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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 Catalan 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 indicated the resulting SPSRQ - Revised and Clarified (SPSRQ-RC) presented with two unidimensional factors, 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 expected 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 fight 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

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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, 2005; Kambouropoulos & 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 fight, flight, or freeze behaviors. In rRST, the FFS is renamed the Fight-Flight-Freeze System (FFFS; Beck, Smits, Claes, Vandereycken, & Bijttebier, 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, Czerczyk, Follent, & 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, Alloy, 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, Colder, & 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 (Brebner & 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

such, scores are ipsative, reflecting intraindividual quantification rather than interindividual information (Clark & Watson, 1995). In most cases, such ipsative measurement of theoretically normally distributed constructs is not recommended (Hicks, 1970). Comrey (1988) has argued in favor of Likert-scaled response formats, as they tend to be more psychometrically reliable, give more stable statistical results, and, thus, produce scales with higher utility, when compared to scales using a forced-choice response format.

Model modifications have resulted in alternative versions of the SPSRQ. Cooper and Gomez (2008) trimmed poorly fitting items to create a short version of the scale (SPSRQ-S; Cooper & Gomez, 2008). In a CFA, the SPSRQ-S demonstrated high factor loadings and improved global fit indices, although it did not have acceptable overall model fit. The SPSRQ-S also demonstrated low intercorrelations, similar to the original SPSRQ, and good discriminant and convergent validity (Cooper & Gomez, 2008). Another short version of the SPSRQ, the SPSRQ-20, reduced the measure to 20 items total and improved the scale's factor structure (Aluja & Blanch, 2011). The SPSRQ-20 demonstrates similar convergent validity and correlations as the original SPSRQ and correlates highly with the SPSRQ (Aluja & Blanch, 2011). However, the SPSRQ-20 relied heavily on principal component analysis (PCA) to select items to retain in the shortened version of the scale. This is a problem as PCA is an atheoretical approach to determining factor structure (Comrey & Lee, 2013), yet the original items of the SPSRQ where written with an underlying latent structure in mind. Additionally, PCA tends to inflate factor loadings, which may maintain the issues with the factor structure across different samples. A child version of the SPSRQ, the SPSRQ-C, was validated in Dutch for children ages 6 to 13 (Luman et al., 2012). However, this measure fit best with four-factor and five-factor models, again reflecting limitations in the two-factor structure (Luman et al., 2012).

Despite concerns with the measurement model, the SPSRQ is derived directly from RST and its psychometric properties of validity and reliability suggest its usefulness in BIS and BAS measurement. Because of this, further assessment and better language translations of the scale are warranted (Cogswell et al., 2006; Cooper & Gomez, 2008; Dufey et al., 2011; Smillie & Jackson, 2005). Establishing the psychometric validity of commonly used approach/avoidance assessments is a critical antecedent necessary for establishing meaningful behavioral prediction from these two personality constructs.

The goals of the present study were to clarify the items from the original SPSRQ in order to improve understanding of the English versions of the items, change the response scale from True/False to a 5-point Likert-type response scale, and to determine, following these changes, the psychometric properties of this revised and clarified version of the SPSRQ-RC. We attempted to accomplish these goals over three studies, one in which we tested the psychometric properties of the reinterpreted SPSRQ, a second study in which we confirmed a new factor structure, and a third in which we assessed the test-retest of the SPSRQ-RC.

2. Study 1: exploratory factor analysis

2.1. Method

2.1.1. Participants

Data for study 1 were collected in the fall semester of 2010 at a large east coast university. Participants (n = 769) ranged in age from 18 to 54 years old (M = 21.47, SD = 3.71). The sample was 71% female and participants self-reported race (12.9% Asian, 0.4% American-Indian/Alaskan Native, 16.2% Black, 2.2% Multiracial, 0.6 Pacific Islander, 62.8% White, 4.2% Chose not to respond) and ethnicity (5.5% Hispanic, 85.9% Not Hispanic, 6.9% Chose not to respond). Participants we enrolled in courses that were participating in the Psychology Research Pool and received research credit for completing the study. The study was conducted via computer in a computer lab on campus

Table 1
Descriptive statistics for the original SPSRQ.

Item	M (SD)	Factor loading even (SR)	Factor loading odd (SP)
1. Refrain from doing illegal	1.2 (0.71)	0.16	0.58
2. Money motivates me	1.2 (0.57)	0.67	0.01
3. Prefer not to ask	1.1 (0.68)	0.46	0.31
4. Being valued encourages me	1.2 (0.56)	0.97	− 0.25
5. I am afraid of new situations	1.0 (0.74)	− 0.04	0.86
6. Physically attractive	1.2 (0.59)	0.74	− 0.05
7. Difficult to call someone	1.1 (0.74)	0.05	0.75
8. Drugs because of pleasure	1.1 (0.75)	0.03	0.73
9. Avoid a fight	1.1 (0.77)	0.04	0.78
10. I do things to be praised	1.1 (0.70)	0.33	0.48
11. Bothered by punishments	1.0 (0.78)	− 0.09	0.89
12. Center of attention	1.1 (0.74)	0.24	0.56
13. I think a lot about failure	1.2 (0.65)	0.53	0.24
14. Spend time good image	1.1 (0.69)	0.48	0.32
15. Easily discouraged	1.1 (0.76)	0.04	0.79
16. People show affection for me	1.0 (0.74)	0.18	0.64
17. I am a shy person	1.1 (0.69)	0.01	0.72
18. My opinions are intelligent	1.1 (0.71)	0.28	0.51
19. Being embarrassed	1.1 (0.72)	0.08	0.72
20. I pick up attractive people	1.0 (0.78)	0.03	0.78
21. A good topic to talk about	0.99 (0.77)	− 0.15	0.97
22. Get people's approval	1.1 (0.71)	0.34	0.47
23. Fall asleep	1.2 (0.63)	0.61	0.13
24. Playing fair	1.0 (0.82)	0.04	0.83
25. Meal is not well prepared	1.1 (0.64)	0.44	0.28
26. Immediate gain	1.1 (0.70)	0.41	0.39
27. Given the wrong change	1.1 (0.70)	0.25	0.51
28. Doing forbidden things	1.0 (0.77)	0.06	0.76
29. Avoid unknown places	0.99 (0.77)	− 0.08	0.91
30. Do everything I can to win	1.1 (0.69)	0.31	0.44
31. Worry about things	1.2 (0.66)	0.35	0.46
32. Tastes and smells	1.2 (0.57)	0.91	− 0.21
33. Ask my boss for a raise	1.2 (0.66)	0.40	0.36
34. Remind me pleasant events	1.2 (0.62)	0.81	− 0.07
35. Avoid speaking in public	1.1 (0.68)	0.20	0.53
36. Difficult for me to stop	0.97 (0.82)	− 0.21	1.0
37. Insecurity or fear	1.1 (0.70)	0.24	0.56
38. I do things for quick gains	1.1 (0.69)	0.33	0.42
39. Afraid of many things	1.0 (0.78)	− 0.11	0.95
40. Distracted attractive stranger	1.1 (0.70)	0.35	0.44
41. Mental tasks is impaired	1.1 (0.76)	0.05	0.79
42. Risky jobs	0.99 (0.80)	− 0.04	0.87
43. Not be rejected by others	1.0 (0.76)	0.02	0.82
44. Competition out of activities	1.1 (0.73)	0.16	0.62
45. Threats to pleasant events	1.1 (0.77)	− 0.01	0.84
46. Socially powerful person	1.2 (0.64)	0.59	0.16
47. Fear of being embarrassed	1.1 (0.70)	0.13	0.67
48. Physical abilities	1.0 (0.77)	0.04	0.76

Note: Items are on a dichotomous True/False scale. Items were extracted using Principle Axis Factoring and Rotated using Promax Rotation, factors were correlated at 0.71.

and had the approval of the Institutional Review Board.

2.1.2. Measures

2.1.2.1. Demographics. Participants completed a demographics questionnaire as part of the battery.

2.1.2.2. SPSRQ. For comparison purposes, descriptive data from the original SPSRQ are presented in Table 1. The SPSRQ (SPSRQ; Torrubia et al., 2001) is a 48-item dichotomous Yes/No self-report measure purported to load on two factors, Sensitivity to Punishment (SP) and Sensitivity to Reward (SR). While research has supported the validity and reliability of this measure (Smillie & Jackson, 2005; Torrubia et al., 2001), other research suggests problems with the two-factor structure (see Cooper & Gomez, 2008 and O'Connor et al., 2004), which were reviewed in the introduction. Note that this data comes from a different sample than the sample that completed the SPSRQ-RC. This sample is comprised of undergraduate students who completed the original SPSRQ as part of a larger study examining predictors of engagement in health risk behaviors. The sample was 71.6% female, 62.4% self-identified as White, 16.7% as Black, and 4.4% self-identified as Hispanic/Latino with an average age of 20.6 (18.1 to 44.3) years.

2.1.2.3. SPSRQ-RC. Participants completed the revised and clarified version of the SPSPQ, which was nested in a battery of measures designed to collect data on predictors of engagement in health risk behaviors. The only revision to the original scale was to change the scale of measurement from true/false to a 1–5 Likert-type scale ranging from 1 – Very Untrue to 5 – Very True, with intermediate anchors 2 – Somewhat Untrue, 3 – Neither Untrue nor True, and 4 – Somewhat True. The clarification attempted to address the awkward translation from Catalan to English noted by previous research (O'Connor et al., 2004). The primary goal for the clarification was to reword items so that they were more clear in English, as the original translation of the SPSRQ appeared to be literal (word-for-word) rather than a dynamic translation (translated for meaning). Additionally, all items were reworded from questions to statements written in first person English. The clarification process consisted of having the lead author and a number of graduate students each rewrite the items in an effort to maintain the meaning of the item being asked but to do so using more common English phrasing, rather than the original Catalan phrasing. Table 2 presents the original SPSRQ items as well as the SPSRQ-RC items so that the reader can clearly see what alterations were made.

2.1.3. Analyses

Data were analyzed in SPSS 23 (IBM Corp, 2015). Descriptive statistics were calculated for all items on the revised and clarified SPSRQ, including range, skew, kurtosis, mean, standard deviation (see Table 3). Exploratory factor analysis (EFA) was then used to determine the factor structure of the revised and clarified SPSRQ. Principle axis factoring with promax rotation was used to determine factor loadings, cross-loadings, and amount of variance explained. Data were extracted to two factors as it was not our goal to devise a new factor structure. All items were retained if their factor loadings were above 0.50 and if they did not cross-load higher than 0.30. Items could also be dropped if their psychometric properties indicated that they were not functioning correctly (i.e., skewed, kurtotic, not all response choices endorsed). Cronbach's α was calculated after the new factor structures were determined.

2.2. Results

Descriptive analyses indicated that revised SPSRQ items had acceptable skew and kurtosis. Additionally, the analyses indicated that all items were roughly normally distributed (see Table 3). Given these results all 48 items were retained for the EFA. The EFA indicated that 14 of the 24 items on the SR scale loaded onto the SR factor with a factor loading < 0.50 (see Table 3). Additionally, 10 of 24 items on the SP factor had factor loadings < 0.50. These items were trimmed from the scale. The next 4 items with the lowest factor loadings were removed from the SP scale to create a subscale with 10 items. The 2 scales with 10 items each explained 36% of the variance. The SR factor had a Cronbach's α = 0.80. The SP factor had a Cronbach's α = 0.86.

2.3. Study 1 discussion

The EFA resulted in a new, 20-item version of the SPSRQ, called the Sensitivity to Punishment, Sensitivity to Reward Questionnaire, Revised and Clarified (SPSRQ-RC). Items loaded onto two factors, Sensitivity to Punishment (SP;10 items) and Sensitivity to Reward (RS; 10 items). Retaining the two-factor model is consistent with the original SPSRQ and its application to RST's BIS and BAS. Each item's translation from Catalan has been clarified to retain the original definition while presenting the item with English phrasing. Additionally the items are now scaled on a 5 point Likert-type response scale, which allows for more freedom in responding compared to the previous true/false response scale (Comrey, 1988). Cronbach's α indicates that both subscales are unidimensional, consistent with RST's prediction that BIS-related punishment and BAS-related reward sensitivities are orthogonal. The next step was to conduct a confirmatory factor analysis using a new dataset.

3. Study 2: confirmatory factor analysis

3.1. Method

3.1.1. Participants

Data for study 2 were collected in the fall semester of 2013 and the spring semester of 2014 from a large western university. Participants (n = 1133) ranged in age from 19 to 58 (M = 22.76, SD = 2.33). Participants (69.3% female) self-reported race (0.4% American Indian/Alaskan Native, 2.8% Asian, 2.9% Black, 4.2% Multiracial, 0.3% Pacific Islander, 86.1% White, and 3.3% Chose not to respond) and ethnicity (12.4% Hispanic or Latino, 77.3% Not Hispanic or Latino, and 3.8% Chose not to respond). Participants were enrolled in courses that were participating in the Psychology Research Pool and received research credit for completing the study. The study was conducted via computer in a computer lab on campus and had the approval of the Institutional Review Board.

3.1.2. Measures

3.1.2.1. SPSRQ-RC. Participants completed the SPSRQ-RC as well as a number of other measures as part of a larger study looking at predictors of engagement in health risk behaviors. Participants also completed a demographic self-report measure. In addition to confirming the factor structure of the SPSRQ-RC, data collected as part of Study 2 were used for discriminate and convergent validity.

3.1.2.2. BIS/BAS. The Behavioral Inhibition System/Behavioral Activation System scales (1994) assess Gray's RST using a 24-item self-report questionnaire (Carver & White, 1994). More specifically, the scales measure individual differences in the behavioral inhibition system (BIS) and the behavioral activation system (BAS). BIS activation inhibits progress towards goals that may result in negative or painful outcomes and is similar to SP on the SPSRQ. Three subscales are used to assess BAS. BAS is indicative of preference for reward, nonpunishment, and escape from punishment and is thus similar to SR of the SPSRQ. BAS Drive measures persistence in achieving goals. BAS Fun-Seeking measures the propensity to search out and engage in potentially rewarding behaviors. BAS Reward-Responsiveness measures anticipation and response to rewarded behavior. Items are endorsed on a Likert scale ranging from 1 to 4 (1 = Not Very True for Me to 4 = Very True for Me). For analyses presented herein the scoring recommended by Demianczyk, Jenkins, Henson, and Conner (2014)

Table 2
Comparison of the Original SPSRQ and the SPSRQ-RC.

Original SPSPRQ	SPSRQ-RC
1. Do you often refrain from doing something because you are afraid of it being illegal?	1. I refrain from doing something because I am afraid of it being illegal.
2. Does the good prospect of obtaining money motivate you strongly to do some things?	2. The high probability of making money motivates me strongly to do some things.
3. Do you prefer not to ask for something when you are not sure you will obtain it?	3. I prefer not to ask for something when I am not sure I will get it.
4. Are you frequently encouraged to act by the possibility of being valued in your work, in your studies, with your friends or with your family?	4. The possibility of being valued in my work, in my studies, with my friends, or with my family encourages me to do certain things.
5. Are you often afraid of new or unexpected situations?	**5. I am afraid of new or unexpected situations.**
6. Do you often meet people that you find physically attractive?	6. I meet people that I find physically attractive.
7. Is it difficult for you to telephone someone you do not know?	7. It is difficult for me to call someone on the telephone that I do not know.
8. Do you like to take some drugs because of the pleasure you get from them?	8. I like to take some drugs because of the pleasure I get from them.
9. Do you often renounce your rights when you know you can avoid a quarrel with a person or an organization?	9. I give up my rights in order to avoid a fight with a person or an organization.
10. Do you often do things to be praised?	10. I do things to be praised.
11. As a child, were you troubled by punishments at home or in school?	11. As a child, I was very bothered by punishments at home or in school.
12. Do you like being the center of attention at a party or a social meeting?	**12. I like being the center of attention at a party or a social gathering.**
13. In tasks that you are not prepared for, do you attach great importance to the possibility of failure?	13. I think a lot about the possibility of failure when engaging in tasks that I am not prepared for.
14. Do you spend a lot of your time on obtaining a good image?	14. I spend a lot of my time on obtaining a good image.
15. Are you easily discouraged in difficult situations?	**15. I am easily discouraged in difficult situations.**
16. Do you need people to show their affection for you all the time?	16. I need people to show their affection for me all the time.
17. Are you a shy person?	**17. I am a shy person.**
18. When you are in a group, do you try to make your opinions the most intelligent or the funniest?	**18. When I am in a group, I try to make my opinions the most intelligent or the funniest.**
19. Whenever possible, do you avoid demonstrating your skills for fear of being embarrassed?	**19. I avoid demonstrating my skills for fear of being embarrassed.**
20. Do you often take the opportunity to pick up people you find attractive?	**20. I take the opportunity to pick up people I find attractive.**
21. When you are with a group, do you have difficulties selecting a good topic to talk about?	21. When I am with a group, I have difficulties selecting a good topic to talk about.
22. As a child, did you do a lot of things to get people's approval?	22. As a child, I did a lot of things to get people's approval.
23. Is it often difficult for you to fall asleep when you think about things you have done or must do?	23. It is difficult for me to fall asleep when I think about things I have done or must do.
24. Does the possibility of social advancement, move you to action, even if this involves not playing fair?	**24. The possibility of social advancement moves me to action, even if this involves not playing fair.**
25. Do you think a lot before complaining in a restaurant if your meal is not well prepared?	25. I think a lot before complaining in a restaurant if my meal is not well prepared.
26. Do you generally give preference to those activities that imply an immediate gain?	**26. I prefer activities that lead to an immediate gain.**
27. Would you be bothered if you had to return to a store when you noticed you were given the wrong change?	27. I would be bothered if I had to return to a store when I noticed I was given the wrong change.
28. Do you often have trouble resisting the temptation of doing forbidden things?	28. I have trouble resisting the temptation of doing forbidden things.
29. Whenever you can, do you avoid going to unknown places?	29. Whenever I can, I avoid going to unknown places.
30. Do you like to compete and do everything you can to win?	**30. I like to compete and do everything I can to win.**
31. Are you often worried by things that you said or did?	**31. I worry about things that I said or did.**
32. Is it easy for you to associate tastes and smells to very pleasant events?	32. It is easy for me to associate tastes and smells to very pleasant events.
33. Would it be difficult for you to ask your boss for a raise (salary increase)?	33. It would be difficult for me to ask my boss for a raise (salary increase).
34. Are there a large number of objects or sensations that remind you of pleasant events?	34. There are a large number of objects or sensations that remind me of pleasant events.
35. Do you generally try to avoid speaking in public?	35. I avoid speaking in public.
36. When you start to play with a slot machine, is it often difficult for you to stop?	36. When I start playing a slot machine, it is difficult for me to stop.
37. Do you, on a regular basis, think that you could do more things if it was not for your insecurity or fear?	37. I think that I could do more things if it was not for my insecurity or fear.
38. Do you sometimes do things for quick gains?	**38. I do things for quick gains.**
39. Comparing yourself to people you know, are you afraid of many things?	**39. Compared to people I know, I am afraid of many things.**
40. Does your attention easily stray from your work in the presence of an attractive stranger	40. I am easily distracted in the presence of an attractive stranger.
41. Do you often find yourself worrying about things to the extent that performance in intellectual abilities is impaired?	**41. I find myself worrying about things so much that my ability to perform other mental tasks is impaired.**
42. Are you interested in money to the point of being able to do risky jobs?	42. I am interested in money to the point of being able to do risky jobs.
43. Do you often refrain from doing something you like in order not to be rejected or disapproved or by others?	**43. I refrain from doing something I like in order to not be rejected by or disapproved of by others.**
44. Do you like to put competitive ingredients in all of your activities?	**44. I like to make a competition out of all of my activities.**
45. Generally, do you pay more attention to threats than to pleasant events?	45. I pay more attention to threats than to pleasant events.
46. Would you like to be a socially powerful person?	**46. I would like to be a socially powerful person.**
47. Do you often refrain from doing something because of your fear of being embarrassed?	**47. I refrain from doing something because of my fear of being embarrassed.**
48. Do you like displaying your physical abilities even though this may involve danger?	**48. I like displaying my physical abilities even though this may involve danger.**

Note: Bolded items in the SPSRQ-RC column are the items retained in the final version of the scale.

was used. Given that the BIS/BAS and SPSRQ are measuring the same theory, they were expected to be highly significantly related as described above.

3.1.2.3. SSPT. The Sensation Seeking Personality Trait (SSPT) scale (Conner & Henson, 2011), examines two facets of sensation seeking: risk seeking (RS) and experience seeking (ES). The risk seeking subscale consists of 9 items that measure the propensity to take risks (e.g., I like to do things that other people think are dangerous.). The experience seeking subscale consists of 5 items and assesses the seeking of novel experiences (e.g., I think it is important to try as many new things as I can.). Previous research indicated that the SSPT has good psychometric properties (Conner & Henson, 2011). Given that both subscales measure approach and reward propensities, it was expected that SR would

Table 3
Descriptive statistics for the SPSRQ-RC.

Item	Study 1		Study 2	
	M (SD)	Factor loading (SP/SR)	M (SD)	Factor loading (SP/SR)
1. Refrain from doing illegal	3.3 (1.4)	0.31		
2. Money motivates me	3.5 (1.3)	0.41		
3. Prefer not to ask	3.3 (1.2)	0.48		
4. Being valued encourages me	4.1 (1.1)	*0.33*		
5. I am afraid of new situations	**2.8 (1.2)**	**0.62**	**2.8 (1.2)**	**0.58**
6. Physically attractive	3.9 (1.0)	*0.31*		
7. Difficult to call someone	3.0 (1.4)	0.51		
8. Drugs because of pleasure	2.1 (1.4)	*0.22*		
9. Avoid a fight	2.4 (1.2)	0.29		
10. I do things to be praised	3.1 (1.2)	*0.41*		
11. Bothered by punishments	3.0 (1.4)	0.35		
12. Center of attention	**2.5 (1.3)**	***0.63***	**2.5 (1.2)**	***0.48***
13. I think a lot about failure	3.6 (1.1)	0.28		
14. Spend time good image	3.3 (1.1)	*0.45*		
15. Easily discouraged	**2.8 (1.1)**	**0.58**	**2.8 (1.1)**	**0.58**
16. People show affection for me	2.7 (1.2)	*0.43*		
17. I am a shy person	**2.9 (1.3)**	**0.58**	**2.9 (1.3)**	**0.54**
18. My opinions are intelligent	**3.2 (1.1)**	***0.50***	**3.2 (1.1)**	***0.47***
19. Being embarrassed	**3.0 (1.2)**	**0.64**	**3.0 (1.2)**	**0.62**
20. I pick up attractive people	**2.9 (1.2)**	***0.53***	**2.9 (1.2)**	***0.46***
21. A good topic to talk about	2.7 (1.2)	0.51		
22. Get people's approval	3.2 (1.2)	*0.39*		
23. Fall asleep	3.7 (1.2)	0.48		
24. Playing fair	**2.4 (1.1)**	***0.56***	**2.4 (1.1)**	***0.51***
25. Meal is not well prepared	3.8 (1.2)	0.37		
26. Immediate gain	**3.2 (1.1)**	***0.62***	**3.2 (1.1)**	***0.60***
27. Given the wrong change	3.2 (1.3)	0.36		
28. Doing forbidden things	2.4 (1.2)	*0.39*		
29. Avoid unknown places	2.7 (1.1)	0.41		
30. Do everything I can to win	**3.2 (1.3)**	***0.51***	**3.6 (1.1)**	***0.63***
31. Worry about things	**3.6 (1.1)**	**0.58**	**3.8 (1.0)**	**0.52**
32. Tastes and smells	3.8 (1.0)	*0.32*		
33. Ask my boss for a raise	3.6 (1.1)	0.58		
34. Remind me pleasant events	3.7 (1.0)	*0.33*		
35. Avoid speaking in public	3.2 (1.3)	0.52		
36. Difficult for me to stop	2.1 (1.1)	*0.27*		
37. Insecurity **or fear**	**3.2 (1.3)**	**0.71**	**3.2 (1.3)**	**0.73**
38. I do things for quick gains	**2.8 (1.1)**	***0.51***	**2.8 (1.1)**	***0.62***
39. Afraid of many things	**2.5 (1.2)**	**0.66**	**2.5 (1.2)**	**0.63**
40. Distracted attractive stranger	3.2 (1.2)	*0.40*		
41. Mental tasks is impaired	**2.8 (1.2)**	**0.58**	**2.8 (1.2)**	**0.61**
42. Risky jobs	2.2 (1.2)	*0.48*		
43. Not be rejected by others	**2.7 (1.2)**	**0.58**	**2.7 (1.2)**	**0.59**
44. Competition out of activities	**2.7 (1.3)**	***0.51***	**2.7 (1.3)**	***0.60***
45. Threats to pleasant events	2.6 (1.1)	0.41		
46. Socially powerful person	**3.4 (1.2)**	***0.52***	**3.4 (1.2)**	***0.56***
47. Fear of being embarrassed	**3.1 (1.3)**	**0.72**	**3.1 (1.3)**	**0.75**
48. Physical abilities	**2.6 (1.2)**	***0.54***	**2.6 (1.2)**	***0.61***

Bold items indicate items that were retained in the final version of the scale. Italicized items indicate items on the SR subscale.

significantly positively correlate with RS and ES and SP would significantly negatively correlate with RS and ES.

3.1.2.4. UPPS + P. The UPPS + P assesses five impulsivity-like traits: negative urgency (NU), or a tendency to behave impulsively especially when experiencing negative affect, premeditation (Premed), or tendency to think before acting, perseverance (Persev), or a tendency to follow through on tasks or plans, sensation seeking (SS), or a tendency to seek out novel or exciting experiences, and positive urgency (PU), or a tendency to behave impulsively when experiencing positive affect (Cyders et al., 2007; Whiteside & Lynam, 2001). Previous research indicates that the UPPS + P has good psychometric properties (Whiteside & Lynam, 2001). Given that the UPPS + P measures impulsivity, we expected some of the scales to be correlated with SR positively and SP negatively. More specifically, we expected that the NU subscale would be significantly positively correlated with SP, but have no relation to SR. We predicted that the SS subscale to be significantly positively correlated with SR and significantly negatively correlated with SP. We expected PU to be significantly positively related to SR and not related to SP. We did not make predictions about relations between SP and SR and Premed and Persev.

3.1.2.5. Risky Behavior Inventory. The Risky Behavior Inventory (RBI; Conner, Stein, & Longshore, 2004) is a comprehensive inventory of risky behaviors. Participants are first asked to indicate whether they have ever tried the behavior. If they endorse Yes then they are asked a series of follow-up questions about their experience with that behavior. Behaviors are organized by domain (i.e., criminal behavior, driving, sex, sports, substances use, and other risky behaviors). For the present study, in order to determine the predictive validity of the SPSRQ-RC, counts of having every tried risky sports and substances were used as dependent variables. For each sport or substance the "Have you ever tried [behavior]?" was scored as No = 0 Yes = 1 and scores across behaviors in domains were summed. This led to the creation of 2 variables, the number of Risky Sports an individual has tried and the

Number of Substances an individual has tried. There were a total of 23 risky sports on the list and the range of responses was from 0 to 15. There were a total of 14 drugs (including alcohol and tobacco) on the list and the range of responses was from 0 to 10. It was expected that SR would significantly positively predict these count distributed variables and SP would not significantly predict them.

3.1.3. Analyses

Descriptive analyses were conducted in SPSS 23.0 (IBM Corp, 2015). Descriptive statistics were calculated for the 20 items on the SPSRQ-RC, including range, skew, kurtosis, mean, standard deviation (see Table 3). Confirmatory factor analysis (CFA) was conducted in Mplus Version 7 (Muthén & Muthén, 1998–2015). In addition to determining if all items load significantly onto their specified factor, CFA in Mplus allows for testing model fit to determine whether the hypothesized model differs significantly from the model present in the data. Model fit was evaluated with the χ^2, the Root Mean Square Error of Approximation (RMSEA; Hu & Bentler, 1999), and the Standardized Root Mean Square Residual (SRMR; Hu & Bentler, 1999). Non-significant values of the scaled χ^2 statistic are preferable; however, χ^2 distributions are sensitive to sample size (McDonald & Ho, 2002). The RMSEA assesses the discrepancy between the hypothesized model and the population covariance matrix and has values that range from 0 to 1. Values of 0.06 and lower are considered evidence of an excellent-fitting model (Hu & Bentler, 1999) with most researchers employing a stringent upper limit of 0.07 (Steiger, 2007). The SRMR is an absolute measure of fit and is defined as the standardized difference between the observed correlation and the predicted correlation. A value of zero indicates a perfect fit between the observed and the predicted correlation. An SRMR value of < 0.08 corresponds to a good fit between the observed correlation and the predicted correlation (Hu & Bentler, 1999). Once the hypothesized model was confirmed Cronbach's α was calculated for each factor. Additionally, correlations were run with the other scales described above to test for discriminant and convergent validity and negative binomial count regressions were run to test for predictive validity. The regressions positioned the counts of ever having engaged in risky behaviors as the dependent variables and SP and SR as the independent variables.

3.2. Results

Means, standard deviations and factors loadings for the measured variables used in the CFA are presented in Table 3. The final version of the SPSRQ-RC is presented in the Appendix A. The results of the CFA of the factor structure resulting from Study 1 indicated that model fit was acceptable, $\chi^2 = 933.42$, $df = 167$, $p < 0.001$, SRMR = 0.079, RMSEA = 0.067, 90% C.I. = 0.063–0.071. In the confirmatory sample the SR subscale had a Cronbach's α = 0.82 and the SP subscale had a Cronbach's α = 0.86.

The results of the discriminant and convergent validity analysis is presented in Table 4. Due to the number of tests we conducted, alpha was set to 0.001. Results indicated that the SPSRQ-RC has good discriminant and convergent validity. More specifically, the SR subscale was significantly positively correlated with measures of sensation seeking, RS and ES from the SSPT and SS from the UPPS + P while the SP subscale was significantly negatively correlated with the sensation seeking subscales. Additionally, the SP subscale was significantly positively correlated with all but one of the subscales of the DERS, while SR was not significantly related to any of the subscales assessing emotion dysregulation. The facets of impulsivity were all significantly related to either SP or SR or both. These relations were in the expected direction.

Analyses of predictive validity indicated that the SPSRQ-RC was predicting risky behaviors in the expected direction, as SR significantly predicted the number of risky sports tried, b = 0.018, SE = 0.006, 95% Wald CI 0.006–0.030, $p < 0.001$, and the number of drugs tried, b = 0.014, SE = 0.007, 95% Wald CI 0.007–0.028, $p < 0.01$ whereas SP did not significantly negatively predicted the number of risky sports tried or the number of drugs tried ($p > 0.05$). For comparison purposes, these same outcome variables were predicted by the SP and SR subscales of the original SPSRQ (see Method Section from Study 1 for participant information). Results indicated significant associations in the same direction as those using the SPSRQ-SR, though there were weaker in magnitude in comparison. More specifically, the original SR significantly predicted the number of risky sports tried, b = 0.014, SE = 0.006, 95% Wald CI 0.004–0.026, $p < 0.001$, and the number of drugs tried, b = 0.010, SE = 0.007, 95% Wald CI 0.005–0.026, $p < 0.01$ whereas the original SP did not significantly negatively predicted the number of risky sports tried or the number of drugs tried ($p > 0.05$) either.

Table 4
Results of validity analyses.

	SP	SR
BIS/BAS		
BIS	**0.55**	− 0.03
BAS Drive	**− 0.23**	**0.39**
BAS Fun Seeking	**− 0.20**	**0.40**
BAS Reward-Responsiveness	0.02	**0.13**
SSPT		
RS	**− 0.26**	**0.29**
ES	**− 0.21**	**0.14**
UPPS + P		
NU	**0.24**	**0.24**
Premed	**− 0.29**	**0.13**
Persev	**0.18**	− 0.04
SS	**− 0.27**	**0.34**
PU	0.06	**0.25**

Note: Bolded values are significant $p < 0.001$.

3.3. Study 2 discussion

Study 2 was conducted to confirm the factor structure of the SPSRQ-RC. A new sample of data was collected and confirmatory factor analysis confirmed the previously identified factor structure. Fit of the confirmatory model was good and reliability analysis results were replicated. The study is somewhat limited in generalizability to the college population. However, findings support that the hypothesized factor structure is stable. This study corroborates the use of the SPSRQ-RC among English-speaking individuals to measure punishment and reward sensitivity related to RST's BIS and BAS. Additionally, results indicate that the SPSRQ-RC has good convergent and discriminant validity with scales measures similar and different constructs. Results revealed that the SPSRQ-RC was closely related in the expected direction to the BIS/BAS scales, an alternative measure of the RST, with SR being significantly positively related to the BAS subscales and not significantly related to the BIS subscale and with SP being significantly positively correlated with the BIS subscale and either significantly negatively correlated with or unrelated to the BAS subscales. This pattern held in comparison to another measure of behavioral approach, the SSPT, with the SR subscale being significantly positively correlated with and the SP subscale being significantly negatively correlated with RS and ES. Relations between the SPSRQ-RC and the UPPS + P were mixed, with some of the significant relations in the expected direction (i.e., SR being significantly positively correlated with SS and PU and SP being significantly positively correlated with NU and significantly negatively correlated with SS) and some unexpected relations (SR significantly positively correlated with NU and Premed and SP significantly negatively related to Premed and significantly positively related to Persev). Future research should be conducted to better understand the relation between Gray's RST and impulsivity as measured

by the UPPS + P. The next step in confirming the SPSRQ-RC as a measure of BIS and BAS was to establish the longitudinal stability of the scale.

4. Study 3: test-retest

Following data collection and analyses to establish and confirm the factor structure of the SPSRQ-RC, data were collected to determine the reliability of the scale. The goal was to establish the test-retest reliability of the SPSRQ-RC.

4.1. Method

4.1.1. Participants

Participants for the Test-Retest study were 59 undergraduate students enrolled in an introductory Psychology at a large Mid-Atlantic University (79.3% female) who completed the study for course credit. Participants ranged in age from 18 to 36.6 years of age (M = 20.7, SD = 2.9) and self-reported race (17.2% Asian/Asian-American, 19.0% African-American/Black, 53.4% European American/White, 3.4% Multiracial, and 6.9% Chose Not to Respond) and ethnicity (5.1% Hispanic/Latino, 88.1% Not Hispanic/Latino, 3.4% Chose Not to Respond). This study had the approval of the University Institutional Review Board.

4.1.2. Measures and procedure

Participants completed the SPSRQ-RC (describe above and presented in the Appendix) and a demographic questionnaire twice. Surveys were administered during the first 10 min of class 8 weeks apart. Data were linked via unique identifier.

4.2. Results

Initial data analysis indicated that all of the items had roughly normal distributions at Time 1 and Time 2. Additionally, all items significantly loaded onto their respective factors, as expected. Items were summed within their respective subscales, SR and SPA. Pearson Product Moment Correlations between Time 1 and Time 2 subscale scores were calculated to estimate the Test-Retest reliability of the SPSRQ-RC. Analyses indicated that the Test-Retest reliability for both subscales was strong, (SR $r = 0.82$, $p < 0.001$; SP $r = 0.86$, $p < 0.001$). Additionally, the internal reliabilities of the subscales were calculated in this sample. Results replicated those found in both Studies 1 and 2. In the test-retest sample the SR subscale had a Cronbach's $\alpha = 0.77$ at Time 1 and a Cronbach's $\alpha = 0.83$ at Time 2 while the SP subscale had a Cronbach's $\alpha = 0.80$ at Time 1 and Cronbach's $\alpha = 0.86$ at Time 2.

4.3. Study 3 discussion

Results of the Test-Retest analysis of the SPSRQ-RC indicate that the measure is stable across time. Additionally, this study further replicates the factor structure and unidimensionality of the scale in 3 samples. Test-Retest using the new response format of the SPSRQ and with the clarified translation resulted in relatively high Test-Retest correlations, which is a good indicator that the scale is working as intended. The stability of the SPSRQ-RC across two time points is consistent with its aim to measure stable personality constructs. Again, given that data were collected in a college sample, generalizability of the results might be limited to that population. Despite the limitations of generalizability, the findings provide a step forward in the operationalization of RST. Overall it appears that modifications to the SPSRQ in the SPSRQ-RC have improved the psychometric properties of the scale and further support for the use of the SPSRQ-RC with English-speaking individuals. The improved properties of the SPSRQ-RC suggest it to be a better measure of RST's BIS and BAS.

4.4. General discussion

Gray's RST describes differences in how individuals perceive reward and punishment and how that in turn effects learning and behavioral responses (1982, 1991). It is thought that approach and avoidance as described by RST underlie key personality dimensions such as impulsivity and anxiety. Unfortunately, operationalization of RST into self-report questionnaires has been problematic (Corr, 2001; Smillie et al., 2006). As such, measurement of RST has become an impediment to advancing understanding of approach and avoidance in relation to human behavior (Jorm et al., 1998; Leone et al., 2001; Torrubia et al., 2001). The purpose of this study was to revise and clarify one of the more popular scales being used to assess approach and avoidance, the Sensitivity to Punishment, Sensitivity to Reward Questionnaire (SPSRQ). The SPSRQ was originally written in Catalan and utilized a force choice, True/False, response scale. The current revision and clarification changed the response scale to a Likert-type scale with 1 = Very Untrue and 5 = Very True and clarified language used in some of the items so that their meaning in English was more clear.

The results of the EFA indicated that 20 items, 10 loading onto each subscale, explained a significant portion of the variance with no items cross-loading and all items loading onto their respective factors significantly with factor loadings > 0.50. This factor structure of this new version of the SPSRQ, the SPSRQ-RC, was then confirmed through CFA. The results of the tests of reliability and validity indicated that the SPSRQ-RC was positively and significantly related to similar scales of similar constructs and not related to scales measuring different construct and that the SR scale was predictive of engagement in risky behavior while the SP was not. Additionally, results of Test-Retest analysis indicated that the scale has temporal stability. We believe these steps - shortening the scale, changing the scale of measurement, and improving the translation - significantly improve the utility of the SPSRQ as a tool to assess Gray's RST.

There are some limitations on the findings from the current study. First, all of the data were collected from college undergraduates. The SPSRQ-RC needs to be tested in a broader community sample to strengthen statements about its generalizability. Additionally, data were collected cross-sectionally, except for data collected in Study 3 to establish test-retest reliability of the scale. The SPSRQ-RC should be used in longitudinal studies to determine its utility in that methodology. All of the items retained in the SPSRQ-RC are written in the same direction, thus there are no reversed items. This is consistent with the original SPSRQ, however, it does present the opportunity for response bias. Additionally, we did not simultaneously collect alternative measures of BIS/BAS to compare the SPSRQ-RC to, this should be done in future research. Finally, the work conducted in this study started with an existing scale in an effort to improve assessment of approach and avoidance as defined in the RST. It is unclear if a better scale would have been developed had we developed a completely new scale. It is clear that researchers need to improve assessment of RST, especially related to operationalizing and measuring the BIS and BAS systems underlying key personality traits. While we think this is a good first step in that direction, future research is needed to further support the psychometric properties of the SPSRQ-RC.

Appendix A

SPSRQ

Revised and Clarified

Directions: Please read the following questions carefully. Then give an answer to each question by marking one of the options. Because people are different, there are no right or wrong answers to these questions. Choose only one response for each item. Do not leave any items blank.

……(1)……..(2)…….(3)……(4)…….…..(5)
Very Untrue Somewhat Untrue Neither Untrue nor True Somewhat True Very True

___ 1. I am afraid of new or unexpected situations. (5)
___ 2. I like being the center of attention at a party or a social gathering. (12)
___ 3. I am easily discouraged in difficult situations. (15)
___ 4. When I am in a group, I try to make my opinions the most intelligent or the funniest. (18)
___ 5. I am a shy person. (17)
___ 6. I take the opportunity to pick up people I find attractive. (20)
___ 7. I avoid demonstrating my skills for fear of being embarrassed. (19)
___ 8. The possibility of social advancement moves me to action, even if this involves not playing fair. (24)
___ 9. I worry about things that I said or did. (31)
___ 10. I prefer activities that lead to an immediate gain. (26)
___ 11. I think that I could do more things if it was not for my insecurity or fear. (37)
___ 12. I like to compete and do everything I can to win. (30)
___ 13. Compared to people I know, I am afraid of many things. (39)
___ 14. I do things for quick gains. (38)
___ 15. I find myself worrying about things so much that my ability to perform other mental tasks is impaired. (41)
___ 16. I like to make a competition out of all of my activities. (44)
___ 17. I refrain from doing something I like in order to not be rejected by or disapproved of by others. (43)
___ 18. I would like to be a socially powerful person. (46)
___ 19. I refrain from doing something because of my fear of being embarrassed. (47)
___ 20. I like displaying my physical abilities even though this may involve danger. (48)

Note: Numbers in parentheses following items correspond to the item numbers in the original SPSRQ

Scoring: Odd items are summed to create an SP score, Even items are summed to create an SR score.

References

Aluja, A., & Blanch, A. (2011). Neuropsychological Behavioral Inhibition System (BIS) and Behavioral Approach System (BAS) assessment: A shortened Sensitivity to Punishment and Sensitivity to Reward Questionnaire version (SPSRQ–20). *Journal of Personality Assessment, 93*(6), 628–636. http://dx.doi.org/10.1080/00223891.2011.608760.

Beck, I., Smits, D. J., Claes, L., Vandereycken, W., & Bijttebier, P. (2009). Psychometric evaluation of the behavioral inhibition/behavioral activation system scales and the sensitivity to punishment and sensitivity to reward questionnaire in a sample of eating disordered patients. *Personality and Individual Differences, 47*(5), 407–412. http://dx.doi.org/10.1016/j.paid.2009.04.007.

Brebner, J. M., & Martin, M. (1995). Testing for stress and happiness: The role of personality factors. In C. D. Spielberger, I. G. Sarason, J. Brebner, E. Greenglass, P. Laungani, & A. M. O'Roark (Vol. Eds.), *Stress and emotion: Anxiety, anger, and curiosity. Vol. 15. Stress and emotion: Anxiety, anger, and curiosity* (pp. 139–172). Washington, DC: Taylor and Francis.

Carver, C. S. (2004). Negative affects deriving from the behavioural approach system. *Emotion, 4*(1), 3–22. http://dx.doi.org/10.1037/1528-3542.4.1.3.

Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioral activation, and affective responses to impeding reward and punishment: The BIS/BAS Scales. *Journal of Personality and Social Psychology, 67*(2), 319–333. http://dx.doi.org/10.1037//0022-3514.67.2.319.

Caseras, X., Ávila, C., & Torrubia, R. (2003). The measurement of individual differences in behavioural inhibition and behavioural activation systems: A comparison of personality scales. *Personality and Individual Differences, 34*(6), 999–1013. http://dx.doi.org/10.1016/S0191-8869(02)00084-3.

Conner, B. T., Stein, J. A., & Longshore, D. (2004). The Sensation Seeking Personality Type and Risky Behavior Checklist Scales. *Poster presented at the 112th Annual Convention of the American Psychological Association, Honolulu, Hawaii.*

Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological Assessment, 7*(3), 309–319. http://dx.doi.org/10.1037/1040-3590.7.3.309.

Cogswell, A., Alloy, L. B., van Dulmen, M. H. M., & Fresco, D. M. (2006). A psychometric evaluation of behavioral inhibition and approach self-report measures. *Personality and Individual Differences, 40*(8), 1649–1658. http://dx.doi.org/10.1016/j.paid.2005.12.008.

Comrey, A. L. (1988). Factor-analytic methods of scale development in personality and clinical psychology. *Journal of Consulting and Clinical Psychology, 56*(5), 754–761. http://dx.doi.org/10.1037//0022-006x.56.5.754.

Comrey, A. L., & Lee, H. B. (2013). *A first course in factor analysis.* Psychology Press.

Conner, B. T., & Henson, J. M. (2011). Validity and reliability of the sensation seeking personality type scale. *Poster presented at the 119th Annual Convention of the American Psychological Association, Washington D.C.*

Cooper, A., & Gomez, R. (2008). The development of a short form of the Sensitivity to Punishment and Sensitivity to Reward Questionnaire. *Journal of Individual Differences, 29*(2), 90–104. http://dx.doi.org/10.1027/1614-0001.29.2.90.

Corr, J. A. (2002). J.A. Gray's reinforcement sensitivity theory: Tests of the joint subsystems hypothesis of anxiety and impulsivity. *Personality and Individual Differences, 33*(4), 511–532. http://dx.doi.org/10.1016/S0191-8869(01)00170-2.

Corr, P. J. (2001). Testing problems in J.A. Gray's personality theory: A commentary on Matthews and Gilliland (1999). *Personality and Individual Differences, 30*(2), 333–352. http://dx.doi.org/10.1016/S0191-8869(00)00028-3.

Corr, P. J., & McNaughton, N. (2008). Reinforcement sensitivity theory and personality. In P. J. Corr (Ed.). *The reinforcement sensitivity theory of personality* (pp. 155–187). Cambridge: Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511819384.

Cyders, M. A., Smith, G. T., Spillane, N. S., Fischer, S., Annus, A. M., & Peterson, C. (2007). Integration of impulsivity and positive mood to predict risky behavior: Development and validation of a measure of positive urgency. *Psychological Assessment, 19*(1), 107.

De Pascalis, V., Arwari, B., Matteucci, M., & Mazzocco, A. (2005). Effects of emotional visual stimuli on auditory information processing: A test of JA Gray's reinforcement sensitivity theory. *Personality and Individual Differences, 38*(1), 163–176. http://dx.doi.org/10.1016/j.paid.2004.03.017.

Demianczyk, A. C., Jenkins, A. L., Henson, J. M., & Conner, B. T. (2014). Psychometric evaluation and revision of Carver and White's BIS/BAS scales in a diverse sample of young adults. *Journal of Personality Assessment, 96*, 485–494. http://dx.doi.org/10.1080/00223891.2013.870570.

Dufey, M., Fernández, A. M., & Mourgues, C. (2011). Assessment of the behavioral inhibition system and the behavioral approach system: Adaptation and validation of the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) in a Chilean sample. *The Spanish Journal of Psychology, 14*(1), 432–440. http://dx.doi.org/10.5209/rev_SJOP.2011.v14.n1.39.

Fowles, D. (1987). Application of a behavioural theory of motivation to the concepts of anxiety and impulsivity. *Journal of Research in Personality, 21*(4), 417–435. http://dx.doi.org/10.1016/0092-6566(87)90030-4.

Fowles, D. C. (1993). Biological variables in psychopathology: A psychobiological perspective. In P. B. Sutker, & H. E. Adams (Eds.). *Comprehensive handbook of psychopathology* (pp. 57–82). (2nd ed.). New York: Plenum Press. http://dx.doi.org/10.1007/978-1-4615-3008-4_4.

Franken, I. H., Muris, P., & Rassin, E. (2005). Psychometric properties of the Dutch BIS/BAS scales. *Journal of Psychopathology and Behavioral Assessment, 27*(1), 25–30. http://dx.doi.org/10.1007/s10862-005-3262-2.

Gray, J. A. (1970). The psychophysiological basis of introversion-extraversion. *Behavior Research and Therapy, 8*(3), 249–266. http://dx.doi.org/10.1016/0005-7967(70)90069-0.

Gray, J. A. (1977). Drug effects on fear and frustration: Possible limbic site of action of minor tranquilizers. In L. L. Iversen, S. D. Iversen, & S. H. Snyder (Vol. Eds.), *Handbook of psychopharmacology. Vol. 8. Handbook of psychopharmacology* (pp. 433–529). New York: Plenum. http://dx.doi.org/10.1007/978-1-4684-3180-3_10.

Gray, J. A. (1978). The 1977 Myers lecture: The neuropsychology of anxiety. *British Journal of Psychology, 69*(4), 417–434. http://dx.doi.org/10.1111/j.2044-8295.1978.tb02118.x.

Gray, J. A. (1981). A critique of Eysenck's theory of personality. In H. J. Eysenck (Ed.). *A model for personality* (pp. 246–276). New York: Springer. http://dx.doi.org/10.1007/978-3-642-67783-0_8.

Gray, J. A. (1982). *The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system.* New York: Oxford University Press.

Gray, J. A. (1987). *The psychology of fear and stress* (2nd ed.). Cambridge: Cambridge University Press.

Gray, J. A. (1990). Brain systems that mediate both emotion and cognition. *Cognition and Emotion, 4*(3), 269–288. http://dx.doi.org/10.1080/02699939008410799.

Gray, J. A. (1991). The neuropsychology of temperament. In J. Strelau, & A. Angleitner (Eds.). *Explorations in temperament: International perspectives on theory and measurement* (pp. 105–128). New York: Plenum. http://dx.doi.org/10.1007/978-1-4899-0643-4_8.

Gray, J. A. (1994). Framework for a taxonomy of psychiatric disorder. In S. H. M. van Goozen, N. E. van de Poll, & J. A. Sergeant (Eds.). *Emotions: Essays on emotion theory* (pp. 29–59). Hove: Lawrence Erlbaum. http://dx.doi.org/10.4324/9781315799551.

Gray, J. A., & McNaughton, N. (2000). *The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system* (2nd ed.). Oxford: Oxford University Press.

Gray, J. A., & Smith, P. T. (1969). An arousal-decision model for partial reinforcement and discrimination learning. In R. M. Gilbert, & N. S. Sutherland (Eds.). *Animal discrimination learning*. London: Academic Press.

Hicks, L. E. (1970). Some properties of ipsative, normative, and forced-choice normative measures. *Psychological Bulletin, 74*(3), 167–184. http://dx.doi.org/10.1037/h0029780.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1–55. http://dx.doi.org/10.1080/10705519909540118.

IBM Corp. Released (2015). *IBM SPSS statistics for windows, version 23.0.* Armonk, NY: IBM Corp.

Jorm, A. F., Christensen, H., Henderson, A. S., Jacomb, P. A., Korten, A. E., & Rodgers, B. (1998). Using the BIS/BAS scales to measure behavioural inhibition and behavioural activation: Factor structure, validity and norms in a large community sample. *Personality and Individual Differences, 26*(1), 49–58.

Jorm, A. F., Christensen, H., Henderson, A. S., Jacomb, P. A., Korten, A. E., & Rodgers, B. (1999). Using the BIS/BAS scales to measure behavioural inhibition and behavioural activation: Factor structure, validity and norms in a large community sample. *Personality and Individual Differences, 26*(1), 49–58. http://dx.doi.org/10.1016/S0191-8869(98)00143-3.

Kambouropoulos, N., & Staiger, P. K. (2004). Personality and responses to appetitive and aversive stimuli: The joint influence of behavioral approach and behavioral inhibition systems. *Personality and Individual Differences, 37*(6), 1153–1165. http://dx.doi.org/10.1016/j.paid.2003.11.019.

Leone, L., Perugini, M., Bagozzi, R. P., Pierro, A., & Mannetti, L. (2001). Construct validity and generalizability of the Carver–White Behavioural Inhibition System/Behavioural Activation System Scales. *European Journal of Personality, 15*(5), 373–390. http://dx.doi.org/10.1002/per.415.

Luman, M., van Meel, C. S., Oosterlaan, J., & Geurts, H. M. (2012). Reward and punishment sensitivity in children with ADHD: Validating the Sensitivity to Punishment and Sensitivity to Reward Questionnaire for Children (SPSRQ-C). *Journal of Abnormal Child Psychology, 40*(1), 145–157. http://dx.doi.org/10.1007/s10802-011-9547-x.

Lyvers, M., Czerczyk, C., Follent, A., & Lodge, P. (2009). Disinhibition and reward sensitivity in relation to alcohol consumption by university undergraduates. *Addiction Research and Theory, 17*, 668–677. http://dx.doi.org/10.3109/16066350802404158.

Lyvers, M., Duff, H., Basch, V., & Edwards, M. S. (2012). Rash impulsiveness and reward sensitivity in relation to risky drinking by university students: Potential roles of frontal systems. *Addictive Behaviors, 37*(8), 940–946. http://dx.doi.org/10.1016/j.addbeh.2012.03.028.

Matton, A., Goossens, L., Braet, C., & Vervaet, M. (2013). Punishment and reward sensitivity: Are naturally occurring clusters in these traits related to eating and weight problems in adolescents? *European Eating Disorders Review, 21*(3), 184–194. http://dx.doi.org/10.1002/erv.2226.

McDonald, R. P., & Ho, M. H. R. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods, 7*(1), 64–82. http://dx.doi.org/10.1037//1082-989x.7.1.64.

Muthén, L. K., & Muthén, B. O. (1998–2015). *Mplus user's guide* (7th ed.). Los Angeles, CA: Muthén & Muthén.

O'Connor, R. M., Colder, C. R., & Hawk, L. W., Jr. (2004). Confirmatory factor analysis of the Sensitivity to Punishment and Sensitivity to Reward Questionnaire. *Personality and Individual Differences, 37*(5), 985–1002. http://dx.doi.org/10.1016/j.paid.2003.11.008.

Pickering, A. D. (1997). The conceptual nervous system and personality: From Pavlov to neural networks. *European Psychologist, 2*(2), 139–163. http://dx.doi.org/10.1027/1016-9040.2.2.139.

Smillie, L. D., & Jackson, C. J. (2005). The appetitive motivation scale and other BAS measures in the prediction of approach and active avoidance. *Personality and Individual Differences, 38*(4), 981–994. http://dx.doi.org/10.1016/j.paid.2004.09.013.

Smillie, L. D., Pickering, A. D., & Jackson, C. J. (2006). The new reinforcement sensitivity theory: Implications for personality measurement. *Personality and Social Psychology Review, 10*(4), 320–335. http://dx.doi.org/10.1207/s15327957pspr1004_3.

Steiger, J. H. (2007). Understanding the limitations of global fit assessment in structural equation modeling. *Personality and Individual Differences, 42*(5), 893–898. http://dx.doi.org/10.1016/j.paid.2006.09.017.

Torrubia, R., Ávila, C., Moltó, J., & Caseras, X. (2001). The Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) as a measure of Gray's anxiety and impulsivity dimensions. *Personality and Individual Differences, 31*(6), 837–862. http://dx.doi.org/10.1016/j.paid.2006.09.017.

Torrubia, R., Ávila, C., Moltó, J., & Grande, I. (1995). Testing for stress and happiness: The role of the behavioral inhibition system. In C. D. Spielberg, I. G. Sarason, J. Brebner, E. Greenglass, P. Langani, & A. M. O'Roark (Vol. Eds.), *Stress and emotion: Anxiety, anger, and curiosity. Vol. 15. Stress and emotion: Anxiety, anger, and curiosity* (pp. 189–211). Washington, DC: Taylor and Francis.

Whiteside, S. P., & Lynam, D. R. (2001). The five factor model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences, 30*, 669–689.