Emotion dysregulation as a partial mediator between reinforcement sensitivity and posttraumatic stress symptoms

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A B S T R A C T

The reinforcement sensitivity theory (RST) asserts that three brain subsystems (i.e., the Behavioral Approach System [BAS], the Behavioral Inhibition System [BIS], and the Fight–Flight–Freeze System [FFFS]) underlie individual variations seen in personality and psychopathology. Though revised by Gray and McNaughton (2000), many researchers continue to utilize the original, and now outdated, theory of reinforcement sensitivity. Additionally, while there is an abundance of research investigating the association between reinforcement sensitivity and psychopathology, the underlying mechanisms between these constructs remain largely unknown. Therefore, the aim of the current study was to test whether emotion dysregulation acted as a partial mediator between FFFS sensitivity and posttraumatic stress symptoms (PTSS) under the revised RST framework. Data was collected from 282 undergraduate students at a Midwestern university who experienced at least one potentially traumatic event. Bootstrapping was used to test the significance of the indirect effect (e.g., amount of mediation) of FFFS sensitivity on PTSS. The indirect effect was significant (2000 bootstrapped CI_95 = .11 – .25), indicating that emotion dysregulation partially mediated the relationship between FFFS sensitivity and PTSS. More specifically, individuals with high FFFS sensitivity reported higher levels of emotion dysregulation, which in turn was associated with greater PTSS scores.

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1. Introduction

The reinforcement sensitivity theory (RST) of personality, as proposed by Gray (1982), draws from the notion that there are individual differences in reactions to punishing and rewarding stimuli. RST posits that three major brain subsystems (i.e., the Behavioral Approach System [BAS], Behavioral Inhibition System [BIS], and Fight–Flight–Freeze System [FFFS]) underlie individual variation in personality and psychopathology. Originally, the BAS was hypothesized to be activated in response to reward and negative reinforcement. Furthermore, the BIS was hypothesized to be sensitive to conditioned aversive stimuli. The BIS was not only related to anxiety, but also to extreme novelty, high intensity stimuli, and innate fear stimuli. Finally, the FFFS was originally known as the Fight–Flight System (FFS) and was hypothesized to be sensitive to unconditioned aversive stimuli. Gray and McNaughton made substantial revisions to RST in 2000, particularly to the BIS and the FFFS. The BIS is now conceptualized as a defensive approach system that is responsible for the emotion of anxiety, while the FFFS is a defensive avoidance system that is responsible for the emotion of fear. However, researchers continue to combine the BIS and the FFFS to form BIS-FFFS sensitivity in current RST literature. Only recently have researchers begun to utilize the revised RST (e.g., Ivory & Kambouroglou, 2012).

RST has been implicated in a number of psychological disorders, including anxiety disorders, depression, substance abuse disorders, and personality disorders (Bijttebier, Beck, Claes, & Vandereycken, 2009). Researchers are beginning to investigate relationships between reinforcement sensitivity and specific anxiety disorders; namely posttraumatic stress disorder (PTSD). The essential feature of PTSD is the development of characteristic symptoms following exposure to a traumatic stressor: persistent re-experiencing of the traumatic event, avoidance of stimuli associated with the trauma and numbing of general responsiveness, and increased arousal (American Psychiatric Association [DSM-IV-TR], 2000).

A major gap in the literature regarding RST and PTSD is that the mechanism through which reinforcement sensitivities lead to variations in PTSD symptomatology remains unclear (Bijttebier et al., 2009). One possible mechanism through which RST brain subsystems affect risk for PTSD expression is emotion dysregulation. Thus, the current study examined whether emotion dysregulation can help explain the relationship between reinforcement sensitivity and posttraumatic stress symptoms (PTSS). In addition, it is believed that these findings will add...
knowledge to the revised RST, as well as demonstrate the importance of RST to psychopathology.

1.1. The reinforcement sensitivity theory (RST)

As stated previously, RST was first postulated by Gray (1982) in order to explain variations in an individual's personality at the biological level. Currently, the BAS is conceptualized as the parallel system to the BIS, and associated personality characteristics include optimism, reward-orientation, and impulsiveness (Corr, 2008). The FFFS is responsible for mediating reactions to all aversive stimuli and mediates the “get me out of this place” emotion of fear, but not anxiety (Corr, 2008). Accordingly, the FFFS is associated with personality factors that are related to fear-proneness and avoidance. The BIS is now generally responsible for the resolution of goal-conflict (Gray & McNaughton, 2000). It mediates the “watch out for danger” emotion of anxiety, not fear. As such, the BAS maps on to disorders such as generalized anxiety disorder (GAD) and obsessive–compulsive disorder (OCD; Gray & McNaughton, 2000).

Recently, researchers have begun to recognize the need for new measurement tools that accurately reflect the revised RST (Corr, 2008). For example, Jackson (2009) attempted to operationalize the theoretical developments of RST into a set of personality scales that would effectively measure the revised RST (e.g., Jackson-5 scales of revised RST). He stated that the revised BIS must be re-conceptualized in terms of anxiety (e.g., sensitivity to uncertainty and social-evaluative stimuli), instead of a mixture of anxiety and fear. The Jackson-5 scales are an important contribution to the RST literature because they (a) are the first scales that adequately reflect the changes in the revised RST and (b) de-emphasize the importance of the BIS by placing more emphasis on the FFFS with regard to specific behaviors (i.e., avoidance and delinquency) and psychopathologies.

1.2. Associations between RST and PTSS

Few research studies have examined the relationship between reinforcement sensitivity and PTSS. For example, Pickett, Bardeen, and Orcutt (2011) found a positive association between BIS sensitivity and PTSS while investigating whether experiential avoidance (e.g., attempting to suppress unwanted emotions, thoughts, and bodily sensations; Hayes, Wilson, Gifford, Follette, & Strosahl, 1996) acted as a moderator between these two constructs. Overall, research has demonstrated strong empirical support for the relationship between BIS sensitivity and anxiety symptoms. In general, higher BIS sensitivity has been shown to be related to higher general anxiety symptoms (Campbell-Sills, Liverant, & Brown, 2004; Johnson, Turner, & Iwata, 2003).

1.3. Associations between RST and emotion dysregulation

Theory suggests that individual differences in reinforcement sensitivity may have implications for the development of emotion regulation (Depue & Iacono, 1989). In other words, whether an individual has high or low BIS, BAS, or FFFS sensitivity may affect the way that individual reacts to or regulates his/her emotions. For example, the emotional states of fear and anxiety may give rise to avoidance. This avoidance, in turn, underlies maladaptive responses to emotions (Tull, Gratz, Latzman, Kimbrel, & Lejuez, 2010). Tull and colleagues (2010) examined the associations between RST and emotion regulation difficulties as measured by the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). They found that BIS-FFFS sensitivity was positively associated with overall self-reported emotion regulation difficulties, along with BAS-Fun-Seeking. Although the study conducted by Tull and colleagues (2010) played a crucial role in extending the literature on reinforcement sensitivity and emotion dysregulation, some limitations must be addressed. For example, the authors continued to use a well-established, but not consistent with revised RST, measurement scale (BIS/BAS Scales; Carver & White, 1994) to assess reinforcement sensitivity levels.

1.4. Associations between emotion dysregulation and PTSS

Emotion regulation is a central concept in one of the major conceptual theories of PTSD: Emotional Processing Theory (EPT; Foa & Kozak, 1986). EPT states that in PTSD, the fear (emotional) structure associated with the traumatic memory promotes avoidance of trauma-related thoughts, images, and situations. This avoidance of emotional stimuli related to the event prevents emotional processing, which is needed in order for recovery to take place. Therefore, the maladaptive use of emotional avoidance can lead to the development and maintenance of PTSD. Extant literature has also demonstrated that persons with PTSD show deficits in emotion regulation. For example, Tull, Barrett, McMillan, and Roemer (2007) investigated whether emotion dysregulation was associated with severity of PTSS in a group of trauma-exposed individuals. As they predicted, PTSS severity was positively associated with reports of multiple emotion regulation difficulties. Tull et al. (2007) also found that individuals exhibiting PTSS at a severity level consistent with a diagnosis of PTSD reported significantly higher levels of emotion dysregulation. In addition, Ehring and Quack (2010) investigated the role of trauma type and PTSD symptom severity on emotion regulation difficulties in a large sample of trauma survivors. These authors found significant correlations between all emotion regulation variables and PTSD symptom severity.

2. Overview and hypotheses

The current study investigated the relationships between reinforcement sensitivity (as it was revised by Gray and McNaughton (2000)), emotion dysregulation, and PTSS. It was hypothesized that there would be a positive association between FFFS sensitivity and PTSS, given that (a) new research has shown that the BIS has a reduced role in mediating responses to punishment compared to the FFFS (Jackson, 2009) and (b) Gray and McNaughton (2000) now conceptualize the BIS as a defensive approach system, while the FFFS is now a separate defensive avoidance system. It was also hypothesized that emotion dysregulation would be positively associated with PTSS. Although no research to date has investigated the relationship between the newly revised FFFS and emotion dysregulation, due to the nature of the FFFS (that it is a defensive avoidance system) and that avoidance of thoughts and feelings is consistent with emotion regulation difficulties, it was hypothesized that FFFS sensitivity would be positively associated with emotion dysregulation. Finally, we expected that emotion dysregulation would act as a partial mediator between the relationship of FFFS sensitivity and PTSS.

3. Methods

A total of 471 undergraduate psychology students from a mid-sized Midwestern university participated in this study. Of this sample, 358 participants reported experiencing at least one traumatic event. Participants needed only to endorse that they were exposed to a traumatic event (DSM-IV-TR criterion A1); it was not required that they endorse feelings of fear, helplessness, or horror (criterion A2). The DSM-5 Task Force has decided to
eliminate the A2 criterion as research findings did not support the utility of criterion A2 (e.g., Friedman, Resick, Bryant, & Brewin, 2011); for this reason we omitted criterion A2 in our definition of a traumatic event.

Sixty-five participants were missing gender variables due to an initial omission in the online survey. All subsequent analyses focused only on the sample of 282 participants who reported experiencing at least one traumatic data and had no missing data. Participants ranged in age from 18 to 28 (M = 19.68, SD = 2.10). Sixty-three percent of participants identified as female, while 37% identified as male. In terms of ethnicity, 11% of participants identified as Latino/a, Hispanic, or being of Spanish origin. In terms of race, 177 participants identified as Non-Hispanic White, 64 participants identified as Black or African American, 13 identified as Asian or South-Asian, 3 identified as Native Hawaiian or Pacific Islander, 1 identified as American Indian or Native Alaskan, 18 identified as “other”, and 6 preferred not to respond. For subsequent analyses, race/ethnicity was collapsed into two groups: Non-Hispanic White and “all others”.

The current study received approval by the university’s Institutional Review Board. Participants were recruited from introductory psychology classes through a computerized enrollment system and received partial course credit for their participation. All questionnaire items were completed via SSI Web, a secure survey software that allows participants to complete questionnaires online. Once participants enrolled in the study, they were given online access to the survey containing informed consent and the battery of measures. Upon completion of the self-report items, participants were directed to an online debriefing form.

3.2. Measures

3.2.1. Emotion dysregulation

The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) is a 36-item self-report questionnaire comprised of six separate (albeit related) factors that measure an individual’s emotion dysregulation. These factors include lack of awareness of emotional responses, lack of clarity of emotional responses, nonacceptance of emotional responses, limited access to emotion regulation strategies perceived as effective, difficulties engaging in goal-directed behaviors when experiencing negative emotions, and difficulties controlling impulses when experiencing negative emotions. Responses for each item range from 1 to 5, where 1 = “completely disagree”, 2 = “disagree”, 3 = “undecided”, 4 = “agree” and 5 = “completely agree”. All five of the proposed factors achieved an adequate Cronbach’s alpha of .70 or greater in previous research (Jackson, 2009). Previous research has failed to demonstrate a significant association between the awareness factor in the DERS and PTSD (e.g., Tull et al., 2007). Findings from a confirmatory factor analysis of the DERS suggest that it may be useful to re-word a subset of the items that comprise the awareness factor (Adams, 2010). All of the items in the awareness factor utilize reverse scoring and do not contain the “When I’m upset” stem included in all other scale items (Adams, 2010). Therefore, in the current study, four of the six items that comprise the awareness factor in the DERS have been reworded as follows: “I pay attention to how I feel” is now worded “When I’m upset, I have difficulty paying attention to how I feel”;

“I am attentive to my feelings” is now worded “When I’m upset, I have difficulty being attentive to my feelings”; “I care about my feelings” is now worded “When I’m upset, I have difficulty caring about my feelings” and “When I’m upset, I acknowledge my emotions” is now worded “When I’m upset, I have difficulty acknowledging my emotions”.

3.2.2. Trauma history

The Traumatic Life Events Questionnaire (TLEQ; Kubany, 2004) is a 22-item measure that assesses exposure to a broad range of potentially traumatic events. Respondents are offered seven options to indicate the extent to which they have experienced each event question: never, once, twice, 3 times, 4 times, 5 times, and more than 5 times. In addition, participants who endorse experiencing at least one type of traumatic event are prompted to answer follow-up questions about the event. The TLEQ has demonstrated good psychometric properties, including convergent validity with other common measures of trauma and test–retest reliability in clinical populations, ranging from 63% to 95% (Kubany, 2004). The TLEQ was used in the current study to assess participants’ trauma exposure. Participants were excluded from the analyses if they did not endorse at least one potentially traumatic event on this measure. Participants were retained in the analyses regardless of their endorsement of feelings of fear, helplessness, or horror.

3.2.3. PTSD

The PTSD Screening and Diagnostic Scale (PSDS; Kubany, 2004) is a 38-item self-report measure for assessing PTSD according to criteria provided in the DSM-IV-TR (2000). Participants are asked to indicate the degree to which they experienced each of the 17 symptoms of PTSD. According to Kubany (2004), the PSDS can be used to make a preliminary diagnosis of PTSD by using a cutoff score of symptom severity (a score of 18 is indicative of PTSD). In the current sample, the 17 items that account for PTSD total score received a Cronbach’s alpha of .95.

3.2.4. FFFS sensitivity

The Jackson-5 Scales of revised RST (Jackson, 2009) is a self-report measure designed to assess BIS, BAS, and FFFS sensitivity in accordance with the revised RST. The Jackson-5 Scales consist of 30 items and five factors (e.g., BAS, BIS, Fight, Flight, and Freeze). Response options are as follows: 1 = “completely disagree”, 2 = “disagree”, 3 = “undecided”, 4 = “agree” and 5 = “completely agree”. All five of the proposed factors achieved an adequate Cronbach’s alpha of .70 or greater in previous research (Jackson, 2009). In the current sample, the 18 items that comprise FFFS sensitivity total score received an adequate Cronbach’s alpha of .70. Consistent with the revised RST, these scales demonstrate that a scale of fear is more correlated to the revised FFFS and its primary scales than the revised BIS. These scales also demonstrate that the revised BIS scale is highly positively correlated to another measure of social comparison, lack of confidence, and sensitivity to one’s own efforts, and that the original BIS scale (BIS/BAS Scales; Carver & White, 1994) with the fear items removed is positively correlated to the revised FFFS. Overall, results suggest that the Jackson-5 Scales have adequate measurement properties and are consistent with the latest version of RST (Jackson, 2009).

3.3. Analytic strategy

Pearson correlations were used to assess bivariate associations between measures of reinforcement sensitivity, emotion dysregulation, and PTSD (see Table 1). Although our hypotheses only included FFFS sensitivity, we included BIS and BAS sensitivity in our bivariate correlation matrix in order to assess if these revised constructs were associated with our variables of interest. The
associations between demographic factors and the variables of interest were examined before conducting the mediation analysis. Demographic variables significantly associated with FFFS Sensitivity, Emotion Dysregulation, and PTSS total score were entered as control variables in the subsequent analysis. Bootstrapping, a non-parametric resampling approach, was used to estimate the indirect effect of emotion dysregulation on FFFS sensitivity and PTSS (Preacher & Hayes, 2004).

4. Results

Demographic variables, specifically, age, gender, and race/ethnicity were added in the analyses as potential covariates. FFFS sensitivity was found to be negatively associated with age ($r = .14, p < .01$), gender ($r = .24, p < .01$) and race/ethnicity ($r = .17, p < .01$). In addition, BIS sensitivity was found to be negatively associated with age ($r = .13, p < .01$), and age, gender, and race/ethnicity (Preacher & Hayes, 2004).

Results indicated that FFFS sensitivity was positively associated with PTSS ($r = .22, p < .01$), even after controlling for age, gender, and race/ethnicity. Furthermore, the revised BIS was not significantly associated with PTSS ($r = .05, p > .05$). Additionally, the revised BAS was not significantly associated with PTSS ($r = .11, p > .05$). Emotion dysregulation was found to be positively associated with PTSS ($r = .50, p < .01$), and FFFS sensitivity was positively associated with overall emotion dysregulation ($r = .36, p < .01$). While the revised BIS was not significantly associated with emotion dysregulation, the revised BAS was negatively associated with emotion dysregulation ($r = -.24, p < .01$).

To test the hypothesis that emotion dysregulation would act as a mediator between FFFS sensitivity and PTSS, a mediational analysis was conducted utilizing Preacher and Hayes’ (2004) approach. Despite the popularity of the causal-steps approach by Baron and Kenny (1986), this method has demonstrated low power in detecting mediation (Hayes, 2009). On the other hand, bootstrapping (e.g., repeatedly sampling from the data set and estimating the indirect effect in each resampled data set) does not require this assumption of normality, and has been shown to have more power than the Sobel test (Hayes, 2009). Therefore, bootstrapping was the method used in the current study to test the significance of the indirect path.

A multiple regression analysis indicated that FFFS sensitivity was significantly related to PTSS beyond the variance accounted for by age, gender, and race ($\beta = .20, p < .001$). However, when FFFS sensitivity and emotion dysregulation were entered together with PTSS total score, the relationship between FFFS sensitivity and emotion dysregulation diminished ($\beta$ decreased from .20 to .01), and the relationship between emotion dysregulation and PTSS total score remained significant, indicating an indirect effect. Bootstrapping in SPSS Amos version 19 was used to detect the true indirect effect of emotion dysregulation, which was estimated to lie between .11 and .25 (95% CI) and was significantly different from zero ($p = .001$). These findings are summarized in Fig. 1.

Although the path model demonstrated that emotion dysregulation partially mediated the relationship between FFFS sensitivity and PTSS, due to the cross-sectional nature of the data it is plausible that FFFS sensitivity mediates the relationship between emotion dysregulation and PTSS. In order to test this, a post hoc mediation analysis was run that examined whether FFFS sensitivity acted as the mediator and emotion dysregulation was the independent variable (in predicting PTSS). This model was not significant for mediation because the bootstrapped confidence intervals contained zero (2000 bootstrapped CI .95 = −.03–.07).

5. Discussion

The aim of the current study was to examine whether emotion dysregulation can help explain the relationship between reinforcement sensitivity and posttraumatic stress symptoms (PTSS). As we expected, FFFS sensitivity was associated with greater PTSS total score. In addition, results from the mediational analysis suggest that the relationship between FFFS sensitivity and PTSS was partially mediated via emotion dysregulation. It may be that individuals who experience higher FFFS sensitivity fail to develop the emotion regulation skills necessary to adaptively cope with trauma.
exposure, which could potentially lead to an increased vulnerability to PTSS in the event of trauma exposure. There are several therapies, such as Skills Training in Affect and Interpersonal Regulation/Prolonged Exposure (Cloitre, Koenen, Cohen, & Han, 2002), that incorporate emotion regulation skills training into PTSD treatment protocols. Results from the current study add to the growing body of research suggesting that emotion regulation skills training may be a promising addition to extant therapies for the treatment of PTSD.

We believe that these findings add knowledge to the revised RST and demonstrate the importance of RST to psychopathology in various ways. One, this is the first study that has investigated the differential relationships of the revised BIS and FFFS to PTSS. In accordance with the revised RST, the FFFS was associated with PTSD, while the BIS was not associated with PTSD. Second, these findings add to the growing body of literature that investigates associations between extreme levels of reinforcement sensitivity and psychopathology. For example, higher levels of FFFS sensitivity were associated with greater PTSS. Finally, this study was one of the first attempts to actually explain the relationship between reinforcement sensitivity (e.g., FFFS sensitivity) and psychopathology.

Despite interesting findings, there are several limitations of the current study worth noting. First, participants’ report on each variable of interest was obtained retrospectively. Therefore, recall bias could impact some of the participants’ self-reporting. Additionally, it is unclear whether the current sample is presenting with diagnosable levels of PTSS symptoms. Using the symptom scoring instructions of the PSDS (Kubany, 2004), 102 participants reported mild to moderate symptoms of PTSD, 14 reported moderate to severe symptoms of PTSD, and 6 reported severe symptoms of PTSD. Therefore, out of the 358 participants that reported at least one mild to moderate symptoms of PTSD, 14 reported moderate to severe symptoms of PTSS. It may be that individuals who have high FFFS sensitivity fail to develop adaptive emotion regulation skills necessary to allow them to cope with a traumatic event. Future studies that aim to assess for variables mediating the relationship between RST and PTSS should ideally be prospective in nature and should assess for known comorbid disorders that are associated with PTSD.

References


