



## Reinforcement sensitivity and social anxiety in combat veterans



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### ABSTRACT

**Objective:** The present study tested the hypothesis that low behavioral approach system (BAS) sensitivity is associated with social anxiety in combat veterans.

**Method:** Self-report measures of reinforcement sensitivity, combat exposure, social interaction anxiety, and social observation anxiety were administered to 197 Iraq/Afghanistan combat veterans.

**Results:** As expected, combat exposure, behavioral inhibition system (BIS) sensitivity, and fight–flight–freeze system (FFFS) sensitivity were positively associated with both social interaction anxiety and social observation anxiety. In contrast, BAS sensitivity was negatively associated with social interaction anxiety only. An analysis of the BAS subscales revealed that the Reward Responsiveness subscale was the only BAS subscale associated with social interaction anxiety. BAS-Reward Responsiveness was also associated with social observation anxiety.

**Conclusion:** The findings from the present research provide further evidence that low BAS sensitivity may be associated with social anxiety over and above the effects of BIS and FFFS sensitivity.

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### 1. Introduction

The revised Reinforcement Sensitivity Theory (r-RST; Gray & McNaughton, 2000) is a biologically based theory of personality that proposes that variation in three major subsystems of the brain—the behavioral inhibition system (BIS), fight–flight–freeze system (FFFS), and behavioral approach system (BAS)—underlie individual differences in motivation, personality, and psychopathology. The BAS is proposed to be responsible for reward-seeking behavior and to underlie the personality trait of extraversion. The FFFS is posited to be responsible for avoidant and escape behaviors in response to aversive stimuli and to underlie the emotion of fear. The BIS is proposed to be responsible for resolving conflicts (e.g., approach–avoidance conflicts) and to underlie the emotion of anxiety and the personality trait of neuroticism (Gray & McNaughton, 2000). Consistent with the position of Gray and McNaughton (2000) and contemporary research in this area (e.g., Heym, Ferguson, & Lawrence, 2008; Kimbrel, Nelson-Gray, & Mitchell, 2012), the current paper takes the position that many self-

report inventories originally developed to assess BIS sensitivity and neuroticism actually reflect combined BIS-FFFS sensitivity. Accordingly, we use the term “BIS-FFFS” to refer to findings from earlier studies that used combined measures of BIS-FFFS (e.g., Kimbrel, Mitchell, & Nelson-Gray, 2010), whereas BIS and FFFS are used to refer to the specific neurobiological systems proposed by Gray.

#### 1.1. The reinforcement sensitivity theory of social anxiety

Consistent with Gray and McNaughton's (2000) basic premise that the BIS and FFFS underlie anxiety and fear, respectively, Kimbrel (2008) proposed that individuals high on BIS and FFFS sensitivity tend to perceive social situations as highly threatening due to biased memory and attention processing. Consequently, individuals high on BIS and FFFS sensitivity are predicted to experience heightened levels of anxiety and fear in response to social stimuli (e.g., public speaking) and to be more likely to develop social anxiety disorder (Kimbrel, 2008). Consistent with this hypothesis, numerous studies have reported that BIS-FFFS sensitivity is positively associated with social anxiety symptomatology (e.g., Coplan, Wilson, Frohlick, & Zelenski, 2006; Kashdan & Roberts, 2006; Kimbrel, Cobb, Mitchell, Hundt, & Nelson-Gray, 2008; Kimbrel et al., 2010, 2012; Ly & Gomez, 2014). Kimbrel et al. (2012)

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further demonstrated that cognitive biases fully mediate the effects of BIS-FFFS sensitivity on state social anxiety in response to a public-speaking task. Thus, the key premise of Kimbrel's (2008) model of social anxiety (i.e., that BIS and FFFS are key motivational factors underlying social anxiety and that their effects on social anxiety are mediated by cognitive biases) has received consistent support in the literature. In contrast, the role of BAS sensitivity in relation to social anxiety is less clear.

### 1.2. Low BAS sensitivity and social anxiety

Corr's (2002) joint-subsystems hypothesis posits that the BIS and BAS are interdependent systems that exert facilitatory and antagonistic effects on each other. Kimbrel's (2008) model of social anxiety builds upon this hypothesis by proposing that low levels of BAS sensitivity facilitate the effects of BIS-FFFS sensitivity on social anxiety such that individuals high on BIS and FFFS sensitivity and low on BAS sensitivity will experience the highest overall levels of social anxiety. While some studies have failed to find the hypothesized negative association between BAS and social anxiety (e.g., Kashdan & Roberts, 2006; Kimbrel et al., 2008; Ly & Gomez, 2014), the majority of studies have observed small, yet statistically significant, negative associations between BAS and social anxiety (e.g., Coplan et al., 2006; Kashdan, 2002; Kimbrel et al., 2010, 2012; Booth & Hasking, 2009; Levinson, Rodebaugh, & Frye, 2011).

One potential reason for the mixed findings regarding BAS sensitivity and social anxiety is that the magnitude of the association may be dependent upon the manner in which social anxiety symptoms are operationalized (Kimbrel et al., 2010). The existence of two separate, but closely related dimensions of social anxiety (i.e., social observation anxiety and social interaction anxiety) is well-established (e.g., Mattick & Clarke, 1998). Social observation anxiety refers to social anxiety in response to social situations involving direct observation by others (e.g., public speaking), whereas social interaction anxiety refers to social anxiety in response to social situations involving interactions with other people (e.g., a conversation with a stranger).

BAS sensitivity appears to be more strongly associated with the social interaction subdimension of social anxiety (e.g., Kashdan, 2002; Kimbrel et al., 2008, 2010; Levinson et al., 2011). For example, Kimbrel et al. (2010) examined the association between BAS sensitivity and the subdimensions of social anxiety across three samples of undergraduates and found that BAS was negatively associated with social interaction anxiety in all three samples, whereas it was unrelated to social observation anxiety across samples. Notably, this finding is consistent with prior research indicating that social interaction anxiety is strongly associated with low levels of positive affect (e.g., Kashdan, 2002, 2007), a closely related construct (e.g., Carver & White, 1994). However, when Kimbrel et al. (2010) explicitly tested whether positive affect might mediate the effect of BAS on social interaction anxiety, they found that BAS continued to predict social interaction anxiety over and above the effects of positive affect. Thus, low levels of positive affect are unlikely to account for the relationship between BAS and social interaction anxiety. While the latter study likely represents the most systematic study of the relationship between BAS and social interaction anxiety to date, it is noteworthy that BAS has been associated with both general social anxiety and social observation anxiety in other studies (e.g., Booth & Hasking, 2009; Kimbrel et al., 2012).

In an attempt to explain the unique association between BAS and social interaction anxiety, Kimbrel et al. (2010) noted that social interaction anxiety is typically associated with more severe and generalized social anxiety (e.g., Heimberg, Mueller, Holt, Hope, & Liebowitz, 1992), which, in turn, is associated with striatal dopaminergic dysfunction (e.g., Sareen et al., 2007; Schneier et al., 2000). Additional support for the role of decreased BAS sensitivity in relation to general social anxiety comes from a recent finding that social anxiety disorder is associated with decreased putamen-anterior cingulate cortex connectivity

(Cremers, Veer, Spinhoven, Rombouts, & Roelofs, 2015). Moreover, the typical motivational preference for social rewards that was found in control participants was largely absent among individuals with social anxiety disorder (Cremers et al., 2015).

Taken together, these findings suggest that low BAS sensitivity may play a significant role in social anxiety, particularly social interaction anxiety. However, a recent study by Ly and Gomez (2014) suggests that the relationship between BAS and social anxiety may also be dependent upon the manner in which BAS is conceptualized. Specifically, they examined the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia, Avila, Molto, & Caseras, 2001) and the subscales of the BIS/BAS Scales (Carver & White, 1994; Heym et al., 2008) in relation to social interaction and social observation anxiety in a sample of 200 college students and members of the general community. Findings indicated that only the BAS-Fun Seeking subscale was associated with social anxiety. Equally interesting, the BAS-Fun Seeking subscale was associated with both social interaction anxiety and social observation anxiety, whereas the other BAS subscales (Reward Responsiveness and Drive) and the SPSRQ Sensitivity to Reward scale were not. Citing prior research suggesting that the BAS-Fun Seeking subscale may actually better reflect impulsivity/lack of control than BAS/reward sensitivity (Gomez & Corr, 2010; Smillie, Jackson, & Dalgleish, 2006), Ly and Gomez (2014) reasoned that:

*When all the RST findings and interpretations are taken together, it can be concluded that when viewed in terms of the r-RST, the BIS is associated strongly and positively with both social observation anxiety and social interaction anxiety, whereas the associations for the FFFS is relatively low. Also, the BAS is not associated with social anxiety. (Ly & Gomez, 2014, p. 24).*

Ly and Gomez's (2014) conclusion that the BAS is not associated with social anxiety appears to be based primarily upon their finding that only one of the three BAS subscales (Fun Seeking) from the BIS/BAS Scales (Carver & White, 1994) was associated with social anxiety, whereas the BAS-Reward Responsiveness, BAS-Drive, and Sensitivity to Reward scales were not. Such a conclusion is understandable based on their findings alone; however, it overlooks findings from at least six previous studies that demonstrate broad support for a negative association between BAS and social anxiety across a variety of BAS and social anxiety measures (Booth & Hasking, 2009; Coplan et al., 2006; Kashdan, 2002; Kimbrel et al., 2010, 2012; Levinson et al., 2011). For example, as noted above, Kimbrel et al. (2010) found that a composite BAS factor derived from both the BIS/BAS Scales and the SPSRQ was reliably associated with social anxiety across three independent samples of undergraduates. Levinson et al. (2011) found that each of the three BAS subscales from the BIS/BAS Scales was negatively associated with social anxiety in a sample of 723 undergraduates. Booth and Hasking (2009) found that both BAS Fun Seeking and BAS Drive were negatively associated with social anxiety in a sample of 454 undergraduates. Kimbrel et al. (2012) found that the SPSRQ Sensitivity to Reward subscale was negatively associated with trait social anxiety and that it predicted social anxiety-related cognitive biases over and above the effects of the Sensitivity to Punishment subscale. Together, these studies provide substantial support for the hypothesis that low BAS sensitivity is associated with social anxiety; however, additional research aimed at delineating the exact nature of this association is needed, particularly in non-college student samples.

### 1.3. Study objective and hypothesis

The primary objective of the present research was to test the hypothesis that low BAS sensitivity is associated with social interaction anxiety. Because the vast majority of prior research on the association between BAS and social anxiety has been conducted in non-clinical college samples (e.g., Kashdan, 2002; Kimbrel et al., 2010, 2012; Booth &

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