



PTSD's underlying symptom dimensions and relations with behavioral inhibition and activation



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ABSTRACT

Reinforcement sensitivity theory (RST) stipulates that individuals have a behavioral activation system (BAS) guiding approach (rewarding) behaviors (Gray, 1971, 1981), and behavioral inhibition system (BIS) guiding conflict resolution between approach and avoidance (punishment) behaviors (Gray & McNaughton, 2000). Posttraumatic stress disorder (PTSD) severity overall relates to both BIS (e.g., Myers, VanMeenen, & Servatius, 2012; Pickett, Bardeen, & Orcutt, 2011) and BAS (Pickett et al., 2011). Using a more refined approach, we assessed *specific* relations between PTSD's latent factors (Simms, Watson, & Doebbeling, 2002) and observed variables measuring BIS and BAS using 308 adult, trauma-exposed primary care patients. Confirmatory factor analysis and Wald chi-square tests demonstrated a significantly greater association with BIS severity compared to BAS severity for PTSD's dysphoria, avoidance, and re-experiencing factors. Further, PTSD's avoidance factor significantly mediated relations between BIS/BAS severity and PTSD's dysphoria factor.

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1. Introduction

According to reinforcement sensitivity theory (RST), the behavioral activation system (BAS) guides behaviors toward positive/rewarding situations (Gray, 1971, 1981); the behavioral inhibition system (BIS) resolves conflict between approach toward a reward and avoiding punishment/threat (Gray & McNaughton, 2000). Some research indicates a significant relationship for post-traumatic stress disorder (PTSD) overall with BIS (e.g., Maack, Tull, & Gratz, 2011; Myers, VanMeenen, & Servatius, 2012) and BAS (Pickett, Bardeen, & Orcutt, 2011). Little is known about the *specific* PTSD symptom dimensions most related to BIS and BAS, and explanatory mechanisms underlying such relationships.

1.1. BAS and BIS dimensions

RST (Gray, 1971) proposes three major brain mechanisms underlying behavior. First is the fight/flight system (FFS) (Gray, 1971), renamed as fight-flight-freeze system (FFFS) in the

revised RST (reviewed in Corr, 2004; Gray & McNaughton, 2000; reviewed in Smillie, Pickering, & Jackson, 2006). FFFS guides escape/aggressive behaviors in response to punishing/non-rewarding stimuli. The FFFS is not our focus here, as it has relatively little empirical research compared to other RST constructs with no instrument to measure it. However, this concept will be considered in the paper given its important role in the revised RST as explained later.

The second RST mechanism is BAS, a reward system guiding approach behaviors, with sensitivity to situations of reward, and terminating feared/punishing stimuli (Gray, 1971, 1981). With the propensity to engage in undesirable behaviors to avoid a feared stimulus, approach behaviors could be impulsive with possibly detrimental consequences (Gray, 1971, 1981), supported by Casada and Roache (2005). Lastly, BIS guides behaviors in punishing, non-rewarding or novel situations, involving suppression (i.e., passive avoidance of negative stimuli), and increased attention/vigilance to the environment (Gray, 1971, 1981). The revised RST re-conceptualized BIS's role as that of conflict resolution between concurrently activated BAS (approach toward reward) and FFFS (avoidance from punishment), representing approach-avoidance conflict and contributing to anxiety (reviewed in Corr, 2004; Gray & McNaughton, 2000; reviewed in Smillie et al., 2006).

RST components differentially relate to several mental health conditions (e.g., Hughes, Moore, Morris, & Corr, 2012). BIS is associated with Cluster C personality disorders (Pastor et al., 2007), while BAS is more associated with Cluster B personality disorders

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Table 1
Models of PTSD factor structure.

PTSD symptoms	DSM-IV	Simms et al.
B1. Intrusive thoughts	R	R
B2. Nightmares	R	R
B3. Reliving traumas	R	R
B4. Emotional cue reactivity	R	R
B5. Physiological cue reactivity	R	R
C1. Avoidance of thoughts	A/N	A
C2. Avoidance of reminders	A/N	A
C3. Amnesia for traumatic event	A/N	D
C4. Loss of interest	A/N	D
C5. Detachment	A/N	D
C6. Restricted affect	A/N	D
C7. Hopelessness	A/N	D
D1. Sleeping difficulties	H	D
D2. Irritability/anger	H	D
D3. Concentration difficulties	H	D
D4. Hypervigilance	H	H
D5. Easily startled	H	H

Note. R, reexperiencing; A, avoidance; N, numbing; H, hyperarousal; D, dysphoria.

(Pastor et al., 2007), and ADHD (Johnson, Turner, & Iwata, 2003), and both BIS and BAS relate to bulimia (Loxton & Dawe, 2006). Little research has investigated PTSD's relation with RST components. PTSD's increased physiological (hyperarousal) and inhibited (avoidance) responding (Casada & Roache, 2005) are conceptually similar to BAS and BIS, respectively. Further, PTSD relates to external measures of anxiety (Myers et al., 2012), and impulsivity (Weiss, Tull, Viana, Anestis, & Gratz, 2012), in turn relating to BIS and BAS respectively (Gray, 1971, 1981). Thus, the RST is relevant to understanding PTSD's subcomponents.

1.2. PTSD's underlying dimensions

Previous research has demonstrated that PTSD's underlying dimensions do not support the DSM-IV tripartite model (re-experiencing, effortful avoidance/numbing, hyperarousal) based on confirmatory factor analysis (CFA) (reviewed in Elhai & Palmieri, 2011; Yufik & Simms, 2010), thus leading to the development of alternative four-factor models such as the dysphoria model (Simms, Watson, & Doebbeling, 2002). PTSD's dysphoria model retains the re-experiencing factor of the DSM-IV model, but creates a new dysphoria factor with the DSM-IV hyperarousal PTSD items D1–D3, and numbing/avoidance items C3–C7. This model is based on the literature supporting a general dysphoria or emotional distress component to the mood and anxiety disorders (Watson, 2005, 2009). Table 1 represents item mappings for PTSD's dysphoria model.

The current study focuses on this dysphoria model, based on strong empirical support (reviewed in Elhai & Palmieri, 2011; Yufik & Simms, 2010), and evidence of a slightly better fit than other PTSD models (meta-analyzed in Yufik & Simms, 2010). Further, the current study attempts to analyze the relation of specific (i.e., trauma-related such as re-experiencing) and non-specific (i.e., general distress represented by dysphoria) PTSD factors with RST as best conceptualized by the dysphoria model to capture purer PTSD constructs, with subsequent implications for treatment and comorbidity explanations.

1.3. PTSD and BIS/BAS

PTSD severity relates to BIS (Casada & Roache, 2005; Gray & McNaughton, 2000; Myers et al., 2012; Pickett et al., 2011) and BAS (Pickett et al., 2011). To elaborate, Myers et al. (2012) found that self-reported behavioral inhibition correlated positively with increased PTSD severity, especially with PTSD's avoidance in a sample of veterans. Similar results were obtained in a study by Pickett

et al. (2011) in a sample of trauma-exposed female college students; however the positive PTSD–BIS relationship was contingent on avoidance of distressing private events (e.g., thoughts and feelings) with maladaptive coping strategies. With the PTSD–BAS relation, there are mixed findings in the literature possibly attributed to the multidimensional nature of the BAS construct. While sensitivity to reward expectation as represented by one BAS dimension was negatively related to PTSD severity, functional persistence toward goals as assessed by another BAS dimension was positively related to PTSD severity (Pickett et al., 2011). In contrast to self-reports, Casada and Roache (2005) used performance-based measures of BAS and BIS, with results indicating that subjects with PTSD had a weakening BAS when perceiving little reward; however were insensitive to inhibition cues (active BAS) when perceiving reinforcement. It could be further said that the FFFS (avoidance–distress) and BAS (reward–achievement) conflict associated with PTSD symptoms may contribute to BIS severity as further elaborated.

PTSD's avoidance dimension in particular may be crucial in explaining relations between BAS/BIS and PTSD symptoms. Several PTSD theories and empirical studies have referenced the role of avoidance in the maintenance of PTSD symptoms (Maack et al., 2011; Myers et al., 2012). Based on stress response theory (reviewed in Brewin & Holmes, 2003; Horowitz, 1986) and emotional processing theory (Foa & Kozak, 1986; Foa, Steketee, & Rothbaum, 1989), PTSD's avoidance of internal/external traumatic reminders is purported to reduce the emotional impact of traumatic event exposure in the short-run. Avoidance is also negatively reinforcing, reducing fear on exposure to conditioned traumatic reminders, based on PTSD fear conditioning theory (reviewed in Brewin & Holmes, 2003; Keane, Zimering, & Caddell, 1985). However, PTSD's avoidance maintains and contributes to PTSD severity and distress by inhibiting emotional processing of traumatic memories (Foa & Kozak, 1986; Foa et al., 1989), and contributing to the re-experiencing of the trauma (Brewin, Dalgleish, & Joseph, 1996; Horowitz, 1986). The avoidance–distress relationship possibly represents the FFFS pathway (Gray & McNaughton, 2000).

In contrast to PTSD's avoidance, there is motivation toward reward achievement (Casada & Roache, 2005) based on BAS (Gray, 1971; Gray & McNaughton, 2000), however there is less reward expectancy and less satisfaction once the reward is achieved (Hopper et al., 2008). Distress and negative affect associated with PTSD symptoms (Marshall-Berenz, Vujanovic, & MacPherson, 2011; Pickett et al., 2011; Weiss et al., 2012) such as re-experiencing may decrease inhibition toward rewards (Casada & Roache, 2005), and consequently increase impulsive behaviors (following from an active BAS) (e.g., Marshall-Berenz et al., 2011; Weiss et al., 2012). Thus, emotion regulation difficulties may explain the PTSD–BAS relationship, with impulsivity relating to BAS (e.g., Aluja & Blanch, 2011) and PTSD (e.g., Ledgerwood & Petry, 2006; Weiss et al., 2012).

Thus, conflict between FFFS (avoidance–distress path) and BAS (reward–achievement path) may relate to BIS activation, and subsequent feelings of anxiety (Gray & McNaughton, 2000). The aforementioned indicates BIS's possible association with PTSD factors of avoidance and dysphoria, and BAS's possible association with PTSD's re-experiencing factor.

1.4. PTSD factors and BIS/BAS

Building on the study by Pickett et al. (2011), we aimed to investigate differential relations between PTSD's dysphoria model latent factors and observed variables of scales measuring BIS and BAS. We use a sample of trauma-exposed medical patients, because trauma and PTSD are highly related to physical health problems (Pacella, Hruska, & Delahanty, 2013) and healthcare seeking (Elhai, North, & Frueh, 2005).

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