to conditioned and unconditioned aversive stimuli. The FFFS is thought to underlie fear and panic ([Gray & McNaughton, 2000](#)). Finally, the BIS is considered to be the subsystem that resolves conflicts among competing goals (e.g., approach–

avoidance conflicts) by inhibiting behavior, increasing arousal, and assessing for risk. The BIS is posited to underlie anxiety and the personality trait of Neuroticism ([Corr, 2004](#); [Gray & McNaughton, 2000](#)).

Given that the most widely-used measures of RST (including the BIS/BAS Scales used here; [Carver & White, 1994](#)) are based on the original (and now outdated) version of RST, these self-report measures actually assess combined BIS–FFFS sensitivity within the revised RST (rRST) framework ([Corr, 2004](#); [Smillie, Pickering, & Jackson, 2006](#)). In recognition of this, the present paper uses the term “BIS–FFFS sensitivity” throughout. That said, we recognize and value the important theoretical distinction made between BIS and FFFS within the rRST framework. Although we are also aware of attempts to distinguish BIS and FFFS sensitivity within the BIS/BAS Scales ([Heym, Ferguson, & Lawrence, 2008](#)), there is only limited support for such revisions to date. For example, [Heym et al.’s \(2008\)](#) proposal to subdivide [Carver and White’s \(1994\)](#) BIS scale into a 4-item BIS and 3-item FFFS scale is based on a single factor analysis of a small sample of undergraduates. One of the only other studies to examine the factor structure and reliability of these proposed revisions ([Vervoort et al., 2010](#)) reported minimally-acceptable factor structure and low internal consistency for the 3-item FFFS scale. Similarly, we found internal consistency to be quite low (.57) for the proposed 3-item FFFS scale in our sample. Thus, based on extant research and our own data, we focused exclusively on the role of combined BIS–FFFS sensitivity in ER.

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Available evidence suggests that Carver and White's (1994) BIS scale is a reliable and valid measure of combined BIS–FFFS functioning (Corr, 2004; Smillie et al., 2006).

### 1.1. RST and emotion regulation difficulties

Individual variations in BIS–FFFS and BAS sensitivity have been theorized to underlie a wide range of psychopathology, including anxiety, mood, substance, eating, and personality disorders (Fowles, 2001; Gray, 1991; Kimbrel, 2008; Kimbrel, Cobb, Mitchell, Hundt, & Nelson-Gray, 2008), and many of these predictions have been substantiated by empirical data (Bijttebier, Beck, Claes, & Vandereycken, 2009; Hundt, Kimbrel, Mitchell, & Nelson-Gray, 2008; Kimbrel et al., 2008; Kimbrel, Mitchell, & Nelson-Gray, 2010). Yet, the mechanisms through which BIS–FFFS and BAS operate to increase the risk for psychopathology remain unclear (Bijttebier et al., 2009). One mechanism that may be particularly relevant is emotion regulation (ER). As defined here, ER refers to adaptive ways of responding to emotions (regardless of their intensity/reactivity), including accepting responses, the ability to control behaviors in the face of emotional distress, and the functional use of emotions as information (Gratz & Roemer, 2004). Thus, ER can be distinguished from a temperamental emotional vulnerability, as ER involves the way in which individuals respond to their emotions (rather than the quality of these emotions). ER difficulties have been implicated in the pathogenesis of many forms of psychopathology (Gratz & Tull, 2010) and are thought to underlie the association between personality and psychopathology (Linehan, 1993).

As for the association between BIS–FFFS, BAS, and ER difficulties, theoretical literature suggests that variations in reinforcement sensitivity may have implications for the development of ER (DePue & Iacono, 1989), affecting the ways in which individuals respond to or regulate their emotions. Although no studies have examined associations between BIS–FFFS, BAS, and ER difficulties as defined here, research has demonstrated that these subsystems are associated with specific behaviors thought to stem from ER difficulties. For example, Randles, Flett, Nash, McGregor, and Hewitt (2010) found that BIS–FFFS sensitivity was significantly positively associated with rumination. Hundt et al. (2008) found that BIS–FFFS sensitivity was negatively associated with drug use, whereas BAS was positively associated with drug and alcohol use (consistent with findings of Voight et al. (2009)). Kimbrel et al. (2008) also found that BIS–FFFS was positively associated with bulimic symptoms. Further, research suggests that the relationship between BIS–FFFS and personality disorders may depend on self-regulation (a broader construct including ER) capacity (Claes, Vertommen, Smits, & Bijttebier, 2009).

### 1.2. Study objectives and hypotheses

In an attempt to further establish the role of ER in RST, the present study examined associations between BIS–FFFS, BAS, and ER using a multi-method approach. Specifically, in order to obtain a more comprehensive understanding of the relationships between BIS–FFFS, BAS, and ER, we assessed ER across subjective (i.e., self-reported ER difficulties) and behavioral (i.e., the willingness to experience emotional distress and ability to engage in goal-directed behavior in the context of distress) indices.

Given that those high in BIS–FFFS sensitivity are likely to engage in avoidance and withdrawal behaviors (which can have paradoxical, emotion-dysregulating effects; Salters-Pedneault, Tull, & Roemer, 2004), we expected that BIS–FFFS sensitivity would be positively associated with self-reported ER difficulties and negatively associated with behavioral indices of ER. Additional support for this hypothesis comes from findings that the emotions of anx-

ety and fear (which correspond to BIS and FFFS sensitivity, respectively) have been associated with numerous ER difficulties (Gratz & Tull, 2010) and the tendency to rely on avoidance as an ER strategy (Salters-Pedneault et al., 2004). Further, BIS–FFFS sensitivity is associated with the Neuroticism facet of Vulnerability, suggesting that people high in BIS–FFFS may be more likely to exhibit poor coping skills when experiencing stress (Mitchell et al., 2007).

BAS-related hypotheses were less straightforward. BAS sensitivity has been found to be associated with personality constructs that map onto particular ER difficulties examined here (e.g., difficulties engaging in goal-directed behavior and controlling impulsive behaviors when distressed). Specifically, BAS was found to be negatively associated with the Conscientious facet of Deliberation (suggesting that high BAS individuals may act without considering future consequences) and positively associated with the Neuroticism facets of Impulsivity and Anger Hostility (Mitchell et al., 2007). Thus, one might expect that BAS would be positively associated with these ER difficulties. However, recent evidence that BAS dimensions may be differentially associated with functional and dysfunctional forms of impulsivity (Leone & Russo, 2009) suggest that the BAS dimensions may have differential associations with ER as well. Specifically, given that the Fun-Seeking dimension of BAS is most strongly associated with dysfunctional impulsivity (Leone & Russo, 2009) and may be characterized by a consummatory urge to persist in appetitive behavior with minimal regard for the outcome (Corr, 2008), we hypothesized that this BAS dimension would be positively associated with ER difficulties, particularly difficulties engaging in goal-directed behaviors and controlling impulsive behaviors when distressed (the ER difficulties most closely associated with dimensions of impulsivity; i.e., lack of perseverance and negative urgency, respectively; Whiteside & Lynam, 2001). In contrast, we expected BAS–Drive to evidence negative associations with ER difficulties, as this BAS dimension is characterized by the persistent pursuit of goals and is most strongly associated with functional impulsivity (Leone & Russo, 2009). We also expected that the Reward-Responsiveness component of BAS would have negative associations with ER difficulties, as this component is primarily characterized by positive emotions and energy in response to rewards rather than impulsivity *per se*.

Finally, given evidence of gender differences in BIS–FFFS and BAS (Heym et al., 2008) and ER (Gratz & Roemer, 2004), as well as findings that gender moderates the association between ER and maladaptive outcomes (Gratz et al., *in press*), we examined if associations between BIS–FFFS, BAS, and ER differ as a function of gender.

## 2. Methods

### 2.1. Participants

Participants were 101 adults (63.4% female) from the community ranging from 18 to 60 years of age ( $mean = 24.38 \pm 10.01$ ). With regard to their racial/ethnic background, 50.5% of participants identified as White, 24.8% as Black/African-American, 10.0% as Asian/Asian-American, and 14.9% as another racial/ethnic background.

### 2.2. Measures

The *BIS/BAS Scales* (Carver & White, 1994) is a widely-used 20-item self-report measure of the sensitivity of the RST subsystems. The BIS/BAS Scales have been found to demonstrate good reliability and convergent and discriminant validity (Carver & White, 1994). Scores are obtained for four subscales: one BIS–FFFS sensitivity and three BAS sensitivity (i.e., Reward-Responsiveness, Drive, and

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