Revision and clarification of the sensitivity to punishment sensitivity to reward questionnaire

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ABSTRACT

Gray's reinforcement sensitivity theory (RST; 1982, 1991) describes two distinct neurobiological systems which underlie motivation and behavioral responding: the Behavioral Activation System (BAS), relating to approach behavior in response to reward, and the Behavioral Inhibition System (BIS), relating to inhibition in response to punishment. The operationalization of RST has been hindered by existing self-report measures. The Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001) was derived directly from RST. The SPSRQ was written in Spanish with a yes/no response format. Existing English translations of the SPSRQ have been literal, impairing the comprehension of items. The present study clarified the English translation of the SPSRQ and changed the response scale to a 5-point Likert-type scale. Exploratory factor analysis indicates that the resulting SPSRQ - Revised and Clarified (SPSRQ-RC) is a unidimensional factor, each comprised of 10 items, consistent with RST's BAS and BIS constructs. Confirmatory factor analysis maintained the factor structure and reliability of the SPSRQ-RC. Test-retest analysis indicated the measure's stability across time. Additionally, reliability and validity analyses indicated that the SPSRQ-RC has good psychometric properties. It also predicted outcomes in the predicted directions. Improvements to this scale increase our ability to properly assess RST.

1. Introduction

Gray's (1982, 1991) reinforcement sensitivity theory (RST) posits that differences in how individuals perceive reward and punishment motivate learning and behavioral responses, underlying key personality dimensions such as impulsivity and anxiety. Initially developed for animal learning research, the application of Gray's RST (1982, 1991) to the study of individual differences in human personality has led to a better understanding of how approach and avoidance traits affect human behavior. RST outlines three distinct neurobiological systems involved in reward and punishment sensitivity and response: Behavioral Activation System, Behavioral Inhibition System (BIS), and Fight/Flight System (FFS).

The BAS is responsible for responding to stimuli that are rewarding or relieve punishment, encouraging approach behavior, and manifesting as trait impulsivity (Gray, 1977, 1981, 1990). The BIS is implicated in the passive avoidance of punishment, the extinction of behavior in response to lacking reward, and behavioral inhibition in response to novel stimuli (Gray, 1978, 1981, 1987, 1990). The BIS is linked with trait anxiety. A recent revision of RST (Smillie, Pickering, & Jackson, 2006) maintains this conceptualization of BAS, but reconceptualizes BIS as a conflict detection system described in more detail below. Lastly, the FFS responds to unconditioned threats, triggering flight away from threats perceived as far away or flight if threats cannot be escaped (Fowles, 1987, 1993; Franken, Muris, & Rassin, 2005; Gray, 1981, 1987, 1990; Smillie et al., 2006; Smillie & Jackson, 2005).

RST predicts that individuals vary in their BAS and BIS sensitivity, resulting in individual differences in mood, personality, and behavioral responding (Gray, 1994). Individuals with higher BAS reactivity are motivated more by reward than punishment, show higher trait impulsivity, and are characterized as more optimistic with a generally positive affective profile. Conversely, individuals with higher BIS reactivity respond more to punishment, demonstrate higher trait anxiety, and are predisposed to a negative, frustrated, or sad affective profile (Carver, 2004; Gray, 1978, 1981, 1987, 1990; Smillie et al., 2006). Trait impulsivity and anxiety are orthogonal personality dimensions in RST; likewise, BAS and BIS activity occur through distinct neurological substrates. Earlier conceptualizations of BIS and BAS considered the activation of these two systems to be independent and mutually
inhibitory, in that each system responds to stimuli separately from the other but activation of both results in one constraining the other (Gray, 1970, 1982, 1987; Gray & Smith, 1969; Matton, Goossens, Braet, & Vervaet, 2013; Pickering, 1997). However, Corr (2002) posited through the Joint Systems Hypothesis that both systems respond simultaneously to stimuli: The BIS facilitates while the BAS antagonizes avoidance-motivated behavior, while approach-motivated behavior is facilitated by the BAS and antagonized by the BIS. Thus, individuals with high BAS and low BIS sensitivity are prone to reward-seeking and approach behavior, while individuals with low BAS and high BIS reactivity are more sensitive to punishment and thus behaviorally inhibited (Corr, 2001, 2002; De Pascalis, Arwari, Matteucci, & Mazzocco, 2001; Kambouroupolos & Staiger, 2004; Smillie & Jackson, 2005).

Gray and McNaughton (2000) revised RST, addressing the function of the BIS and FFS and removing the emphasis of conditioned versus unconditioned stimuli. In the revised reinforcement sensitivity theory (rRST), the FFS responds to all aversive stimuli, regardless if conditioned or unconditioned, initiating flight, fight, or freeze behaviors. In rRST, the FFS is renamed the Fight-Flight-Freeze System (FFFS; Beck, Smits, Claes, Vандereycken, & Bijttebeir, 2009; Gray & McNaughton, 2000). The BIS assumes a conflict-resolution role in rRST by attending to novel or conflicting stimuli and encouraging behavioral inhibition or activation of the FFFS (Beck et al., 2009; Gray & McNaughton, 2000; Luman, van Meel, Oosterlaan, & Geurts, 2012). Individual differences in BIS and BAS reactivity still account for personality in rRST, such that high BAS is related to trait impulsivity and positive affect and high BIS is related to trait anxiety and negative affect (Corr & McNaughton, 2008).

In addition to personality and behavioral responding, the BAS, BIS, and FFFS are related to the development and presentation of psychopathology. For example, panic and phobia disorders have been linked with increased FFFS reactivity. Increased BIS reactivity has been associated with anxious-rumination, generalized anxiety, and obsessive compulsive disorder. Addictive behaviors and alcohol misuse have been associated with increased BAS reactivity (Corr & McNaughton, 2008; Gray, 1982; Lyvers, Czerckzyzk, Follen, & Lodge, 2009; Lyvers, Duff, Basch, & Edwards, 2012). Eating disorders have been associated with different profiles of punishment and reward sensitivity, stemming from variations in BIS and BAS reactivity (Beck et al., 2009; Matton et al., 2013). Because the literature has established relations between BAS and BIS and psychopathology, assessment of individual differences of BAS and BIS reactivity is warranted.

Unfortunately, the operationalization of Gray’s theory into self-report questionnaires has been problematic (Aluja & Blanch, 2011; Corr, 2001; Smillie et al., 2006). As such, the measurement of Gray’s personality dimensions has become an impediment to advancing understanding of their relation to human behavior (Jorm et al., 1999; Leone, Perugini, Bagozzi, Pierro, & Mannetti, 2001; Torrubia, Ávila, Moltó, & Caseras, 2001). The assessment of BIS and BAS functioning of RST has focused on the related anxiety and impulsivity personality traits and resulting behavior (Torrubia et al., 2001). One of the more prominent measures used in RST literature is Carver and White’s (1994) BIS/BAS Scales (Torrubia et al., 2001). However, the BIS/BAS Scales were constructed on a broader conceptualization of sensitivity to reward and punishment and do not directly derive from Gray’s RST. Because of this, the BIS/BAS Scales’ direct application to RST is questionable (Cogswell, Alley, van Dulmen, & Fresco, 2006; Torrubia et al., 2001). In response, Torrubia et al. (2001) developed the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ). The SPSRQ is a 48-item self-report questionnaire comprised of two scales, Sensitivity to Punishment (SP; 24 items) and Sensitivity to Reward (SR; 24 items). Responses to all items in the scale are in “yes/no” format. Items in the SP scale address individual differences in BIS activity by describing specific circumstances in which individuals might perceive punishment and display inhibition or avoidance. Items in the SR subscale address individual differences in BAS activity by describing specific situations in which participants might be cued for reward and engage in approach behaviors (Torrubia et al., 2001). The SPSRQ was written in Catalan and validated with samples of Spanish undergraduate men and women. Reliability was good for the SP scale for men (alpha = 0.83) and women (alpha = 0.820) and for the SR scale for men (alpha = 0.78) and women (alpha = 0.75). Additionally, three-month test-retest correlations were good for both the SP (r = 0.89) and SR (r = 0.87). The SPSRQ also demonstrated good construct validity (Torrubia et al., 2001). Torrubia, Ávila, Moltó, and Grande (1995) found that scores on the SP and SR were associated with performance during a computer task. High SP scores were associated with a low number of punishable errors and a low number of responses when the participant was unsure of a correct answer during a computer game while those high scores on SR were associated with a high number of passive avoidance errors. Furthermore, following termination of reward, those higher in SP were quicker to extinguish approach behavior. Although Torrubia et al. (1995) conducted an exploratory factor analysis (EFA) of the SPSRQ and concluded that items loaded onto two factors adequately, they did not present factor loadings (O’Connor, Coldor, & Hawk, 2004).

Other studies endorse the validity of the SPSRQ. The SP and SR scale do not correlate significantly with each other, supporting divergent validity (Caseras, Ávila, & Torrubia, 2003; O’Connor et al., 2004; Smillie & Jackson, 2005). Also, the SP scale significantly positively correlates with other BIS measures while the SR scale significantly positively correlates with other BAS measures and not significantly with other BIS measures (Brebben & Martin, 1995; Caseras et al., 2003; O’Connor et al., 2004; Smillie & Jackson, 2005; Torrubia et al., 2001). However, in their review of the SPSRQ, O’Connor et al. (2004) identified limitations in convergent and divergent validity of the English translation of the SPSRQ: correlations between items within each scale were only slightly higher than correlations between items across scales (O’Connor et al., 2004). In a confirmatory factor analysis (CFA) of the SPSRQ, O’Connor et al. (2004) found the two-factor model did not fit the data well. Because of this, EFA was used to examine alternative models, resulting in a model of best fit that trimmed six items from the SP scale and seven from the SR scale (O’Connor et al., 2004). CFA indicated the items in the trimmed measure loaded significantly and substantially on the two-factor model and correlated well with theoretically similar measures. However, the authors note that an awkward translation from Catalan to English may have hindered the original scale’s model fit, identifying a need for a better translation of the original measure (O’Connor et al., 2004). A replication of O’Connor et al.’s (2004) factor analysis yielded similar results in that the two-factor model did not fit the data well and identified nine items hindering fit in their analysis - items which were trimmed in O’Connor et al.’s (2004) model (Cogswell et al., 2006). After trimming these items, the two-factor model better fit the data in a second sample (Cogswell et al., 2006).

The factor structure of the SPSRQ has not been supported even when language and culture are accounted for. In a Chilean sample of men and women, the SPSRQ demonstrated acceptable validity and high reliability in the total sample. However, SR and SP were significantly correlated in their sample of men, a relation that violates RST’s prediction of orthogonality between SP and SR and the scale’s validity (Dufey, Fernández, & Mourgues, 2011). Further, CFA revealed poor model fit of the two-factor structure, both when the analyses were conducted by sex and when the entire sample was analyzed, even when problematic items were eliminated (Dufey et al., 2011). Thus, issues with model fit to the two-factor structure may extend beyond language comprehension across cultures (Dufey et al., 2011).

The next issue with the SPSRQ is the response format chosen by the original authors. They decided to use a True/False dichotomous response format. This response type can be problematic, as respondents must choose between only 2 options that may actually represent different constructs, rather than high and low values on one construct. As
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