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Revised Reinforcement Sensitivity Theory: Implications for psychopathology and psychological health

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ABSTRACT

We examined the utility of revised Reinforcement Sensitivity Theory (r-RST) in comparison with original Reinforcement Sensitivity Theory (o-RST) in further understanding psychopathology and well-being. In line with theory, we found o-BIS to be a non-specific predictor of anxiety and stress whereas r-BIS and r-FFFS scales were predictors of anxiety and stress. Consistent with the joint systems hypothesis, depression was associated with r-BIS, but only when r-BAS was low. The r-BAS, low o-BIS and low r-Freeze were the only predictors of psychological well-being. These findings suggest that r-BAS as we measured it reflects more functional approach behaviour than measures of o-BAS. Further, while o-BIS appears to be associated with broad negative affective states, the parsing of r-BIS from fear potentially provides r-RST with a more refined understanding of psychopathology and reduced well-being.

1. Introduction

Reinforcement Sensitivity Theory originally proposed by Jeffrey Gray in 1970 (o-RST; Gray, 1970) and, to a lesser extent, its *revision* in 2000 (r-RST; Gray & McNaughton, 2000) have been used to help explain individual differences in human functioning. In o-RST, the Behavioural Activating System (o-BAS) acts as a motivational system sensitive to signals of reward that lead to positive emotions and approach behaviour. The Behavioural Inhibition System (o-BIS) is sensitive to signals of punishment and is associated with anxiety, fear and avoidance behaviour. A major departure of r-RST from o-RST is the parsing of o-BIS into two separate neurological and conceptual systems–a Fight, Flight, Freeze System (r-FFFS), which detects threat and punishment and elicits the subjective experience of *fear*, and r-BIS which is concerned with conflict detection and resolution and elicits *anxiety*.

RST has been applied to the study of problematic behaviours, such as substance abuse, eating disorders, pathological gambling, depression and anxiety disorders (Bijttebier, Beck, Claes, & Vandereycken, 2009), as well as functional behaviours, including work performance (Izadikhah, Jackson, & Loxton, 2010). Most research has been from the perspective of o-RST, given the lack of valid and reliable measures of the r-RST constructs.

Attempts to use existing o-RST scales as proxy measures of r-RST by separating fear and anxiety items into separate measures of r-BIS and r-FFFS (e.g., Heym, Ferguson, & Lawrence, 2008) have been criticised on the grounds that existing measures of o-BIS lack sufficient items assessing fear and anxiety and no items reflecting the cautious approach component of o-BIS (Dissabandara, Loxton, Dias, Daglish, & Stadlin, 2012). A further potential problem is that the word "anxiety" as understood in the English language might be different from more constrained definitions such as employed by White and Depue (1999). Thus, simply dividing items into those seemingly related to fear and anxiety would not provide good measurement of the underlying constructs. Jackson (2009) presented scales designed to measure the five systems of r-RST (known as the Jackson 5, or J5), thus providing a means of investigating the relationship between personality and behaviour from an r-RST perspective. In the J5, r-BAS is a single scale associated with generally functional reward seeking behaviour, r-BIS is associated with social anxiety in line with the perspective taken by White and Depue (1999) and r-FFS comprises of three scales r-Fight (defensive aggression), r-Flight and r-Freezing. The aim of the present study is to investigate psychopathology (anxiety and depression) and well-being from the perspective of both o-RST and r-RST (as measured by the J5).

1.1. RST and anxiety

We used the Depression, Anxiety and Stress Scale (DASS; Lovibond & Lovibond, 1995) as a measure of psychopathology. The DASS does not distinguish anxiety and fear as conceptualised

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in r-RST, with several of the "anxiety" items on this scale including symptoms of fear or panic (e.g., 'I was worried about situations in which I might panic and make a fool of myself') and several "Stress" items including symptoms of anxiety (e.g., 'I found it difficult to relax'). Given this mixture of anxiety and fear items it seems likely that a measure of o-BIS would be more strongly associated with the DASS Anxiety and Stress scales than the J5 measure of r-BIS which assesses conflict and anxiety in terms of the evaluation of personal adequacy during social interactions (White & Depue, 1999). This suggests:

Hypothesis 1. The o-BIS will show a stronger positive correlation with the Stress and Anxiety sub-scales of the DASS than the r-BIS.

Support for H1 would confirm how fear and anxiety are generally confounded in both our understanding of o-RST and anxiety and stress, rather than suggest that o-RST is a superior model to r-RST.

1.2. RST and depression

As high BAS sensitivity is associated with positive affect and low BAS sensitivity with dejected emotions, the approach system may play an important role in the aetiology of depression (Trew, 2011). At the behavioural level, Trew (2011) suggested low BAS activity leads to approach deficits and thus a reduction in positive rewarding experiences. Indeed, mildly depressed individuals show a reduction in exercise and social activities, have lower expectations of rewarding experiences, and experience potentially rewarding experiences as less rewarding (Hopko, Lejuez, Ruggiero, & Eifert, 2003; Jones & Day, 2008). Lower BAS functioning has predicted slower recovery from depressive episodes and less clinical improvement at follow-up (Kasch, Rottenberg, Arnow, & Gotlib, 2002; McFarland, Shankman, Tenke, Bruder, & Klein, 2006).

The avoidance system may also play a role in depression. While at least two studies have failed to find an association between the o-BIS scale and positive affect Carver & White, 1994; Heubeck, Wilkinson, & Cologon, 1998), Campbell-Sills, Liverant, and Brown (2004) found that in a clinical sample, patients high in o-BIS reported less positive affect. Pinto-Meza et al. (2006) found people suffering from a major depressive disorder reported low o-BAS and high o-BIS. These results are consistent with the joint subsystems hypothesis (Corr, 2002) that conceptualises the r-RST systems as a dynamically interacting network in which the behavioural output of each of the motivational systems is determined by an interaction between the systems. For example, FFFS activity includes inhibitory output to the BAS, reducing overall BAS output (Smillie, Pickering, & Jackson, 2006b). It is possible that high r-BIS/r-FFFS activity may lower r-BAS output (resulting in reduced positive emotionality), exacerbating the depressive symptoms to a clinically significant level. The above leads to the following hypotheses in relation to depression:

Hypothesis 2. o-BAS and r-BAS will be negatively correlated with depression and o-BIS and r-BIS will be positively correlated with depression.

Hypothesis 3. r-BIS will moderate the relationship between r-BAS activity and depression, specifically, clinically significant levels of depression will be reported when r-BAS activity is low, but only if r-BIS is at least moderately high.

1.3. RST and well-being

While the relationship between personality and well-being has received relatively little attention, it is widely agreed that activation of the o-BAS is associated with positive affective well-being (Carver & White, 1994; Erdle & Rushton, 2010) and happiness (Jorm et al., 1999). However, how BAS operates to influence personality is uncertain (see Pickering & Smillie, 2008). One conceptualisation, common in measures of o-BAS, is that BAS activation influences a number of traits, including novelty seeking, rash impuslivity and reward dependence (Pickering & Smillie, 2008). In the development of the J5, Jackson (2009) argued that an r-BAS scale should primarily measure functional approach behaviour, as rash approach behaviour may reflect activity at the cortical level rather than BAS functioning (Dawe & Loxton, 2004; Gullo & Dawe, 2008; Smillie & Jackson, 2006; Smillie, Jackson, & Dalgleish, 2006a). This suggests that r-BAS, as measured by the J5, is more likely than o-BAS to be associated with wellbeing (Smillie & Jackson, 2005; Smillie & Jackson, 2006).

While the role of personality as an influence on affective well-being is quite strong, there is only weak support for personality variables directly influencing cognitive well-being. Cognitive well-being, as a general rating of life satisfaction, is likely to be influenced by factors other than personality (Ryff & Keyes, 1995). Jovanovic (2011) found a relationship between personality variables (activity, low neuroticism) and affective well-being, but not cognitive aspects of well-being when affective well-being was partialled. Erdle and Rushton (2010) found self-esteem (an index of cognitive well-being) showed only a small-moderate positive correlation with o-BAS and a negative correlation with o-BIS ($r \sim .25$). Desiardins, Zelenski, and Coplan (2008) found Diener's Satisfaction With Life Scale to be negatively correlated with o-BIS ($-.33$) but uncorrelated with o-BAS. This leads to the following hypotheses:

Hypothesis 4. o-BAS will be less strongly correlated with well-being than r-BAS.

Hypothesis 5. r-BAS will be positively correlated with measures of well-being and r-BIS/r-FFFS will be negatively correlated with measures of well-being.

Hypothesis 6. r-RST measures will show a stronger correlation with measures of affective well-being than cognitive well-being.

2. Methods

2.1. Participants

Participants from two related studies were included in the analysis. The first sample comprised 174, the second 167 undergraduate students. In both samples 76% of participants were female, with a mean age of 19.7 (range 16–45 years). The majority (60%) were Caucasian, 28% Asian, and 12% 'other' ethnicity. Participants received course credit.

3. Measures

3.1. r-RST

The J5 (Jackson, 2009) is a 30-item scale measuring r-BAS, r-BIS, r-Fight, r-Flight and r-Freeze, as described above. Items are scored on a 5-point Likert scale from 1 (completely disagree) to 5 (completely agree) with higher scores reflecting higher activity of the motivational systems. The internal consistency of the scales in this study were; r-BAS ($\alpha = .80$), r-BIS ($\alpha = .70$), r-Fight ($\alpha = .75$), r-Flight ($\alpha = .62$) and r-Freezing ($\alpha = .61$). Other studies have re-